AUTOMATIC INDEXING OF CARAKA SAṂHITĀ

Dissertation submitted to Jawaharlal Nehru University
in partial fulfillment of the requirements
for the award of the
degree of

MASTER OF PHILOSOPHY

by

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INDIA

2011

विशिष्ट संस्कृत अध्ययन केन्द्र
जवाहरलाल नेहरू विश्वविद्यालय
नई दिल्ली – ११००६७

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July 21, 2011

CERTIFICATE

The dissertation entitled **'Automatic Indexing of Caraka Saṃhitā'** submitted by **Archana Tiwari** to **Special Centre for Sanskrit Studies, Jawaharlal Nehru University, New Delhi – 110067** for the award of degree of **Master of Philosophy** is an original research work and has not been submitted so far, in part or full, for any other degree or diploma in any University. This may be placed before the examiners for evaluation.

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DECLARATION

I declare that the dissertation entitled **'Automatic Indexing of Caraka Saṃhitā'** submitted by me for the award of degree of **Master of Philosophy** is an original research work and has not been previously submitted for any other degree or diploma in any other institution/University.

(Archana Tiwari)

Acknowledgements

I acknowledge with deep sense of gratitude, constant help and encouragement from my supervisor ***Dr. Girish Nath Jha****, which he has provided despite his busy schedule. It is his patience, generosity and excellent guidance which have molded my work in this present shape. . He has always paid sincere attention on us students and our work and gave time for that. He always encouraged us to proceed higher and higher in study and excellence.*

I express sincere thanks and gratitude for Chairperson, ***Prof. Vaishna Narang****, and teachers of our centre,* ***Prof. Shashi Prabha Kumar, Dr. Rajneesh Kumar Mishra, Dr. Hari Ram Mishra, Dr. Santosh Kumar Shukla*** *and* ***Dr. Ram Nath Jha****. They gave me time and attention whenever I approached them. They provided me valuable suggestions and criticism which have been useful in improving the quality of research. I am also grateful to them for they taught me in M.A. and developed good understanding of different disciplines of Sanskrit. I also express my sincere thanks to all the office staff of my centre, and those who directly or indirectly helped me for completing this work.*

I duly acknowledge University Grants Commission (UGC) for providing me the financial assistance.

My special thanks to my Seniors ***Manji Di, Surjit Sir, Bakamoone Indaratana*** *and* ***Diwaker Mani*** *for helping me to develop the ideas for my research. I express my special thanks to my junior* ***Deepro Chakrobarty*** *and my friend* ***Shaurav*** *for their great job of proof-reading. My special thanks to* ***Diwakar Mishra sir*** *for helping me systematize and structure the ideas for my research.*

I extend my special appreciation to juniors of MA for entering data of this research.

Here I mention those without them, I never can complete this journey. My friend ***Shashi, Devlina, Paritosh, Jay, Nripendra****, and my room-mate* ***Ayang****, They have always been with me in hot or cold days.*

I am thankful to my dear friends ***Akansha, Abhinav, Anupam and Kaushal,*** *who have always been the source of inspiration.*

I am deeply indebted to My ***Didi, Chacha and Chachi*** *for their affection and immense support.*

With deep sense of indebtedness, I express my heartfelt gratitude to ***Ma-Papa,*** *and my Sisters,* ***Richa, Puja*** *and brother* ***Vaibhav*** *for their constant motivation and invaluable sacrifice all through my studies.*

I am solely responsible for any kind of error in this dissertation.

Archana Tiwari

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Transliteration key used in the dissertation

अ	=	a	ढ्	=	ḍh
आ	=	ā	ण्	=	ṇ
इ	=	i	त्	=	t
ई	=	ī	थ्	=	th
उ	=	u	द्	=	d
ऊ	=	ū	ध्	=	dh
ऋ	=	ṛ	न्	=	n
ॠ	=	ṝ	प्	=	p
ऌ	=	ḷ	फ्	=	ph
ए	=	e	ब्	=	b
ऐ	=	ai	भ्	=	bh
ओ	=	o	म्	=	m
औ	=	au	य्	=	y
क्	=	k	र्	=	r
ख्	=	kh	ल्	=	l
ग्	=	g	व्	=	v
घ्	=	gh	श्	=	ś
ङ्	=	ṅ	ष्	=	ṣ
च्	=	c	स्	=	s
छ्	=	ch	ह्	=	h
ज्	=	j	क्ष्	=	kṣ
झ्	=	jh	त्र्	=	tr
ञ्	=	ñ	ज्ञ्	=	jñ
ट्	=	ṭ	ऽ	=	’
ठ्	=	ṭh	ं (*Anusvāra*)	=	ṃ
ड्	=	ḍ	ः (*visarga*)	=	ḥ

Devanāgarī input mechanism

[According to Baraha software (http://www.baraha.com)]

VOWELS

a [अ], aa/A [आ], i [इ], ee [ई], u [उ],

oo [ऊ], Ru [ऋ], RU [ॠ], lRu [ऌ], lRU [ॡ],

e [ए], ai [ऐ], o [ओ], au [औ], aM [अं],

aH [अः]

CONSONANTS

k [क], kh/K [ख], g [ग], gh [घ], ~G [ङ],

c [च], C [छ], j [ज], jh/J [झ], ~J [ञ],

T [ट], Th [ठ], D [ड], Dh [ढ], N [ण],

t [त], th [थ], d [द], dh [ध], n [न],

p [प], ph [फ], b [ब], bh [भ], m [म],

y [य], r [र], l [ल], v/w [व], sh/S [श],

Sh;[ष] s [स], h [ह], kSh [क्ष], tra [त्र],

j~J [ज्ञ],

Introduction

Introduction

Caraka Saṃhitā (CS) is the most authentic text of *Āyurveda*, the ancient medicine of India. Although it is famous as the text of *Kāyacikitsā* (a part of the *Aṣṭāṅga Āyurveda*), but it deals with all the eight branches of the *Āyurveda*, briefly. This is the core text of *Agniveśa Tantra.* It has a long tradition of centuries. This text has preserved all the medical knowledge of these centuries. *CS* claims that whatever is stated in the compendium of *Agniveśa*, both with regard to to the maintenance of positive health and the treatment of disease, that alone can be found elsewhere, what is not here can nowhere else be found.

Cikitsā, vahniveśasya, susthāturahitaṃ prati,
Yad ihāsti tadanyatra, yannehāsti na tat kvacit ||8.12 53-54

CS was written by Agniveśa (on the basis of his teacher Ātreya Punarvasu's teachings), enlarged by Caraka and redacted by Dṛḍhabala. It is divided into eight *sthānas*. Each *sthāna* is divided into chapters (*Adhyāya).* There are 120 chapters in the text. It is written in both prose and verse. Originally it had 12,000 verses,[1] but now there are 8419 verses and 1111 paragraphs.

This text gives lots of scientific information, which is relevant for modern medical world. *CS* represents an authentic thesaurus of the various aspects of this science, with special reference to the fundamentals principals of medicine. It has studied and referred to by the physicians, teachers, research workers and *Āyurveda* all over world. Many commentaries have written and translations have been done on *CS.* This text is also important from the philosophical point of view, as it gives its own *Pramāṇa-mīmāṃsā, Padārtha-mīmāṃsā* (epistemology and metaphysics). *CS* is also important as a source of history as the the diseases it describes, gives the social structure of that particular era. Thus *Caraka Saṃhitā* is not only a medical treaty, but it is important source of philosophical, historical and cross-cultural information. This makes *CS* important for the knowledge of the medicine, history culture and philosophy.

[1] Sharma, Ram Karan, Vaidya Bhagwan Dash, 2002 Agnivesa's Caraka Saṃhitā: Text with English Translation and Critical Exposition Based on (Cakrapani Datta's Āyurveda Dīpikā)

But this is a very large text, and quite a tough work for a person to read the whole text. It makes the indexing of the *CS* important and necessary. As modern world is a computer-world, the automatic indexing can make the work of the student, medical practitioner, and researchers easy.

An indexing is a basic step towards a search engine. Automatic indexer is a web crawler, which browses the web in a methodical, automated manner. The crawler copies the visited web pages and those are indexed to give fast search results. The indexing system of Sanskrit documents can be used in various NLP applications like building Sanskrit WordNet, dictionaries, Sanskrit-Indian Language Machine Translation Systems (MTS) etc. This work, besides being an essential resource in NL system of Sanskrit, may also be useful for authentic and referential knowledge about Indian heritage and Ayurvedic references. The system can also be very useful for the researches of historical, socio-political, botanical, Ayurvedic and medical researches by providing the facts from the huge text, which cannot be easily read.

Caraka Saṃhitā is the most authentic text of *Āyurveda*. Scholars have always had a keen interest in this thesaurus of ancient Indian medicinal work. It has undergone several editions. The edition selected for the automatic indexing of *Caraka Saṃhitā* is Nirṇaya-Sāgar Press edition edited by Jadavaji Tikamji Acharya, Published from Bombay, in 1941. It was digitized by the researcher and M.A. students of the Special Center for Sanskrit Studies in Unicode Devanāgarī Text format.

After this the text has been adapted to the database system. The original text has been stored in database tables. The other information of the structure of the text has been stored in different tables and those are connected with each other. The connections of table complete the reference of the searched query and connect all the data with other relative data. The database has three tables having the information *sthāna, adhyāya,* and the *sūtra* respectively. The connections have been defined through the table diagram in the database.

A dynamic search engine-cum-indexer has been developed under this research. It is built in the front-end of Apache Tomcat Web server using JSP and Java servlets. It has its data in MS-SQL Server 2005 with Unicode support. For connecting the front-end to the database server

the MS-JDBC connectivity has been used. The system is available online on http://sanskrit.jnu.ac.in/caraka/index.jsp with input and output in Devanāgarī Unicode. The system works as an interactive and multi-dimensional knowledge based indexing system for *CS*. The system can be used also as a generic system for all Sanskrit texts of similar structure.

This dissertation as the part of M. Phil. research is divided into four chapters. First chapter entitled 'Indexing Tradition and Computational Linguistics' discusses the concepts of indexing, automatic indexing, its usefulness, and comparison between human and automatic indexing. This chapter also gives brief details of ancient Indian indexing tradition, computational linguistics, its sub-fields and automatic Sanskrit indices of present. The chapter further mentions the Ayurvedic dictionaries and automatic search engines of *Āyurveda*.

Second chapter has titled as '*Āyurveda* and Ayurvedic lexical recourses'. This chapter firstly gives a brief introduction of the tradition of *Āyurveda*. Then it deals with Ayurvedic texts and Ayurvedic lexical texts. The relevance of the *Āyurveda* in modern medical system and the need of the indexing of Ayurvedic text have been discussed in the end.

Third chapter has titled as 'A Comprehensive Analysis of the *Caraka Saṃhitā*'. It consists of two portions. The first one is the introduction of the *Caraka Saṃhitā* viz. its compilation, different editions, commentaries and commentators, translations in different languages, contributions of the concerned text and the tradition of *Agniveśa Tantra*. The second portion deals with the structure and content of the text. There are tables of *sthānas* and *adhyāyas* with the topics they deal. At the end of the chapter, the computer adaptation of the *Caraka Saṃhitā* has been described.

Fourth chapter has titled as 'The Implementation of the Indexing System'. This chapter describes the implementation of Automatic Indexing of *Caraka Saṃhitā*. This consists of the architecture of the system, front and back-end of the system, the code description, how the system works. At the end of the chapter the screenshots of the system and its description has been given.

In the concluding part of the dissertation, the limitations of the system and its implications for future research have been summarized.

Chapter 1

Indexing Tradition and Computational Linguistics

Chapter 1

Indexing Tradition and Computational Linguistics

1.1 Introduction

This chapter gives a basic detail of indexing and its advantage for information retrieval, a description about the indexing tradition in ancient India. The chapter further discusses automatic indexing, its brief history, methods description of human and automatic indexing and their comparison and then the importance of automatic indexing. Introductive information of computational linguistics and its sub-field has been given as well. The second part of the chapter contains the survey portion and gives brief information about some online indices for Ayurvedic search engines and *kośas*.

1.2 Indexing

The term index has been derived from the Latin word 'indicare' which means 'to indicate' or 'to point out'. Generally, indexing means to prepare an index of items in a particular group or collection. This is in its simplest way the list of items with some information to locate it in its origin.

1.2.1 Definitions of Index

In the Encyclopedia of Library and Information Science, J. Rothman defines an index as 'a device that serves as a pointer or indicator, more often an alphabetic list that includes subjects and names of people and places that are considered to be of significance in a graphic record.[1]

A **database index** is a data structure that improves the speed of data retrieval operations on a database table at the cost of slower writes and increased storage space. Indexes can be created using one or more columns of a database table, providing the basis for both rapid

[1] Rothman, J., Index, Indexer and Indexing. In *Encyclopedia of Library and Information Science*. V.11, 1974, pp.189-99

random lookups and efficient access of ordered records. The disk space required to store the index is typically less than that required by the table (since indices usually contain only the key-fields according to which the table is to be arranged, and exclude all the other details in the table), yielding the possibility to store indices in memory for a table whose data is too large to store in memory.

Some other definitions of index are following-

An index is a systematic guide to the items of a collection or the concept derived from it. It comprises entries arranged in a known or searchable order, with reference to show where each item indexed is located.[2]

An index is a systematic guide to the location of the words, concepts or other items in books, periodicals or other publication. An index consists of series of entries appearing, not in the order (e.g. alphabetical) chosen to enable the user to find them quickly, together with reference to show where each item is located.[3]

An index is a systematic guide to the items of published literature in a collection, or the concepts derived from a collection. The purpose of an index is to locate or to retrieve the needed items or concepts in that collection.

The collection may mean a single document mentioning, describing or discussing the item or the concept. It may also mean a number of such documents. Such an index consists of two elements:

- A descriptor
- The location where the item or concept has been discussed or is available.[4]

From the above discussion, it becomes clear that:

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[2] Chakraborty, A.R. et. al., *Indexing Principals Process and products.*, 1983, p.1.

[3] *British Standards Institution. Recommendations for the preparation of indexes for books, periodicals and other publication*, (B.S.3700:1954). London,1964. P.5

[4] Parasar, R.G., *Index and Indexing systems*, 1989,p.1

1. An index is a guide to the names, places, items, concepts, etc. in a document or documents.

2. The items or concepts in the index are arranged systematically, generally in an alphabetical order.

3. There are references to show where each of these items is located in the document or documents.

Thus an index lists concepts, ideas or other items in the documents instead of document themselves. Index is different from catalogue or a bibliography, because the unit of listing for a catalogue or a bibliography is a document, whereas it can be an idea, or a concept, or a piece of information in an index.

1.2.2 Need of Indices

Basic purpose of indexing is to help maximum recall or retrieval of relevant information with minimum of noise. In the absence of any need for recall there would not be any need for indexing.

Index is an operating tool. The indexing tools became necessary because any store of information or document containing information is required to be organized for repetitive use by user.

The advantage of index is can be described in these points:-

1. Indexes guide user to the documents and other things.

2. Indexes provide guide to materials that the user may wish to recall or that he may not know exists, that is, indexes are used to question of recall or discovery.

3. Without indexes, the searcher would waste time by turning though page by page...indexes save time and make practical searches that would otherwise be given up.

4. Indexes provide, in highly compact form, useful information about a person or a field.

5. The cross reference in subject indexes guide users to accepted facts of a field. Thus synonyms can be found as well as genus-species, part-whole, and cause-effect relationship that have been established. Facts, such as these from indexes, aid users to enter new field and get new information about their fields.

6. A major reason for indexes is to aid in solving problem presented by the different languages in which material has now published. Only few user of this material can handle more than several languages. Indexes, in one language, serve as guides to this material and help searchers to determine the need to consult the original article. Informative abstracts interposed between the index and the document further aid the searcher in selection

7. The solution to the problem of getting information from the enormous number of documents has aided by indexes, which facilitate rapid selection of relevant material.

The advantage of using index lies in the fact that index makes search operation perform very fast.

1.3 Indexing Tradition in Ancient India

Veda is the most ancient document of the world. Indexing tradition started form the need of the preservation of Veda. The Vedic indices are called *anukramaṇī*. *Anukramaṇī* is an index of Vedic hymns. It records poetic meter, content and traditions of authorship. It consists of systematic indices to various portions of the ancient Vedic literature. The most perfect *Anukramaṇī* is that of the *Saṃhitā* of the *Ṛgveda*. Kātyāyana, an author chiefly known by his works in the Yajur Veda and Sāma Veda is attributed with the authorship of *Anukramaṇī*. Its name is *Sarvānukramaṇī* i.e., the index of all things. It gives the first words of each hymn, the number of verses, the name and family of the poets, the names of the deities and the meters of every verse.

Vedic indices are a kind of *viṣaya-sūcī* (content-list). They give different types of details and information of their concerned Vedas. Information of particular Veda's *ṛṣi, devatā,* and *chanda* have been given in these indices. Every Veda has its indices. They are the key

instrument for the preservation of the Vedic texts. By Vedic indexes, content and structure of Vedas can be easily grasped.

For the purpose of historical analysis of the Vedas, indexes provide lots of information, which deals with the most undeniably historical aspect of the Veda: the index of *ṛsi,* which provides us with details about the living and breathing historical personalities who composed the hymns. *Devatā* and *chanda* information gives detail of the cultural and literary glory of Vedic period.

There are two main Vedic scholars who contributed a lot in the preservation of the Vedic text by writing different indexes and other text. They are-

- Kātyāyana- He is the author of *Ṛgvedasarvānukramaṇī*, the main index of *Ṛgveda.*
- Śaunaka- *Ārṣānukramaṇī, Chandānukramaṇī, Devatānukramaṇī, Anuvākānukramaṇī.*

1.3.1 Prominent Indices of Sanskrit Texts

Ṛgvedānukramaṇī

For the detailed knowledge of the important subjects of *Ṛgveda, Ṛigvedānukramaṇī* is the most famous and authentic index of *Ṛgveda.* This index was compiled by Kātyāyana. The style of this index is sūtra style.

The *anukramaṇī* or index of the *Ṛgveda* provides us with the most basic information about each of the 1028 hymns of the *Ṛgveda* in 10 *kāṇḍas*– Information about *Ṛgveda*'s 10 *maṇḍalas.* In 12 chapters of the text definitions have been given. In the first chapter- content and its importance and in the second chapter- definition of *ṛṣi, devatā, chanda* etc. have been given. Rest of the chapters contains the description of the *chanda.*

Ārṣānukramaṇī-

This index is also concerned with *Ṛgveda.* It is composed by Śaunaka. This index is divided in 10 maṇḍalas (chapters). In each chapter, there is a description of *Ṛgvedic ṛṣi.* This index

gives lots of information about the Vedic period and the environment of that time. Sāyaṇa has given reference of this index in his *Ṛgveda-bhāṣya* (1.100.1).

Chandānukramaṇī-

This index is composed by Śaunaka in poetry style. It has 10 *maṇḍalas* .These *maṇḍals* are related with *Ṛgvedic maṇḍalas*. In this index Śunaka has given the detailed description of *Ṛgvedic* meters.

Anuvākānukramaṇī-

This index has been compiled by Śaunaka. It is related with *Ṛgveda*. In this index, the number of the meters is 45. These meters give information and description about *Ṛgvedic anuvākas*. This is also an important index, which gives the detail of the structure of the *Ṛgveda*.

Sūktānukrmaṇī

Sūktānukrmaṇī is compiled by Śaunaka. It is concerned with *Ṛgveda*. In this index, the writer has given the description about *Ṛgvedic sūktas*. From literary aspects of *Ṛgveda,* this is a very important index.

Ṛgvedānukrmaṇī

As it is clear with the name, this index is related with *Ṛgveda*. The writer of this index is Veṅkaṭamādhava. But this text is collected by Kuñjanarāja. In this text the following eight chapters named as *anukramaṇī* are collected.

Svarānukramaṇī, Ākhyātānukramaṇī, Nipātānukramaṇī, Śabdānukramaṇī, Ārṣānukramaṇī, Chandānukramaṇī, Devtānukramaṇī and Mantrānukramaṇī.

Thus this index deals with every aspect of *Ṛgveda*. This is a guide of *Vedic* linguistic as it gives a wide description about *svara, ākhyāta, nipāta*, and *śabda.*

Taittirīyaśākhānukramaṇī-

This index is related with *Taittirīyasaṃhitā*. According to Max Muller, this index contains not only *Taittirīya-saṃhitā*, but also *Taittirīya-brāhmaṇa* and *Taittirīya-āraṇyaka*'s catalogues. It gives information about *kānda*, *praśna*, *anuvāka*, and *kāṇḍikā*. It also collects all the available details of particular *yajña*.

Cārāyaṇīyaśākhānukramaṇī-

According to Max Muller, this index's name is *Mantrārṣādhyāya*. This is related with the sub-stream of *Cārāyaṇīyaśākhā* of *Yajurveda*.

Madhandinīya-vājasaneya-anukramaṇī-

The compiler of this index is Kātyāyana. This index is related to the *Mādhyandinīya* branch of the *Yajurveda*. It gives the detail about *ṛṣi*, *devatā*, *chanda*, and *khila*. It is important for the information of the structure and the content of the *mādhyandinīya saṃhitā*.

***Purāṇa* Index**

Purāṇas are infallible source of information of Indian history of religion, philosophy, culture, and civilization, polity of society, arts and crafts, architecture and iconography besides royal dynasties and period of their rule.

Prof. V.R. Ramachandra Dikshitar, an eminent historian of the Madras University, has worked on Five *Mahāpurāṇa* viz. *Vāyupurāṇa*, *Brahmāṇḍapurāṇa*, *Matsyapurāṇa*, *Viṣṇupurāṇa* and *Bhāgavtapurāṇa*. This index is in three parts, published by Motilal Banarasidass.

***Mahābhārata* Index**

Book indexing of *Mahābhārata* is an ongoing project at *Sanskrit evam Prachya Vidya Sansthan*, Kurukshetra University. They have completed first two Parvas (i.e., *Ādiparva* and *Sabhāparva*) indexing of *Mahābhārata* which is based on BORI's critical edition of *Mahābhārata*.

Mahābhārata Names Index

A western scholar S. Sörensen created an index of "Names in the Mahābhārata". This index of names occurred in Mahābhārata is published by Motilal Banarasidas.

Ṛgveda- padapāṭhānukrmaṇikā (Index of the *Ṛgveda-* padapāṭha)

The First edition of *Padapāṭha* Index has been published by Swami Vishveshvaranad and Nityananda in 1907.

With few innovations, This *Pada-* index incorporates, in their own alphabetical order, all the *padas* in the form in which they have been registered as well as accounted for in the *Padapāṭha*-text of the *Ṛgveda.*

This edition has been issued in seven volumes (1963-65). In the eighth volume, it contains five alphabetical indices, namely

1. *Mantrānukramaṇikā*
2. *Padapāṭhānukramaṇikā*
3. *Ṛṣyanukramaṇikā*
4. *Devatānukramaṇikā*
5. *Chando'nukramaṇikā*

This Index has been edited by Vishva bandhu and Published from Vishveshavarananada Institute in1966.

1.4 Automatic Indexing

Automated indexing is the process of assigning and arranging index terms for natural language without human intervention (Tulic 2005). The automated index is produced using algorithms. These algorithms work on database containing document representations, including full text or bibliographic records, and also on non-text databases such as images or music.[5]

Automatic indexing is the ability for a computer to scan large volumes of documents against a controlled vocabulary, taxonomy, thesaurus or ontology and use those controlled terms too quickly and effectively to index large document depositories. As the number of documents exponentially increases with the proliferation of the internet, automatic indexing will become essential to maintain the ability to find relevant information in a sea of irrelevant information.[6]

The term automatic indexing has extended to include semi-automatic. The semi-automatic indexing methods can be considered within the wide spectrum ranging from manual indexing with a minimum of computer assistance to fully automatic indexing with a minimum of human intervention.

Automatic indexing has based on two assumptions,

- There is a collection of documents. Each contains information on one or several subjects.
- There exists a set of index terms or categories from which one or several of them can describe the subject content of every document in the collection

[5] Automated Indexing: The Key to Information Retrieval in the 21st Century, Toni L.Obesaki & Ambrose alli University

[6] http://en.wikipedia.org/wiki/Automatic_indexing

1.4.1 The Brief history of Automatic Indexing

In the beginning the computers were considered useful for searching operation in information retrieval. This thought prevailed until 1957-58 and after this period the computers were thought useful for providing alphabetical indexes.

The basic and simplest concept of automatic indexing developed in the 1950s was the KWIC or Keyword in Context index based on permutations of significant words in titles, abstracts or full text -- manipulated by machine. The first major report on the application of this indexing concept occurred at the International Conference on Scientific Information (ICSI) held in Washington, D. C. in November of 1958. H.P. Luhn of the International Business Machines and Herbert Ohlman of the System development Corporation, planned to generate and distribute indexes at ICSI. Both produced title index but used different approaches. Luhn used computer and named his index as Keyword in Context (KWIC) whereas Ohlman used ordinary punch-card machine. Luhn called his index as 'Keyword In Context (KWIC) and used IBM computer to generate it. Two new Luhn inventions, the 9900 Index Analyzer and the Universal Card Scanner, and the new Luhn Keyword-in-Context (KWIC) indexing technique had introduced. Luhn developed the concept with suggestions for auto-abstracting, auto-encoding and auto indexing. Hans Peter Luhn and Phyllis Baxendale have been deservedly credited as the pioneers in this area of automatic indexing. Baxendale developed auto-indexing techniques that identified topic sentences, and she developed methods of automatic phrase selection and syntactical deletion. But many others of the day were involved and much work was going on simultaneously across the world.[7]

Most frequently used automatic indexing systems are web-crawlers. A **Web crawler** is a computer program that browses the World Wide Web in a methodical, automated manner or in an orderly fashion. Other terms for Web Crawlers are *ants*, *automatic indexers*, *bots*, *Web spiders*, *Web robots*, or—especially in the FOAF community—*Web scutters*.[8]

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[7]References to the Early Years of Automatic Indexing and Information Retrieval Organizing and Providing Access to Information -- LIS 391D.2 -- Spring 1998

[8] http://en.wikipedia.org/wiki/Web_crawler

This process is called *Web crawling* or *spidering*. Many sites, in particular search engines, use spidering as a means of providing up-to-date data. Web crawlers are mainly used to create a copy of all the visited pages for later processing by a search engine that will index the downloaded pages to provide fast searches. Crawlers can also be used for automating maintenance tasks on a Web site, such as checking links or validating HTML code. Also, crawlers can be used to gather specific types of information from Web pages, such as harvesting e-mail addresses (usually for sending spam).[9]

1.4.2 Methods of Automatic Indexing

Automatic Indexing is based on this assumption that the word in the text and their relationships to each other are sufficient to represent content concepts. Thus, subject can be derived by mechanical analysis (computer) of the words in a document.

In other words, automatic indexing has based on word frequency. Therefore, a truly automatic indexing is 'derived' or 'word' indexing. However, subject indexing is also possible by using some human intervention and by use of advanced linguistic techniques, including automatic syntactic and semantic analysis.

The three basic methods of automatic indexing have studied:-

- Statistical analysis of text
- Syntactic Method
- Semantic method

1. Statistical Method

Statistical method determines the frequency with which words appear in the document. It is based on the assumption that very few words which crop up again and again are not significant. The second group of words that occurs less often is concerned as significant. Then there is a third group of words which rarely encountered—they are considered as being

[9] http://en.wikipedia.org/wiki/Web_crawler

specific. On the basic of this, the computer can be programmed to select words of given frequency for indexing purpose. It is made to calculate the frequency of words appearing in the full text of documents or in sets of abstracts and then to extract those lying within the optimal range. These words are then used to index the documents in which they appear, without change or modification.

The use of this method may result in the selection of large number of index terms most of which will provide poor guidance to subjects reported by the author. This practice is not very satisfactory since indexing is not the name of merely selecting and counting word used more than minimum number of times. Secondly human indexers do not use this as criterion for index selection. The number of times a term is used in word counts cannot be used as a sole basis for selection. This method had however been developed in the mid 1960s.[10]

2. Syntactic Method

In syntactic method, the computer analyses sentences according to a grammar (whether the word is used as a noun or as a verb) and the relation among the words in the sentence stored in its memory or at least allows for the relative positions of words (co-occurrence) in selecting those to be used for indexing. The linguistic model is proposed by Chomsky. It distinguishes between surface and deep structure of language.

3. Semantic Method

Semantic analysis helps to establish class relationship among terms to associate words with simple concepts. The method ends in identifying the subjects and content-bearing words of the document or surrogate text. A number of procedures have been studied, including-

a) Keyword normalization; (to exclude prefixes and suffixes)
b) Dictionary or thesaurus references- In this the extracted word is looked up in a thesaurus
c) Various classification techniques aimed at grouping related words.

The values of these techniques of semantic analysis need more experiment.

[10] Muhammad, Riza., 1987. *Advanced Indexing and Abstracting Practices.*

1.4.3 KWIC Indexing

An early form of computer-produced index was the Keyword in Context (KWIC). KWIC index was introduced by Luhn and popularized by American Chemical society with its publication of Chemical Titles.

KWIC indexing system has based on the principal that the title of a scientific document represents its contents. The significant word in title indicates the subject of the text. A KWIC index makes an entry under each significant word in the title, bringing it in turn to keep the context intact.

Some variation in the keyword indexing system had also introduced to overcome its limitation and to improve its working. Important among the variations are

1. Keyword Out of Context (KWOC)
2. Keyword Augmented in Context (KWAC)
3. Keyword With Context (KWWC)
4. Key-term Alphabetical (KEYTALPHA).[11]

A Feature of KWIC indexes is that they have produced with minimum of intellectual effort. The computer needs only to be given a program and a stop-list. A program is their reliance on titles of documents, which are not always particularly helpful for indexing.

1.5 Human and Automatic Indexing

Human indexing is done by humans. Human indexers use their knowledge to find the "aboutness" of the writing they are analyzing. They can find concepts within the text and then use terms to help the searcher connect to that text.

[11] Parasar, R.G., 1989, Index and Indexing systems.Sager(M.P.), Medallion Press,.p.1

Human indexing tends to "focus on large documentary units, such as complete periodical articles, complete chapters in collections, or even complete monographs"[12] In human indexing terms are based on knowledge & understanding.

Automatic indexing is the process whereby a computer is used to process a natural language text that is already in machine-readable form so that indexing terms are allocated to its content without direct human intervention.[13] Automatic indexing often refers to indexing done by computer algorithms. Although humans are involved with creating the program for the computers, and in setting the parameters, but the work is done by computers. It is the most user-centered approach because of its dynamic, helpful, and flexible nature, but on the other hand, indexing is based solely on the text stored and is completely immune to the particular group of users and their queries.[14]

The importance of this is to confirm that human indexing often uses the computer as a tool (clerical support/data entry, quality control, intellectual assistance), but that these uses of the computer is not the same as automatic indexing when the computer extracts the terms to index.

1.5.1 Comparison between Human Indexing and Automatic Indexing

Human Indexing is expensive per unit indexed because it is labor-intensive, automatic Indexing is cheaper in comparison. Human indexing involves more time and on the extent of indexable matter. It may be limited to abstract or summarization of the text. Human indexing also has limited vocabulary, they use more generic terminology. In browse-able displayed index human indexing use multi-term context-providing headings. Human indexers however

[12] Anderson J.D.,& Perez-Carballo,J, 2001a, p. 236(the nature of indexing : How Human and machine analyze messages and text for retrivel. Part I : Research and the nature of human indexing. Information Processing and Management, 37(2), p.231-256.

[13] (Tulic 2005:1; Underwood 2005:112).

[14] Fiedel, R.(1994). User-Centered Indexing. Journal of the American Society for information Sciences, 45(8), p.572-575

can have their personal biases or experiences influence their work. Human indexers are inconsistent.[15] Human indexer's cognitive process reflects individual indexers' culture.

On the other hand, automatic indexing can index large amounts of material in short amount of time. It can organize all words in a text and in a given database and make statistical operations on them. In extent of index able, matter automatic indexing can index more of the index able matter because it is routinely based on complete text. Automatic indexing uses very specific terminology, and with the use of different type of dictionaries, it has a larger vocabulary, so it has higher specificity than human indexing. It gives exact descriptions and its process is mechanical. It has greater consistency. It also compensates incorrect aboutness decisions which human indexing cannot. It also compensates for difference between indexing terms and terms used in a search.

Human Indexing has some advantages, which automatic indexing lacks. It can understand words and texts on the background of implicit knowledge. Human indexer uses rules, interpret, and encode text. So it becomes standard. It is better in vocabulary management. It can cross-reference and link synonyms or like terms, and point to related terms easily. In searching syntax and displaying syntax human indexing has advantage as it uses wide range of syntactic patterns and can adopt quickly to include newer terminology, as well as older subject headings.

1.5.2 Importance of Automatic Indexing

Immense technological advancement has resulted in the phenomenon of 'information explosion' during and after World War II. This dramatic increase in the amount of information warranted the attention of the researchers to discover advanced techniques to reduce time spent on processing and disseminating the information. Varied techniques were developed for fast consistent indexing of the material. In the domain of information service, indexes are major document analysis tools, now produced on large scale in the world in the

[15] Fiedel, R.(1994). User-Centered Indexing. Journel of the American Society for Information Sciences, 45(8), p.572-576.

fields of natural sciences, technology and social sciences. They organize the material to ease access and consultation.

An index is a small table having only two columns. The first column contains a copy of the primary or candidate key of a table and the second column contains a set of pointers holding the address of the disk block where that particular key value can be found.

An index is an identifier of content and location. It helps user to retrieve information from a document or a collection of documents. Without an index user has to scan entire tables to return requested data. It is like the index page in a book. You check for the keyword you want to read about in the index and you jump directly to the page where the content belongs, instead of scanning page by page for the material you want to read.

Similarly a table index allows you to locate data without the need to scan the entire table. With the growth in quantity and complexity of published literature, and with the realization of the importance of information in research and decision- making, the importance of an index has been growing steadily.

The only minor disadvantage of using index is that it takes up a little more space than the main table. Additionally, index needs to be updated periodically for insertion or deletion of records in the main table. However, the advantages are so huge that these disadvantages can be considered negligible.

1.6 Computational Linguistics

Computational Linguistics (CL) is discipline between linguistics, computer science and mathematics, which is concerned with the computational aspects of the human language faculty. In it, mathematics and linguistics contribute an understanding of special properties of language data as well as theories and descriptions of language structure and use, while computer science provides theories and techniques for designing and implementing computer systems. It belongs to the cognitive sciences and overlaps with the field of **artificial intelligence (AI)**, a branch of **computer science** aiming at computational models of human cognition. Computational linguistics has applied and theoretical components.

Computational Linguistics came into existence in 1949 CE, as a Machine Translation (MT) project when Warren Weaver suggested in his famous memorandum that translation by machine might be possible.

Appeals of the CL as a field:

- Human language is a most exciting and demanding puzzle
- Computer science is a most growing and expanding field
- Language processing using computers is an important part of CS applications
- These prospects look good for the future

The ultimate goal of the CL field is to building a computer system that could understand and produce human language as well as humans can. Its applications would be endless.

1.6.1 Major Application Areas

1. **Machine Translation** - To devise a system capable of translating from one human language to another is called machine translation.

   Approaches: these are the main approaches for MT

- **Bi-Lingual Corpora Approaches**

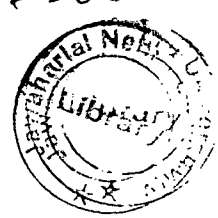
  ➔ **Example-based MT (EBMT)** - This is a translation by retrieval in which previous translations are used as templates for translation of new text.

  ➔ **Statistical-based MT (SBMT)** - This approach capitalizes on the idea that translation examples implicitly contain rules of translation. Statistical techniques are used to reveal rules.

- **Linguistics Based Approaches (LBMT)**

2. **Information Retrieval**- Finding relevant documents in large collections of text. The current work is related with this area.

3. **Expert Systems with Natural Language Interfaces-** Answering questions about a subject area.
4. **Computer-Assisted Language Learning-** Helping humans in learning languages spoken by other humans.
5. **Summarization**-Automatic summarization is the creation of a shortened version of a text by a computer program. The product of this procedure still contains the most important points of the original text. There are two distinguish approaches: extraction and abstraction.
6. **Natural Language Generation-** Natural Language Generation (NLG) is the natural language processing task of generating natural language from a machine representation system such as a knowledge base or a logical form. NLG system is like a translator that converts a computer based representation into a natural language representation. SPOTLIGHT system developed at A.C. Nielsen, AGILE, Drafter-I, HealthDoc, KOMET, MOOSE are some NLG.
7. **Parsing-** Parsing is the process of analyzing a text, made of a sequence of tokens (for example, words), to determine its grammatical structure with respect to a given (more or less) formal grammar. Top-down parser and bottom-up parser are two types of parser.
8. **Localization-** Localization is the process of adapting internationalized software for a specific region or language by adding locale-specific components and translating text. A localized system has been adapted or converted for use in a particular locale (other than the one it was originally developed for), including the language of the user interface (UI), input and display, and features such as time/date display and currency. Each instance of the system only supports a single locale, and there is no explicit support for languages that are not part of that locale although the character set may coincidentally be usable for other languages.
9. **Internationalization** - Internationalization is the process of designing a software application so that it can be adapted to various languages and regions without engineering changes. An internationalized system is equipped for use in a range of "locales" (or by users of multiple languages), by allowing the co-existence of several languages and character sets for input, display, and UI. In particular, a system may not be considered



internationalized in the fullest sense unless the UI language is selectable by the user at runtime. Full internationalization may extend beyond support for multiple languages and orthography to compliance with jurisdiction-specific legislation (in respect of copyright, for instance) and other non-linguistic conventions.

10. **Speech Synthesis**-Speech synthesis is the artificial production of human speech. A computer system used for this purpose is called a speech synthesizer, and can be implemented in software or hardware. A text-to-Speech (TTS) system converts normal language text into speech; other systems render symbolic linguistic representations like phonetic transcriptions into speech.

1.7 Electronic Indices

There are several prominent indices of Sanskrit available. These are useful for searching the Sanskrit content.

1. **Database query to Lubotsky's Rigvedic Word Concordance**

The database access to *A Rgvedic Word Concordance* by Alexander Lubotsky (New Haven, Connecticut: American Oriental Society, 1997) was converted by S. Starostin and A. Lubotsky in July, 2000.

2. **Database query to Bloomfield's Vedic Concordance**

This is an electronic version of M. Bloomfield's *Vedic Concordance* prepared by Marco Franceschini, under the supervision of Prof. Alessandro Passi, at the University of Bologna (conversion into the STARLING-format by A. Lubotsky, October 2000, and May 2005).

3. **The Sanskrit Heritage Dictionary**[16]

This is an online searchable hypertext Sanskrit-French dictionary with normal search, search without diacritical marks, and search for inflected forms. The system, developed by Gerard Huet, requires Devanāgarī fonts and open type fonts for Roman transliteration with diacritics.

[16] It is available at- http://sanskrit.inria.fr/DICO/index.html (accessed on June 12, 11)

4. **Spoken Sanskrit Dictionary**[17]

This is a new bilingual online hypertext dictionary for Sanskrit-English and English-Sanskrit, designed to focus on spoken Sanskrit, which is alive as a common language. This Sanskrit dictionary is still under construction, and the correction process has not yet been finished. Obvious errors may be corrected by using the Edit- link to the right of each dictionary entry.

5. **Online Apte English-Sanskrit Dictionary**[18]

This program, also built by the Institute of Indology and Tamil Studies, Cologne University depends on Vaman Shivaram Apte's English-Sanskrit Dictionary. The output can be seen in Unicode Devanāgrī, Roman Unicode, HK, SLP1 and ITRANS. One can also see a scanned copy of the original dictionary by clicking the page numbers which comes in parenthesis with the English word.

6. **Online Monier Williams (MW) Sanskrit-English Dictionary Advanced Search**[19]

This MW dictionary with advanced search options is prepared by the Institute of Indology and Tamil Studies, Cologne University and contains a total of 196,198 entries. The program does partial word searches for Sanskrit head words or English words in the MW dictionary. It takes queries for Sanskrit words in ITRANS, HK and SLP1 and gives output in several schemes.

7. **Cologne Digital Sanskrit Lexicon & Capeller's Sanskrit-English Dictionary**[20]

The Cologne Digital Sanskrit Lexicon developed at the Institute of Indology and Tamil Studies, Cologne University, is based on Monier Williams' Sanskrit-English dictionary and contains 166,434 entries while the online Capeller's dictionary is based on Capeller's 1891 Sanskrit-English Dictionary which includes 37,413 entries. In both the digital dictionaries, the English description contains a translation, and grammatical and other information listed in their respective printed form. One may search it in entirety from both the languages. For the Sanskrit query, the transliteration is based on the Harvard-Kyoto (HK) convention.

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[17] It can be accessed at- http://spokensanskrit.de/ (accessed on June 20, 11)

[18] It can be accessed at -http://www.sanskrit-lexicon.uni-koeln.de/aequery/index.html (accessed on July 1,11)

[19] It can be accessed at -http://www.sanskrit-lexicon.uni-koeln.de/mwquery/ (accessed on July 1,11)

[20] It can be accessed at -http://webapps.uni-koeln.de/tamil/ (accessed on July 1, 11)

8. **Online Macdonell Sanskrit-English Dictionary**[21]

This online dictionary is based on '*A Practical Sanskrit Dictionary*' by Arthur Anthony McDonell with transliteration, accentuation, and etymological analysis throughout. The system includes both Devanagari and Roman alphabets.

9. **E-index for Sanskrit Dramas**[22]

The work 'Multimediale Datenbank zum Sanskrit-Schauspiel' (Multimedia Database to Sanskrit drama) which mainly focused on word indexing of *Bhāsa*'s (a great Sanskrit dramatist) drama and also includes *Mudrārākṣasa* of Viśākhadatta and *Abhijñānaśākuntalam* of Kālidāsa has been developed by Indology Department, University of Wurzburg, Germany.

10. **SriPedia Initiative**[23]

The SriPedia initiative attempts to provide universal access to some of the numerous texts that comprise the body of Vedic knowledge.

11. **Sanskrit documents**[24]

It is a compilation of Sanskrit documents in Devanāgarī display and transliteration format. In addition to Sanskrit texts, there are various tools for learning Sanskrit such as dictionaries, Sanskrit Tutorials, Sanskrit pronunciation guides, and software for learning Sanskrit and producing documents in Devanāgarī & Roman formats, and much more.

12. **Online Indexing of Mahabharata**[25]**-**

It was developed as the part of M. Phil. research submitted to Special Center for Sanskrit Studies, JNU in 2008 by Diwakar Mani (M. Phil. 2006-2008) in Special Centre for Sanskrit Studies. This web-application has been developed using Java servlets on Apache Tomcat 4.0 and RDBMS techniques using MS SQL server 2005 in Unicode. The application allows three kinds of searches- Direct Search, Alphabetical search and Search by the structure of the text.

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[21] It can be accessed at -http://dsal.uchicago.edu/dictionaries/macdonell/ (accessed on June 12, 11)

[22] It can be accessed at - http://www.indologie.uni-wuerzburg.de/bhasa/index.html (accessed on June 15, 11)

[23] It can be accessed at -http://www.ibiblio.org/sripedia/ (accessed on June 15, 11)

[24] It can be accessed at - http://sanskritdocuments.org/index.html(accessed on June 15, 11)

[25] It can be accessed at - http://sanskrit.jnu.ac.in/mb/index.jsp (accessed on June 15, 11)

13. **Vedanta Search**[26]

This project was presented at the 18th International Vedanta Conference organized by the Center of Indic Studies, University of Massachusetts, USA in July 2009. The authors of the paper are Dr. Girish Nath Jha, Diwakar Mani, Umesh Kumar Singh and Prachi Sinha. This system takes input in Unicode Sanskrit and provides search facility in many texts on a single page.

14. **Online Apte Sanskrit Hindi Dictionary Project**[27]

This work has been done by M.A. students of Special Center for Sanskrit Studies,J.N.U.,in as their course work.It is a complete 100,000 word dictionary.

1.8 Autometic Āyurveda Indexing System and Search-engine

1. **Search Āyurveda**

This search engine delivers the search results related with *āyurveda*, It takes the help of Google for searching the Ayurvedic content. Any query related with *āyurveda* comes in search results.

2. **Search Engine for Āyurveda Articles**

Literature searches for scientific publications on *āyurveda* provide special challenges. Many of the Indian journals, in which articles on Āyurveda appear, are not indexed by 'main stream' biomedical (allopathic) databases such as PubMed and Cochrane CENTRAL. Researchers and patients always feel the need for a "search engine" in Āyurveda. This site provides a search for Ayurvedic articles. The Search strategy of this site is to recover the great majority of articles on any given topic associated with *āyurveda.*

[26]It can be accessed at_- http://sanskrit.jnu.ac.in/vedanta/index.jsp (accessed on June 15, 11)
[27]It can be accessed at-
http://sanskrit.jnu.ac.in/student_projects/lexicon.jsp?lexicon=shlexicon(accessed on 12/7/11)

3. **Dictionary of Ayurveda terms**[28]

This online dictionary of Ayurvedic terms is built by thinkquest and the students of Bhilai Institute of Technology and Government Engineering Collage. It gives user to search the Ayurvedic contents and terms. It also provides a search about yoga and articles related with *āyurveda*.

1.9 Ayurvedic Kośas

1. **Ayurveda Encyclopedia: Natural secrets to healing, prevention and longevity**[29]

This is an encyclopedia of *āyurveda* gives different Ayurvedic medicines, terms, therapies and principles. This lexicon is compiled by Swami Sadashiva. It has been published by Sri Satguru Publication, New Delhi, in the year 2004. It is also in pdf format and can be downloaded from various sites.

2. **A Descriptive Glossary of Diseases in Āyurveda**

Āyurveda which is a complete medical system gives an elaborate and comprehensive description of diseases. These descriptive terms have been collated from various classical texts of Āyurveda such as the *Caraka Saṃhitā*, *Suśruta Saṃhitā*, *Aṣṭāṅga-hṛdaya*, *Mādhava-nidāna*, *Kāśyapa Saṃhitā* etc. This lexicon is collected by Dr. S.R. Sudarshan.

3. **Ayurvedic Dictionary by A.P. Singh**

This dictionary targets terms used in classical Ayurvedic texts. The words have been arranged alphabetically and definitions discussed on modern parameters. This lexicon is compiled by A.P. Singh and published by Black and white Publication, Delhi in 2006.

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[28] It can be accessed at_-http://library.thinkquest.org/04apr/01297/text-only/dictionary.htm (accessed on 12/7/11)

[29] http://ebookee.org/The-Ayurveda-Encyclopedia-Natural-Secrets-to-Healing-Prevention-amp-Longevity-Repost-_780598.html (Accessed on 14/5/2011)

1.10 Other Significant Works Related to *Caraka Saṃhitā* (*CS*)

1. **Nivārakaṃ Sāmājikaṃ ca vaidyakam Caraka Sṃhitayāyāḥ Mukhya-sandarbhe**

This work has been done by Bakamoone Indaratana as a dissertation, submitted to Jawaharlal Nehru University for the Degree of M. Phil in year 2008. This work gives a detail analysis of the Preventive and social medicines described in *Caraka Saṃhitā.*

2. **Maharshi University of Management**

This site has created a huge collection of Indian heritage text in pdf form. All Eight chapters of *Caraka Saṃhitā,* are available here. It is in downloadable form.

3. **Caraka Saṃhitā: A sample survey**

This is a work of Ram Karan Sharma. It gives introductory details of *Caraka Saṃhitā.* This book has been published by Rahtriya Sanskrit Sansthan, New Delhi, in year 1995 CE.

4. **Caraka Saṃhitā (A Scientific Synopsis)**

This work has been done by P. Ray. & H.N. Gupta. It deals with the scientific aspect of *Caraka Saṃhitā.* It has tables, which give information about the botanical names of the medicine, diseases and concepts, discussed in *Caraka Saṃhitā.* It has been published from National institute of Sciences of India, New Delhi, in 1965 CE.

Chapter 2

Āyurveda and Ayurvedic Lexical Recourses

Chapter 2

Āyurveda and Ayurvedic Lexical Recourses

2.1 Introduction

Preservation of the body is the intensive need of the living being and as such, desire for health is one of the basic characters of human being. It is natural, because of the above, that man began to contemplate on modes and measures to maintain his material frame in possible condition by preventing illnesses and counteracting them if they appeared. For this, the medicine system is evolved. In India, this medical system is called *Āyurveda*. This chapter gives a basic detail of *Āyurveda* the traditional Indian medical system. The development of this ancient science has been discussed according to the time-line. Then the sections of this medical system have been described briefly. The second section of the chapter deals with Ayurvedic texts and the lexical texts of this system. The relevance of this ancient medical science in this modern era has been proved in the next section. Some manuscripts of the *Āyurveda* and the need of the automatic indexing of Ayurvedic texts have been described at the end.

2.2 Āyurveda : as a Science of Life

Āyurveda (Sanskrit: *āyu*—life; *veda*—knowledge of) or Ayurvedic medicine is a form of alternative medicine. In Sanskrit, words *āyus*, meaning "longevity", and *veda*, meaning "related to knowledge" or "science". Thus, the meaning of *Āyurveda* is "the complete knowledge for long life". It is a native to India and south Asia.

The *Caraka saṃhitā (CS)* states that the term '*Āyurveda*' is derived from two words, *Āyus* and *veda*. Many Ayurvedic commentators define *Āyus* as 'life',but *Caraka* expands upon this definition, telling us that *Āyus* is the '. . . combination of the body, sense organs, mind and soul', the factor (*dhārī*) responsible for preventing decay and death, which sustains (*jīvita*) the body over time (*nityaga*), and guides the process of rebirth (*anubandha*). The second part of

the word is *Veda* and can be translated as 'knowledge' or 'science', but more specifically suggests a deeply profound knowledge that emanates from a divine source, and hence *Ayurveda* is known as the 'divine science of life'.

Caraka states further on the approach of the *Āyurveda-*

'Beneficial, non-beneficial, happy and unhappy are four kinds of human being. Knowing whatever is pleasant or unpleasant; and beneficial or harmful for the living being is *Āyurveda* approach to Holistic Medicine. How various materials, their qualities, and activities affect life favorably or unfavorably with quantitative and qualitative knowledge is also a part of *Āyurveda.*'[1]

2.3 Origin of *Āyurveda*

Several theories exist on the genesis of *Āyurveda*, the knowledge being passed on from person to person:

According to *Caraka Saṃhitā,* Lord *Brahmā* transferred the Ayurvedic teachings and knowledge to:

1. Daksha Prajāpati, who transferred them to
2. Aśwani kumār, who in turn transferred them to
3. Indra, who passed them them on to
4. Bhardwaj, who transferred them to
5. Ātreya Punarvasu, who next passed them to
6. Agniveśa, who finally passed them onto
7. Jātukarṇa, Bhel, Pārāśar, Hārīta and Kśarpaṇi.

[1] Caraka Saṃhitā, 1.1.41, Longevity - Ayurveda Definition

But according to Suśruta *Saṃhitā*, Lord Bramhā transferred the knowledge to:

1. Daksha Prajāpati
2. Aśwani kumār
3. Indra
4. Dhanvantari
5. Aupdhenav, Vaitaraṇ, Aurabhra , Pushklavata, Karveerya, Gopur Rakshit and Sushruta.

In another view, accroding to *Kāśyap Saṃhitā,* Lord Brahmā transferred the knowledge to:

1. Aśvini Kumāra
2. Indra
3. Kāśyapa

Vaśiṣta, Atri, Bhṛgu etc and lastly among them Atri transferred the knowledge to his son and his pupils subsequently.

2.4 Development of *Āyurveda* in Ancient India[2]

History of medicine in India begins since pre-historic times. Preservation of health has been instinctive necessity of human kind from the very beginning of creation. That is according to Caraka *Āyurveda* (the science of life) is beginning less and eternal.[3] Suśruta, going a step further, says that the creator has delivered it even before creation[4] evidently with the idea that the creature would need it urgently. There was never any break in continuity of this tradition, which has come down to man in present time. The word '*śāśvata*' denotes this idea.

2.4.1 Vedic age

In this age, the sages were deeply thoughtful in knowing about the nature and its miracles. With the worship of nature, they studied the nature with their keen observation and discovered

[2] History of medicine in India, *Development of Indian medicine though the ages: A resume.* P.V. Sharma
[3] caraka saṃhitā,1.30.25
[4] Suśruta saṃhitā,1.1.6

many things beneficial for maintaining their health and alleviating the diseases. That time *mantra* combined with drug was the approach towards the health problems.

Ṛgveda

Ṛgveda defines many plants with their names and forms, which have been governed by the king of medicine called *Soma*. The miraculous feats of the twin *Aśvins* in medicine and surgery definitely present the picture of a physician who is skilled in the arts both medical and surgical. The Vedic seer has a clear idea about two types of disease-innate and exogenous- and as such, a hymn says that the physician is he who tackles both.

Atharvaveda

Atharvaveda mentions quite a large number of plants and other substances used as drug. It also recorded various types of disease-syndromes, which had been defined by that time and had given specific names. Specific treatments had also been formulated for these diseases. The concept of *tridoośa-vāta, pitta*, and *kapha*- which is the scientific basis of *Āyurveda* was much more clear than in the *Ṛgvedic* age. Here *Vāyu* with its types has described at many places. *Pitta* has also explicitly mentioned with its igneous character and *kapha* has indicated by the word '*balāsa*'.

Brāhamaṇas* and *Upaniṣads

The period of *Brāhmaṇas* and *Upaniṣads* contributed considerably in the classification of concepts and facts. The physiological processes such as digestion and metabolism and circulation had been known. On the basis of color, different types of vessels were recognized. The period of *Upaniṣad* was an age of intellectual ferment when different types of concepts and doctrine were being discussed and formulated.

Thus in the Vedic age, ground was fully prepared for the rational medicine which was busy in its make-up to the stage shortly.

2.4.2 Post Vedic age

The compendium of *Āyurveda* came into existence in this cultural and philosophical background. This was the *Agniveśa Tantra* composed by collecting the preaching of

Punarvaśu Ātreya, the founder of the school of medicine, the eight branch of *Āyurveda* has defined in this age and treaties and compendia has written on almost all the specialties. This was the age of rationalism, when the rational therapy has given its due position. However, the mantra therapy was not fully deleted from the scene. The basic concepts of *pañcakarma, tridoṣa,rasa-guna-vīrya-vipāka-prabhāva,* and *saptadhātu* were clearly established. Disease syndromes had been demarcated with their characteristics, signs, and symptoms in all aspects. The pathogenesis of every disease had been explained based on pathological factors *(doṣa-dūṣya)* so that the treatment might process according to the rational lines. Diseases and drugs had been classified according to their nature action and use of drugs. Theory of causation had been propounded and means of valid knowledge had been described.

This age of the medicine is not only concerned with human beings but the other biological areas were also examined. Medicine in relation with elephants (such as *Pālakapya*), horses (that of *śālihotra*) and cows etc. were developed and treatises were written on them. Even medicine for plants was also described in a branch of *Āyurveda* as *Vṛkṣāyurveda.* Thus in this age medicine covered almost all the areas of biological field.

2.4.3 Buddhist Period

This was the practical expansion era of *Āyurveda.* The theoritical foundation which was established during the *Atreya-Agniveśa* period required royal patronage and people support which helped the sick and as such the Buddhist *Vihāras* acted as centers of medical relief. Buddhism was the main factor by which medicine of India reached far and wide in other countries. Buddhism had a patronge of king Bimbisāra (6th C. BCE) of the Magadaha empire and also of traders and merchants Medicine too naturally recieved their patronage and generous support. This perioad synchronised with the golden period of Takṣaśilā which had teachers like Ātreya and Jīvaka, who was also the Physician of Lord Buddha. Asoka the great (272-232 C.BCE) established a chain of hospitals in the country and organised public medical relief on systematic lines and under goverment control.

Kaniṣka (1st century CE) also patronized *Āyurveda.* His empire was extended to Central Asia touching the borders of China. *Āyurveda* went to those distant regions with the Buddhist

missionaries. The Buddhist monks carried some essential medicines and some books of medicine like *Nāvanītaka* (this book reached Central Asia and was discovered by Bower).

Jainas contributed to expansion of *Āyurveda* literature by composing various treaties on different aspects of medicine.

During the period between Asoka and Kaniṣka, Caraka redacted the old *Agniveśatantra* making it fitting to the requirements of the times. He further consolidated the earlier establishments and recorded the contemporary practices. The discription of hospitals mentioned in *CS* (1.15) most probably corresponds to the pattern of the hospitals established by Asoka.

2.4.4 Gupta Perio. .d

In the golden era of Indian history known as the Gupta period, the position of *Ayurveda* was further consolidated and facilites for teaching of medicine and medical relief were provided amply. The university at Nālandā was established during the reign of Kumārgupta I (414-45 century CE.) in which medicine was prescribed as one of the compulsory subject. As Fahian states, during the reign of Candragupta (375-414 century CE .), there was a big hospital at Pāṭaliputra in which people from all over the country came and received the best medical treatment. This time period was also noticeable for the redactions of old treatises and making them up-to date. Dṛḍhabala, a Kaśmīrī scholar, redacted *Caraka Saṃhitā* and also removed its difficiences by reconstructing its lost portion, which amounted to one-third of the text.

In this process, the medical literature became so vast that it became unaffordable for a medical student to study the whole literature, to become a general physician. Hence the need of the time was a book that has all the parts of *Āyurveda* in one place for general practitioners. This need was fulfilled by Tāgabhaṭa who wrote the *Aṣṭāṅgahṛdaya* by collecting materials from important *Saṃhitās*. This became very popular and a Chinese traveler (7th century CE.), has referred Tāgabhṭa as founding the tradition of compilation.

On the policy of compilation, text on diagnosis and treatment were also written separately for the convenience of physicians who could not study the voluminous texts. *Mādhavanidāna*

(7th century CE.), a text on diagnosis, arranged diseases in a definite sequence which was followed by later authors like Tṛnda and Cakrapāṇidatta. The rise of tantricism (4th century CE.) from the time of Asaṅga, and Indrabhūti (7th century CE.) made a great impact on *Āyurveda* and hit harshly at the very root of the doctrine of *Āyurveda,* this changed the future course completely. Here too the assimilation and synthesis quality of Indian culture worked, and *Rasaśāstra* merged in the main stream of *Āyurveda.*

Ayurveda got introduced to Mesopotamia and the Middle East by the traders and travelers. A good number of Ayurvedic texts including *Caraka saṃhitā* got translated into Arabic, which influenced not only the Arabic medicine but also the Greek medicine indirectly. According to Filliozat, Greeks were in contact with Indian physicians long before Alexander. Tibetan medicine was primarily based on Indian Medicine, as in ancient time students from Tibet used to come to India to study in Nālandā and Takṣaśilā universities and scholars from these universities went to Tibet who translated the text of *Āyurveda* in Tibetan.

In conclusion, It may be said that medicine in India gradually disassociated itself from superstitions and exorcism and developed into a scientific medicine long before Hippocrates. This pace continued till Gupta period after which compilation and commentaries came. This may be put chronologically as follows-

1000-500 C. BCE .	--	Age of compendia.
500 B.C.-500 CE. .	--	Age of Consolidation and expansion
500-1000 CE.	--	Age of compilation and commentary

2.4.6 Traveler's Documents –

The Chinese pilgrim Fa Hsien (ca. 337–422 CE) wrote about the health care system of the Gupta empire (320–550 CE) and described the institutional approach of Indian medicine, also visible in the works. Mādhava (700 CE), Sārṅgadhara (1300 CE.), and Bhavamisra (1500 CE) compiled works on Indian medicine. The medical works of both Suśruta and Caraka were translated into the Arabic language during the Abbasid Caliphate (750 CE). These Arabic works made their way into Europe via intermediaries. In Italy, the Branca family of Sicily and Gaspare Tagliacozzi (Bologna) became familiar with the techniques of Suśruta. British

physicians traveled to India to see rhinoplasty being performed by native methods. Reports on Indian rhinoplasty were published in the *Gentleman's Magazine* in 1794 CE. Joseph Constantine Carpue spent 20 years in India studying local plastic surgery methods. Carpue was able to perform the first major surgery in the western world in 1815 CE. Instruments described in the *Suśruta Saṃhita* were further modified in the Western World[5].

2.5 Teachings of *Āyurveda*

Āyurveda is the science of life. It is based on two main principles:

- **Preservation of health** - The main goal of *Āyurveda* is to maintain health and to keep the human body healthy and fit to avoid sickness. For this, it has focused on building the immune system strong.
- **Diagnosis**- If a person got sick then the *Āyurveda* has methods, medicine, and tactics for management of diseases and ailments to cure and procure a return to normal health.

2.6 *Aṣṭaṅga Āyurveda* : Eight Sections of *Āyurveda*

Traditional Ayurveda speaks of eight sections, known as *Aṣṭāṅga Āyurveda*:

1. *Śalya Cikitsā*

This part of the *āyurveda* deals with the removal of foreign bodies including abnormal fetus, application of instruments, alkali, cattery and diagnosis of surgical diseases. It also describes the surgery / surgical treatment and midwifery. More than 2,000 years ago, sophisticated methods of surgery were known. The main text related to surgery is *Suśruta Saṃhita,*. Apart from this, *Bhojatantra, Bhālukitantra, kapilatantra* and *Gautamatantra* are related to this section.

2- *Śālākya* (Otology, Rhinology, Dentistry, and Ophthalmology): This section deals with the diagnosis and treatment of eyes, ear, nose, throat, nape of the neck, cervical problems,

[5] http://en.wikipedia.org/wiki/Ayurveda (accessed on 11/5/11)

head, teeth, mouth etc. *śālākya* means probe or blunt instruments, used for diagnosis of nose, ear throat, eye and disease of head. *śālākya* is a branch dealing with cause, pathology, symptoms, complications, and treatment of diseases of organs above clavicle or color bone. Major *saṃhita*, related with this branch were written during Buddha era around 500 to 600 BC, e.g. *Videha Tantra*, *Cākśuṣya Tantra*, *Kātyayana Tantra* and *Nimi Tantra*. Suśruta reveals approximately 72 eye diseases, surgical procedures for all eye disorders (e.g., cataracts, eyelid diseases), and for diseases of the ears, nose, and throat.

3- *Kāyācikitsā* (internal medicine): *Kāyā* means body, mind and *cikitsā* means treatment procedures. This part is related to the soul, mind, and body. *Kāyācikitsā* is the treatment of physical and psychological diseases. Psychosomatic theory recognizes that the mind can create illness in the body and vice versa. The seven body constitutions and seven mental constitutions were delineated here: *Vāyu* (air/energy), *Pitta* (fire), *Kapha* (water),*Vayu/Pitta, Vayu/Kapha, Pitta/ Kapha*, and a combination of all three (*tridoṣa*). Although finding the cause of an illness is still a mystery to modern science, it was the main goal of *Āyurveda*. Six stages of the development of disease were known, including aggravation, accumulation, overflow, relocation, a buildup in a new site, and manifestation into a recognizable disease. *Pañcakarma* and all other allied methods for purification are part of *kāyācikitsā*.which deals diagnosis and treatment, management of the bodily ailments. The main treaties of *kāyācikitsā* are *Caraka saṃhita, Kharnādaś saṃhita,Viśvāmitra saṃhita, Aṣṭāṅga Hṛdaya.*

4- *Bhūta vidyā* (Psychopathology / Psychology / Microbiology): This section deals in diagnosis, treatment, management of the psychological, psychogenic, and psychosomatic disorders. This branch deals with various diseases, which has caused by viruses and bacteria as well as with treatment of various disorders caused by the evil effects of planets. It has concerned with psychological diseases, their etiology, symptoms, and details of different treatment procedures.

5- Kaūmāryabhṛtya (Pediatrics, Gynecology, & Obstetrics. Pediatrics): In this branch prenatal and postnatal care of the baby and mother has discussed. Topics Include methods of

conception; choosing the child's gender, intelligence, and constitution; and childhood diseases and midwifery.

6- *Agada Tantra* (*Viṣagara-vairodha Tantra*- Toxicology, Medical jurisprudence): In this section, the treatment of the poison and toxins are given. In these topics, include air and water pollution, toxins in animals, minerals, vegetables, and epidemics; as well as keys for recognizing these anomalies and their antidotes. The main treaties of this *tantra* are *Kāśyapasaṃhitā, ālambāyanasaṃhita, Uśanahsaṃhita*, etc.

7- *Rasayana Tantra* (Science of rejuvenation)- This section deals with the process to maintain the longevity, intellectual behavior, rejuvenate the body, narrates about the maintenance of general health conditions. Prevention and longevity have discussed in this branch of *Āyurveda*. Caraka says that in order to develop longevity, ethics and virtuous living must be embraced

8- *Vājīkaraṇa Tantra* (Science of Aphrodisiacs / Maintenance of Vigour):-deals to promote the sexual power strengthen the body, vigor etc. This section deals with two aspects: infertility (for those hoping to conceive) and spiritual development (for those eager to transmute sexual energy into spiritual energy).
The basic motive of *Āyurveda* is to keep the healthy person healthy and to cure the illnesses.

2.7 Scientific evidence

As a traditional medicine, many *Āyurveda* products have not been tested in rigorous scientific studies and clinical trials. In India, research in *Āyurveda* is largely undertaken by the statutory body of the central government, the Central Council for Research in Ayurveda and Siddha (CCRAS), through a national network of research institutes. A systematic review of *Āyurveda* treatments for rheumatoid arthritis concluded that there was insufficient evidence, as most of the trials were not done properly, and the one high-quality trial showed no benefits. A review of *Āyurveda* and cardiovascular disease concluded that while the herbal evidence is not yet convincing, the spices are appropriate, some herbs are promising, and yoga is a promising complementary treatment.

Some Ayurvedic products, mainly herbs used for physiotherapy have been tested with promising results. Studies suggest that turmeric and its derivative cur cumin are antioxidants. *Tinspora cordifolia* has tested. Among the *medhyā rasāyanas* (intellect rejuvenation), two varieties of *Salvia* have been tested in small trials; one trial provided evidence that *Salvia lavandulifolia* (Spanish sage) may improve word recall in young adults, and another provided evidence that *Salvia officinalis* (Common sage) may improve symptoms in Alzheimer's patients. In some cases, Ayurvedic medicine may provide clues to therapeutic compounds. For example, derivatives of snake venom have various therapeutic properties. Many plants used as *rasāyana* (rejuvenation) medications are potent antioxidants. Neem appears to have beneficial pharmacological properties.

Mitra & Rangesh (2003 CE) hold that cardamom and cinnamon stimulate digestive enzymes that breaks down polymeric macromolecules in the human body. Research suggests that *T. arjuna* is useful in alleviating the pain of angina pectoris and in treating heart failure and coronary artery disease. *T. arjuna* may also be useful in treating hypercholesterolemia.[6]

2.8 Āyurvedic Texts

2.8.1 *Bṛhattrayī* (The Greater Triad)

The *Caraka* and *Suśruta Samhitā* are compendiums of two traditions rather than text written b y single authors. A third tradition is that of the Kāśyapas. Some Āyurvedic plant remedies are also mentioned in the earlier Tedic literature. Both the Suśruta and *Caraka Samhitā* are the pr oducts of several editorial hands, having been revised and supplemented over a period of seve ral hundred years.

The scholar Vāgbhata, who lived in Sindh at the beginning of the 7th century CE, produced a grand synthesis of earlier Ayurvedic materials in a verse work called *Aṣṭāṅga Hṛdayam*. Another work associated with the same author, the *Aṣṭāṅga Saṃgraha*, contains much the same material in a more diffuse form, written in a mixture of prose and verse. The relationship between these two works, and a third intermediate compilation, is still a topic of

[6] http://en.wikipedia.org/wiki/Ayurveda

active research. The works of Caraka, Suśruta, and Vāgbhata are considered canonical and reverentially called the *Vṛhad Trayī*, "The Triad of Ancients"; or *Bṛhattrayī*, "The Greater Triad." In the early 8th century, Madhav wrote his *Nidāna*, a work on etiology, which soon assumed a position of authority. In the 79 chapters of this book, he lists diseases along with their causes, symptoms, and complications.

2.8.2 After *Bṛhattrayī*

At one time, it was believed that those who read and fully understood the contents of *Bṛhat Trayī*, were good practitioners of *Āyurveda*. The tradition says that the legendary Ayurvedic practitioner *Vāgbhaṭa* lived during the time of the epic Mahābhārata and was the chief physician of king Yudhiṣṭhira. Most believe that the author of the *Aṣṭāṅga Saṃgraha* was born before 200 CE and has properly known as Vāgbhaṭa the 1st. Another man named Vāgbhaṭa (who was born about 100 BCE) recomposed the, including the writings of Caraka, Suśruta under a new title *Aṣṭāṅga Hṛdayam*.

Living some time after Vāgbhaṭa was another legendary Ayurvedic physician known as Vangsen. Myths place him in ancient Bengal where he wrote a classic Ayurvedic book, simply called *Vaṅgsen*. The book has written in easy and understandable language and adds many new chapters to the previous texts.

After *Vaṅgsen*, a scholar by the name of Mādhavācārya composed the book, *Mādhava Nidāna*. He is thought to have been the prime minister for the king of Vijay Nagar (a state that existed in southern India before Independence). *Mādhava Nidāna* is widely considered the best Ayurvedic book for disease diagnosis. (Although it understandably does not contain the description of some modern diseases.)

After *Mādhava Nidāna*, the next in line of famous Ayurvedic books *Bhāva Prakaśa* was written during the time that the Portuguese first came to India in 1498 by a man named Bhāva Mishra of Madras (now known as Chennai). The period in which he wrote can be pinpointed so accurately because in the *Bhāva Prakaśa*, he described the symptoms of a disease called "*Phirang*" [Gonorrhoea and Syphilis],which was introduced to the subcontinent through contact with the Europeans. ("Phirangi" was the word used to describe Europeans in India.)

Bhava Mishra's other contribution to Ayurvedic medicine was the introduction of pulse examination / pulse diagnosis. His reputation as an excellent Ayurvedic doctor lives on because he began and introduced so many effective methods of controlling and curing diseases.

Many writers after Bhava Mishra contributed to Ayurvedic literature. Among them Śarańgdhar,Cakra Dutta, Vaidya Vinod, Vaidya Vāmanotsava, Bhaiṣajya Ratnawali, and the great Lolimb Raj, who wrote the *Vaidya Jīvana* in verse form. The first lines of the verses of the *Vaidya Jīvana* are addressed to the author's "beloved," while the rest of the verse contains information about curing a disease.

About 200 years ago, Pranacharya Shri Sadanand Sharma wrote the *Rasa Taraṅgiṇī*, which was the "base book" for modernizing Ayurvedic practices. In this book, advances in chemistry area included. The book describes the use of many chemical substances as medicine and their successful uses. Upon considering the advice of this book, Ayurvedic practitioners began to process the traditional herbs in a new manner. Ayurvedic herbs in sulphate, nitrate, muriate, phosphate and nitromuriate forms. *Sarpagandhā* [Latin: Rauwolfia Serpentina Muriate,] *Sarpagandhā* Sulphate, *Sarpagandhā* Phosphate, *Sarpagandhā* Nitrate, *Sarpagandhā* nitromuriate and many others have been prepared and tested on the patient successfully and effectively. *Rasa Taraṅgini* mentiones "*Śaṅkhadrava*", which is a medicine used internally and externally in many disease conditions. *Śaṅkhadrava*"-based herbal medicine, invented by an Indian physician is well appreciated by the National Innovation Foundation, Ahmadabad, India.

2.7.3 Lexicographical texts of *Āyurveda*

Every śāstra has two main parts-

1. Rules
2. Lexicon

Āyurveda is a science as well as a *śāstra*. Each of the Ayurvedic text contains rules (*sūtra*) and lexicon (description of Ayurvedic drugs, herbs and other relevant things).

The literature on *Dravyaguṇa* is known as '*Nighaṇtu*'. Its origin goes back to *Vedic Nighaṇtu* which was explained and annotated in *Nirukta* - one of the six *aṅgas* of Veda. *Nighaṇtu* contained synonyms, which throw light on different aspects of the entity and thus expose the hidden meanings[7].

On the lines of *Vedic nighaṇtu*, *nighaṇtus* in *Ayurveda* were also composed which described drugs and food substances by way of synonyms. In the present *CS*, there is no *nighaṇtu* portion; the drugs and food substance are dealt there mainly in *bheṣajacatuṣka* and *āhāracatuṣka* respectively. There is indication, on the basic of a manuscript that the *Suśruta saṃhitā* had such *nighaṇtu* portion,[8] on basis of the drugs mentioned in *Aṣṭāṅga Hṛdayam*. A separate *nighaṇtu* named '*Aṣṭāṅga nighaṇtu*' by Vāgabhaṭa came into existence. The *Siddhasāra* also has its *Nighaṇtu* at the end. This tradition continued further and Nighaṇṭus like *Paryāyaratnamālā*, *Dravyāvalī*, *Madanādinighaṇtu*, *Śabdacandrikā*, *Nighaṇṭuśeṣa*, *Hṛdayadīpaka* and *Śivakoṣa* were composed on this line The *koṣas* like *Amara*, etc. also had a *Vanauṣadhivarga*.

Mere enumeration of synonyms did not suffice and satisfy the physicians who required more information about the drug action with its rationale. To fulfill this need, another line of *nighaṇṭus* was started which, along with synonyms, also described the work where, under a separate heading(*auṣadhi-varga*), the drugs have been described with properties and actions in a systematic order. Before this, though Suśruta dealt with them in groups, individual entities were not described. This tradition developed with the composition of *Dhanvaṇtari-Nighaṇṭu*,

Dravyaguṇasaṅiraha,Soḍhalanighaṇṭu, Madanavinoda,Kaiyadeva- Nighaṇṭu, Rāja Nighaṇṭu and Bhavaprakasha- Nighaṇṭu.

[7] Nirukta. 1.1.1. (nigamanān nighaṇṭavaḥ).
[8] Sharma Hemaraja: Kāśyapa-saṃhita, int. p.58

2.8.4 Prominent Lexica of *Āyurveda.*[9]

The information concerning *Dravayaguṇa*, right from the *vedic* period was grouped under *nighaṇṭus* . The precise description of *dravyas* or medicinal plants with their morphological characters, their *Rasa Pañcaka* and properties, are all described throughout the *nighaṇṭu* texts.

2.8.4.1 *Aṣṭāṅga nighaṇṭu*

This *nighaṇṭu* was written in 8th century CE. The writer of this lexicon is Vahatacārya or Vāgbhaṭa. Itis not only a compilation of drugs from the *Aṣṭāṅga Saṁgraha* and *Aṣṭāṅga Hṛdayam*, but also contains some drugs which are not found in both these books. The author, Vāhat, is definitely different person than Vṛddha Vāgbhaṭa or the Laghu Vāgabhata. Two manuscripts *Aṣṭāṇga Nighaṇṭu* are mentioned in the descriptive catalogue of manuscripts of the government Oriental manuscripts library, Chennai, one with Tamil meaning and one with Telugu meaning.

This work belongs to the class of the *Nighaṇṭu*, which deals with synonyms only. It was edited by Dr. P.V. Sharma, and published by Kuppuswamy Sastri Research Institute, Madras in 1973.

2.8.4.2 *Abhidhānaratanamāla*)

It is a *Nighaṇṭu* of synonymous style. This work has placed in between 12th or 13th century CE. The subject matter of this text is arranged in Six *skandhas* according to six *rasa*. *Madhura Skandha* (102),*Amla Skandha* (32), *Lavaṇa Skandha* (11) *Tikta Skandha* (128), *kaṭu Skandha* (70) *Kaṣāya Skandha* (115). This text gives many new information about *dravya*. It has been edityed by P.V. Sharma, and published by Chaukhamba Oriental varanasi, in 1977.

2.8.4.3 *Dhanvaṇtari nighaṇṭu*

This is a classic of *Dravyaguṇa* with systematic classification of drugs in the seven classes.

The book can be vividly seen to give information on the two aspects of drugs, their names along with their synonyms and their properties; described under the heads of *Dravyāvali* and *gunavāli* respectively. This is the first *nighaṇṭu* giving synonyms as well as descriptions of

[9] Lucas, D.Shanthkumar, *An introduction to Nighaṇṭu of Ayurveda*

properties, actions as well as uses of drugs. It stood as an ideal pattern of *Nighaṇṭu*, which was followed by Soḍhala, and Narahari in *Rājanighaṇṭu*. It was referred by Niścalakara as *Dravyāyavali* . This work must have been prior to 11th century CE. as Manakā of *Anekārthakośa* makes a reference to *Dhanvantari*. The date of existing text may be fixed as 10th to 13th century CE.

Influenced by mogul invasions of that period, the book describes some drugs like *Āhiphena, jāypala, agnijāra, bhāṅga* etc. these drugs were more in practice in the middle east even in those days.This work was edited by Prof. P.V. Sharma and Published by Chaukhambha Orientalia, Varanasi 1982.

2.8.4.4 *Paryāyaratnamālā*

Often quoted by Sarcvānand Vadyghaṭīya (1159 CE.) in his commentary on *Amarakośa*, reffered to by Medini (1300 CE.), Rayamukta(1430 CE.), brifly known as *Ratnamālā*, *Paryāyaratnamālā* is a famous work of Indian Materia Medica. The author of this work is Mādhavakara, the author of *Rgviniśchaya*, popularly known as '*Mādhavanidāna*'. As *Nidāna* was translated into Persian at the time of Haroun-al-Rasid, in eight century, concludes that the time of *Mādhava* was in around 7th century CE. The present text has based on a collection of nine manuscripts and a printed text. All the manuscripts are in Bengali scripts. This work was edited by Dr. Tarapada chowdhary, and reprinted from Patna University Journal, vol. II Patana.

2.8.4.5 *Siddhasāra Nighaṇṭu*

This text was written by Ravigupta, the son of Durgāgupt. It is is similar to other classical text of *Āurvededic* system. At the end of the text contains a Nighaṇṭu portion. Six manuscripts of these texts are in Nepal and kept under Nepal-German Manuscripts preservation project. The timing of this text is 9th Century CE. It has divided into 31 topics, each dealing with a different subject. There are descriptions of plants *lavaṇa, kṣāra, dhātu, ghṛta, kṣīra*, combination of drugs and, measures in 191 lines of *śloka*. The *Siddhasāra Saṃhita,* along with the *ṇighṇṭu* part, published as *Siddhasāra of Ravigupta* by Franz Steiner Verlag GMBH Wiesbaden, Germany in 1980. Mr. R.E. Emmerick edited it.

2.8.4.6 *Bhāvaprakaśa Nighaṇṭu-*

It is an important work of *Āyurveda*, which is enumerated among '*Laghutrayi*'. It is one of the classical works of Bhāvamiśra. The author gives importance to the basic principles and included new drugs. In this book, there were two portions, one is *Saṃhitā* and the other one is *nighaṇṭu*. The *nighṇṭu* has been considered as the latest among classical works in the field of Dravyaguṇa. The period of Bhāvamiśra is between 15th century CE. and 17th century CE. that is 16th Century CE.

2.8.4.7 *Haramekhalā nighaṇṭu*

This is also a *nighaṇṭu* appended at the end of the text of Haramekhala. Unlike other *nighaṇṭus*, it is in prose. The author of this work is Mādhava, grandson of Kavimaṇḍana and resident of Chitrakuta. It is quoted by Niścala Kara.The date of this text is fixed as 9th century CE.

2.8.4.8 *Madanādi Nighaṇṭu*

It is also known as *Gana Nighaṇṭu* because it deals with the drugs enumerated in *madanādi gaṇas* of *Aṣṭāṅga Hṛdayam*.It also contains, like the '*Aṣṭāṅganighaṇṭu*', a section on miscellaneous drugs its author is Ravinandana. Candranandana is also the author of the comm. *Padārthacandrikā* of *Aṣṭāṅga Hṛdayam. Candranandana-nighaṇṭu* is quoted by *Kṣīrasvāmī* must be earlier than 11th century CE. it has 33 sections or *gaṇas* drawn from the *Aṣṭāṅga Hṛdayam.*

2.8.4.9 *Soḍhala Nighaṇṭu*

It is an important work of Indian Materia Medica. This is a text of 12th century CE. There are two manuscripts available. The author of this text is Soḍhala, the son of Bhāskara, and father of Śārṅgadeva, the author of *Saṅgīta Ratnākara* and *ādhyātma Viveka*. This text adopted the style of *Dhanavantari Nighaṇṭu*. Nevertheless, it omitted the unnecessary information given in *Dhanavantari Nighaṇṭu*. The text is divided into 26 *vargas*. The basic concepts have been explained based on *Aṣṭāṅga Hṛdaya*. The peculiarities of this work are, it is practical oriented. The author, in this work, has presented a new school of *nighaṇṭu* where in the importance is given to the pharmacology and therapeutics of *dravya* otherwise for the karma and rogāhnta;

rather than dealing with *paryāyanāma* of the *dravya*. The importance is given to the action and uses of the drug. Prof. P.V.Sharma has edited this text.

2.8.4.10 *Anekārtha Kośa*

This is a glossary-containing medical and non-medical terms. Manakā has prepared this work. The period attributed to this work is in between 1128-1149 CE. and he has placed in 12th century CE.

2.7.4.11 *Śivakośa*

Śivakośa is a lexicon of homonyms, restricted to subject matter of Ayurvedic Materia Medica. There are 540 verses this work was prepared by Śivadatta Miśra, who belonged to Karpūra, and was the son of Caturbhuja.The author himself wrote a commentary by the name *Śivakoṣa Vyākhyā* otherwise known as *Śiva Prakāśa* .The time period of the text is 1599 i.e. 1677 CE.. The manuscripts are available at-Bhandarkar Oriental Research Institute,Poona, and Wilson collection,Bodleian Library,Oxford.

2.7.4.12 *Kalpadrukośa*

This *kośa* was compiled by Keśava. It is very helpful and useful glossary containing about 4000 *ślokas*. This is the biggest synonyms lexicon. The period of its composition is 17th century CE. It contains three skanda as Bhūmi, Bhuvā and Sarga. This is a nonmedical glossary but consisting medical terms.

2.7.4.13 *Dravyaguṇa kośa*

This lexicon is penned by Prof. Priya Vrata Sharma, the author of *Priya Nighaṇṭu*. He has collected terms relating to medicinal plants from all possible sources with exact reference. This *kośa* has completed in 1997 and published by Chaukamba Orientalia, Varanasi. It contains terms relating to medical plants, their properties and action with exact reference of the source texts. It has two sections, one on *dravya* and the other on guṇa (including actions) their names in Sanskrit, Hindi and other regional languages, as well as Botanical names are given so as to make their identification clear. Etymological derivation of the words adds to

process of elucidation. Commentators like Dallaṇa and Cakrapāṇi have coined many terms for medicinal plants. These are included here.

2.7.4.15 *Bedi Vanasapati kośa*

This is a unique *kośa* on medicinal plants, written by Prof. Ramesh Bedi. This huge *kośa* is presented in six volumes and is arranged in Devanāgarī alphabetical order. It is enriched with 2400 photos. This lexicon comprises medicinal economical, industrial, and agricultural horticultural, ornamental, religious, cultural and plants grown throughout. He has also furnished the names of the plants in Hindi, Sanskrit, English, Latin and regional languages with their botanical character, habitat, chemical composition, uses etc. The author has used the complete Indian literature including Vedic, Jain, Buddhist, Puranic and Epic works of Sanskrit Literature along with Ayurvedic *nighaṇṭus*. In the end of every volume, the author has furnished the Botanical (Latin) names with their proper reference.

2.9 Relevance of Āyurveda in Modern Medical world

There is a keen interest all over the world to find out nontoxic and effective remedies from herbal and other natural sources for the treatment of diseases. *Ayurveda,* specially its classical work *Caraka Saṃhita,* is the repository of such herbal and natural products which are used uninterruptedly for thousands of years to justify their nontoxic nature and therapeutic efficiency.

Modern medical research has made a phenomenal progress but it is not multi-faceted and multi-dimensional. Specialization in the diseases afflicting different parts/organ of the body is increasing, because of this the individual as a whole is losing its identity. *Ayurveda* considers different parts of human body as a physiologically interconnected. Therefore, in addition to the afflicted part or organ, the entire body has examined, and the individual as a whole is treated.

The individual is composed of five consecutive layers called *kośas*. For a good health, the harmonious and disharmonious states of these five *kośas* are responsible respectively. *Āyurveda* emphasizes upon the psycho-somatic concepts of diseases, so it deals with all the *kośas*, while modern medical research is mostly confined to the *anna-maya- kośa*.

Āyurveda plays a good deal of emphasis upon preservation and promotion of positive health, which is the primary objective of *Āyurveda.*

Modern scientific research generally aims at finding out a microbe as the cause of different diseases, and locate them and to develop the anti-microbial drugs. These drugs are very much effective and instant but by the course of the time the body become used to, and some genetic changes take place. Then the new anti-microbial drugs required to be developed.

Āyurveda also described microbes as causative factors of several aliments but the primary are the distribution of *rasa* and *doṣas* and *dhātus* (tissue elements) which make the immunity of body strong, so the microbe ca not grow and multiply and make the person ill. Instead of using antimicrobial drugs, the immunity of the body to fight, to arrest the growth and to destroy them is required to develop.

For some metabolic diseases, modern medical science provides palliative therapies, which gives temporary relief but after a span of time they become the cause of steroids and the patient succumbs to the adverse effects which are more painful rather than the original. But in *Ayurveda* there are lots of herbal and natural products for such diseases. According to *āyurvedic* principles, the actions of these natural therapies may be slow but their effects are stable.

The holistic approach to man is the massage of *Āyurveda*, the medicine of India, to the modern world which is troubled now with divisions and diversities.

2.10 Manuscripts of Āyurveda.[10]

2.10.1 *Ayurveda-prakāśa (pākāvalī)-*

This is a work of Mādhava. The text is related to the preparation of medicines. It discusses topics like, *Pūgapāka, Bṛhatpūgapāka, Vijayāpāka, Nāgarapāka, Saubhāgyaśuṇṭhīpāka, śuṇṭhīguḍāvalehaḥ, Ahiphenapākaḥ, Kaserupākaḥ, Jīrakaśatapatrikāpākaḥ.* The manuscript has 53 folia and its catalogue reference is G-4454.

[10] A Descriptive Catalogue of Sanskrit Manuscripts in the Collection of the Asiatic Society, Dalia Bandury.

2.10.2 *Añjananidānam-*

It is a work of *Agniveśa* with Hindi commentary name Śirorogāvaloka. This manuscript contains 21 folia. There are 232 *śloka* in this work. The commentary date is 1829 CE. The Catalogue reference is G-2911.

2.10.3 *Paryāyaratnamālā-*

The author is Mādhavakara, and the scribe is Pareśanātha Sena of Bhavānipura The date of the scribe mentioned in the post colophon is *śaka* 1763= CE. 1841. The catalogue reference is G-3475. It has been edited by Tarapada Chaudhari, Patna university pub. 1946.

2.10.4 *Arkaprakāśa*

The author of this text is *Rāvaṇa*, The king of *Laṅkā*. It is a dialogue between *Rāvaṇa* and *Mandodarī*.The condition of the manuscript is bad (moth-eaten). The script is Devanāgari. It deals with obstetrics and also deals with medicines which pregnant lady should use for the gradual development of fetus in her womb. Although it is complete but the last verse no. 100 is missing, which is possibly interpolation. This is published from Bombay, *śakābda* 1841 with Hindi commentary by *mukundarāma.*

2.10.5 *Abhidhānacintāmaṇiḥ*

Also known as *Nighaṇṭurāja* and *Rājanighaṇṭuḥ.* It is a work of Nārāyaṇa Paṇḍita. It contains Sanskrit names with Marathi and Kannada synonyms – "*vyaktiḥ kṛtātra karṇāṭakīmahārāṣṭrībhāṣayā āndhralāṭādibhāṣāstu jñātavyāstadvayāśrayāḥ*" . It has 148 folia and Manuscript is complete, the scribe date is śaka 1780, *samvat* 1915 = 1858 CE. The Catalogue reference is G-4443.

2.10.6 *Dravyaprakāśaḥ*

This is a lexion of Ayurvedic words ordered with number of meanings of word, from 1 meaning word to 7 meaning word. The folia are 15, and Catalogue reference is G-5106.the authors name is not mentioned in the manuscript.

2.10.7 *Nibandhasaṅgrahaḥ*

This is a commentary on different sections of *Suśrutasaṃhitā*. The author of this work is Dalhaṇa. the numbers of folia are 473, 119, 176 respectively. This is a complete work, by many other manuscripts together complete the whole text. The catalogue references are G-1540D, G-1540C/1, G-1540C/2.

2.10.8 *Dhāturatnamālā*

It deals with metallic preparation of medicines. The author of the text is Devadatta. The folia are 4. It is a complete work. According to Manuscripts in Bodleian Library, It is a part of *Aśvinīkumārasaṃhitā*. The Catalogue reference is III.A.53

2.10.9 *Indrakośaḥ*

It is a medical dictionary compiled by Bhaṭṭa Rāmacandra, under the patronage of Rājā Indrasiṁha. Date of the scribe mentioned in the Post-colophon is Saṁvat 1868= CE 1811.the script is Nāgarī, folios 1-284. The Catalogue reference is (G-1162).

2.11 Need of Indexing of Ayurvedic Texts

Āyurveda is an alternative medicine system extremely important in our times. It is becoming popular these days as lot of side effects of modern medicine is ruining the life of a common man. Observation of the health rules prescribed in *Āyurveda* will go a long way in making the society free from physical, mental and spiritual ailments. Today many Ayurvedic clinics, medical stores and websites are available who provide the medicine and information about the *Āyurveda*. But the information is authentic or not is a question. The knowledge of this science is preserved in the Ayurvedic text from century. These texts give the full details of the all the eight branches of Ayurveda and they are practiced by many generation. But reading a whole *Āyurveda* text is a Herculean task. Modern world is a word of computers and internet. By automatic indexing of these texts anyone can easily search the text by giving his query. It will save his time and efforts.

Automatic Indexing of Ayurvedic text makes the work of researchers easy, as they can read the portion of the text which they want to know about, rather than going across the whole text.

Chapter 3

A Comprehensive Analysis of the *Caraka Saṃhitā*

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3.1 Introduction

This chapter consists of two portions of which the first one is the introduction of the *Caraka Saṃhitā* viz. its compilation, different critical editions, commentaries and commentators, translations in different languages, contributions of the concerned text and the tradition of *Agniveśa Tantra*. The second portion deals with the structure and content of the text. There are tables of *sthānas* and *adhyāyas* with the topics they deal. At the end of the chapter, the computer adaptation of the *Caraka Saṃhitā* has been described.

3.2 *Caraka Saṃhitā*

The *Caraka saṃhita* is a well-known treatise of ancient India. It stands at the top of the ancient texts representing the school of medicine i.e. *āyurveda* that is said to be founded by the great scholar-sage *Punarvasu Ātreya*. It is the most ancient, comprehensive, and authoritative work of *āyurveda*. The *Caraka Saṃhitā* is the original book of holistic āyurvedic medicine and central to the modern-day practice of āyurvedic medicine. Alongwith the *Suśruta Saṃhita,* it is identified as an important source of medical understanding and practice in antiquity. The *Caraka Saṃhitā* represents one important branch of *āyurveda* known as *Kāyā Cikitsā* (inner medicine). Its value has been further enhanced by the fact that it is the only text available in complete form whereas other contemporary *saṃhitās* such as of Jātukarṇa, Parāśara etc. has been no longer in existence. *Bhela Saṃhitā* is incomplete and *Hārīta Saṃhitā* is dragged into controversy. Therefore, any scholar desirous to know about the fundamentals of *āyurveda* and its approach to life, health and disease has essentially to take resort to the study of this text unique in depth and divergence. Historically too, the *Caraka Saṃhitā* is quite interesting. An analytic study can reveal its three distinct state of authorship ascribed to Agniveśa, Caraka and Dṛḍhabala in successive order.

3.3 Composition of *Caraka Saṃhitā*

It is very difficult to decide the date of many ancient Indian texts as there was no convention of mentioning time or author's detail. *Āyurveda* is a continuous stream. Hence, it is likely a difficult task to determine the date of the compilation of the āyurvedic texts.

Our text gives a detailed account of its composition. A conference of sages, meeting somewhere in the *Himālaya*, with the common object of alleviating human suffering and assuring a long, healthy and satisfying life to all, decided to take all necessary steps to acquire the necessary knowledge for that purpose.[1] Later one of these sages, Ātreya Punaravasu by name, requested six of his disciples to compile his teaching in writing.[2] The treatise of Agniveśa, revised by Caraka later, formed the basis of Dṛḍhabala's edition. In fact, the major portion of the text is presented in the form of question-answer between the disciple Agniveśa and his teacher, *Ātreya.*

The only text available at present is a reduction by a 9th Century scholar, Dṛḍhabala who is repeatedly mentioned in the body of the text as he merely edited this ancient work of this name, restoring and reconstructing some missing passage. Although a major portion of the *saṃhitā*, '*Siddhisthāna*', was added by him.

The *Caraka Saṃhitā*, as available in its present form is originally the work of Agniveśa who composed his *tantra* by collecting the teaching from his teacher Ātreya Punarvasu. This *tantra*, presumably small in size and content, was later improved and enlarged by Caraka on whose name it came to be known popularly. After a lapse of time, some of its portions were lost and then it was reconstructed by Dṛḍhabala. Thus the present *Caraka Saṃhita* is originally authored by Agniveśa (on the basis of Ātreya's teaching), enlarged by Caraka and redacted by Dṛḍhabala.[3]

A great difficulty is to identify Ātreya, Agniveśa and Caraka, because the authors of the same name mentioned in the Brāhmaṇical, Buddhistic, Chinese and Arabic literatures.

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[1]Caraka Saṃhitā, 1.1.7-14

[2] Caraka Saṃhitā,1.1-30-31

[3] Roy, P., H.N. Gupta, *Caraka Saṃhitā (A Scientific Synopsis),* 1965.

Ātreya of the *Caraka Saṃhitā* is Ātreya Punarvasu, son of Candrabhāgā.[4] The text mentions another Ātreya.[5] According to the *Caraka Saṃhitā*, Agniveśa is a disciple of Ātreya, who in his turn received the knowledge of *āyurveda* and also from another teacher, Bhāradvāja by name.[6]

The name Ātreya is reckoned in the *aśvādi gaṇa*(4.1.110) and Agniveśa with Parāśara and Jātukarṇa in *gargādi gaṇa* (4.1.105) of Pāṇini's *Aṣṭādhyāyī*. Therefore, it is clear that Ātreya and Agniveśa were quite renowned during Pāṇini's time (7th Century BCE.). Ātreya Punaravsu's teaching represents the highest stratum of medicinal material, which belongs to the Upaniṣadic period.[7] It is said that *āyurveda* is more attached to the *Atharvaveda*. This saying indicates the pre-existence of the latter. Thus Ātreya's date may be fixed between the *Atharvaveda* (1500 C BCE) and Pāṇini (7th C BCE) i.e. 1000 BCE[8].

Agniveśa was the foremost among the six disciples of Punarvasu Ātreya. He composed the *Agniveśa-Tantra* collecting and arranging the talks, lectures and deliberations of his teacher. *Agniveśa-Tantra* was extent for quite a long time (at least upto 15th CE),which is evident from its quotations in the commentaries of Ḍalhaṇa, Śrikaṇṭha and Śivadāsa.[9]

About the age of Caraka, there is great divergence of opinions. Sylvain Levi has discovered in the Chinese translation of the *Tripiṭaka*, that Caraka was the court physician of the Indo-Seythin King Kaṇiṣka.[10] But according to P.V.Sharma he was not that Caraka who enlarged the text *Caraka Saṃhitā*. B.C. Hoernle places Caraka between Kaṇiṣka and Bower's manuscript. According to Meulenbeld, the *Caraka Saṃhitā* has written during first two or three centuries CE. *Yājñavalkya-smṛti* (3rd century CE.) and *Navanītaka* (2nd cent. CE) have taken many theories from the *Caraka Saṃhitā*. The *Caraka Saṁhitā* was translated into Pahlavī language in the early Christian era. Hence, the original text might be quite earlier. The

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[4] Caraka Saṃhitā,1. 13.100.
[5] Caraka Saṃhitā,1.1.9
[6] Caraka Saṃhitā, 1.1
[7] Roy, P., H.N. Gupta, *Caraka Saṃhitā (A Scientific Synopsis)*, 1965.
[8] Sharma, Priyavrat, *History of Medicine in India*, 1992. p.180
[9] Sharma, Priyavrat, *History of Medicine in India*, 1992. p.179
[10] Sharma, Priyavrat, *History of Medicine in India*, 1992. p.181

Milindapañha (2nd C. BCE) mentions many things similar to those of the *Caraka Saṃhitā.* According to Dr. P.V. Sharma, Caraka may be dated after Pāṇini (7th cent. BCE) and before *Milindapañha* (2nd C. BCE) i.e. about 3rd -2nd Cent. CE.

Dṛḍhabala was the son of Kapilabala, born at *Pañcanadapura.* He added the 17 chapters of *Cikitsā-sthāna* along with entire *Kalpa-sthāna.* His time is around 4th Century CE as his father was quoted by Bhāgavata in his *Aṣṭāṅgasaṅgraha,* a work in the 6th Century CE. Apart from the reconstruction of the lost one-third of the *Caraka Saṃhitā* on the basis of other available texts, he probably retouched the entire text and made addition and alterations, for he himself says that he adopted the methods of *'viśeṣonchaśiloccaya'* [11]and thus completed the lost portion. Further, he says that he made it non-deficient in words and ideas and made the *Saṃhitā* complete in every respect as far as possible.

Thus, historical layers may be distinctly analyzed in the *Caraka Saṃhitā* as follows:

1. Ātreya- Agniveśa- 1000 BCE. (original composition)
2. Caraka-3rd- C. BCE. (revision and enlargement)
3. Dṛḍhabala-4th C. BCE. (restoration and reduction)[12]

[11] It is not quite clear from the commentary. The 'uñchaśila' means 'ṛta' (truthful) (Amarakośa 2.9.2) and 'viśeṣa', means 'specific' thus it would mean' collection of specific true facts or ideas'. He consulted the *Tantras* available at that time and collected ideas of facts which are specific on the topic and were tried as effective and successful.

[12]History of Medicine in India, pg. 188

3.4 Manuscripts of *Caraka Saṃhita-*

Library	City	Manscripts No.
University Library	Tubingen,Germany	458,459
Government of India oriental library	Chennai	447
Sanskrit collage Library	Banaras	41
Palace Library	Alwar	1624
Raghunath Temple Lib.	Kashmir	3266, 3209,3330
Palace Library	Jamnagar	--
Deccan collage library	Pune	368,92
Benares Hindu University	Varanasi,	C3688
Anup Sanskrit Lib	Bikaner	3985, 3986, 3995, 3996, 3997
Sarasvati Bhavan	Varanasi	44842, 108824, 108685, 44870, 44870
Bhogilal Leherchand Institute of Indology	Alipur	5283, 5527
UniversitätsBibliothek	Tübingen	I.459, I.460 + I.474
Ānandāśrama	Pune	1546
Bhandarkar Oriental Research Institute (BORI)	Pune	555 of 1875-76, 925 of 1891-95, 64,67
Oriental Research Institute	Mysore,	902
India Office Lib. (IOL)	London,	338,335, 881, 1445b
Maharaja Sawai Man Singh II (MSMS) Museum	Jaipur	2069, 2561
Rajasthan Oriental Research Institute (RORI)	Kota	1563
Gujarat Ayurved University Lib.	Jamnagar,	GAS 103 , 118, 96/2
G. Jha Kendriya Sanskrit Vidyapeetha	Allahabad	25398, 8783/87, 37089
Trinity College Lib.	Cambridge	R 15.85
Asiatic Society	Kolkata	G 4391, 2503/1, 4474/3
Lib. of Calcutta Sanskrit College	Kolkata	23,24
Oriental Institute (OI)	Baroda	12489, 25034

[**Table-3.1**.The reference of these manuscripts have been collected from Indian Journal of Philosophy of Science 44.2 (2009) pp. 163-185 by Phillip A. Maas and from the bibliography of **Caraka saṃhitā: a scientific synopsis** by P.Ray and H.N. Gupta.]

3.5 Editions of the *Caraka Saṃhitā* –

Caraka Saṃhitā has undergone several editions-

1. Jībānnada Vidyāsagar edited *CS* and It was published from Culcutta, in 1877. The second edition had come in 1896 (2nd Ed.).

2. Gaṅgādhar Kaviratana edited *CS* .This was a complete text with commentary *Jalpakalptaru*.It had three Volumes and it was Published by Dharanidhar Roy Kaviraj. The First edition of the book was published from Berhampur (Bangal,) in 1879 and the Second edition came in 1880-81 from Culcutta.

3. Edited by Abinash Chandra Kaviratna (incomplete text with cakarpaṇI datta's commentary Ayurveda Dīpika) published by editor from jotish Prakash Jantralaya; Culcutta, 1884-1888

4. Gupta, Culcutta, 1897

5. Edited by Hari Naāth Viśārad. There was some portion of sutrasthan and vimānasthāna. Published by Visharad Ausadhalay;Culcutta.1892.complete text with cakrapaṇI datta'

6. Text with commentary of Cakrapāṇidatta, Calcutta, 1892-93

7. Jaśodānandana Sarkār, with Bengali translation (Bangabasi edition), 1894.

8. *Caraka Saṃhita* with *Āyurveda Dipikā*, edited by Vaman Keshav Datar, Nirnaya-Sagar Press, Bombay, 1922.

9. Edited by Jotishchandra Saraswati, It was an incomplete text. this edition was published by S.K.Saraswati, from Indian Press; Banaras,1937.

10. *Caraka Saṃhita* with Bengali translation by Satishchandra Kavibhushana, Calcutta,

11. Edition of Upendranath Sen and Debedranath Sen, culcutta

12. Jogindranath Sen's edition with his commentary, Culcutta, 1920 A.D.

13. Edited by shree Gulabkunverba Ayurvedic Society (with introduction, commentary and indices, and with English, Hindi and gujrati translations). Published by the satguru society in six volumes, Jamanagar, 1949.

14. Edited by Jadavaji Tikamji Acharya (complete text of *CS* with Cakrapaṇi datta's commentary) Nirṇaya-Sāgar Press, Bombay,1933,third 1941.

15. Edited by Haridatta sastri(text of *CS* with Cakrapaṇi datta's commentary with editors commentary).Published by Motilal banarasi das ;Lahore 1940-41.

16. Critical edition of *Vimānasthāna* of *Carakasaṃhitā* with an annotated English translation.[13].

3.6 Translations of the *Caraka Saṃhitā*

Caraka saṃhitā was translated into Persian (Pahlavi) by Manaka Hindi and then it was rendered into Arabic by 'Abdulla bin Ali'. Ali Ibn Zain translated Caraka As 'Saraka' from Sanskrit to Arabic in the beginning of the eighth century CE.[14]I

There are many references of Caraka in the Latin translation of the Arabic book *Aburasi*. It had then later translated in Latin as well. The name Caraka occurs as "*Sharaka Indianus*" in the translation of Avicenna, Rhazes and Serapion.[15]

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[13] A series of projects – *"Philosophy and Medicine in Early Classical India I & II"* funded by Austrian Science Fund FWF aims among other things a 'critical edition of *Vimānasthāna* of *Carakasaṃhitā* with an annotated English translation'. The project is running in the Department of South Asian, Tibetan and Buddhist Studies, University of Vienna, Austria. The initial findings of the project are published in a paper in Indian Journal of Philosophy of Science 44.2 (2009) pp. 163-185 by Phillip A. Maas. For the critical edition of the third book of the *Caraka Saṃhitā* i.e. the *Vimānasthāna*, the images of fifty-four manuscripts has been collected from the libraries in India, Europe, and Nepal. All these manuscripts originated in the northern part of India, with the only exception of a quite modern paper-manuscript collected from Mysore. These manuscripts are in four scripts --- forty-three in Devanāgarī, nine in Bānglā, one in Kannada and one in Shāradā. Jadavji Trikamji Acharya's collative edition, in which all the manuscripts have been compared, is chosen as the standard.

[14] H.H. Wilson-On the Medical and Surgical Sciences Of Hindus Oriental Magazine, Work III, London, 1864

[15] History of Indian Medicine, Pg.614

Almansur(753-774 CE) translated the *Caraka* and *Suśruta Saṃhitā* in relation to Toxicology. Rajaj, the court physician of Almansur has mentioned Caraka very respectfully.[16]

K.S.Śāstri has translated the *Caraka Saṃhitā* in Telagu. It was published in 1920 from Madras.

3.6.1 English Translations of *Caraka Saṃhitā*

1. The first English translation was done by A.C. Kaviratana from Kolkata in 1920 A.D.
2. Dr. Bhagvanadas and Ramakarana Sharma translated the *Caraka saṃhitā* in two parts which are published in the Chukhamabha Sanskrit Series.
3. The Chaukhabha Oriental has published the English translation of the *Caraka Saṃhitā* of Dr. Priyavrata Sharma.
4. Gulabkunverba also translated *CS* in 1949. It had published in Jamnagar, Ayurvedic Society.

3.6.2 Marathi Translation of *Caraka Saṃhitā*

1. Vaidya Shankar Daji Shastri Pade translated the *CS* in the year 1901 along with the original verses of the book.
2. Dr. R.L Joshi has translated only three *sthāna* of *CS* and published from Sholapur in 1972.
3. Vaidya Y.G. Joshi has translated and published with his own commentary in 2004.

3.6.3 Hindi Translation of *Caraka Saṃhitā*

1. Vaidya jayadeva Vidyalankara, a scholor from Gurukul kangadi at Haridwar has translated as well as commented on *CS* in Hindi.
2. Vaidya Atrideva Vidyālaṃkār also commented and translated *CS* in Hindi.

[16] Harbilas sharada-Hindu superiority, p.52

3. Mihircandra,(1898) from Bambay,Venkateshvar press.

4. Kalicarana Sharma and Pt. Kḥamapati Sharma, (1900).

5. Jaydev vidyālṃkar, has translated *CS* in three Vol. this translation has been published from Motilal Banarasidas Press, New Delhi.

6. Ravidatta Śāstri' translation of *CS* has been published from, Nirṇaya Sāgar Press, Mumbai, in 1911 A.D.

3.6.4 Bengali Translations of *Caraka Saṃhitā*

1. Kavirāj Dharmadās Sen guptā, translated *CS*, From Sanskrit to Bangali. His work had been published from Valamiki Press, Kolkata.

2. Avinasā Candra' translation of *CS* of had published by Vidyāratna Prss, Kolkata.

3. Yaśonandansarkār' translation of *CS*, had been published in 1910 (2nd ed.) by BangaVasi electo-machine-press, Kolkata.

3.7 The Commentators of *Caraka Saṃhitā*

More than forty Sanskrit commentaries have been written on *CS*.

1. **Patañjali-** His time is probably 2nd C. BCE. His commentary is now not available.

2. **Hariścandra** – Hariścandra was a resident of Ujjain in around 6th century CE. He wrote a commentary called *Carakanyāsa* on the *Caraka Saṃhitā*. Presently the commentary is available only up to the third chapter of the *Sūtra Sthāna*. A manuscript of this commentary is preserved in the Madras Govt. Library.

3. **Jajjaṭa-** Jajjaṭa is the author of the commentary called *Nirantarapadavyākhyā*. This commentary had written in a simple manner. From his commentery it appears that apart from Kashmir recension of *Caraka Saṃhitā,* there was a Saindhavi (sindhi) recension also. However, the complete text is not available now. He is dated around

9th Century CE. The commentary of Jaijjaṭa, revised by Haridatta was published by Madras Government Oriental Library.

4. **Cakrapāṇidatta-** Cakrapāṇidatta is the author of the most famous commentary of the *Caraka Saṃhitā* called *"Āyurveda-Dīpikā"* or *Caraka-Tātparya-Ṭīkā*. He lived in Bengal sometimes in the 11th Century CE. Dr. P.C. Roy considers his work the *Āyurveda-Dīpikā* as a work of 1060 CE.[17] This commentary widely used and followed.

5. **Śivadāsa Sena-** Śivadāsa Sena was also a resident of Bengal. His commentary on the *Caraka Saṃhitā* is called *Tattvapradīpikā*. He is supposed to belong to the 15th Century CE. Only a fragment of his work consisting of twenty-seven chapters of the *Sūtrasthāna* is available in the Royal Asiatic Society Library, Bombay.

6. **Gaṅgādhara Rāi-** Gaṅgādhara's commentary *'Jalpakalpataru'* is very famous. He wrote his commentary on the *Caraka Saṃhitā* with a special stress on the correlation between the principles of this *saṃhitā* and the Indian Philosophy projected though the *Nyāya* and *Vaiśeṣika* system. His time period is 1799-1855 CE.

7. **Svāmī Kumāra-** Svāmī Kumāra has written the *Caraka Pañjikā*. Only a portion of the commentary i.e. up to the fifth chapter of *Sūtrasthāna* is available. He lived in *Avanti* sometimes in the 7th Century CE. A manuscript of this work is available in the Government Library, Madras.

8. **Gayādāsa-** Gayādāsa is referred to by Vijayarakṣita, Niścalakara and Śivadāsa Sena. He is the author of the *Carakacandrikā*, a famous commentary on the *Caraka Saṃhitā*. He should be dated around 11th Century CE, contemporary to Cakrapāṇi.

9. **Narasiṁha Kavirāja-** Narasiṃha Kavirāja is the author of the *Caraka-Tattva-Prakāśa-Kaustubha-Ṭīkā*.

[17] History of Indian Medicine, p. 615.

10. **Vaidyaratna Yogīndranātha Sena-** Yogīndranātha's commentary, known as *Upaskāra* is published from Kolkata in 1920. Recently it is republished by Swami Lakṣhmi Ram Trust, Jaipur.

11. **Āṣāḍhavarman-** He had written a commentary named *Parihārvārtikam.* Vijayarakṣita and Niścalakara has referred to this commentary. This text is not available now. It was written sometimes in the 11th 12th Century CE.

12. **Amitaprabha-** Amitaprabha's time is 9th Century CE. His commentary, *Carakanyāsa* is presently unavailable.

13. **Sadānanda-** Sadānanda's commentary is *Auśadhivivṛti.* It has been published from Marchantel press, Lahore in 1926.

There are several commentaries of the *Caraka Saṃhitā* which are no longer available. However, other authors have given their references and quotations. A list of these commentators is prepared below:

1. Himadatta. 2. Vaiṣnava 3.Aruṇa data. 4. Amarākar

5. Bhadravarman(9th A.D.) 6. Bhāsadatta (10/11th A.D.)

7. Bhīmadatta (10th /11th A.D.) 8.Bhoja 9. Brahmadeva

10. Celladeva (8th A.D.) 11. Ḍalhaṇa 12. Govardhana

13. Guṇākara (11th A.D.) 14. Hemacandra 15. Hemādri

16. Himadatta 17. Indukara 18.Īśvaraṣena 19.Jayanandin

20. Kārtika/kund 21. Mādava 22.Medhāvin 23. Munidāsa.

24. Nāgadeva 25. Naradatta 26. Saīdeva 27. Śrīkaṇṭha

28. Svāmī Dāsa 29. Vaiṣṇva 30. Vācaspati.

3.8 The Structure of the *Caraka Saṃhitā*

The subject matter of the *Caraka Saṃhitā* has divided into eight *sthānas* (sections) and 120 *adhyāyas* (chapters). The quadruped style of Pāṇini and Patañjali is present in remnant form in only chapters (1,2, Cikitsā sthāna).

Name of the Section	No. of Chapter	Concepts
1.Sūtra Sthāna	**30**	Origen, basic principal, and Philosophy
2.Nidāna Sthāna	**08**	Causes of disease
3.Vimāna Sthāna	**08**	Factors affecting drug administration
4.Śārīra Sthāna	**08**	Anatomy and physiology
5. Indriya Sthāna	**12**	Prognosis
6.Cikitsā Sthāna	**30**	Diagnosis and treatment of diseases
7. Kalpa Sthāna	**12**	Pharmacy
8. Siddhī Sthāna	**12**	Cure of diseases by purification therapy.

[Table3.2 : Sthānas , chapters number and content of caraka saṃhitā, according the information given in '**A Text Book Of History of Ayurveda' by**]

The *Caraka Saṃhitā* contains 120 chapters. The number of 120 appears to bear some significance in as much as the other two among the 'Great Trio' also contain 120 chapters. The total number of chapters probably indicates the maximum life span of man because the ultimate object of treatise is to promote longlivity. The title of some chapters, which are based on the first word occurring in the chapters, are also suggestive of its contents[18].In some other cases, the name of a chapter is based upon the subject matter discussed[19].At the end of each chapter, contents are given in brief under the caption, "*Tantra-śloka*". All of them are in verse form.

[18] Caraka Saṃhitā, 1.1. 1:3.
[19] Caraka Saṃhitā, 1.9.

Adhyāya	Content	Sūtra/verses
Dīrghañjīvitīyādhyāya	Origin of *Āyurveda*, composition of medical text,Pañcamahābhūta, Padārtha, etc.	140
Apāmārgataṇḍulīyādhyāya	Description of Drugs deals with elimination and purgation and administration of pañcakarma.	36
Āragvadhīyādhyāya	Details of recipes for *vāta,vātarakta,pārśvaruk*.allevaition of cold and poisoning, diaphoresis, headache.	30
Ṣḍvirecanaśtāśritīādhyāya	Description of six hundred recipes for purgation, ingredients, Decoction, pharmaceutical processes.	29
Mātrāśitīyādhyāya	Quantity of food,use of collyrium, smoking, oiling, and things of daily routines.	111
Tasyāśitīyādhyāya	Dietetics and regimen for different seasons.	51
Navegāndhāraṇīādhyāya	Non-suppressions of natural urges, effect of exercise, physical constitution etc.	66
Indriyopakramaṇīyādhyāya	Description of sense organs.	34
Khḍḍākacatuṣpādāādhyāya	Qualities and duty of physician, medicament,medical attendant, and patient.	28
Mahācatuṣpādādhyāya	Utility of medicine and details of prognosis.	24
Tistraiṣaṇīyādhyāya	Three basic desires Longevity wealth and happiness for future, rebirth and seven triads.	65
Vātakalākalīyādhyāya	Merits and demerits of vāta.	17
Snehādhyāya	Details of oleation therapy	100
Swedadhyāya	Factors sign materials and types of fomentation.	71
Upkalpanīyādhyāya	Description about the requirements of a Physician	25
Cikitsāprābhṛtīyādhyāya	Duties of a qualified physician	41
Kiyantaḥśirasīyādhyāya	Enumeration of diseases relating to head ,heart, Etiopathology of diabetics mellitus.	121
Triśothīyādhyāya	Three types of swelling and their cure.	56
Aṣṭodarīyādhyāya	Number of the various types of Abdominal diseases	9

Mahārogādhyādhyāya	Classification of diseases on the basis of vatā, *pitta* and *kapha*.	25
Āṣṭauninditīyādhyāya	Eight types of undesirable constitution, obesity and sleep	62
Lṁghnabṛṁhaṇīyādhyāya	Dialogue regarding reducing and Nourishing therapies pharmacology.	44
Santarpaṇīyādhyāya	Disadvantage of excessive nourishing diet and their management. Recipe for nourishing therapy.	40
Vidhiśoṇitīyādhyāya	Description about blood and its diseases, Pathogenesis of psychic disorders.	60
Yajjḥpuruṣīyādhyāya	Origin of Man and his diseases	51
Ātreyabhdṛakāpyīyādhyāya	Discourse among Ātreya and Bhadrakāpya etc. about *rasa* matter etc.	113
Annapānavidhi	Properties of diet and drinks	352
Vividhaaśitapītīyādhyāya	Various types of food and drink	48
Daśaprāṇātanīyādhyāya	Ten resorts of life	14
Arthedaśamahāūlīyādhyāya	Synonyms and importance of hearts, definition of *āyurs*, details of *āyurveda* etc.	89
Jvaranidānādhyāya	Diagnosis of fever and its type , synonyms and means of diagnosing a disease, sign and symptoms and pathogenesis	44
Raktapittanidānādhyāya	Diagnosis of *Rakta-pitta*-a condition characterized by bleeding from various parts of body.	29
Gulmanidānādhyāya	Diagnosis of Phantom tumor and its type	18
Pramehanidānādhyāya	Diagnosis of *Prameha* or obstinate urinary disorders including diabetes mellitus	55
Kuṣṭhanidānādhyāya	Diagnosis of Kuṣṭa or obstinate skin diseases including leprosy	16
Śoṣanidānādhyāya	Diagnosis of consumption	17
Unmādanidānādhyāya	Diagnosis sign symptoms and types of insanity.	24
Apasmāranidānādhyāya	Origin sign symptoms therapy and diagnosis of epilepsy	44

Rasavimānādhyāya	Specific attributes of rasa and *Doṣa*, eight factors determining the utility of food and rules for taking food.	28
Trividhakukśīyavimānādhyāya	Specific characteristics of stomach capacity and diagnosis of *Āma doṣa* ,*Āmāśaya* and its function.	19
Janapadodhvaṁsanīyavimānādhyāya	Details of epidemics diseases, cause of pollution, Yugas, span of life, death and elimination therapy	52
Trividhadharogaviśeṣavijñānīādhyāya	Determination of factors for understanding diseases.	14
Strotovimānādhyāya	Details of channels of circulation	31
Rogānīkavimānādhyāya	Specific characteristics of diseases	22
Vyādhitarūpīyavimānādhyāya	Specific characteristics of patients	32
Rogabhiṣgjitīyavimānādhyāya	Specific requirements of treatment, duties of medical students, different types of debate, examination strategies. Taste of different drugs. Enema	157
Katidhāpuruṣīyaśārīrādhyāya	Empirical soul concepts of puruṣa, mind, sense organs, Mahābhūtas, 24 el ements, desire and miseries, and yoga	156
Atulyagotrīyaśārīrādhyāya	Embryological development.	48
Khuḍḍikāgarbhavakrāntiśārīrādhyāya	Formations of embryo, factors responsible for procreation ,factors from parents and *panñchamahābhūta* and hereditary abnormalities etc.	27
Mahatīgarbhavakrāntiśārīrādhyāya	Composition of foetus, *garbha*,process of conception, development of fetus –month-wise, problems.	45
Puruṣavicayaśārīrādhyāya	Individual and universe	26
Śarīravicayaśārīrādhyāya	Constitution of physique, process of delivery etc.	34
Śarīrasaṁkhyāśārīrādhyāya	Enumeration of organs, parts of body, major orifices etc.	20
Jātisūtrīyaśārīrādhyāya	Methods of procreation, treatment and care of pregnant woman. Delivery and labor pain,	69

	care of new-born baby and mother. and excellence of breast milk, etc.	
Varṇasvarīyendriyādhyāya	Changes in complexion and voice indicating imminent death.	27
Puṣpitakendriyādhyāya	Changes in odor indicating imminent death.	23
Parimaśanīyendriyādhyāya	Tactical changes indicating imminent death.	7
Endriyānīkendriyādhyāya	Characteristics features of sense organs indicating imminent death.	27
Pūrvarūpīendriyādhyāya	Details of premonitory symptoms of disease indicating imminent death.	47
Katamāniśarīrendriyādhyāya	Physical features of patients indicating imminent death	25
Patrarūpīyendriyādhyāya	Conditions of pupil indicating imminent death.	32
Avākśirasīyendriyādhyāya	Inverted shadow indicating imminent death	27
Yasyaśyāvanimittendriyādhyāya	Coloration of eyes indicating imminent death	24
Sadyomaraṇīyendriyādhyāya	Sign indicative of impending sudden death.	21
Aṇujyotīyendriyādhyāya	Diminution of bodily heat indicating imminent.	29
Gomayacūrṇīyendriyādhyāya	Appearance of a substance resembling cowdung powder indicating imminent death.	90
Rasāyanādhyāya>>>abhayā malakīya rasāyanapāda	Rejuvenation therapy, types, medicine, methods of collecting drugs, attributes and recipes of *Harītakī, Cyavana Prāśa,*	234
Prāṇakāmīyam rasāyanapāda	*Āmlakaghṛta,avaleha,Cūṛna*, And different types of *Bhallātaka*	
Karapracitīya rasāyanapāda	Rejuvenation therapy dealing with by the administration of *Āmalakī,* different types of *rasāyana.*	
Āyurvedasamasthānīyam rasāyanapāda	Fourth quarter of the chapter on rejuvenation therapy dealing with original propagation of *Āyurveda.*	
Vājīkaraṇādhyāya saṁyogasaramūlīya Vājīkaraṇpāda	Aphrodisiacs dealing with Saṃyoga *śarmūla.* Objects of aphrodisiacs and its excellence.	169

Āsiktakśīrika Vājīkaraṇpāda	Second quarter of the chapter on Aphrodisiacs dealing with *āsiktakṣīrika.*	
Māṣaparṇabhṛutīya Vājīkaraṇpāda	Third quarter of the chapter on aphrodisiacs dealing with *Māṣaparṇābhṛtīya.*	
pumāñjātabalādika Vājīkaraṇpāda	Fourth quarter of the chapter on aphrodisiacs dealing with semen attributes of semen, and different types of drugs for *Vajīkaraṇa.*	
Jvaracikitsādhyāya	Mainly deals with different types of fever factors and treatment. Administration of emetics diet, ghee, kaṣaya, yavāgū, purgtion fumigation and coll yrium, variouse therapies.	346
Raktapittacikitsādhyāya	Treatment of *Rakta pītta*, prognosis, diet line treatment.	111
Gulmacikitsādhyāya	Treatment of Phantom Tumor, different types, Bloodletting and its utility, surgery, Massage therapy, diets and drinks, incurability and complication.	188
Pramehacikitsādhyāya	Treatment of Obstinate Urinary disorders including diabetes.	61
Kuṣṭhacikitsādhyāya	Treatment of *Kuṣṭha* and different skin desiese	180
Rājayakśmācikitsādhyāya	Treatment for Tuberculosis, origin factors and types, sign and symptoms, specific utility of meat and alcohol etc.	191
Unmādacikitsādhyāya	Treatment of *Unmāda* (insanity),sign/symptoms types incurability, smoking and bloodletting therapy,	98
Apasmāracikitsādhyāya	Treatment of epilepsy, causative factors pathogenesis, sign, symptoms varieties, and different types of recipes.	68
Kśatakśīṇacikitsādhyāya	Treatment of Phthisis , pathogenesis, sign, symptoms varieties and different types of recipes	97
Śvayathucikitsādhyāya	Treatment of Oedema, variety, pathogenesis, sign, symptoms, different stages, medicines	103

	therapies hernia and scrotal tumor, fistula-in-ano, Elephantiasis etc.	
Udaracikitsādhyāya	Treatments of the diseases related with stomach, Etiologies and pathogenesis, different types of *cūrṇa*, and *gṛta*, and administration of Snake-Venom, surgical Measures.	196
Arśaścikitsādhyāya	Treatments for piles, types, etiology recipes, diet , details of Enema etc.	255
Grahaṇīdoṣacikitsādhyāya	Treatments of Sprue-syndrome, Process of Digestion, Process of metabolic transformation time taken, circulation of *rasa*.different types of meals etc.	249
pāṇḍurogacikitsādhyāya	Treatments of Anemia, types pathogenesis, sign, symptoms	139
Hikkaśvāsacikitsādhyāya	Treatment of Hiccup and Asthmaa, varieties and etiology pathogenesis, smoking therapy, diet, drink and inhalation therapy.	151
Kāsacikitsādhyāya	Treatments of Bronchitis, types cause of variation in Pain, sign and symptoms Recipes and therapies.	191
Atisāracikitsādhyāya	Treatment of Diarrhea, Types, , sign and symptoms, prolapsed of rectum, types, Anal suppuration, Enema etc.	123
Chrdicikitsādhyāya	Treatment of Vomiting, types, etiology, Pathogenesis, sign and symptoms.	48
Visarpacikitsādhyāya	Treatment of Erysipelas and Herpes, types, etiology, Pathogenesis, sign and symptoms cauterization and surgical intervention etc.	146
Tṛṣṇārogacikitsādhyāya	Treatment of Morbid Thirst. Types, etiology, Pathogenesis, sign and symptoms. Use of rain water etc.	63
Viṣacikitsādhyāya	Treatment of Poisoning, types of poison, effects, stage of Poisoning, Augmentation and diminution of Poisoning, Recipes etc.	254
Madātyayacikitsādhyāya	Treatment of Alcoholism, useful and harmful	211

	effects of alcohol, stage of alcoholic intoxication, therapies etc.	
Dvivraṇīyacikitsādhyāya	Treatment of Ulcers, varieties, surgical intervention, types of surgery.	21
Trimarmīcikitsādhyāya	Treatment of afflictions of three vital organs, different causes of Dysuria and their sign symptoms, treatments and pathogenesis of nasal problems, head and mouth, eyes and teeth	294
Ūrustambhacikitsādhyāya	The treatment of spasticity of the thighs.	62
Vātavyādhicikitsādhyāya	Treatment of diseases caused by *vāyu*, Importance, divisions, function, different aggravation, occlusions of *vāyu* by different organ etc.	249
Vātaśoṇitacikitsādhyāya	Treatment of Gout and arthritis.	165
Yonivyāccikitsādhyāya	Treatment of different types of gene-problem , seminal and lacteal morbidities	341
Madanakalpādhyāya	Pharmaceutics of *Madana, Vamana-virecana*, Appropriate habitat, time, methods collection and storage of drugs, various recipes of *Madana-Phala* etc.	30
Jīmūtakalpādhyāya	Pharmaceutics of Jīmūtaka, recipes of *Jīmūtaka*, and their effects.	15
Ikśvākukalpādhyāya	Pharmaceutics of *Ikṣvāku*, recipes and their effects.	23
Dhāmārgavakalpādhyāya	Pharmaceutics of *Dhāmārgava*, various recipes	29
Vatsakakalpādhyāya	Pharmaceutics of *vatasaka*, various recipes	12
Kṛtavedhanakalpādhyāya	Pharmaceutics of *Kṛtavedhana*, various recipes	14
Śyāmātrivṛtkalpādhyāya	Pharmaceutics of *Śyāmā-Trivṛt*,synonyms various recipes	80
Caturaṁgulakalpādhyāya	Pharmaceutics of Caturaṃgula, various recipes and their uses.	18
Tilvakakalpādhyāya	Pharmaceutics of *tilvak*, various recipes	18

Sudhākalpādhyāya	Pharmaceutics of *sudā*, various recipes	22
Saptalāśakhinīkalpādhyāya	Pharmaceutics of *saptalā-śkhinī*, various recipes	19
Dntīdravantīkalpādhyāya	Pharmaceutics of *dantī-dravantī*, various recipes their digestion characteristics, types of cooking etc	107
Kalpanāsiddhi adhyāya	Procedure for successful administrative of *Pañca-Karma*, different type of therapies and their administration.	60
Pañcakarmīyāsiddhi adhyāya	Description of indication and contra-indications for successful administration of *Pañca-karma* therapy.	28
Bastisūtrīyāsiddhi adhyāya	Perfection in treatment though knowledge of *Basti*- Principals.	71
Snehavyāpatsiddhi adhyāya	Complications of unctuous enema and their successful management.	56
Netrabastivyāpatsiddhi adhyāya	Complication of defective nozzle, etc., and their treatment.	19
Vamanavirecanavyāpatsiddhi adhyāya	Complication of wrongly administered emetic and purgation therapies and their successful treatment.	95
Bastivyāpatsiddhi adhyāya	Complication of enema therapy and their treatment.	66
Prāsṛtayogīyavyāpatsiddhi adhyāya	Recipes for *Nirūha*, treatments of different types of Diarrhea	46
Trimarmīyavyāpatsiddhi adhyāya	Diseases of vital organs and their treatment.	119
Bastisiddhi adhyāya	Effective recipes of medicated enema for different diseases.	48
Phalamātrāvyāpatsiddhi adhyāya	Determination of appropriate drugs for enema and its veterinary dosage.	37
Uttarabastisiddhi adhyāya	Description of excellent enema recipes.	55

[Table3.3 : *Adhyāya* of *caraka saṃhitā* and their content , According to the information given in **Agnivesa's Caraka Samhita : Text with English Translation and Critical Exposition Based on (Cakrapani Datta's Ayurveda Dipika)**]

Sūtra- *Caraka Saṃhitā* is written in *sūtra* and prose style. The *sūtras* of the *Caraka Saṃhitā* is classified into the following four categories:-

1. *Guru-sūtra*-the statement made by teachers. Ex. Sūtra-1:4:22.
2. *Śiṣya-sūtra*- the statement or enquiries made by the Disciple. Ex. 1:4:21
3. *Prati-saṃskartṛ-sūtra*- The statements of the redactor. Ex. 1:4:22
4. *Ekīya-Sūtra*- or the statement made by individual scholars. Ex. 4:6:21

In the *Caraka Saṃhitā* the tradition of the order of describing a topic is this--

- *Uddeśa* (statement in brief)[20]
- *Nirdeśa* (detailed expansion of the brief statement)[21]
- *Lakṣaṇa* (definition)[22]

Presentation and Seminar

The *Caraka Saṃhitā* is presented in the following three different forms :

1. As the record of the proceeding of a seminar or debate.
2. As a dialogue between the teacher and his disciple
3. As a narrative of instructions.

3.9 Content of the *Caraka Saṃhitā*

Caraka Saṃhita is divided into 8 *sthānas*. Each *sthāna* discusses a particular area of *āyurveda*. The division of *Caraka Saṃhitā* into eight sections is based on the distribution of topics dealing with specific aspects of the fundamental principles and the applied therapeutics. Content of each section are explained below—

[20] Caraka Saṃhitā,1:28-29
[21] Caraka Saṃhitā,1:1:44
[22] Caraka Saṃhitā,1:1:45

3.9.1 *Sūtra Sthāna-*.

The *Sūtra-sthāna* deals with the origin and propagation of *āyurveda*, the *mahābhūtikā* i.e. the composition of the universe, their relationship with the composition of human body with special reference to the *dhātus* or the basic tissue elements. The mode of drug action is also described here. Various attributes of food ingredients including methods of preparation and effects of food ingredients on human body is also described. It efficiently touches all the aspects of health maintenance, pathology, pathogenesis, treatment principals, food etc. The fundamental principal governing the line of treatment and contents of the entire work in brief are furnished. Besides, universality and eternity of *āyurveda* has explained. This part gives a glance of the whole text.

Moreover, the matter of *Sūtrasthaāna* is divided into seven *Catuṣṭaka* (quadruplets). There are total of thirty chapters divided into seven *catuṣṭaka* comprising 28 chapters and the last two are grouped to form the *Saṃgraha adhyāya* (concluding chapters).

Auṣadhi catuṣṭaka : Briefly describes the evolution of *āyurveda*, principals of properties of substances, prerogatives and essentials for performance of *pañcakarma.*

Svāsthya catuṣṭaka : These chapters talks about the maintenance of health. It deals with daily routines like dietetic rules and regulations, avoidance of withholding physical natural urges, and withholding temperamental urges.

Nirdeśa catuṣṭaka: This quadruplet describes the patient in general, drug, and the nurse and physician's qualities.

Kalpanā catuṣṭaka –The prerequisites of *pañcakarma*, and sedan has covered under this expanse along with some treatment of principals.

Roga catuṣṭaka- Various types of diseases, their classification, attributes of a particular condition leading to derangement of just one *doṣā* have been dealt with.

Yojana catuṣṭaka- Types of diseases, depending upon the course adopted for their treatment and the disorders of the blood has explained in this *cartuṣṭaka.*

Annapāna catuṣtaka- Properties of most of the then available eatables has specified in this part.

Saṅgraha catuṣtaka- These are of a type of self and discussed about the Function of heart..

3.9.2 *Nidāna sthāna-*

The etio-pathigenesis of diseases and their applications in all deranged conditions has described with eight model diseases—*Jvara* (Pyrexia), *Raktapitta* (blood deformities), *Gulma* (mass like formation), *Prameha* (pre-diabetic condition), *Kuṣṭha* (skin diseases), *Śoṣa* (chachexia), *Unmāda*(Psychological disturbances) and *Apasmāra* (epileptics conditions).

3.9.3 *Vimāna Sthāna-*

This is a specialty of the *Caraka Saṃhitā*. It reconsiders the topics mentioned in the *sūtra sthāna* and still elaborates and explains them further. To name some, this chapter discusses the properties of specific drugs, diseases, and approach to personal constitution. It gives the details of the factors, responsible for a person's health, the place in which a person is born and brought up, the place of a person's body which is afflicted, the patient, *bala* or energy reserves to tolerate the disease as well as the drug etc.

3.9.4 *Śārīra Sthāna-*

The origin and destruction of the live body and all the processes which occur in between these two phenomena are described. It gives the whole description about a human body and its structure.

3.9.5 *Indriya Sthāna-*

This *sthāna* gives the details of prognostics signs and symptoms in a broad manner. The focus of this *sthāna* is the diagnosis and prognosis. It also describes the fundamental governing the prognostic sign.

3.9.6 Cikitsā-Sthāna-

In this *sthāna* the management of the healthy person as well as the treatment of diseases is described. The prescriptions deal more with the applied rather than theoretical aspects. All the information regarding the pathogenesis and treatment of the diseases mentioned in the *Nidāna sthāna* has again described here elaborately. In addition to these diseases, twenty more diseases have been described. The first two chapters are *Rasāyanādhyāya* (rejuvenation therapy) and Vājīkaraṇa respectively. These chapters have 4 sections each. This sthāna has a total of thirty chapters.

3.9.7 *Kalpa Sthāna-*

It deals with the pharmacy section of the Caraka Saṃhitā and gives information about various pharmaceutical aspects of certain medicinal preparations and their utilization.

3.9.8 Siddhi-Sthāna -

This section of the *Caraka Saṃhitā* describes the principals of governing the administration of elimination therapies. It discusses about the cure from the diseases and deals exclusively with the various aspects of the classical form of Ayurvedic treatment popularly known as *pañcakarma.*

Thus, all the eight branches of *Āyurveda* are discussed in this text, even though, it considered to be the primarily a work on *Kāyacikitsā.*

3.10 Contributions of *Caraka Saṃhitā*[23]

The major contributions of the *Caraka Saṃhitā* are as follow:

- **Scientific Symposia and Seminars-** the tradition of scientific symposia and seminar has rightly exposed in it. Discussion with experts on particular subject had considered necessary for arriving at logical conclusion and improve knowledge.

[23] Agnivesa's Caraka Samhita : Text with English Translation and Critical Exposition Based on (Cakrapani Datta's Ayurveda Dipika)

- **Fundamental Doctrine**- Though the basic concepts are found in their formative stage even in Vedas, they are fully developed and crystallized in the *Carka Saṃhitā*. These concepts include the theories of *Pañca Mahābhūta, Tridoṣa* and harmacodynamics *(Rasa-Guṇa Vīrya-viāpaka- Prabhāva)* All these are again based on the law of Uniformity of Nature (*Loka-puruṣa-sāmānya*) which was scientifically established by the sages.

- **Investigating Attitude**- The method of investigation rather than empirical attitude has been advocated in the *Caraka Saṃhitā*. That is why the word *'parīkṣa'* has used several times instead of *'pramāṇa'*. Moreover, proposition of a new *pramāṇa 'yukti'* shows the rational attitude of the *Caraka Saṃhitā* that first examines and then proceeds.

- **Psychosomatic concepts**- the person has duly recognized as *ṣaḍdhātvātmaka* consisting of matter as well as spirit. This has further advanced in the realms of Physiology and Pathology where both body and mind interact and cause events.

- **Expansion of ideas**- Previously *āyurveda* was *'Triskandha'* (having three Trunks) which was expanded further by Caraka. *Nidāna-Pañcaka* was developed from *hetu* and *linga.*

- **Individual variations**- organism is better than mechanism and each individual has got his special make-up called *'Prakṛti'*(constitution) which is an important consideration. On one side, the theory of *Tridośa* is a generalized concept and, on the other side, the concepts of *Prakṛti* are quite specialized one. Thus, unique synthesis of general and particular is found in the *Caraka Saṃhitā.*

- **Concepts of Natural Immunity and Nature-cure**- Caraka emphasized on the natural process for prevention and cure. On prevention side, the *ojas* (principle of *Vyādhikṣamatava* has to be pointed and, on the cure side, the theory of *Svabhāvoparama* is accepted. The method of treatment is only to help the nature. It is the natures, which prevents or cure disease. That is why the emphasis has been given on the *Rasāyana* therapy including *Ācāra-Rasāyana.*

- In course of time, the *Caraka Saṃhitā* earned great reputation and became the most authoritative text representing the School of *Kāyācikitsā.*

3.11 Computer Adaptation of Caraka *Saṃhitā*

The *Caraka Saṃhitā* has multi-layered hierarchy. As previously described, it is divided into *sthānas*. Each *sthānas* has chapters. The text is written in prose as well as poetry style. Therefore, each chapter has verses and *sūtras*. The hierarchy of *Caraka Saṃhitā* is-

Sthāna → Adyāya→Sūtra

For preparing the indexing system of the *Caraka Saṃhitā,* the computer adaptation and a relational database development is required. The database of the *Caraka Saṃhitā* has three tables as follows –

- AdhyāyaSthāna
- Sthāna
- Sūtra

Each section of every level is given a unique identity and adjoined to the tables of other levels.

Data Structure of each table is as follow

Sthāna table

sthanaID	int
sthanaName	nvarchar(255)

[Table 3.4- Database structure of sthān table (without data]

AdhyāyaSthāna table

sthanaID	int
adhyayaID	int
adhyayaName	nvarchar(255)
adhyayaIDSequencial	int

[Table 3.5: Database structure of AdhyāyaSthāna table (without data)]

Sūtra table

ID	int
AdhyayaID	nvarchar(10)
SutraID	nvarchar(10)
sutraSamhita	nvarchar(1000)
sutraPada	nvarchar(1000)
AdhyayaIDSequencial	int

[Table 3.6: Database structure of Sūtra table (without data)]

In the first table, there are two-columns - **sthana_Id** and **sthana_name**. In these columns, the *sthāna* and its unique id has been given. The names of the *sthānas* are also in this table. It connects with the *adhyāya* column of the second table. The structure for database storage is as follows:

sthan_id	**sthan_name**
1	सूत्रस्थान
2	निदानस्थान
3	विमानस्थान
4	शारीरस्थान

[Table 3.7: Structure of database storage, it is first table among three called 'sthāna']

Second table is called AdhyayaSthana. It has **SthanaID, AdhyayaID, AdhyayaName** and **AdhyayaNoSequencial. Sthana** table has unique id of the *sthāna*. AdhyayaID has unique ID which connects with the **AdhyayaSequential** column of this table. **AdhyayaName** has name of each *adhyāya*. The structure for database storage is as follows:

sthanID	adhyayaID	adhyay_name	adhyayaNo
1	1	दीर्घञ्जीवितीयाध्याय	1
1	2	अपामार्गतण्डुलीयाध्याय	2
1	3	आरग्वधीयाध्याय	3
1	4	षड्विरेचनशताश्रितीयाध्याय	4

[Table 3.8: Structure of database storage, it is first table among three called 'Adhyāya']

The sutra table has four columns. Adhyayaid stores the unique id if each adhyaya, sutraid stores unique id of each sūtra, sutrasamhita has the samhitā pāṭha and the sutrapada has the pada pāṭha of the text. Each column has some connection with appropriate columns in other tables

The structure for database storage is as follows:-

ID	AdhyayaID	sutraID	sutraSamhita	sutraPada	AdhyayaSequential
1	1	1	अथातो दीर्घ जीवितीयमध्यायं व्याख्यास्यामः	अथातो दीर्घ जीवितीयमध्यायं व्याख्यास्यामः	1
2	1	2	इति ह स्माह भगवानात्रेयः	इति ह स्माह भगवानात्रेयः	2
3	1	3	दीर्घञ्जीवितमन्विच्छन्भरद्वाज उपागमत् । इन्द्रमुग्रतपा बुद्ध्वा शरण्यममरेश्वरम्	दीर्घञ्जीवितमन्विच्छन्भरद्वाज उपागमत् । इन्द्रमुग्रतपा बुद्ध्वा शरण्यममरेश्वरम्	3

[Table3.9 : Structure of database storage, it is first table among three called 'sūtra']

Chapter 4

Implementation of the Indexing System

Chapter 4

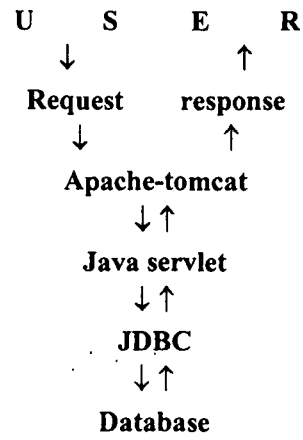
Implementation of the Indexing System

4.1. Introduction

This chapter describes the implementation of Automatic Indexing of *Caraka Saṃhitā (CS)* as a part of the present M. Phil. Research. The computational model uses Java in the web format for the indexing of words occurring in *Caraka Saṃhitā* through the identification and connection with the original *sūtra* stored in the database. The system accepts three kinds of search inputs and gives analyzed output according to that. The first input mechanism is '**Direct Search**' where the user can enter a keyword in Devanāgarī Unicode UTF-8 and get all the references and details from *Caraka Saṃhitā*. The second is '**Alphabetical Search**' facility where one can just click a letter of Devanāgarī alphabet to get the index of the words starting with that alphabet. The third input mechanism is '**Search by Classes**' where the user can click on **"Sthāna"** → **"Adhyāyas"** to get the index of each word of the selected Adhyāya. Clicking on an indexed word will display the details with the *sūtra* in which it occurs. It also gives facility to search that word in some other online lexical resources.

4.2. Architecture of the system

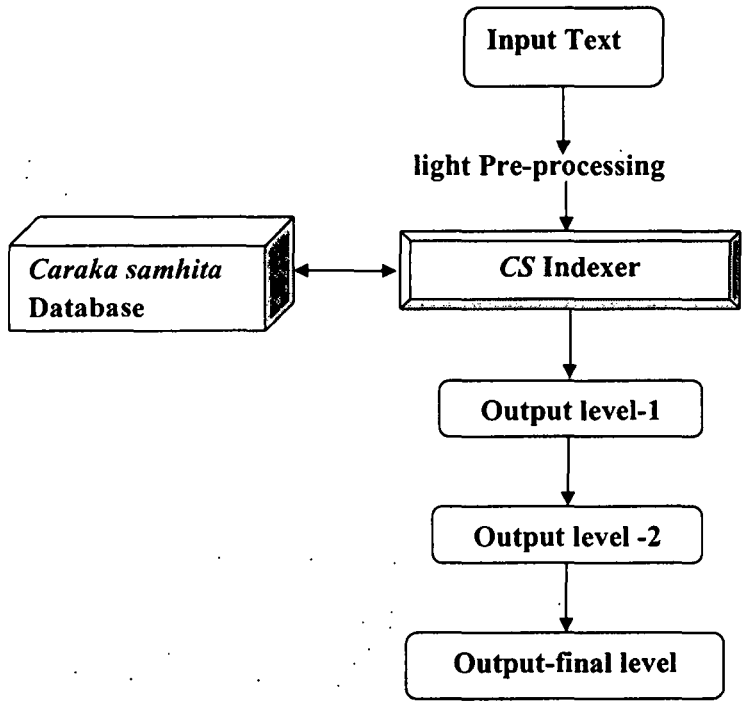
The indexing system of *CS* is developed in front-end of JSP with Java servlet, Back-end of RDBMS and JDBC connectivity. The web server for Java/JSP is Apache Tomcat 4.0 and the RDBMS used is MS-SQL Server 2005 Database in Unicode scheme. The following model describes the interaction between multi-tier architecture of the indexing system of *CS*:



[Fig 4.1: Multi-tier architecture of the Caraka saṁhita Indexer]

4.3. Process of the Indexing system

There are three ways to give input to the system e.g. Direct Search, Alphabet search and Search by the structure of the text in Devanāgarī UTF-8 format



[Fig 4.2: Process of Indexing system]

Step I: Preprocessing

Preprocessing a text mainly consists of normalizing it. It identifies the symbols and punctuations which may have been accidently inserted in the query and cleans the text. This is only needed in the direct search.

Step II: *CS* Indexer and Database

At this step, the indexer makes an indexed list of exact and matching words. Getting the query as an input, the indexer, after a slight preprocessing, sends it to the database. If the word has its occurrence in the database, the system gives the output. And if the exact match is not found, it gives in result the words in which the queried word occurs as part or substring.

Step III: Output level-1

At this level, the indexer gives all the occurrences of the searched query with its numerical reference in a hyperlinked mode.

Step IV: Output level -2

Clicking any hyperlinked word in output level 1, the system shows its original place in the *sūtra* and also gives its full reference in the text. It also offers to bring further information from other online lexical resources.

Step V: Output - final level

Here, the indexer gives a list of online lexical resources and gives the facility to do morphological analysis of the query with the help of POS Tagger[1] and Subanta Analyzer[2] and search the word in other online lexical resources.

[1] http://sanskrit.jnu.ac.in/post/post.jsp
[2] http://sanskrit.jnu.ac.in/subanta/rsubanta.jsp

4.4. The Front-end of the *CS* Indexer

The front-end of this indexer contains the JSP page, Java classes and web server Apache Tomcat 4.0. In this portion there are three JSP pages- **index.jsp, ibasic.jsp, searchNet.jsp**. index.jsp shows the content of the front page. ibasic.jsp is the main jsp page which makes search and gives results. The third searchNet.jsp sends the searched word to external links for final level search.

4.4.1. Java Server Pages

Java Server Pages (JSP) technology is the Java platform technology for delivering dynamic content to web clients in a portable, secure and well-defined way. The Java Server Pages specification extends the Java Servlet API to provide web application developers with a robust framework for creating dynamic web content on the server using HTML, and XML templates, and Java code, which is secure, fast, and independent of server platforms. The Java Server Pages 1.2 specification provides web developers with a framework to build applications containing dynamic web content such as HTML, DHTML, XHTML and XML. A JSP page is a text based document containing static HTML and dynamic actions which describe how to process a response to the client in a more powerful and flexible manner. Most of a JSP file is plain HTML but it also has, interspersed with it, special JSP tags.

To process a JSP file, one needs a JSP engine that can be connected with a web server or can be accommodated inside a web server. Firstly when a web browser seeks a JSP file through an URL from the web server, the web server recognizes the .jsp file extension in the URL requested by the browser and understands that the requested resource is a Java Server Pages. Then the web server passes the request to the JSP engine. The JSP page is then translated into a Java class, which is then compiled into a servlet.[3]

The Code Description of Main JSP Page

This function of JavaScript sends the search query to the java classes-

[3] http://www.roseindia.net/jsp/javaserverpagestutorial.shtml

```
        function submitForm2(ddfocus, searchtype){
              //alert(searchtype);
              document.forms[1].ddfocus.value=ddfocus;
              document.forms[1].searchtype.value=searchtype;
              document.forms[1].submit();
        }
    </script>
```

The following code imports the main java class 'Ayur' to the jsp page

```
<%@ page import="Ayur" %>
```

The following code sets the language and encoding setting of jsp page.

```
<%@ page
    language="java"
    pageEncoding="utf-8"
    contentType="text/html; charset=utf-8"
    import="java.util.*"
%>
```

The following code declares different variables --

```
<%! Hashtable sthanas, adhyayas, wordlist; %>
<%! Enumeration en; %>
<%! String key, val; %>
```

The following code declares the basic search variables and their initial values--

```
<%
	Ayur a = new Ayur();
	request.setCharacterEncoding("UTF-8");
	String searchtype = "direct";
	int sthana = 0;
	int adhyaya = 0;
	int sutra = 0;
	String ddfocus="sthana";
	String token="";

	String searchstr="";
```

The following code obtains the values of previously declared search variables---

```
	try{
		ddfocus = request.getParameter("ddfocus");
	}
	catch(Exception e){
		ddfocus="sthana";
	}
```

```
try{
      searchtype = request.getParameter("searchtype");
}
catch(Exception e){
      searchtype="direct";
}


try{
      searchstr = request.getParameter("itext");
}
catch(Exception e){
      searchstr="";
}


try{
      sthana = Integer.parseInt(request.getParameter("sthana"));
}
catch(Exception e){
      sthana=0;
}

try{
```

```
        adhyaya = Integer.parseInt(request.getParameter("adhyaya"));
    }
    catch(Exception e){
        adhyaya=0;
    }

    try{
        sutra = Integer.parseInt(request.getParameter("sutra"));
    }
    catch(Exception e){
        sutra=0;
    }

    try{
        token = request.getParameter("token");
    }
    catch(Exception e){
        token="";
    }
```

The folloeing code sets default values of search type and query---

```
    if (searchtype==null)
```

```
            searchtype="partial";


      if (searchstr==null)
            searchstr="";


      if (ddfocus==null)
            ddfocus="sthana";


      if (token==null)
            token="";

%>
```

The following code creates form to enter search query and selact search options--

```
<form name=f1 method=get action="ibasic.jsp#result"  accept-Charset="UTF-
8">


<input type=hidden name=searchtype value=<%=searchtype %>>
```

The following code sets the value of search string to be displayed in the search box----

```
                  <% if (searchstr.length()>0) { %>
                        <br><input type=text name=itext value="<%=
searchstr %>"
                  <% } else { %>
```

```
                        <br><input type=text name=itext value="<%= token
%>"                <% }  %>
```

The following code sends the search input to java scripts function to submit the query--

```
                    <input type=submit value="search  Ayurveda Database"
onClick=submitForm1("direct")></td>

</form>
```

```
      <% if (searchtype.equals("direct") && searchstr !=null &&
searchstr.length()>0){ %>

            <%= a.searchIndex(searchstr)

      }%>
```

The following code hyperlinks devanagari letters for **search by alphabet--**

```
<a href=ibasic.jsp?searchtype=alphabet&itext=ॐ>ॐ</a> </a>  

<a href=ibasic.jsp?searchtype=alphabet&itext=अ>अ</a> </a>  

<a href=ibasic.jsp?searchtype=alphabet&itext=आ>आ </a>  

<a href=ibasic.jsp?searchtype=alphabet&itext=इ>इ </a>  

--

--

--

<a href=ibasic.jsp?searchtype=alphabet&itext=ा>ा </a>  

<a href=ibasic.jsp?searchtype=alphabet&itext=ष>ष </a>  
```

```
<a href=ibasic.jsp?searchtype=alphabet&itext=स>स </a>  

<a href=ibasic.jsp?searchtype=alphabet&itext=ह>ह</a>  

<a href=ibasic.jsp?searchtype=alphabet&itext=क्ष>क्ष</a>  

<a href=ibasic.jsp?searchtype=alphabet&itext=त्र>त्र</a>  

<a href=ibasic.jsp?searchtype=alphabet&itext=ज्ञ>ज्ञ</a><br><br>
```

The following code calls **alphabet search** function on clicking hyperlinked letters of devanagari---

```
      <% if (searchtype.equals("alphabet") && searchstr !=null &&
searchstr.length()>0){ %>

            <%= a.alphabetSearch(searchstr)

      }%>
```

The following code generate form for **hierarchical search** --

```
<form method=get action="ibasic.jsp"  accept-Charset="UTF-8">


<input type=hidden name=searchtype>

<input type=hidden name=ddfocus value="">
```

```
<hr>
<font color=#1B67AD size=4><b><u>SEARCH BY CLASS</u><b></font>
```

Following code generates first dropdown box of *Caraka saṃhita's* sthāna--

```
            <td><b>sthana</b><br>
            <select name=sthana>
<option value=1 <% if (sthana==1){ %> selected <% }  %> >सूत्रस्थान </option>
<option value=2 <% if (sthana==2){ %> selected <% }  %>  >निदानस्थान</option>
<option value=1 <% if (sthana==3){ %> selected <% }  %> >विमानस्थान</option>
<option value=2 <% if (sthana==4){ %> selected <% }  %>  > शारीरस्थान</option>
<option value=1 <% if (sthana==5){ %> selected <% }  %> > इन्द्रियस्थान</option>
<option value=2 <% if (sthana==6){ %> selected <% }  %>
>चिकित्सास्थान</option>
<option value=1 <% if (sthana==7){ %> selected <% }  %> >कल्पस्थान</option>
<option value=2 <% if (sthana==8){ %> selected <% }  %>  >सिद्धिस्थान</option>

                    </select>

<input type=button value=">>>" onClick=submitForm2("sthana","class")>
```

```
</td><td>
```

The following code generates list of *Adyāyas* in the selected *sthāna* in a dropdown box----

```
                <% if ( (sthana>0) && (ddfocus.equals("sthana") ||
ddfocus.equals("adhyaya"))     ) { %>

                        <%

                                adhyayas=a.getAdhyayaBySthana(sthana) ;

                                en = adhyayas.keys();

                                if (en.hasMoreElements()){

                        %>

                                <b>Adhyaya</b><br>

                                <select name=adhyaya>

                        <%

                                while ( en.hasMoreElements() ){

                                        Object obj = en.nextElement();

                                        key = obj.toString();

                                        val = adhyayas.get(obj).toString();


                        %>

                                        <option value='<%= val %>'  <% if
(adhyaya==Integer.parseInt(val) ) { %> selected <% }   %>  ><%= key %>


                                <% } %>

                                </select>
```

```
                                <input type=button value=">>>"
onClick=submitForm2("adhyaya","class") >

                            <% } %>

</form>
```

The following code generates the index of selected *Adhyāya* with token and reference---

```
<% if (searchtype.equals("class")){ %>


      <% if ( ddfocus.equals("adhyaya")  ){ %>

                  <%=a.getIndexForAdhyaya(adhyaya) %>

      <% } %>


<% } %>

<%

      if (sutra >0) {

            a.getSutraById(sutra, token);

      }

%>
```

The following code displays the detailed discription of queried token ----

```
<% if ( sutra>0 || searchtype.equals("full") ){ %>
```

```
    <% if ( a.getSearchStatus() < 1 ) { %>

          <font color=red size=4>Search Found no results for "<%= searchstr
%>"<font>

    <% } else {


    %>

<hr>

<a name=results>

<font color=orange size=6><b><u>Results</u></b></font>

<table>

      <tr><td colspan=2 bgcolor=d3d3d3><b>Index Search for'<%=token
%>'</td></tr>


            <tr><td><b>Sutra:</b></td><td><%= a.getSutraText() %></td></tr>

            <tr><td><b>Reference:</b></td><td><%= a.getSutraRefActual()
%>(<%=a.getSutraRefDescriptive() %>)</td></tr>

            <tr><td><b>Tantra:</b></td><td><%= a.getTantra() %></td></tr>

            <tr><td><b>Sthana:</b></td><td><%= a.getSthana() %></td></tr>

            <tr><td><b>Adhyaya:</b></td><td><%= a.getAdhyaya() %></td></tr>
```

The following code generate links to search the queried ---

```
            <tr><td><b>Search other sources:</b> </td><td><a
href=searchNet.jsp?word=<%= token %>>search this word on other online
resources</a>
```

```
            </td></tr>
<% }%>
            </td></tr>

</table>
```

4.4.2 Java classes

The name of the java class is Ayur.java. The above described JSP code calls this ayur.java class. This class is connects with CS database brings search results.

The Description of Main Java class

Here is the code description of the main java class, and it's function.

The following code imports different packags to be used in this class. Java.sql is used to connect connect with MS-sql server data-base.

```
import java.lang.*;
import java.util.*;
import java.io.*;
import java.sql.*;
```

The following code defines the main class 'Ayur'--

```
public class Ayur {
}
```

The following code declares different variables for connecting to the database --

```
    Hashtable wordlist = new Hashtable();
    int searchStatus = 1;
```

```
        static String TAB=
"        ";
        static String NL = "<br>";

        String shabda;

        Connection conn = null;
        Statement stmt = null;
        String errmsg="";

        int cat;

        String hostname="";
        String akuser="";
        String akpwd="";
        String connport="";
        String tinuser="";
        String tinpwd="";
        String ayuruser="";
        String ayurpwd="";
        String ayur_user="";
        String ayur_pwd="";
        String adminusr="";
```

```
String adminpwd="";

int wordid=-1;

String mbuser="";

String mbpwd="";
```

Following code declares different string for search functions--

```
String sutrasamhita, sutrapada, adhyaya,  sthana, baseword,
sutraidDesc;

int adhyayaid,  sthanaid,  sutraid_incremental;

float sutraid;


LexiconReader conf = new LexiconReader("..... ");
```

The following is class-constructor to create a copy of main class---

```
public Ayur(){

      sutrasamhita = sutrapada= adhyaya= sthana= adhyaya=baseword="";

      adhyayaid=tantraid=sthanaid=0;

      sutraid = 0;


      loadConf();

      cat= 0;

      shabda ="";
```

The following code connects to the Data-base of CS -

```
            try{

      Class.forName("com.microsoft.jdbc.sqlserver.SQLServerDriver");

                  conn  =
DriverManager.getConnection("jdbc:microsoft:sqlserver://"+hostname+connport
,ayur_user,ayur_pwd);


                  stmt = conn.createStatement();

            }

            catch(Exception e){

                  errmsg = errmsg+ "\n error in connection "+e.toString();

                  System.out.println(errmsg);

            }

      }
```

The following function gets data to connect Web-server to Database server---

```
      public void loadConf(){

            Hashtable configdata = conf.getFileData();

            try{

                  .....

                  .....

                  .....

            }
```

```
            catch(Exception e){
                  .....
                  .....
            }
      }
```

The following function gets the list of Adhyāyas for selected sthāna---

```
      public Hashtable getAdhyayaBySthana(int sthana){
            .....
            return adhyayas;
      }
```

The following code creates the index of all word in the selected Adhyāya---

```
      public String getIndexForAdhyaya(int adhyaya){
            .....
            .....
            .....
            return "search found "+tknCount+" results for the above
adhyaya"+ r;
```

```
}
```

The following code generates the detailed description of searched token --

```
public String searchIndex(String word){

        ..........

        ..........

        ..........


        if (etknCount>0)

                return "Exact Search found "+etknCount+" results for the
'"+word+"'"+ er;

        else

                return "Exact search did not find any match...<br>Partial
Search found "+ptknCount+" results for the '"+word+"'"+pr;


}
```

This code create the index of all word beginning with the selected letter--

```
public String alphabetSearch(String alph){

        ..........

        ..........

        ..........
```

```
            return "Alphabet search found "+tknCount+" results for
'"+alph+"'"+ r;


        }
```

The following code generates the result for the token selected from the index generated---

```
        public void getSutraById(int sutraid, String tkn){

            ..........

            ..........

            ..........

        }
```

4.4.3 Apache Tomcat 4.0 web server

Apache Tomcat is an open source servlet container developed by the Apache Software Foundation (ASF). Tomcat implements the Java Servlet and the Java Server Pages (JSP) specifications from Sun Microsystems, and provides a "pure Java" HTTP web server environment for Java code to run. The *CS* indexer runs on this Apache Tomcat 4.0 platform.

4.4.4 The Back-end

The back-end of the indexing system consists of RDBMS, which contains co-relative data tables.

This Tomcat server based program connects to MS-SQL Server 2005 RDBMS through JDBC connectivity. The lexical resources are stored in Devanāgarī Unicode UTF-8 format.

There are three tables namely; 'sthana', 'adhyaya', and 'sutra'. The descriptions of the tables have been given in the previous chapter.

4.5. Database connectivity

The database connectivity has been done through the JDBC driver software. JDBC Application Programming Interface (API) is the industry standard for database independent connectivity for Java and a wide range of database- SQL databases. JDBC technology allows to use the Java programming language to develop 'Write once, run anywhere' capabilities for applications that require access to large-scale data. JDBC works as bridge between Java web server and Database server. SQL server 2005 and JDBC supports input and output in Unicode, so this system accepts Unicode Devanāgarī text as well as prints result in the same format.

4.6. How does the indexing system work?

This *Caraka Saṃhitā* Indexer is an online indexing system. If users have any search query related with *Caraka Saṃhitā* text then they can access the system on *http://sanskrit.jnu.ac.in/caraka/index.jsp*. The indexer provides them the facility to search words from the text and see the reference. Then can also see the search terms in other web source.

4.6.1. How to use the *CS* Indexer

The system takes input and gives output in Devanāgarī UTF-8 encoding. For this, a Unicode input mechanism is required like Baraha,[4] INSCRIPT key-board.[5] There is also an inbuilt JavaScript Devanāgarī input mechanism which automatically converts the text entered in i-TRANS into Devanāgarī Unicode. By this, one can type one's desired word for exact search. There are other facilities to search the queries like- one can choose a character from the Devanāgarī alphabet with which the desired word begins. The search result will display a list of hyperlinked words with their references and the list of indexed words could be exact or partial string. The further information can be obtained by clicking the specific word. The

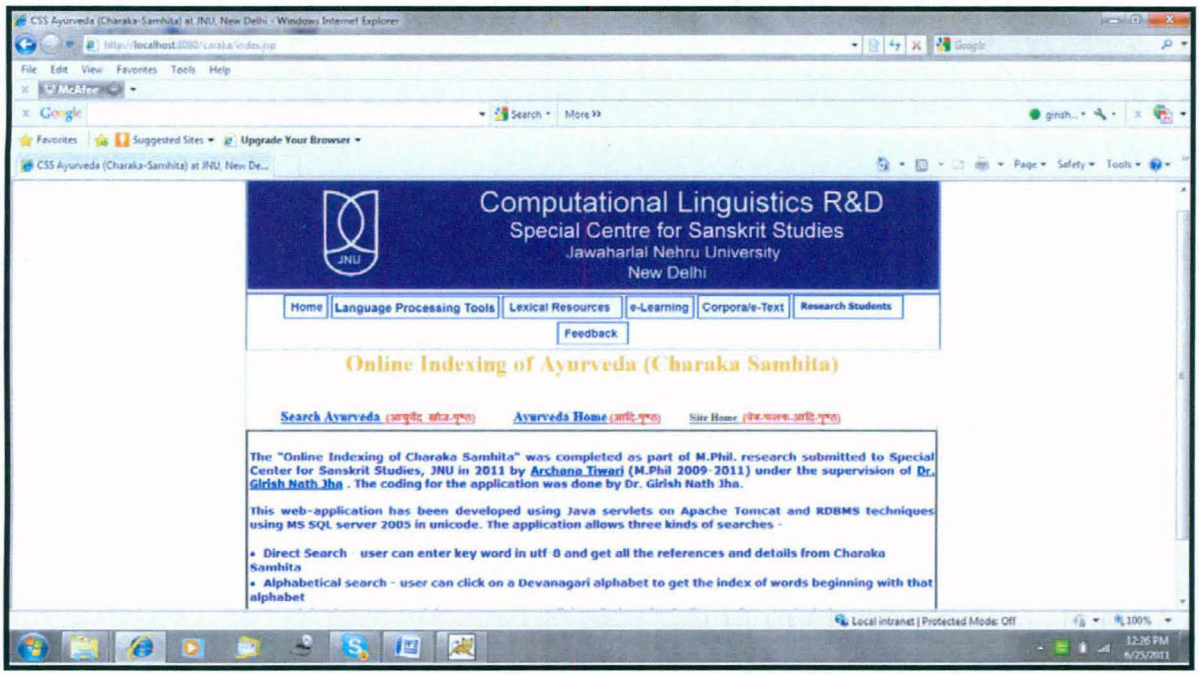
[4] The Baraha can be freely downloaded at- www.baraha.com
[5] It can be freely downloaded from- http://www.bhashaindia.com/Downloadsv2/ListCategories.aspx

drop-down boxes, according to the structure of the text, are the third searching facility, where the user can first choose a "*sthāna*" from the box. Selecting the "*sthāna*" the "*adhyāya*" list appears. Then system will make an index of the words according to the specific *adhyāya*.

At second step, the user has to click a word among the list of indexed words. Clicking the required word the page will move to another page where he can find the detail of the searched query with its origin (i.e., in a *sūtra*) and full reference on the basis of the *Caraka saṃhitā*. On the same page, there is an option to search additional information from other online lexical resources. Clicking that link, the user will get the links of several sites where he can find further information. On clicking on one of those links, the queried word is submitted to that site.

4.7 Sceenshots of *CS* indexer

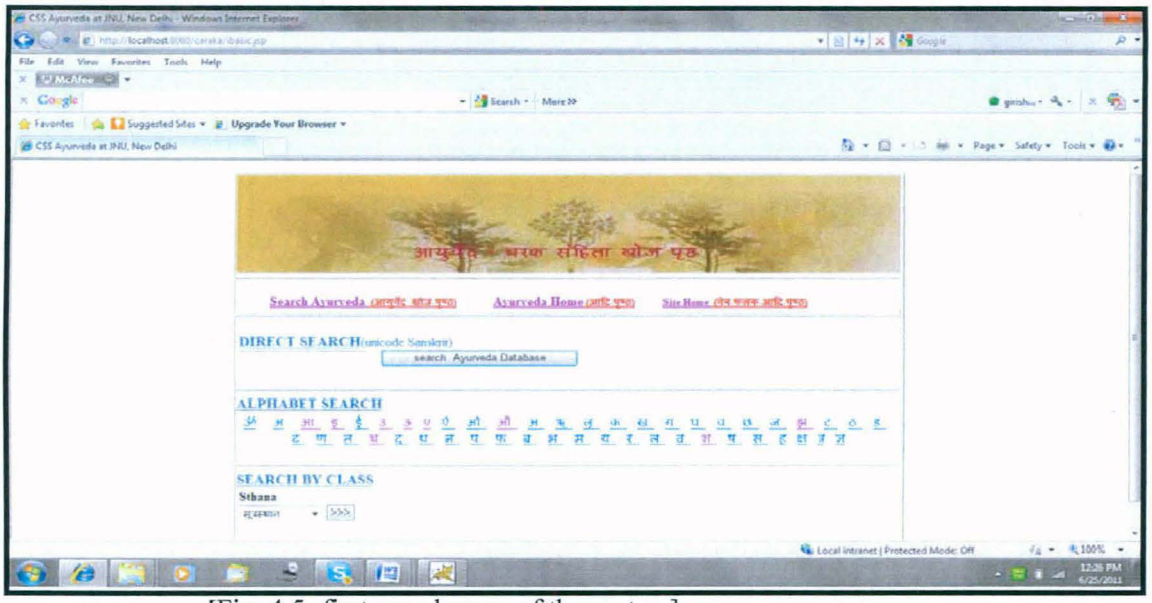
Here are some snapshots of the *CS* Indexer.



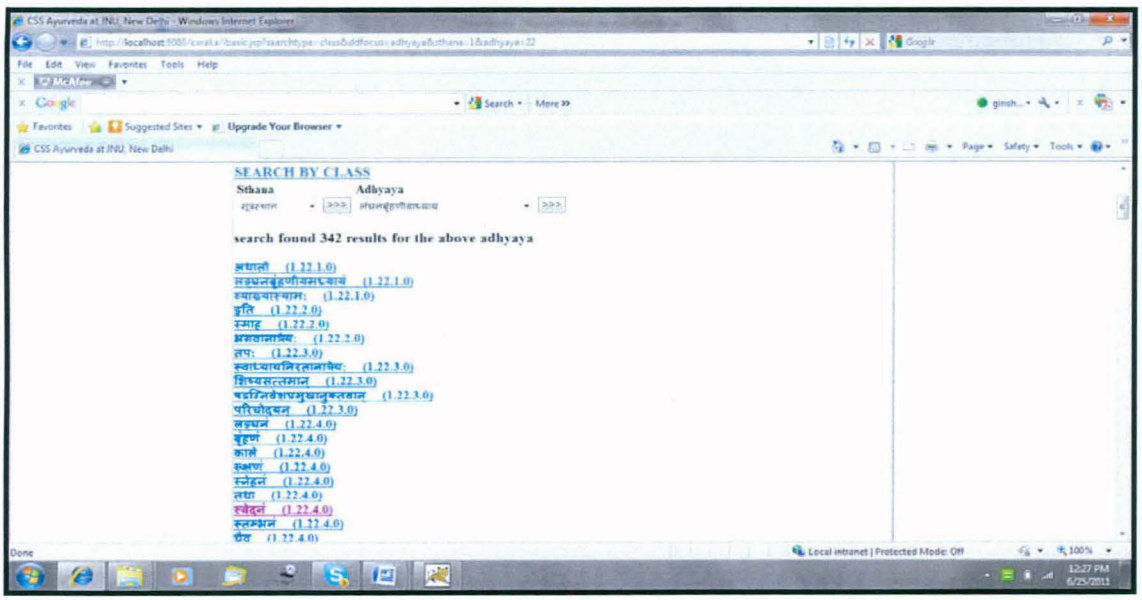
[Fig. 4.3: [main page of CS indexer]

Snapshot 1 shows the main page of CS indexer. This page gives simple introduction of the CS Indexing system and its developers.

Snapshot 2 – This Snapshot shows the first search page of the system. This page provides the user to search by three ways, alphabetical search, direct search and search by class.



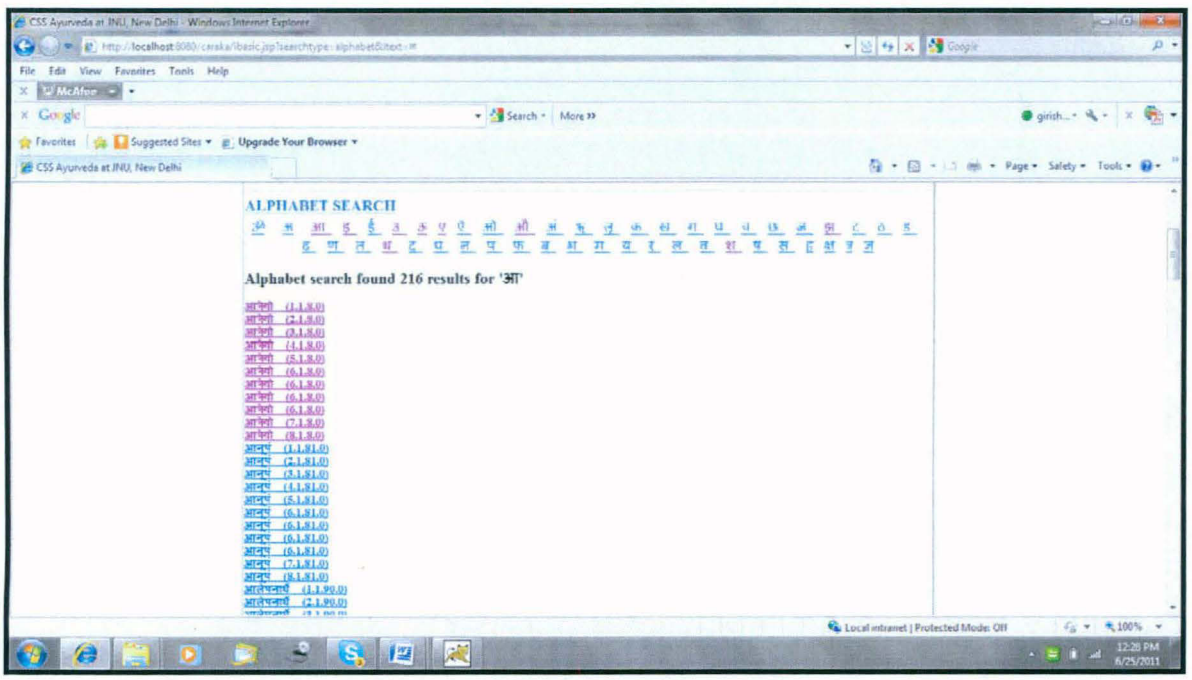
[Fig. 4.5- first search page of the system].



[Fig. 4.6first level output of the searched query]

Snapshot 3: This snapshot of the system gives the first level output of the searched query by user, as the list of word and its reference, hyperlinked. The picture contains the example when searched by class.

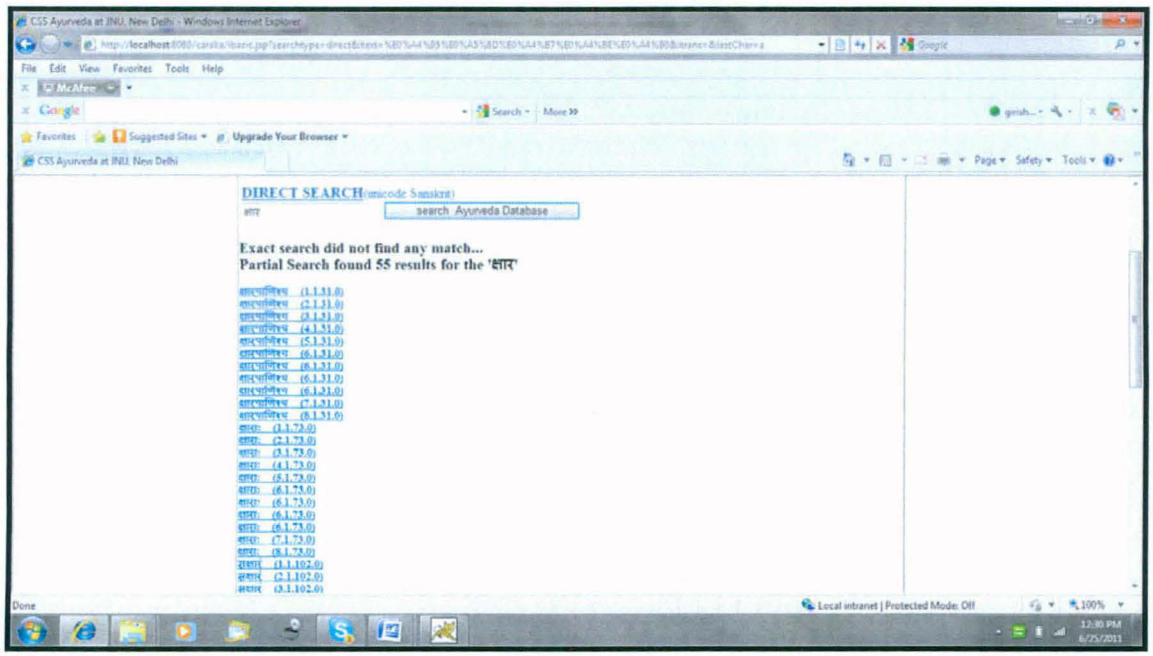
Snapshot 4: This snapshot gives the first level output of the searched query of user, when it searched by alphabet.



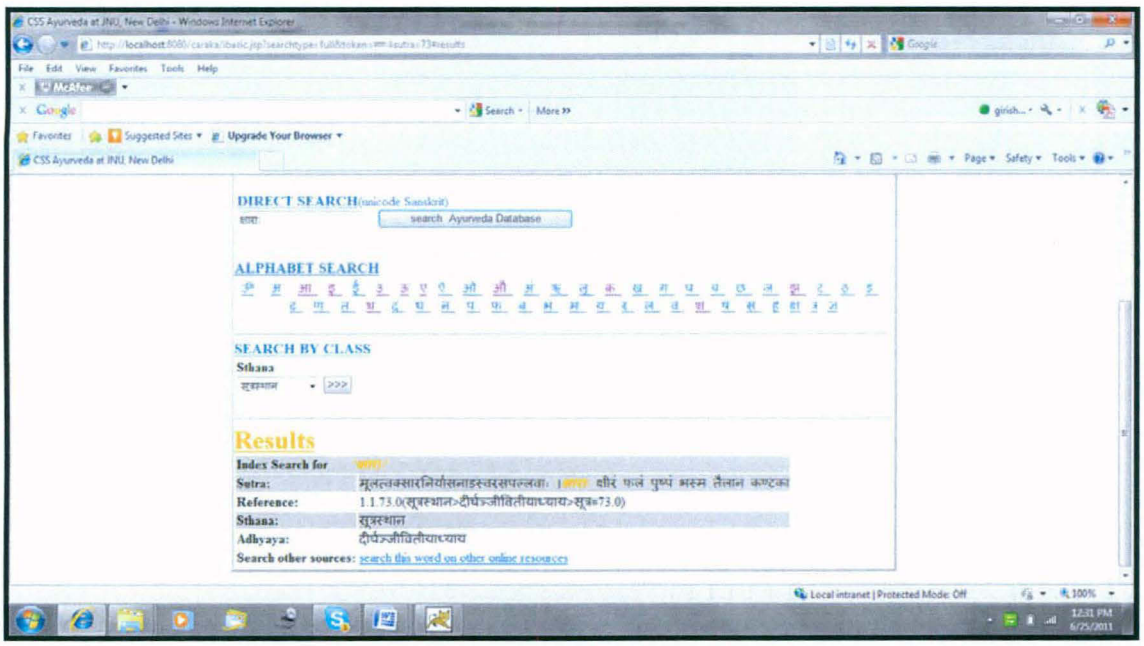
[Fig. 4.7First level output of the searched query of user, when searched by alphabet.]

Snapshot 5: The snapshots of the system is the first level output, When the word kShar is searched directly appear.

Snapshot 6: The snapshot is the second level output of the system searched by user, selected by first level search.



[Fig. 4.8First level output, of the searched word kśar.]



[Fig. 4.3:second level output of the system with details]

Conclusion

Conclusion

Getting the textual reference is one of the important needs of a researcher. Making that easy is a great help to the researcher community. The automatic indexer provides the facility of checking and searching the references. The present research does this for *Caraka Saṃhitā*. In the current stage it searches on string base and advancements like semantic and synonymic indexing is not involved, yet it is going to be useful to the users.

The present work is an R&D effort at the M. Phil. level for developing an Online Indexing system of *Caraka Saṃhitā*. It was a two year program: one year for course work and the next one year for R&D. Within this one year, a research on making database structure for the text was done. Besides this, the evaluation of tools and techniques- JSP-Java for front-end, servlet objects and Apache Tomcat for web server was studied and an online interface was developed which is live at *http://sanskrit.jnu.ac.in/caraka/index.jsp*.

Limitations of the System-

The system provides the search in three ways to facilitate the user, but still it has certain limitations, which can be described as follows.-

- This system has fixed input and output mechanism. One can search his query in Unicode Devanāgarī only and the output will be in the same format.
- At present, the system is unable to give the translation in any language.
- If a base word is searched, it cannot be found in all its forms.

Future Research-

The present ***Automatic Indexing Of Caraka Saṃhitā*** has tremendous potentials in the field of Sanskrit Computational Lexicography and M(A)TS. Some of the immediate and future applications of the system are discussed below:

- **An Online Indexer for Sanskrit documents-** the present work only deals with *Caraka Saṃhitā*,but the same methodology can be applied to build an indexing system o for another Sanskrit documents which are based on this ~~text~~
- **Support for other encoding schemes-** at this point, the system takes the input in UTF-8 format but in the future, it may be upgraded to process the input in other encoding schemes also.
- **Machine Translation System (MTS)-** This R&D has potential for M(A)TS from and to Sanskrit which is a major goal of this and other R&D currently in progress at the SCSS , JNU.
- **Key words related with particular disease, medicine and information -** Present work has gives the detail of searched sūtra, but in future it can also provide search with a particular Keyword.
- **Translation of the text-** Present work gives the output in Sanskrit. But in future the system aim to give translation in different language.

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