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Computer & Information Science (CIS): Raiganj University into a New Research & Professional Direction

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ABSTRACT

Computing is responsible for the collection, selection, organization, processing, management and dissemination of information. Information Technology has different components such as Database Technology, Networking Technology, Multimedia Technology, Communication Technology etc., and responsible for the information management. Hence it is responsible for the information and IT affairs in the organizations, institutions and individuals. It is a fact that the growing need of computing and IT in different subjects and fields are responsible for the creation of newer subjects and many universities were moved on Information Science from IT and new interdisciplinary fields has been started viz. Health Information Sciences etc. The Computing and its applications into the society and individuals led the Computer & Information Science (i.e. Information Science with focus on Computing or merged CS & IS) nomenclature. As a developed nation, few Indian universities have been started different skillful as well as domain centric Information Sciences. This paper is a kind of documentation on Computing related domains and responsible for creating awareness and clearing misconception of information and computing related and allied interdisciplinary fields/ programs. The paper is a case study of Raiganj University, a state aided university in India where full-fledged department and the program has been started on 'Computer and Information Science (CIS)'. Paper highlights the SWOT of the program, department with graphical representation.

Keywords: Information, Information Science, Interdisciplinary, Computing, Skills, Employment, Research, CIS, iSchools, Educational Planning, Modern Education

Information and Technology both are related and most valuable facets these days for the promotion of organizations, institutions and complete development of the society. There are many subjects available in the knowledge world for the promotion of technological utilizations in different facets and settings.

Computer Science, Computer Engineering, Information Technology, Information Systems etc.[3],[6]. These related subjects have and their respective requirement leads the creation of much newer and broader interdisciplinary subject called Information Science. However among these subjects most available and popular is Computing (i.e. both Computer Science and Computer Applications) and for that many universities around the world have started programs and even full-fledged Department on Computer and Information Science (CIS). India is gradually developing in interdisciplinary movement and initiatives; many universities, government bodies have started programs and departments having interdisciplinary facets. The Raiganj University (at West Bengal, India) is one where a full-fledged Department and even programs on CIS started! Planned for a modern skill based and interdisciplinary training, education and research affairs The Department of CIS started its journey in 2016.

Objectives

The paper is a policy based work and also a kind of case study dedicated to exploring aspects of CIS and its Journey at the Raiganj University. The following are few aims and agenda of this paper which include but not limited to—

- ❖ To aware about Information and Computing branch as a whole which include related and allied programs available in India and aboard.

- ❖ To learn about the nature, role and internal facets of Computing, Computer Science, Computer Applications, Information Technology Information Science etc.

- ❖ To become knowledgeable about latest trend in interdisciplinary market which include but not limited to Merged Domains; both related and non-related.

- ❖ To become aware about the need of interdisciplinary programs, departments and also about Raiganj University and its Dept. of CIS.

- ❖ To learn and highlight emerging areas of Computer and Information Sciences including possible job areas that are possible with CIS.

- ❖ To become knowledgeable about the Universities worldwide that started Department of CIS.

- ❖ To learn about the challenges and issues related to the Computer and Information Science in Indian context with due credit on Dept. of CIS, Raiganj University, India.

Raiganj University: Background

Raiganj University was established on 3rd February, 2015 while previously it was treated as Raiganj College (University College) established in 1998 under The University of Calcutta and become full-fledged University with the Vice Chancellorship of Prof. Anil Bhuimali[15]. After its status it has reformed undergraduate syllabi and also started honours (including BCA) programs under semester system even with CGPA Grade. It is important to note that the Higher Education Department, Government of West Bengal has approved twenty one post-graduate departments at Raiganj University (RGU). Moreover it has started Ph.D. program in many departments. Even in 16 Departments MPhil program has been initiated. Today University has some of the unique and advanced and non-traditional departments such

as Sericulture, Microbiology, Statistics, Management (comprises BBA & MBA) etc. And out of which Computer and Information Science is important one[16].

Dept. of CIS and its Background

The Department has started its journey during the period of University College under NBU with BCA Program. Though from the year 2016 the Department has been rejuvenated and clustered with several interdisciplinary academic ornaments and named as Department Of Computer and Information Science (CIS).

The new nomenclature of the Department 'CIS' has started to keep the expertise and academic affairs much broader and working and merging related subjects (*such as Computing, Computer Science, Information Science, Informatics, IT, ICT and also other hand allied domain based IS/IT subjects e.g. Health Information Science, Quantum Information Science, Library Information Science, Geo Information Science*). Moreover, the university has followed international and contemporary style of academic dealing and as a result MSc-Computer & Information Science program has been started from 2016 session. The main agenda of the Department (along with MSc-CIS products) is to produce not only scientific thoughts among its students but also prepare them for the industry and for that Applied curriculum has been adopted in the line of the universities, aboard. Hence the Department of CIS is following the style of *iSchools* (that practiced globally, in recent past) academic attributes in their agenda for promoting interdisciplinary research and industrial products[1],[2],[7].

Why CIS and Raiganj University?

There are many reasons to study CIS and obviously at Raiganj University, West Bengal.

But before that lets look some other related areas of study and prologue on CIS.

Computer science is a kind of theoretical and mathematical study responsible for the design and development of Computing Systems & Products. It is close with the hardware and a systematic study of the feasibility, structure, appearance etc of the algorithms. It is also responsible for the cause of the collection, depiction, processing, storage as well as communication and access of the information and similar content[4],[5],[8].

Fig. 1: Some of the surrounding terms & areas of IT

Moreover, CS may also define as a study and subject that deals with the theory, hypothesis of computation and manipulation of the design of computational and similar systems.

Computing is a designing, developing in addition to building of hardware, software, processing, managing a variety of information which are performed by the Computing. However in other context it is simply computing field and sometimes denote as substitute for the computer engineering, computing systems as a *close branch* and information sciences, software engineering, information systems, and information technology, information and communication technology as a *related branch*[7],[10].

Information Technology (IT) is an applied science domain dedicated for the collecting, storing, retrieving, transmitting, and manipulating information. Computers and allied products applications in the context of a business as well as other enterprises is also called as Information Technology. Information Technology also has several components apart from Software Technology such as Database Technology, Multimedia Technology, Networking Technology, Communication Technology, Computing Technology etc.[17],[18].

Computer Applications (CA)

Gradually the development of Computer systems and its public availability become responsible for designing and development of new subjects (though it varies from India in respect of western countries). The large number of computers in public and private companies demanded skilled manpower for applied information practice. The universities such as BIT Mesra and Pune University play a lead role in introducing a new branch in India called *'Computer Application'*. Interestingly the subjects and program was introduced keeping in mind the job prospect factors and demand in the Industry. Unfortunately among the chosen areas core and centered was—Software Technologies. To see India as a leading hub in software industry gradually many universities have been started 'Computer Application' as a program of study with initially as Masters program called (MCA). The program started to employ graduates from other streams (Arts, Commerce, Medicine, Pharmacy etc) into IT industry (though interestingly IT mainstream was considered as Software Technologies/Sector). It is important to note that while 'Computer Application' program was started but the subject 'Computer Science' still exists to cater internal affairs of Computing and mainly for the students of the concerned stream or mathematical sciences[9],[11].

Information Systems is a study of theories and practices related to the information. Information Systems is also responsible for analysis, use, creation, as well as development of Information Systems. Information systems also study the effects of information systems and computing in the organizations and companies[19].

It is important to note that Information System overlap its nature depending upon focus, purpose, as well as orientation of their activities. Information Systems is only concentrated on Business and Managerial affairs whereas Information Science is more than that and Social Issues and Concentration is always an added feature of Information Science. The main difference between CS, IT and Information Science, Information Systems is depicted in Fig. 2.

Information Science (it is important to note Informatics term originated & popularized in UK and Information Science in US & follower countries) is another domain which deals with Information. It is closely associated with the IT though additionally it is related with the Social areas, issues and components in respect of Information and IT products/tools. Hence, it is a branch of Information lies on Technology. But holds a distinct features than IT responsible for applications of all these following technologies (which deals with IT) in:

- ❖ Software Technology
- ❖ Database Technology
- ❖ Multimedia Technology
- ❖ Networking Technology
- ❖ Communication Technology
- ❖ Other Emerging Technologies

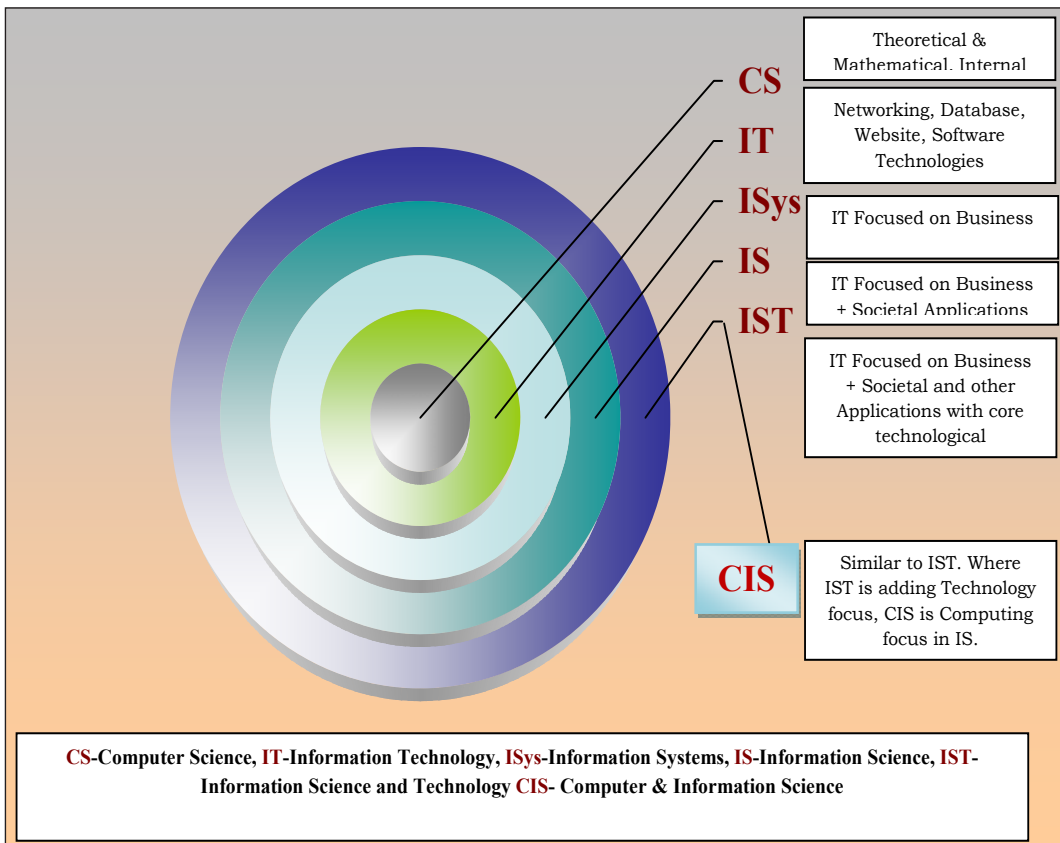The development and applications of IS in other subjects have also created other merged domain/ subjects[6],[8].

CS – Theoretical & Mathematical, Internal

IT – Networking, Database, Website, Software Technologies

ISys – IT Focused on Business

IS – IT Focused on Business + Societal Applications

IST – IT Focused on Business + Societal and other Applications with core technological

CIS – Similar to IST. Where IST is adding Technology focus, CIS is Computing focus in IS.

CS-Computer Science, **IT**-Information Technology, **ISys**-Information Systems, **IS**-Information Science, **IST**-Information Science and Technology **CIS**- Computer & Information Science

Fig. 2: Smaller and larger gradients of Information Science and IST

Combining Computing/CS *and* Information Science both have created *'Computer & Information Science'* (CIS) to deal and utilizing both in integrated way. Similarly, Health Science and Information Science combined as *Health Information Science (HIS)*.

Library and Information Science (LIS) was originated from the Library Science and Information Science merging. In other context Geo Science and Information Science created *Geo Information Science (GIS)*.

Bio Informatics from Bio Sciences and Information Sciences, may also called as *Bio Information Science*. This trend is continuing and thus many other domains have been noticeable in knowledge market like *Business Information Science*, Chemo Information Science, and Environmental Information Science and so on.

According to the study of Information Scientist and Professionals the transition of this automated and computing based Information Science has its root in Information Studies, Management and Documentation etc. (A detail drafting is listed in Fig. 3).
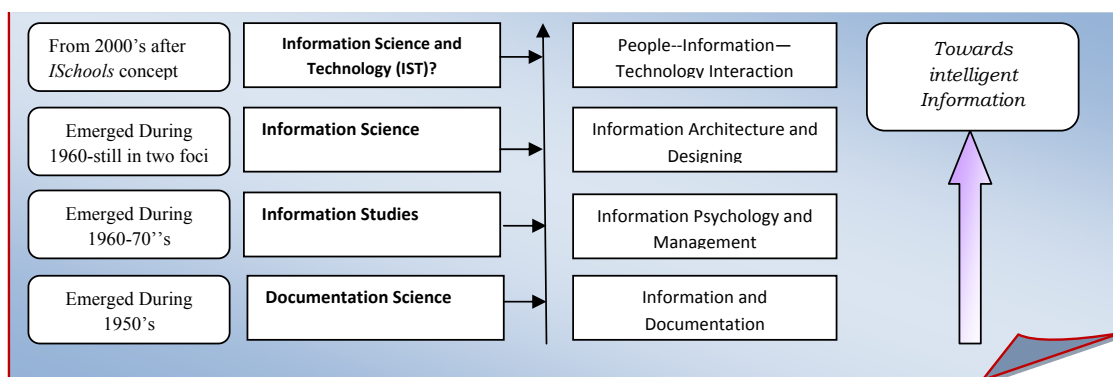
Fig. 3: Generation wise Main Responsibility of Information Centric Programs and nomenclature of Information Field

Information, Computing: A Merged Domain Perspective

It is worthy to mention that during recent past (mainly in late 1990's onwards) a concept of Merging domain has arrived where combination of two related and non related subjects have the potentiality (and/or ability) for integration to fulfill the sorts of objectives. The following are some related merged/ integrated domains—

- ❖ Computer Science & Engineering (CSE)— Traditional; *Available throughout the world & in India*

- ❖ Computer Science & Applications (CSA)— Traditional; *Available mainly in India*

- ❖ Information Systems & Technology— *Interdisciplinary (Information-Business-Technology Focused) Available allover except in India*

- ❖ Information Science & Technology (IST)— *Interdisciplinary (Information-People (Society)-Technology Focused) Available allover except in India*

- ❖ Computer & Information Science (CIS) — *Interdisciplinary (Information-Society-Computing Focused) Available allover except in India* (A very few universities & HEIs are offering/ started CIS as a broader version of CS/CA/IT in India.

Hence, whether Computer & Information Science (CIS) or IST both are related and allied branches and comes with following attributes—

- ❖ Merging Domain

- ❖ Related Subject's merging

- ❖ Interdisciplinary and focused with Community or Society.

It is revealed from the study that still many universities and academic entities have adopted the same focus of IST but nomenclature as Information Science/s. *Although,* Information Science may also available with traditional information management nature based on several tools of knowledge organization etc (closely associated with Information Studies/Documentation etc). Hence, it is many be tool based or technology based (i.e. extension of IT with social focus) and domain based[6],[13].

Some available Information Science connected with other domain (non-related) but having potentialities of Computation and Technological are already listed above in 'Information Science' section. Such as HIS, MIS, LIS, BIS etc. The following diagram (Fig. 4) is a complete look of types of Information Sciences including examples.
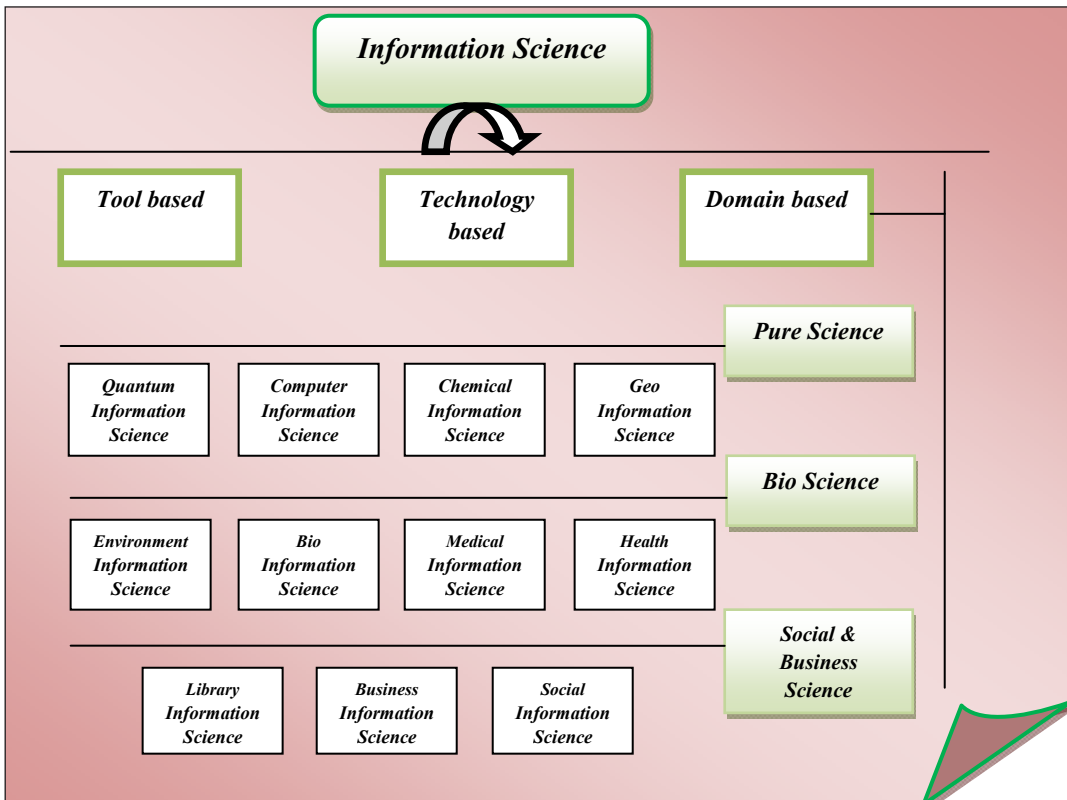

Fig. 4: Domain based Information Sciences at a glance

CIS: The Conclusion

From the above it is learned that there are many informations and computation related subjects available worldwide, but among them Computing is smaller one. Though, Information Technology is broader than Computing, Computer Science, Computer Technology, Software Engineering etc and all of these combine as IT.

Though, Information Systems (or *Information Systems & Technology*) is broader than IT as it holds few other knowledge gradients such as Management Information Systems, Social & Organizational Systems[14],[16].

Fig. 5: Depicted an idea level IT based culture which believe CIS

Interestingly the Combination of the Information Science with Computing/CS creates CIS (i.e. *Computer & Information Science*)—which is much broader than Information as special attentions of technologies have played a great role. The subject is much broader than all others and also related with Information Science & Technology. The HCI, Cloud Computing, Green Computing, Business Analytics, Social Media Analysis etc are the part of CIS/ IST with social and business context. These are also practiced in the Computer Science, Information Technology with the approaches of theory and scientific study and internal issues. A look of CIS with the context of HCI in future is depicted in Fig. 5 & 8.

Department of CIS: The Differences

The Department of Computer & Information Science, DCIS in short is an Interdisciplinary Academic body at the Raiganj University. The Department of CIS and its focus in is many ways is different with other traditional Computing an allied academic body in West Bengal. It has established to draw a common platform for information and technological solutions to create a knowledge society. When most of the Computing Schools dealing in bellow mentioned areas of research and skills in their curricula, The Department of CIS has opened up a new eye for *merging interaction and integration* of Computing, Information Technologies for the Society and Service Sector.

As a Service Science, Computer & Information Science is relatively new and much popular in *Western Countries*. The program on CIS and even Departments are established in many international universities (see Table: 1) for more details.

Table 1: Some of the popular universities around the world having CIS Department

Sl. No.	University	Country
1	University of Pennsylvania	USA
2	University of Oregon	USA
3	University of Delaware	USA
4	Cleveland State University	USA
5	Gannon University	USA
6	Malmstens Linköping University	Sweden
7	Towson University	USA
8	Arkansas Tech University	USA
9	University of Northumbria	UK
10	The Ohio State University	USA
11	Clarion University	USA
12	Florida Agriculture and Mechanical University	USA
13	Temple University	USA
14	The University of Mississippi	USA
15	University of Technology, PETRONAS	Malaysia
16	King Saud University	UAE
17	Northeastern University	USA
18	King Mongkut University of Technology North Bangkok	Thailand
19	Keio University	Japan

20	Regis University	USA
21	Indiana University, South Bend	USA
22	University of Gothenburg	Sweden
23	University of Hawaii	USA
24	Mansfield University	USA
25	University of San Carlos	Philippines
26	Southwest Baptist University	USA
27	Covenant University	Nigeria
28	Linköping University	Sweden
29	Tokyo University of Agriculture and Technology	Japan
30	Sojo University	Japan
31	Ibaraki University	Japan
32	Hosei University	Japan
33	The University of Alabama at Birmingham	USA

The endeavor for establishing such school of practice in India is really difficult in many senses but still to reach the agenda *of Digital Society, Knowledge Society or Simply Digital India*—The Department of Computer & Information Science is working for.

The Department of CIS has its vision in the areas of Social Technologies which include E-Governance, E-Commerce, Disaster Management, GIS, Geo-Spatial Technologies, Intellectual Property Rights, AI and Expert Systems, Computing, Networking, Soft Computing, High Performance Computing, Social Computing, HCI, Cloud Computing, Green Informatics, Information Management and Other Emerging Technologies (e.g. depicted in Fig. 6).

Programs at CIS: At present it offers Three Degrees

1. Bachelor Degree (BCA- Bachelor of Computer Applications) with little different than other BCA Program with curriculum in the areas of few selected technologies fall under CIS.

2. Masters Degree (MSc-Computer & Information Science) the flagship program and curricula includes as depicted in this research paper with full concentration of CIS/IST.

However, Computer & Information Science is also synonymously called as Information Science & Technology as the broadest branch within computing and informatics and it deals with applications of IT products, knowledge

Fig. 6: Information System Management at workplace: An important focus of CIS

management tools for the other sectors and domains i.e. directly to the people or community. Simply IST denotes the interaction of information-technology-people. Hence several domain based Information Science is also part of main agenda of the Department of CIS. A Few possible at present (and in future may be) listed following. It is important to note that in future educational programs in these areas may also be offered depending upon development of infrastructure and supports.

- ❖ Health Information Science (HIS).
- ❖ Library and Information Science (LIS).
- ❖ Geo Information Science (GIS).
- ❖ Bio Information Science.
- ❖ Business Information Science.
- ❖ Chemo Information Science.
- ❖ Environmental Information Science and so on.

However research programs, research activities including workshop, conferences and other knowledge events are on offer from the Department of CIS. With this if academic programs in all other domains not possible to run in one umbrella it can fulfill other areas of CIS by the activities like this. With the rapid development of information technology, researchers in all fields are eager to exchange new ideas connected with information science and technology. It will provide a valuable opportunity for researchers, scholars and some scientists to exchange their ideas face-to-face.

1. Masters Research Degree leading to M.Phil. in Computer & Information Science started with focus and specialization in Business Informatics and Social Informatics.

2. Doctoral Degree leading to Ph.D. in Computer & Information Science started with focus and specialization in Business Informatics and Social Informatics.

Vision and Mission

CIS and similar interdisciplinary academic body started its revolution in United States and gradually the concepts as well as strategies have been adopted by internationally by many universities. Academic units of CIS mainly fall under several bodies which include Faculty/School of Engineering and Technology, Faculty/School of Sciences, Faculty/School of Innovative Technologies, Faculty/School of Interdisciplinary Sciences. However few universities are established full-fledged Faculty or School on CIS or Information Sciences and Technology (IST).

They have established either by merging old related and relevant departments in to one umbrella or newly created institutes. The vision of the Dept. of CIS is most sought after in Industries, please refer Fig. 7. With strong interdisciplinary approaches the *Department* believes in opportunities and challenges of information management and information technology solutions, with more focus on universal access and user-centered information systems creation and design.

Development of a nation depends on several criteria which includes the industrialized country, with advanced technological infrastructure. With good amount of the economic development which includes GDP, Gross National Product, the Per capita Income etc.
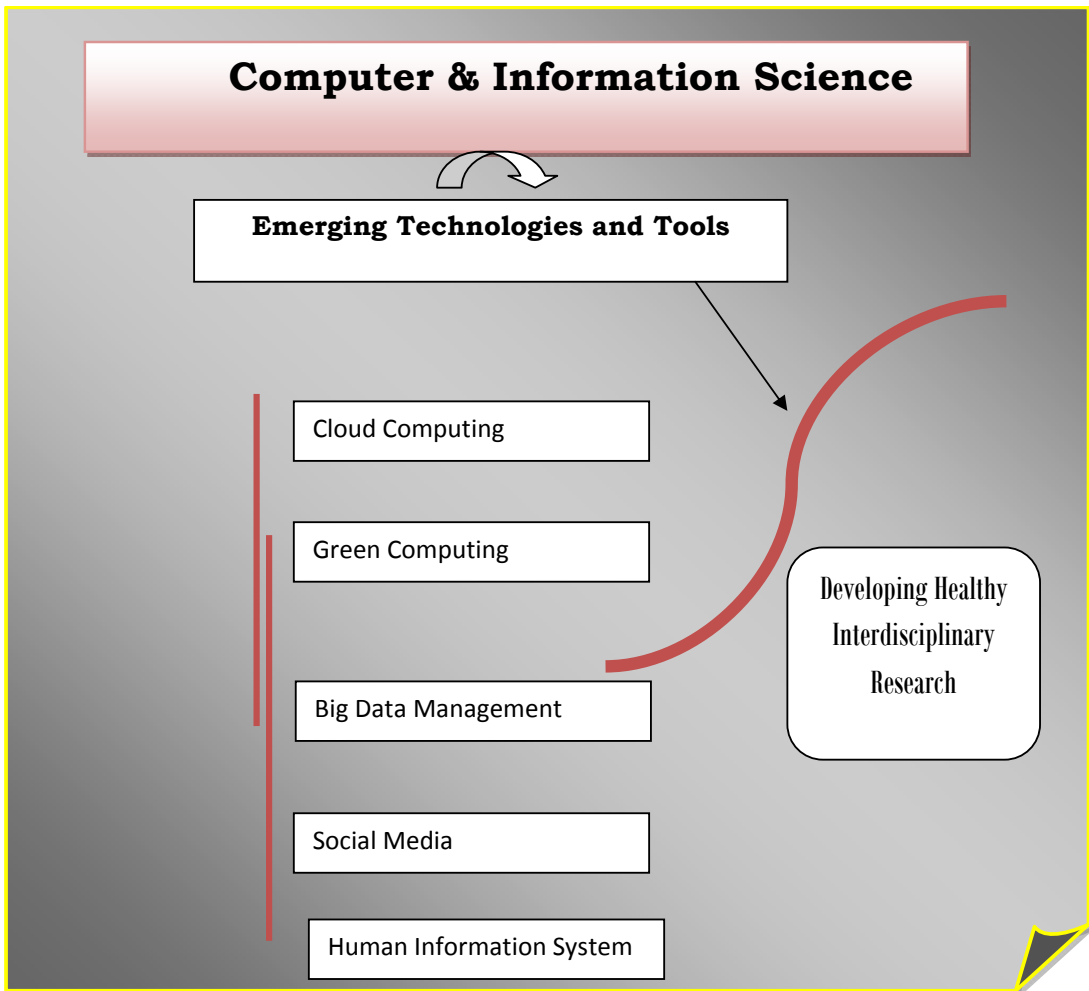
Fig. 7: Core areas of current research at the Dept. of CIS

It is an important fact that development truly lies on industrialization, widespread infrastructure, general standard of living etc. And here Information and Technology both played a vital role. In conventional educational context, Information Technology and related subjects are taught and practiced in the different departments while in the *Dept. of CIS,* all the related programs of IT, Information and Computing are combined in one circle with the subjects responsible for social development such as Economics, Management, Social Issues etc. Hence proper information and technological development are possible in many contexts with CIS and this type of interdisciplinary courses in the developing countries.

Hence job wise CIS fields (or program or Departments *with all gradients in focus*) may lead better and many job opportunities from Computing and Informatics/Information Systems. Some of the areas as per Bureau of Labor Statistics (BLS) depicted in Fig. 9 & 10.

Fig. 8: Man Machine Interaction (MMI): an Imagination

Research Areas and Agenda of the Department of Computer & Information Science, Raiganj University, India

Academicians from the diverse fields and are expected to work (or with association) in the Department of Computer & Information Science for its solid success and development. Here other departments of the same universities or other universities may work for the better and enhanced research. A few research areas may be (apart from Computing and IT) as follows (but not limited to).

❖ **Mathematics & Statistics** (Applications of the Domain in Computing & IT etc.)

❖ **Physics** (IT in Physics and Vice Versa, e.g. Quantum Information Science)

❖ **Economics & Commerce** (MIS, E-Commerce, E-Business, Knowledge Economy and Development)

❖ **Botany & Zoology** (Applications of IT in these fields e.g. Bio Informatics)

❖ **Sericulture, Microbiology & Bio Technology** (Applications of IT in these fields including emerging Health Informatics, Bio Technologies vis-à-vis Computing)

❖ **Geography & Geology** (Such as GIS, Remote Sensing)

Fig. 9: Some possible job areas that covers CIS program/ Dept in Comp. Context

- ❖ **Political Science & Public Administration** (Social Computing, Uses of IT Applications in Political Affairs, E-Governance)

- ❖ **Sociology & Social Work** (Social Informatics, People addiction in IT products, Community Development with Information/IT)

- ❖ **English & Languages** (Natural Language Processing, Human Expression in Computers)

- ❖ **History** (Historical aspects of Computers, Internet, Changing life style using computers)

Fig. 10: Some possible job areas that covers CIS program/ Dept in Informatics Context

- ❖ **Philosophy & Education** (Cognitive Sciences in IT, E-Learning, Education Technology)

- ❖ **Chemistry & Bio Chemistry** (Chemical Informatics, IT in Bio Science) etc.

Challenges & Issues

Computer & Information Science is an interdisciplinary and emerging field and started in many developed countries. The situation i.e. challenges and issues at Raiganj University may be same or similar with other universities established in India or similar developing countries. A few of such have depicted as follows—

- ❖ Any Interdisciplinary programs or departments needs multidisciplinary skill and talent base to run a program or to fulfill the objective. At the Department it is an important challenge to offer skills to the students which make CIS from different perspective. But at present the Dept. of CIS is trying its best to create interdisciplinary environment.

- ❖ An Interdisciplinary nature is new in Indian context and thus it is an important issue and challenge to do a best deal with other departments i.e. integrated Information-Technology and tools into their department. As far as Dept. of CIS at Raiganj University is concerned it is doing well and still more are expected and have to reach.

- ❖ CIS is a broad field and combing all the technologies of Information Technology *(i.e. Database Technology, Multimedia Technology, Networking Technology, Communication Technology, Computing Technology) i*ncluding aspects of society and business etc. Hence keeping and managing balancing curricula is always important and crucial. Though it has reached a status due to students ability in knowledge gathering in theirs examinations and participation in various allied activities in National and International events.

- ❖ It deals with Networking Technologies etc which recently deals with the several newer technologies and tools such as Cloud Computing, Virtualization, Big Data etc hence building an infrastructure including skilled trainer is still tough. However good news is university already build a good infrastructure in IT Systems and there our students can take exposure and internship to solve real world situation.

❖ As an interdisciplinary department The Dept. of CIS in future has plan to offer several domain based IS/CIS program in its course list to maintain its nature like Western countries and similar iSchools. In this range many steps are awaiting for. Although interesting step is that The Department has already started its research work in diverse areas viz. Health Information Science, Business Information Science, Chemical Information Science, Library Information Science, Social Information Science or even Education Informatics/ Education Technology. Hence a better scope is awaiting for creating, managing IT in other areas of knowledge.

❖ Awareness is an important factor for success of any initiatives. It is a fact that, still large number of students and academic community are not aware about CIS and its features. Even its distinct role and potentiality (in jobs and research) than that of commonly available programs and department like Computer Science, Computer Application and even IT. However many now the Department of CIS is planning for initiation of the efforts on this.

CONCLUSION

The world is changing rapidly and the interdisciplinary knowledge is becoming a vital weapon these days for the success of individual and development in all perspects. Universities of the western countries few years back started the revolution and initiative for the promotion of interdisciplinary research and gradually interdisciplinary academic programs[07],[11],[16]. Lastly they have added Interdisciplinary Departments for better and healthy research. In such an academic journey the Department and Programs on Mathematics with Education/ Philosophy have been noted. Even integration of all the Bio-related subjects created Biological Sciences. More than that the combination and integration of Bio-Sciences with Societal/ Management whether programs or Department!

The Computing has also witnessed the journey of interdisciplinary knowledge cultivation and efforts. Previously Computing was integrated with among its godfather Mathematics. Gradually many programs, departments and schools were established with the combination of Computing and Mathematics. Then more broader subjects and departments were created in the areas of Information Technology. Gradually, mainly in the last decade, Computing have merged with other possible subjects (but having potentiality in Computing & IT on that subject/s) and created Information Sciences. And interestingly the integration of IT/IS created domain specific Information Science viz. Health Information Science, Chemo Information Science, Business Information Science, Library Information Science, Quantum Information Science and so on. Hence this way academic body and units worldwide are moving in the direction of interdisciplinary culture. CIS and the Dept. of CIS are responsible and dedicated for the better integration of technology-information with or for the society!

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