

BRAC HEALTH INFORMATICS SYSTEM

A Thesis

Submitted to the Department of Computer Science and Engineering

of

BRAC University

by

Hasnain Feroze

Student ID: 01101060

Soriful Alam Sumon

Student ID: 01101006

In Partial Fulfillment of the

Requirements for the Degree

Of

Bachelor of Science in Computer Science

May 2005

DECLARATION

I hereby declare that this thesis is based on the results found by myself. Materials of work found by other researcher are mentioned by reference. This theis, neither in whole nor in part, has been previously submitted for any degree.

Signature of
Supervisor

Signature of
Author

ACKNOWLEDGMENTS

I would like to express my gratitude to my respected thesis project advisor, Mr. Matin Saad Abdullah for his co-operation and influential suggestions for completing this project successfully. Without his co-operation it would not be possible for me to organize such an enormous project and a thesis report on a short span of time. His dynamic guidance at all stages of work encouraged me to accomplish my work fruitfully. I would like to express my gratefulness to my other respected advisor, Mr. Manzur Ashraf for his overall support and co-operation. I am grateful to all the employees of the BRAC Health Program for helping me to collect a lot of information about the existing system. A very special thanks to the director of BRAC health program, Mr. Faruque Ahmed, who gave me the opportunity to work on BRAC health program. I would also like to thank the health district coordinator, Mr. Abdul Salam and Management Information System coordinator, Ms. Mahbuba, for giving me their valuable time to explain me the whole working process of BRAC health program and also for his opinion and information which assisted me in completing this project successfully. I would also like to thank my dear friends Fahmida Tani Ahmed, S.M.Mahbubuzzaman, Samina Azad, Nourin Mujib Khan, Rizwana Choudhury, Md. Samirul Huq and Suriful Alam Sumon for all their encouragement and support. Finally, I thank the Almighty Allah for enabling me to complete my thesis project in time.

ABSTRACT

At the beginning of the 21st century, the field of global public health is changing rapidly, not only in its basic methods, but also in technological aspects. The first and foremost concerns of BRAC health program is to provide health service to mass populations. To cope up with changing world's need BRAC Health department should accept the fruit of technology. As a result we have proposed three solutions to automate the entire health process namely- (I) using hand scanner, mobile phone and OCR technology, (II) using Epi Info software package tools for data analysis, (III) web-based database system. This report focuses on automation using hand scanner, mobile phone and OCR technology. It offers real time data usability and scope for analysis. Thus provides rapid and accurate decision making opportunity.

TABLE OF CONTENTS

	Page
TITLE	i
DECLARATION	ii
ACKNOWLEDGEMENTS	iii
ABSTRACT	iv
TABLE OF CONTENTS	v
LIST OF TABLES	viii
LIST OF FIGURES	ix

CHAPTER I. INTRODUCTION

1.1 Overview of BRAC Health Program.....	1
1.2 Objectives of the Project.....	3
1.3 Methodology	3

CHAPTER II. EXISTING SYSTEM

2.1 Requirements Analysis of Existing System.....	4
2.2 BRAC Essential Health Care (BEHC) Program	6
2.3 BRAC EHC Service process.....	7
2.3.1 Shastho Shebikas (SS).....	7
2.3.2 Shastho Karmis (SK).....	10
2.3.3 Program Organizer (PO).....	15
2.3.4 Management and supervision.....	17
2.3.5 Monitoring and improving quality.....	18
2.3.5.1 Monitoring department.....	18
2.3.5.2 Quality assurance department.....	19
2.3.6 Health workers training.....	20
2.4 Components of the EHC Program.....	21
2.4.1 Water and sanitation.....	21
2.4.2 Family planning.....	22
2.4.3 Immunization.....	22
2.4.4 Pregnancy related care.....	22

2.4.5 Health and nutrition education.....	23
2.4.6 Basic curative service.....	23
2.4.7 Tuberculosis.....	24
2.5 Management Information System (MIS) Division.....	24
2.6 Information Flow of the Existing System.....	25
2.7 Drawbacks of Existing System.....	28

CHAPTER III. PROPOSED SYSTEM

3.1 Epidemiology.....	30
3.1.1 Epidemiology in evaluation.....	31
3.1.2 Characteristics of Epidemiology.....	31
3.1.3 Benefits of Epidemiology.....	33
3.1.4 Limitations of Epidemiology.....	34
3.1.5 <i>Where</i> <i>it</i> is used?.....	34
3.2 Proposed System Overview.....	35
3.3 Using Hand Scanner, Mobile phone and OCR technology.....	37
3.4 Using Epi Info Software Package Tools for Data Analysis.....	39
3.4 Using web-based Database System.....	41

CHAPTER IV. DATA TRANSFER AND STORAGE USING HAND SCANNER, MOBILE PHONE AND OCR TECHNOLOGY

4.1 An Overview.....	42
4.2 Hand Scanner.....	43
4.3 OCR Technology.....	45
4.3.1 Function of OCR.....	46
4.3.2 Features of OCR.....	46
4.3.3 Advantages of OCR Technology.....	46
4.3.4 Disadvantages of OCR Technology.....	47
4.4 Using OCR Technology and Data Parsing.....	47
4.4.1 Process stages.....	48
4.4.2 System requirements.....	53
4.5 Instead of OCR Technology and Data Parsing, Use Data Storage Software.....	54
4.5.1 Planning phase.....	56
4.5.2 Analysis phase.....	59
4.5.2.1 Requirements gathering.....	59
4.5.2.2 Interviewing the users.....	60
4.5.2.3 Selecting the best alternative design strategies.....	64
4.5.2.4 Finalizing the design of the prototype.....	64
4.5.2.5 Process modeling.....	65
4.5.2.5 Use-Case Modeling.....	68
4.5.3 Design phase.....	73
4.5.3.1 Designing the database.....	73
4.5.3.2 Designing the forms.....	77
4.5.3.3 Forms of the database.....	78

4.6 Risks of the proposed system.....	90
---------------------------------------	----

CHAPTER V. CONCLUSION

5.1 Concluding Remarks.....	91
5.2 Further Improvements.....	91

REFERENCES.....	92
-----------------	----

APPENDICES.....	94
-----------------	----

.

LIST OF TABLES

Table	Page
4.1 Description for manage security use-case.....	69
4.2 Description for receive and view images use-case	70
4.3 Description for enter data use-case	71
4.4 PRC card part one information.	74
4.5 PRC card part two information.....	75
4.6 PRC card part three information.....	76

LIST OF FIGURES

Figure	Page
2.1 A Shastho Shebika is providing information about her work.....	8
2.2 A Shastho Karmi provides prenatal care.....	11
2.3 A Program Organizer is providing information about his work.....	15
2.4 Manual data passing diagram of the existing system.....	26
2.5 Data flow diagram of the existing system.....	27
4.1 Hand Scanner.....	43
4.2 Pen Hand Scanner.....	44
4.3 Hand Scanner.....	45
4.4 A newly designed Pregnancy Related Care (PRC) card.....	49
4.5 A scanned form.....	50
4.6 Converted text form.....	52
4.7 A functional hierarchy diagram.....	65
4.8 Context level diagram.....	66
4.9 Data flow diagram.....	67
4.10 Use case diagram for Health Informatics data storage system.....	72
4.11 Main Menu.....	78
4.12 User Login form.....	78
4.13 Task Menu form.....	80
4.14 Task Menu form after selecting image.....	80
4.15 Part One form.....	82

4.16 View Image form.....	83
4.17 Part One form with corresponding image form.....	84
4.18 Part Two form.....	85
4.19 Part Two form with corresponding image form.....	86
4.20 Part Three form.....	87
4.21 Part Three form with corresponding image form.....	88
4.22 Delete image form.....	89

CHAPTER I

1. INTRODUCTION

1.1 Overview of BRAC Health Program

BRAC, a national private development organization, set up in 1972 by Mr. Fazle Hasan Abed, was initially established as a relief organization to provide relief and assistance to resettle refugees returning to Bangladesh from India after Bangladesh's Liberation War. The immediate task of relief and rehabilitation over, BRAC turned its focus on the long-term issue of poverty alleviation and empowerment of the poor in the rural areas of Bangladesh. By 1977 BRAC had created and trained a cadre of village health volunteers through its Manikgonj Integrated Development Program, which still continues to serve as the health program's core team of front-line health workers. Today, BRAC Essential Health Program has evolved into a comprehensive set of interventions, including prevention, primitive, curative and rehabilitative health services extending up to the national level. In 2003 BRAC provided health services to more than 31 million people while actively collaborating with the Government of Bangladesh in numerous national programs [1].

The objectives of the BRAC health program are to decrease maternal and child mortality, reduce vulnerability to common diseases, and control infectious diseases such as tuberculosis, acute respiratory infection, and diarrhea. BRAC provides reproductive and family planning services, pregnancy-related care, basic curative care and treatment for tuberculosis. BRAC is also encouraging rural people to use safe water for domestic purposes and to employ hygienic sanitation for the benefit of their health [1].

The BRAC Health Program focuses principally on the community with a particular focus on women and children with its strategies implemented in three tiers. The first tier is a cadre of community health volunteers, called Shastho Shebikas, who are the front-line workers of BRAC's Health Program. They go door-to door to educate community members on critical health matters, they provide treatment for basic ailments, disburse essential health commodities, and help to create "health-empowered" communities. The second tier is a cadre of health paramedics, called Shastho Karmis. As a relatively new addition to the BRAC Health Program, these women oversee the work of the Shebikas, provide pregnancy related care, and hold health education forums where the community's health concerns are addressed. The third tier is a network of clinical facilities, called BRAC Shushasthos. The Shushasthos provide technical and clinical back up to the Shebikas and Karmis, who often refer patients to these centers. Though not available in all regions of the country, the Shushasthos provide diagnostic and treatment expertise with comprehensive laboratory services, outpatient facilities, and in-patient services, all with the support of diploma nurses and physicians [1].

The BRAC Health Program continues to evolve and meet new community demands. The BRAC Health Program achieves its innovation through the implementation of pilot projects. The BRAC Health Program is an effective innovator because its pilot projects are carefully conceived and, upon implementation, are closely monitored and externally evaluated. BRAC is committed to learning from its activities and evaluations. It therefore works to change pilot programs as necessary to ensure that health initiatives and services are of high quality, efficient and responsive. BRAC is currently implementing pilot projects for HIV/AIDS awareness and prevention, treatment of malaria, micro-health insurance, community-based arsenic mitigation, as well as initiatives for saving newborn babies, achieving early childhood development and strengthening public-private partnerships. The BRAC Health Programs strives for

accountability through the monitoring of its activities as well as through external research and evaluation [1].

1.2 Objective of the Project

The advancement in technology in the last few decades has improved our lives in every aspect. Manually driven systems are being substituted by the computerized systems. The existing system that the BRAC Health Program is using is totally manual to keep track of all the necessary records such as patient's records, inventory records and creating monthly reports etc [2]. BRAC Health Program uses a very lengthy process to keep track of all the information and there is a possibility of inaccuracy in transferring information manually. Information may be lost because of human error, intentionally or unintentionally. Humans are slow and inefficient processors of large amount information.

The objective of this project is to formulate a realistic and cost effective analysis in order to design a new information system for the BRAC Essential Health Care (EHC) Program, which is a part of the total BRAC Health Program [3]. This report provides a detailed guideline to bring about the necessary steps needed in course of the implementation structure. It embodies an approach towards the assigned design problem and how to obtain a feasible solution.

1.3 Methodology

First, key data has been extracted from a detailed description of the current BEHC system as a whole, and then potential problems in the current system have been identified. Next proposed system has been elaborated and after that the goal of the project has been established to provide better data reliability, more automation and less effort. Efficient real time data storage and data manipulation capabilities are the most important concern of the proposed system. Then, key aspects of the new proposed system has been explained in

details and to develop a prototype-planning phase, analysis phase and design phase have been explained in depth. Risks and further improvements of the proposed system have been mentioned at the ending of the report.

CHAPTER II

2. EXISTING SYSTEM

2.1 Requirements Analysis of Existing System

Requirements analysis is the process of gathering information about existing system. It is one of the most important and complicated part for developing a new system. The foremost objectives of the requirements analysis are to understand the existing system, identify its problems and collect required data to develop a concept for the new system.

We have visited many different places to collect the data. With the help of our academic advisor, we met some people who are not directly involved with the on going BRAC health program, but are involved with some similar on going health project, and with other organizations like UNICEF. Besides that, we went to the BRAC Head office several times and their other Thana level offices.

To collect the required data for our project we went to BRAC head office that is situated in Mohakhali BRAC Center complex. There we met the director of BRAC health who gave us an overall briefing about all the health related projects of BRAC. Then we were referred to a district health coordinator who explained the whole BRAC health process and its various projects. He provided us with some documents and reports on BRAC health program.

After studying all the relevant documents on BRAC health program we have selected BRAC Essential Health Care (EHC) Program for our research purpose. Through our report we have given some enhanced technology based solutions, which will help them to do their work smoothly and timely. Essential

Health Care (EHC) Program is the main program under the BRAC health sector that focuses on the general people of rural Bangladesh. This program essentially deals with some common complex diseases, mother care, childcare, immunization, tuberculosis etc.

After selecting our interested program, BRAC Essential Health Care (EHC), we again met the director of the BRAC health program and explained our objective and interest about the on going BRAC Essential Health Care (EHC) Program. Then, the district health coordinator gave us an elaborate idea about the work and data passing process of the on going BRAC EHC program. He explained all the steps of the on going Thana level EHC program and gave some sample data for our focus area. This helped us understand the program as a whole, which BRAC is providing to the mass people at the Thana level. He has also explained the limitations of the on going EHC program. They have to depend on some raw data to make several projections for the next upcoming month. This is because the current Management Information System does not process and give any concrete analytical information but only provide some raw data.

To understand and observe BRAC EHC program properly, we visited one of the BRAC health area office and surveyed their field level workers. The area office is located at Gazipur district where we spent a full day with the field level workers to understand their work in full details.

There we met with all the individuals who are directly involved with the BRAC EHC program. First, we went to the field where a health worker called SS (Shastho Shebika) was providing her health service to the rural people. There we visited from one house to another along with the SS according to her tour schedule. From this part of our field visit we got the idea of how the SS collects data from her work place. We found that at the time of their visit to the patient's house they collect many data through their register book. The collected data are not only related with the disease but also related with the service that they provide, i.e., the products that they sell. By conversing with the SS and seeing

her day long work process we have tried to find out her ultimate goal and the limitations that she is facing.

After visiting SS's work area we went to SK's (Shastho Karmi) work area. SK (Shastho Karmi) is the supervisor of ten SSs'. According to her schedule, SK sat in a particular place monitoring targeted patient and providing Pregnancy related care. From the visit of the SS and SK's work place we found out how they make their work schedule, co-ordinate with the area office and provide their services to the people. At the end we observed the work of PO (Program Officer), who works at the area office and monitors the activities of the SS and SK. We have also observed their manual data passing process from the field level to the head office. The entire existing system is described in the next section.

2.2 BRAC Essential Health Care (BEHC) Program

Initiated in 1991, the Essential Health Care Program offers an essential package of health services to the whole community in all areas where BRAC has established Village Organizations (VOs). This program is an integrated approach to reducing maternal, infant, and child mortality as well as improving the nutritional status of women, children, and adolescents. At the beginning, the program covered only 1.6 million people and then the BEHC program; gradually it has expanded and now covers a population of 31 million [1].

The Essential Health Care program approaches health issues comprehensively and offers a basic package of health services. Notably, BRAC provides critical services in reproductive health and disease control, mobilizes women, disseminates information through village organization meetings, meetings with community members, and home visits, and collaborates with the Government of Bangladesh to help implement national programs, such as the tuberculosis, immunization and sanitation programs. Most critically, BEHC pays particular attention to the poorest and most vulnerable members of the community [1].

2.3 BRAC EHC Service process

There are three groups under BRAC's Essential Health Care service, who play the crucial role for the running of the program. They are:

- 1) Shastho Shebikas (SS)
- 2) Shastho Karmis (SK)
- 3) Program Organizer (PO)

2.3.1 Shastho Shebikas (SS)

BRAC's community health volunteers, or Shastho Shebikas (SS), are the foot soldiers of BRAC's Essential Health Care program who play a critical role in every EHC program component. Going door to door, the Shastho Shebikas are the first to contact the community members and build a network between them and BRAC's health system [1].

All Shastho Shebikas are members of BRAC's Village Organization, and number over 24,000 throughout the country and most of them are women. Each Shastho Shebika is assigned an average of 300 households and usually visits about 15 households per day. At the end of the month, each Shastho Shebika generates an advance tour schedule for the next month and they submit this tour schedule report at their area office. While visiting households each Shastho Shebika follows their tour schedule and gets to know her clients, treats them for basic diseases, identifies pregnancies, provides family planning assistance, sells essential health commodities, and promotes health education [1].

A Shastho Shebika is trained to recognize the onset of a serious disease during her frequent visits, and then refers the patients for more advanced treatment at a government or BRAC health center. All the Shastho Shebikas get 15 days residential training at the beginning of their employment.



Fig. 2.1 A Shastho Shebika is providing information about her work.

The Shastho Shebikas work on a voluntary basis but they are able to earn some income from the sale of essential health commodities. Shebikas receive Tk. 500 to participate in a revolving fund that allows them to sell some essential drugs and health commodities such as antihistamines, oral saline, antacids, antihelminthics temporary contraceptives (condoms and the pill), birthing delivery kits, hygienic soap, iodized salt, sanitary napkins, and vegetable seeds. The sale of these goods allows them to earn a small income while community members gain access to high quality affordable items that enable them to improve their health. At the end of the month, SS generates the monthly sold product report and submits it to Shastho Karmis [1].

The Shebikas work to educate and mobilize community members regarding critical health matters. For example, they provide information on child health, educate and encourage the use of family planning methods and inform family members about national immunization day locations. They also provide other essential information regarding care during pregnancy, water and sanitation, personal hygiene, nutrition and tuberculosis [1].

The Shebikas also provide assistance to government health initiatives. They help to distribute vitamin-A capsules and help organize satellite clinics. They also work on increasing immunization coverage by mobilizing targeted children and pregnant women for immunization, assisting in the management of government immunization centers, identifying children who have missed immunizations and working as vaccinators during National Immunization Days [1].

The collective works of the Shastho Shebikas serve as the backbone for all activities and aspects of the Essential Health Care program. The Shebikas work to improve the health of their communities, and they also gain respect and income as active and knowledgeable community members [1].

To summarize, the Shastho Shebikas (SS) are performing the following activities:

- ◆ Generate Advance Tour Schedule.
- ◆ Collect their essential drugs and other health commodities from area office.
- ◆ Visit households and register patient's information according to their disease and treatment and provide necessary drugs.
- ◆ Generate the monthly sold product report.
- ◆ Attend a monthly meeting.

2.3.2 Shastho Karmis (SK)

In order to support and supervise the work of the Shastho Shebikas, a cadre of community health nurses, called Shastho Karmis (SK), have been recruited and trained. In addition to monitoring targeted households and providing pregnancy-related care each Shastho Karmi supervises the work of ten Shebikas. Additionally, she conducts four health education meetings in the community every month, where different health topics, such as immunization, family planning methods, sanitation and so on are addressed. They maintain coordination with government health and family planning workers at the community level. To begin their work, Shastho Karmis initially receive four week training program which includes the information already provided in the Shastho Shebika training together with in-depth training on maternal health and antenatal care [1].

Each Shastho Karmi (SK) generates an advance tour schedule for the next month. In this tour schedule report she (SK) decides which Shastho Shebika she will accompany during her visits. While visiting households each Shastho Karmis follow their tour schedule and at that time she also maintains her house movement record. SK tour schedule report consists of six types of records including visiting date, name of the Shastho Shebika who is accompanying the SK on her household visits, name of the village, name of the area, name of the meeting spot, and type of the work.

Movement record consists of date, starting time of the visit, ending time of the visit, name of the village, name of the area, name of the spot, type of the work and comments on work (if necessary).

Pregnancy often and unnecessarily endangers the life of women. BRAC EHC program has implemented a program to reduce maternal and neonatal mortality and morbidity by providing community-based antenatal and postnatal care [1]. In the course of their door-to-door work, the Shastho Shebikas identify all pregnant women and register them.



Fig. 2.2 A Shastho Karmi is providing prenatal care.

The Shastho Karmis visit the pregnant women and first collect information regarding present and past pregnancies. Thereafter the Shastho Karmis provide the pregnant women with services. These services include health and nutrition education that also address topics such as good hygienic practices, clothing, and the need for light exercise. They also track the pregnancy, recording weight and height. The Shastho Karmis also take measurements for anemia, jaundice, edema, blood pressure, temperature, and albumin and sugar levels in the urine. They perform abdominal examinations to determine height and fetal position. In addition, they motivate pregnant women to receive Tetanus Toxoid (TT) immunization, provide iron and folic acid (IFA) tablets, and promote breast feeding and family planning. Lastly, Shastho Karmis advise the mother to use a trained birth attendant in the case of a normal delivery and refer her to the hospital if complications arise. Additionally, a referral linkage has been established to provide basic and comprehensive Emergency Obstetric Care (EOC) at local health centers [1].

Shastho Karmis (SK) distributes Iron Folic Acid among anemic patients and keeps all the necessary records on her register book including date, how many tablets are distributed, and how many tablets left. A total of 837 ultra-poor individuals identified as severely anemic were included in the iron supplementation program. A total of 55,942 Iron Folic Acid (IFA) tablets were donated by the government health department, and 53,518 (95.7%) were distributed among severely anemic patients by BRAC Shastho Karmis (SK) [1].

In the course of their household visits the Shastho Shebikas and Shastho Karmis educate women about the use and benefits of modern methods of contraception. The Shebika is able to provide pills and condoms, and she can refer women to the government's secondary and tertiary facilities for other temporary and permanent contraceptive methods. The Shastho Karmi (SK) monitors for side effects and refers women to health centers for side effect management. SK keeps all the records about households and couple's family planning. SK also gives advice about safe water, Immunization, and Sanitation [1].

The EHC program carries out immunizations of infants as well as pregnant women. The Shastho Karmi and Shastho Shebika play critical roles in supporting Bangladesh's Expanded Program on Immunization. Both workers are responsible for educating women about the importance of immunization. They provide information regarding the location of vaccination centers in addition to mobilizing the community during National Immunization Days for polio eradication. They also monitor for any vaccine induced side effects [1].

In December, BRAC's independent Monitoring Department performed an assessment of EHC's immunization activities. EHC achieved immunization coverage as follows: coverage for BCG was 97%; for DPT/OPV-1 it was 97%; for DPT/OPV-2 it was 94%; for DPT/OPV-3 it was 87%; for OPV-4 it was 82%. Total measles coverage was 77%, while the percentage of children covered with all age-appropriate vaccine was 77%. For pregnant women, the percentage immunized with tetanus toxoid (TT) was 78% [1].

The provision of safe water and good sanitation facilities plays a vital role in promoting health and improving the hygiene status at the community level, thus increasing the productivity and well being of the nation. Inadequate provision of safe drinking water and sanitation is directly related to the spread of communicable diseases, increased health risks, poor health and environmental pollution [1].

The role of the Shebikas and Karmis is to help generate demand for safe water and sanitation facilities through household visits and health education forums on sanitation problems. Recognizing the importance of safe water and sanitation in public health, Shastho Karmi has made the provision of a safe water supply and sanitation as one of the vital components of its health program. The water and sanitation program emphasizes increasing awareness and developing capacity at multiple levels [1].

The Shastho Karmis use promotional materials like flip charts, posters and leaflets to communicate their critical messages. In addition, information is disseminated through popular theatre, workshops, rallies and campaigns as well as through the orientation of teachers and religious and community leaders. Another feature of this program is the promotion of private-sector involvement in service delivery. BRAC provides interest free loans from Taka 10,000 to Taka 15,000 to local entrepreneurs to manufacture slab latrines. In 2003, BRAC helped to establish 100 slab ring production centers. Each Shastho Karmi keeps all the records about Sanitation in her register book [1].

The Shastho Karmi organizes one health education meeting each week with the assistance of the Shastho Shebika. The topic of the meeting varies each week but topics include information and education on family planning, pregnancy-related care, immunization, water and sanitation, personal hygiene, child health, and tuberculosis. Information is also provided by the Shastho Shebikas during their household visits. They discuss nutrition, including natural sources for Vitamin A and the appropriate diet during pregnancy and lactation. They also motivate the community to cultivate vegetables and fruits in their

homesteads to ensure food security. Twice each year they distribute various types of vegetable seeds to the community members [1].

To summarize, the Shastho Shebikas (SS) are performing the following activities:

- ◆ Generate Advance Tour Schedule and maintain a movement record.
- ◆ Provide pregnancy related care and register all the records.
- ◆ Distribute Iron tablets and keep all the records about it and generate a total distributed Iron tablets report.
- ◆ Visit households and register patient and treatment information.
- ◆ Provide information regarding immunization and register necessary records.
- ◆ Put emphasis on hygienic sanitation and keep records about it.
- ◆ Generate the monthly-referred patient report.
- ◆ Arrange a monthly issue meeting for every Shastho Shebika.
- ◆ Finally generate monthly performance report for Program Organizer (PO), which has three parts.

2.3.3 Program Organizer (PO)

One Program Organizer (PO-health) works at the area level. They are managing and strengthening the work of EHC. He/She is responsible for supervising and monitoring the activities of the Shastho Shebikas and Shastho Karmis.

In order to improve the quality of services offered in the program, one Program Organizer (PO) works in every region (district level) to help develop the skills of the Shastho Shebikas and Shastho Karmis. A team of three Senior Medical Doctors supervises and provides the necessary technical support to all regional level PO-Trainers. The Program Manager, Program Coordinator, Director, and Deputy Executive Director provides overall support to implement the program smoothly [1].



Fig. 2.3 A Program Organizer is providing information about his work.

Program Organizer mainly emphasizes on inventory maintenance system. PO keeps records of the sold BRAC Health materials in his register book. These materials include BRAC saline, sanitary napkin, delivery kit, medicine, family

planning kit, soap etc. PO also keeps the name of the Shastho Shebika who bought health materials from him and the total amount of money.

Program Organizer (PO) purchases health materials directly from Pharmaceutical Company representative. When PO traces out that the health materials reserve is inadequate then s/he gives requisition for required product to Pharmaceutical Company. Then that company delivers product and PO keeps all the records including date, company name, invoice number, total amount of money, receiver's name and signature, area manager's name and signature in his register book. PO also records paid and due bill information.

All the Shastho Shebikas receive a fixed amount of revolving fund that allows them to sell some essential drugs and health commodities. SS returns that fund within some installments and PO records installment collection information in his register. Shebika refreshers form is maintained for gathering information about SS name, address, and the date of the attendance in the meeting. PO also maintains a stock register and daily sold and purchased product record book.

To summarize, the Program Organizer (PO) is performing the following activities:

- ◆ Maintain health materials sold records.
- ◆ Maintain health materials purchase records.
- ◆ Keep all the records about bill payment.
- ◆ Update SS revolving fund installment information.
- ◆ Arrange a monthly meeting for Shastho Shebika and keep SS refreshers attendance information.
- ◆ Finally, analyze monthly performance report submitted by Shastho Karmis and generate new monthly performance report for Regional Manager, which also has three parts.

2.3.4 Management and supervision

Any successful program needs to have an excellent supervisory process and an efficient management system in order to be effective. For the BRAC EHC program, the management and supervision are accomplished through a structure, which includes the central office of the Director of BRAC EHC program and staff [1].

The Program Organizer (PO) works at the area level s/he directly reports to the Regional Manager. His job is to supervise and monitor the activities of the Shastho Shebikas and Shastho Karmis. PO collects monthly performance reports from SK and based on that s/he (PO) helps them (SK) to develop the skills and improve the quality of the services offered in the program [1].

A Regional Manager (RM) at the district level imparts technical and supervisory support to the Program Organizers, Shastho Karmis and Shastho Shebikas at the field level. Their duties include supervising the program, training the Program Organizers and other staff members, routinely monitoring all the activities of the field staff, overseeing finances, collecting monthly performance reports from PO, analyzing those reports and generate new monthly performance reports for Head Office [1].

A team of three Senior Medical Doctors supervises and provides the necessary technical support to all regional level. The Program Manager, Program Coordinator, Director, and Deputy Executive Director provides overall support to implement the program smoothly. The Director is responsible for developing program policies. He manages the program and makes a liaison to the other BRAC program [1].

2.3.5 Monitoring and improving quality

The Essential Health Care program are regularly monitored and evaluated to ensure most favorable performance. This occurs primarily through the work of three divisions. The monitoring division performs external evaluations of the EHC program and quality assurance group internally assesses the quality of EHC program activities.

2.3.5.1 Monitoring department

BRAC's Monitoring Department is wholly independent and provides a reliable description of EHC's accomplishment and performance. The EHC program has its own monitoring department includes 34 Field Monitors who work in eight geographical blocks under the direction of eight Head Office Staff. The staff at the head office work to check the data collection process and to verify the collected data in the field [1].

The Monitoring Department, in association with the BRAC Health Program Staff, identifies programs that will be evaluated and the indicators used to judge them. Every year the Monitoring Department fix some sets of issues to monitor the health program such as: family planning, immunization, patient treatment policy, sale of health commodities, activities of Shastho Shebikas, knowledge levels of Shastho Shebikas and patient and EHC service coverage. The Monitoring Department shares their findings with respective programs through quarterly workshops [1].

2.3.5.2 Quality assurance department

The quality assurance (QA) team consists of nine members selected from the rank of field officers that is independent of the EHC staff undertaking program implementation. Eight of the individuals are stationed in a specific region of Bangladesh, where they are responsible for the collection of raw data, and one individual is located at BRAC's head office in Dhaka, where s/he performs data analysis and formulates recommendations [1].

QA issues are selected on the basis of identified program needs and feedback from statistical reports generated by the MIS division unit. As the QA team assesses a specific EHC program component, it considers multiple dimensions of quality and uses different tools in the assessment process. A comprehensive quality checklist is developed, enabling a standardized assessment of staff performance [1].

Once a QA issue is identified and a comprehensive checklist developed, the eight field staff monitors the issue in randomly selected areas of the country. When the quality assessment is completed, the raw data is first shared with the program staff at the field [1]. Participation through the evaluation process also helps to ensure the integrity of collected QA data. After the raw data is collected, a monthly QA report is prepared and disseminated to individuals in the EHC program.

Quality assurance findings are later shared and discussed at monthly EHC program meetings. Quality assurance for the EHC program is a continuous process. When QA results have been submitted and disseminated in six months time, an identical evaluation is performed in the same geographical area where the initial QA assessment occurred, thus creating an incentive to act on the original QA findings and to improve program performance [1]. Overall, the quality assessment activities have a significant impact on the work of the EHC program.

2.3.6 Health workers training

All Shastho Shebikas (SS) receive:

- ◆ 15 days residential training or 21 days non-residential (area office) training at the beginning of their work.
- ◆ Additional 3 days each for malaria and TB control.
- ◆ The training course covers topics ranging broadly in terms of preventive, curative and rehabilitative issues. They are trained in first aid and are educated to recognize and provide basic treatment for 10 common diseases. Lastly, the Shebikas are oriented on how to keep health records and maintain their stock of health.
- ◆ Every month SS receives a one-day refreshers training. This session is one of the critical feedback mechanisms that maintains and improves the quality of EHC activities.
- ◆ The refresher course addresses problems identified by the Shastho Shebikas' supervisors over the previous month and SS identify other problems they have encountered in the current month, and the Program Organizers (POs) address the questions accordingly.
- ◆ Lastly, new questions or topics are addressed. For example, new health initiatives, such as TB control, are discussed during the sessions.

All Shastho Karmis (SK) receive:

- ◆ Shastho Karmis receive four-week training program.
- ◆ The training course includes the information provided in the Shastho Shebika training, though much of the material is covered in greater depth.
- ◆ Additionally, a comprehensive training program of two weeks on maternal health and antenatal care is provided in government hospitals.
- ◆ The Shastho Karmis also receives refresher training for one day every month.

2.4 Components of the EHC Program

BRAC Essential Health Care Program has seven components, such as:

- ◆ Water and Sanitation
- ◆ Family Planning
- ◆ Immunization
- ◆ Pregnancy Related Care
- ◆ Basic Curative Care
- ◆ Health and Nutrition Education and
- ◆ Tuberculosis

2.4.1 Water and sanitation

Safe water supply and household sanitation program emphasizes on development and awareness and capacity building at different levels. The provision of safe water and good sanitation facilities plays a vital role in promoting health and improving the hygiene status at the community level, thus increasing the productivity and well being of the nation. Inadequate provision of safe drinking water and sanitation is directly related to the spread of communicable diseases, increased health risks, poor health and environmental pollution. Recognizing the importance of safe water and sanitation in public health, BRAG has made the provision of a safe water supply and sanitation as one of the vital components of its health program [1].

Another feature of this program is the promotion of private-sector involvement in service delivery. BRAC provides interest free loans from Taka 10,000 to Taka 15,000 to local entrepreneurs to manufacture slab latrines. BRAC has targeted to install 1,290,000 sets of latrines during the project period of 2006 [1].

In areas where BRAC works, 76% of households are currently using safe water for day-to-day purposes. BRAC, along with other NGOs, works closely with

the government of Bangladesh to achieve and address the national goal of 100% sanitation by 2010.

2.4.2 Family planning

In the course of their household visits the Shastho Shebikas and Shastho Karmis educate women about the use and benefits of modern methods of contraception. The Shebika is also able to provide pills and condoms, and she can refer women to the government's secondary and tertiary facilities for other temporary and permanent contraceptive methods. The Shebika monitors for side effects and refers women to health centers for side effect management [1].

2.4.3 Immunization

BRAC plays a big role in motivate and social mobilization for immunization. BRAC EHC gives more emphasize on children and pregnant women. The Shastho Karmi and Shastho Shebika play critical roles in supporting Bangladesh's Expanded Program on Immunization. Both workers convey the message about usefulness of immunization. They provide information regarding the location of vaccination centers in addition to mobilizing the community during National Immunization Days for polio eradication. They are also responsible for any sort of side effects [1].

2.4.4 Pregnancy related care

BRAC EHC Program has been providing the community based pregnancy related care to rural women. BRAC has implemented a program to reduce maternal and neonatal mortality and morbidity by providing antenatal and postnatal care [1]. While visiting household, the Shastho Shebikas identify all pregnant women and register them.

The Shastho Karmis visit those pregnant women and first collect information regarding present and past pregnancies. Thereafter the Shastho Karmis provide the pregnant women with services. These services include health and nutrition education. For every pregnant woman, BRAC provides a "Pregnancy Related Care Card". On that card, SK keeps track about all the current and previous pregnancy related records.

During the past year, 332,087 pregnant women received antenatal care and 191,636 women received postnatal care from BRAC. BRAC currently provides 54% of all pregnant women in its catchments area with antenatal care. Additionally, the program strives to provide vitamin-A capsules and IFA to all the mothers within 42 days of delivery [1].

2.4.5 Health and nutrition education

The Shastho Karmi organizes each week one health education meeting with the assistance of the Shastho Shebika. The topic of the meeting decides based on the current required issues include information and education on family planning, pregnancy-related care, immunization, water and sanitation, personal hygiene, child health, and tuberculosis. SK arranges this type of meeting for each SS area. Each SS distributes 50 packets of different types of vegetables seeds twice a year. BRAC also helps distribute Vitamin A capsules to children during National Immunization Days, when SS work in the outreach centers [1].

2.4.6 Basic curative service

Illness is a major factor for 'income erosion' among the rural poor. About 60%-70% of the common diseases can be treated at the community level through basic curative services. The Shastho Shebika is responsible for diagnosis, prevent and treat some basic disease including: anemia, diarrhea, dysentery, common cold, helminthiasis, ringworm, scabies, hyperacidity, angular

stomatitis and goiter. Additionally, they refer individuals with more complicated conditions to the local public and private health facilities. The SSs' efforts ensure affordable and timely curative services, critical to avoiding financial catastrophe amongst the poor and vulnerable [1].

2.4.7 Tuberculosis

The overall goal of BRAC's Tuberculosis control program is to develop and implement a community based approach that increase access to directly Observed Treatment Short-course (DOTS) and improves the quality of the services offered. In 1984, BRAC initiated a community-based tuberculosis treatment pilot project in Manikgonj upazilla. The program has gradually expanded and today covers 283 upazillas in 42 districts including the Chittagong Hill Tracts and five city corporations [1].

The main feature of the program is the involvement of the Shastho Shebika as primary service provider for dissemination of information, identification of suspect, implementation of Directly Observed Treatment Short course (DOTS), follow-up of patients, and referral of cases with complications. The patients are asked to deposit Taka 200 and sign a bond as a guarantee of treatment completion. Upon completion, Tk 125 is given to the Shebika in payment for her services and TK 75 is refunded to the patient [1].

2.5 Management Information System (MIS) Division

An information system consists of data, hardware, software, people and procedures, all with their strengths and weaknesses. Procedures include priorities in running different applications on the computer and security measures. Any information system that helps managers and other professionals in planning, control, and decision-making activities comes under the umbrella of

Management Information Systems (MIS) [4]. MIS division is involved in system development and concerned with system efficiency and effectiveness.

The current Management Information Systems (MIS) division of BRAC is responsible for collecting EHC program data and statistics. These divisions work collectively to improve performance, effectiveness, and consumer satisfaction. They help to provide a snapshot of current performance, identify opportunities where service delivery can be improved, and propose solutions to existing problems.

The main MIS division which is situated in BRAC head office (3rd floor) collects all the monthly performance reports that come from different regional offices. Then they use MS Access to enter all the data into the database and send it to the BRAC health MIS division (16th floor). BRAC health MIS division is responsible for generating final monthly performance reports in MS Excel. That Excel report is not very much functional for taking any managerial decision, because there is no opportunity to analyze the report and find out their improvements or problems and they are not getting any update or real time data. They are getting present month's reports in the following month. That is why top-level management cannot decide whether their performance is improving or not and in which area they are facing crisis or in need of immediate help.

2.6 Information Flow of the Existing System

To summarize, the information of BRAC EHC program information flows from root level (Area Level) to top level (Head Office). Firstly, Shastho Shebikas and Shastho Karmis collect all the records from households and submit the reports to PO (Area Office). PO hands over those reports to Regional Office and finally head office gets those reports from Regional Office. The information flow diagram and data flow diagram of the existing system are shown in the following.

Information Flow Diagram of the Existing System

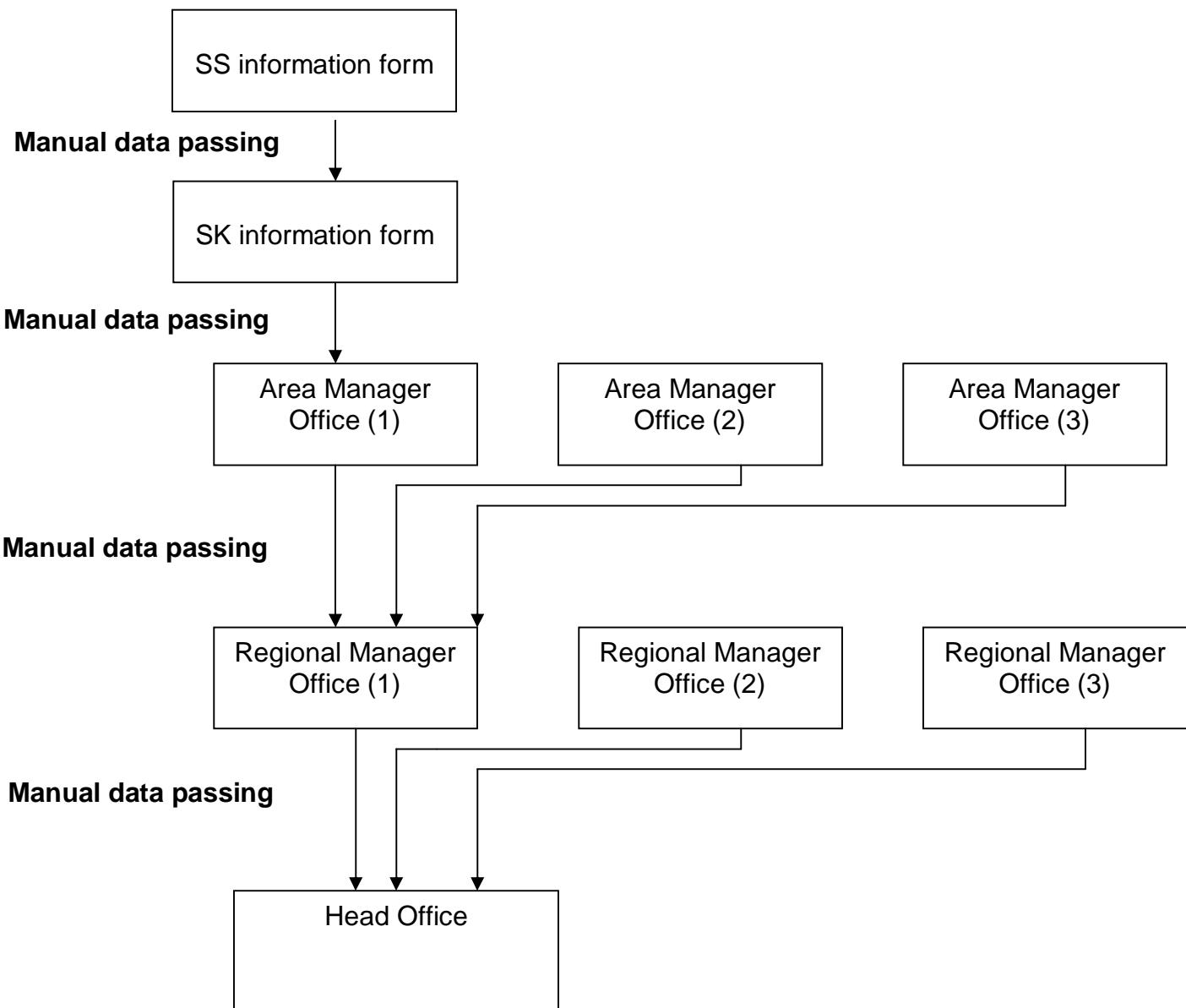


Fig. 2.4 Manual Data Passing diagram of the existing system.

Data Flow Diagram of the Existing System

Fig. 2.5 Data flow diagram of the existing system.

2.7 Drawbacks of Existing System

The current BRAC Essential Health Care Program has some drawbacks. The main drawbacks are:

- 1) Data flow from the lower level offices (area office) and regional offices to the head office requires many days and gets delayed.
- 2) When the head office wants to know any information about the area offices or makes any query it does not get the answer quickly and there is a considerable delay, as the staffs need to collect and deliver the answers personally. Finally, when the information arrives it may not be needed any more. The slow communication system always ages the information [3].
- 3) Again, when the area office faces any problem it cannot inform the head office about this or get the solution from the head office quickly.
- 4) The current state and condition of area offices are not completely visible and transparent to the head office as there is considerable delay in information flow.
- 5) If an employee or a group of employees do something wrong they can hide it by changing the information. It is hard to trace how and where information has been changed and sometimes hard to know that it was changed [3].
- 6) As there are pen and paper work involved (only in the head office there is data entry in computer) there may be many data inconsistency and redundancy. Almost all of the calculation does not involve software, so there may be errors in calculation.

- 7) Without the use of computer (except in some cases) more works, calculations have to be done manually and it requires large manpower. Therefore, there is a large amount of employees only for doing simple types of services [3].
- 8) Accurate, reliable and up-to-date information, which ensures better management and thereby more efficiency in the administrative work, cannot be achieved in the existing system [3].

CHAPTER III

3. Proposed System

3.1 Epidemiology

Public health is primarily concerned with the prevention of disease in human population. Public health differs from clinical medicine, and the emphasis is on prevention rather than treatment, and its focus is on population rather than individual patients. Epidemiology is a branch of public health, which attempts to discover the causes of disease in order to make disease prevention possible [5].

In this proposal, mainly pregnancy related care and its complications are focused and Epidemiological methods can be used to control and determine the problems of prenatal and antenatal care. The major problems of BRAC Essential Health Care (EHC) Program and other public health care institute are that they do not get any real time data and also do not store that pregnant patient's information. That is why public health management cannot get any sort of analytical data and cannot take any step to prevent any sort of important or uncertain problem. To go in depth about proposed system, brief descriptions about Epidemiology is given below.

Epidemiological methods can be used particularly in clinical research. But this short preliminary content focuses on the use of Epidemiology in public health and it is used as part of the wider process of discovering the causes of disease and preventing its occurrence in human populations [6]. Epidemiology has been defined as the study of the distribution and determinants of health-related states or events in specified populations and the application of this study to control health problems [5].

The key feature of Epidemiological study is that they are quantitative rather than qualitative, based on observational rather than experimental studies

of the determinants of disease and focus on human populations rather than individuals. The observational approach is a major strength of Epidemiology as it enables a study to be conducted in a situation where a randomized trial would be unethical or impractical [5].

3.1.1 Epidemiology in evaluation

There is an argument that, “whether Epidemiology is primarily an applied public health discipline or primarily a science in which methods and theory dominate over practice and application”. However, Epidemiology is a “science” and public health is a “mission”. Epidemiology contributes to the rationale for public health policies and services and is important for use in their evaluation. Epidemiologists can make their (public health) goal journal publication, public interpretation of findings, or public health interventions and Epidemiology’s full value is achieved only when its contributions are placed in the context of public health action, resulting in a healthier population [5].

3.1.2 Characteristics of Epidemiology

Epidemiological investigations are sometimes usefully characterized as descriptive, analytic or problem based [5, 6].

Descriptive Epidemiology: Descriptive Epidemiology describes the health conditions and health-related characteristics of populations, typically in terms of person, place, and time. This information serves as the foundation for studying populations. It provides essential contextual information with which to develop hypotheses, design studies, and interpret results. Surveillance is a particular type of Descriptive Epidemiology, to monitor change over time [6].
Types of descriptive studies:

- ◆ Routine analyses of vital statistics (births, deaths), communicable disease reports, other noticeable events (outbreaks, induced abortions).

- ◆ Periodic surveys of health status, knowledge, beliefs, attitudes, practices, behaviors, environmental exposures, and health care encounters e.g. National Center for Health statistics surveys, Centers for Disease Control and Prevention Behavioral Risk Factor Surveillance System.
- ◆ Specialized surveys to establish prevalence of a condition, a characteristic, or use of a medical procedure
- ◆ Studies comparing information across geographical or political units, or between migrants and persons in their country of origin to look for differences and patterns.

Analytic Epidemiology: Analytic Epidemiology involves the systematic evaluation of suspected relationships, for example, between an exposure and a health outcome. Because of their narrower focus, analytic studies typically provide stronger evidence concerning particular relationships [6]. Types of analytic studies:

- ◆ Case-control studies, comparing people who develop a condition with people who have not.
- ◆ Follow-up (retrospective, prospective) studies, comparing people with and without a characteristic in relation to a subsequent health-related event.
- ◆ Intervention trials (clinical, community), in which a treatment or preventive intervention is provided to a group of people and their subsequent experience is compared to that of people not provided the intervention.
- ◆ Analytic studies typically involve the testing of hypotheses, which in turn may arise from Case reports, Case series, Laboratory studies, Descriptive epidemiologic studies and other analytic studies.

The descriptive and analytic classification is more of a continuum than a dichotomy. Many studies have both descriptive and analytical aspects, and data that are collected in one mode and may end up being used in other as well. Whether a particular study is primarily “descriptive” or “analytic” may be

considered as a matter of the investigator's position in relationship to the study question and the collection of the data. Since Analytic Epidemiology is often accorded a higher status than Descriptive Epidemiology, with some regarding a study without a hypothesis as not science, investigators sometimes feel constrained to come up with a hypothesis and present their work as analytic, even if the hypothesis is contrived or is not the study's real focus [6].

Problem-Based Epidemiology: Problem-based approach may be particularly valuable in encouraging epidemiologists to focus on the major public health problems and to take the population context into account. Problem-based approach to teaching clinical medicine has been increasingly adopted in medical schools around the world. The value of this approach is that theories and methods are taught in the context of solving real-life problems. Starting with "the problem" at the population level provides a "reality check" on existing etiological theories and identifies the major public health problems which new theories must be able to explain. A fruitful research process can then be generated with positive interaction between epidemiologists and other researchers. Studying real public health problems in their historical and social context does not exclude learning about sophisticated methods of study design and data analysis, but it may help to ensure that the appropriate questions are asked [6].

3.1.3 Benefits of Epidemiology

- Discover the agent, host, and environmental factors that affect health, in order to provide scientific basis for the prevention of disease and injury and promotion of health [6].
- Determine relative importance of causes of illness, disability, and death, in order to establish priorities for research and action [6].

- Identify those sections of the population, which have the greatest risk from specific causes of ill health and benefit from specific interventions, in order that the indicated action may be directed appropriately [6].
- Evaluate the effectiveness of preventive and therapeutic health programs and services in improving the health of the population [6].
- Study the natural history of disease from its precursor states through its manifestations and clinical course [6].
- Conduct surveillance of disease and injury occurrence in populations [6].
- Investigate outbreaks to identify their source and controlling epidemics [6].

3.1.4 Limitations of Epidemiology

The main limitation of epidemiological studies is that lack of randomization means, the groups being compared may differ with respect to various causes of disease (other than the main exposure under investigation). Thus, epidemiological studies in general, experience the same potential problems as randomized controlled trials, but may suffer additional problems of biasness because exposure has not been randomly allocated and there may be differences in baseline disease risk between the populations being compared [5].

3.1.5 Where it is used?

Epidemiology has made significant contributions to the understanding and control of many health related conditions, and epidemiologists are actively involved in studying many others [5]. Some of the classic investigations and some areas of recent and current attention are listed below [6]:

- Scurvy - intervention trial, nutritional deficiency.
- Scrotal cancer - occupational health, carcinogens.
- Measles - incubation period, infectious period.
- Cholera - waterborne transmission, natural experiment.
- Puerperal fever - hygienic prevention.

- Rubella and congenital birth defects - prenatal exposure.
- Lung cancer and smoking - coming of age of chronic disease epidemiology.
- Poliomyelitis immunization trial - a massive experiment that demonstrated the effectiveness of the vaccine against this greatly feared virus.
- Cardiovascular disease - longitudinal community studies; community intervention trials.
- Breast cancer screening – a large-scale randomized trial of effectiveness of cancer early detection through screening.
- Psychiatric disorder - challenges in disease classification and assessment.
- Lead and cognitive development - a crucial role for a biologic marker.
- HIV - a new or newly-recognized virus that has transformed the public health and epidemiology landscape with respect to infectious diseases in general and sexually-transmitted infections specifically.
- Tuberculosis - reminding epidemiology of its roots; control of a pathogen is very different from its eradication.

Now, the entire descriptions of the proposals are explained as follows:

3.2 Proposed System Overview

Considering the Epidemiological studies and existing problems of BRAC EHC program, we have come up with some of the following proposals, which will simplify the work of the BRAC health staffs. The solutions include:

1. Using Hand scanner, mobile phone and OCR technology.
2. Using Epi Info software package tools for data analysis.
3. Using web-based database system.

1. **Using Hand scanner, mobile phone and OCR technology:** Using hand scanners and mobile phones, all the data from the field level can be transferred to the head office workstation. Then using both the methods i.e. one using OCR technology and another without OCR technology, all the data can be stored in the database.
2. **Using Epi Info software package tools for data analysis:** The data that is stored can be analyzed using the Epi Info software package. Here, various analytical and comparative information can be obtained which can be used in the Epidemiological study.
3. **Using web-based database system:** The current manual data passing system can be automated as a web based database system. Using the web based database system the management get the data on time and it can be used in their decision making process.

In point of fact, the major aspect of these three solutions is getting updated and real time data, which will helpful for Epidemiological study.

3.3 Using Hand Scanner, Mobile phone and OCR technology

Shastho Shebika and Shastho Karmis gather raw data from the field, which are recorded in their register book. These data are processed in the Regional Centers like the current working system. The Shastho Karmis supply raw data to the office (area office) of the Program Organizer (PO). The Regional centers collect data from the area offices and transfer all the data to the Head Office. Up to this level all data transfer is carried out manually. A data entry operator then input all the data into the Head office computer. Here all the raw data are processed into useful information for BRAC EHC program. Since all data are collected manually and it is very time consuming, some important data are lost at the field level. They also cannot keep all the necessary data or card information (Pregnancy Related Care Card) in their register book or database.

With the existing system, all data are collected by asking questions to the patient by SS and SK and they record those data manually in their register form. SK also fills up a Pregnancy Related Care Card manually and that pregnant patient keeps this card. Since there is no copy of the information in the card, the information's is completely lost. Since they are using hand written form or card and these data are transferred manually in a step-by-step process from area level to head office and it eat up a lot of time to accumulate the data at the Head office.

Considering these problems we came up with an enhanced technology based solution. Instead of that manual data passing system we can use a mobile phone and a hand scanner to transfer data directly to the head office. When a SS or SK records all the information in their form or card, they can use a hand scanner to scan the form which will be connected to the mobile phone and the data can then be sent it to the head office using SMS technology. The Head office will get scanned forms or cards in image format in their server. To enter those data into the database we can use two methods.

- 1) We can use Optical Character Recognition (OCR) technology to convert image documents into text documents. By parsing those text documents all data will be stored into the MS Access database. Then the health management can see real time data and will get update report. With this updated database, and statistical data analysis reports will be generated using Epi Info software.
- 2) We can use another method without using OCR technology and data parsing. After head office gets all image documents in the server in the same manner described above, they will get to know which forms or cards have recently arrived from area office through SMS using data storage software. Then, a data operator will open those image documents and will enter all image data in the database. After that, health management can get similar opportunity (e.g. method one) to see the real time data and can generate reports using Epi Info software using these updated database statistical analysis.

3.4 Using Epi Info Software Package Tools for Data Analysis

Epi Info is a public domain software package designed for the global community of public health practitioners and researchers. BRAC EHC Program or any other public health need analytical, graphical and comprised statistical data and reports, which will be easier for them to take any decision. When all the data will be saved into the database then Epi Info will do those analyses. With Epi Info and a personal computer, epidemiologists and other public health and medical professionals can rapidly develop a questionnaire or form, customize the data entry process, and enter and analyze data. Epidemiologic statistics, tables, graphs, and maps are produced with simple commands such as READ, FREQ, LIST, TABLES, GRAPH, and MAP. Epi Map displays geographic maps with data from Epi Info [7].

The primary applications within Epi Info are [8]:

- ◆ Make View: A program for creating forms and questionnaires which automatically creates a database and it can use existing MS Access database.
- ◆ Data Entry: A program for using the forms and questionnaires created in Make View to enter data into the database.
- ◆ Analysis: A program for producing statistical analyses of data, report output and graphs.
- ◆ Epi Map: A program for creating GIS maps and overlaying survey data on to them.
- ◆ Epi Report: A tool that allows the user to combine Analysis output, Data Entry and any data contained in Access or SQL Server and present it in a professional format. The generated reports can be saved as HTML files for easy distribution or web publishing.

Key features of Epi Info software [8]:

- ◆ Maximum compatibility with industry standards, including:
 - Microsoft Access and other SQL and ODBC databases
 - Visual Basic
 - World Wide Web browsers and HTML
- ◆ Extensibility, so that organizations outside CDC can produce additional modules.
- ◆ Nut Stat, a nutrition anthropometry program that calculates percentiles and z-scores using either the 2000 CDC or the 1978 CDC/WHO growth reference.
- ◆ Logistic regression and Kaplan-Meier survival analysis.
- ◆ Data Compare does double data entry comparison.
- ◆ Epi Lock password protects, encrypts, and compresses Epi Info™ data.
- ◆ Allows analysis and import of other file types.

3.4 Using web-based Database System

Computers can be provided in the root level for data entry as well as in the higher positions in the data processing hierarchy and may connect all the computers in various networks. Therefore, all the computers and all the units of BRAC EHC program can exchange data as required. Here network based MYSQL or ORACLE database server can be used to manage the whole database throughout the country. This system would require almost no manual data transfer. The network system administrator will control access to database of any person of the data hierarchy.

All the regional centers of BRAC EHC program possess phone lines. There are 13 regions at the present system and these regional centers have computer facilities. So it can be easily to provide with the required manpower and Internet facilities in all regional centers. The computers can be connected to each other using modems and local ISPs and data transfers can easily be implemented with web-based facilities. Although the regional centers are separated by long distances but use of web-based database system will minimize the amount of data transfer and corresponding costs.

CHAPTER IV

4. DATA TRANSFER AND STORAGE, USING HAND SCANNER, MOBILE PHONE AND OCR TECHNOLOGY

4.1 An Overview

Among the three proposals, first one- using hand scanner, mobile phone and SMS technology transfers data from field level to head office. Head office receives scanned forms or cards in image format in their server. To enter those data into the database two methods can be used. The methods are:

Method One: Using OCR technology and data parsing.

Method Two: Instead of OCR technology and data parsing use data storage software.

Before looking at these two specific methods of data storage a brief introduction to hand scanner and OCR technology is given below.

4.2 Hand Scanner

A Hand Scanner, which is ergonomically designed to fit comfortably in the palm of hand. Usually it looks like an oversized computer mouse that allows the user to scan image as wide as 10 centimeters. In this case, the scanner is moved across the surface to be scanned, so the user must maintain a constant speed of the hand to obtain an average-quality result. Hand scanner is used for reading bar code, scanning field level forms, and taking fingerprints or handprints. It also takes geometric readings of a person's hand - its size, length, thickness and surface area and then it creates a three-dimensional model that is coded mathematically and stored in computer memory. Each time a form or a hand is placed on the machine, the information is automatically updated [9].



Fig. 4.1 Hand Scanner

The most advanced hand-held scanner for Windows PC is the pen hand scanner and its latest version; C-Pen800C is sold all over the world. It has an 8 MB memory and performs reading, saving and transferring text. Unlike other scanners, it contains a comprehensive address book, a calendar, a translation facility, memory capability of up to 3000 pages of text and the ability to send messages via cell phones either to a fax, or to another phone as an SMS message [9].



Fig. 4.2 Pen Hand Scanner

If people want effective graphical images using a hand scanner along with SMS technology used in mobile phones, then there are a number of things to be consider, such as: minimize network traffic and effective presentation of the images [10]. In current instance, Hand Scanner with Bluetooth wireless technology is an innovative device combines the power of laser scanning with fuzzy logic and the convenience of Bluetooth wireless technology in a single compact, lightweight device that is ergonomically designed to fit comfortably in the palm of your hand. Bluetooth wireless technology transforms device connections with each other, offering new possibilities for using mobile computer with other devices without the hassle of cables or the awkwardness of a protruding antenna. Using Hand scanner is the most efficient way to enter data into a database system and it is 50 times faster and 10,000 times more accurate than manual data entry [11].



Fig. 4.3 Hand Scanner

4.3 OCR Technology

Optical character recognition (OCR) is the branch of computer science that involves reading text from paper and translating the images into a form. This is an efficient way to turn hard-copy materials into data files that can be edited and otherwise manipulated on a computer [12]. OCR is a technology that provides a full alphanumeric recognition of printed or handwritten characters at electronic speed by simply scanning form.

All OCR systems include an optical scanner for reading text, and sophisticated software for analyzing images. Most OCR systems use a combination of hardware and software to recognize characters. Advanced OCR systems can read text in large variety of fonts, but they still have difficulty with handwritten text [12].

4.3.1 Functions of OCR

Forms containing characters, images can be scanned through a scanner or a hand scanner. The recognition engine of the OCR system then interprets the images and turn images of handwritten or printed characters into ASCII data (machine-readable characters). Therefore, OCR allows users to quickly automate data capture from forms, eliminate keystrokes to reduce data entry costs and still maintain the high level of accuracy required in forms processing applications [12].

4.3.2 Features of OCR

The OCR technology provides a complete form processing and document capturing solution. Usually, OCR uses a modular architecture that is open, scaleable and workflow controlled. It includes form definitions, scanning, image pre-processing, and recognition capabilities. OCR is needed if documents need to be electronically stored and maintained. Because with OCR technology, images can be scanned, indexed, and written to optical media [12].

4.3.3 Advantages of OCR Technology

- ◆ OCR deals with less paper works that leads an organization not to carry papers or forms to and from workstations, clear desks, quicker processing, and no storage of papers or forms near operators are required [12].
- ◆ There are significant savings in costs and efficiency by not using papers.
- ◆ Scanning and recognition of forms allows efficiently managing and planning the rest of the processing workload. Once the papers are recognized people knew how much works (repair work, edit failures) have to do.
- ◆ This is less time consuming process.

4.3.4 Disadvantages of OCR Technology

- ◆ **Accuracy:** While OCR technology can be effective in converting handwritten or typed characters, it does not give as high accuracy for reading data, where users are actually marking forms. Because sometimes OCR creates problem to recognize unclear handwritings and other symbols.
- ◆ **Additional workload to data collectors:** OCR has several limitations when it comes to human handwriting. The main text form characters must be hand-printed with separate characters in boxes [12].

4.4 Using OCR Technology and Data Parsing

Shastho Shebika and Shastho Karmis collect data from field levels, which are recorded in their register book. Shastho Karmis deliver raw data to the office (area office) of the Program Organizer (PO). The Regional centers collect data from the area offices and transfer all the data to the Head Office. Up to this level all data transfer is carried out manually by a data entry operator. Also they cannot keep all the necessary data or card (Pregnancy Related Care Card) in their register book and this card information is completely lost. Since they are using hand written form or card and these data are transferred manually in a step-by-step process from area level to head office.

As an alternative of that manual data passing system, a mobile phone and a hand scanner can be used to transfer data directly to the head office from root level. When a SS or SK records all the information in their form or card, they can use hand scanner to scan the form and send it to the head office by the SMS technology used in mobile phones. Head office will get scanned forms or cards in image format in their server. Then use Optical Character Recognition (OCR) technology to convert image documents into text documents. By parsing that text document, all data will be stored into the MS Access database. To accomplish these there are several step-by-step

processes that will be used in the Pregnancy Related Care Card and its corresponding data.

4.4.1 Process stages

1) Redesign the Forms: Initially all the forms need to be redesigned. Because one of the major factor affecting data entry or form processing cost is the design of the source document. Many organizations never consider the impact of the actual form design on data entry efficiency or accuracy until after they learn how much it will cost to process their documents. Since these forms will be scanned and converted into text documents using OCR technology. So the forms should be designed in a different way. And redesign of forms will not only consider the impact on scanning, but it will also provide some benefits such as: reduce budgets, minimize excessive time needed to prepare the documents for scanning or data entry. This will also reduce excessive time by minimizing the time required to read unclear data [13].

Most people do not write very legibly, especially when they write in the field and get numerous data within a very short period of time. Unreadable hand writing and printing not only reduces accuracy, it also increases the time taken to key the data or to recognize the data [13]. On BRAC EHC Program's existing forms there are a very little restrictions on how responses can be entered, which habitually promotes careless and unreadable entries. The following is an example of such form:

Name:	
Address:	
Education:	

If the person writing the form in hurry then the above format will almost insure a high percent of careless and unreadable entries. The most effective way to promote readable hand print is to provide a lettering grid for each field into which a person would print one letter at a time into a single block and use check boxes or radio buttons to standardize answers and promote single-value entries. This will vastly improve the chances of data entry accuracy and efficiency [13]. The following is an example:

PREGNANCY RELATED CARE CARD
PART ONE

Shastho Shebika:

Patient Name: [REDACTED] **Age:** [REDACTED]

Education: _____ **Profession:** _____

Husband's Name: _____

Village: _____ Union: _____

PART TWO

Alive Children: Last Period Date:

Dead Children: **Expected Delivery Date:** / /

Total Children: **T.T.Date:** 1st dose

5th dose

Diabetic

Patient's Complex Diseases: Heart Diabetic

Tuberculosis High Blood Pressure Asthma

PART THREE

Previous Pregnancy Information:

Pre-acclamsia **Acclamsia** **Pre-pregnancy Bleeding**

Pregnancy time Bleeding Longtime Pregnancy Pain

Twin Baby For safe Delivery Caesarian

Fig. 4.4 A newly designed Pregnancy Related Care (PRC) card.

2) Document Scanning Process: After collecting all necessary data and filling up the form, the SS or SK can scan that form. Scanning speed, quality, and cleanliness is determined by the quality of the scanner machine [11]. The images are stored into the temporary memory of the scanner. The following is an image of a scanned form:

PRAGNANCY RELATED CARE CARD			
PART ONE			
Shastho Shebika:	R A H I R A B E G U H		
Registration number:	0 1 1 0 2 9	Date:	2 9 0 3 2 0 0 5
Patient Name:	H A L I M A K H A N A M	Age:	2 5
Education:	S S C	Profession:	T E A C H E R
Husband's Name:	A B D U L K A R I M		
Village:		Union:	
Upazilla:		District:	D M A K A
PART TWO			
Alive Children:	0 2	Last Period Date:	0 2 0 3 2 0 0 5
Dead Children:	0 1	Expected Delivery Date:	0 1 1 2 2 0 0
Total Children:	0 3	T.T.Date:	1 st dose 1 2 - 1 2 - 0 4 2 nd dose 3 rd dose 4 th dose 5 th dose
Patient's Complex Diseases:	Heart <input checked="" type="checkbox"/>	Diabetic <input checked="" type="checkbox"/>	
Tuberculosis	<input checked="" type="checkbox"/>	High Blood Pressure	<input type="checkbox"/>
		Asthma	<input type="checkbox"/>
PART THREE			
Previous Pregnancy Information:			
Pre-acclamsia	<input type="checkbox"/>	Acclamsia	<input type="checkbox"/>
Pre-pregnancy Bleeding	<input type="checkbox"/>	Longtime Pregnancy Pain	<input type="checkbox"/>
Twin Baby	<input type="checkbox"/>	For safe Delivery	<input type="checkbox"/>
		Caesarian	<input checked="" type="checkbox"/>

Fig. 4.5 A scanned form.

3) Transfer Image by SMS Technology: All the scanned images are sent to head office using SMS technology used in mobile phones.

4) Recognizing Process: When the images appear into the head office the recognizing process interprets all the images. It ensures that the images are stored into the right memory (directory) and compare the value of the interpreted image with the real image of the form.

5) OCR Technology: Optical character recognition (OCR) converts optically scanned images of printed or written text characters into character codes. This is an efficient way to turn hard-copy materials into data files that can be edited and manipulated on a computer. While OCR technology can be effective in converting handwritten or typed characters, but it does not give as high accuracy for reading data, where users are actually marking forms. Sometimes it cannot recognize some similar words or characters. Following is an example of a converted text form, where it cannot recognize some similar characters, like it takes "I" as "1", "√" as "V" and also take some data fields as image format [13].

PRANGNENCY RELATED CARE CARD
PART ONE

Shastho Shebika: R A H 1 M A B E G U M

Registration number: 0 1 1 0 2 9 Date: 28 03 2005

Patient Name: H A L 1 M A K H A N A M Age: 2 5

Education: S S C Profession: T E A C H E R

Husband's Name: A B D U L K A R I M

Village: Union:

Upazilla: District: D H A K A

PART TWO

Alive Children: 0 2 Last Period Date: 0 2 0 3 2 0 0 5

Dead Children: 0 1 Expected Delivery Date: 01 1 2 2 0 0 6

Total Children: 0 3 T.T.Date:1st dose 1 2 - 1 2 - 0 4
2nd dose
3rd dose
4th dose
5th dose

Patient's Complex Diseases: Heart V Diabetic

Tuberculosis V High Blood Pressure Asthma

PART THREE

Previous Pregnancy Information:

Pre-acclamsia Acclamsia Pre-pregnancy

Bleeding

Pregnancy time Bleeding V Longtime Pregnancy Pain

Twin Baby For safe Delivery Caesarian V

Fig. 4.6 Converted text form

6) Parse the Data and Enter into the Database: After getting the text version of the forms, there are some problems in understanding the character or reading data. Therefore initially all the required data manipulation should be done on a computer. All the data will be then parsed and directly entered into the MS Access database.

Then health management can see real time data and will get update report. With this updated database, statistical data analysis and report will be generated using Epi Info software.

4.4.2 System requirements

➤ **Hardware Requirement:**

PC Computers with minimum capacity:

Processor: Pentium IV

RAM: 512 MB

Disk: 80 GB

Form modules are designed to operate in a batch processing, run under LAN and PC based platforms and take full advantage of the graphical user.

➤ **Mobile Phone:**

A mobile phone with color display, memory card, infrared technology, and Blue tooth technology.

➤ **Scanner Requirement:**

OCR scanners with minimum capacity:

Duplex scanning

Speed: 60-sheets/ min

Automatic Document Feeder (ADF): Scanning can take a significant amount, and the system lets user scan up without doing the OCR.

➤ **Software Requirement:**

- ◆ OCR converter software
- ◆ Data parsing software

4.5 Instead of OCR Technology and Data Parsing, Use Data Storage Software

From the above illustration, it is obvious that Shastho Shebika and Shastho Karmis collect data from field levels, and Head Office gets all the data from Area Office. Up to these levels all data is passed manually. Instead of that manual data passing system, we can use a mobile phone and a hand scanner to transfer data directly to the head office. When a SS or SK records all the information in their form or card, they can use hand scanner to scan the form and send it to the head office by the SMS technology used in mobile phones. Head office will get scanned forms or cards in image format in their server.

In first method, it is explained that when all the scanned forms appear in Head Office server then Optical Character Recognition (OCR) technology converts image documents into text documents. By parsing that text document, all data will be stored into the MS Access database. But OCR technology and data parsing have some problems. OCR technology does not give as high accuracy for reading data from scanned image forms. It cannot convert handwritten or typed characters into text format because it has several limitations when it comes to human handwriting. Characters must be clearly hand-printed with separate Characters in boxes. Data parsing is an enhanced technology. That is why it requires a high quality parsing software and to maintain this software a skilled professional is desirable and it requires a huge cost. The another problem of data parsing is that it maintains some certain rules and while parsing if any rule go against it then data parsing generate error.

Considering these problems, we have come up with another effective solution. Instead of using OCR technology and data parsing, we can use this method. Field levels to Head Office data transferring steps are same as first method. When head office gets all image documents in the server, then by using software we can know which forms or cards are recently arrived from area office by SMS technology. Finally, a data operator will open those image documents and will enter all image data in the database. Exclusive of final step, all the preceding steps are same as earlier method (use OCR technology and data parsing). Transferring data from image form to text form, data storage software is required.

After categorizing all sorts of difficulties with implementation of software projects, building a health data entry prototype may possibly solve some of the problems and can give a clear concept about the whole system. There are many different systems development methodologies and each one is unique based on System Development Life Cycle (SDLC). For this system prototyping-based methodology is appropriate and it performs the analysis, design, and implementation phase concurrently and all three phases are performed repeatedly in a cycle until the system is completed. With these methodologies, the basic of analysis and design are performed and work immediately begins on a system prototype [14].

Prototype

A prototype is a quick-and-dirty program that provides minimal amount of features. It however helps the user to conceptualize what the final system would look like very quickly [14]. So the users can interact with the prototype and thus understand whether the analyst understood, what they want and also helps the analyst to refine real requirements quickly by modifying the prototype with the given feedback. The analyst uses this feedback to improve the prototype and takes the new version back to the users [15].

Prototyping Process

Prototyping technique involves the user in analysis and design and its ability to capture requirements in concrete, rather than verbal or abstract form. The prototyping process begins with a brief requirements collection, followed by prototyping and user evaluation. Often the end users may not be able to provide a complete set of application objectives, detailed input, processing, or output requirements in the early stage. After the user evaluation, another prototype is made based on feedback from users, and again the cycle returns to client for user evaluation. Prototype is used to minimize the risk associated with the final system by ensuring that important issues are understood before the real system is built. Once the issues are resolved, the project moves into

design, acceptance and implementation. The prototype would represent the accepted functionality design of the real system [14].

It is impossible to start building a system immediately without first considering the required functionality and identifying the parts of the whole system. We have already analyzed and gathered detail information about whole BRAC EHC program but for this prototype we need specific requirements from MIS department of BRAC health. Because MIS department will deal with this prototype and data entry operator will operate this prototype as user. Data entry operators (user) are not trained computer scientist or professional users and they have no knowledge of advanced designing methods used in computer science, therefore, the method of abstraction must be simple yet effective and not require much learning. Prototyping offers such a perception.

4.5.1 Planning phase

The first step in any new development project is planning. Generally planning phase explains about business need, functionality, expected value and feasibility analysis of the proposed system [14].

Business Need: The business need describes why this system should be build and explains to the approval committee why the organization should fund the project [14]. From this system, BRAC health sector will get updated real time data and can take analytical report while taking any major decision.

Functionality: The functionality of a system explains what the information system will do for the organization. That is why it needs to be explained at the high level so that the approval committee and project team understands what the business unit expects from the final system [14]. It indicates what the features and capabilities the system will have to include. Using the automated data storage system users (data entry operator) should be able to entry real time data and generates necessary reports. The users should be able to:

- ◆ Work on a data entry system, where all the scanned image format data arrive at server from field level.
- ◆ Monitor all the real time data and enter into the database server.
- ◆ Generates and delivers up-to-date necessary reports.

Expected value: The expected value indicates what the organization gains from the system. It is most useful when it includes values that can be measured after the system is in place so that the actual results can be compared to the original goals in a post-system assessment [14]. The expected values of the system:

- ◆ Faster report generation from database.
- ◆ Improved decision-making process.
- ◆ Improved client satisfaction.

Technical Feasibility Analysis: Feasibility analysis guides the organization in determining whether to proceed with a project and identifies the important risks associated with the project. The objective of this analysis is to determine whether a solution to the problem is feasible to prevent wasting time and money on it [14].

Technical Feasibility determines whether the technology needed for the proposed system is available and how it can be integrated within the organization [14]. Technical evaluations must also assess whether the existing system can be upgraded to use the technology and whether the organization has the expertise to use it.

Once the needs for the system and its basic functionality have been defined, a more detailed technical feasibility analysis was carried out to better understand the opportunities and limitations associated with the proposed project [14]. This feasibility analysis mainly focused on these aspects:

- Familiarity with the application.
- Familiarity with technology
- Project size.

The Technical feasibility analysis for BRAC EHC Program is stated here:

Technical feasibility (moderate)

Familiarity with the application (excellent):

- The BRAC health MIS department already has the experience of working Personal Computer environment. The department is also using spreadsheets applications like MS Excel.

Familiarity with technology (risky):

- The users have no experience of working in a network environment.
- There is no LAN connection within the PCs to run the system in a network environment.

Project size (moderate):

- We estimate that the project is moderate in size.
- With some effort the to-be system can be replaced by the current system without much complexity.

4.5.2 Analysis phase

System analysis is the part of the systems development life cycle in which one can determine how the current information system functions and assess what users would like to see in a new system [15]. There are many sub phases in analysis such as: requirements gathering, requirement structuring, selecting best alternative design and finalizing the design. Analysis of the whole existing system has been described before. Only the MIS department's analysis part is included here, because it is required for the development of the prototype.

4.5.2.1 Requirements gathering

Defining user requirements requires an understanding of how the system works and what its problems are. There are many important issues to consider in getting a clear picture of a system. One is to look at the current processes in the system and identify the tasks in those processes. The tasks can then be examined in detail. Such examination can identify the users, who carry out the tasks, the interactions between the users. Thus an analyst must always consider the users and what they do [15].

For requirements gathering it was important to select the "right person". An analyst let the objective and needs of the analysis tasks drive the selection of the people who participate during analysis. BRAC EHC program's MIS department has only one employee Ms. Mahbuba who is working with the current information system and district coordinate officer of BRAC health Chittagong division Mr. Abdul Salam has total knowledge of the overall system. So, both of them have been selected as the primary persons who will participate during analysis.

4.5.2.2 Interviewing the users

Interviewing is perhaps the most commonly used technique in analysis. There is no real way to avoid interviews, as they must precede any other method for gathering information about system requirements it is always necessary first to approach someone and ask them what their problems and priorities are, and later to discuss with them the results of the analysis. Interviewing is the main approach used to analyze large structured system. Interviewing is gathering information by asking questions. There are some basic steps to the interview process: selecting interviewees, designing interview questions, preparing for the interview, conducting the interview and follow-up [14].

There are many ways to arrange an effectively interview and no one is superior to others. However, experienced analysts commonly accept some following best practices for an effective interview:

- Prepare the interview carefully, including appointment, priming question, checklist, agenda, and questions
- Listen carefully and take note during the interview (tape record if possible)
- Review notes within 48 hours after interview
- Be neutral
- Seek diverse views

The first step in developing an interview plan is to identify the users to be interviewed. For this project, Mr. Abdul Salam and Ms. Mahbuba have been interviewed.

Designing questions for interview

Designing the questions for the interview is very important. There are three types of interview questions [14]:

- Closed-ended questions.
- Open-ended questions.

➤ Probing questions.

Closed-ended questions are normally those that require specific answer. So, these questions are used when the analyst is looking for specific, precise information [14].

Open-ended questions are those that leave scope for elaboration on the part of the interviewee. Open-ended questions are designed to gather rich information and give the interviewee more control over the information that is revealed during the interview [14].

Finally, probing questions follow up on what has just been discussed in order to learn more. They are often used when the interviewer is unclear about an interviewee's answer [14].

The initial questions were prepared based on the problems occurred during the analyzing the whole health system. Several formal and informal interviews and meetings were carried out during the project lifetime. A sample interview report is given here:

Interview Report

Person Interviewed:

- Mr. Abdul Salam (District coordinate officer, BRAC Health Sector, Chittagong division)
- Ms. Mahbuba (MIS department, BRAC Health Sector, Head Office)

Interviewer:

Hasnain Feroze, Suriful Alam Sumon and Nourin Mujib Khan

Date:

16th March 2005.

Primary Purpose:

To gather information about the current data storage system and also to identify problems and solutions (if any) for future improvement system.

Question Format:

Q1. Give a brief idea about the current data passing and storage system you are using?

Ans: Normally all the data are collected from field level. We get all the final monthly performance reports from our regional office. We do not get all the information such as: patient information, pregnancy related care information etc. we store only monthly performance report information in a spreadsheet using MS Excel.

Q2. What are the main problems in this current system?

Ans: Actually we do not get any updated data. We get all the reports in the subsequent month. That is why if we need to take any major decision than we do not get any feedback or any sort of analytical comparison from current reports and we are

doing our comparison analysis process manually. Sometimes MIS department may fail to notice a request for requisition. Another problem is there is no information about pregnant patient.

Q3. What are your expectations from our system or what type of facilities you want from the future enhanced system?

Ans: Well, we want up-to-date information and a database for keeping all the records. It will be very helpful for us if there is any way to generate comparison based reports, which is very important for our decision making process.

Summary of Interview:

From the interview it is obvious that the current system has numerous limitations. Precise problems can be realized from user point of view. Some measures can be taken to update the existing system so that it performs more efficiently. The current system will be more efficient if the problems are solved.

Open Items:

- It is clear that the BRAC health sector needs an automated real time system.
- A back-end database will help the users a lot to store update information and generate reports.

4.5.2.3 Selecting the best alternative design strategies

An analyst is usually considering a number of alternative solutions, one of which is chosen as the most acceptable satisfaction. It is advisable to investigate as many alternatives as possible to ensure that the best solution is chosen. Just using the first idea that comes to mind is not the best approach. A certain amount of skill is needed to propose good alternatives and choose the right direction. Selecting the best alternative is usually done with the help of a quantitative procedure. Analyst will recommend what they believe to be the best alternative but the management of an organization will make the ultimate decision about which system design strategy to follow. Selecting best alternative design strategies depends on some important issues such as: hardware and systems software issues, implementation issues, organizational issues, cost benefit analysis issues etc [15].

4.5.2.4 Finalizing the design of the prototype

After analysis all the aspects and according to feedback given by users, the design is finalized for the prototype. All the scanned image forms will be stored in the head office server. The data entry operator will enter all the data into the database server. Since here only the pregnancy related care data are focused, so all the database and forms are designed based on that pregnancy related care card. The full database and forms design descriptions are given in the subsequent design phase.

4.5.2.5 Process modeling

Functional Hierarchy Diagram

The following hierarchy diagram shows the BRAC health pregnancy related care data storage system process at a high aggregate level or at a highly detailed level. The data storage system works with these four high level processes [2]. This is the basic functional hierarchy for the data storage system.

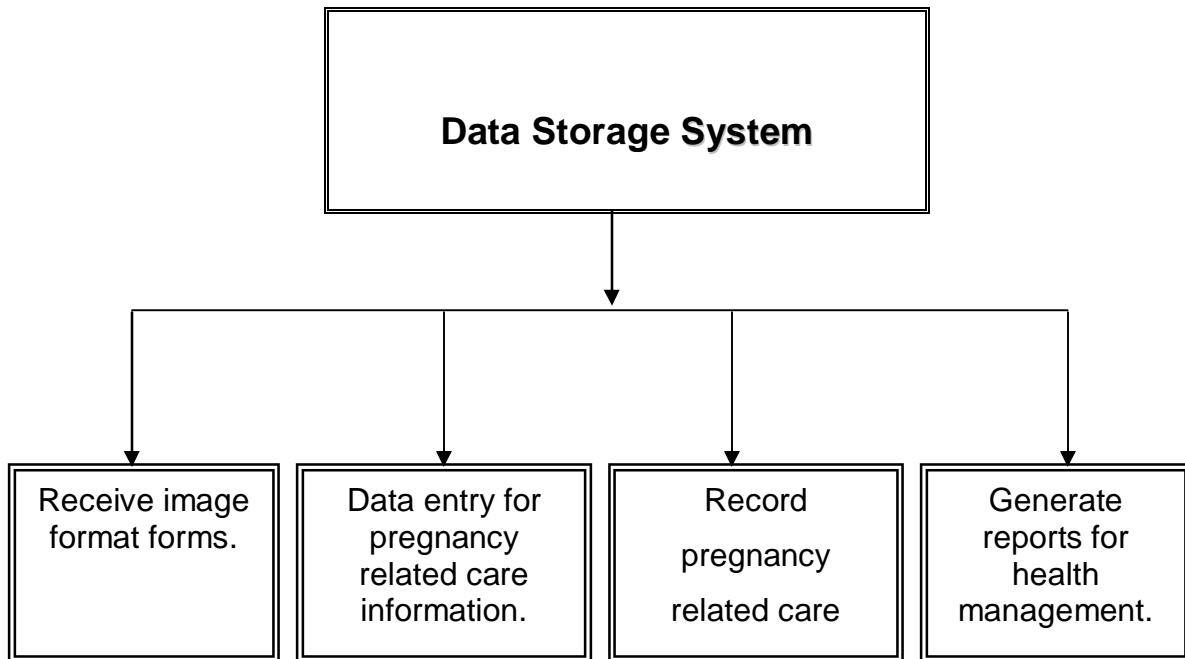


Fig. 4.7 A functional hierarchy diagram.

Context Diagram

This is the context diagram of the BRAC health pregnancy related care data storage system. This context diagram contains only one process and this single process represents the data storage system. Shastho Shebika/Shastho Karmis, MIS Department and Health Management are source/sinks of the system and are represent the environmental boundaries of the system.

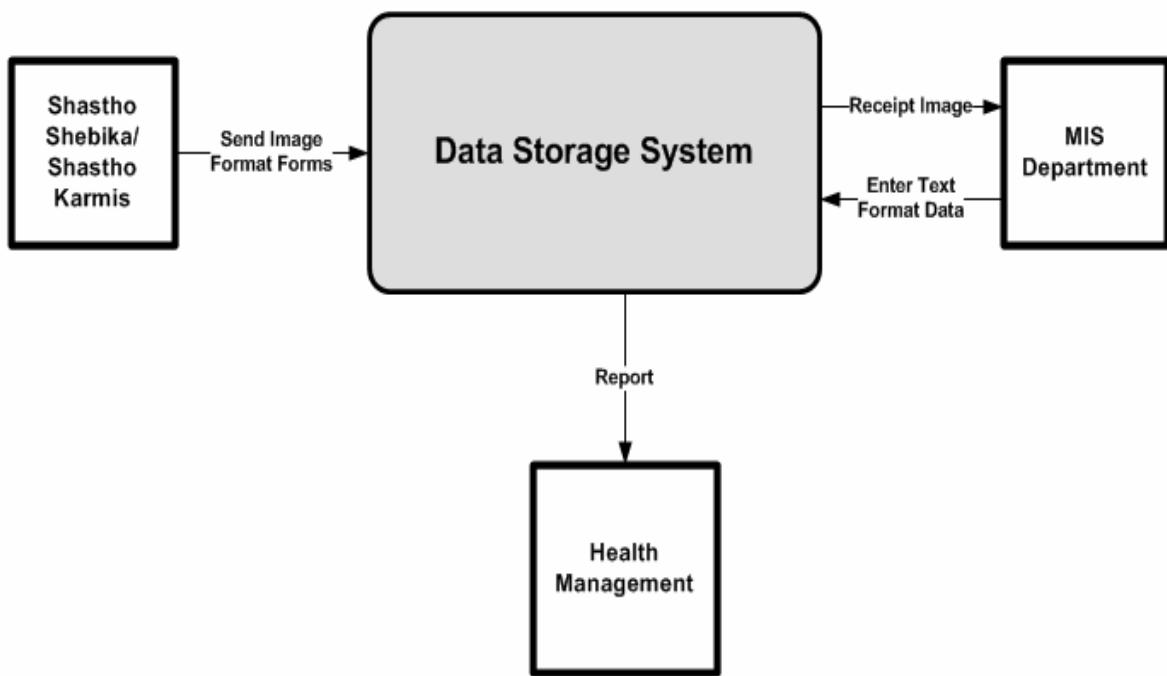


Fig. 4.8 Context level diagram.

Data Flow Diagram

Data flow diagram shows the flow of the data between external entities, processes and data storage within the system. The data flow diagram of our project is given below:

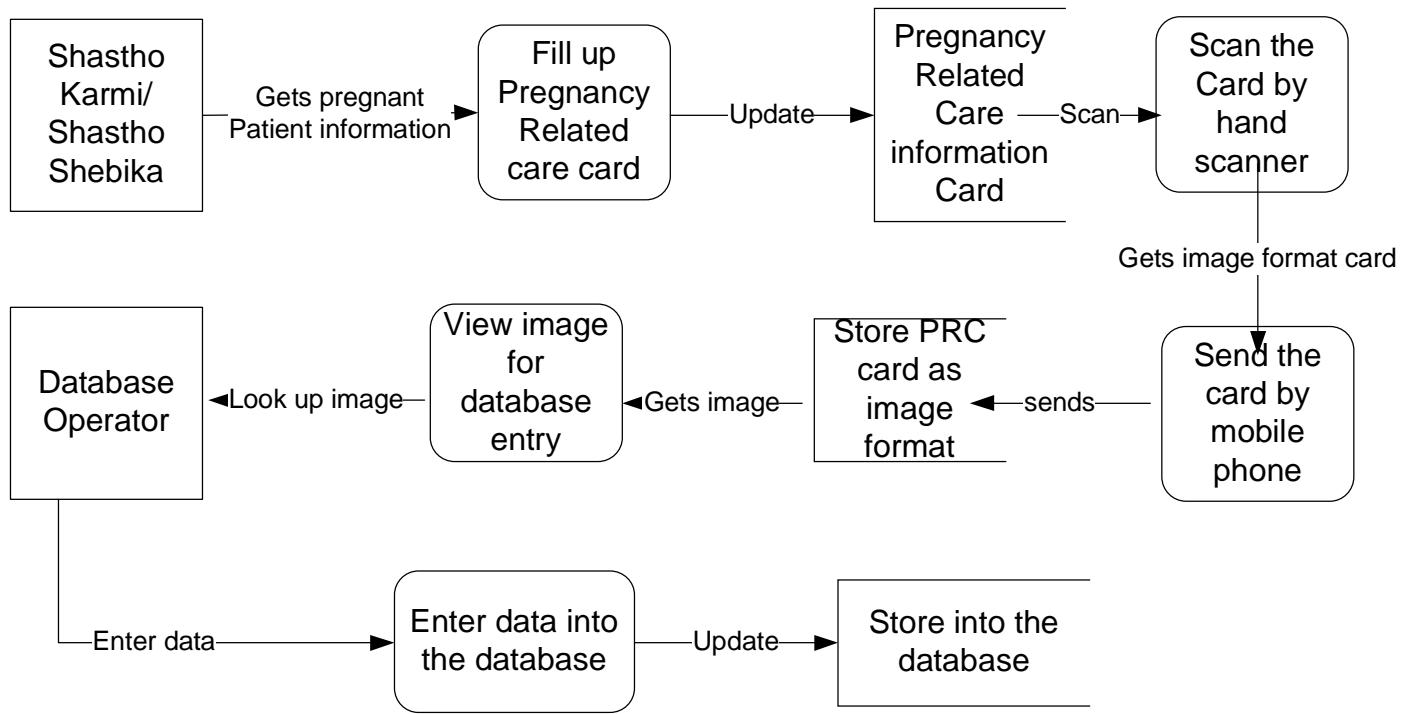


Fig. 4.9 Data flow diagram.

4.5.2.5 Use-Case modeling

Use-case description

Here, the use-case descriptions containing all the information needed to build the use-case diagram BRAC health pregnancy related care data storage system. The use-case diagram is shown in the last part of use-case description [16].

Table 4.1
Descriptions for manage security use-case

Use case name: Manage Security	ID: 1	Importance level: High		
Primary actor: Data Entry Operator	Use case type: Overview, essential			
Stakeholders and interests: Data Entry Operator - wants to change his/her password for security.				
Pre Condition: A data entry operator should have a confirmation name and password to enter into the system.				
Post Condition: A data entry operator enters login name and password.				
Main Success Scenario: <ul style="list-style-type: none"> ➤ Data entry operator logins to the system. ➤ He/she changes the password by confirming his old password (if required). 				

Table 4.2
Descriptions for receive and view images use-case.

Use case name: Receive and view image	ID: 2	Importance level: High
Primary actor: Data Entry Operator	Use case type: Detail, essential	
Stakeholders and interests:		
<p>Data Entry Operator - wants to receive new images and view those images.</p> <p>Shastho Karmis- wants to send scanned images by using SMS technology.</p>		
Pre Condition: A data entry operator needs to login into the system and find out the currently arrived image file in to the directory.		
Post Condition: A data entry operator wants to view currently arrived image and its corresponding data.		
Main Success Scenario: <ul style="list-style-type: none"> ➤ Data entry operator searches for new image in the image directory. ➤ System shows the list of image files. ➤ Then he or she select image from that list. ➤ System then views that image. 		

Table 4.3
Descriptions for enter data use-case.

Use case name: Enter data	ID: 3	Importance level: High		
Primary actor: Data Entry Operator	Use case type: Detail, essential			
Stakeholders and interests: Data Entry Operator - wants to enter data into the database from image files.				
Pre Condition: A data entry operator needs to view the currently arrived image file.				
Post Condition: A data entry operator wants to enter and save data successfully into the database.				
Main Success Scenario: <ul style="list-style-type: none"> ➤ System views an image. ➤ Data entry operator select corresponding forms for enter data. ➤ Data entry operator enters data into that form by looking image file. ➤ He or she saves all the data. ➤ Then data are store into the database. 				

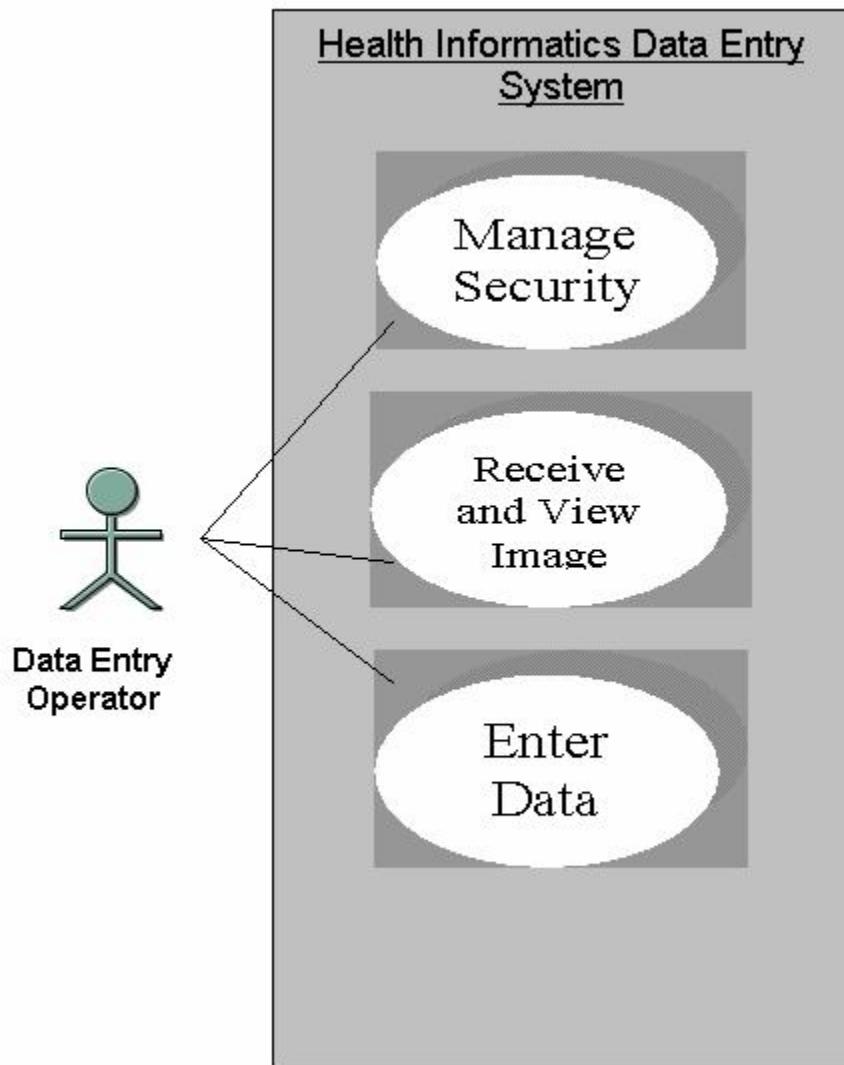


Fig. 4.10 Use case diagram for Health Informatics data storage system.

4.5.3 Design phase

4.5.3.1 Designing the database

Database design is one of the most important parts of the system. Database is a central source of data meant to be shared by many users for variety of applications. Actually it is shared, integrated computer structure housing. The heart of a database is Database Management System (DBMS), which manages data, controls access to data and contains query language [3]. A database administrator ensures the objectives of the database. The effectiveness objectives of the database include ensuring that data can be shared among users for multiple applications, maintaining data that are accurate, consistent and not redundant, ensuring that all data required for current and future applications will be readily available [16].

There are three major tables in the database for pregnancy related care data storage system. These three tables are Pregnancy Related Care (PRC) card part one information, part two information, part three information where all the records about current pregnancy information, previous pregnancy information, prenatal and antenatal care information etc are included. The back-end database is created using Microsoft® Access. There is no query in the database. Queries are maintained from the front-end. Detail PRC card information table description is explained below.

Table 4.4
PRC card part one information.

Field Description	Field Id	Data type
Shastho Shebika Name	Shasthoshebika	Text
Registration Number	Reg_num	Number
Date	Date	Date/time
Patient Name	Patientname	Text
Age	Age	Number
Education	Education	Text
Profession	Profession	Text
Husband's Name	Husbandname	Text
Village	Village	Text
Union	Union	Text
Upazilla	Upazilla	Text
District	District	Text
Alive Children	Alivechild	Number
Dead Children	Deadchild	Number
Total Pregnancy	Total_preg	Number
Last Period Date	Last_period	Date/time
Expected Delivery Date	Expected_deli	Date/time
First T.T Dose	1stdose	Date/time
Second T.T Dose	2nddose	Date/time
Third T.T Dose	3rddose	Date/time
Forth T.T Dose	4thdose	Date/time
Heart Disease	Heart	Yes/No
Diabetic	Diabetic	Yes/No
Tuberculosis	Tuberculosis	Yes/No
High Blood Pressure	High Blood Pressure	Yes/No
Asthma	Asthma	Yes/No

Table 4.5
PRC card part two information.

Field Description	Field Id	Data type
Per-Acclamsia	Pre_acc	Yes/No
Acclamsia	Acclamsia	Yes/No
Pre-pregnancy bleeding	Pre_bleeding	Yes/No
Pregnancy time bleeding	Prag_time_bleeding	Yes/No
Longtime pregnancy Pain	Long_time_pain	Yes/No
Twin baby	Twin	Yes/No
For safe delivery	Frosafedelivery	Yes/No
Caesarian	Caesarian	Yes/No
Check up date	Check_date	Date/time
Weight	Weight	Number
Temperature	Temp	Number
Anemia	Anemia	Number
Jaundice	Jaundice	Number
Edema	Edema	Number
Albumin	Albumin	Number
Sugar level	Sugarlevel	Number
Headache	Headache	Yes/No
High fever	Highfever	Number
Delivery date	Deli_date	Date/time
Alive Delivery	Alive	Yes/No
Dead Delivery	Dead	Yes/No
Home Delivery	Home	Yes/No
Hospital Delivery	Hospital	Yes/No
Doctor	Doctor	Yes/No
F.W.V	Fwv	Yes/No

Other	Other	Yes/No
Normal Delivery	Del_normal	Yes/No
Caesarian Delivery	Del_ceasarian	Yes/No

Table 4.6
PRC card part three information.

Field Description	Field Id	Data type
Check up date	Date	Date/time
Weight	Weight	Number
Temperature	Temp	Number
Anemia	Anemia	Number
Jaundice	Jaundice	Number
Edema	Edema	Number
Lucia	Lucia	Number
Pressure	Pressure	Number
Bleeding	Bleeding	Number
High Fever	Highfever	Number
Baby Weight	Baby_weight	Number
Baby temperature	Baby_temp	Number
Fever Yes	Fever_yes	Yes/No
Fever No	Fever_no	Yes/No
Jaundice Yes	Jaundice_yes	Yes/No
Jaundice No	Jaundice_no	Yes/No
Nerve yes	Nerve_yes	Yes/No
Nerve No	Nerve_no	Yes/No
Immunization Yes	Immu_yes	Yes/No
Immunization No	Immu_no	Yes/No

4.5.3.2 Designing the forms

The form is a business document containing some predefined data and often includes some areas where additional data are to be filled in. The forms of the final system are designed in standard Windows approach. Screens of the forms are developed in Microsoft® Visual Studio 6.0 [16]. The final prototype system has following features:

- The final system has text fields for data entry.
- It uses command buttons to complete most of the tasks.
- A user-friendly Main Menu categorizes all the tasks.
- It uses separate forms to view, add or delete data.
- It has a login option as a security feature.
- The back-end database is not visible in the final system.
- A user has no access to change the back-end database.

4.5.3.3 Forms of the database



Fig. 4.11 Main Menu.

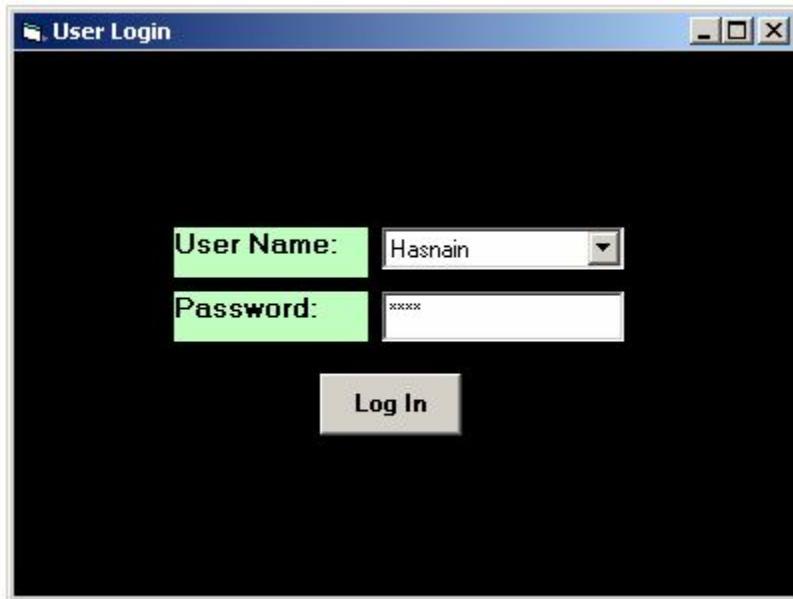


Fig. 4.12 User Login form.

The preceding figures (Fig. 4.11 and Fig. 4.12) show the main menu and the user login form of the system. To access all the options of the system a user has to login using the login form. User can login as an Administrator, as a user or as a guest. Different login options will provide user with different access environment [16].

- An administrator can access all the options.
- A user also has access to all the options apart from the permission to add new user or delete an existing user.
- A guest can only access the view image or observe data option of the system.

To login user has to select his/her user name and type their own password. Then if the password and user name is correct then clicking the “Log In” button will confirm the login process. A wrong user name or password will display a warning message about wrong user name or password.

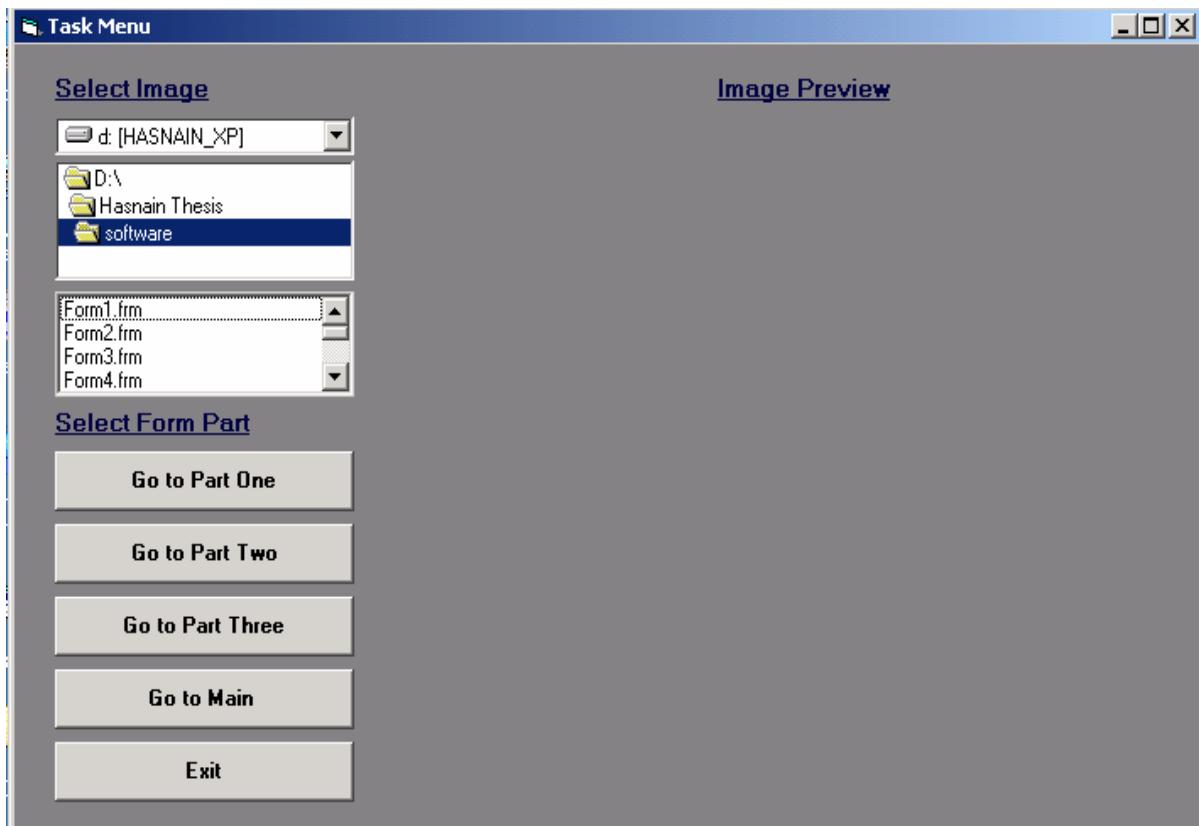


Fig. 4.13 Task Menu form.

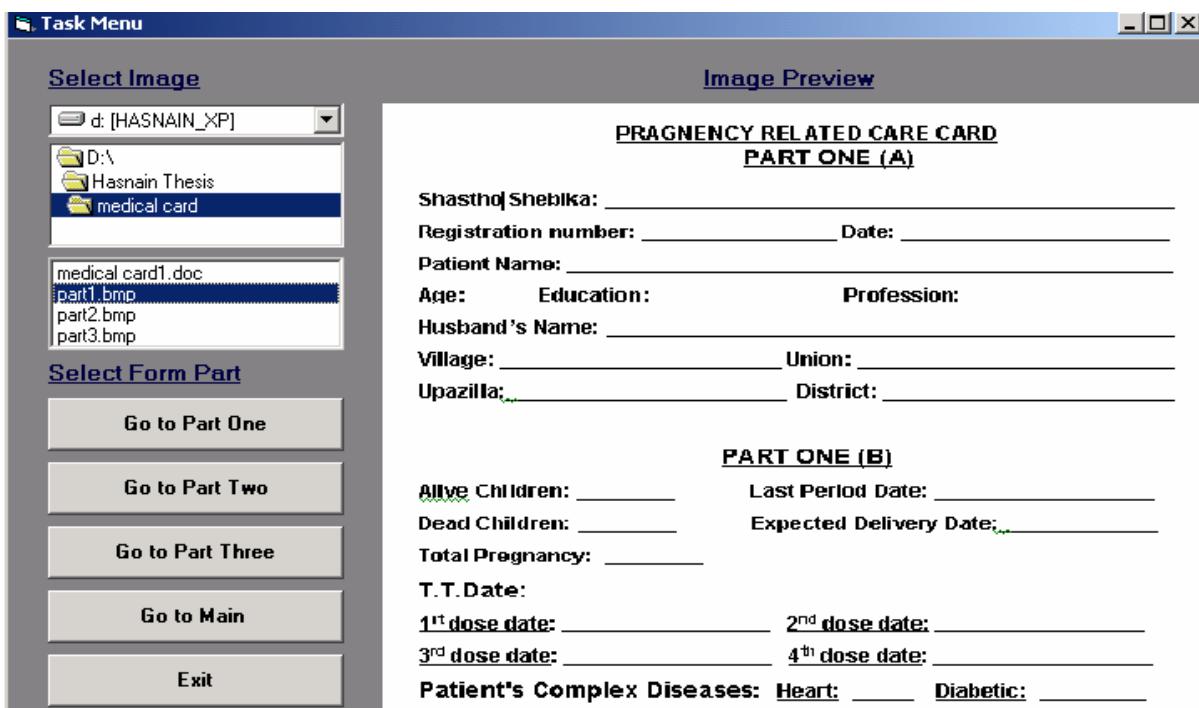


Fig. 4.14 Task Menu form after selecting image.

When the username and password is accepted then the Task Menu form will be opened. This form is for searching new arrived image forms. If new image forms arrived in the workstation then selecting that image it will be shown in the image preview box. Pregnancy Related Care card has three parts. User should select image consecutively Part One, Part Two and Part Three. When part one image form will be selected then user will click on “Go to Part One” button and corresponding text form will be opened. This process is same for part two and part three image forms.

Part One

PART ONE

Show Image	Shastho Shebika		
Add Data	Registration Number	Date	
Save Data	Patient Name	Age	
Go to First Data	Education	Professor	
Previous Data	Husband's Name		
Village		Union	
Upazilla		District	
Next Data	Alive Children	Last Period Date	
Go to Last Data	Dead Children	Expected De Date	
Delete	Total Pregnancy		
Go to Next Form	T.T.Date		
Go to Task Menu	1st Dose	<input type="text"/>	
Delete Image form	2nd Dose	<input type="text"/>	
Exit	3rd Dose	<input type="text"/>	
	4th Dose	<input type="text"/>	
Patient's Complex Diseases			
<input type="checkbox"/> Heart <input type="checkbox"/> Diabetic <input type="checkbox"/> Tuberculosis <input type="checkbox"/> High Blood Pressure <input type="checkbox"/> Asthma			

Fig. 4.15 Part One form.

Part One form is the text version of part one image form. It also contains several buttons such as: Show Image, Add Data, Save Data, Go to First data, Previous Data, Next Data, Go to Last Data, Delete, Go to Next Form, Go to Task Menu, Delete Image Form and Exit. These buttons are linked with the related forms. Clicking on Show Image button will show the corresponding image which is selected from Task Menu.

View Image Form

**PRAGNANCY RELATED CARE CARD
PART ONE (A)**

Shastho|Shebika: _____

Registration number: _____ Date: _____

Patient Name: _____

Age: _____ Education: _____ Profession: _____

Husband's Name: _____

Village: _____ Union: _____

Upazilla: _____ District: _____

PART ONE (B)

Alive Children: _____ Last Period Date: _____

Dead Children: _____ Expected Delivery Date: _____

Total Pregnancy: _____

T.T.Date: _____

1st dose date: _____ 2nd dose date: _____

3rd dose date: _____ 4th dose date: _____

Patient's Complex Diseases: Heart: _____ Diabetic: _____

Tuberculosis: _____ High Blood Pressure: _____ Asthma: _____

Hide Image

Fig. 4.16 View Image form.

The above figure shows the View Image form of the system. It will show the image in a separate form and Hide Image button will close this form. This form will be used for data entry from image format form to text format form.

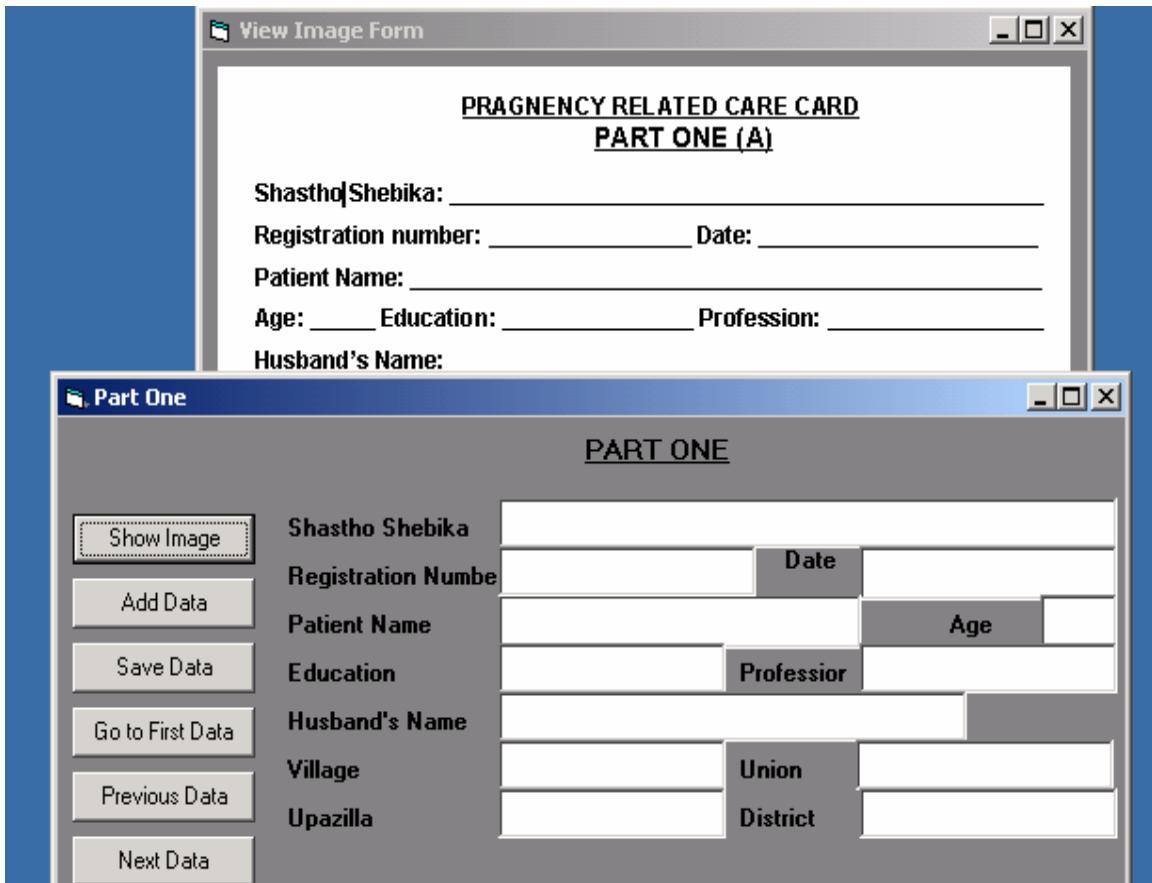


Fig. 4.17 Part One form with corresponding image form.

The above figure shows the Part One form with corresponding image form. User will enter data into the Part One form by looking equivalent image form. To add initial information about pregnant patient this Part One form is used. After putting all the information to the respective fields, clicking the Save Data button will save that data and give again the option to add record if the Add button is clicked. Any time user can delete the entry by clicking the Delete button. After entering all the information, if user wants to delete that image from directory then Delete Image Form button will show the related form.

Part Two

PART TWO

Show Image

Add Data

Save data

GO to First Data

Previous Data

Next Data

Go to Last Data

Delete

Go to Next Form

Go to task Menu

Delete Image form

Exit

Previous Pregnancy Information

Pre-acclamsia Aclamsia Pre-pregnancy Bleeding
 Pregnancy time Bleeding Longtime Pregnancy Pain
 Twin Baby For safe Delivery Caesarian

Current Pregnancy Information

Checkup Date	<input type="text"/>	Weight	<input type="text"/>		
Temperature	<input type="text"/>	Anemia	<input type="text"/>	Jaundice	<input type="text"/>
Edima	<input type="text"/>	Albumin	<input type="text"/>	Suger Level	<input type="text"/>
Headache	<input type="text"/>	High Fever	<input type="text"/>		

Delivery Information

Delivery Date:

Delivery Result: 1) Alive 2) Dead
 Delivery Place: 1) Home 2) Hospital
 Delivered By whom: 1) Doctor 2) F.W.V 3) Others
 Deivery Type: 1) Normal 2) Caesarian

Fig. 4.18 Part Two form.

The preceding Part Two form is the text version of part two image form. It also contains similar buttons like Part One form. Such as: Show Image, Add Data, Save Data, Go to First data, Previous Data, Next Data, Go to Last Data, Delete, Go to Next Form, Go to Task Menu, Delete Image Form and Exit. These buttons are linked with the related forms. Clicking on Show Image button will show the corresponding image which is selected from Task Menu.

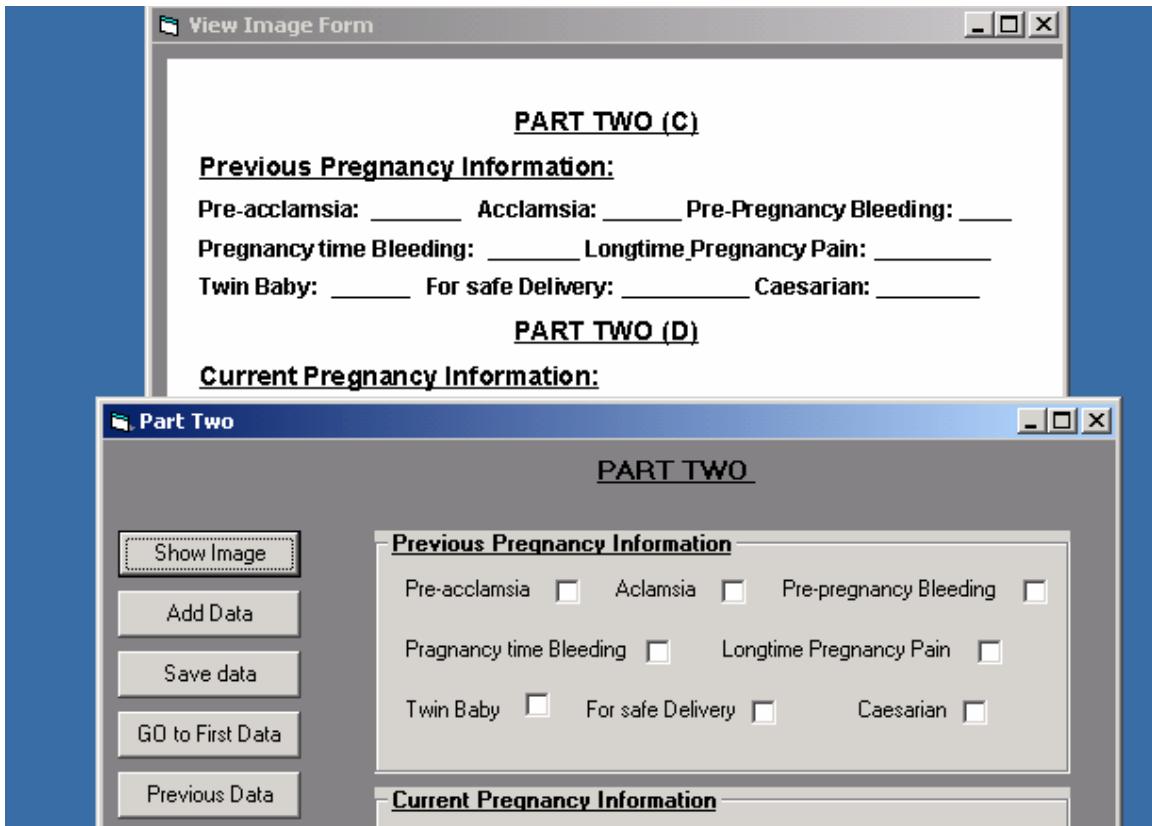


Fig. 4.19 Part Two form with corresponding image form.

The above figure shows the Part Two form with corresponding image form. User will enter data into the Part Two form by looking equivalent image form. To add 2nd part information about pregnant patient this Part Two form is used. After putting all the information to the respective fields, clicking the Save Data button will save that data and give again the option to add record if the Add button is clicked. Any time user can delete the entry by clicking the Delete button. After entering all the information, if user wants to delete that image from directory then Delete Image Form button will show the related form.

PART THREE

Post Delivery Mother's Condition

Checkup Date	[Text Box]				
Weight	[Text Box]	Temperature	[Text Box]	Anemia	[Text Box]
Jaundice	[Text Box]	Edema	[Text Box]	Lucia	[Text Box]
Pressure	[Text Box]	Bleeding	[Text Box]	High Fever	[Text Box]

New Born Baby's Condition

Weight	[Text Box]	Temperature	[Text Box]	
Fever	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Jaundice	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Nerve Condition	Yes	<input type="checkbox"/>	NO	<input type="checkbox"/>
Immunization Advice	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>

Fig. 4.20 Part Three form.

Here, Part Three form is the text version of part three image form. It also contains several buttons such as: Show Image, Add Data, Save Data, Go to First data, Previous Data, Next Data, Go to Last Data, Delete, Go to Next Form, Go to Task Menu, Delete Image Form and Exit. These buttons are linked with the related forms. Clicking on Show Image button will show the corresponding image which is selected from Task Menu.

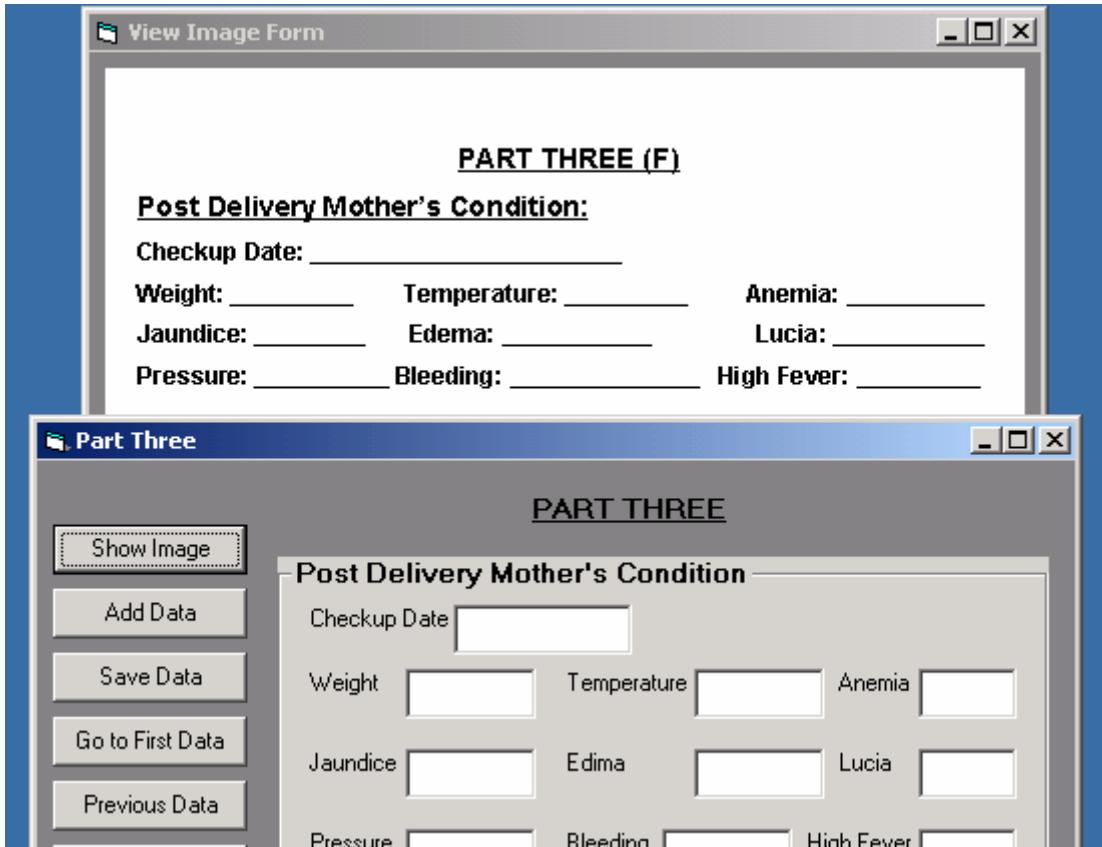


Fig. 4.21 Part Three form with corresponding image form.

The above figure shows the Part Three with corresponding image form. User will enter data into the Part Three form by looking equivalent image form. To add last part information about pregnant patient this Part Three form is used. After putting all the information to the respective fields, clicking the Save Data button will save that data and give again the option to add record if the Add button is clicked. Any time user can delete the entry by clicking the Delete button. After entering all the information, if user wants to delete that image from directory then Delete Image Form button will show the related form.

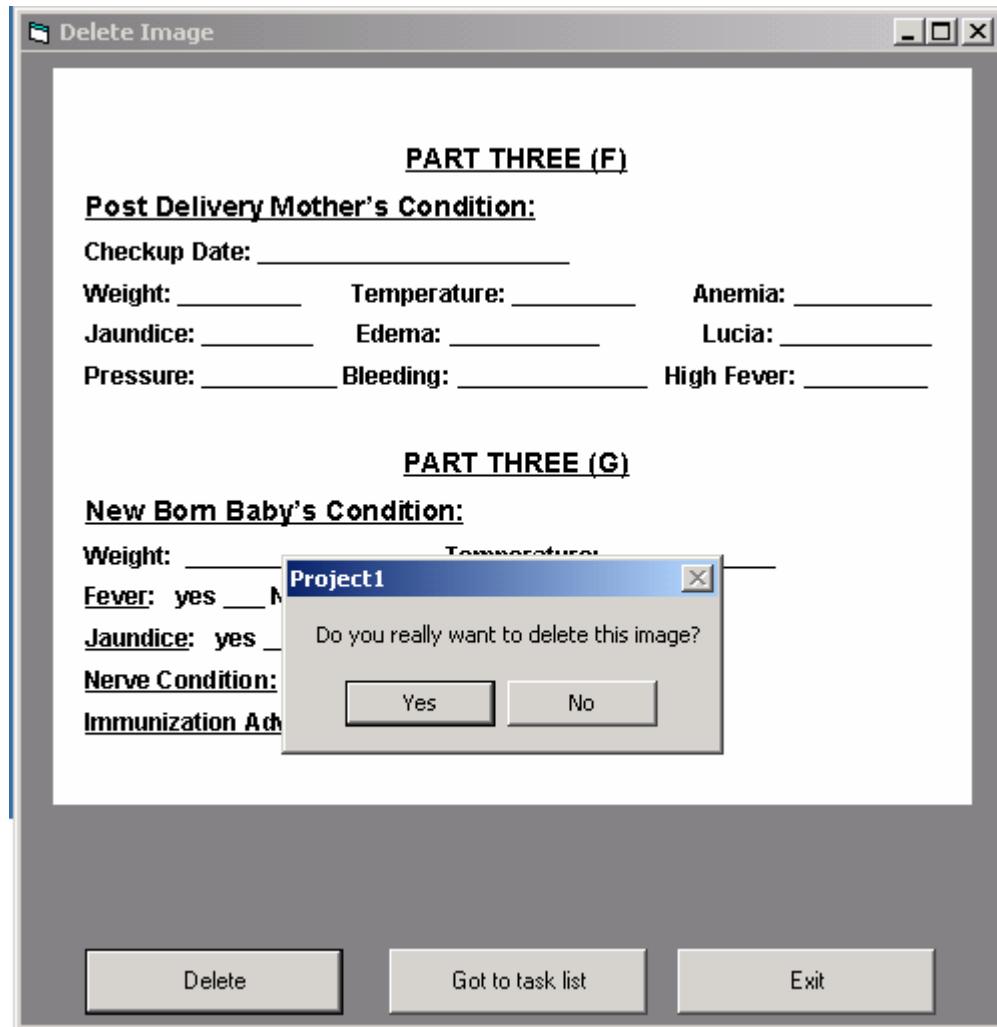


Fig. 4.22 Delete image form.

The above figure shows the Delete Image form of the system. It will delete the image from the image directory after entering all the data into the database.

4.6 Risks of the Proposed System

For some very practical reasons this highly efficient system cannot be implemented in the present technological standard of our country [3]. The main reasons are:

- The computer network cannot be implemented as the computers of the system are physically separated by long distance and all the places where our computers will be located do not have Internet connection.
- The mobile network is not available from every rural area of Bangladesh.
- It requires a large number of computers, hand scanner and mobile phone as the system of BRAC Essential Health Program (BESC) covers a wide spread area consisting of many root units. So this will not be cost effective.
- We also do not have such available skilled manpower to operate hand scanner, mobile phone and computers.
- Many people who are now working in manual data transfer of BRAC Essential Health Program (BESC) may lose their job in the new systems (who are unable to deal with new system). This will not be ethical under the current situation of our country.

CHAPTER V

5. CONCLUSION

5.1 Concluding Remarks

The advancement in technology has improved people's lives in every aspect. Manually driven systems are being overtaken by enhanced computerized systems. BRAC EHC program is one of the most important programs of BRAC health. It provides services for root level people, who are unable to get proper and on the spot treatment. However BRAC health program does not have any concrete database to store their information and generates analytical reports. They are also unable to get real time data. In our proposed system, three enhanced technology based solutions are specified and such technology-based solutions will improve the standards of the services quality of BRAC EHC program.

5.2 Further Improvements

Nowadays days GSM and GPRS Technology are using worldwide. So in future this technology can be used to make the proposed system more efficient. Also other departments of BRAC such as: accounts department, research and evaluation department etc that deal with health program can be automated gradually to make the whole processes faster and efficient. Lastly, in this report only parsing technology is focused theoretically but In future it can be implemented as well.

LIST OF REFERENCES

- [1] Annual Report 2003, BRAC Health Program, BRAC Publications, 2003.
- [2] Hasnain Feroze, Suriful Alam, Nasiruzzaman and Toffazzal Rownak,"TARC Library Management System", Final Project Report, CES 471, BRAC University, Consolidation Summer Semester, 2003.
- [3] Abhishek Rahman, Naznin Mizan,Md. Sobur Chowdhury,Binte Ali Hanium Maria,Samina Sharmin Joya, "System Analysis & Design of Non-Formal Primary Education (NFPE)", Final Project Report, CES 411, East West University, 2003.
- [4] Effy Oz, "Management Information Systems", 1st edition, India: Galgotia Publications Pvt. Limited, 1999.
- [5] Victor J. Schoenbach and Wayne D.Rosamond, "Understanding the Fundamentals of Epidemiology", Fall Edition, Department of Epidemiology, School of Public Health, University of North Carolina at Chapel Hill, U.S.A, 2000.
- [6] Neil Pearce, "A Short Introduction to Epidemiology ", 2nd edition, Centre for Public Health Research, Massey University of Wellington, New Zealand, February 2005.
- [7] www.cdc.gov/epiinfo/about.htm
- [8] www.cdc.gov/epiinfo
- [9] <http://users.pcnet.ro/luly2002/sn4.html>
- [10] <http://www.colomar.com/scanner.shtml>
- [11] <http://www.socketcom.com/product/CX2800-489.asp>
- [12] Dr. Sihar Lumbantobing," Guidelines on the Application of New Technology to Population Data Collection and Capture", Statistics and Computer Training Center, BPS-Statistics, Indonesia.
- [13] www.axiondata.com/data-entry-form-design.htm
- [14] Alan Dennis, Barbara Haley Wixom and Devid Tegarden," Systems Analysis and Design", India:John Wiley and Sons, Inc., 2002.

- [15] Jeffrey A. Hoffer, Joey E. George and Joseph S. Valacich, "Modern Systems Analysis and Design", 2nd edition, India:Pearson Education Asia,2001.
- [16] Mahbubuzzaman, *Implementation of a sales monitoring system for Pathfinder Travel Network Ltd*, Bechelor's Thesis, Department of Computer Science and Engineering, BRAC University, February 2005.

APPENDICES