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ANALYSIS AND DESIGN OF AN AUTOMATED SYSTEM TO MANAGE USER'S PAID BILL INFORMATION OF GRAMEEN PHONE LIMITED

Uddin Ahmed, Towsif

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ANALYSIS AND DESIGN OF AN AUTOMATED SYSTEM TO MANAGE USER'S PAID BILL INFORMATION OF GRAMEEN PHONE LIMITED

by

Towsif Uddin Ahmed
ID#0220413

An Internship Report Presented in Partial Fulfillment
of the Requirements for the Degree
Bachelor of Business Administration

INDEPENDENT UNIVERSITY, BANGLADESH
May 2008

ANALYSIS AND DESIGN OF AN AUTOMATED SYSTEM TO MANAGE USER'S PAID BILL INFORMATION OF GRAMEEN PHONE LIMITED

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Towsif Uddin Ahmed
ID#0220413

has been approved
May 2008

_____

Mr. A. Zaman Sarkar
Lecturer
School of Business
Independent University, Bangladesh

MAY 18, 2008

Mr. A. Zaman Sarkar
Lecturer
School of Business
Independent University, Bangladesh

Subject: Submission of a report on Analysis and Design of an Automated System to manage User's Paid Bill Information of Grameen Phone Limited.

Dear Sir,

With humble submission I would like to draw your kind attention to the fact that I have great pleasure as I have been successful in submitting the report Analysis and Design of an Analysis and Design of an Automated System to manage User's Paid Bill Information of Grameen Phone Limited., which was assigned to me as a partial requirement of my internship. I have tried my level best to make this report an exclusive one within the given time period. I deem to be highly rewarded if this report serves its objectives in all aspects.

I state that this report has not been submitted or used for any other degree or course. I shall be pleased to answer any query you think necessary as now and when needed with best regards.

Sincerely,

Towsif Uddin Ahmed
ID # 0220413

ACKNOWLEDGEMENT

It is my pleasure to take this opportunity to acknowledge the guidance, help and patience of many people to whom I render my gratitude, without those I would have never been able to accomplish my internship and also this project to this stage.

First of all I like to pay my gratitude to my academic supervisor Mr. A. Zaman Sarkar (Lecturer, Independent University, Bangladesh) for giving me the opportunity to do the project. His insightful discussions, constant suggestions and guidance enabled me to resolve a number of issues related to my project and helped me to work without staggering. Without his help this report could not have been a comprehensive one.

I also like pay my appreciation to Mr. Nowshad Ahmed (Deputy Manager)for giving me the opportunity to implement my knowledge and studies and to offer me the opportunity to use the resources of his organization for the evolvement of my studies through database development

I like to express my sincere thanks to my organizational supervisor Mr. Mahfuzur Rahman (System Engineer) for his careful suggestion and direction for successful accomplishment of my project. In the entire course of this project, from the beginning to the end, he helped me consistently and constructively.

Executive Summary

This research paper is based on the Analysis and Design of an Automated System to manage User's Paid Bill Information of Grameen Phone Limited. This report will attempt to let the user identify the necessity of an automated information system of Grameen Phone Ltd. The existing system is time consuming and need human resource. They are greatly looking for a new system which will solve the entire existing problem. This report is being generated to develop an automated information system for payment information management process instead of an existing manual system. To develop this system the waterfall model which is a popular version of the SDLC model for software engineering has been used. The current manual system has number of problem like; complicated data sharing process, time is needed to acquire information and they are failing to run their organization smoothly etc. The proposed system will overcome these problems. The proposed system is designed using the modern technique of system development such as Data Flow Diagram and Entity-Relationship model and also the physical design is carried out where a Data Dictionary is used for documenting all the specific data terms. The object oriented database design approach has also been carried out for this project. In objects oriented approach a range of UML (Unified Modeling Language) diagrams have been used to get a very clear picture of their user's bill payment information collection process to design the automated information system as smooth as possible. The prototype user interface has also been designed and some skin shot of the user interface has been shown in chapter 6. This system is developed using MS SQL Server2000 at the back end and Visual Basic 6.0 at the front end. The system has developed as friendly as possible so that to operate this software no extra training is needed. The existing hardware and software will be sufficient to run this system. The feasibility study has been carried out and it is found that the system is feasible. Due to the time limitation the software hasn't been tested. It was not also possible for the researcher to run much error checking. Sometimes it became really hard for the researcher to develop the system as the client intended due to some ambiguous information. It is possible to overcome these problems and the researcher hopes that in future these problems will be overcome and the system will work smoothly and efficiently as it is required. Future improvement of the information system will be based on the client's feedback, associates and their future requirements.

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1.1 Introduction

In present day, largely through advances in computer and communication technology we are living at a time that most people call as the Information age. It is because most working people today have information-intensive jobs. For example, jobs such as of teacher, accountant, lawyer and manager are predominantly based on the handling of information. But even until the eighties, managers did not need to know much about how information was collected, processed and distributed in their organizations, and technology involved was minimal. Information was not considered an important asset of the firm. The management process was considered a face-to-face personal art and not a global coordination process. Today Information processing has become a matter of strategic importance for any organizations. Information has become an essential resource as capital or manpower. Expectation of today's customers can only be met by high technological computerized systems. Information system has defined by many people in many ways. Some says information system is “A collection of interrelated components that collect, process, store and output information needed to complete business tasks” some says it is “The combination of people, procedures, equipment, and data that process data and information” other says it is nothing but “Computer-based tool that helps people transform data into information.” Actually they are all right in their own perspective. An Information System can be defined as a set of interrelated components working together to collect, process and store, and distributing information to support decision making, coordination and control in an organization. In addition it may also help managers to analyze problems, visualize complex subjects and create new products. A sound information system can help its users to achieve their goals much efficiently and quickly. But a bad developed information system will cause more trouble for its users rather than help them. The success of any information system relies on how smoothly the business process has been analyzed and user requirements have been consider.

1.2 Background of the project

This project has been prepared for fulfilling the requirement of the internship program, which is titled as “Analysis and Design of an Automated Information System to Manage User’s Paid Bill Information of Grameen Phone Ltd”. This task has been assigned to me by the organizational supervisor Mr. Mahfuzur Rahman and has been approved by the academic supervisor Mr. A. Zaman Sarkar (Lecturer, Independent University, Bangladesh).

1.3 Problem Justification

Grameen Phone has no automated system for collection of user's paid bill information from its associate banks. Most of their works are paper based and because of that their daily task becoming more complicated. The company is facing several problems because of their manual system. These problems include difficulty in data sharing between different department, huge duplication of data, time consuming process, and data confliction. The manual system is also responsible for lack of data security and there is also a possibility of getting inaccurate data.

1.4 Purpose of the Project

After surveying their daily work it has been identified that they are facing various difficulties because of their existing business process. But if the company maintains a computerized central database system they will be able to simplify their work. They will be needed to maintain a DBMS to run their daily operation smoothly. But currently the authorities of the organization want to construct a database to manage their user's paid bill information. The company can obtain various benefits by using the automated information system. The user (GP & associate banks) of the proposed system will get the following benefits from the software:

- Preparing the reports more efficiently, accurately and quickly.
- Minimum input of data.
- Checking and crosschecking of data's so that any kind of error corruption will be detected more accurately and precisely.
- Any kind of product information will be just one mouse click ahead.

1.5 Objective of the project

The main objective of this project is to build a database management system for Grameen Phone Ltd. There are number of problems that have been identified with the existing system. We have followed specific formalized steps to develop a solution for these problems. As the existing system of Grameen Phone Ltd. is mostly a manual one, therefore simple storing and retrieval of information has become a very time consuming and inefficient task. As a result, the existing information system (IS) makes it impossible for the management to take quick, efficient and effective decisions. Looking at the problems posed by the existing IS of "Grameen Phone Ltd." the objective can be summarized as developing an automated information system for managing the User's Paid Bill Information "Grameen Phone Ltd." that

will efficiently and effectively store all information related to the various aspects of service operation, and will allow the management to accesses those information as necessary and informs that they (information) are desired by the management, in order to made quick and effective decisions for proper and optimal business operations.

1.6 Limitations of the project

This project was aimed to provide a complete automated database solution for "Grameen Phone Ltd.". While working on the project the problems came across when the length of time has taken to conduct the project, because the given time length is not sufficient enough for conducting a project like this. Since most design decisions were driven by a single developer (including database design), many design choices were not the best choices available. So, from time to time it has become very hard to develop the system.

1.7 Significance of the project

If the proposed DBMS could be implemented successfully the company will be able to obtain various benefits by using it. They will be able to share data, reduce data redundancy; speed up data process time, reduce data confliction, maintain higher security. They will also be able to use accurate and up-to-date information which will help the management to take swift decisions effectively and efficiently.

2.0 Organization in Brief

Grameen Phone Ltd. is the market leader in the telecommunication sector in Bangladesh. With the beginning of 2003 the company has completed its sixth year of business. The 3 company achieved remarkable success during this period. It is now able to say that it has the largest network, the widest coverage, the biggest subscriber base and more value added services than any other mobile phone operators in Bangladesh. GP has a very strong competitive position in the telephone industry in the country.

2.1 Name. Location and Organizational History

The full name of the company is Grameen Phone Ltd. It is a private limited company. The Head Office is situated at Gulshan in Dhaka. The Ministry of Post and Telecommunication of the Government of Bangladesh offered Grameen Phone a nationwide digital cellular license on November 28, 1996. Grameen Phone launched its services in Bangladesh on 26 March

1997, the Independence Day of Bangladesh. It has taken lease of railway fiber optics on September 1997 for 20 years. The service of the company is spread in all over Bangladesh and also in 51 foreign countries through 137 international roaming partner operators.

2.2 Founders

Grameen Phone Ltd. is a unique joint venture of four companies: Grameen Telecom, Telenor AS, Marubeni Corporation and Gonofone Development Corporation.

2.3 Vision

The vision of Grameen Phone Ltd. is 'To be the leading provider of telecommunication services all over Bangladesh with satisfied subscribers, shareholders and enthusiastic employees."

2.4 Objective

Grameen Phone Ltd. has a duel objective: to receive an economic return on its investments and to contribute to the economic development of Bangladesh through telecommunications. This is why Grameen Phone, in collaboration with Grameen Bank and Grameen Telecom, is aiming to place one phone in each village to contribute significantly to the economic benefit of the poor. It is on the way to bring a total revolution in the telecommunication field. By attaining the success factors,

Grameen Phone would like to be recognized as a reliable, honest and committed company to its valued subscribers and stakeholders.

2.5 Strategy

The basic strategy of Grameen Phone Ltd. is for the overall coverage of both urban and rural areas. It builds continuous coverage, cell after cell, with an intention to bring the whole country under its network. Though the priority of the intensity of coverage varies from area to area, the basic strategy of cell-to-cell coverage is applied through the whole country.

2.6 People

The young, dedicated and energetic employees have made the enormous growth of Grameen Phone possible. The people of the company belong to both sexes and minority groups in Bangladesh being well represented. They all know in their hearts that Grameen

Phone is more than phones. This genuine sense of purpose gives them the dedication and the drive of producing, in about six years, the biggest coverage and the highest subscriber base in the country. The talents and the energy of its people are among the keys of both of its core and distinctive competencies. Grameen Phone knows it well and treats its employees accordingly.

2.7 Technology

Global System for Mobile or GSM technology is the most widely accepted digital system in the world currently used by over 750 million people in 150 countries. Grameen Phone uses GSM 900 & 1800 technology. GSM brings the most advanced developments in cellular technology at a reasonable cost by spurring severe competition among manufacturers and driving down the cost of equipment. Thus by using this technology, consumers get the best for the least.

2.8 Achievements

As a telecommunication service provider Grameen Phone Ltd. plays a very important role in the economic development of Bangladesh. National Board of Revenue (NBR), Ministry of Post and Telecommunications. Bangladesh Telephone and Telegraph Board (BTTB) and Bangladesh Railway (BR) arc the Government bodies that are directly or indirectly benefited by Grameen Phone Ltd. By bringing electronic connectivity .to rural Bangladesh, Grameen Phone is bringing the digital revolution to the doorsteps of the poor and unconnected. Grameen bank borrowers are engaged in a business by providing valuable phone service to their fellow villagers. For them mobile phone is a weapon against poverty.

The growth trend of the number of subscribers of Grameen Phone Ltd. is a unique example in the telecommunication field in Bangladesh. The total number of GP subscribers at present are 18,000,000. This is really a fabulous achievement in such a short period of business history.

2.9 Organ gram of Grameen Phone

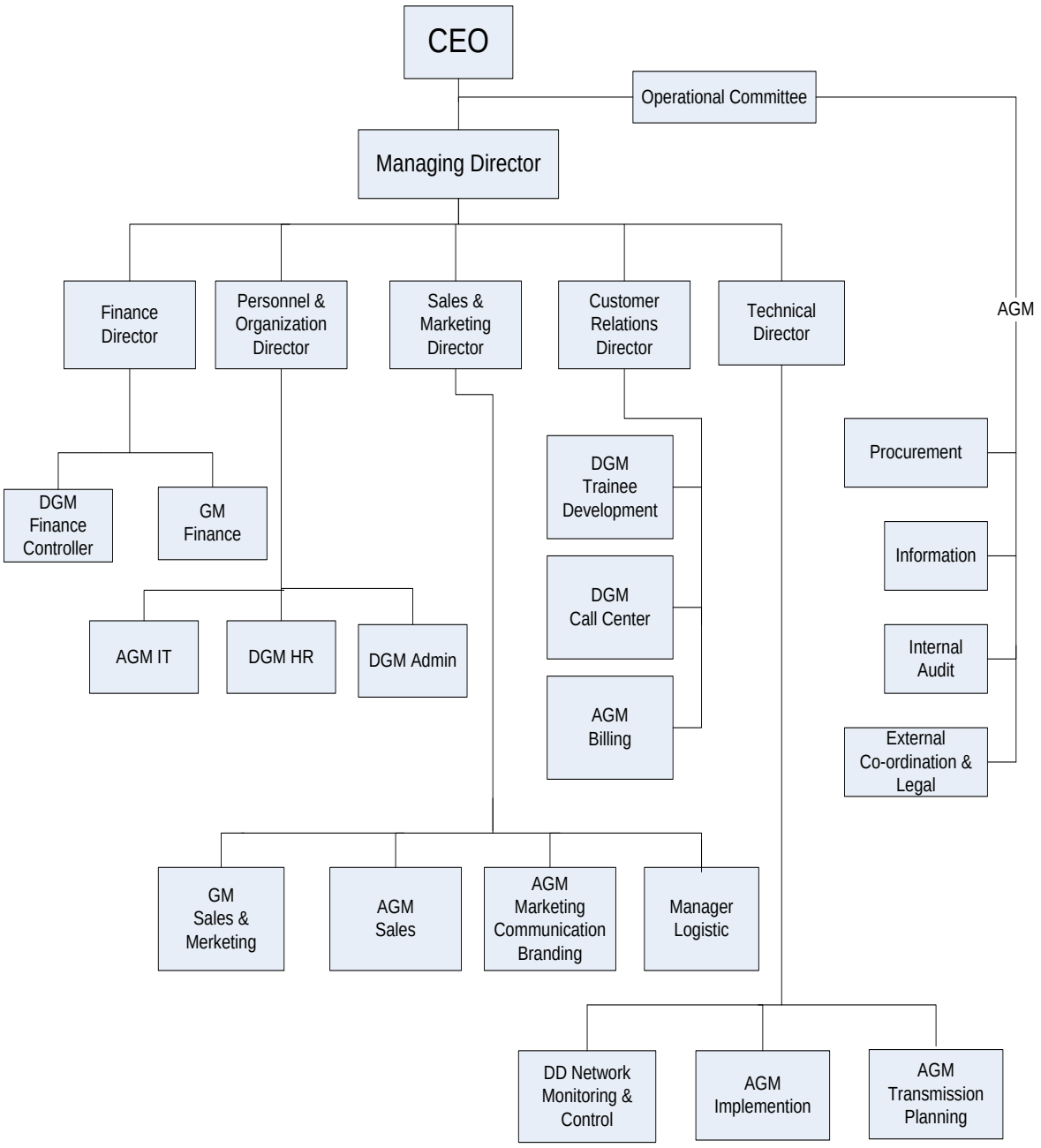


Figure-2.1: Grameen Phone Ltd. Management Hierarchy

3.0 Methodology

System development requires careful research, planning and coordination. These factors are essential in determining the success of any software development project. System Development Methodology is a collection of procedures, techniques, tools and documentation aids, which help the system developers in their efforts to implement a new system. The classic system development life cycle (SDLC) is one of the most popular system development methodologies.

SDLC refers to a methodology for developing systems. It provides a consistent framework of tasks and deliverables needed to develop systems. The SDLC methodology tracks a project from an idea developed by the user, through a feasibility study, systems analysis and design, programming, pilot testing, implementation, and post-implementation analysis. Documentation developed during the project development is used in the future when the system is reassessed for its continuation, modification, or deletion. Now a day's system developers are using many versions of SDLC.

The waterfall (traditional) model is a popular version of the SDLC model for software engineering. Often considered the classic approach to the systems development life cycle, the waterfall model describes a development method that is rigid and linear. Waterfall development has distinct goals for each phase of development where each phase is completed for the next one is started and there is no turning back.

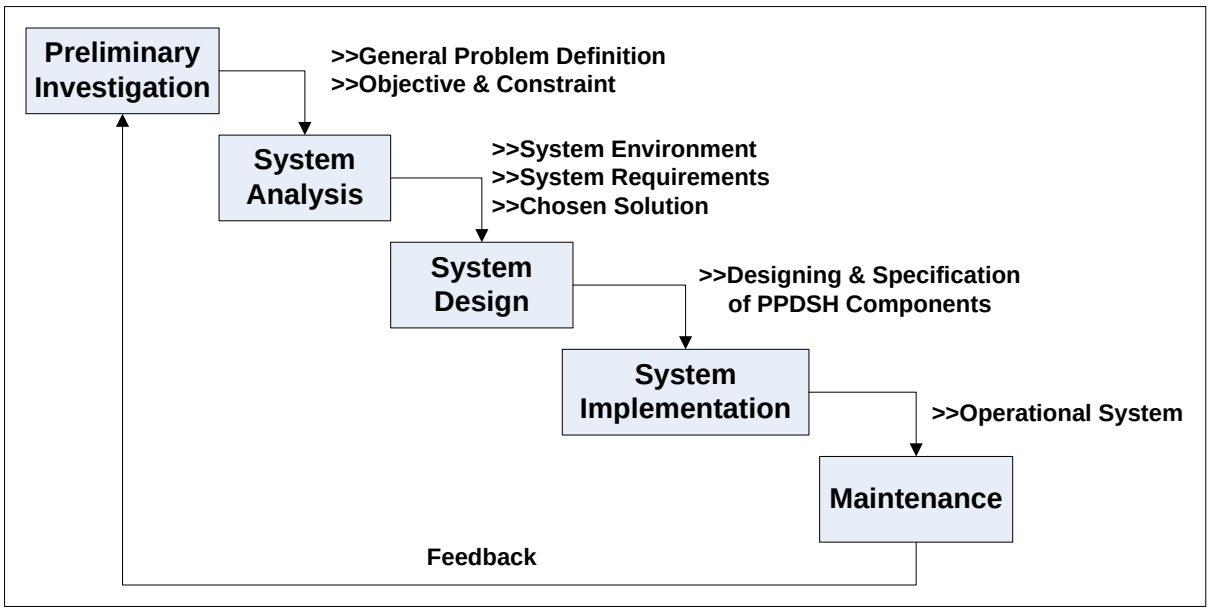


Figure-3.1: Waterfall (Traditional) System Development Methodology

The perceived advantages of the waterfall process are that it allows for departmentalization and managerial control. A schedule is typically set with deadlines for each stage of development and a product can proceed through the development process. In theory, this process leads to the project being delivered on time because each phase has been planned in detail. Waterfall system development methodology is consisting of the following phases.

- Preliminary Investigation
- System Analysis
- System Design
- System Implementation
  - Coding
  - Testing
  - Conversion
- Maintenance

3.1 Preliminary Investigation

There are basically two purposes of this phase, to answer the question “Is this project worth looking at?” and establishing the project charter. The researcher has defined the perceived problems, opportunities and directives that triggered the projects and assess the risk of pursuing the project. And also he figure out the scope of the project, preliminary requirements and constraints, project participants, budget and schedule to establish the project charter. To find these aspects the researcher has used the fact finding techniques.

3.1.1 Fact Finding Techniques

Fact-finding techniques are used to collect data about requirements. Requirement determination involves studying the current business system to find out how it works and where improvements should be made. The very first step is to understand the system as the systems designers are not part of the user departments and thus do not have the same base of facts and details as users in those areas. The researcher has used the following fact-finding techniques.

- Interview
- Record Review
- Questionnaire
- Observation

3.1.1.1 Interviews

Interview is a formal meeting where the analysis can obtain information about the operation of the present system and the requirement for the new system. This is the most common method used to verify the proposed system design and gather fact about the procedure. For interview the researcher asked selected question to different employee GP. The candidates to be interviewed were managers and senior officers. We had to carefully ask the question so that they must relevant to the interviewee and appropriate to his level and status.

3.1.1.2 Questioner Survey

No questioner survey had been performed here in GP to collect information about various aspects of the existing system from the employee.

3.1.1.3 Record Review

Record review is to review the documents that represent formal information flow in the organization. Record includes written policy manuals, regulations and standard operating procedures. The organization has different departments. These entire departments maintain their various transactions. The researcher has reviewed those transactions and also has reviewed some report, which they produced by Ms Access & Ms. Excel.

3.1.1.4 Observation

Through observation analysts can obtain firsthand information about how activities are carried out. The researcher observed the normal flow of work and typical bottlenecks. He also observed informal systems for storing and producing information and also the interoffice communication and handling of spontaneous queries.

3.2 System Analysis

System Analysis is studying business systems to learn current methods and assess effectiveness. In this phase the existing system was studied and the requirements for the new system was determined. This phase itself consists of component phases:

- Problem Analysis
- Requirement Analysis
- Decision Analysis
- Feasibility Study

3.2.1 Problem Analysis

In the problem analysis phase existing user's paid bill info collection system of GP was studied. The flaws and shortcomings of the current system were identified.

3.2.2 Requirement Analysis

Defining and prioritizing new system requirements were done in this phase. This phase was considered as the most important phase because errors or omissions in requirement analysis phase result in user dissatisfaction with the final system and costly modifications. The researcher has identified who needs what information, where, when, how etc.

3.2.3 Decision Analysis & Feasibility Study

In this phase candidate solutions will be identified. Feasibility of these solutions will be analyzed and a new system will be recommended. Though feasibility study is a separate phase of system analysis but because of which solution needed to be implemented to determine that, the researcher has to carry out the feasibility phase along with the decision analysis phase. Technical, Economical and Operational feasibility were carried out to ensure that the new project is viable and will be accepted in the organization based on their resources and constraints.

3.3 System Design

This is the phase of the system development where an appropriate solution is devised to fulfill all the information requirements of the system identified from the previous System Analysis phase. The design phase is concerned with technology-based views of the system's data, processes and Interfaces. Design specifications can take many forms including written documentation, or working computer generated prototypes of the new system. The researcher has used three types of design strategy for this system.

3.3.1 Logical Design

Logical design lays out the components of the system and their relationship to each other as they would appear to users. In this project the researcher has used two types of logical design. They are:

- Process Modeling: Data Flow Diagram (DFD)
- Data Modeling: Entity Relationship Diagram (ERD)

3.3.2 Physical Design

Physical design is the process of translating the logical abstract model into the specific technical design for the new system. In this project the researcher will develop a Data Dictionary for physical data modeling.

3.3.3 Object Oriented Design

The researcher has also used the object-oriented approaches besides process and data oriented approach to develop this system. The principals of objects, encapsulation, inheritance, and polymorphism are the foundation for object-oriented systems development. To understand and express the essential and interesting features of an application in the complex real world, an object-oriented model is built around objects. An object encapsulates both data and behavior, implying that analysts can use the object-oriented approach for both data modeling and process modeling.

The researcher has used the Unified Modeling Language (UML) as an object-oriented approach. It is a language for specifying, visualizing, constructing, and documenting the artifacts of software systems, as well as for business modeling (UML Document Set, 2001). UML includes many modeling language. Among them two popular and commonly used diagrams are shown in this project.

• Use Case Diagram

• Activity Diagram

3.4 System Implementation

System implementation is the fourth phase of the waterfall system development method. This phase is consist of another three different phases. Coding, Testing and Conversion are the three phase of implementation. The researcher has carried out the coding phase for this project but due to time limitation it hasn’t been possible for him to carry the other two phases.

3.4.1 Programming/Coding

In this phase standards User-Interface were designed and Coding were done. Various user-friendly forms were designed. Incase of form designing similar and consistent color was maintained. A user-friendly menu was developed for easy understanding. Wherever possible a variety of options were put in place to reduce confusion or facilitate user input by using different designing concepts like combo boxes, data control etc.

3.4.2 Testing & Conversion

In future this two phase will be carried out to ensure that the top quality and workability of the software. Future studies should identify and analyze these factors of database development.

4.0 System Analysis

Before starting the system analysis phase we have to know about what is an information system and what are its component. In the introduction the researcher has already discussed about what is an information system. In here the components of an information system will be discussed briefly.

4.1 Components of the Information System

The five major components of information systems are people, procedures, data, hardware and software. With the extensive use of network systems in today's business organizations, some researchers consider network as a separate components of information systems.

4.1.1 People

People are required for the operation of all information systems. People are divided into two classes. Users are people who use an information system or the information it produces. They can be accountant's salespersons, engineers, clerks, customers or managers. They can be further divided into following basic groups:

- **End-users**: directly using the information system to perform their job activities. Associate banks have their own system to manage their daily activities.
- **User manager**: supervising the end-users. For three different departments the organization has different managers who are working as user manager.

IS specialists are people who develop and operate information systems. They include systems analysts, programmers, computer operators, etc.

4.1.2 Procedures

Simply stated procedures are sets of instructions that tell people in the organization how to perform their jobs. As an organization evolves, it develops standard operating procedures (SOP) to guide its operations. These procedures may be formal or informal. Undocumented procedures belong lo the informal category. Procedures are instruction for people. The procedure components of an information system are of three types:

• Control procedures: backing up data or verifying input. In this system after any new record has been entered; the system has to keep a copy of the records in paper in addition to the computer file with the help of a file system.

• Application procedures: how to run the business application. Computerized application procedures include running the application in MS-Excel sheet. Besides the manual sorting of customers files in ordered way and get into the information is also an application procedure in this system.

• System procedures: describe how to operate hardware. The organization runs their applications in the Windows XP professional operating system in several computers.

4.1.3 Data

The raw data is collected from the banks. Customer mobile number, payment amount, bank name, bank account number, payment method. It is kept on a database system and send the daily collection amount statement to GP through courier.

4.1.4 Software

Software resources include all sets of information processing instructions for the computer. There are two types of software are used to maintain the information of customer bill payment of GP.

• System Software (O/S)**:** Will run on Windows 2000 Server platform. The networking is also done by this operating system.

• Application Softwares (MS Office, Microsoft SQL Server 2000 etc.): The main purpose of this software packages is to calculate, record keeping, word processing and to maintain the database.

4.1.5 Hardware and Network

Hardware resources include all physical devices and materials used in information processing. It includes computers, calculators, printing devices, input devices, storage media, etc, that is all tangible objects. Both Associate banks and Grameen Phone are equipped sufficiently to run this system. The Connectivity will be established by a secured/dedicated TCP/IP connection with every associate bank's main system by which they will access this system server.

4.2 Phases of System Analysis

The analysis stage begins with the business models developed during the initial strategy stage. The preliminary analysis findings are verified and expanded into sufficient detail to describe exactly "what" will and will not be built into the system. It is the process of gathering and interpreting facts, diagnosing problems, defining the problem and recognizing causes using the information to recommend improvements to the system. The information obtained during the analysis stage is documented in the requirement specification. The requirement specification establishes the foundation for all-subsequent design and development work. This phase itself consists of four different phases. The phases are:

• Problem Analysis
• Requirement Analysis
• Decision Analysis
• Feasibility Study

For analyzing GP's current user's paid bill collection process and to recommend improvement for the system the researcher has carried out all these four phases.

4.3 Problem Analysis

In problem analysis the current system is analyze and the problems that are hampering the process are identified.

4.3.1 Description of the User's Paid Bill Information Collection Process of GP

GP has two types of customer through different package. Pre-Paid & Post-Paid. GP sells Talk-Time to their customer in two methods. One approach is costumers go to the retailer called Flexi-Load Agent. The retailer make customer request on their company assigned mobile and send it to main Flexi-Load Server and the server recharge their account and send a

confirmation to both customer and retailer with transaction ID. The user pays his bill to the retailer. This approach can perform by both Pre-Paid & Post-Paid customers. Another approach for Post-Paid customer. Approach through ATM machines, banks and Internet Banking. These entire approaches users pay their bill through their credit card or cash. After each day banks send a statement to GP through courier service (manually) on the next day to Credit Control Department & Finance Department. GP has no just in time data sharing system with its associate banks. The Credit Control Dept input all this data manually in BSCS (main billing system). This BSCS system has two modules. Control & Database. When data are updated the control module barr or unbar the user's connection automatically.

Payment Method	Description
Bill Copy	Can pay bill through the bill copy in GP enlisted banks.
Deposit Slip	Can pay bill, security deposit, and other fees through GP deposit slips available in banks.
ATM	GP subscribers having Standard Chartered ATM, Dutch Bangla Bank ATM, or Credit Card (Auto Debit), LankaBangla Finance (Auto Debit) and ETN E-Cash Card can pay their local bills through ATM machines & the respective cards
Auto Bills Pay	Standard Chartered account holders can avail the facility of 'Auto Bills Pay'. The mentioned services require prior arrangement with respective bank & card authority.
Easy Pay	HSBC has 24-hours 'Easy Pay' service for GP subscribers to pay their bills.
Internet Banking	Offered exclusively for GP subscribers by Dutch Bangla Bank Ltd., Eastern Bank Limited and Commercial Bank of Ceylon.

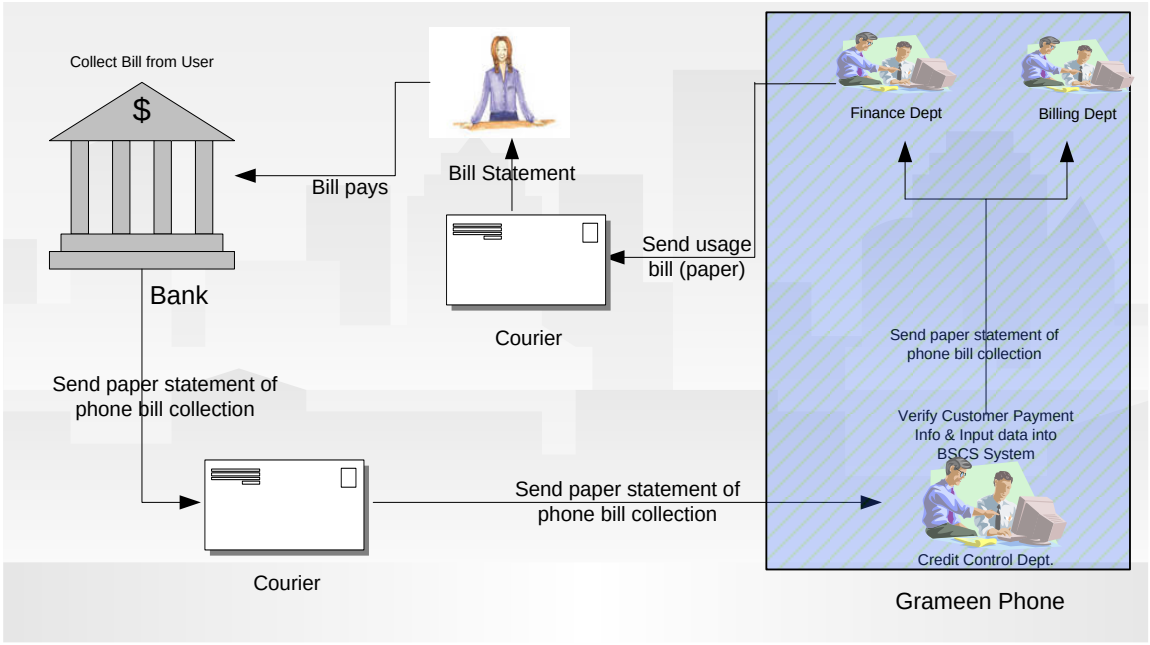


Figure 4.1 : *Rich Text Picture of Current User's Paid Bill Information collection process of GP*

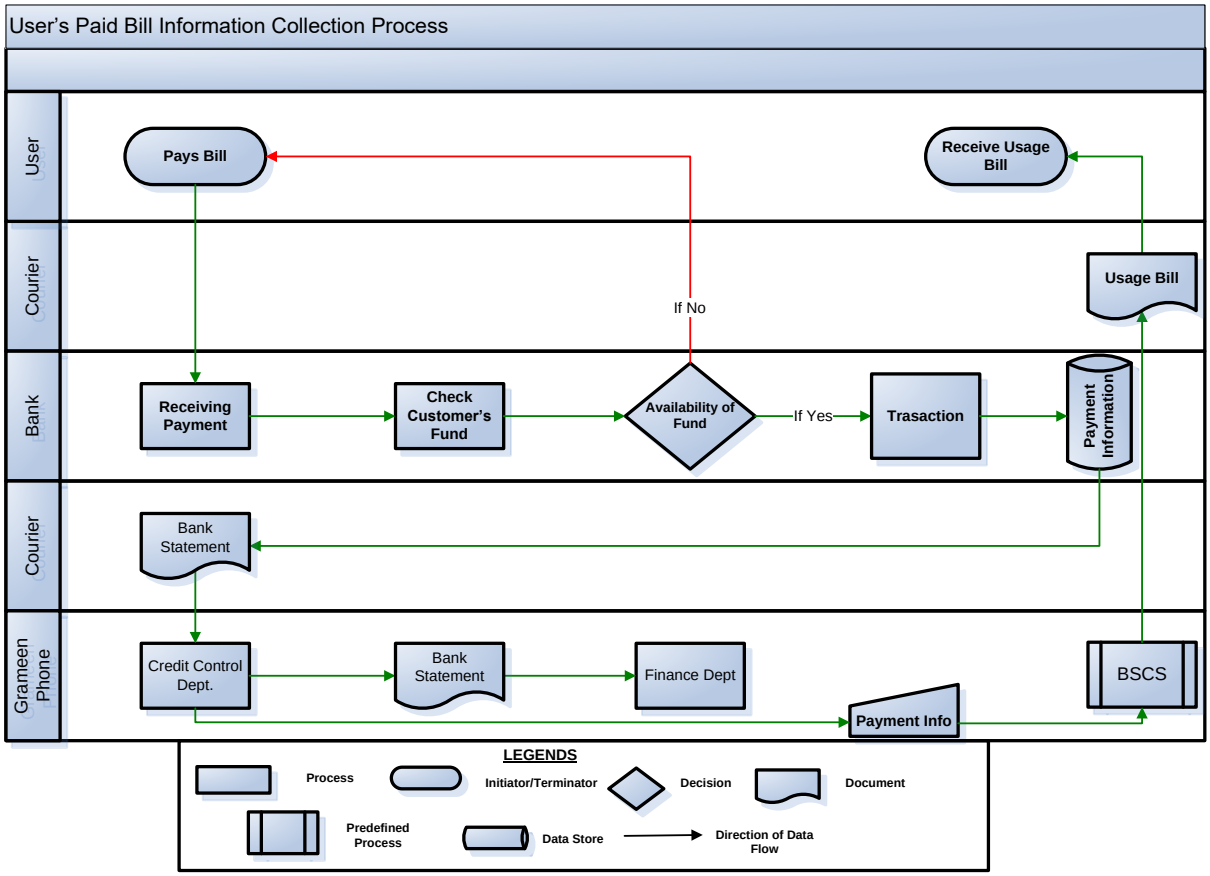


Figure-4.2*: Work Flow Diagram of User's Paid Bill Information Collection Process (As-Is Diagram)*

4.3.2 Identified Problems

A number of problems have been identified in the current business process and manual information. These problems are:

- Because of manual system various data sharing is very complicated.
- Because of the existing manual system there is a huge duplication of data.
- Simple retrieval of important information takes a long time, as a result the business process become very time-consuming.
- Since the data's are handle by people the security of those data very less, like an employee can manipulate those as he/she want.
- Sometimes inaccurate data's are providing in manual system.

4.4 Requirement Analysis

It is the stage for defining and prioritizing business requirements. This is perhaps the most important phase. Errors or omissions in requirement analysis result in user dissatisfaction with the final system and costly modifications. Establish what the new system must do. This phase involves identifying who needs what information, where, when and how, broadly speaking this stage identifies the data, process and interface requirements for the users of the new system. Both functional and non functional requirements have been identified in this phase.

4.4.1 Functional Requirements

A system function is an activity or process step, which is expressed as an action verb followed by the object of the action. Functional requirements describe the behaviors (functions or services) of the system that support user goals, tasks or activities. An information system performs five basic functions.

4.4.1.1 Input

Involves inserting and updating, which are to be entered and processed in the module. The types of input that are implemented in this module are:

- Information about Customer's Mobile Phone Number
- Information about Paid Amount
- Information about Bank Name
- Information about Bank Branch Code
- Information about Payment Method

4.4.1.2 Processing

Processing functions describe the way that data are manipulated to perform business function. This involves the processing of inputs that are later used to generate reports as output. The basic processing involves:

- Processing of Payment information

4.4.1.3 Output

In GP the outputs from the processing are the report such as the payment information, due bill, paid amount, balance, credit etc. These reports are printed daily and weekly basis depending on their needs.

4.4.1.4 Storage

Storage Functions describe the activities required to maintain system data. Captured data must be stored in storage medium in an organized way for subsequent retrieval of the data. Data's are retrieved from database using SQL queries. Currently the company is storing their data into different separate databases which they are maintaining manually. But in the proposed automated system data will be store in a single central data store.

4.4.1.5 Control

Control functions describe the manual and automated activities performed to verify the validity and accuracy of inputs and outputs, to ensure the integrity of stored data and provide data security with controlled access to data and processing information. Insertions of data are controlled by various warning message. For example; checking the insertion of Customer's Mobile number, Bank ID, Branch ID, Payment method ID and Payment amount etc, the main field that must be entered are controlled by following coding convention. [A-Z][A-Z][1-9][0-9][0-9][0-9][0-9][0-9]. Proper data must be entered if the data is to be inserted successfully.

4.4.2 Non Functional Requirements

A system has properties that emerge from the combination of its parts. These emergent properties will surely be a matter of accident, not design, if the non-functional requirements, or system qualities, are not specified in advance. Non-functional requirements include constraints and qualities. Which means what the information system can do better and in what step its work will be hampered. Non Functional Requirements of proposed customer bill payment information process of GP is identified as:

- **Accuracy:** The system has accuracy. It means that the system has a provision of right or agreed results or effects.
- **Compliance:** The system is altered to application related standards.
- **Fault Tolerance**: The system has the ability to tolerate a given level of performance even if there are faults.
- **Analyzability:** Identification of deficiencies, failure causes, parts to be modified, etc will be easy to analyze.
- **Maturity:** The software has a moderate frequency of failure by faults.
- **Understandability:** Users can easily understand the structure of the system. Thus, they can control and of operate the system by giving less effort.
- **Changeability:** The system requires less effort for modification and fault removal activities.
- **Stability:** Risk of unexpected effects of modification is low.
- **Testability:** Less effort is needed for validating the modified software.
- **Install ability:** Less effort is needed to install the software in a given environment.
- **Adaptability:** The system has a moderate chance for adaptation to different environments.
- **Recoverability:** Capability of reestablish level of performance after faults is high.
- **Time behavior:** Response and processing times and throughput rates are relatively low.
- **Stability:** Risk of unexpected effect of modifications is low.

4.5 Decision Analysis and Feasibility Study

The purpose of this phase is to identify candidate solutions, analyze their feasibility and recommend a new system. Though feasibility study is a separate phase of system analysis but because of which solution needed to be implemented to determine that the researcher has to carry out the feasibility phase along with the decision analysis phase. To solve the problems which GP is facing for their current user's paid bill information collection process the researcher has proposed two different solutions. These solutions are:

- **Solution A:** The Company can buy a new software system from any software developer for its customer's paid bill information management system.
- **Solution B:** An automated information system could be developed for managing the user's paid bill information of GP. This will convert the existing manual into a computerized database system.

4.5.1 Feasibility Study

In addition to suggesting a solution, systems analysis involves a feasibility study to determine whether that solution is feasible, or achievable, given the organization's resources and constraints. Three major areas of feasibility must be addressed:

1. **Technical Feasibility:** whether the proposed solution can be implemented with the available hardware, software and technical resources. Does the company staff have the technical expertise to use the solution?

2. **Economic Feasibility:** whether the benefits of the proposed solution outweigh the costs (is it cost-effective?).

3. **Operational Feasibility:** whether the proposed solution is desirable within the existing managerial and organizational framework. How the proposed solutions change the work environment? How do the users feel about such a solution?

To determine which solution has a better chance of solving the problem feasibility study has carried out of two of the proposed solutions and for better understanding a feasibility matrix has been provided at the end of feasibility study.

4.5.1.1 Feasibility Study of Solution A

- **Economic Feasibility**: This solution is economically feasible. It is not only affordable but it will reduce cost for the company in the long run.
- **Technical Feasibility:** This solution is technically feasible because the hardware, software and technical resources available GP is compatible with the software.
- **Operational Feasibility:** Senior management will not support this solution because these softwares are default made. There is an immense possibility that this software will not fulfill all the requirement of the company.

4.5.1.2 Feasibility Study of Solution B

- **Economic Feasibility:** GP has the capability to develop a new system which will reduce cost for the company in the long run. Another economic benefit is to run the new system they will not need any additional resources. They will be able to manage the new system with their existence resources that they have i.e. with their current hardware, software. So the new system will be cost effective.
- **Technical Feasibility:** Since the system will be designed as the company required, they will know how to operate and maintain the system. The researcher has analyzed that

whether the proposed solution could be implemented with the hardware, software and technical resources available at associate banks (End user).

- **Operational Feasibility:** Senior management will support this solution as the system will be designed according to the company's requirement. It will help the company to sort out all of their problems.

4.5.2 Proposed Solution

In the workflow of existing business processes the customer service will be delayed if not the customer inform GP about his/her payment. Some frauds have done before, due to informing GP about payment over phone for instant service. On the other hand GP maintains separate database for bank's bill payments transaction and user's payment record. All these databases are maintained by different department of GP. As the company is keeping separate databases for different activities the company is facing many problems; like data redundancy, data sharing problem etc. As the company is trying to solve all these problems it has been suggested that they can develop an automated information system (common database) to manage their payment information instead of maintaining different databases for their activities with their associate banks. This central database will be connected with all the databases that are maintained by the different department of the company. By maintaining this central database it will be possible for the company to minimize the above mentioned problems. By maintaining a central database different department of the company will be able to share information and also they don't have to store same information again and again. In a central database it is possible to customized data access level which means no person can access any important data without proper authorization. As a result the security level of confidential data will be high. The company will also be able to handle various data very simply because of using one common database rather than maintaining different databases.

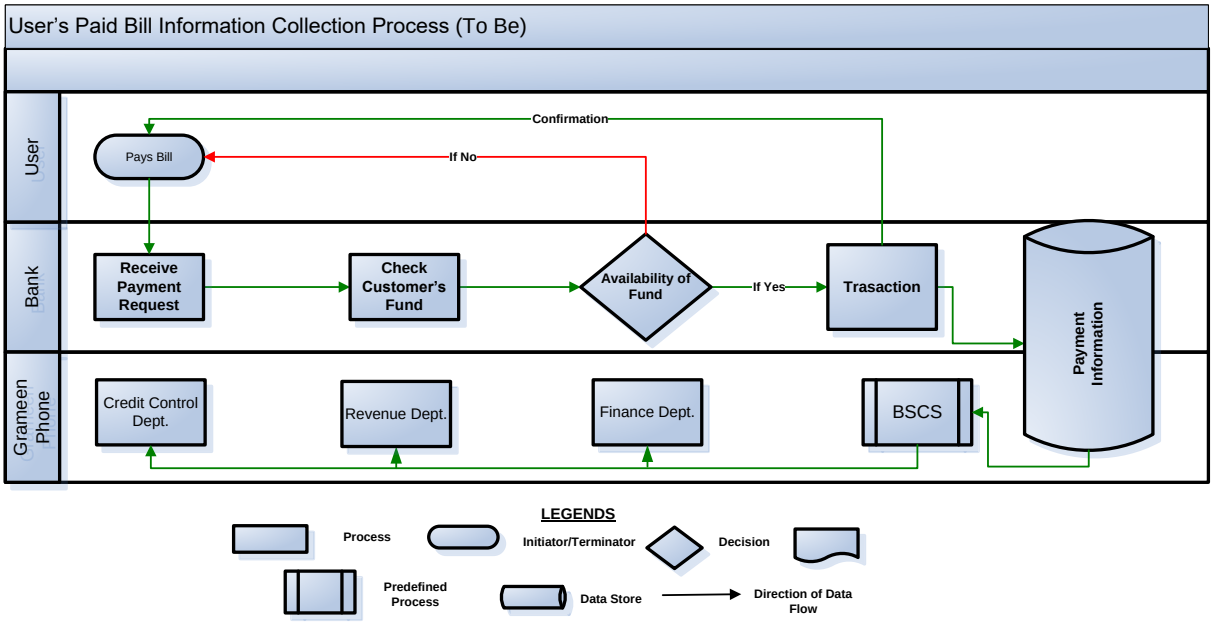


Figure-4.3: Work Flow Diagram of the Proposed Solution (To-Be Diagram)

5.0 Systems Design

While systems analysis describes what a system should do to meet information requirements, systems design shows how, the system will fulfill this objective. The design of an information system is the overall plan or model for that system. Systems design has three objectives:

- Systems designer is responsible for considering alternative technology configurations for carrying out and developing the system.
- Designers are responsible for the management and control of the technical realization of systems.
- The system designer details the system specification that will deliver the functions identified during analysis. The design phase is concerned with technology-based views of the system's Data, processes and Interfaces. Design specifications can take many forms including written documentation, or working computer generated prototypes of the new system. There are two types of design

    1) Logical design;

    2) Physical design.

In this chapter both logical and physical design of GP proposed Bill Payment Management System has been carried out.

5.1 Logical design

Logical design lays out the components of the system and their relationship to each other as they would appear to users. In this project two types of logical design have been used. They are:

• Process Modeling: Data Flow Diagram (DFD)

• Data Modeling: Entity Relationship Diagram (ERD)

5.1.1 Process Modeling: Data Flow Diagram (DFD)

The DFD is an excellent communication tool for analysts to model processes and functional requirements. One of the primary tools of the structured analysis efforts of the 1970's it was developed and enhanced by the likes of Yourdon, McMenamin, Palmer, Gane and Sarson. It is still considered one of the best modeling techniques for eliciting and representing the processing requirements of a system.

Used effectively, it is a useful and easy to understand modeling tool. It has broad application and usability across most software development projects. It is easily integrated with data modeling, workflow modeling tools, and textual specs. Together with these, it provides analysts and developers with solid models and specs.

5.1.1.1 DFD Symbols

The diagrams use four symbols to represent any system at any level of detail. The four symbols that must be represented are:

• Processes - transforms of incoming data flow(s) to outgoing data flow(s)

• External Entities - sources or destinations outside the specified system boundary

• Data Flows - movement of data in the system

• Data Stores - data repositories for data that is not moving

The following figure presents the symbols of a DFD that are developed by Gane and Sarson (1979)

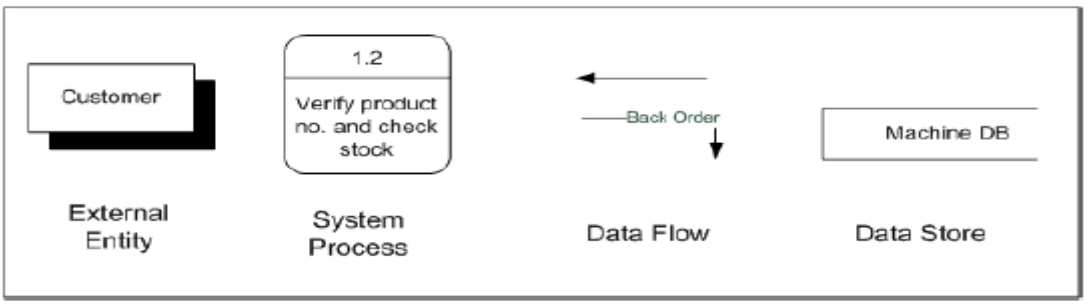


Figure-5.1: Gane and Sarson DFD Symbols

External Entity(s) (Sink, Source, Terminator)

Also known as ‘External sources/recipients’ are things (e.g. customer, machines, company etc.) which contribute data or information to the system or which receive data/information from it. The name given to an external entity represents a type not a specific instance of the type. It is common practice to have duplicates of external entities in order to avoid crossing lines, or just to make a diagram more readable. The symbol used for this is rectangular box which may be shaded.

Process (Activity, Function)

Depending on the level of the diagram it may represent the whole system as in a Context diagram or a business area, process (activity), function, etc. in lower levels. Each box has a unique number as identifier (top middle). The symbol used for represent process are circle (Yourdon notation), or a rounded rectangle (Gane & Sarson notation).

Data Flows

It shows the directional movement of data to and from external entities, the process and data stores. In the physical model, when it flows into a data store, it means write, update, delete, etc. and when it flows out of data stores mean read, query, display, select types of transaction. The symbol used for this is solid line with arrow. The arrows must either start and/or end at a process box. It is impossible for data to flow from data store to data store except via a process, and external entities are not allowed to access data stores directly. Each data flow is identified with a descriptive name that represents the information (data packet) on the data flow.

Data Store

A data store is a repository of information. In the physical model, this represents a file, table, etc. In the logical model, a data store is an object or entity. The symbol used for this is two parallel lines (Yourdon notation), or an open ended rectangle (G&S notation). As like external entities, it is common practice to have duplicates of data stores to make a diagram less cluttered.

Layers (Levels) of Data Flow Diagram

Data flow diagrams are usually drawn in several nested layers. A single process node on a high level diagram can be expanded to show a more detailed data flow diagram. The data flow

diagram is analogous to a road map. It is a network model of all possibilities with different detail shown on different hierarchical levels. The different levels are Context Diagrams and System Level. The context diagram is the highest level in a data flow diagram and contains only one process, representing the entire system. All external entities are shown on the context diagram as well as major data flow to and from them. The diagram is fairly simple to create.

More detail than the context diagram permits is achievable by "exploding the diagrams." Inputs and outputs specified in the first diagram remain constant in all subsequent diagrams. Diagram 0 is the explosion of the context diagram and may include up to nine processes. Each process is numbered with an integer. The major data stores of the system and all external entities are included on Diagram 0.

Each process on Diagram 0 may in turn be exploded to create a more detailed child diagram. The process on Diagram 0 that is exploded is called the parent process, and the diagram that results is called the child diagram. The child diagram is given the same number as its parent process in Diagram 0. For example, process 3 would explode to Diagram 3. The processes on the child diagram are numbered using the parent process number, a decimal point, and a unique number for each child process. On Diagram 3, the processes would be numbered 3.1, 3.2, 3.3, and so on. This convention allows the analyst to trace a series of processes through many levels of explosion.

5.1.1.2 Context Level DFD of Customer's Paid Bill Information Management System

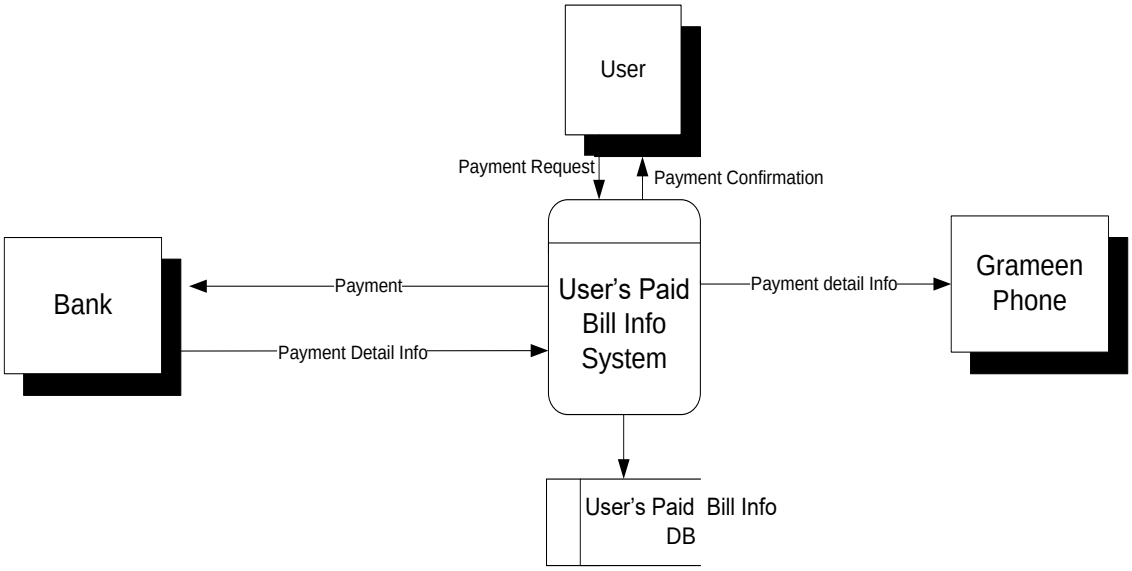


Figure 5.2 : Context Level DFD

Context level DFD generally shows the total background of a process. Every entity that is involved with the system is shown here and it has the main data store in which every data which are generated by the process are stored. So we can say that context level DFD is the basic structure of the information flow in a system.

In this context level DFD there are three entities. Grameen Phone, user and bank. The process in which these entities are involved is addressed as User's Paid Bill Management System. The data store is called the User's Paid Bill Info Database. This process initiated when customer pays his due bills to a bank, the bank then collect the payment give the customer a money/ payment receipt. The cashier of the bank input the transaction in proposed system. The system summarizes all the phone bill information and store in UPBI (User's paid bill info) Database. Then GP's billing system BCSC call for updates and will get updates from UPBI database.

5.1.1.3 System Level DFD User's Paid Bill Information Management System

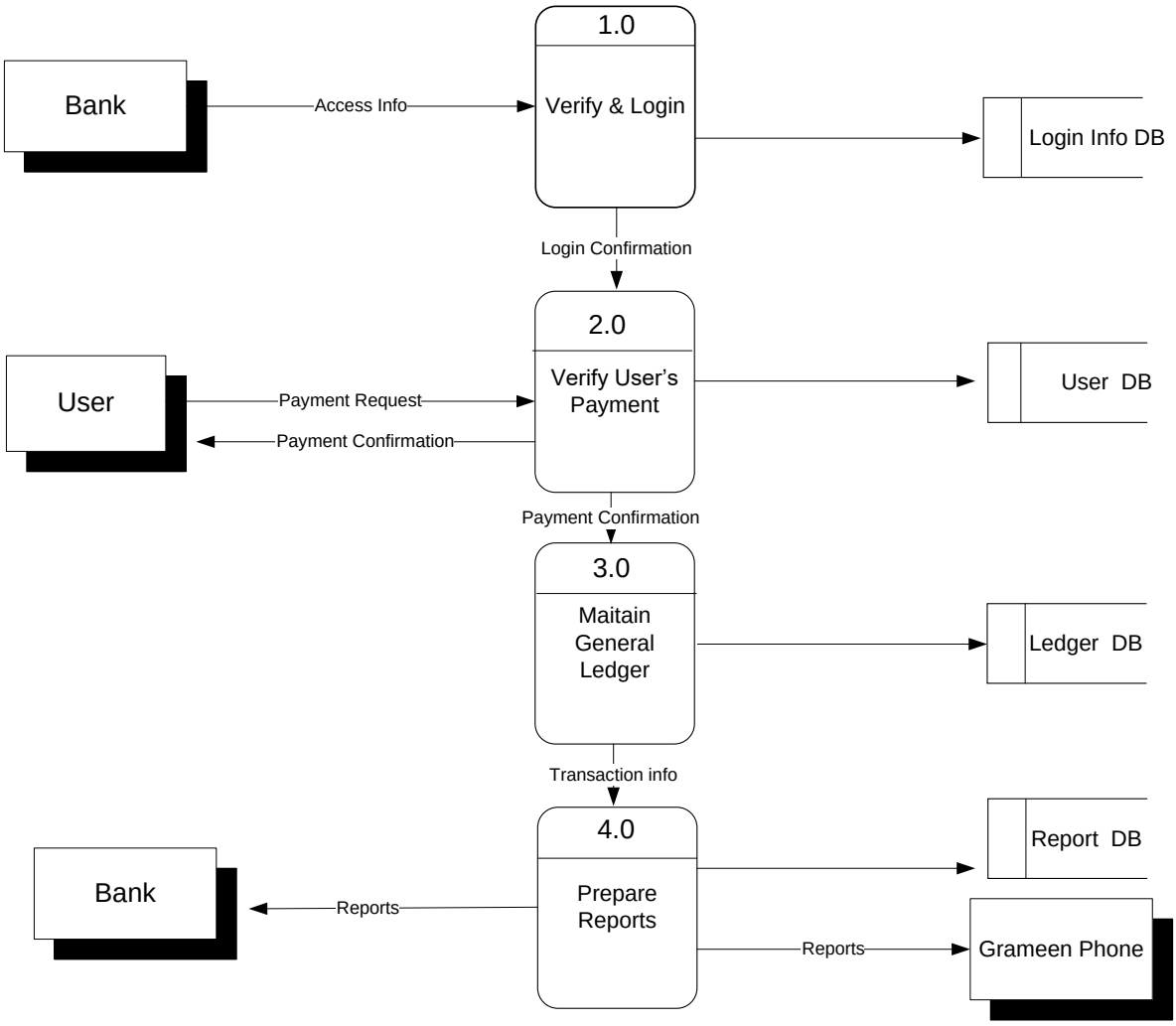


Figure-5.3: System Level DFD (0 Level Diagram)

This is the second level of DFD. This level is also known as '0' level DFD. This level consists of three entities, four processes and four databases. These are:

External Entities

- User
- Bank
- Grameen Phone

Process

- Login verification process
- Payment Verification process
- Maintain Ledger process
- Prepare Report process

Databases

- Login database
- User database
- Ledger database
- Prepare Report database

This process initiated when a user place a bill payment request to bank. Then bank executive login in the system and login info is stored in login database and make user's bill payment request. The system verifies the request and stored in user database. This payment is verified and received by the bank and stored in the ledger database. Make a report and stored in report database. Grameen Phone's BSCS (Billing System) will upgrade its database.

5.1.2 Logical Data Modeling: E-R Diagram

The entity-relationship model or entity-relationship diagram (ERD) is a data model or diagram for high-level descriptions of conceptual data models, and it provides a graphical notation for representing such data models in the form of entity-relationship diagrams. Such models are typically used in the first stage of information-system design; they are used, for example, to describe information needs and/or the type of information that is to be stored in the database during the requirements analysis.

The Entity-Relationship (ER) model was originally proposed by Peter in 1976 [Chen76] as a way to unify the network and relational database views. Simply stated the ER model is a conceptual data model that views the real world as entities and relationships. A basic component of the model is the Entity-Relationship diagram which is used to visually represent data objects. Since Chen wrote his paper the model has been extended and today it is commonly used for database design for the database designer.

5.1.2.1 Basic Constructs of E-R Modeling

The ER model views the real world as a construct of entities and association (relationship) between entities.

Entities

Entities are the principal data object about which information is to be collected. Entities are usually recognizable concepts, either concrete or abstract, such as person, places, things, or

events which have relevance to the database. An entity is analogous to a table in the relational model. An entity occurrence (also called an instance) is an individual occurrence of an entity. An occurrence is analogous to a row in the relational table. There are also some special entity types. Associative entities (also known as intersection entities) are entities used to associate two or more entities in order to reconcile a many-to-many relationship.

Relationships

A Relationship represents an association between two or more entities. It illustrates how two entities share information in the database structure. Relationships are
classified in terms of degree, connectivity, cardinality, and existence. These concepts are discussed below.

Classifying Relationships

Relationships are classified by their degree, connectivity, cardinality and existence. Not all modeling methodologies use all these classifications.

Degree of a Relationship

The degree of a relationship is the number of entities associated with the relationship. The unary relationship is the general form for degree n. A unary relationship occurs when an entity is related to itself. An example might be "some employees are married to other employees". Special cases are the binary, and ternary, where the degree is 2, and 3, respectively. Binary relationships, the association between two entities are the most common type in the real world. A ternary relationship involves three entities and is used when a binary relationship is inadequate. Many modeling approaches recognize only binary relationships. Ternary or unary relationships are decomposed into two or more binary relationships.

Connectivity and Cardinality

The connectivity of a relationship describes the mapping of associated entity instances in the relationship. The values of connectivity are "one" or "many". The cardinality of a relationship is the actual number of related occurrences for each of the two entities. The basic types of connectivity for relations are: one-to-one, one-to-many, and many-to-many.

A one-to-one (1:1) relationship is when at most one instance of an entity A is associated with one instance of entity B.

A many-to-many (M:N) relationship, sometimes called non-specific, is when for one instance of entity A, there are zero, one, or many instances of entity B and for one instance of entity B there are zero, one, or many instances of entity A. Many-to-many relationships cannot be directly translated to relational tables but instead must be transformed into two or more one-to-many relationships using associative entities.

Existence

Existence denotes whether the existence of an entity instance is dependent upon the existence of another, related, entity instance. The existence of an entity in a relationship is defined as either mandatory or optional. If an instance of an entity must always occur for an entity to be included in a relationship, then it is mandatory.

Attributes

Attributes are the properties or characteristics of an entity. Attributes describe the entity of which they are associated. A particular instance of an attribute is a value. The domain of an attribute is the collection of all possible values an attribute can have. The domain of Name is a character string. Attributes can be classified as identifiers or descriptors. Identifiers, more commonly called keys, uniquely identify an instance of an entity. A descriptor describes a non-unique characteristic of an entity instance.

5.1.2.2 ERD Notation

There is no standard for representing data objects in ER diagrams. Each modeling methodology uses its own notation. The original notation used by Chen is widely used in academics texts and journals but rarely seen in either CASE tools or publications by non academics. Today, there are a number of notations used; among the more common are Bachman, crow's foot, and IDEFIX. All notational styles represent entities as rectangular boxes and relationships as lines connecting boxes. Each style uses a special set of symbols to represent the cardinality of a connection. The symbols used for the basic ER constructs are:

- Entities are represented by labeled rectangles. The label is the name of the entity. Entity names should be singular nouns.
- Relationships are represented by a solid line connecting two entities. The name of the relationship is written in a diamond shaped rectangle. Relationship names should be verbs.
- Attributes, when included, are listed inside a circle. Attributes which are identifiers (primary key) are underlined. Attribute names should be singular nouns.

• Cardinality of many is represented by a line ending in a crow's foot. If the crow's foot is omitted, the cardinality is one.

• Existence is represented by placing a circle or a perpendicular bar on the line. Mandatory existence is shown by the bar (looks like a 1) next to the entity for an instance is required. Optional existence is shown by placing a circle next to the entity that is optional.

Entity Relationship Diagram (ERD)

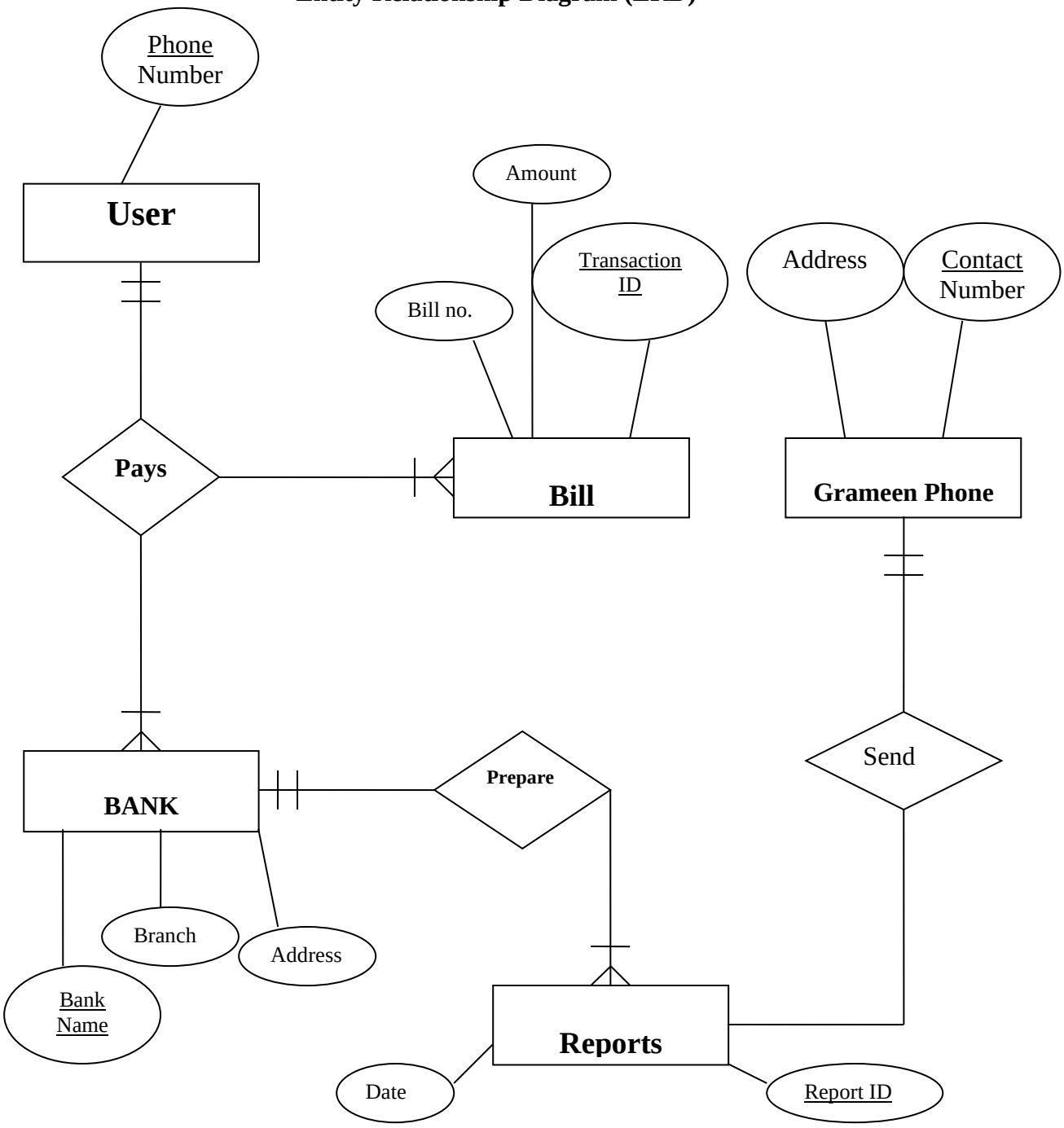


Figure-5.4: Relational Tables of User's Paid Bill Information Management System of Grameen Phone (with Primary & Foreign Key)

Relational Tables

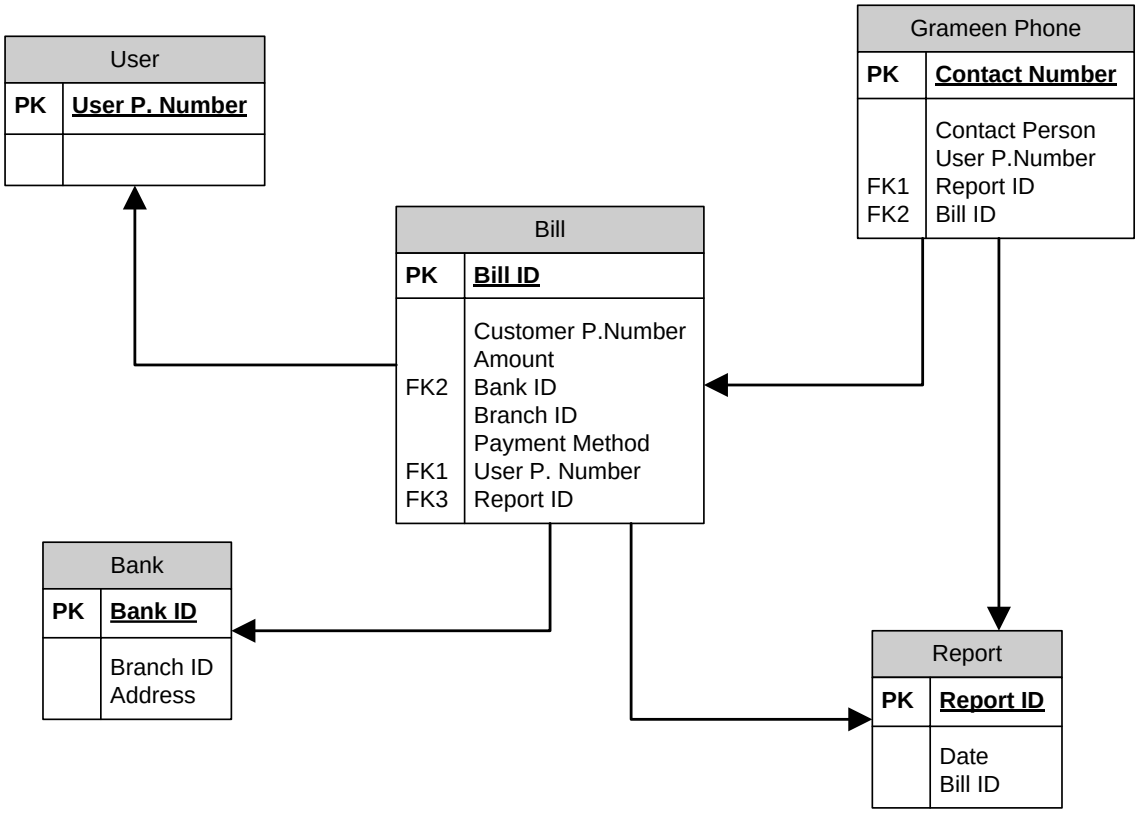


Figure-5.5: Relational Tables of User's Paid Bill Information Management System of Grameen Phone (with Primary & Foreign Key)

5.3 Physical design

Physical design is the process of translating the logical abstract model into the specific technical design for the new system.

6.0 User Interface

An interface is the 'tangent plane' between the user and the computer (the user interface) or the link between components (both software and hardware) in computer systems. Data are exchanged in two directions via the interface. A proper standardization of the user interface leads to the simplification of human/computer interaction and contributes a great deal to the transparency for the user.

Physical design follows logical design. The logical design is implemented to the physical design. Physical design provide user interface for the end user. User interface can be classified into user menu, user forms, and user reports and under these three categories there

may have data entry form, multiple windows, reports etc to facilitate the end user. There are only one user interface of User's Paid Bill Info management system of Grameen Phone Limited. That is Payment module (End-User Bank).

The user interface of User's Paid Bill Info management system of Grameen Phone Limited only 1 output reports. That is Bill payment report

6.1 Input Modules

Module Name: Payment information module

Purpose: This form is used for store various information of the user payment.

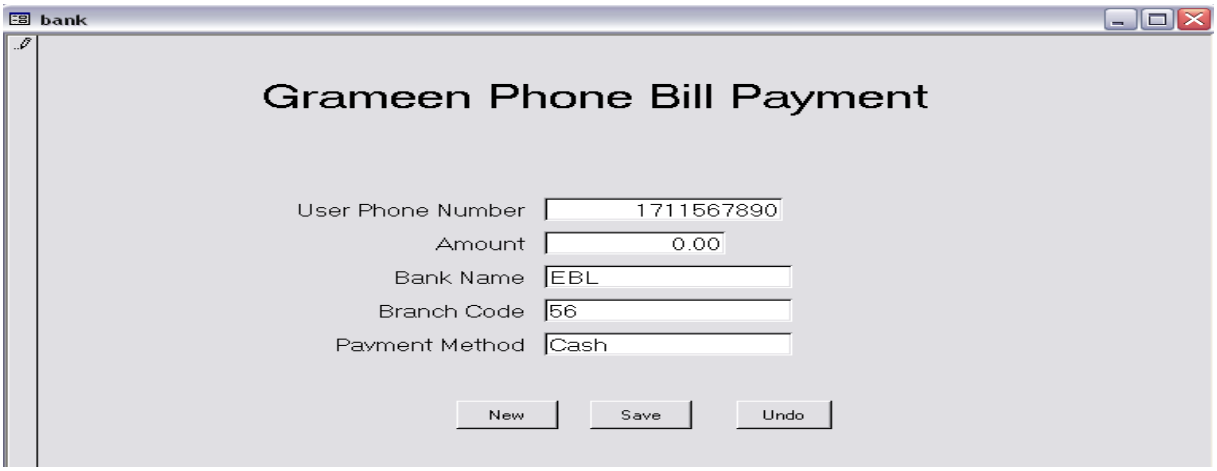


Figure 6.1: Payment information module

6.2 Output Report

Report Name: Bill Collection

Purpose: This report shows detailed information about user's bill payment information.

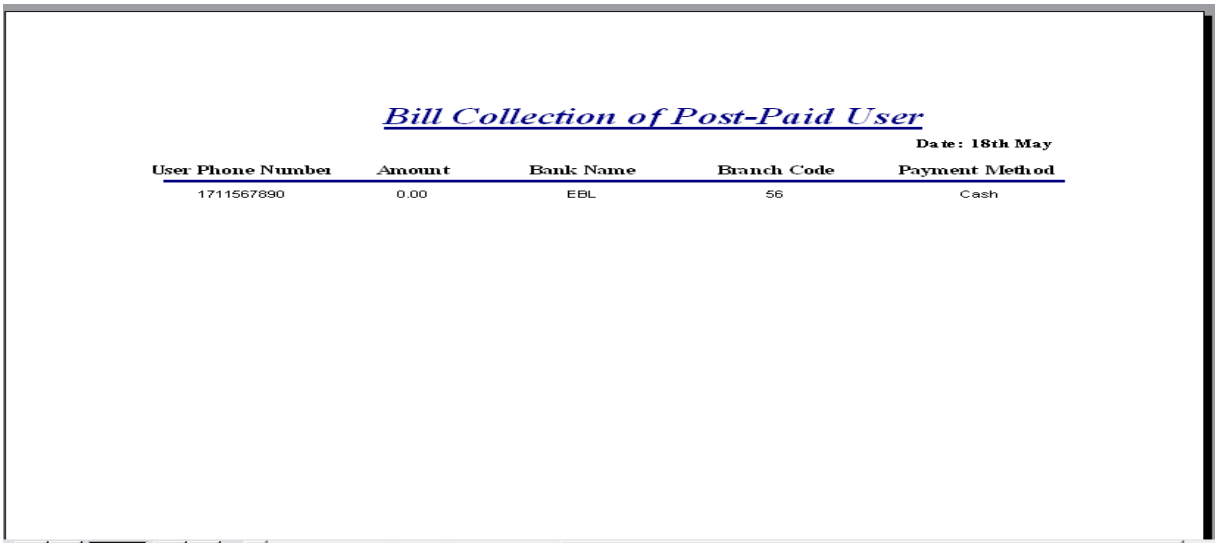


Figure 6.2: Payment report

7.1 Future Development

This project was aimed to provide a complete database solution to the User's Paid Bill Info management system of Grameen Phone Limited but due to time and other limitations the project has not been developed as it was intended earlier. Future studies should identify and analyze other factors of database development including the following issues. Because of the lack of time it was not possible to test the system. As a result it was not possible to know if it will return the data that it is suppose to. But in the future the software will be tasted and hopefully it will run error freely. Since most design decisions were driven by a single developer (including database design), many design choices were not the best choices available. This is due to the fact that the developer may not have expert database design skills. So, in future running much error checking process the system may work smoothly as it is required. Communication between the Grameen Phone and its associate banks is not properly clear sometimes. So, from time to time it has become very hard to develop the system as the GP's management desire.

7.2 Conclusion

The target of database based software is not just to enter the records, but also to analyze and represent them to the management for making decisions and corrective plans. At the end of the day, week or month the reports are produced to serve the management needs and provide them with accurate picture of the transaction records in summarized form.

"Analysis and Design of an Automated Information System to Manage the User's Paid Bill of Grameen Phone Limited" is the project I was assigned to. I had to struggle and managed to solve all the problems that I faced in my project work. I have to go through various online documents and several books to solve the problems which arise in my work. The software has been developed as user required it. I have developed this software using Visual Basic 6.0 in the front-end of it and MS SQL Server2000 in the back-end.

The implementation of a new system is subject to organizational change. Whether the organization accepts this change mostly depends on the successful implementation of the developed system. This system is user-friendly than the previous manual system. I have tried my best to make this project a complete & successful one, but due to time and other limitations I could not make the system more resourceful. Since this project has introduced me with the arena of real world for the first time, there may be some errors in developing the system.

As a graduate of management information system I am supposed to solve any kind of problems in a real world system that will reflect my ability and knowledge in this field if I can do it successfully. I am highly obliged that I had the opportunity to deal with such a project, which has helped me to lift my confidence to a higher level, and also has given me the strength to face the challenge that is ahead of me. Besides, these will help me a lot in future not only while working in industries but also in higher studies.

References

Activity Diagram in UML, Retrieve from http://www.developer.com/design/article.php/2247041

Activity Diagram, *Visual Paradigm Gallery*, Retrieve from http://www.visual-paradigm.com/VPGallery/diagrams/Activity.html

A.J.Pae Galgotia Publication Pvt. Ltd, *Relational Databases Concepts, Selection & Implementation, First Edition (1993).*

C.J. Date, *An Introduction to Database Systems*

Data Flow Diagram, *The IT Analyst's Desktop*, Retrieve from http://www.infoarchgroup.com/qrdfd.htm

DR. Indrani Haque, *MIS & System Analysis.*

Fred R. Mcfadden, Jeffrey A. Hoffer, Mary B. Prescott. *Modern Database Management.*

How to draw data flow diagram, *SmartDraw Software Design Center,* Retrieve from http://www.smartdraw.com/tutorials/software-dfd/dfd2.htm

Introduction to Data Modeling, *The University of Texas at Austin*, Retrieve from http://www.utexas.edu/its/windows/database/datamodeling/dm/erintro.html

Ivan Bayross, *SQL, PL/ SQL, The Programmer Language of Oracle, Second Edition (2001), BPB* Publication Pvt. Ltd

Jian Wang, "Object-Oriented Analysis Methodology*", School of Business Administration - University of Missouri-St. Louis.* Retrieve from http://www.umsl.edu/~sauter/analysis/488_f01_papers/wang.htm

Kenneth A. Kozar (Spring 1997), "Representing Systems with Data Flow Diagrams" Retrieve from http://spot.colorado.edu/~kozar/DFD.html

Kenneth A. Kozar (Spring 1997), "The Technique of Data Flow Diagrams" Retrieve from http://spot.colorado.edu/~kozar/DFDtechnique.html

Linda V. Knight, Theresa A. Steinbach, Vince Kellen, "System Development Methodologies for Web Enabled E-Business: A Customization Paradigm" Retrieve from http://www.kellen.net/SysDev.htm

Michael V. Mannino, *Database: Design, Application Development and Administration.* Noel Jerke, The *Complete Reference Visual Basic 6, Seventh Edition (1999,* Tata McGraw-Hill Publishing Company Limited.

Pere Botella, Xavier Franch et. el. "Modeling Non-Functional Requirements" *University Politecnica de Catalunya (UPC).*

Ramez Elmasri, Shamkant B. Navathe, *Fundamentals of Database System.*

SQL Server 2000 Documentation.

System Development Life Cycle Methodology, *Texas State University-San Macros,* Retrieve from http://www.txstate.edu/effective/upps/upps-04-02-03.html

UML Tutorial, *Sparx System* Retrieve from, http://www.sparxsystems.com.au/UML_Tutorial.htm

Understanding Entity Relationship Diagrams, Retrieve from http://folkworm.ceri.memphis.edu/ew/SCHEMA_DOC/comparison/erd.htm

Use Case Fundamentals, Retrieve from http://members.aol.com/acockburn/papers/AltIntro.htm

Use Case Modeling: capturing user requirement, Retrieve from http://www.zoo.co.uk/~z0001039/PracGuides/pg_use_cases.htm

http://atlas.kennesaw.edu/~dbraun/csis4650/A&D/UML_tutorial/activity.htm

http://atlas.kennesaw.edu/~dbraun/csis4650/A&D/UML_tutorial/history_of_uml.htm

http://seattlecentral.org/faculty/sconge/ITC255/Lectures/Chapter1Terms.html

http://www.mariosalexandrou.com/methodologies/waterfall.asp