Improved Order Management and Delivery of Medicines of Pharmaceuticals in Context of Rural Bangladesh

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DECLARATION

In accordance with the requirements of the degree of Bachelor of Computer Science and Engineering in the division of Computer Science and Engineering, I present the following thesis entitled *'Effective Stock Management For The Pharmaceuticals in context of Rural Bangladesh'*. This work was performed under the supervision of Dr. Yousuf Mahbubul Islam.

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

_____	_____
Signature of Supervisor	Signature of Author

ACKNOWLEDGEMENT

I would like to express my sincerest appreciation and profound granitite to my supervisor Dr.Yousuf Mahbubbul Islam, Professor Department of Computer Science and Engineering BRAC University, for his supervision, encourage guidance. In the course of the project development he discussed problems. He helped to overcome hurdles. His keen interest and valuable suggestions and advice were the source of all inspiration to us.

I would also like to give heartiest thanks to my friends, especially Firoj Alam for his cooperation and inspiration to complete this work

ABSTRACT

Pharmaceutical supplies their product throughout rural Bangladesh. However collecting orders for product is very difficult, as the infrastructure does not allow easy communication. If order information or information regarding consumption of Pharmaceutical product was available, it would make order and delivery management system easier.

To have an Improved Order Management and Delivery of Medicines of Pharmaceuticals We need an effective data collection from all parts of Bangladesh. The recent growth of mobile phones and infrastructure allows us to use this technology not only as data collection devise but also as a limited output device.

This thesis explores how text messaging can solve the problems of data collection and dissemination throughout rural Bangladesh. Using this system product manufacture and distribution can be made more effective and less costly in terms of expired medicine, extra production run and distribution cost.

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CHAPTER I : INTRODUCTION

Pharmaceuticals products are distributed throughout the country. These products are equally necessary in urban areas to rural areas. For the limitation of communication infrastructure, it is not always possible to distribute these products as required, especially in rural areas. Pharmaceuticals Company employs Medical Representatives (MR) throughout the country for collecting the orders from the retailers or chemists. MR collects the requirement from them. They place orders in many different ways, by phone fax or by postal service. These type order placements are time consuming and costly process. However pharmaceuticals products distribution is crucial, because it has no other alternatives. Life saving drugs needs special care in manufacturing, storing and delivery to the consumer. After production these items should be delivered to the right place to store so that customer can have it within the expired date of any product. Drugs are usually stored in central warehouse and distributed through out the country. Under the main warehouse/factory there are many regional offices. Regional offices also maintain their won stock. All the products are then distributed from those regions. Under each region there are many area offices. Medical Representatives work under these area offices. Medical Representatives collects required products from his nearest region offices and delivered to retailers/chemists. Medical Representatives are not only responsible for selling items to the retailers but also responsible for making the company's product popular in the market. The more they can sell the more the benefit they get.

Pharmaceutical products are usually produced batch wise. Each products has a batch number and expired date. They are stored in stores (depot) batch wise, so that it can be ensured that earliest manufactured products distributed first. Again Pharmaceutical products required special care in storing. Cost

increases as the number of depot increases. For this reason Pharmaceutical company like to have lowest number of depot. Again lowest number of depot creates problem in distribution of the products. As many of the Medical Representatives collect orders from the rural areas, so with less number of depot it tikes more time to reach the order to the depot. The following figure gives a basic idea of a typical distribution system throughout the country.

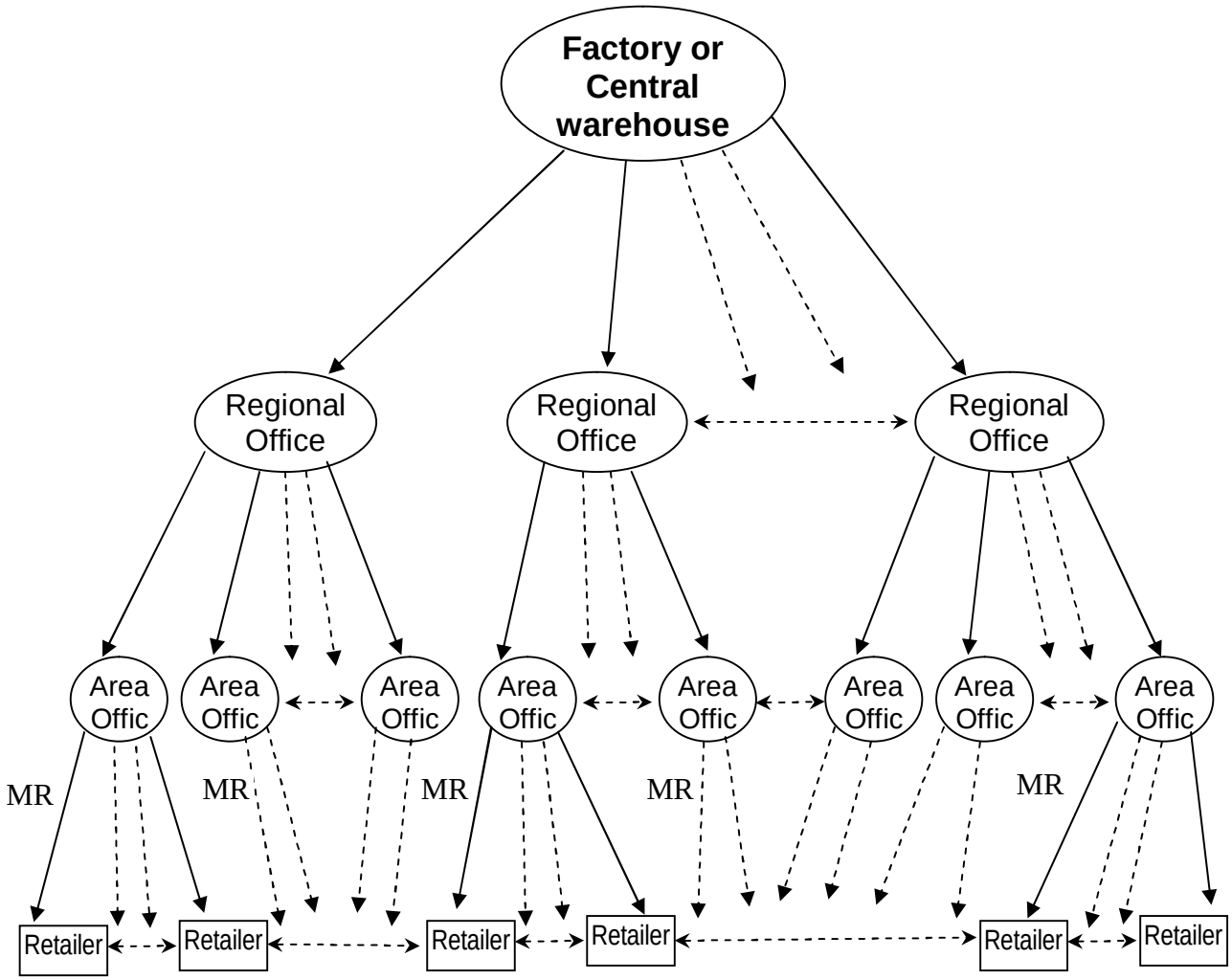

Fig 1: Typical distribution system of Pharmaceutical inventory

To solve the problem of placing orders from rural areas we take the advantage of current growth of mobile phones. We have build a system through

which MR can place orders by sending SMS messages. Our system also automates the invoice creation from that order. The system can give feedback to the MR about confirmation of his orders.

1.1 Existing System:

Existing order processing & delivery systems are available in both manual and automated format. Many organizations automated their system recently, but still they need substantial amount of time for receiving the orders from rural areas. After receiving the orders they input it to the system and generate the invoice. There are many drawbacks both with the manual and available automated system.

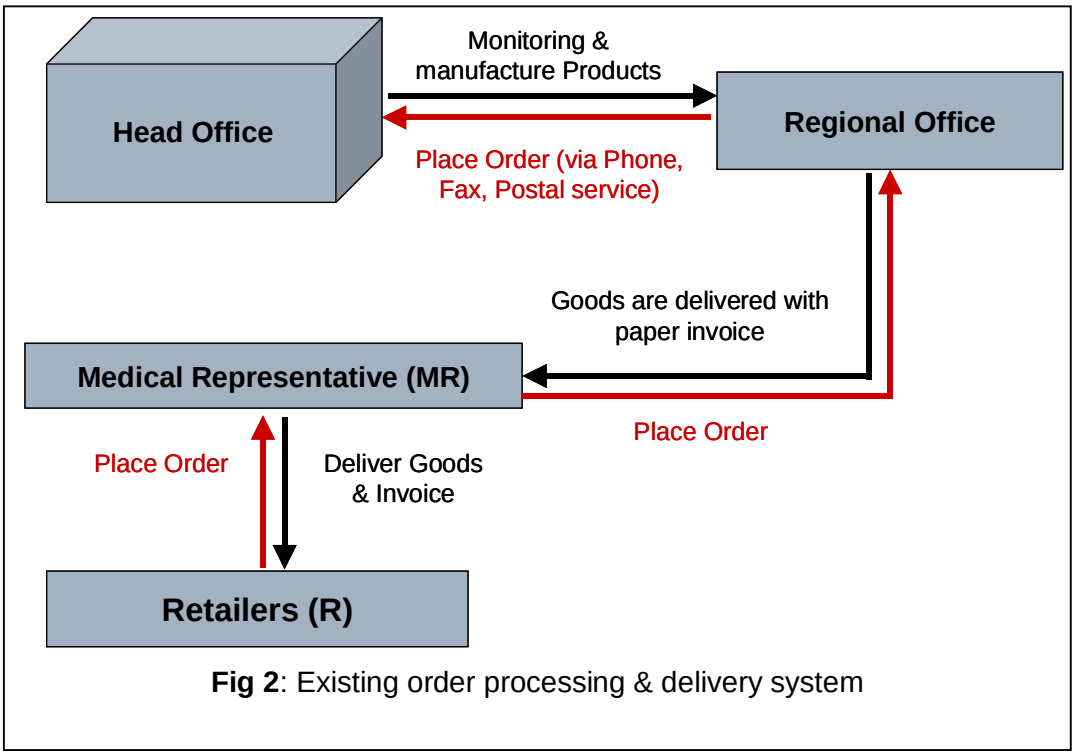

Fig 2: Existing order processing & delivery system

1.2 Pharmaceuticals Visited and Result:

We have visited two Pharmaceuticals Company Square Pharmaceuticals and Incepta Pharmaceuticals and one retailer Al-Modina Pharmacy where we talk to a Medical representative of Incepta Pharmaceuticals.

1.2.1 Square Pharmaceuticals:

Square Pharmaceuticals is one of the leading companies in our country. They have a large distribution channel all over the country. Their total distribution personnel are 675. The permanent is 343 and the 332 is casual. As this a large company, we go there to know how they manage to distribute their product. Though they supply their product to abroad but we focus on our country's process. An interview session with the senior accountant officer of Square Pharmaceuticals Company, we found out their order collection process and distribution policy. The policy is that they have a one central depot, 11 depot and 158 vehicles to deliver the products. The 11 depots are Dhaka, Pabna, Bogra, Rangpur, Khulna, Barisal, Comilla, Mymensingh, Chittagong, Maizdee, Sylhet. Each depot has covered so many areas. Each area has lot of MR who collects the order from their retailer and sends to the area office. The area office sends that orders sheet to the Depot. Then the depot make an invoice against the order and deliver to the area office. Then the products deliver to the Retailer by vehicle. The capacity of each depot's stock is huge. So they can keep huge amount of products. As a result they can distribute their products on time. But sometimes MR faces a challenge to collect the order. Especially for those retailers who are in rural areas. However when they collect the orders from retailer, then they face another challenge to send order forms to the area office. Again if the area office is very far away from the depot, then orders obviously reach in depot within very long time. To send the orders from the rural area office to depot is very time consuming and costly. Because the area office send the orders by fax, telephone or postal service to the depot. But as we mention that their depot is huge, so 97%

case there is no shortage of products. That's why they easily distribute the ordered products. They do not need to send emergency based products. Because the central depot has a plan which is each month how many products will be remain in the depots. So the central depot sends their products to the depot according to their monthly schedule.

1.2.2 Incepta Pharmaceuticals:

Incepta Pharmaceuticals Ltd. is a leading pharmaceutical company in Bangladesh established in the year 1999. The company has a very big manufacturing facility located at Savar. The company produces various types of dosage, which include tablets, capsules, oral liquids, ampoules, dry powder vials, powder for suspension, nasal sprays etc. Since its inception, Incepta has been launching new and innovative products in order to fulfill unmet demand of the medical community.

By the end of the year 2002 Incepta was ranked the 10 th company of the country. The company registered an excellent growth of 28.5% over the previous year. By the end of the year 2003 Incepta was ranked the 8 th company of the country. Incepta now has one of the largest and competent sales force and large distribution network of its own, operated from 13 different locations throughout the country. A most dynamic skilled and dedicated marketing team comprising of pharmacists and doctors are at the core of the marketing operation. These highly skilled professionals play a crucial role in providing the necessary strategic guideline for the promotion of its products. Due to the dedication of the employees, the ranking are up again and the company is currently (2004) ranked the 5^{th} largest company of the country with the highest growth rate among the top five.

The company virtually covers every single corner of the rural as well as urban area of Bangladesh. It has its own large distribution network having 13

depots all over the country. Under these depots there are 5-10 Area Offices. Medical representative (MR) works under these Area Offices. There are total of 800 MR throughout the whole country. Under each MR there are number of retailers. MR collects orders from the retailers and sent those orders to the head office. Head Office prepares the invoice. Products are delivered from the nearest depots.

Currently their order processing and stock management system is automated. But they had some problems in receiving orders from rural areas. These orders are generally send by phone, fax or postal services. These processes are costly and time consuming. Again due to the late of receiving orders and frequent changes in orders they some times need to create the invoice manually.

After visiting Incepta Pharmaceuticals we have point out that this company is highly motivated, really like to use new technology and face challenges. So we recognize some of there problems as follows and we are very much interested to solve these problems.

1. Receiving orders from rural areas.
2. Less flexibility in making the invoice.

1.2.3 Al-Modina Pharmacy:

We found the useful information from Al-Madina Pharmacy (Retailer). How they place their order, how their ordered item is delivered, how long it takes time orders to be deliver, what situation they and the suppliers faces every day, what policies they take to get over it.

The Medical Representative (MR) introduces their products to them. If retailers like it they will order it. He also orders some other products. The MR takes their order in an Order Book with product name, quantity and delivery date. They place these orders to their regional office. The regional office allocates the

products according to the order book and prepares invoice. The MR delivers these products in time and asks again for new order if need. The MR visits the retailer twice or more in a week. The retailer may also place order to the regional office if they wish. They are satisfied with the current system.

1.3 Challenges In Existing System:

1.3.1 Challenges of current automated system:

From taking order to making invoice everything is done by hand.

- Order Transmission from rural areas are time consuming.
- Require more manpower.
- Frequent possibility of error.
- Costly.
- Order processing is delayed.
- Preparing invoice.
- Updated Stock information is not available.
- Problems in taking Manufacturing decisions.

1.3.2 Challenges of current automated system:

- Orders came from rural area by fax or phone or by post.
- Time consuming.
- Need to input all orders to system by the officials.
- Less flexibility in full or partial order processing.

1.3.3 Challenges in context of rural area:

Since number of regional depot is limited and lots of Medical Representatives covering the rural area they need to send their order through postal service or by phone or fax. Posted orders take 3 to 4 days to reach to the depot. Again in the rural areas fax or phone line is not always available.

1.4 Solution Required:

According to the challenges studied we have some major problems. One is data collection from rural areas, where good communication infrastructure is not available. Second is received data needs to be input into the system, that is processing the order. Third is keeping flexibility for generating invoices and report from those data.

1.4.1 Data Collection:

Pharmaceuticals Company has their distribution network throughout the country. Collecting orders from urban area is pretty easy. Medical representatives collect the requirement from the retailers on daily or weekly basis. Then he or she personally collects the goods from his nearest depot and delivered to the retailers and collect the money. But in rural area problem arises due to the lack of communication facility. Pharmaceuticals Company had to spend a lot of money and time behind their employees for collecting those orders. About 70 percent of the population of Bangladesh lives in rural areas. They are the major consumer of the pharmaceutical items. So timely and effective data collection is very urgent. Now a day companies train their MR so good that they can gather the orders from rural areas. They also provide handsome remuneration to the maximum order collector. But still the problem remains in sending the orders to the depots or to the head office. Usually they send it by fax, phone or by courier service. All this process are time consuming and costly.

1.4.2 Order Processing:

When a paper of order is reached at the depot or Head Office they input the orders to the system to process the order. During processing, official's needs to check the current stock whether ordered items are available or not. Depending on the availability of items he can supply those products. Again he needs to be

sure about the total order against some particular products. If the total order count for a particular product exceeds the current stock amount then he has no way to deliver the items. Pharmaceutical products are lifesaving items this items has specified expired date. A manufactured product must be distributed within well ahead of the expired date. During the processing the order it must be guaranteed that earliest manufactured goods are delivered first. It must follow the FIFO (First In First Out) method. So it is required to have a lot of flexibility when processing the orders. We have not found any company who can provide such type of flexibility during order processing. For all those special case they need to follow manual processing. Again when an order is processed it needs to be distinguished from all the other orders, which are not yet processed. For all the orders those have been processed, total ordered product in those order must be deducted from the stock. Since just after processing it is deducted from the stock, it must be noted that those items are not physically delivered from the stock. So the deducted stock must be treated as virtual stock.

1.4.3 Urgent required medicine:

Head Office does not have updated information of the current stock spread throughout the country. If a depot run short of a product and that product is urgently required at some particular region there is no way to know which depot has this item and how much. If it is available in some other regional stock it could be delivered from that region in urgent basis. Again the head office must take immediate decision that this urgently needed item must be manufactured in emergency basis.

1.5 Our Proposed Solution:

To over come the challenges of Data collection that is order collection and Order processing, our proposed solutions are based on web server and using SMS.

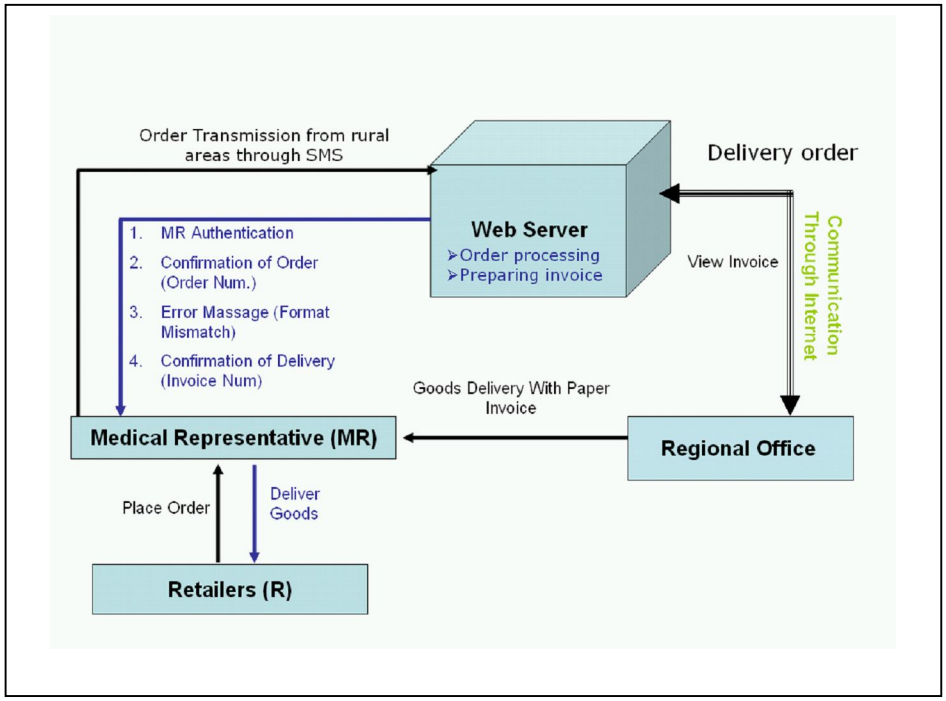

Fig 3: Order processing System

1.5.1 Solution of Data Collection:

In order to solve the data collection problems we use SMS and web server.

1.5.1.1 Data Collection through SMS from rural areas:

Our solution for data collection is that, by sending the order through SMS rather than fax, post or telephone. We call that solution as a SMS solution. MR goes to the retailers to collect order in weekly basis. Then MR will send those orders through SMS. From the Fig 3 we saw that the retailer office place the

Order to the MR. Then MR sends the order through SMS to the web server. So through SMS MR will easily send the data to the head office.

1.5.1.2 Benefit of Using SMS from rural areas:

First of all MR can quickly send the orders to the head office using SMS. Secondly it reduces the cost to send data to the head office. Sending data using SMS takes only 2 taka. Again if the pharmaceuticals company becomes a corporate subscriber of any cell phone provider they will even get cheaper rate for SMS. On the other hand if MR uses telephone, fax or post then it will take minimum 10 to 20 taka for per order. The final benefit is that the data is automatically inserted into the database. No one needs to insert the data manually.

1.5.1.3 Data collection through web:

Actually this solution is for those areas where Internet facilities are available. In this system MR will login into the system. After login he will view the products list, which may be ordered. Then the MR will select the products and ordered the items with quantity, delivery date, and retailer id. When he ordered it would be stored into the database.

1.5.1.4 Benefit of this system:

It will save times and reduce the cost to send the order.

1.5.2 Solution of Order Process:

To distribute the ordered products effectively our proposed solution uses the web server. Web server will keep all the information of stock, pending orders, order details, product details in the database. To make an invoice admin will login to the web server. He can view the pending orders. Then he

can take the decision whether the order could be fully delivered or partially delivered. For this reason he has to check the current stock information. If Stock quantity is greater than ordered quantity, then he will check the total orders are given for that particular product. If the total amount of orders for that particular item is greater than the available stock then he can take the decision for partial delivery. Even it is possible not deliver the item at all. Other wise he can delivers full amount of orders. After taking the decision, admin makes invoice. Then the invoice paper is send to the regional office. Regional offices view the invoice and pack the items and quantity according to the invoice paper and send to the MR. MR will deliver the products to the retailer office.

1.5.2.1 Benefit of the Order process Solution:

The head office admin can take the partial and full deliver decision. Admin can create invoice automatically. After creating invoice they send the invoice paper to the region by the web server. Ultimately Head office delivers the products to the retailer.

1.5.3 Solution for urgent required medicine:

Since we shall have a web database so Head Office or any regional office can access the database and can have an idea of short running product. Even we shall keep the option to query the database through SMS. So any MR can see the current stock status of a particular item in his region and even in other regions.

CHAPTER II: SYSTEM DEVELOPMENT

2.1 Methodology:

We shall follow the SDLC process for system development.

2.1.1 Phase 1: Project identification and selection.

- Learn how the existing system works and how much of the system have been automated and current challenges and problems of existing system. For this reason we shall visit Pharmaceuticals Companies, talk to both with the people of marketing department and also with the people of IT sections if exists.
- Review the system for solving prevailing drawbacks.
- Determine the requirements for the proposed system.
- Structure the system requirements using Context diagram, DFD's of different level.
- Build Conceptual Data modeling; build E-R Diagram (Entity Relationship Diagram).

2.1.2 Phase 2: Project initiation and planning.

2.1.2.1 Project Initiation:

- Build up the project initiation team
- Establishing customer relationships
- Developing a plan to get the project started
- Setting management procedures

2.1.2.2 Project Planning

- Defining clear, discrete activities and the work needed to complete each activity
- Make baseline Project Plan (BPP)
  - ✓ Scope
  - ✓ Benefits
  - ✓ Costs
  - ✓ Risks
  - ✓ Resources
- Outlines work needed to be performed
- High-level description of system
- Lists all work to be performed

2.1.2.3 Assessing project feasibility

- Economic
- Operational
- Technical
- Schedule

2.1.3 Phase 3: Analysis:

Gather information on what system should do from many sources. Information collected from users, Existing documents and files, Computer-based information, Understanding of organizational components, Business objective, Information needs, Rules of data processing, Key events, Gather facts, opinions and speculations, Be neutral, listen and Seek a diverse view, Problems with existing system, Opportunity to meet new need, Reasons for current system design, Prototyping, build rudimentary version of system is built, Quickly converts requirements to working

version of system. Once the user sees requirements converted to system, will ask for modifications or will generate additional requests.

2.1.4 Phase 4 System Design:

Design the logical database. Need to consider all inputs, outputs and every data element on the E-R Diagram. Finalize the prototyping that meet all the requirements. Based on that prototype design the physical database, use the relational database model. Design the forms and reports. Finalize the Interfaces, Dialogues and design specification.

2.1.5 Phase 5 Implementation:

Code the system according to the design specification. Test the new system and after the successful testing install the system. Prepare the Documentation for the System.

2.2 Finalized Prototype:

Fully workable prototype was build. Excel and its macro were used to quickly build a prototype. The prototype system is able to take orders, can prepare invoice, fully or partially. Stock can be checked for availability for goods. Total order for particular product can also be checked. Order from mobile phone is tested in the prototype. Format of the mobile message is finalized. Parsing algorithm and validation checking is also completed in this stage.

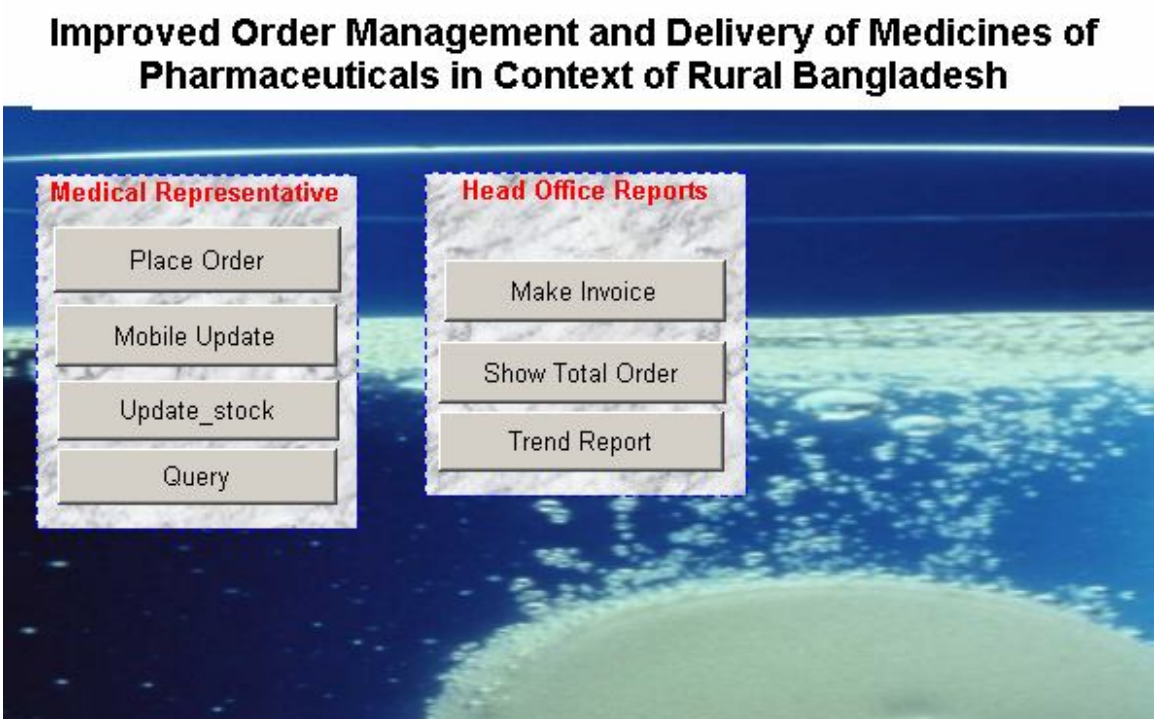

Fig 4: Main window of the prototype

Helps to guide through all the forms and reports

Product List

Back To Main

Add new Product

Product_ID	Product_Name	Pack_Size	Strength	Price	Description	Product Code
AC	Acuren	10X10	500mg	100	Paracitamol 500mg tablet	ACT
AD	Adora	10X10	50 mg	120	Diazipum 50 mg tablet	ADT
AL	Aldecox	10X10	100 mg	300	Raniridine 100 mg Tablet	ALT
AE	Alervil	10X10	500 mg	200	ZIF 500 mg Iron Capsule	AET
AN	Alneed	5X5	400 mg	200	Sephradine 400 mgAntibiotic tablet	ANT
AO	Aloxif	2X5	50 mg	50	Paracitamol Suppository	AOT
AM	Ambolyt	1X1	60 ml	50	Liquid paracitamol Suspension	AMT
AS	Ameloss	1X1	60 ml	24	Alatrol Syrup 60 ml	AST
AQ	Aqualax	10X10	150 mg	188	Alatrol tablet 60 ml	AQT
AR	Arafin	10X10	100 mg	226	Clofenac SR tablet 100 mg	ART

Fig 5: Shows the Product List of the stock

New Products can be added here. Any outdated product can be deleted. Stock table find the product id from this product list

Main Stock

Add Stock | Back To Main

Batch_ID	Product_ID	Pack Size	Quantity	Manufacture_Date	Expired_Date	Stock_Price	Arae Id
1	ACT	10X10	976	6/18/2004	6/18/2008	99790	DA01
1	ADT	10X10	2000	6/19/2004	6/19/2008	240000	DA01
1	ALT	10X10	1980	6/20/2004	6/20/2008	599370	DA01
1	AET	10X10	500	6/21/2004	6/21/2008	100000	DA01
1	ANT	5X5	581	6/22/2004	6/22/2008	119580	DA01
1	AOT	2X5	4000	6/23/2004	6/23/2008	200000	DA01
1	AMT	1X1	6976	6/24/2004	6/24/2008	349896	DA01
1	AST	1X1	8000	6/25/2004	6/25/2008	192000	DA01
1	AQT	10X10	900	6/26/2004	6/26/2008	169200	DA01
1	ART	10X10	900	6/27/2004	6/27/2008	203400	DA01
2	ACT	10X10	1000	6/18/2005	6/19/2009	100000	DA01
2	ADT	10X10	2000	6/19/2005	6/20/2009	240000	DA01

Fig 6: Region Stock

This is the main stock of the prototype. This table design will slightly modified in the final implementation. The main stock will be treated as region stock and it will be further normalized.

Place Order

Back To Main

Retailer ID SYA1 Delivery Date 26-Jun-2005

Order Date 26-Jun-2005

Send

Sl No	Product ID	Product_Name	Strength	Pack Size	Quantity
1	ACT	Acuren		10X10	12
2	ADT	Adora		10X10	
3	ALT	Aldecox		10X10	10
4	AET	Alervil		10X10	
5	ANT	Alneed		5X5	14
6	AOT	Aloxif		2X5	
7	AMT	Ambolyt		1X1	12
8	AST	Ameloss		1X1	
9	AQT	Aqualax		10X10	
10	ART	Arafin		10X10	

Fig 7: Form for placing order.

Placing order is much easier here. MR just need select a retailer from the drop down list select delivery date; Order date will show the current system date. Place the required amount in the quantity field. Click on send. Your order is send

Total Product Order

Back To Main

ACT

Search Dealer

Distribute

Product ID	Total Order	Current Stock	Order ID	Dealer ID	Delivery Date	Order Quantity	Partial
ACT	24	976	1	1	6/26/2005 18:43	12	
ADT		2000	2	2	6/26/2005 18:43	12	
ALT	20	1980					
AET		500					
ANT	28	581					
AOT		4000					
AMT	24	6976					
AST		8000					
AQT		900					
ART		900					

Fig 9: Total order for the products.

After many MR places the order the admin can prepare invoice. But before creating the invoice he can check the total order against each products and which MR want that product by how much.

Fig 10: Mobile order format.

Fig 11: Mobile Acknowledge format.

Using this form order from the mobile phone is tested. Parsing algorithm and validation is finalized through this testing. Figure 9 shows the acknowledge generated automatically after the invoice is generated

2.3 BLOCK DIAGRAM OF THE OVERALL SYSTEM

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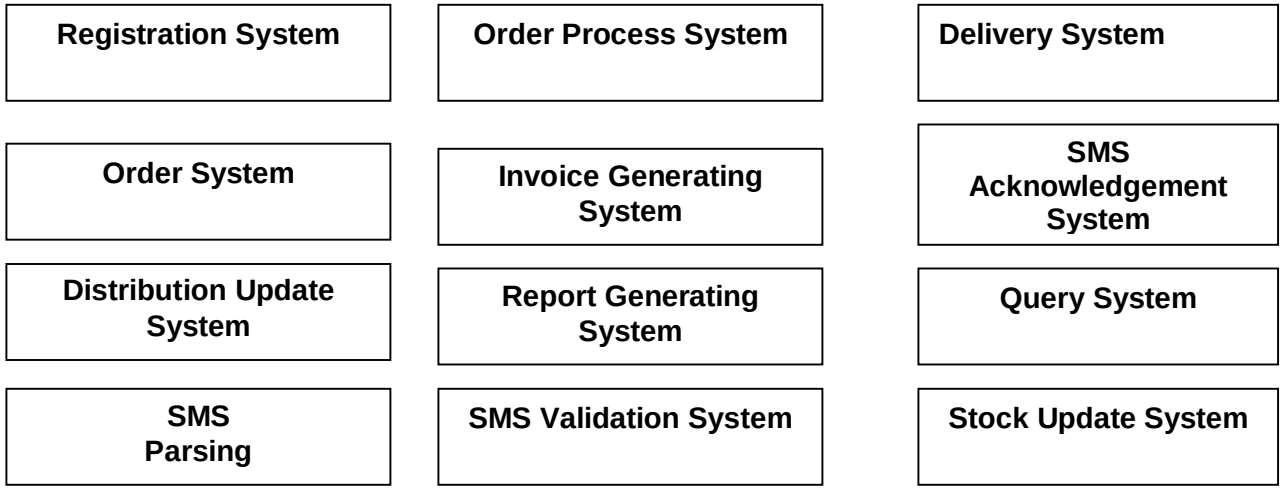

Fig 12: Block Diagram of overall System

Group Members		Responsibilities
Name	ID:	
Saidur Rahman	01101037	1. Order Process System 2. Invoice Generating System 3. Report Generating System 4. SMS Validation System
Md. Khaleed Al- Amran	01201081	1. Delivery System 2. SMS Acknowledgement System 3. Query System 4. Stock Update System
Ali Al Asadullah Md. Shafi	01201082	1. Registration System 2. Order System 3. Distribution Update System 4. SMS Parsing

Fig 13: Showing the members responsibilities

The shaded portion is my module. Descriptions of my modules are given in the next section.

2.3.1 My Modules

Improved Order Management and Delivery of Medicines of Pharmaceuticals in Context of rural Bangladesh

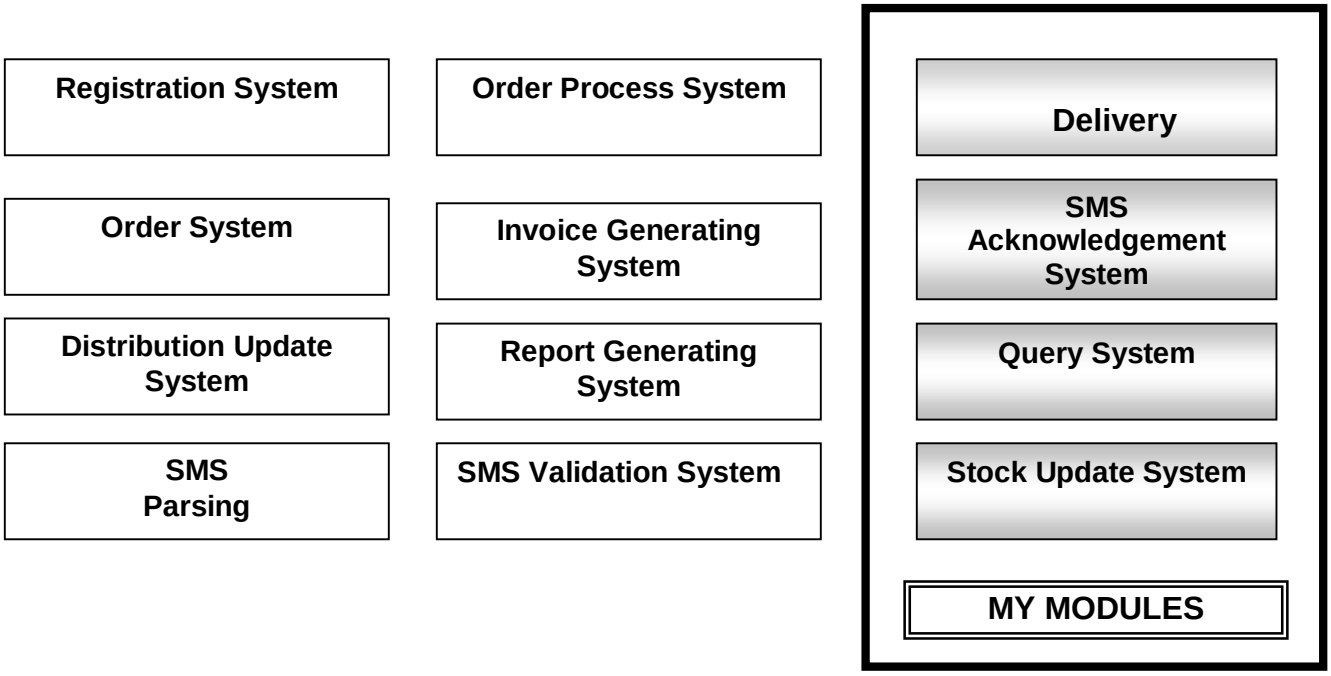

Fig 14: My Modules

I am responsible for the following modules

1. Delivery system
2. SMS Acknowledgement System
3. Query System
4. Stock Update System

2.3.1.1 Delivery system

This system processes the issued invoice items. When MR places an order the corresponding invoice is generated and sets its status Issued. These invoice are available to the regional office. The regional office views all issued invoice and packs the products according the invoices items. When it is ready they prints the invoice and set its status as delivered. The items are delivered are automatically subtracted by the system form the regional stock in FIFO (First-In-First-Out) method.

Advantage: It helps to track down the stock status in future easily.

2.3.1.2 SMS acknowledgement system

The previous module only changes the status of ordered items no notification is available for medical representatives. This system provides the notifications to the Medical representatives via SMS. When ever an invoice and products are issued and acknowledgement with in voice number and its total price is sent to medical representatives

Advantage: It helps medical representative aware about their request.

2.3.1.3 Query system

This system helps the registered user to search a particular in stock. Two types of query are available.

1. Search a product in his sock. The user will send the request the search via SMS. The system will automatically fiend the regional stock where he belongs, perform the search and send back the results in total quantity. Because products are stored as batch wise. So there are same products multiple times but of different batches.
2. Search a product in any own sock. It is similar as the pervious one except that here user can search a particular product in any region.

Advantage: By finding the proper allocation of the products urgently based order can be placed.

2.3.1.4 Stock update system

This system is used to update the products, production information and stock information. Administrator adds new products batch wise to the regional stock.

Advantage: It keeps the stock and product information up-to-date.

2.3.2 Specialty of my modules

My modules make the system user-friendlier and more interactive with users. User feedback is provided to the authenticated users. So the system is secured.

2.4 Analysis

2.4.1 Information Gathering

First, we visited to the pharmaceutical company and retailer office. We had tried to find how they collect the orders and distributed to the retailer. Interview session is placed. We collected some documents and reports. We found the medical representative activities. Also try finding out the lacking of current system. Then we tried to find out current system requirements and define what our proposed system requirements would be. We also found out about the operation and issue of the current system and needs for system that we want to develop.

2.4.2 Context Diagram

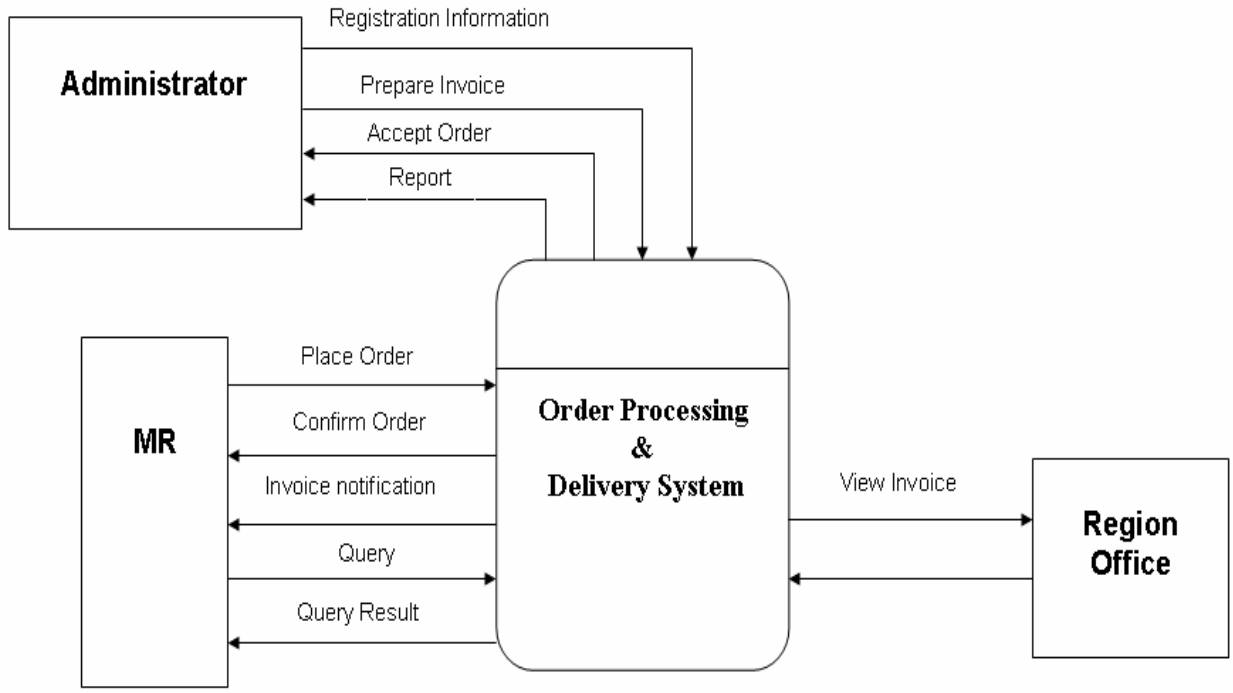

Fig 15: *Context diagram of the system*

The MR places the order to the system. The administrator accepts the order. Administrator makes an invoice for that Order. Then they send that invoice paper to the regional office. The regional office view that invoice. Then regional office sends an invoice notification to the MR. MR can also query for to know about the stock information. Then system will inform result to the MR. Necessary feedback is provided to all years.

2.4.3 Data Flow Diagrams

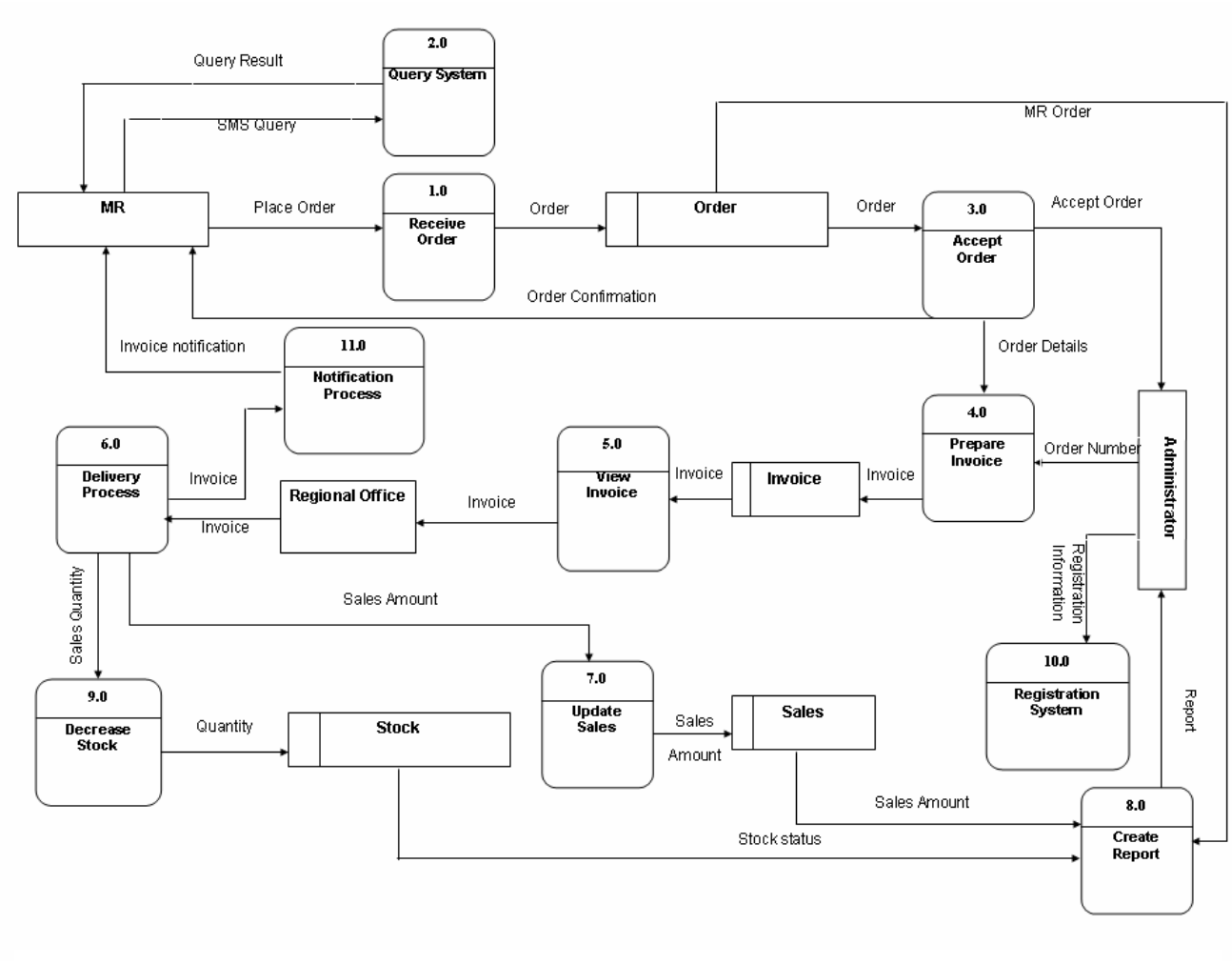

***Fig16**: level-0 DFD*

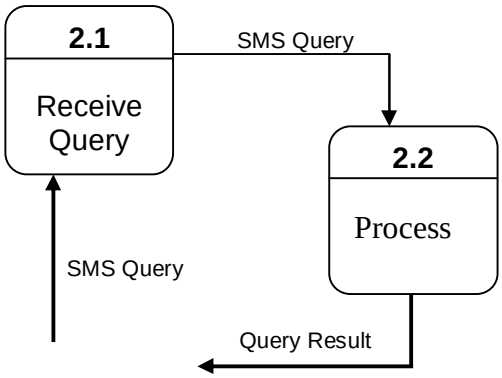

Fig- 17: *level-1 DFD decomposition of 2.0*

Get the SMS request then process the query.

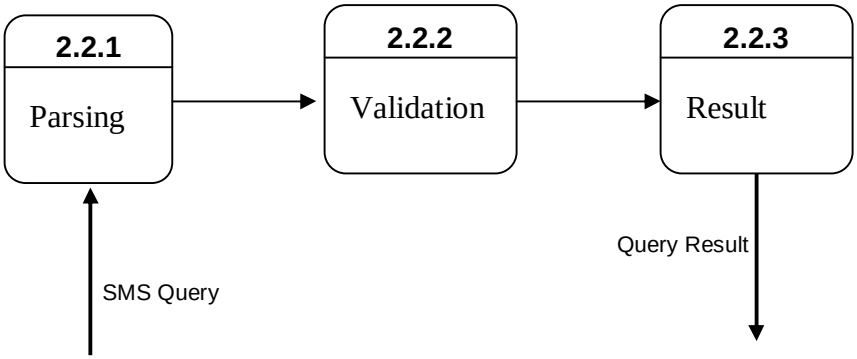

Fig-18: Level-2 DFD Decomposition of 2.2

Parse the request, find out the user validity, request validity, find the result then send back it to the user.

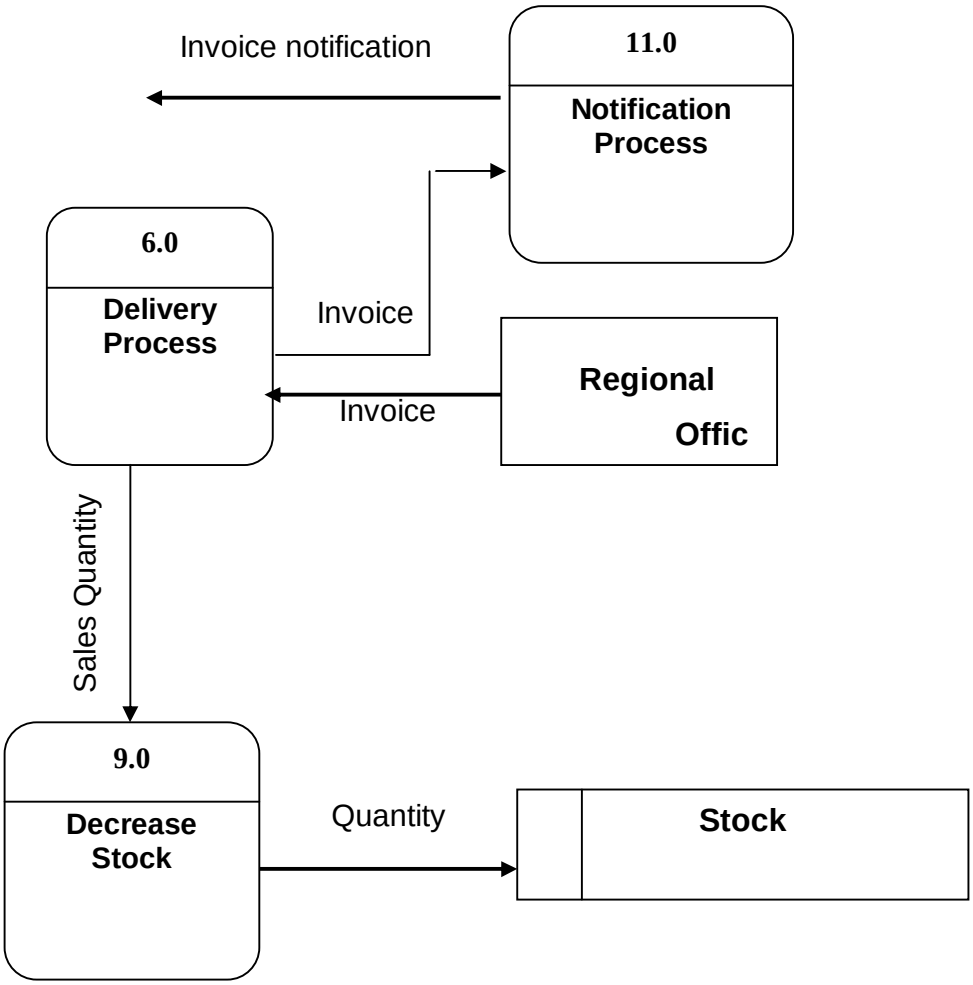

Fig-19: Level 0 of delivery process

Take the issued invoice. Prepare the package to deliver it to MR. Decease the stock quantity and notify the MR

2.5 Data Base Design

Database is an essential part of this system. It should be well designed for reliable data access and manipulations. In the following section the detailed design is available.

2.5.1 Entity relationship diagram (ERD)

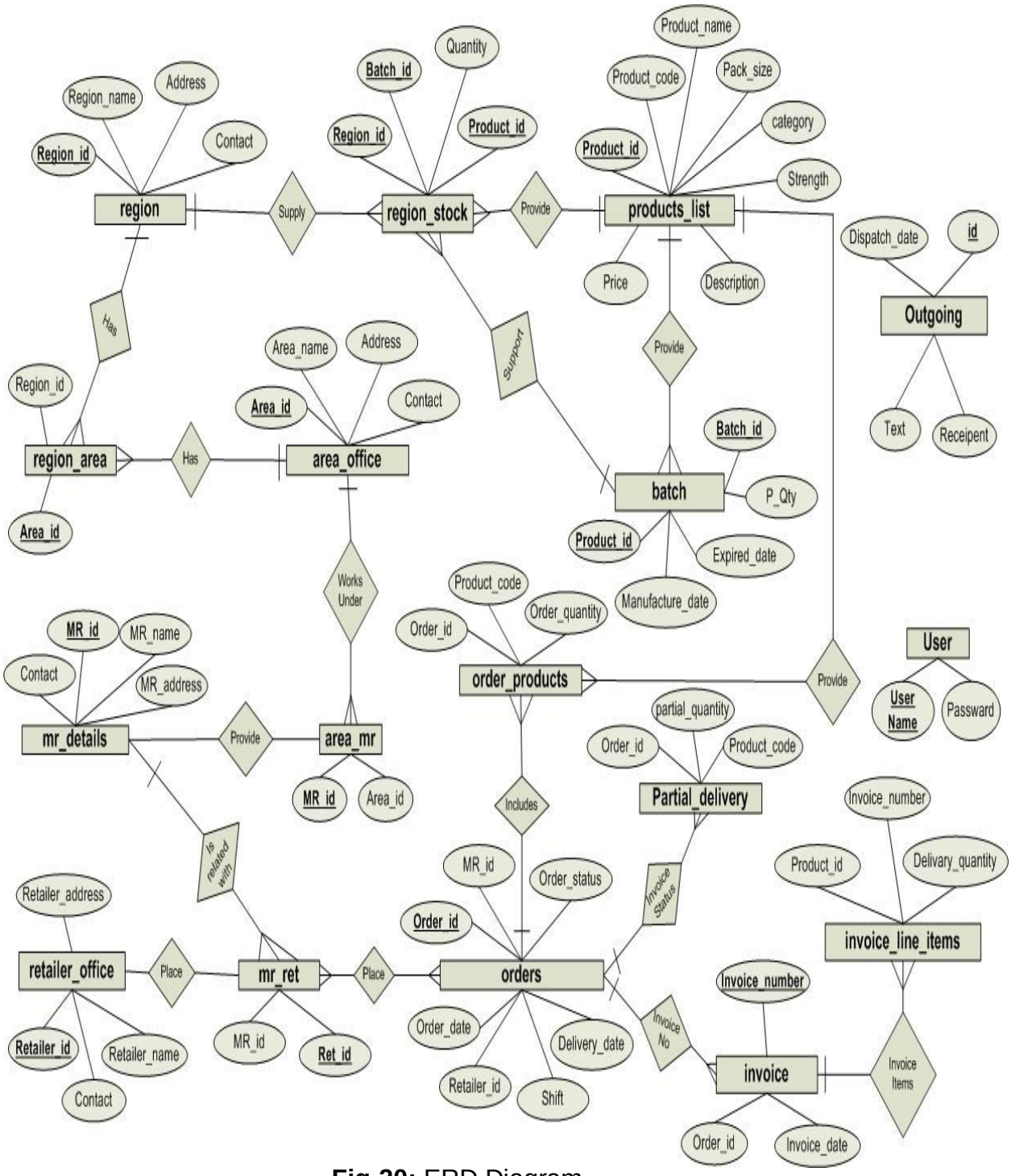

Fig-20: ERD Diagram

2.5.2 Table Design

1. Table Name: Area_mr

Purpose: Keep MR under a Particular area.

Field	Type
Area_id	varchar(50)
MR_id	varchar(50)

Description: Area_mr table contains MR List under a particular area. Each area has many MR. Here MR_id is the primary key.

area_mr(Area_id , MR_id)

2. Table Name: Area_office

Purpose: Keep details information of Area Office.

Field	Type
Area_id	varchar(50)
Area_name	varchar(50)
Address	varchar(50)
Contact	varchar(20)

Description: This table contains all the specific information of each area. Each area office has different area id, area name and address. Here Area_id is the primary key.

area_office(Area_id , Area_name, Address , Contact **)**

3. Table Name: Batch

Purpose: Keep the expired date and manufacture date of products.

Field	Type
Product_id	varchar(50)
Batch_id	varchar(20)
Manufacture_date	date
Expired_date	date
Quantity	bigint(20)

Description: Each product has expired date and manufacture date. The products also produce under a specific batch. All the products have a batch id. Here Product_id and Batch_id is **Primary Key** (**Candidate key)**. Because there are so many products that have a same batch key. That's why product_id and batch_id both are the primary key.

Batch(Product_id , Batch_id,Manufacture_date,Expired_date**)**

4. Table Name:Invoice

Purpose: Keep the specific invoice number of each order.

Field	Type
Invoice_number	bigint(20)
Order_id	varchar(50)
Invoice_date	date

Description: This table contains the information of invoice number of specific orders. It also contains the date of invoice creation. Here invoice number is the primary key. The order id is the Foreign key.

Invoice(Invoice_number, Order_id ,Invoice_date)

5. Table Name: Invoice_line_items

Purpose: Keep the items and delivery quantity information of invoice.

Field	Type
Invoice_number	bigint(11)
Product_id	varchar(50)
Delivary_quantity	bigint(20)

Description: Invoice_line_items keep the information of delivery quantity of ordered products. Here Invoice number and Product_id is the candidate key.

invoice_line_items (Invoice_number,Product_id,Delivery_quantity)

6. Table Name: mr_details

Purpose: Keep information of MR.

Field	Type
MR_id	varchar(50)
MR_name	varchar(50)
MR_address	varchar(50)
Contact	varchar(20)

Description: Keep the personal information of each MR. This table contains 6 fields. When MR uses the web services then for authentication password is needed. So the password field contains the password of MR and the user name is MR_id. There is a field mobile which tells that this MR uses the mobile for SMS. MR_id is primary key

Mr_details(MR_id, MR_name, MR_address , Contact)

7. Table Name: mr_ret

Purpose: Keep retailer information under a Particular MR

Field	Type
MR_id	varchar(50)
Ret_id	varchar(50)

Description: mr_ret table contains Retailer List under a particular MR. Each MR has many Retailer. Here Ret_id is the primary key.

Mr_ret(MR_id , Ret_id)

8. Table Name: neworder

Purpose: Keep the information of items and quantity which will be ordered

Field	Type
Mr_id	varchar(20)
Ret_id	varchar(10)
Product_id	varchar(20)
quantity	bigint(20)

Description: New order table contains the items and ordered quantity which are selected by mr. This table contains the products and ordered quantity which will not be confirmed. Here Mr_id is the primary key.

Neworder(Mr_id,Ret_id,Product_id,quantity)

9. Table Name: order_products

Purpose: Keep the information of items and quantity which is ordered

Field	Type
Order_id	bigint(20)
Product_code	varchar(20)
Order_quantity	bigint(20)

Description: Order_products table contains the items and ordered quantities which are ordered by MR. The product code field one to one mapped with product_id. Because of SMS we use 2 digits. So the product code is 2 digits. Here order_id is the primary key.

Order_products(Order_id, Product_code,Order_quantity)

10. Table Name: Orders

Purpose: Keep the information of order status and delivery information of MR.

Field	Type
Order_id	bigint(20)
MR_id	varchar(50)
Retailer_id	varchar(50)
Order_date	Date
Delivery_date	Date
Order_status	char(3)
Shift	char(1)

Description: This order table contains the order status and delivery information of MR. If the Order_status field is No, it means that the order is still pending. When yes that means the order is already distribute.

Orders(Order_id,MR_id,Retailer_id,Order_date,Delivery_date,Order_status,shift)

11. Table name: outgoing

Purpose: sms will send from web server to mobile.

Field	Type
Id	bigint(20)
recipient	varchar(32)
Text	varchar(160)
Dispatch_date	Datetime

Description: The outgoing table keeps the information of message which will send to mobile. Id is the primary key of outgoing.

Outgoing(id ,recipient ,text ,dispatch_date)

13. Table name: products_list

Purpose: Keep all the products information.

Field	Type
Product_id	varchar(50)
Product_code	varchar(50)
Product_name	varchar(50)
Pack_size	varchar(50)
Strength	varchar(50)
Price	bigint(20)
Description	varchar(100)
category	varchar(20)

Description: Products table keeps the detail products information. Product id is the primary key of this table.

Products_list(Product_id,product_code, Product_name,Pack_size, Strength, Price, Description, category)

14. Table name: region

Purpose: Keep information of Region office.

Field	Type
Region_id	varchar(50)
Region_name	varchar(50)
Address	varchar(50)
Contact	varchar(50)

Description: Region table keeps the detail information of region office.

Region(Region_id, Region_name, Address)

15. Table name:region_area
Purpose: Keep area office under a Particular Region office.

Field	Type
Region_id	varchar(50)
Area_id	varchar(50)

Description: region_area table contains area office List under a particular area. Each area has many area office. Here Area_id is the primary key.

Region_area(Region_id, Area_id)

16. Table name: region_stock

Purpose: keep the stock information of all region.

Field	Type
Region_id	varchar(50)
Batch_id	varchar(20)
Product_id	varchar(50)
Quantity	bigint(20)

Description: region_stock keeps the stock information i.e products quantity remains in the region office. Region_id,Batch_id,Product_id are primary key.

Region_stock(Region_id,Batch_id,Product_id,Quantity)

17.Table name: retailer_office

Purpose: Keep details information of retailer_office.

Field	Type
Retailer_id	varchar(50)
Retailer_name	varchar(50)
Retailer_address	varchar(50)
Contact	varchar(50)

Description: retailer_office keeps the details information of retailer office.

Retailer_office(Retailer_id, Retailer_name, Retailer_address, Contact)

18. Table name: User

Purpose: Authenticate user

Field	Type
User_Name	varchar(50)
Password	varchar(50)

Description: Keep details information of users who should be have access to the system.

user(user_name, password)

2.5.3 Dialog design

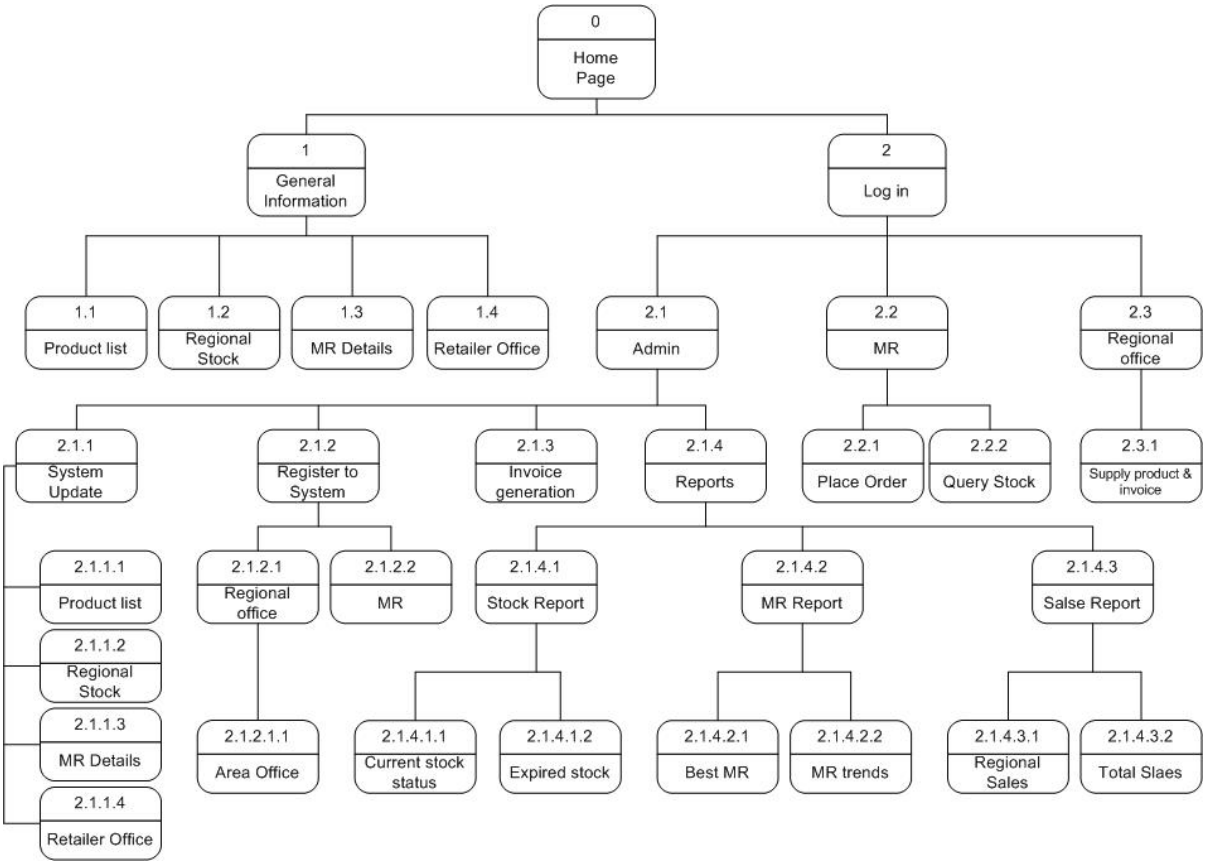

Fig-21: Dialog Design

2.5.4 Forms and Interface design

2.5.4.1

Narrative overview:

Form	Region office login
User	Region office
Task	User Authentications
System	Microsoft Windows, Linux
Environment	Standard Office environment

Sample Design:

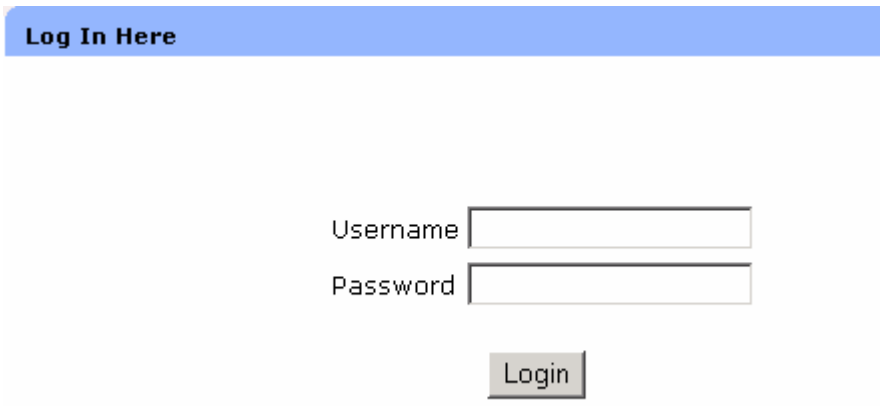

Fig-22: Loin form

Testing Method:

Speed of performance

Find errors

2.5.4.2

Narrative overview:

Form	Show Delivery Invoice
User	Region office
Task	List all issued invoice
System	Microsoft Windows, Linux
Environment	Standard Office environment

Sample Design:

SHOW Deliver Invoice

Order Id	MR_id	Retailer_id	Delivery Date	Schedule	Option
23	DHK001	Rdh001	2005-07-22	m	VIEW DETAILS

Fig-23: Issued invoice

Testing Method:

Speed of performance

Find errors

2.5.4.3

Narrative overview:

Form	Details delivery order
User	Region Office
Task	Print invoice and update stock
System	Microsoft Windows, Linux
Environment	Standard Office environment

Sample Design:

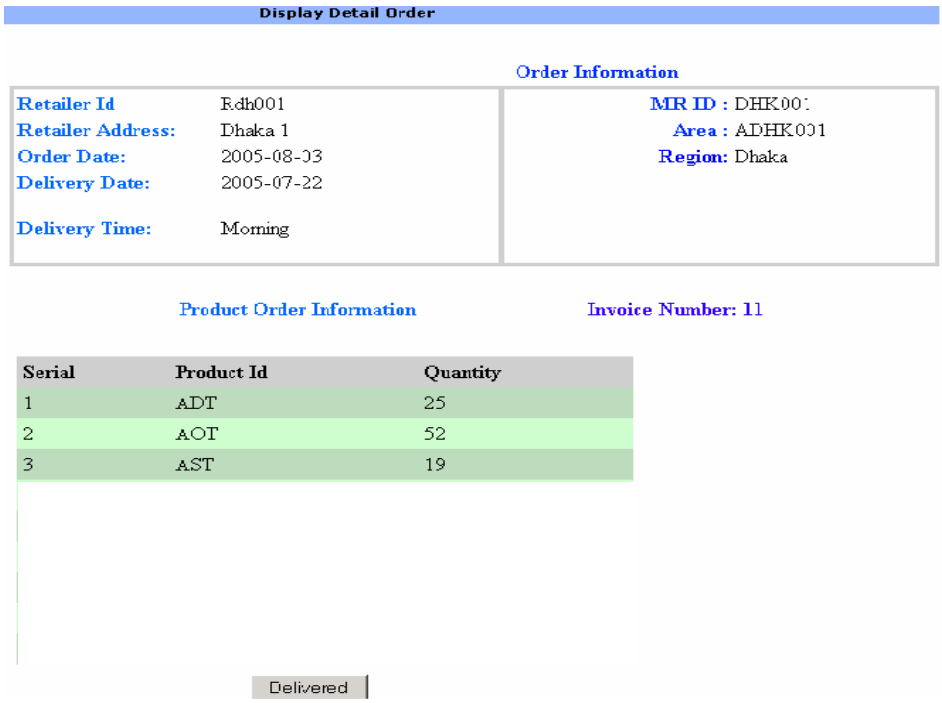

Fig-24: Details delivery order

Testing Method:

Speed of performance

Find errors

2.5.4.4

Narrative overview:

Form	Query
User	MR
Task	Send SMS Query
System	Microsoft Windows, Linux
Environment	Standard Office environment

Sample Design:

Fig-25: Query

Testing Method:

Speed of performance

Find errors

2.5.4.5

Narrative overview:

Form	Query Result
User	MR
Task	Receive Query result
System	Microsoft Windows, Linux
Environment	Standard Office environment

Sample Design:

Fig-26: Query Result

Testing Method:

Speed of performance

Find errors

2.5.4.6

Narrative overview:

Form	Delivery notification
User	MR
Task	Notification the delivery information
System	Microsoft Windows, Linux
Environment	Standard Office environment

Sample Design:

Fig-27: Notification

Testing Method:

- Speed of performance

Find errors

2.5.4.7

Narrative overview:

Form	Product list
User	Administrator
Task	Updates product information
System	Microsoft Windows, Linux
Environment	Standard Office environment

Sample Design:

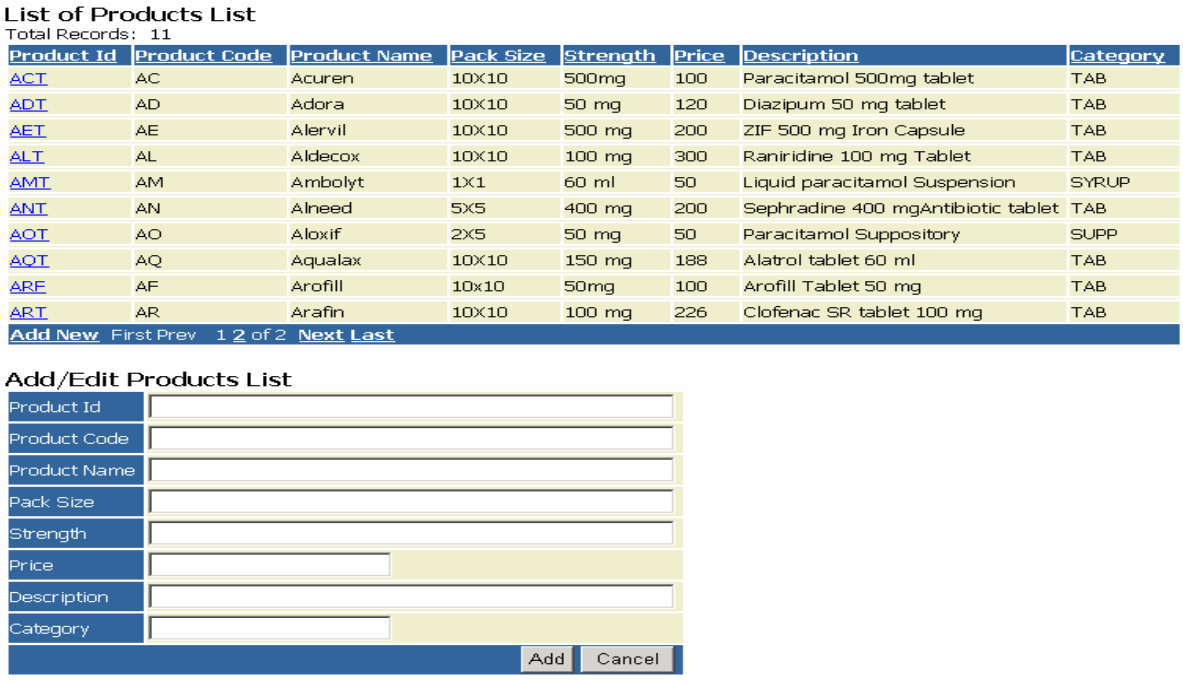

Fig-28: Update Product list

Testing Method:

Speed of performance

Find errors

2.5.4.8

Narrative overview:

Form	Stock
User	Administrator
Task	Updates product information
System	Microsoft Windows, Linux
Environment	Standard Office environment

Sample Design:

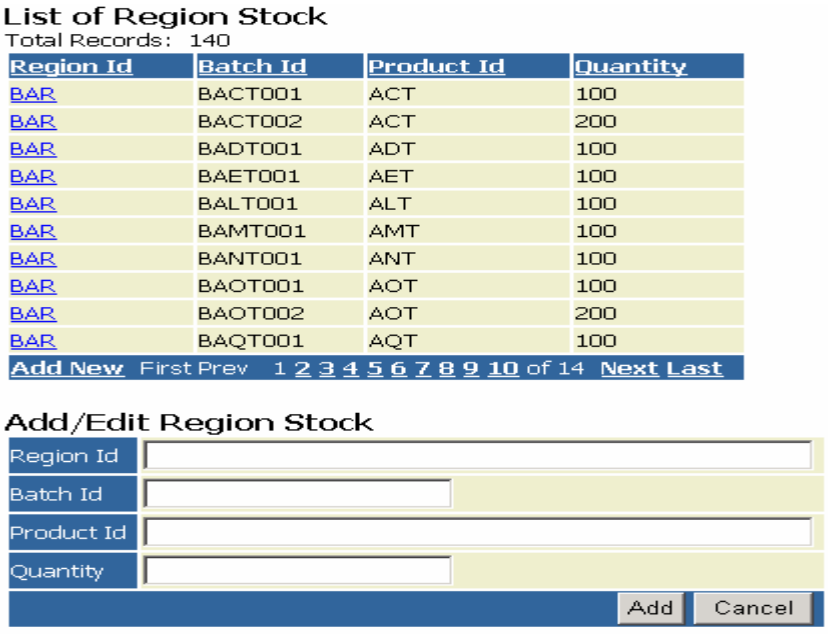

Fig-29: Update Stock

Testing Method:

Speed of performance

Find errors

2.5.5 Database Queries

1. Find all products from Product list
2. Find all products batch wise
3. Find the expired product in current date
4. Fin All region Information
5. Find the total product of each region
6. Find total product of each product by Region id & Product id
7. Find the total product at each region
8. Find the total product at each region Batch wise
9. Find the region where an MR belongs
10. Find the total of each region
11. Find the total region stock of each quantity ordered by MR
12. Find Orders details
13. Find all order details
14. Find the ordered items against each order
15. Find the order by delivery Status
16. Find the order by delivery Shifts
17. Find a particular product quantity in the region stock where MR Belongs
18. Find the Total of each pending items of each region
19. Find the Total of each delivered items of in each region
20. Find the issued product if against an order number
21. Find the order no placed by each MR
22. Find the MR information who has placed orders
23. Find the quantity of each products placed by a particular MR
24. Find All Products and All Regions
25. Find Products and by ALL Region
26. Find Products by Region and by expired date
27. Find the region of a particular MR

28. Find the quantity of each products placed by a particular MR

2.6 System Implementation

2.6.1 System Development

The purpose of implementation is to build a proper working system. System development consists of translating previous specifications into computer programs and manual procedures.

2.6.2 Computer Programming

This general design of the program is usually documented in the form of a macro level flow chart, which depicts the major logical flow of the program. Once we have prepared the macro level chart, the detailed sequence of decisions, data movement, computations, and linkage in the program will be shown in a micro level program flow chart. This micro level chart then becoming the basis for actual coding of the program.

2.6.3 Actual coding

For coding, we used PHP at Front End interface and MySql 4.1 at Back End for database. The reason we used this tool is because php is very popular server side scripting language and open source and MySql essay to host to web. It requires fewer overheads than Oracle 9i. MySql is also open source. We used apache server. And for the SMS handling we use the JDK. In the coding phase we first decided the function. After that the function details are decided. Each module is implemented by separately.

2.6.3.1 Delivery system

First find the user validation. Get issued ordered information from order table. When the order is delivered the item quantity will be deducted from stock. The products with lowest batch id will be reduced first as FIFO method.

2.6.3.2 SMS acknowledgement system

Whenever a delivery product is ready an SMS confirmation will be generated with order number, total amount and cost and delivery date. And send to SMS server who will send the SMS to the user.

2.6.3.3 Query system

The SMS server will receive the request. A parser program will parse the request and tokenize the information. Then it will check its authentication. For a valid user it will process the query and generate the result. The result will be

2.6.3.4 Stock update system

This system is used to update the products, production information and stock information. Only administrator will be able to add new products, update stock information of regional stock. Any update must be reflecting in all other tables.

CHAPTER III: SYSTEM TESTING

In this section my modules test sample is shown

3.1 SMS notification testing

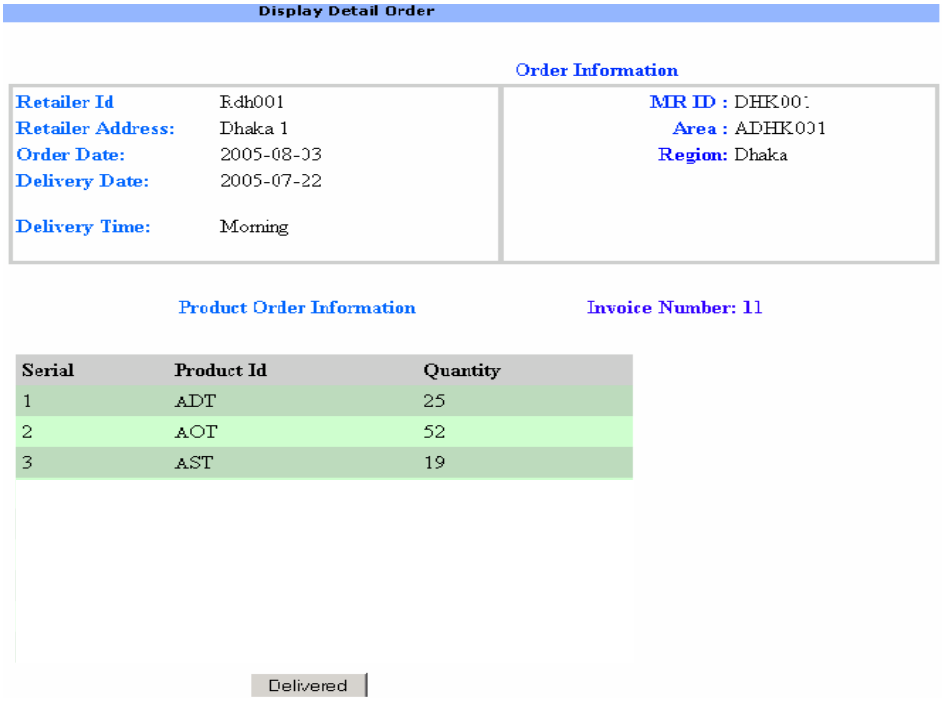

Fig 30: Input date

Fig 31: Generated SMS output

3.2 SMS Query Testing

3.1.1 SMS inputs

a

b

Fig 32: SMS query input **a.** ac only for current stock **b.** ac in DHK region

3.1.2 SMS Feedback

a

a

Fig 33: SMS query output **a.** ac at current stock **b.** ac at DHK region

3.1.3 Real data in database

Product_id	Region_id	Total Qty
ACT	**BAR**	**150**
ACT	**DHK**	**100**
ACT	CHT	200
ACT	KHU	30

3.3 Update information testing

3.3.1 Update Product list

Product_id	Product_code	Product_name	Pack_size	Strength	Price	Description	category
ACT	AC	Acuren	10X10	500mg	100	Paracitamol 500mg tablet	TAB
ADT	AD	Adora	10X10	50 mg	120	Diazipum 50 mg tablet	TAB
AET	AE	Alervil	10X10	500 mg	200	ZIF 500 mg Iron Capsule	TAB
ALT	AL	Aldecox	10X10	100 mg	300	Raniridine 100 mg Tablet	TAB
AMT	AM	Ambolyt	1X1	60 ml	50	Liquid paracitamol Suspension	SYRUP
ANT	AN	Alneed	5X5	400 mg	200	Sephradine 400 mgAntibiotic tablet	TAB
AOT	AO	Aloxif	2X5	50 mg	50	Paracitamol Suppository	SUPP

Fig 34: Before updating product list

Product_id	Product_code	Product_name	Pack_size	Strength	Price	Description	category
ACT	AC	Acuren	10X10	500mg	100	Paracitamol 500mg tablet	TAB
ADT	AD	Adora	10X10	50 mg	120	Diazipum 50 mg tablet	TAB
AET	AE	Alervil	10X10	500 mg	200	ZIF 500 mg Iron Capsule	TAB
ALT	AL	Aldecox	10X10	100 mg	300	Raniridine 100 mg Tablet	TAB
AMT	AM	Ambolyt	1X1	60 ml	50	Liquid paracitamol Suspension	SYRUP
ANT	AN	Alneed	5X5	400 mg	200	Sephradine 400 mgAntibiotic tablet	TAB
AOT	AO	Aloxif	2X5	50 mg	50	Paracitamol Suppository	SUPP
AQT	AQ	Aqualax	10X10	150 mg	188	Alatrol tablet 60 ml	TAB

Fig 35: After updating (Add Aqualax) product list

3.3.2 Update Batch information

Product_id	Batch_id	Manufacture_date	Expired_date	P_Qty
ACT	BACT001	2005-01-01	2006-10-31	1100
ADT	BADT001	2004-01-10	2005-11-31	1100
AET	BAET001	2005-01-20	2007-10-31	1100
ALT	BALT001	2005-02-01	2008-07-31	1100

Fig 36: Before updating Batch

Product_id	Batch_id	Manufacture_date	Expired_date	P_Qty
ACT	BACT001	2005-01-01	2006-10-31	1100
ACT	BACT002	2005-05-01	2008-10-31	2200
ADT	BADT001	2004-01-10	2005-11-31	1100
AET	BAET001	2005-01-20	2007-10-31	1100
ALT	BALT001	2005-02-01	2008-07-31	1100

Fig 37: After updating (New ACT) Batch

3.3.2 Update Region Stock

Region_id	Batch_id	Product_id	Quantity
BAR	BACT001	ACT	100
BAR	BACT002	ACT	200
BAR	BADT001	ADT	100
DHK	BAET001	AET	100
DHK	BALT001	ALT	100
DHK	BAMT001	AMT	100
DHK	BANT001	ANT	100
DHK	BAOT001	AOT	100

Fig 38: Before updating Region Stock

Region_id	Batch_id	Product_id	Quantity
BAR	BACT001	ACT	100
BAR	BACT002	ACT	200
BAR	BADT001	ADT	100
DHK	BAET001	AET	100
DHK	BALT001	ALT	100
DHK	BAMT001	AMT	100
DHK	BANT001	ANT	100
DHK	BAOT001	AOT	100
CHT	BAOT002	AOT	200
CHT	BAQT001	AQT	100
CHT	BARF001	ARF	100
CHT	BART001	ART	100

Fig 39: After updating (Add product to CHT) Region Stock

3.4 DATABASE QUERIES TESTING

1. Find total product of each product by Region id & Product id

Region_id	Product_id	SUM(Quantity)
DHK	ACT	280

2. Find the expired product in current date

Product_id	Batch_id	Manufacture_date	Expired_date
ACT	BACT	2001-1-1	2005-1-1

3. Find the total product of each region

Product_id	SUM(Quantity)
ACT	2935
ADT	890
AET	960
ALT	916
AMT	973
ANT	1000
AOT	2844
AQT	1000
ARF	1000
ART	1000
AST	2888

4. Find the total region stock with respect to MR's Order

Product_id	Region_id	SUM (Quantity)
ACT	BAR	300
ADT	BAR	100
AET	BAR	100
ALT	BAR	100

5. Find Orders details

Order_id	MR_id	Retailer_id	Order_date	Delivery_date	Order_status	Shift	Order_id	Product_code	Order_quantity
18	SYL001	RSY001	2005-08-03	2005-08-03	yes	m	18	AC	30
18	SYL001	RSY001	2005-08-03	2005-08-03	yes	m	18	AD	30
18	SYL001	RSY001	2005-08-03	2005-08-03	yes	m	18	AE	30
19	SYL001	RSY001	2005-08-03	2005-08-03	Iss	m	19	AC	10
20	DHK001	RDH001	2005-08-03	2005-08-10	yes	e	20	AC	10

6. Find the orders items against each order

Order_id	MR_id	Retailer_id	Order_date	Delivery_date	Order_status	Shift	Order_id	Product_code	Order_quantity
18	SYL001	RSY001	2005-08-03	2005-08-03	yes	m	18	AC	30
18	SYL001	RSY001	2005-08-03	2005-08-03	yes	m	18	AD	30
18	SYL001	RSY001	2005-08-03	2005-08-03	yes	m	18	AE	30

7. Find the order according their delivery Status

Order_id	MR_id	Retailer_id	Order_date	Delivery_date	Order_status	Shift	Order_id	Product_code	Order_quantity
21	DHK002	DHR005	2005-08-03	2005-08-03	no	m	21	AS	5
28	DHK001	RDH001	2005-08-09	2005-08-09	no	m	28	AD	10
28	DHK001	RDH001	2005-08-09	2005-08-09	no	m	28	AL	15

8. Find the Total of each pending items of in region.

Region_name	Region_id	Product_name	Product_id	Total
Dhaka	DHK	Acuren	ACT	50

9. Find the issued product if a particular order

Invoice_number	Product_id	Delivary_quantity	Invoice_number	Order_id	Invoice_date
6	ACT	10	6	20	2005-08-03
6	AET	10	6	20	2005-08-03
6	AMT	7	6	20	2005-08-03

CHAPTER IV: SECURITY ISSUE

Security issue is an important feature because it saves the system from being misused and damaged. The following security issue is maintained in our system.

4.1 Registration:

In this system only registered user has access to the system. Even Products region, medical representative and retailer must be registered. Any operation with invalid information is denied.

4.2 Authentication:

Mobile users are registered user. They are also special user because they are permitted to access to the system by mobiles. The administrator assigns only one mobile per MR. His identification is his mobile number. When ever he makes a request first his mobile number is crosschecked with his registration information. System will not respond for invalid users. For a valid user system will also cross check the requested information. For valid information system will serve the request else notify the error and asks for re-request.

4.3 Web Security:

The web pages are with session management. So multiple users can access the system at a time but everyone's task will not conflict with each other's. Even they are not allowed to access to other areas are not allocated for them.

CHAPTER V: LIMITATIONS OF THE SYSTEM

Due to lack of time and resource limitation some other features are not implemented some feature is not implemented with full power. Following limitations are found in the system.

5.1 One order per SMS:

This system can handle only one order request per SMS. So even space is available it will be wasted.

5.2 Short feed backs:

This system provides only short feedbacks. Only acknowledgement of order number, invoice number and total cost. More specific feedback also can be provided.

5.3 Error massages detection:

This system provides only error massages, which notify that which massage generated the error. It will not try to fix it by it self due absence of Artificial Intelligent (AI). For the same reason it is also not possible to send proper suggestion to the requested user.

5.4 Reach monitoring system and Warning management:

This system has regular monitoring system where administrator uses available system features and performs his tasks. Automated monitoring system and warning management system is absence where system is able to warn admin the following features

1. Sent massage to management when stock quantity is low.
2. Find out the areas where customer services are to be concerned.
3. Automatically send massage to the MR whose performance is fall to some predefined criteria.

CHAPTER VI: FUTURE DEVELOPMENTS

All limitations described in the previous section will be taken care properly.

Customer service is the key to success system should be friendlier to them. It should use the tools and devices available in the market and affordable by customers. Keeping this in mind the following features may be added to the system

1. WAP technology will be implemented. Short for the Wireless Application Protocol, a secure specification that allows users to access information instantly via handheld wireless devices such as mobile phones, pagers, two-way radios, smart phones and communicators. WAP is supported by all operating systems. WAPs that use displays and access the Internet run what are called micro browsers--browsers with small file sizes that can accommodate the low memory constraints of handheld devices and the low-bandwidth constraints of a wireless-handheld network.

2. With regular mobiles PDA will also be used. PDA Short for personal digital assistant, a handheld device that combines computing, telephone/fax, Internet and networking features. A typical PDA can function as a cellular phone, fax sender, Web browser and personal organizer. Unlike portable computers, most PDAs began as pen-based, using a stylus rather than a keyboard for input. This means that they also incorporated handwriting recognition features. Some PDAs can also react to voice input by using voice recognition technologies.

PDAs of today are available in either a stylus or keyboard version. As a result the system will become user-friendlier.

SCHAPTER VII: CONCLUSION

Pharmaceutical has a huge prospect in Bangladesh. Their products are scattered all over the country. Monitoring their performance is essential for them. Specially time duration and distribution of their medicines. Because the medicines are dated products. Well distribution flow can reduce their money, time and energy.

This system is designed keeping these cases in mind. Though most of the features are implemented in the system but bore the commercial release more testing and user feedback is required. It may take few more time. After that will made available to the interested customers. Still farther development may be needed. So customer support will be provided.

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