

Acknowledgement

First and foremost, we would like to express our gratitude to our college, Infomax College of IT & Management, for allowing us to conduct research and providing us with invaluable guidance and research materials.

We are most grateful to our lecturer, Raghunath Gyan Sir, for his invaluable help with the research. His dynamism, the ability to see things through to the end, tenacity, keenness of intent, validity, and in-your-face nature have had a profound impact on us. He guided us in the proper research and writing process, as well.

And we are grateful to our parents for all their love, support, encouragement, and the training they provided us. We would like to extend our appreciation to those who have assisted us, and we thank those who helped us directly and indirectly.

Abstraction

The clinic management system was created to help with the day-to-day operations of the clinic. The clinic's owner was having trouble managing and retrieving data using the manual system, so he hired our team to create software that would help them overcome all of the problems they were having with manual systems. This system can handle all aspects of patient registration, billing, data storage, and inventory control. This system aids in both improving customer service and lowering costs. We used the System Development Life Cycle (SDLC) approach to finish this system. Prototyping tool (Adobe XD) is used to create user interfaces, C# programming language is used for compiling the application while MySQL is used to create databases. Similarly, Entity Relationship Diagrams (ERD) and Data Flow Diagrams (DFD) are designed to show the logical flow of data within the system. In order to make the system more effective, staff, doctors, the owner, and customers provide input, which helps to meet their expectations. Overall, the system is capable of carrying out the tasks correctly.

Table of Contents

1. Introduction	5
1.1.Introduction of the Company	5
1.2.Business Overview.....	6
2. Problems and Proposed Solutions	7
2.1.Problem Identification	7
2.1.1. Problems of existing system:.....	7
2.1.2. Causes and effects	7
2.2.Aims and Objectives	8
3. Project Planning.....	9
3.1.System Development Life Cycle (SDLC)	10
3.1.1. System Planning	10
3.1.2. Analysis	10
3.1.3. Design	11
3.1.4. Implementation	11
3.1.5. Maintenance and Support	12
4. Feasibility Study	13
4.1.Operational.....	13
4.1.1. PIECES Framework	14
4.2.Technical	17
4.3.Economic	18
4.4.Schedule	20
5. System Analysis.....	21
6. Design Diagram.....	22
6.1.Context Diagram.....	22
6.2.Level-0 DFD	24
6.3.ERD.....	26
7. Interface Design.....	27
7.1.Design Prototype.....	27

8. Requirement Gathering.....	33
8.1.Traditional Methods.....	33
9. Design.....	52
9.1.Data Dictionary.....	52
9.2.DFD Level 1	55
10. Conclusion.....	77
11. References	78

1. Introduction

1.1.Introduction of the Company



Quantum Software is a company founded in 2020 to develop system-based software. We develop cost-effective solutions to deliver the ultimate customer satisfaction based on technical expertise. Using cutting-edge technology, clean design and user-friendly interface, we provide quality services. To meet all the IT needs of your business, Quantum Software provides one of the best services globally. Your organization is tailored, not only to be different, but to be the best, with thorough strategic analysis and the best heads working to provide solutions.

Vision:

“Our vision is to develop platform and productivity services for those who are looking for an affordable solution to their business maintaining what we call The Quality.”

Our mission:

Our mission is to boost our customers' business growth by providing creative design and market defining solutions that generate value and reliable competitive advantage for customers around the world in an economic manner.

Goal:

Our primary goal is to develop steadily and become a leading player in this competitive global marketplace. Fortunately, we were able to gather a team of professionals who can shape and mold their collective experiences, all of whom have excellent talent that can help speed up your organization.

1.2.Business Overview

The project planning was done following the principle of system development life cycle. The initial assessment and feasibility study was conducted during the planning phase. The feasibility study showed that the project was feasible and, without further due process, the client's requirement analysis was carried out. Logical system design was done after studying the existing system in Willy's clinic. The project then headed towards detailed system specification. The detailed system was designed with prototyping and then coding, testing and debugging started. The system was launched after few tunings. Both sides came to an agreement to initially deploy the system for a trial and bring minor modifications and enhancements later.

2. Problems and Proposed Solutions

2.1. Problem Identification

The existing problem first must be identified before implementing any strategies and solutions. After framing the current structure of Dr. Willy's clinics, the following problems were discovered, which eventually are slowing the everyday tasks.

2.1.1. Problems of existing system:

- Loss of data
- Difficult to retrieve previously stored data
- Time consuming
- Redundant data storage
- Higher operation cost

2.1.2. Causes and effects

- There is no system for monitoring time, so people get upset with waiting longer in the clinic.
- Having an appointment via telephone call may trigger error to be obtained with inaccurate data.
- It is a very time-consuming method to manually search historical patient files/reports.
- As a consequence of no reminder, patients can miss their appointment time.

These problems are faced by Dr. Willy who is now hiring our company for the better management of their data in his clinic.

2.2.Aims and Objectives

The main objective of this management system is to minimize the problems of existing management system of the clinic which are listed below:

- To make it easier to maintain the records of patients, doctors, staffs and inventory using DBMS.
- To get secured and real-time data collection.
- To get accurate medication information within the clinic.
- To develop crowd less clinic environment.

3. Project Planning

Planning is the beginning phase in the system development life cycle. As our system requirement is well distinct, clear and fixed we choose the waterfall model for our system development. During the SDLC level, each phase is configured to perform unique activities.

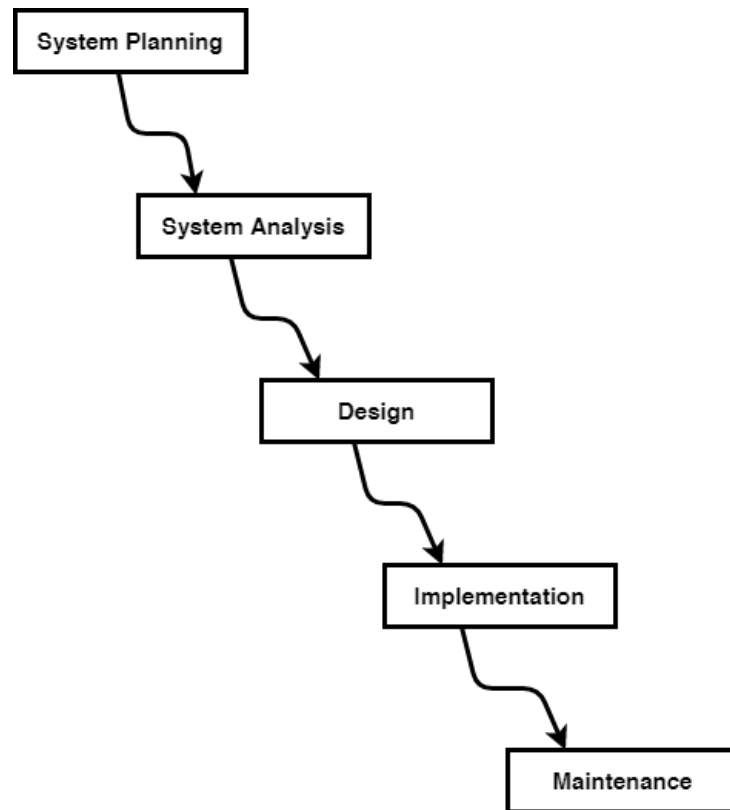


Figure: System Development Life Cycle

3.1.System Development Life Cycle (SDLC)

3.1.1. System Planning

The planning stage is the most critical step in the development of an effective system, during which you determine precisely what you want to do and the issues you are trying to solve (Radack, 2009). In our context, we broke down the time to identify whether we can finish our project within a target time period or not. Secondly, budget and manpower calculation were done as the part of feasibility study. Since it was possible to develop our system within the time period and budget provided to us by the company, we proceed to the next step of the system development life cycle.

3.1.2. Analysis

The main task of the analysis phase is requirements gathering which can be done by conducting meetings with their client, by doing questionnaires, analyzing existing documents. So, while collecting requirements for our project, we conducted an interview with clinic owners and end users. As the data collected through interviews were not sufficient to develop the software, again we need to gather information through observation. So, the main task of the analysis phase is requirements gathering which can be done by conducting meetings with their client, by doing surveys, analyzing existing documents (Computerworld, 2002).

To collect the facts and statistics, our system analysts will conduct interviews, document review, observation, research, survey with the client. Logical modeling will be prepared following the conceptual data modeling. This process will generate detailed design specification for the system design.

3.1.3. Design

One of the most important phases of the system development life cycle is the design phase. The system is designed according to the plan made and requirements gathered during the planning and analysis phase. So, in this stage the company should be able to convert the question of what to develop to how to develop. The system platform is decided in this step like hardware and software where the system will run. Selection of the programming languages that are going to be used for the development of the system takes place in this phase. Similarly, user interface design, database design also comes under this stage.

3.1.4. Implementation

In the very first step of implementation, developers start to code the program according to the design given by the system designer. After completing coding, the system is tested whether the system fulfills the customer requirements or, and finds out the bugs, and checks whether they function properly or not. If any glitches are present, then they are detected and fixed as soon as possible. After testing is completed then the system is installed and users are trained for the daily use. During the starting time both old and new system are parallely used until the users are not familiar with the new system.

3.1.5. Maintenance and Support

This is the last phase of system development life cycle. Once the system comes into operation it needs time to time maintenance. To make the system more effective it is essential to update the system continuously so that it performs at a high level.

In our scenario, the system will be deployed in a DVD consisting the installation file. User manual and training will be provided to the client side. Since the existing system is supposed to be replaced by parallel operation, future enhancements will be done when the client side calls upon us.

4. Feasibility Study

A feasibility study is an analysis or evaluation that determines if a proposed system is viable, both financially and technically. The prime objective of feasibility study is to find whether the system development project can be finalized and also to recommend feasible alternatives solutions for the complications. As a whole, feasibility study should be able to lay out sufficient data so that the management can decide:

- Whether it can sustain for a long spell of time.
- Whether the accomplished project will satisfy end users.
- Whether the company should invest in aimed project.

Accumulating detailed information, problems related to the current system are detected and obligatory requirements and constraints on the new system are proposed.

4.1.Operational

The operational feasibility determines whether or not the proposed system fits in the company. It is the study on how the system will be utilized and how comfortably it will assist in solving problems. Moreover, it also visualizes distinctive issues like, social acceptability, and organizational conflicts.

4.1.1. PIECES Framework

Performance

The performance of the clinic looked deteriorating with inclination in the patient's number. With the current way, staff found it quite laborious to recognize data. The throughput rate was very low as it took hours to find a patient name from the files. The crowd in the clinic was uncontrollable and medicines weren't accessible because of weak preparations.

In the proposed system, the data is entirely computerized and displays all the information about patients and medications instantly. The medications can be supplied without any confusion while the crowd can be controlled by providing patients a specific time to visit the clinic. Furthermore, the data can be simply retrieved and modified after a patient is diagnosed. With this system, the throughput rate gets incredibly high and performance gets better.

Information

- **Input:**

In the current system, information is recorded using paper files or notebooks. This way of collecting the data fabricates undistinguished errors and complications. When the same patient visits the clinic more than once, the data is repeated multiple times which creates confusion. In a designed system, data is recorded digitally and at a specific location to avoid any sort of confusion. Database is used in the new system that prevents data redundancy and saves time during information finding.

- **Output:**

The time consumed in finding the information with the current system is very high. In the proposed system, data can be found and displayed

in the computer screen with some easy steps. The data can be studied in detail and required modifications and updates can be done with the data.

- **Stored Data:**

Storing data in the current system is challenging. Information is lost and can rarely be retrieved. The repetition of the same data in files creates chaos which makes the job of workers even harder.

The database used in the new system will avoid data repetition and redundancy while errors will be minimum in the system. The data are secured and can be stored without any uncertainty.

Economics

Economic feasibility refers to demonstrate the logistical and cost-benefit analysis for business or examined project, which ensures that it is possible to implement it. This statement helps to analysis of a project's potential in which decision-making process is supported through objectively identify its weakness, strength, risks and opportunities associated for resource that will be needed for project implementation and chance of success in assessment projects. Economic feasibility is made up of technical, market, economic and strategic analysis.

Control and Security

Control and security are one of the weakest parts of the current system. There is no proper guard of recorded information. Those data can be easily modified as well as stolen for many bad causes. Also, that file-based information can be lost even when someone accidentally drops water or tears the pages.

The user account protection on the system will prevent access to unrecognized users. Information stored in the device can be easily retrieved and the system will also provide backup which prevents loss of data. Implementing enhanced privacy features, the new system will also avoid unexpected errors.

Efficiency

The proposed system will have a very high efficiency while performing several actions. Similarly, there will be no collision between similar information which makes it way more efficient than the current system.

Service

When we look at clinic reviews, there is an increasing number of clients who are complaining about degradation in service. This is because of unplanned management of the clinic and staff. Currently, staff in the clinic are unable to provide required medications being out of stock, which does not please customers. Patients are kept in lobby for hours because of unplanned appointment timing. These things annoy customers and many of them will never ever revisit seeking better services.

In the new system, medicine details will be accurately stored which will make staff sure about the availability. The prices of all the medicines can also be updated which will assist in preparing bills within a short period of time. Moreover, a token system can be applied which prevents unnecessary crowds in the clinic and saves time for both patients and doctors.

4.2. Technical

Technical feasibility is the major area or type of feasibility study. It is the study of technical resources (software, hardware and manpower) which are needed for a project or proposed new system. Our company planned to develop the proposed system within 8 month including system planning, analysis, design and implementation. The Clinic Management System is based on desktop applications. For the Clinic Management System, C# programming will be used. The Clinic Management System is a desktop application which will easily manage foreground and background processes. For this proposed system Visual Studio 2019 will be as an IDE and MySQL Server as the database. The minimum hardware requirement to design and compile the proposed system are 1.8GHz processor, 8GB RAM and a Solid-State Drive (SSD). Our developers are using Dell XPS 15 (2020) as a workstation surpassing the minimum hardware specifications.

Recommendation to client side.

- Operating System: Windows 10 (64-bit)
- Processor: 1.6GHz or above. (8th generation or above)
- RAM: 4GB or above.
- Storage: SSD (if possible)

4.3.Economic

Economic feasibility is made up of technical, market, economic and strategic analysis. Cost benefit analysis was done in order to extract the accurate economic statement for proposed system which is as follows:

Cost-Benefits Analysis – Clinic Patient Management System									
Costs	Months								
	0	1	2	3	4	5	6	7	8
Development Cost	-742.12								
Direct Cost		-371.06	-371.06	-371.06	-371.06	-371.06	-371.06	-371.06	-371.06
Total Cost	-742.12	-371.06	-371.06	-371.06	-371.06	-371.06	-371.06	-371.06	-371.06
Cumulative Cost	-742.12	-1113.17	-1484.23	-1855.29	-2226.35	-2597.40	-2968.46	-3339.52	-3710.58
Benefits									
Tangible Benefits form New system	0	0	0	0	0	0	0	0	371.06
Intangible Benefits form New system	0	0	0	0	0	0	0	0	296.85
Positive Benefits form New system	0	0	0	0	0	0	0	0	371.06
Total Benefits	0	0	0	0	0	0	0	0	1038.96
Cumulative Benefits	0	0	0	0	0	0	0	0	1038.96
Cumulative Benefits + Costs	-742.12	-1113.17	-1484.23	-1855.29	-2226.35	-2597.40	-2968.46	-3339.52	-2671.62

From the above table, the total cost of system is \$ 3710.58 which includes development and operational cost. The total cost of system is comparing with budget given by Dr. Willy \$ 3710.58 which fits with the given budget. Let's take an example,

though clinic management system announced to stop using paper and files for storing information in the system, but staff never stop to waste time for managing files or sales report on sales, analysis the inventory of medicine and number of patients. This condition had reduced the schedule of workload in which working process can be smooth and provide quick service. This situation can help clinic to reduce payment which paid to staff who has done overtime for the job. This leads to attract and increase the customer with their satisfaction as they get a quick service from the system. Let us suppose if customer provides medicine quickly in terms of their requirement without taking queue for number, customer will satisfy positively and attract more towards the system. This leads to get positive benefit in system because of quick service and better management. If clinic continually provides this kind of service, then revenue of the clinic will increase to \$1038.96.

At last, from table it clearly shown that the cost of development is smaller than value of benefits. As long as clinic system continue to propose of system, then it helps to bring lots of positive benefits to the clinic.

4.4.Schedule

The schedule feasibility means that the probability of plan, project time and process being completed inside the organizational time frame for effecting changes. A better schedule feasibility not only needs to gather the information, collect the necessary things and to estimate cost as per the suggestion of the client for the project, but it needs to set estimated time taken by a software project to finish it. It is a process to complete a task proposed by a customer in a deadline time set by a customer.

Let us suppose as an example, a task is not going at that speed that you are expecting. In that case, you can hire staff to build and finish the project within a customer deadline time. On the other hand, when you do not have enough budget to hire more workers to boost up the work that you expect and you feel that the afterward project might not complete in time. In this case, you can retrain the staff that you have for a project that helps you and your project boost up the speed sustainably which speed that you are needed.

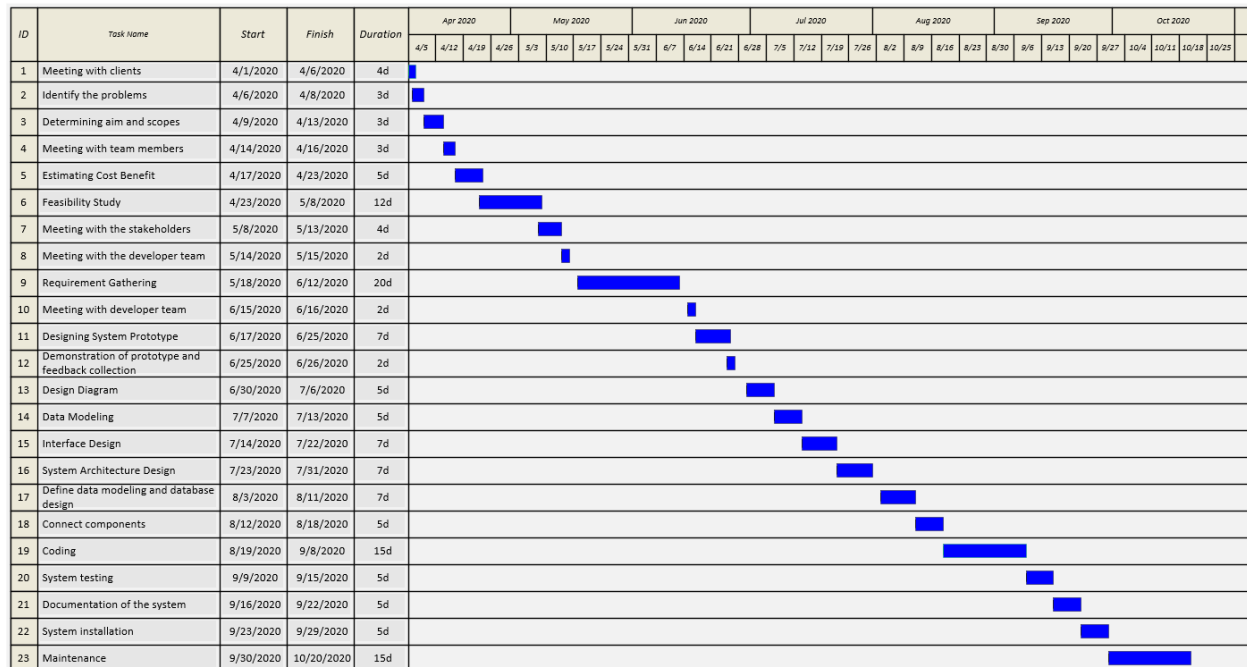


Figure: Gantt Chart

5. System Analysis

5.2. Functional Requirements

- The system should keep the patients records like name, address, email, date of birth, contact info, medical condition etc.
- The system should keep appointment records of patients and doctors.
- The system should generate a queue management token for the patients.
- The system should track the visit record of patients. It should be able to recognize previously visited patients and their treatment and medical history.
- Doctor prescription to the patients should be forwarded through the system.
- The system should track the incoming, outgoing and stock stuff in the inventory. Medical purchase, sales, equipment purchase, release must be recorded in the database.

5.3. Non-Functional Requirement

- The system should be accessible all time.
- The system should ensure data security.
- The system should have clean and minimal user interface.
- The system should be scalable.
- The system should be compatible to different hardware and operating system.
- The system should support future enhancements.

6. Design Diagram

6.1.Context Diagram

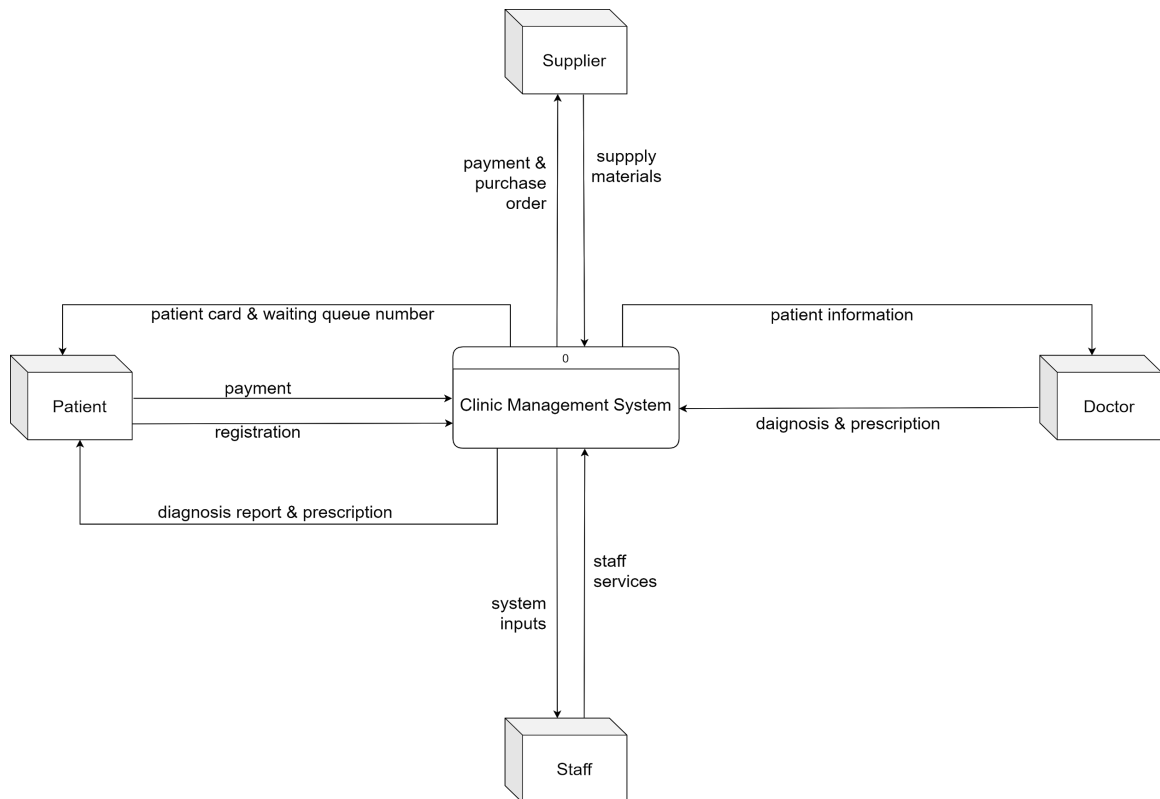


Figure: Context diagram

Above shown diagram is context diagram of the clinic management system. There is total four external entities and a process which represent function of the entire system. External entities are represented by rectangular shape and process by rounded rectangle. Similarly, data flow is shown by arrow. External entities in above diagram are patient, doctor, supplier and staff whereas process is system itself that is clinic management. Here, patient provide their personal detail to the system to register and receive their card. Suppliers supplies material to the system and get back the payment and purchase order. Similarly, doctor collect patient information and provide prescription and diagnose diseases. Then patient receive reports and prescription from the system and do payment. Also, staff provide service and get back the payment.

6.2.Level-0 DFD

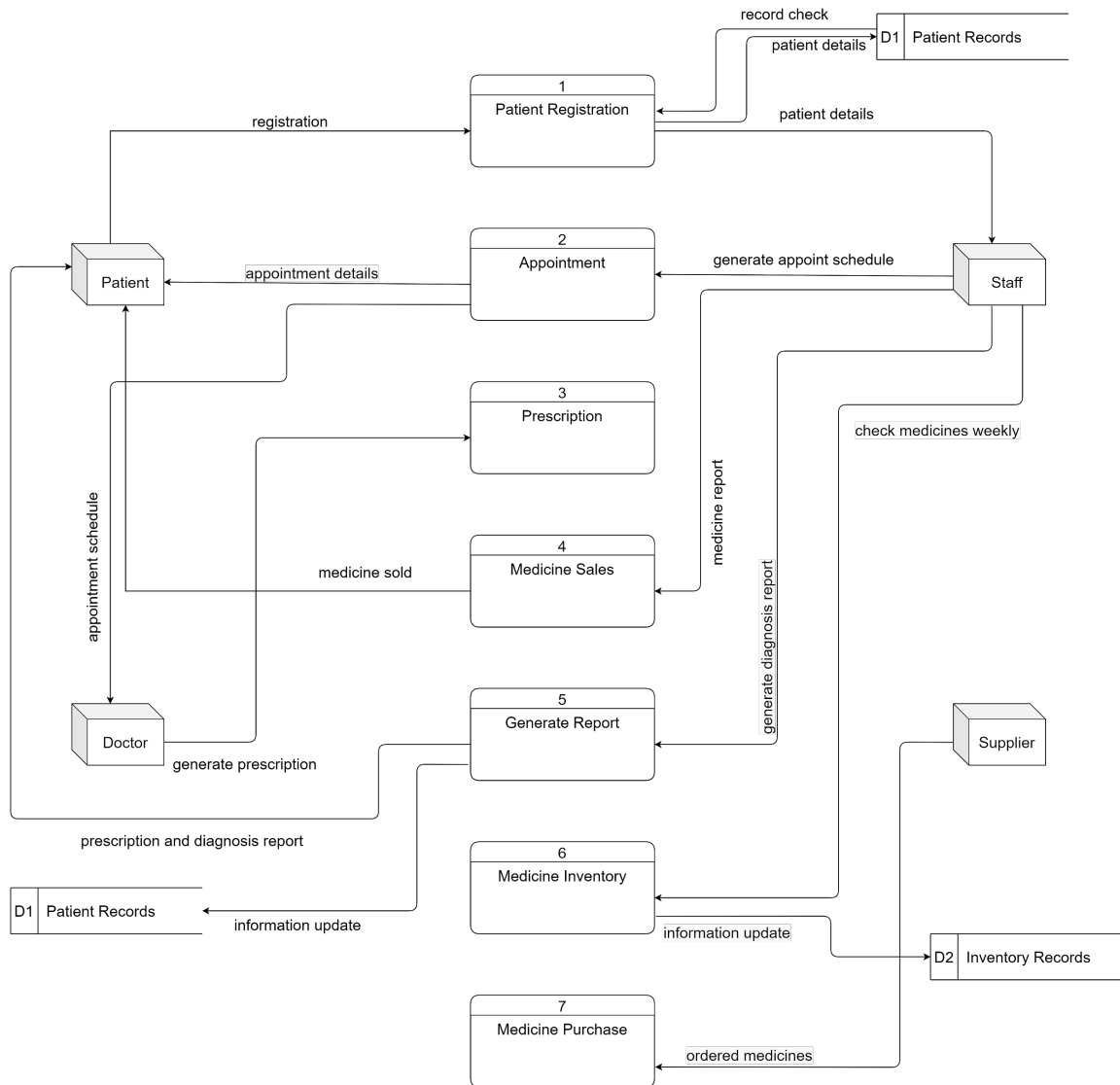


Figure: Level 0 DFD

In the level 0 DFD, external entities remain same whereas process gets split into other small sub process. This level provides detail information about the system than the of

context diagram. So, after further break down of the process of context diagram seven sub process are formed but the external entities remain same. Similarly, database is also shown in this process where information is stored. There is total two database shown in above figure shown in database figure that is patient records, inventory record. In patient record database information about patient are stored whereas inventory information gets stored in inventory record database.

6.3.ERD

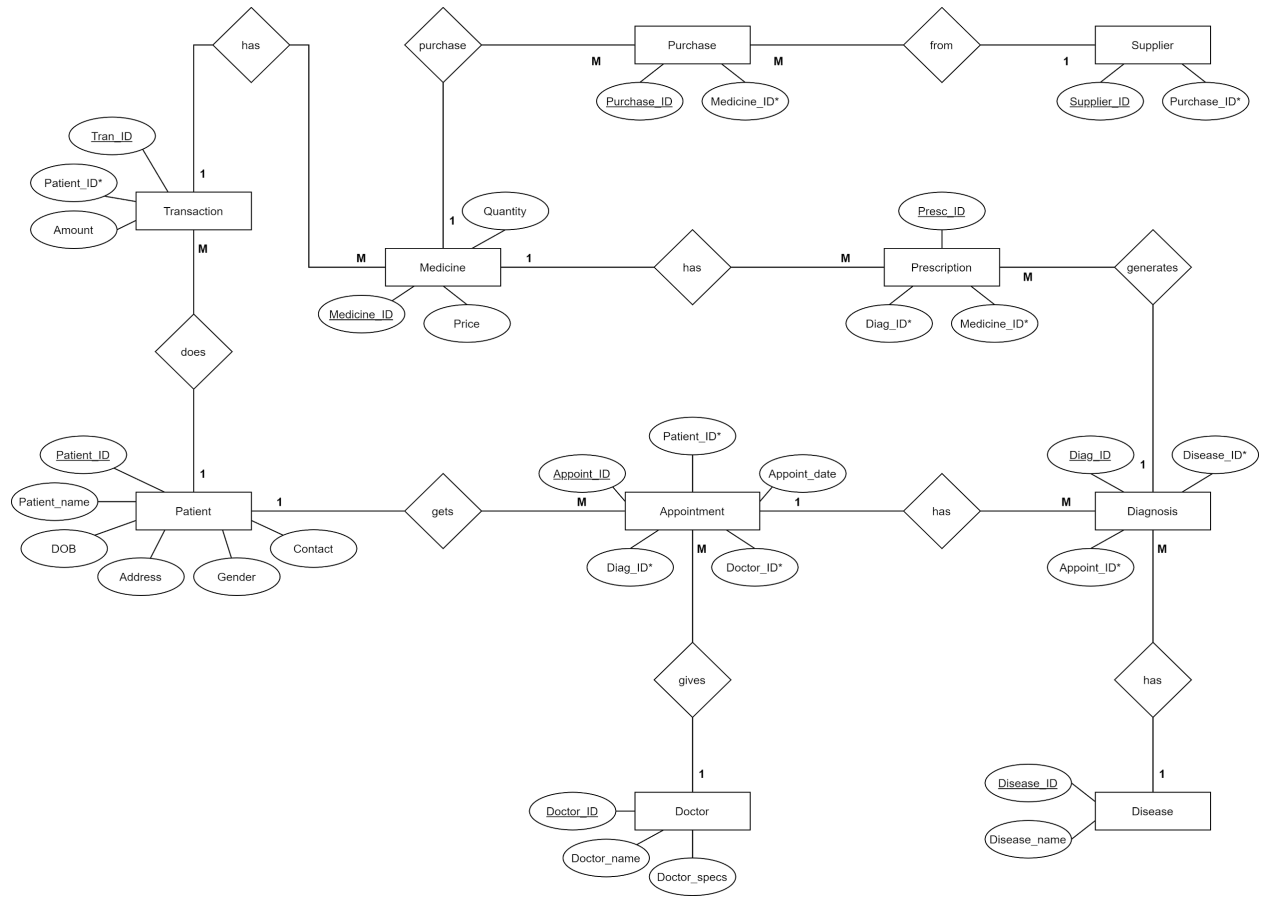


Figure: Entity Relationship Diagram

7. Interface Design

7.1.Design Prototype

7.1.1. Interface design

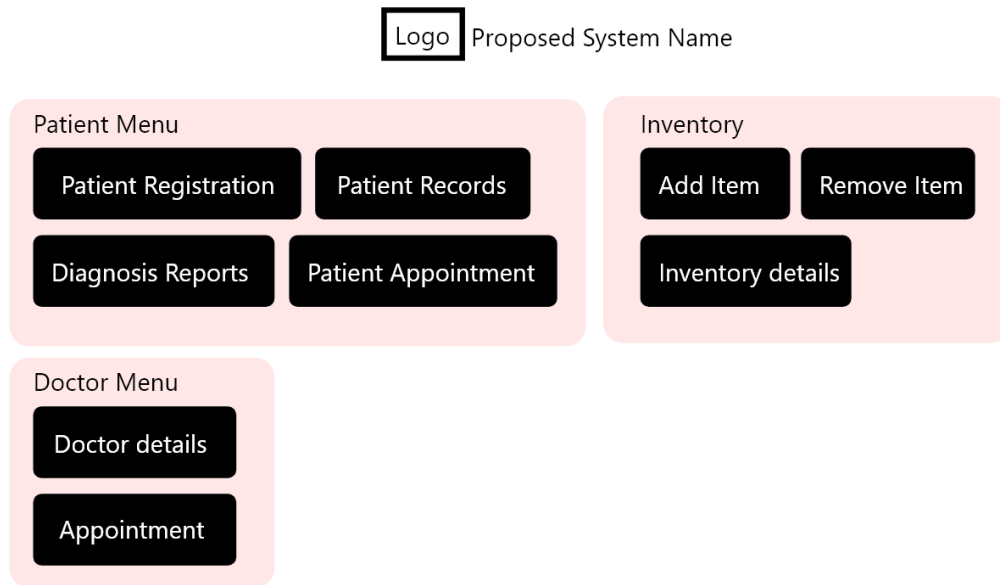
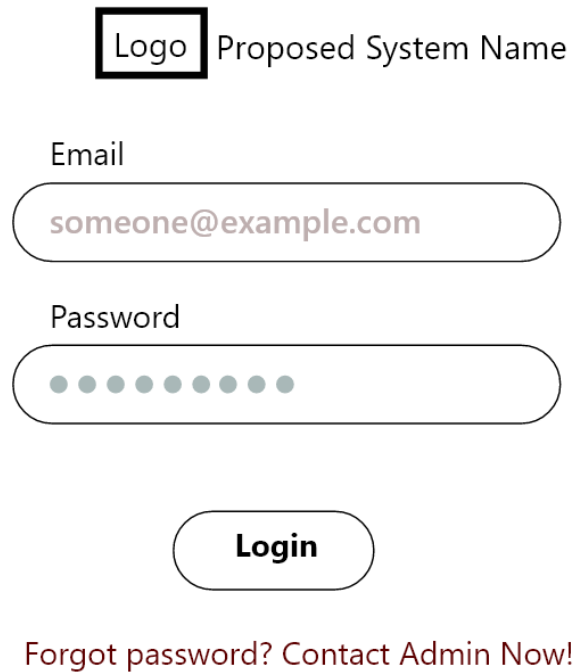


Figure: Main interface of proposed system

7.1.2. Input/Output



The diagram illustrates a login interface. At the top, there is a label "Logo" enclosed in a black rectangular box, followed by the text "Proposed System Name". Below this, the label "Email" is positioned above a rounded rectangular input field containing the text "someone@example.com". Underneath the email field, the label "Password" is positioned above another rounded rectangular input field, which contains eight small grey dots representing a masked password. Below the password field is a rounded rectangular button with the text "Login". At the bottom of the interface, the text "Forgot password? Contact Admin Now!" is displayed in a reddish-brown color.

Figure: Login interface

- Output

The diagram illustrates a login interface layout. At the top, there is a placeholder for a 'Logo' (a square box) followed by the text 'Proposed System Name'. Below this is an 'Email' label above a rounded input field containing the text 'staff1@gmail.com'. Underneath the email field is a black error message bubble that says 'Login failed, incorrect password', with a small triangle pointing to the password field below it. The password field is a rounded rectangle containing ten dots. Below the password field is a rounded 'Login' button. At the bottom of the interface is a link that reads 'Forgot password? Contact Admin Now!'.

Figure: Login interface

- Input

Patient Registration

Patient ID:	<input type="text" value="55647237"/>	*auto generated	Contact Number:	<input type="text"/>
Patient Name:	<input type="text"/>		Email Address:	<input type="text"/>
DOB:	<input type="text" value="mm / dd / yyyy"/>		Gender:	<input checked="" type="radio"/> Male <input type="radio"/> Female <input type="radio"/> Others

Figure: Patient registration interface

- Output

Diagnosis Report

Patient Information

Patient ID: 55647237

Patient Name: John Doe

Age: 30

Contact Number: +977XXXXXX

Diagnosis Details

Diagnosis ID: 55647237 Doctor Name:

Diagnosis Description: Appointment Date:

-- Description --

Figure: Diagnosis report interface

- Concept

The interface has clean and minimal user interface. The components in the user interface like form input, text area, radio buttons are shaped using same color palettes. Visual hierarchy between the header, the input, the button is same to avoid confusion between the different menu and sections. Button like register, login is placed separately and special emphasis is given to design them. The system does not include additional graphics and is very easy, fun and addictive to use.

Patient Information	
Patient ID:	5564
Patient Name:	John
Age:	30
Contact Number:	+977
Diagnosis Details	

Figure: Example of use of proper visual hierarchy

The interface is designed in such a way that avoids the collection of unnecessary user data. For instance, the system does not ask for additional attributes like patient's age, instead it generates his/her age from the date of birth he/she provided earlier during registration. The system is light but it is designed to perform heavy tasks.

Different labels in the interface are labeled using only short and specific words. This makes the interface look pretty clean and luxurious. Moreover, the system warns the user if they provide invalid data like wrong password, invalid email address, wrong contact information. Similarly, confirmation pops up before submitting and executing sensitive tasks like registration, deletion. Such confirmation and warning option gives user a chance to check whether their decision is appropriate or not.

8. Requirement Gathering

8.1.Traditional Methods

S.N.	Student Name	Student Roll No.	Method
1.	Sandesh Subedi A	NPI000040	Interview

❖ Interview:

Interview is one of the typical and efficient procedure of requirement gathering process. It is one of the widely accepted method conducted to bring out system objectives. A verbal communication, usually among two people is done to gather certain amount of information from a person. Interviews are mainly classified into two major groups. They are:

i. Structured Interview

Structured interview, also known as ‘open interview’ is based on predefined set of questions. In structured interview, a skillful analyst can gather significant amount of data with proper examination of a interviewee. This method of interview is supposed to be effectual while concept and research cannot always be maximum.

ii. Unstructured Interview

Unlike structured interview, unstructured interview is open without any sort of strict limitation. The unstructured interview does not consist of any fixed set of questions but rather focus on user expectation and ideologies. It is believed to be uncomplicated and helps analyst gather qualitative data.

❖ **Benefits of Interview as a method of requirement gathering**

- Interview can be helpful in assembling notable amount of information effectively.
- Confusion between participants can be cleared straight away.
- Interactive interviews can produce functional results along with creative conception.
- Face to face conversation in interview assists interviewer to analyze additional information (other non-verbal behaviors and response).

❖ **Drawbacks of Interview as a method of requirement gathering**

- Conducting interview as a requirement gathering method can consume plentiful of time.
- Interviews can be considered less flexible as two people should be together at the same time.

A suitable method of interview is planned along with required participants and appropriate location. Participant who asks questions is interviewer whereas participant who answers those questions are interviewee. An interview with open-end questions can be conducted for collection of qualitative data. A pilot testing is performed to refine queries and make necessary revision for the interview (Kvale, 2007).

In our scenario, the interview participants will be Dr. Willy (owner of the clinic) along with some pharmacists and staffs, who will operate the system. Dr Willy's concern is how the proposed system will upgrade his clinic management. Likewise, pharmacists and other staffs are end users who are concerned about the usage of system. The interview can be conducted in a comfortable office considering manageable time for every participant.

Sample Interview Questions:

- I. What are the complications faced while using the current manual system?
 - How satisfied are customers and clinic staffs with current system?
 - Where are record details stored in manual system?
 - How are medicine stocks checked with manual system?
 - What are your expectations from proposed system?
 - Who will have access to the newly proposed system?
 - Do you think the new system can successfully replace manual system?
 - How will the newly proposed system assist in appointment punctuality?

S.N.	Student Name	Student Roll No.	Method
1	Rabin Acharya	NPI000035	Prototyping

❖ Prototyping

Prototyping is one of the conventional methods used for collecting system requirements, consisting iterative procedures. Clients first provide the system requirement, and then the system analyst delivers the prototype directly. The customer evaluates the prototype and checks for missing requirements. Prototyping is very effective in specifying requirement. It consists of repetitive review of system prototypes.

❖ Advantages of prototyping

- Prototyping model is flexible in design as it offers several modifications.
- Errors can be easily detected.
- User participation in the development ensures greater user satisfaction.
- Missing functionalities can be spotted easily.
- Prototypes can also be reused for other works in the future.

❖ Drawbacks of prototyping

- As the prototype has to be designed and distributed multiple time, this method is considered costly.
- A repetitive review of documents may cause a great deal of variation in requirements.
- It requires lots of homework for system designers to draft multiple prototypes.

The construction of prototype was done being based on gathered requirement. Rather than using throwaway prototyping, evolutionary prototyping method was used incorporating the specifications. During design, the cost margin and customer's interest was also considered. Following prototype template was distributed to the Dr. Willy's side.

Logo Proposed System Name

Email
someone@example.com

Password
● ● ● ● ● ● ● ●

Login

Forgot password? Contact Admin Now!

Figure: Prototype sample for Login



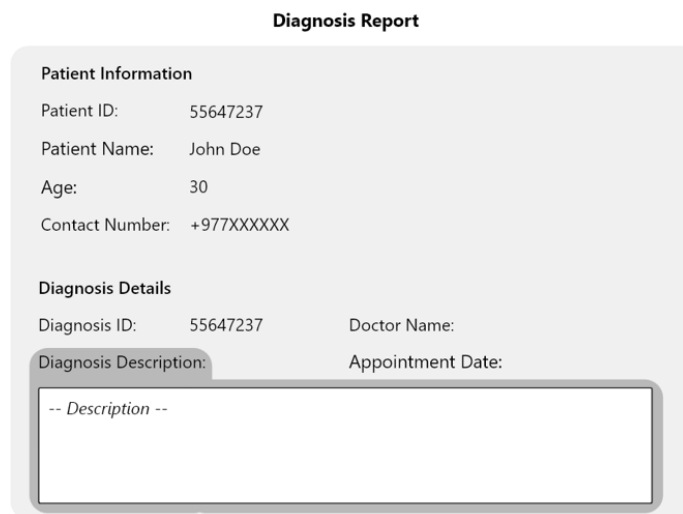
Patient Registration

Patient ID: *auto generated Contact Number:

Patient Name: Email Address:

DOB: Gender: ☒ Male ☐ Female ☐ Others

Figure: Prototype sample for Patient Registration



Diagnosis Report

Patient Information

Patient ID: 55647237
Patient Name: John Doe
Age: 30
Contact Number: +977XXXXXX

Diagnosis Details

Diagnosis ID: 55647237 Doctor Name:

Diagnosis Description: Appointment Date:

Figure: Prototype sample distributed for proposed system.

After getting the hands on the prototype the client did the requirement matching. The feedback showed the deployed prototype matched their desire and requirement. Hence, no further modification was needed, as the design was accepted by the client side it was time to move towards next step of system design, i.e., developing the actual system.

S.N.	Student Name	Student Roll No.	Method
1	Suraj Pandey	NPI000051	Document review

❖ **Document review:**

It is the requirement gathering methods in which requirement for the project are gathered by sample collection of documents of the existing system which is going to be replaced by new system. In this system all the samples of manual system are gathered and problem is identified.

❖ **Benefits:**

- Helps to understand history and operation of program.
- It is comparatively inexpensive.
- Background information can be obtained.
- Helps to answer evaluation queries.

❖ **Setback:**

Besides, positive sides there are several limitations of gathering requirements through interview which are:

- Information may be inapplicable.
- Document review can be time consuming as we need to obsess each and every samples and find solution for them.

❖ **Conduct methods:**

During the conduction of this kind of method, as mention above the samples report of manual system is collected from the clinic. Sample of document review methods are as follows:

Date	Sales Detail					Total sales Qty	Total Amount
Jan-16	Deptt.1	Deptt.2	Deptt.3	Deptt.4	Deptt.5		
Feb-16							
Mar-16							
Apr-16							
May-16							
Jun-16							
Jul-16							
Aug-16							
Sep-16							
Oct-16							
Nov-16							
Dec-16							
Total							
	Signature Sales Officer						Sales Manager

fig: weekly sales report

Above shown picture is of sales report of manual system where staffs need to manually write sales report which is time consuming. Similarly, papers are used in this system which is costly too. So, in new system we are going to introduce computer-based database system. In this system staff need not to enter data manually as sales report is automatically generated after entering the data in the system. Also, old sales report is also easily accessible.

Fig: manual patient registration form

Patient Registration Form

First Name _____ MI _____ Last Name _____ Title _____

Date of Birth _____ Social Security # _____ Gender ☐ Male ☐ Female

Mailing Address _____

Physical Address _____

Driver's Lic # _____

Home Phone _____ OK To Call ☐ Best Time To Call _____
 Work Phone _____ ☐ _____
 Cell Phone _____ ☐ _____

Marital Status ☐ Single ☐ Married ☐ Separated ☐ Divorced ☐ Widowed ☐ Unknown

Employment Status ☐ Full-Time ☐ Part-Time ☐ Self Employed ☐ Active Duty ☐ Disabled ☐ None ☐ Student ☐ Retired ☐ Unknown

Email Address _____ Interpreter Required? ☐ Language _____

Patient Employer _____ Spouses Employer _____
 Address _____ Address _____

 Phone _____ Phone _____
 Occupation _____ Occupation _____

How did you hear about us?

<input type="checkbox"/> Physician	<input type="checkbox"/> Hospital	<input type="checkbox"/> Marketing Ad - Print
<input type="checkbox"/> Employer	<input type="checkbox"/> Cross Referral	<input type="checkbox"/> Marketing Ad - TV
<input type="checkbox"/> Case Manager	<input type="checkbox"/> Friend - Word of Mouth	<input type="checkbox"/> Marketing Ad - Billboard
<input type="checkbox"/> Former Patient	<input type="checkbox"/> Attorney	<input type="checkbox"/> Marketing Ad - Direct Mail - Email
<input type="checkbox"/> Adjustor	<input type="checkbox"/> Self	
<input type="checkbox"/> School	<input type="checkbox"/> Screens - Open Houses	

Specify: _____

Above shown image is of manual patient registration form. In this form patient need to enter data manually which is also time consuming and inaccurate. So, to overcome this problem we have introduce a new patient registration system which is easy to use as well as data are more secured. So, to reduce data redundancy we have introduced computer-based system to enter data and those data get stores in database which are easily accessible any time. The sample of new propose system of patient registration is:

Fig: design patient registration of newly proposed system

Patient Registration

Patient ID: *auto generated Contact Number:

Patient Name: Email Address:

DOB: Gender: ☒ Male ☐ Female ☐ Others

S.N.	Student Name	Student Roll No.	Method
1	Nabin Chhetri	NPI000032	Observation

❖ **Observation as a method of requirement gathering:**

Observation is a method that contains reading, watching, listening, record behavior and quality of objects, living beings or phenomena. An observation is an effective way to

conduct the judgement environment for how users do their work. It is one of the best methods to gather information about required facts. It is used to improve process of an objective which is monitored. To capture all details about the project, it can be performed with various tools and aids. Objective facts can be mentioned on verbal and nonverbal behavior.

❖ Benefits

- Work measurement can be performed through permitting the analyst by observation.
- Directness is also an advantage of observation which can gather data at the time they create.
- Observation collect data about experimentation survey research or document study on nonverbal articulations.
- It describes the object collected data by occurring natural settings.

❖ Drawbacks

- Observation may affect the data while handling over variables of extraneous.
- It creates difficult to research and collect information about preference, opinions, intentions or attitudes.
- Observation kept sample size at a minimum for conducting in-depth studies with data which are difficult to quantify.

❖ **Conduct the investigation method for observation:**

In our scenario, separating parts for interviewer and questionnaire must be observed to get feedback if needed. Collection of information should be analyzed through combining and change the information for making reasonable and suitable. Creating the researching

tool for advance observation research and create meeting about concerning how and when information can be collected. By proving and provide authentic proof, information should be observed.

❖ Sample Question:

1. Brief description about information collection?
2. How can you prove your information is authentic or not?
3. Is your information reasonable or not?
 - a) Yes
 - b) No
4. How can you observe your collecting information and Is it best for investigation or not? If Yes? why? if No? why?

S.N.	Student Name	Student Roll No.	Method
1	Tej Bahadur Thapa	NPI000054	Survey

❖ Survey

For required information gathering for our proposed system I used a survey for information gathering. Survey is the one of the traditional methods of collecting data or doing research. Survey is the method of collecting and analysis data from group of respondents, it not only gathers information by using questions, survey researchers measure the collected data for meaningful research.

❖ Benefits of Survey

- Survey is cost-effective, but it depends upon method of survey, for example it is cost-effective than interview method of data collection while researchers use online/email and phone method of survey.
- By survey researcher can get data faster than other method, by doing phone and online/email method of survey researcher can get data faster than other methods.
- Questionnaires can't cover complex topic but survey can cover any type of topic.
- In survey respondents remain anonymous while researcher use online/email and phone method of survey, which make more comfort to respondents while answering.
- In survey researcher can compare the data collected from the target respondents for measure changes.
- In survey researcher can use any format of question such as questionnaires, open-ended, quizzes, multiple-choice question and polls.

❖ **Setbacks of Survey**

- While researchers use phone and online/email methods of survey the respondents do not give 100% right answers, some respondents lie or ignore the question.
- Not all respondents understand in the same way, there are differences in understanding and explanation, while using phone and online/email methods of survey.
- If the question of the survey was an objective or multiple-choice question, some respondents choose the answer of that question before reading it.
- It is more expensive than questionnaires because in face-to-face surveys we need to hire people for surveys.
- The face-to-face survey will be effective if the interviewers was well trained or has high knowledge about the project.

❖ **Conduct of the investigation method.**

Survey is the traditional method of collecting data from respondents. In survey, researcher collect data by using question and analysis that collected data for meaningful research. The survey can be done by online/email, phone and face-to-face. Researcher do face-to-face interview with the staff and doctor of the clinic who are on duty to gather

information. And mailed that question to other staff and doctors of the clinic who are off duty at that time.

According to our scenario, the owner of the clinic (Dr. Willy) is the top-level manager and he uses the proposed system for administrative tasks. The staff and doctor of the clinic use the proposed system for operational tasks. Dr. Willy, doctor, nurse and other staff of the clinic are the target users for the proposed system. The location of the survey will be in the clinic meeting room for face- to-face interviews. The set of questions and the link of the question will be distributed to other staff and doctors who are off duty.

Sample Question of survey:

- 1) What are the problems with the current system?
 - Data loss.
 - Data redundancy.
 - No space for files.
 - Data inconsistency.
- 2) Why does the new system need the queue system?
- 3) Are you satisfied with the current system?
 - Yes
 - No
- 4) Where will the patient get the medicine after diagnosis in the current system?
- 5) Which change-over strategies can we use for replacing the current system with new?
 - Direct Cutover.
 - Parallel Operation.
 - Pilot Operation.
 - Phased Operation.
- 6) How does the staff check the medicine in the store in the current system?
- 7) Do you think the new the system solves the existing problem?
- 8) How does the current system keep the record of sales?
- 9) If the patient will visit the clinic for a second time does, he/she need to register again in the current system?
 - Yes
 - No
- 10) How does the staff order the finished medicine in the current system?
- 11) What kind of features are needed in the new system?

S.N.	Student Name	Student Roll No.	Method
1	Pradip Kunwar	NPI000034	Questionnaire

❖ Questionnaire

The method for collecting information for our proposed system is questionnaires. Questionnaires is the research tool that consists of a collection of questions with the purpose to obtain data from respondents. (What is a questionnaire - Definition, samples, and examples | QuestionPro, 2021)

❖ Benefits

- Questionnaires are more cost-effective than other methods.
- In questionnaires methods we can collect information from remote respondents through telecommunications.
- It is simple to design, develop and administer.
- Questionnaires put less pressure on respondents, in this method respondents can answer the question by taking its own time.
- The questionnaires guarantee the privacy of its respondents which increases the confidence level of respondents while giving answers.

❖ Setbacks

- Respondents ignored the question in questionnaires.
- Questionnaires are not effective or we can't get proper information in the case of complex emotional topics.
- Different respondents understand the question of questionnaires in different ways.
- In questionnaires there is no guarantee that the respondent gives the right answer because it depends upon the respondent's mood.
- Open-ended questions generate a flood of data that makes it difficult to analyze and it takes a long time to analyze that data.

❖ Conduct investigation method:

Concerning about our scenario, question will generate for the participant Dr. Willy (owner of the clinic) who will operate the system. Question should be generating before taking an interview which can be conducted in a comfortable office with managing time. Set of questions were already send to the team member through mail. Team member create the question for Dr. Willy about their plan and update in clinic management system.

Sample of questionnaire question:

- i. Brief short description about planning against problem faced through proposed system?
- ii. What are the reasons to need new information system for clinic?
- iii. What are the feedbacks provided from clinic doctor and staff about updating system?
- iv. Differentiate between the facilities in current system and previous system?
- v. Can new system have reduced the problems faced by your system?
 - a) Yes
 - b) No
- vi. What are the facilities can get by the patient after updating new system?
- vii. How can the current system help to satisfy patients and clinic customers?

9. Design

9.1.Data Dictionary

Entity:

Name of Entity	Patient
Description	Patient details registered by staff, take appointment schedule to visit related doctor, details about payment, get approval at appointment and take receipt card after payment is given.
Ongoing data flow	Time of appointment, payment receipt card
Outgoing data flow	Patient registration, appointment attend, create payment details.

Process:

Name of process	Prescription, diagnosis and medicine update
Description	After registrations of patient with getting appointment, doctor generate the diagnosis and prescription report, staff updating the medicine stock and create a report of necessary medicine for supplier, medicine purchase by staff and sold to patient.
Ongoing flow chart	<ul style="list-style-type: none">• Patient details• Information of medicine purchase
Outgoing flow chart	<ul style="list-style-type: none">• Patient details update• Medicine stock details update

Data flow:

Name of data flow	Information of new patients
Description of data flow	Send information of new patients to update the details process
Source	Registration process of patients
Destination	Storing information data of patients
Structure of data	Information of new patients = Name of patient + Address of patient + Email of patient + Phone number of patients
Elements of data	<p>Name of data element: Name of patient Description: Identify each patient name Type: Alpha numeric Length: 240 Format of output: Suraj Pandey</p> <p>Name of data element: Address of patient Description: documentation of each patient address Type: Alpha numeric Length: 240 Format of output: Pokhara metropolitan-17, kaski</p> <p>Name of data element: Email of patient Description: documentation of each patient email Type: Alpha numeric Length: 240 Format of Output: surazpandey077@gmail.com</p> <p>Name of data element: Phone number of patients Description: documentation of each patient phone number Type: Numeric Length: 15</p> <ul style="list-style-type: none"> • Format of Output: +977 9814135677

9.2.DFD Level 1

Rabin Acharya (NPI000035)

Data dictionary:

Process:

Data Dictionary	
Data description	
Module	Process
Figure name	Patient registration
Description:	It takes patients information, check existing patients' registration, and save patients record in database patient.
Ingoing data flow:	- Patients information.
Outgoing data flow:	- Registration card
Process description	- First patients provide details to staff, staff check the information in database. If the patient is registered already than update his information. If the patient is new than staff register the patients and provide registration card.

Data element:

Name of data element	Type	Description
Patient ID	Numeric	A registration ID for each patient.
Name	Alpha Numeric	Name of the patient.
Price	Numeric	Price of medicine

Data Dictionary	
Data Description	
Module:	Process
Figure Name:	Appointment
Description:	Appointment schedule for patients and doctor to visit and concern about disease after take approval from staff.
Ingoing Data Flow:	<ul style="list-style-type: none"> - Request for appointment - Details of patient recorded
Outgoing Data Flow:	<ul style="list-style-type: none"> - Details of appointment
Process description	Request of appointment should be received by staff in which information of patients have been recorded. Provide the appointment details to patients and doctor get the appointment details and information of patients through staff.

Data flow:

Name of data flow	Details of appointment
Description of data flow	Concerning about appointment schedule information
Source	Process of appointment
Destination	External entity of patient External entity of doctor
Structure of data	Appointment details = number to get appointment + date + time to start + time to end + location
Elements of data	<p>Name of data element: Number to get appointment Description: Identify various appointment number uniquely Type: Alpha numeric Length: 4 Format of output: 8976</p> <p>Name of data element: date Description: date of appointment schedule Type: Alpha numeric Length:12 Format of output: 14/02/2021</p> <p>Name of data element: time to start Description: in 24-hour format, appointment start time Type: Alpha numeric Length: 4 Format of Output: 09:00</p> <p>Name of data element: time to end</p>

	Type: Numeric Length: 4 Format of Output: 10:00 Name of data element: location Description: location of room where patient can visit doctor Type: Alpha Numeric Length: 7 Format of Output: Room _ 06
--	--

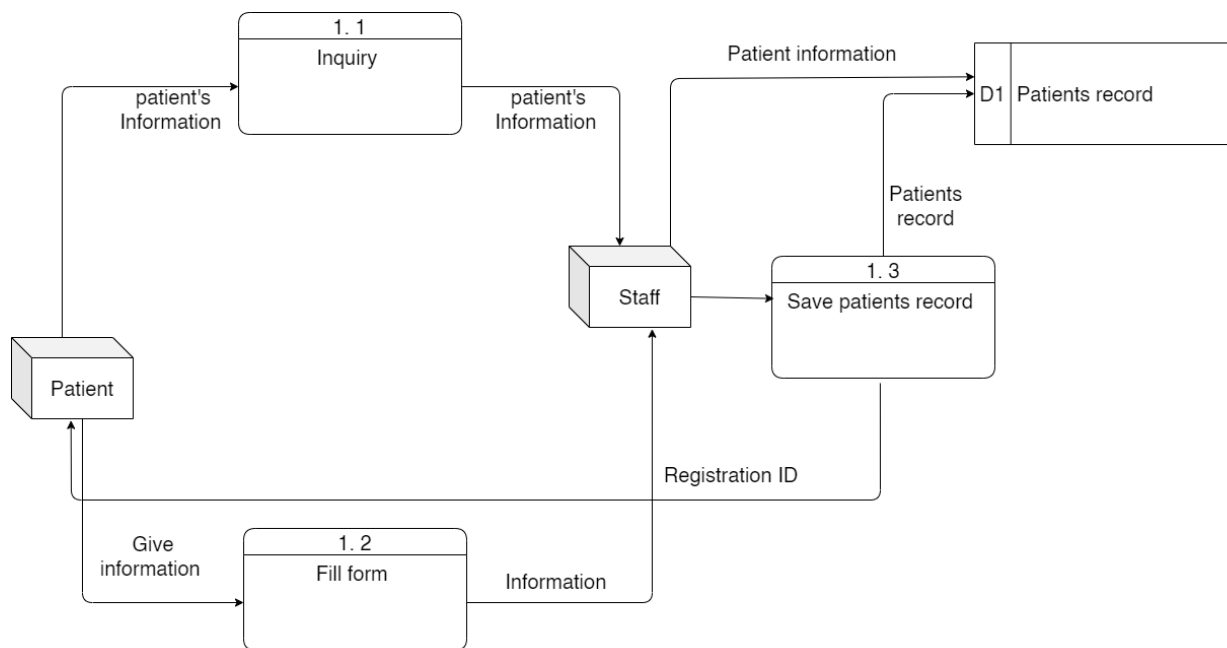


Figure: Level 1 DFD: process 1.0 patient registration

Suraj Pandey (NPI000051)

Data Dictionary	
Data Description	
Module:	Process
Figure Name:	Appointment
Description:	Appointment schedule for patients and doctor to visit and concern about disease after take approval from staff.
Ingoing Data Flow:	<ul style="list-style-type: none">- Request for appointment- Details of patient recorded
Outgoing Data Flow:	<ul style="list-style-type: none">- Details of appointment
Process description	Request of appointment should be received by staff in which information of patients have been recorded. Provide the appointment details to patients and doctor get the appointment details and information of patients through staff.

Data flow:

Name of data flow	Details of appointment
Description of data flow	Concerning about appointment schedule information
Source	Process of appointment
Destination	External entity of patient External entity of doctor
Structure of data	Appointment details = number to get appointment + date + time to start + time to end + location
Elements of data	<p>Name of data element: Number to get appointment Description: Identify various appointment number uniquely Type: Alpha numeric Length: 4 Format of output: 9999</p> <p>Name of data element: date Description: date of appointment schedule Type: Alpha numeric Length: 12 Format of output: 10/02/2021</p> <p>Name of data element: time to start Description: in 24-hour format, appointment start time Type: Alpha numeric Length: 4 Format of Output: 09:30</p> <p>Name of data element: time to end Description: in 24-hour format, appointment end time</p>

	Length: 4 Format of Output: 10:30 Name of data element: location Description: location of room where patient can visit doctor Type: Alpha Numeric Length: 7 Format of Output: Room 07
--	---

Data Dictionary	
Data Description	
Module:	Process
Figure Name:	Prescription
Description:	Doctor suggest prescription to buy related medicine from the medicine sales and prepare medicine list for the patient.
Ingoing Data Flow:	<ul style="list-style-type: none"> - Confirmation of disease - Medicine prescription
Outgoing Data Flow:	<ul style="list-style-type: none"> - Medicine provided to patient
Description of process	after getting disease confirmation report, doctor prescribed medicine for patient, patient receive medicine from medicine sales as prescribed in report.

Data Element

Data Element Name	Type	Description
Patient Number	Numeric	Identify the number name of patient
Name of Patient	Alpha Numeric	Patient identification
Medicine number	Numeric	Documentation of medicine unit number
Name of medicine	Alpha Numeric	Identify the medicine name
Quantity of medicine	Numeric	Number of medicine's amount to buy from patient
Description of medicine	Alpha Numeric	Medicine effect description
Price	Numeric	A total amount medicine to buy from patient.

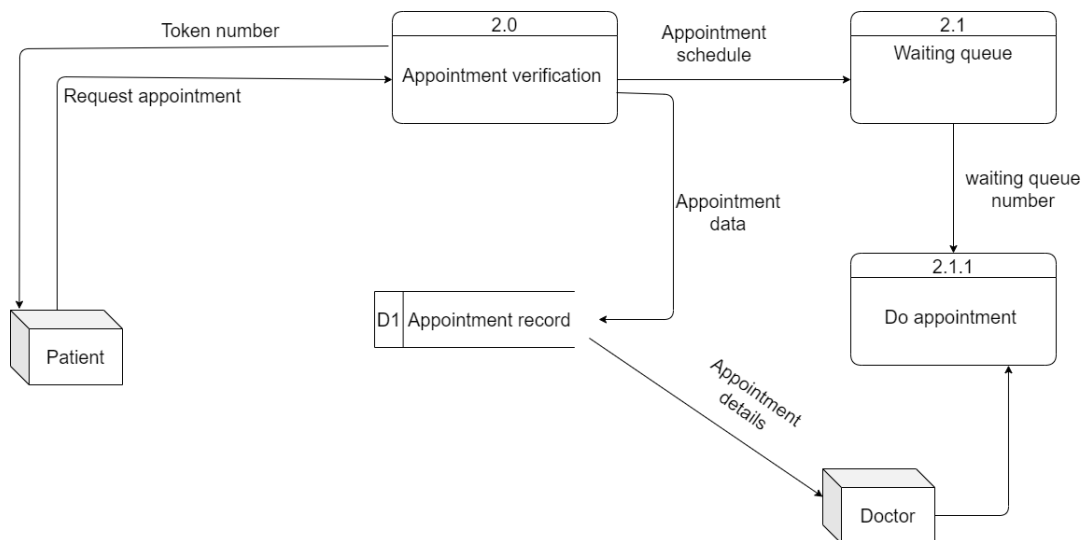


Figure: Level 1 DFD: process 2.0 appointment

Tej Bahadur Thapa (NPI000054)

Data Dictionary	
Data Description	
Module:	Process
Figure Name:	Prescription
Description:	Doctor suggest prescription to buy related medicine from the medicine sales and prepare medicine list for the patient.
Ingoing Data Flow:	<ul style="list-style-type: none">- Confirmation of disease- Medicine prescription
Outgoing Data Flow:	<ul style="list-style-type: none">- Medicine provided to patient
Description of process	after getting disease confirmation report, doctor prescribed medicine for patient, patient receive medicine from medicine sales as prescribed in report.

Data Element

Data Element Name	Type	Description
Patient Number	Numeric	Identify the number name of patient
Name of Patient	Alpha Numeric	Patient identification
Medicine number	Numeric	Documentation of medicine unit number
Name of medicine	Alpha Numeric	Identify the medicine name
Quantity of medicine	Numeric	Number of medicine's amount to buy from patient
Description of medicine	Alpha Numeric	Medicine effect description
Price	Numeric	A total amount medicine to buy from patient.

Data Dictionary	
Data Description	
Module:	Process
Figure Name:	Generate Report
Description:	Receive patient details and provide schedule reports, diagnosis report and prescription report, Generate report to prescription report
Ingoing Data Flow:	<ul style="list-style-type: none"> - Confirmation of disease - Medication prescription - Generate prescription report - Provide prescription report
Outgoing Data Flow:	<ul style="list-style-type: none"> - Provide prescription report

Data Element

Data Element Name	Type	Description
Patient ID	Numeric	Patient number
Patient Name	Alpha Numeric	Patient Identification
Appointment schedule	Numeric	Create the schedule to visit related doctor
Diagnosis Name	Alpha Numeric	Identify the disease
Prescription Report	Alpha Numeric	Use to describe the suggestion against related disease

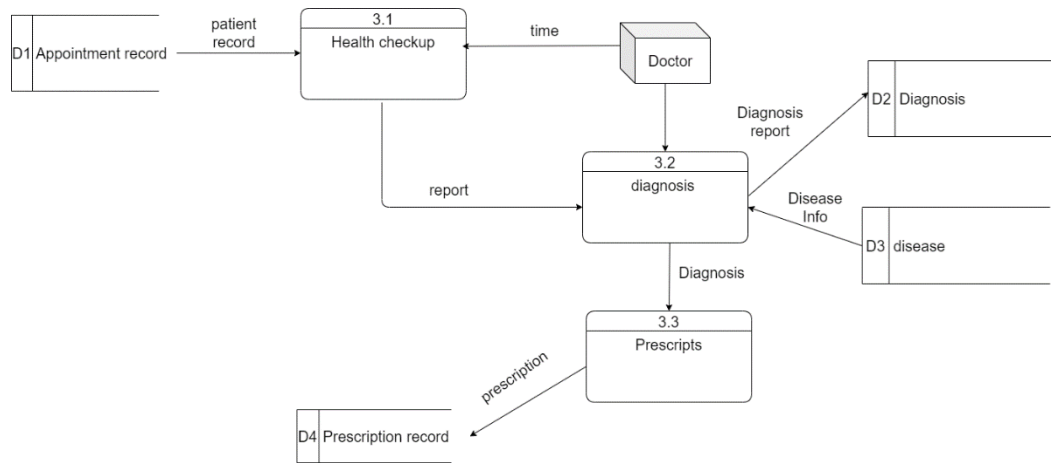


Figure: Level 1 DFD: process 3.0 prescription

Nabin Chhetri (NPI000032)

Data Dictionary	
Data Description	
Module:	Process
Figure Name:	Generate Report
Description:	Receive patient details and provide schedule reports, diagnosis report and prescription report, Generate report to prescription report
Ingoing Data Flow:	<ul style="list-style-type: none">- Confirmation of disease- Medication prescription- Generate prescription report- Provide prescription report
Outgoing Data Flow:	<ul style="list-style-type: none">- Provide prescription report

Data Element

Data Element Name	Type	Description
Patient ID	Numeric	Patient number
Patient Name	Alpha Numeric	Patient Identification
Appointment schedule	Numeric	Create the schedule to visit related doctor
Diagnosis Name	Alpha Numeric	Identify the disease
Prescription Report	Alpha Numeric	Use to describe the suggestion against related disease

Data Dictionary	
Data Description	
Module:	External Entity
Figure Name:	Medicine inventory
Description:	Information about the sending or receiving medicine report. Updating about medicine stock. Medicine preparation includes generating and provide medicine,
Ingoing Data Flow:	- Receive medicines
Outgoing Data Flow:	- Receive medicine order list - Provide medicine - Receive or medicine

Data Element

Data Element Name	Type	Description
Medicine Number	Numeric	Identify the unit name of medicine
Medicine description	Alpha Numeric	Medicine Identification
Quantity of medicine	Numeric	Use to create list about the medicine which have to buy
Medicine name	Alpha Numeric	Identify the medicine name
Price	Numeric	A total amount medicine to buy.

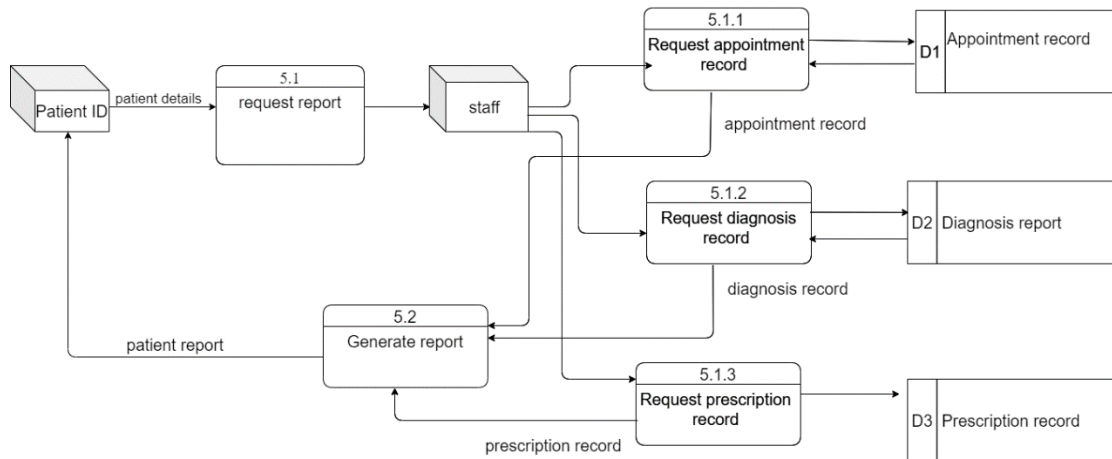


Figure: Level 1 DFD: process 5.0 generate report

Sandesh Subedi A (NPI000040)

Data Dictionary	
Data Description	
Module:	External Entity
Figure Name:	Medicine inventory
Description:	Information about the sending or receiving medicine report. Updating about medicine stock. Medicine preparation includes generating and provide medicine,
Ingoing Data Flow:	- Receive medicines
Outgoing Data Flow:	- Receive medicine order list - Provide medicine - Receive or medicine

Data Element

Data Element Name	Type	Description
Medicine Number	Numeric	Identify the unit name of medicine
Medicine description	Alpha Numeric	Medicine Identification
Quantity of medicine	Numeric	Use to create list about the medicine which have to buy
Medicine name	Alpha Numeric	Identify the medicine name
Price	Numeric	A total amount medicine to buy.

Data Dictionary	
Data description	
Module	Process
Figure name	Medical sales
Description:	It takes prescription from the doctor, check availability of the rescripted medicine, and store sold medicine record to the medicine sales database.
Ingoing data flow:	<ul style="list-style-type: none"> - Prescription details - Provide medicine details - Payment record
Outgoing data flow:	<ul style="list-style-type: none"> - Cell report - Payment bill
Process description:	<ul style="list-style-type: none"> - First doctor provide prescription to patients. - Staff check the availability of the rescripted medicine. - If the medicine available than staff sale the medicine to patient and receipt payment. - Finally, staff store sales data into sales record.

Data element:

Name of data element	Type	Description
Patient ID	Numeric	A unique number provided for each patient.
<u>Trn_ID</u>	Numeric	A unique number assigns to each sale.
Amount	Numeric	Price of medicine

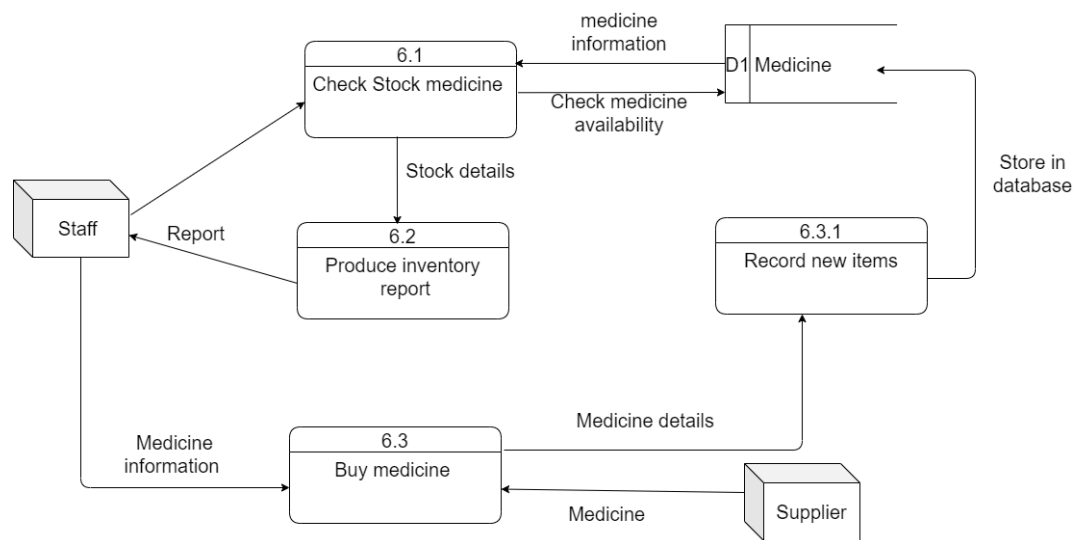


Figure: Level 1 DFD: process 6.0 medicine inventory

Pradip Kunwar (NPI000034)

Data Dictionary	
Data description	
Module	Process
Figure name	Medical sales
Description:	It takes prescription from the doctor, check availability of the rescripted medicine, and store sold medicine record to the medicine sales database.
Ingoing data flow:	<ul style="list-style-type: none"> - Prescription details - Provide medicine details - Payment record
Outgoing data flow:	<ul style="list-style-type: none"> - Cell report - Payment bill
Process description:	<ul style="list-style-type: none"> - First doctor provide prescription to patients. - Staff check the availability of the rescripted medicine. - If the medicine available than staff sale the medicine to patient and receipt payment. - Finally, staff store sales data into sales record.

Data element:

Name of data element	Type	Description
Patient ID	Numeric	A unique number provided for each patient.
<u>Trn ID</u>	Numeric	A unique number assigns to each sale.
Amount	Numeric	Price of medicine

Data dictionary	
Data description	
Module	Process
Figure name	Patient registration
Description:	It takes patients information, check existing patients' registration, and save patients record in database patient.
Ingoing data flow:	- Patients information.
Outgoing data flow:	- Registration card
Process description	- First patients provide details to staff, staff check the information in database. If the patient is registered already than update his information. If the patient is new than staff register the patients and provide registration card.

Data element:

Name of data element	Type	Description
Patient ID	Numeric	A registration ID for each patient.
Name	Alpha Numeric	Name of the patient.
Price	Numeric	Price of medicine

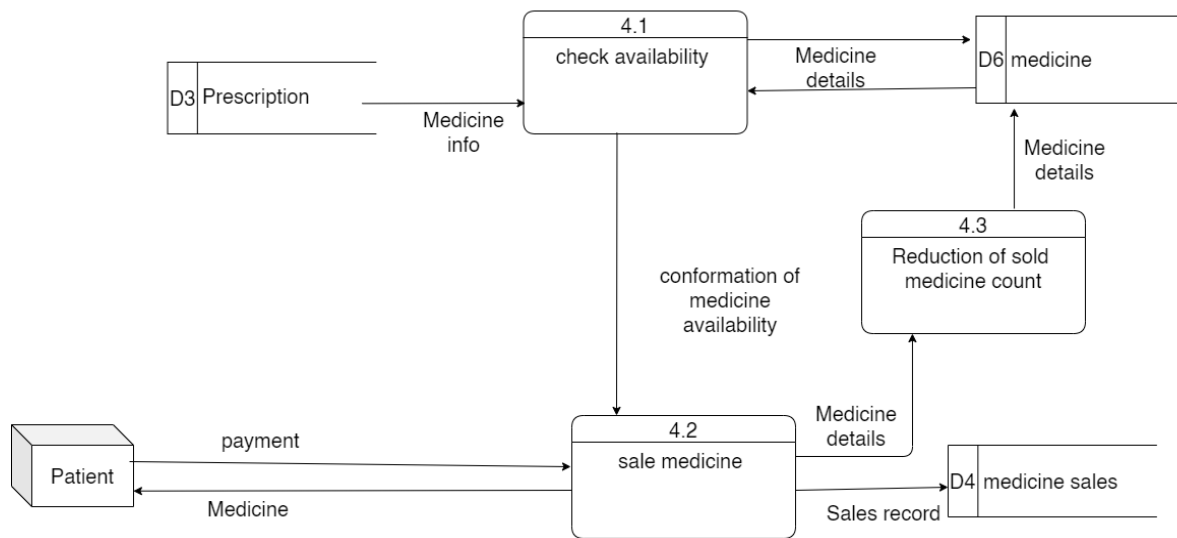


Figure: Level 1 DFD: process 4.0 Medicine sales

10. Conclusion

The proposed system is entirely based on the principles of System Development Life Cycle phases. Several models exist in the System Development Life Cycle; however, each has their own advantages as well as drawbacks too. The proposed software is designed to work well and accurately complete the assigned tasks.

Finally, the report has concluded by reviewing the system design criteria and their impact on the overall process and design. However, it also researched tools and techniques for the application for systems development. In the end, the conclusions of the systems development and user requirements have been outlined in the report.

11. References

- Network, I.D., 2002. QuickStudy: system development life cycle. *Computerworld*, 14.
- QuestionPro. 2021. *What is a questionnaire - Definition, samples and examples* | *QuestionPro*. [online] Available at: <<https://www.questionpro.com/blog/what-is-a-questionnaire>> [Accessed 28 February 2021].
- Radack, S., 2009. *The system development life cycle (sdlc)* (No. ITL Bulletin April 2009 (Withdrawn)). National Institute of Standards and Technology.
- Gaille, L., 2020. *20 Advantages and Disadvantages of Survey Research*. [online] Vittana.org. Available at: <<https://vittana.org/20-advantages-and-disadvantages-of-survey-research>> [Accessed 21 February 2021].
- Questionpro.com. 2021. *Survey research: Definition, Examples and Methods* | *QuestionPro*. [online] Available at: <<https://www.questionpro.com/article/survey-research.html>> [Accessed 20 February 2021].
- QuestionPro. 2021. *What is a survey | Definition, characteristics, examples of a good survey* | *QuestionPro*. [online] Available at: <<https://www.questionpro.com/blog/surveys/>> [Accessed 22 February 2021].
- Kendall, K.E. and Kendall, J.E., 2011. *Systems analysis and design* (Vol. 2013). Upper Saddle River, NJ: Pearson Prentice Hall.
- Wasson, C.S., 2005. *System analysis, design, and development: Concepts, principles, and practices* (Vol. 22). John Wiley & Sons.
- Gibson, M., Arnott, D., Jagielska, I. and Melbourne, A., 2004. Evaluating the intangible benefits of business intelligence: Review & research agenda.

In *Proceedings of the 2004 IFIP International Conference on Decision Support Systems (DSS2004): Decision Support in an Uncertain and Complex World* (pp. 295-305). Prato, Italy.

- Molinos-Senante, M., Hernández-Sancho, F. and Sala-Garrido, R., 2010. Economic feasibility study for wastewater treatment: A cost–benefit analysis. *Science of the Total Environment*, 408(20), pp.4396-4402.
- Bergot, T., Hello, G., Joly, A. and Malardel, S., 1999. Adaptive Observations: A Feasibility Study. *Monthly Weather Review*, 127(5), pp.743-765.
- Mohamed, M., Farag, H., Taweel, N. and Ferguson, M., 2004. Announcement (ScienceDirect Article in Press). *Assessing Writing*, 9(1), p.III-IV.
- MacDonald, R., 2004. JSTOR: A History20047Roger C. Schonfeld. JSTOR: A History. Princeton, NJ: Princeton University Press 2003. 412 pp., ISBN: 0691115311 US\$29.95 (hardback). *The Electronic Library*, 22(1), pp.84-85.
- Macauley, A., Chandrasekar, A., Geddis, G., Morris, K. and McClelland, W., 2003. Operational feasibility of routine bacterial monitoring of platelets. *Transfusion Medicine*, 13(4), pp.189-195.