WEB BASED DISTRIBUTED SYSTEM: DWB MODEL FOR COMMUNICATION BETWEEN PHC, THO AND DHO

4.0: Introduction

Work explained in this chapter is about the Web Based Distributed System as DWB model. Initially we explain the flow of information in the designed system i.e. Flow diagram, the tools used for the development of the model, life cycle followed as a research methodology. The building of the model, input and output interfaces, testing of the model and performance evaluation is explained at the end of chapter.

DWB model is based on Object Oriented Programming (OOP) platform. The software platform used for the development of the tool is high level infrastructure for Distributed Computing. This allows us to make use of Object Oriented Paradigms about process location, operating systems and programming languages. DWB objects are distributed on client (Dot .NET web pages on browser environment), Web Server (IIS : Internet Information Server 7.5) [H. M. Deitel, P. J. Deitel, A. B. Goldberg. 2007] and database used Microsoft Access 2003. The system provides a Distributed Web Based interfaces. The users from PHC, THO and DHO office accesses DWB services through a standard Internet browser.

Tasks Performed by PHC, THO and DHO Users:

Before developing the model, we studied the tasks performed by the users at PHC, THO and DHO units. Table 4.1 shows the various tasks performed by PHC, THO and DHO users.
Table 4.1: Tasks performed by PHC, THO and DHO users

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Users at</th>
<th>Tasks performed</th>
</tr>
</thead>
</table>
| 1.      | PHC      | • Preparation and submission of monthly reports  
          |          | • Implementation of schemes stated by THO and DHO  
          |          | • To provide medical services to the patients  
          |          | • Medical help assistance to the villagers.  
          |          | • To represent the Village at the Tahsil level for healthcare related activities. |
| 2.      | THO      | • Collection of data from PHCs. After compilation, submission of monthly reports to DHOs  
          |          | • To plan, implement and communicate the information of schemes stated by DHOs  
          |          | • To educate the villagers by providing, sharing the information about medical schemes & services through PHC  
          |          | • To represent the Tahsil at the District level for healthcare related activities |
| 3.      | DHO      | • Collection of data from THOs. After compilation, submission of the monthly reports to Divisions, State Govt. etc.  
          |          | • To plan, implement and communicate the information of schemes received from Divisions and health department of State Govt.  
          |          | • To educate the peoples in district by providing, sharing the information about medical schemes & services through THO and PHC  
          |          | • To represent the District at the Divisional level for healthcare related activities. |

These tasks are useful for the designing of model.

4.1: Flow Diagram
Fig. 4.1 to 4.11 shows the flow diagrams of DWB model. Here the analysis of the designed model is given in the form of flow Diagrams. The list of flow Diagrams and their description is mentioned in the Table 4.2 under:

Table 4.2: Flow Diagrams and Figure numbers

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Fig. No.</th>
<th>Title of flow Diagram and Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>4.1</td>
<td>Flow Diagram for Password Validation: It shows the process of authentication.</td>
</tr>
<tr>
<td>2.</td>
<td>4.2</td>
<td>Flow Diagram for accessing DWB model: The flow Diagram shows how does the sub modules of DWB model are accessed and their linkages.</td>
</tr>
<tr>
<td>3.</td>
<td>4.3</td>
<td>Flow Diagram for the THO Reports: It shows the process of creation of THO reports.</td>
</tr>
<tr>
<td>4.</td>
<td>4.4</td>
<td>Flow Diagram for the DHO Reports: It shows the process of creation of DHO reports.</td>
</tr>
<tr>
<td>5.</td>
<td>4.5</td>
<td>Flow Diagram for PHC - Vaccination programme: It shows the flow of data for vaccination programme.</td>
</tr>
<tr>
<td>6.</td>
<td>4.6</td>
<td>Flow Diagram for Child Dose details: It shows the flow of data for conduct of child dose process.</td>
</tr>
<tr>
<td>7.</td>
<td>4.7</td>
<td>Flow Diagram for Patient Information: It shows the flow of data during patient data processing.</td>
</tr>
<tr>
<td>8.</td>
<td>4.8</td>
<td>Flow Diagram for the Doctors Interface: It describes doctors consultation for further tests.</td>
</tr>
<tr>
<td>9.</td>
<td>4.9</td>
<td>Flow Diagram for Laboratory Application: It shows the flow of data for laboratory tests and billing process.</td>
</tr>
<tr>
<td>10.</td>
<td>4.10</td>
<td>Flow Diagram for Post Consultation: It describes the review of patient’s reports.</td>
</tr>
<tr>
<td>11.</td>
<td>4.11</td>
<td>Flow Diagram for the Billing at PHC: The flow Diagram shows how does the bill will be computed?</td>
</tr>
</tbody>
</table>

4.1.1: Flow Diagram for the Security Model
Fig. 4.1 shows how does the security for the model is provided.

Fig. 4.1: Flow Diagram for Password Validation
4.1.2: Flow Diagram For Accessing DWB Model

Fig. 4.2 shows, how to access the DWB model and its sub modules.

4.1.3: Flow Diagram for THO Reports
Fig. 4.3 shows the flow of data for the THO reports in the DWB model.

Fig. 4.3: Flow Diagram for the THO Reports

4.1.4: Flow Diagram For DHO Reports
Fig. 4.4 shows the flow of data for the DHO reports in the DWB model.

![Flow Diagram for the DHO Reports](image)

**4.1.5: Flow Diagram for PHC: Vaccination Programme**
Fig. 4.5 Describes the flow Diagram for the PHC module: Vaccination programme.

Fig. 4.5: Flow Diagram for PHC: Vaccination programme

1. Start
2. Select the village Id for updating of Immunization Data
3. Display the selected data.
4. Read Immunization programme details like ProgId, Name, proddate, Target allocated
5. Compute actual data and the percentage of Achievement
6. Update the data about Target given and achievement
7. Stop
4.1.6: Flow Diagram for Child Dose Details

Fig. 4.6 describes the flow Diagram for child dose detail programme.

Start

Read Name of child in full
Age, sex, Permanent address, No. of doses completed, type of dose, date of dose

Check for Duplication by using the validation

If Duplicate?

Yes

Accept the Input value and perform addition record

No

Is the last Record: child?

No

Yes

STOP

Fig. 4.6: Flow Diagram for Child Dose details
4.1.7: PHC Working: Patient Information
Following flow diagram shows the day to day working of PHC units.

a) **Security Module**: Flow Diagram for Security Module is as shown in Fig. 4.7

![Flow Diagram for Security Module](image)

**Fig. 4.7**: Security of PHC Model

b) **PHC Patient Information**:

Fig. 4.8 shows the flow Diagram for the patient information.
c) **Flow Diagram for Doctors Module**

Flow chart for the doctors’ module is shown in Fig. 4.9

![Flow Diagram for Doctors Module](image)
d) **Flow Diagram for Laboratory**: Fig. 4.10 shows the flow Diagram of the laboratory module.

![Flow Diagram for Laboratory Application](image)

**Fig. 4.10 : Flow Diagram for Laboratory Application**

e) **Flow Diagram for Post Consultation**

Fig. 4.11 shows the flow Diagram for Post consultation.

![Flow Diagram for Post Consultation](image)

**Fig. 4.11: Flow Diagram for Post Consultation**
f) Flow Diagram for Billing

Fig. 4.12 shows the flow Diagram for the Billing process at PHC

4.2: Tools Used for DWB Model

All these models are developed by using .Net platform with framework 3.5 and the database i.e. backend tool used is MS Access 2005. The Reports i.e. output interfaces are developed in grid view which are displayed as read only. The reports can be saved in Excel format. The various web interfaces for PHC, THO and DHO modules are developed by using ASP.Net C# language and the database, tables and a program of DWB model of login interface used is mentioned in the Appendix- C. [Liliana Ardissono, Anno Goy, Giovanna Petrone, Alexander Felfering, Ralph Schefer].

The tool is based on Client Server Architecture which is as shown in Fig. 4.13:

Fig. 4.12 : Flow Diagram for the Billing at PHC
Fig. 4.13: Block diagram for communication between Clients and Server

Fig. 4.14 describes the organization of Three Tier Architecture. There are three layers or tiers: Database Tier (Data access Layer), Web Tier (Presentation Layer) and Application Tier (Business Logic) [George Porter, Randy H. Katz, Francesco FEDELE, 1995].

DWB Model Architecture:

Fig. 4.15 shows the architecture for the DWB model. The model comprises with:
- Application Server, Database Server and Web Server
- PHC, THO and DHO Modules
- Users

The Application server, Database server and Web server are required during the development of model. The PHC, THO and DHO modules are software tools developed by us. The users are: PHC, THO, DHO, Admin.
4.3: Design & Development of DWB Model

We surveyed the PHC, THO and DHO centers in Satara, Sangli, Kolhapur and Solapur districts and studied their regular working process through on site visits and interactions with users of PHC, THO and DHO and authorities. We collected the data. The analysis for the model has been carried out by using recorded data. The design aspects are carried out at the following levels:

- Designing of Input interfaces/web pages.
- Designing of Tables.
- Designing of Output Interfaces or web pages: Reports

As per the requirements collected from PHC, THO and DHO units the databases and the interfaces have been designed. The key constraints are defined in the tables at master level only.

4.3.1: Concept of Web Design and DWB Model

There are different design aspects of Distributed Systems. Presently we selected Distributed Web Based model for this study. The distributed systems are the Internet applications, which are used to build web based systems or web applications [Stan McClellan & Gary Grimes, Ken Burst., 1999]. Hence we mentioned the web design aspects as noted by Thomas Powell, 2003.

There are five areas that covers major web design aspects and our observations are as follows:
1) Content:

It includes the form and how does the sites or web application contents are organized.

Observation in DWB Model:

The model contains different forms as web interfaces. The contents are organized which is explained as Site map of the tool.

Site Map of the DWB Tool:

The site map of the DWB tool is shown in the Fig. 4.16. The map explains the overall structure of web application and the various modules in the designed DWB model. The links: Home, User Login, Goals, Functions, Objectives, Contact Us, are displayed as menu items in Home Page.

![Fig. 4.16: Site Map of DWB Model](image)

2) Visuals:

This refers to the screen layouts used in web applications. It may include graphic elements either as decoration or for navigation. The visual aspects of the web application is the most oblivious aspects of web design is not the so important.
Observation in the DWB Model:

It is observed that, the model comprises with four modules. Each module is formed with different web interfaces and database tables. The web interfaces are designed, which contains navigation aspects for the movements. The required graphical objects are used in our model. This is the research work, hence we did not decorated the tool at every stage. Also few pages are designed with graphics.

3) Technology

The technologies used for the web developments are such as HTML, ASP, client side and server side scripting language [Dirk Knemeyer, 2005].

Observation in DWB Model:

The tool is developed by using the .Net platform which is used for client side (PHC, THO) and server side (DHO) programming or scripting as a technology.

4) Delivery

The delivery aspect of web based system or an application is the speed and reliability of the system over the Internet [V. Cardellini, E. Casalicchio, M. Colajamni, P. S. Yu., 2002].

Observation in DWB Model:

The testing process illustrates that, the speed of DWB tool is better [Jadhav B. T and Patil P. P., 2008b] as compared to other Distributed Systems designed by us in Chapter II and III. Here we feel that, the DWB tool is reliable. The web pages are easier for understanding according to Miller E., 2000. The requirements of the users are satisfied by the tool.

5) Purpose

The important part of the web design is the reason for need of design of web based system and its economic issue.

Observation in DWB Model:

As the DWB tool is web application. The data communication and processing cost is less as compared with the cost considerations of other Distributed Systems developed in Chapter II and III. Hence we feel that, it is economic.

4.3.2 : Web Design Pyramid

The web design pyramid is shown in: Fig. 4.17
Fig. 4.17: Web pyramid: The facets of web design

The web pyramid is surrounded by the designers and users. Three facets of web design processes are: Function (Technology), Form (Visuals) and Purpose (Economic). In this pyramid users are: PHC, THO and DHO. The designers are Researchers acts as developers and the contents are 1) PHC Module 2) THO Module 3) DHO Module. The pyramid is economic for healthcare centers.

4.3.3: Medium Used In Web

A web application is primarily a basic client server model having three common components as stated by Thomas Powell, 2008.

1) The Server side

The server side includes the web server, hardware and software along with web application developed and built in technologies. Our server side is at DHO office.

2) The Client side

The client side is related to the web browser and its supported technologies such as client side scripting. In the designed model, our clients are THO and PHC units and their users.

3) The Network

The network medium comprises with the various connectivity components used to deliver the web based system to the users. Here we use the wired and wireless Internet network.
The DWB model is developed as stated by the steps mentioned in the **Web Development Life Cycle** [Benny Alexander] shown in Fig. 4.18.

**Fig. 4.18 : Web Development Life Cycle : (WDLC)**

The research methodology used to develop the tool is System Development Life Cycle (SDLC). But the DWB tool is web based application which supports Client Server architecture hence the **Web Development Life Cycle** has been followed by us for the development of the DWB model.

Table 4.3 illustrates the phases of the Web Development Life Cycle in brief. The activities performed during the development of DWB model at each stage is described in this table.

**Table 4.3: Web Development Life Cycle Phases**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Application Development Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Analysis</td>
<td>After collecting the requirements the, flow Diagram has been drawn for all the modules of PHC, THO and DHO. The flow Diagram explains the structural layouts and flow of data items of health care centers.</td>
</tr>
<tr>
<td>2.</td>
<td>Specification Building</td>
<td>The existing manual system of healthcare units has been divided into four modules. For each module, the layouts are prepared. Each module comprises with different specifications about interfaces.</td>
</tr>
<tr>
<td>3.</td>
<td>Design &amp;</td>
<td>Design is performed after analysis. Databases, tables, input and</td>
</tr>
<tr>
<td><strong>Development</strong></td>
<td>output interfaces of all the healthcare units are designed. The web applications are developed by using the tool or platform.</td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>4. Content Writing</strong></td>
<td>According to the requirements of healthcare center users and their offices (PHC, THO and DHO), the interfaces and the contents of web pages are designed and created.</td>
<td></td>
</tr>
<tr>
<td><strong>5. Coding</strong></td>
<td>The coding i.e. writing the scripting language program for the development of web interfaces.</td>
<td></td>
</tr>
<tr>
<td><strong>6. Testing</strong></td>
<td>After the coding, the DWB model is hosted on Internet as well as Local Area Network and accessed for the testing purpose.</td>
<td></td>
</tr>
<tr>
<td><strong>7. Promotion</strong></td>
<td>For promotion of DWB model, the researcher, promoted the model at the PHC, THO and DHO staff by demonstrating them to make use of model.</td>
<td></td>
</tr>
<tr>
<td><strong>8. Maintenance &amp; Updating</strong></td>
<td>The maintenance can be done after getting some suggestions for the changes in the existing web pages/ interfaces during the usage of the system. Some suggestions are implemented.</td>
<td></td>
</tr>
</tbody>
</table>

### 4.4: Input and Output Interfaces

DWB model is **Web Based Distributed System**. The model can be accessed and used by: PHC authorities and users at villages, THO authorities and users at Panchyat Samiti, DHO authorities and users at Zilla Parishad and Administrator. The DWB model comprises with five modules which are:

- A] ADMIN Module
- B] DHO communication module
- C ] THO communication module
- D] PHC Communication module
- E] Guest User

DWB model has Hierarchical structure. DHO user is responsible to create and manage THO units. THO user is responsible for to create and manage PHC units. In the view of this the data should be entered from DHO to THO and PHC. For report generation or data extraction the data flows from PHC to THO and from THO to DHO and vice versa for messaging and yojana communication.
Input Interfaces:

The module wise interfaces for the data reading, writing and processing tasks are as follows.

Login Interface: Security Module

Here the term interface is a screen or web page. The web address is http://www.phcdatacenter.com. Note that to access the DWB Model first we have to create and fill the district details with DHO user, which we have created e.g. Satara district. By using THO login, we have to create PHC users and allocate the grants to the Tahsil and fill up the staff information which we have made. The PHC login has two sub modules:

a) PHC data communication

b) PHC Day to Day working i.e OPD (Out Patient Department).

Following interface allows us to login as PHC, THO, DHO and ADMIN: Administrator. If you are not authorized user, the module doesn’t allow you to access the system. The interface is shown in Fig. 4.19.

Users:

- The Admin is powerful user having access to all the modules at a glance.
- To access the DHO module at district level, you have to login as DHO user.

![Fig. 4.19: Data Center: Home Page](image)
To make use of PHC day to day working and communication tool as PHC module, you have to login as PHC user from PHC units.

And when you login as THO user then you can use THO module from THO units.

For Guest as visitor the feedback facility is available through contact us. The suggestions and feedback can be received through e-mail.

Make a note of, while accessing the DWB model, as the Hyper Text Transfer Protocol (http) does not maintain the states in the programming because of that we used session and application states. Session timeout by default is 20 minutes. While accessing the DWB model please do not keep model idle more than 10 minutes. Otherwise session will expire automatically and the model stops functioning correctly. For reuse, repeat from beginning.

A] ADMIN Module:

DWB Model: Data Center

The admin login interface is shown in Fig. 4.20. Admin is the powerful user. He has right to access the complete web tool. All the modules can be accessed through this interface.

![Admin Login Interface](image)

Fig. 4.20: Admin Login Interface

The admin user name is ppp and Password is Yuva48 at ADMIN level. Administrator (ADMIN) is one of the powerful user of the system.

i) Data Center : Menu Driven Interface

After successful login, as (PHC/THO/DHO/Admin), the model allows us to access other facilities available as shown in the Fig. 4.21
To access the DHO module the users and authorities of health section DHO at Zilla Parishad, have to login as DHO with login type as DHO. For DHO user, use username (e.g.dhosatara) and password (e.g. dhosatara). Note that user DHO is responsible for creation of users and filling staff at THO units and THO has to create PHC logins and submit the staff details at PHC. This way the DWB model can be accessed. Its security interface is shown in Fig. 4.22.

ii) District Master

To insert information about various Districts, the interface shown in Fig. 4.23 should be accessed. It supports for Edit, Delete and Save operations.
DHO Module comprises with following interfaces.

1) Grant for Tahsil
2) Yojana Master
3) Organizational chart
4) Message Box [Data Communication Services]
5) DHO level reports

1) Grant For Tahsil

This interface is useful to allocate the Grants to the Tahsil within the District. It is shown in Fig. 4.24. The grant for Tahsil interface contains the data items such as: Grant code and Date, District code, Tahsil code, Total grant in Rs.
2) Yojana Master:

The Yojana Master form is accessed in DHO module. The interface is shown as view records as shown in Fig. 4.25. This is filled by DHO. The data items displayed are: Date, Yojana code, Yojana name, declared by, declare date, reason for declaration, Target group. All the above said data items can be saved, modified and removed from the model. This Master data can be read by THO and PHC users.

![Yojana Master Interface](image)

Fig. 4.25: Yojana Master Interface

3) Organizational Chart

There are various informative web interfaces that shows the goal, objectives and Functions and responsibilities of PHC, THO and DHO units. e.g. Fig. 4.26 shows the Organizational chart developed by Directorate of Health Services in Govt. of Maharashtra.
4) Message Box [Data Communication Service]

Data communication is of two types:

- Yojana Communication with Data
- Message Box

**Yojana Communication with Data:**

Yojana communication is the facility for data communication. The interface allows you to send data about various schemes or programmes and medical campaigns to other users. We can send and receive data between PHC, THO and DHO units.

**Message Box:**

Message box is one of the communication facility available with PHC, THO and DHO modules. Any user (authority) can write (send) and read (receive) messages from other users as authorities. Following modes of data communication are available as message services.

- DHO sends message to THO and PHC
- THO sends message to DHO and PHC
- PHC sends message to THO and DHO
- PHC sends message to other PHC
After login as any PHC/THO/DHO user we see the messages received in the Fig. 4.29. The window shows the boxes for various text messages.

The interface allows us to send message to the THO and PHC from DHOs office shown in Fig. 4.27 and Fig. 4.28 respectively. The message interface contains data items about: Message Id, Year, Month, District code, District name, Addressing to, Message, name of person who wants to send the message.

Fig. 4.27 : Message for THO, PHC

The message from THO and PHC to DHO is shown in Fig. 4.29
Fig. 4.28: THO Communication center

Fig. 4.29: Messages from THO and PHC

Fig. 4.30 shows the Yojana communication messaging interface where message received from PHC (e.g. masurphc) is displayed in the yojana communication box.
5) DHO Level Reports

The DHO level reports interface is shown in Fig. 4.31. The interface allows us to display the data.

The sample Master and Transactional reports are shown and explained (Appendix-D Part: D3 and D4).

a) DHO Janani Suraksha Yojana Report
b) DHO Yojana Expense Report
c) DHO Patient welfare expense Report
d) DHO Yojana Grant Report
e) Doctor Check up report for DHO
Now user has to logout from the system.

**C] THO Communication Module**

To access the THO module by the users and authorities of health section of Tahsil Health Office in Panchayat Samiti, we have to login as username (e.g. thopatan), password (e.g. thopatan) login type as THO. The security interface is shown in Fig. 4.32

![THO Security Interface](image)

**Fig. 4.32 : THO Security Interface**

The THO module is comprised with following web interfaces. These are

a) THO account creation

b) PHC : accounts creation for staff

c) Grant for PHC

a) **Tahsil Health Officer Interface : Account Creation**

This interface allows us to login with THOs user name and password. This is shown in Fig. 4.33. It allows us to Create and Delete THO accounts.
b) PHC : Creation of Staff Login

The module has facility to create and delete the staff accounts for the PHC.

c) Grant For PHC

The interface is shown in Fig. 4.34. It contains the data items such as: Grant code, Date, Year, Month, District Code, Tahsil code, PHC code, Grant in Rs. and other totaling to Total Grant. It allows us to Edit and Delete the records.
THO Level Reports:

Fig. 4.35 shows the THO Level Reports interface. The sample screens of THO master reports are enclosed in the Appendix – D (D4).

We can display the various reports shown through this interface. We have enclosed five transactional reports as sample tests cases Ref. Appendix: D Part - D2.

1) THO Janani Suraksha Yojana Report
2) THO Patient welfare commission Report
3) THO Yojana Grant Report

D] PHC: Daily working and Information Communication module.

The PHC module performs day to day working of PHC as small hospital (Out Patient Department) and information communication activities also.

PHC Login: Home page

User has to login as PHC with appropriate user name (e.g.masurphc) and password (e.g. masurphc) given by THOs. After successful login the interface looks like shown in Fig.4.36. This interface allows you to display the Goals, Functions and Objectives of the PHC. It also shows the Message Desk where the messages received are displayed.
Following are the important web interfaces of PHC module for information communication.

i) PHC Master : User name and password

The PHC user creation and equipment data, expenses links are shown in Fig. 4.37. For create user, the interface accepts data about : PHC Code, Staff ID, user name and password. This is useful for creation of users of PHC units. We can add equipments to the PHC and expenses can be registered as whole information.

Fig. 4.36: PHC Home Page- Interface.

Fig. 4.37: PHC user creation, equipments interface
ii) PHC Master

This is one of the interface of PHC module. It is shown in Fig. 4.38. This shows data about: Date, Financial Year, District code, Tahsil code, PHC code, PHC name.

![Fig. 4.38 : PHC Master Interface](image)

**Staff Information:**

The staff information includes Staff Id, Staff name, Address, Phone No. Mobile no, etc.

**Personal Information:**

The personal information consists of Gender, Date of Birth, Age, Blood Group, Designation and Educational Qualification. We can Add, Edit and Delete the records shown in Fig. 4.39.

![Fig. 4.39 : Staff Entry Interface](image)
The PHC administration module is developed which consists of [Jadhav B. T., Patil P P, 2008a] two sub modules:

1) PHC Administration (Communication : Data Filling )
2) PHC : Day to Day working (Out Patient Department)

Fig. 4.40 shows security interface for PHC day to day working as transactions.

![PHC Security interface for Day to Day working](image)

**Fig. 4.40: PHC Security interface for Day to Day working**

PHC: Day to Day working (Out Patient Department) module contains the following interfaces :

a) Patient Registration Form 

b) Doctor Checkup and Tests 

c) Patient Medicine Report 

d) Patient Billing Form 

For Patient Registration, billing and administrator level activities use username=pppatil with Password=pppatil. Login username=Sawant, Password=sawant as Doctor for patient check up and laboratory tests and medical related activities. The Administrative staff, username=Jadhav with password=Jadhav performs message sending and creation of staff with yojana data communication. The Administrator can send and receive messages. The Doctor has to perform patient and laboratory related activities by putting data. The Administrative staff registers the patients, staff entries and prepare the bill.

**PHC Day to Day Working :**

The PHC data to day module is useful for PHC activities which includes Patient based and data submission to other units e.g. THO, DHO and Other PHC.
a) **Patient Registration Form:**

This interface is shown in Fig. 4.41. The interface comprises with data items: Patient Id, Date of Registration, PHC code, Name, Address, Phone No., Mobile No., Gender, Age (yrs), Weight (kg.) and Blood Group.

**Disease Information:**

This includes Primary Reason for checkup, few details about illness, Duration of Illness, Registration charges (Rs.)

This interface provide facility to save the records.

![Patient Registration Interface](image)

Fig. 4.41 : Patient Registration Interface

b) **Doctor Checkup and Tests**

The interface is shown in Fig. 4.42. The Doctor user read the patient information already registered and suggests for various tests. The tests details with billing (Fees in Rs) and registration charges are recorded for the patient selected. We can display the medicines prescribed with advise from doctor.
c) Patient Medicine Report:

This interface is shown in Fig. 4.43. The medicine report shows the medicines prescribed by the Doctor as user.

---

Fig. 4.42 : PHC : Doctor Check up

d) Billing for patients

To take bill the Doctor has to logout. The user pppatil has to login as administrative staff and access the bill interface. The interface is shown in Fig. 4.44.
It shows the information about patient Registration data items. The same is presented in the report format and can be printed if required as Bill. The interface shows the Total Bill which is the sum of Laboratory Charges, Doctors Fees and Registration Fees.

PHC Administration module comprises with following interfaces.

i) Yojana Information report

ii) Immunization/Vaccination Report

Table 4.4 shows the PHC interfaces.

Table 4.4 : PHC Communication interfaces and its Description

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>PHC Interface and its Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Yojana Interface</td>
</tr>
<tr>
<td></td>
<td>Details of different yojana shown as below and its present status can be displayed.</td>
</tr>
<tr>
<td></td>
<td>- Yojana expenses form</td>
</tr>
<tr>
<td></td>
<td>- Patient welfare commission expenses form</td>
</tr>
<tr>
<td></td>
<td>- Janani Surekhsha scheme form</td>
</tr>
<tr>
<td></td>
<td>- Doctor in village scheme form</td>
</tr>
<tr>
<td></td>
<td>- Sub center expenses form.</td>
</tr>
</tbody>
</table>
2. **Immunization (Vaccination) Report**:

   The interface shows the vaccination information shown in Fig. 4.45. The form comprises with the data items such as: Record No., Date, District, Tahsil, PHC code, Sub center code, Village No. Particular (as animal type of bite details), Add is useful to insert new animal bite type, no. of bite patients, no. of deaths and the total. The interface also allows to Add, Edit and Delete records.

![Fig. 4.45: Immunization Interface](image)

**iii) Sub center Master**

   This interface is shown in Fig. 4.46. The sub center interface allows us to perform Add, Edit and Delete operations on the records. The data items are: Date, Sub center code, name and no. of villages District code, THO code and PHC code.
iv) PHC: Staff Information Interface

The interface is shown in Fig. 4.47 displays the information about staff. It contains data about: PHC Name, Staff ID, Name and other details.

This is a client server based system so reports are generated at both the ends.

PHC REPORTS:
Fig. 4.48 shows the PHC Level Transaction Reports interface. The sample screens of PHC master reports are enclosed in the Appendix-D (Part : D1) as web interface or reports. We have mentioned here transactional reports as test cases.

1) Janani Suraksha Yojana Report
2) Patient welfare commission Report
3) Yojana Expenses Report
4) Yojana Grant Report
5) Patient Committee expenses Report

E) Guest User:

For visitors or guests, the model can be accessed through the contact us link. The visitors access the informative part of the model only. The visitors can register their feedback shown in the interface Fig. 4.49.
The received feedback or suggestion is shown to the researchers' mail address. A test case is shown in the Fig. 4.50

4.5: Deployment

It means publishing (Compiled code) the web application. Deployment is one of the important facilities available in the .Net platform. After completion of development of DWB Model, we have to integrate module web pages as model, Tables and required files to form a file i.e. a tool. This tool is executable and portable. It is same as setup creation for any system. Fig. 4.51 shows the DWB model which has been deployed and formed the application named PHC as Microsoft Visual Studio Solution.
4.6: Web Quality of DWB Model

The model is tested after the process of hosting. Hosting has done after complete development of tool it is available on the global network – Internet. This process keeps the web application available for real world user on the Internet which is a global platform for resource sharing as mentioned by Loudon K.C and Traver C.G., 2005. We have measured the web quality in DWB model as:

A) Testing DWB Model by using Internet and implementation.
B) Measures of Web site Quality

A) Testing DWB Model By Using Internet

Hosting is the process through which the web application can be made available on the Internet as global resource. The web address of DWB model is:

http://www.phcdatacentre.com

The web space is created in the control panel whose login details are as below:

1) URL: http://www.phcdatacentre.com:8880
2) username: phcdatacentre.com
3) password: ***********

File Transfer Protocol software is used to upload and download the DWB model as web based tool. The downloading of the web based tool means removing web based tool from the internet and uploading means putting the web based tool in the web space.

Here we have uploaded the DWB model and performed the testing.

The various users of the DWB model with their username are:

- For PHC, Username is PHC
- For THO, Username is THO
- For DHO, Username is DHO (DHO works as Administrator)
- For ADMIN, Username is ADMIN
- For Guest user

Administrator can handle all the operations in the DWB model. He can create all the users. DHO can create THO users. THO can create PHC users.

**Implementation of DWB Model as a Web Based Distributed System:**

We have developed DWB model as Web Based Distributed System. The DWB model is used and implemented by healthcare experts. Here we have implemented the tool by presenting it to the users.

The DWB model has been presented in the following ways:

1. On site presentation to the experts of healthcare centers for suggestions
2. Access of DWB model through Internet

**i) On site presentation to the experts of healthcare centers for suggestions**

The DWB model has been presented to the some of users of Satara and Sangli District at PHC and Tahsil level from health department.

**ii) Access of DWB model through Internet**

The tool was presented to the users at PHC and THO. The users were asked to access the tool.

**B) Measures of Web Site Quality**
According to Miller E., 2000, we attempt to maintain the web qualities.

Table 4.5 shows parameters for measuring the web quality and experimental observations of DWB model.

Experimental Observations:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Measures of Quality</th>
<th>Experimental Observations of Researcher</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Structural Quality: All the parts of the web site need to be working well. Check that all the links (inside and outside) working ? Are all the images loading?</td>
<td>All the parts of the DWB model are working efficiently. The pages are checked by the users at PHC, THO offices. It is observed that the links are correct and images are loading.</td>
</tr>
<tr>
<td>2.</td>
<td>Content: This is not limited to spell checking and proof reading of the web page contents. It should be checked so that the consistency of the contents either all of the other pages or with the request from the user. Does the content of the critical pages matches? What is supposed to be there in the critical web pages?</td>
<td>The Contents are retrieved by the different users. All the pages are displaying the correct contents of DWB model.</td>
</tr>
<tr>
<td>3.</td>
<td>Response Time: Does the response time to a browser request with in the certain performance parameters?</td>
<td>It is observed that, the average access i.e. response time is 2.88 sec. shown in testing table 4.6.</td>
</tr>
<tr>
<td>4.</td>
<td>Performance: This includes the performance of usage or load. Is the web page loading in less than eight seconds?</td>
<td>As compared to the DLBDS system and wired and wireless NBDS systems the interfaces of DWB model are opened with in less time. The time required to read, process and write operations is comparatively less.</td>
</tr>
</tbody>
</table>

4.7: Testing, Performance and Security of DWB Model

a) Testing of DWB Model

Table 4.6 shows the performance of DWB model. The performance of each sub module is measured. The parameters observed are:

1) Testing time
2) Access failure
3) Abort rate
4) Access time (sec)
5) Access time to text (sec)

Some of the key point indicators for DWB model browsing performance measurement according to Beng Magnor Orstad, Erling Reizer, 2006 are noted.

- **Access Failure**: Can a client is able to connect to the server or not? It may be Yes or No.
- **Abort Rate**: No. of times when a HTTP transmission is started but aborted before the page is fully loaded.
- **Access Time**: It is the time which takes from user clicks on the page to the user see the first contents of the page.
- **Access Time to Text**: It is the time which takes from user clicks on the page to the user see the first full text (but not the images) on the page.

**Table 4.6: DWB Model Testing**
Module wise Testing is shown as:

<table>
<thead>
<tr>
<th>Observation No.</th>
<th>Time of Testing</th>
<th>Access failure</th>
<th>Abort rate : No. of Times</th>
<th>Access time (Sec)</th>
<th>Access time to text (Sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PHC Module:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>10am</td>
<td>No</td>
<td>2.81</td>
<td>2.81</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>12pm</td>
<td>No</td>
<td>1.88</td>
<td>1.82</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3pm</td>
<td>No</td>
<td>1.77</td>
<td>1.75</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4pm</td>
<td>No</td>
<td>2.95</td>
<td>2.91</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>5pm</td>
<td>No</td>
<td>2.94</td>
<td>2.90</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>6pm</td>
<td>No</td>
<td>2.45</td>
<td>2.40</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>7.30pm</td>
<td>No</td>
<td>2.22</td>
<td>2.23</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>8pm</td>
<td>No</td>
<td>2.76</td>
<td>2.70</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>8.30pm</td>
<td>No</td>
<td>2.35</td>
<td>2.39</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>9pm</td>
<td>No</td>
<td>2.20</td>
<td>2.22</td>
<td></td>
</tr>
<tr>
<td><strong>A</strong>: Average Time (sec)</td>
<td></td>
<td></td>
<td></td>
<td>2.43</td>
<td>2.41</td>
</tr>
<tr>
<td><strong>THO Module:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>10.20am</td>
<td>No</td>
<td>3.10</td>
<td>3.08</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>12.25pm</td>
<td>No</td>
<td>3.78</td>
<td>2.75</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3.30pm</td>
<td>No</td>
<td>2.15</td>
<td>2.15</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4.14pm</td>
<td>No</td>
<td>7.60</td>
<td>7.57</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>5.14pm</td>
<td>No</td>
<td>5.31</td>
<td>5.20</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>6.15pm</td>
<td>No</td>
<td>2.71</td>
<td>2.60</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>7.30pm</td>
<td>No</td>
<td>2.20</td>
<td>2.20</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>8.35pm</td>
<td>No</td>
<td>2.67</td>
<td>2.62</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>8.50pm</td>
<td>No</td>
<td>2.12</td>
<td>1.99</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Time</td>
<td>Status</td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>---</td>
<td>---------</td>
<td>--------</td>
<td>----</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>10</td>
<td>9.20pm</td>
<td>No</td>
<td>5.63</td>
<td>5.58</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>DHO Module:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>10.30am</td>
<td>No</td>
<td>2.90</td>
<td>2.88</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2.22pm</td>
<td>No</td>
<td>2.20</td>
<td>2.15</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3.45pm</td>
<td>No</td>
<td>2.75</td>
<td>2.70</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4.10pm</td>
<td>Yes</td>
<td>3.41</td>
<td>3.35</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>5.20pm</td>
<td>No</td>
<td>3.78</td>
<td>3.60</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>6.10pm</td>
<td>No</td>
<td>2.64</td>
<td>2.60</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>7.20pm</td>
<td>No</td>
<td>2.74</td>
<td>2.71</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>8pm</td>
<td>No</td>
<td>1.36</td>
<td>1.32</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>8.50pm</td>
<td>No</td>
<td>1.61</td>
<td>1.57</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>9.14pm</td>
<td>No</td>
<td>1.78</td>
<td>1.72</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>C:</strong> Average Time (sec)</td>
<td>2.51</td>
<td>2.46</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Average Time (A+B+C) in sec.</strong></td>
<td>2.88</td>
<td>2.81</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figs. 4.52, 4.53 and 4.54 shows the graphical testing of DWB model according to the PHC, THO and DHO modules respectively.

![DWB Model: PHC Performance](image_url)

**Fig. 4.52 : PHC Module Testing**
We found that, access time is different. This is due to the problem of service provider, server traffic and design aspects of PHC, THO and DHO modules. It is in the hands of designer. But designer can make some corrections when model is actually loaded on server. If he can tune the model properly then access time can be reduced. This we attempt to tuned model and minimize the access time.
b) Performance Measurement of DWB Model

The performance of DWB Model as distributed system is measured by using the performance objects listed in Table 4.7 by using the Performance Tool of windows operating system XP.

- Logical Disk
- Memory
- Processor
- Server

Table 4.7 : DWB Model Performance Parameters and counters

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Performance Object</th>
<th>Counter Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Logical Disk</td>
<td>Current Disk Queue Length: It is the number of requests on the disk at the time the performance data is collected. It includes requests at the time of the collection. <strong>For good performance, this should be average less than two.</strong></td>
</tr>
<tr>
<td>2</td>
<td>Memory</td>
<td>Pages/sec: This is the rate at which pages are read from or written to disk to resolve hard page faults. This counter is a primary indicator of the kinds of faults that cause system-wide delays.</td>
</tr>
<tr>
<td>3</td>
<td>Processor</td>
<td>% Processor Time: It is the percentage of elapsed time that the processor spends to execute a non-Idle thread. This counter is the primary indicator of processor activity, and displays the average percentage of busy time observed during the sample interval. It is calculated by monitoring the time that the service is inactive, and subtracting that value from 100%.</td>
</tr>
</tbody>
</table>
| 4       | Server             | a) Bytes Transmitted/sec: The number of bytes the server has sent on the Internet. This shows how busy the server is.  
  b) Bytes Received/sec: The number of bytes the server has received from the Internet. It indicates how busy the server is. |

The performance of DWB model is observed for 50 readings and the status of the various counters are recorded as shown in Table 4.8.
<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Current Disk Queue Length</th>
<th>Pages/sec</th>
<th>% Processor Time</th>
<th>Bytes Transmitted /sec</th>
<th>Bytes Received/sec</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>30.71</td>
<td>100.00</td>
<td>231.33</td>
<td>349.83</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>0.00</td>
<td>3.75</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>1.00</td>
<td>1.25</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>96.00</td>
<td>4.06</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>76.80</td>
<td>5.16</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
<td>0.00</td>
<td>0.47</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>0.00</td>
<td>0.31</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>8</td>
<td>0</td>
<td>0.00</td>
<td>0.47</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>9</td>
<td>0</td>
<td>0.00</td>
<td>0.16</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>10</td>
<td>0</td>
<td>0.20</td>
<td>2.50</td>
<td>0.00</td>
<td>0.00</td>
</tr>
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<td>11</td>
<td>0</td>
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<td>0.31</td>
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<td>0.00</td>
</tr>
<tr>
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<td>0</td>
<td>0.00</td>
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<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
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<td>2.50</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
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<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>15</td>
<td>1</td>
<td>1.80</td>
<td>6.41</td>
<td>0.00</td>
<td>0.00</td>
</tr>
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<td>2</td>
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<td>0.94</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>17</td>
<td>0</td>
<td>0.00</td>
<td>0.31</td>
<td>0.00</td>
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</tr>
<tr>
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<td>0.62</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>19</td>
<td>0</td>
<td>0.00</td>
<td>1.25</td>
<td>8194.31</td>
<td>12421.56</td>
</tr>
<tr>
<td>20</td>
<td>0</td>
<td>0.00</td>
<td>1.56</td>
<td>9516.06</td>
<td>14547.88</td>
</tr>
<tr>
<td>21</td>
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<td>0.00</td>
<td>0.47</td>
<td>9516.07</td>
<td>14547.90</td>
</tr>
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<td>22</td>
<td>0</td>
<td>0.00</td>
<td>0.31</td>
<td>9516.07</td>
<td>14475.89</td>
</tr>
<tr>
<td>23</td>
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<td>0.00</td>
<td>1.88</td>
<td>9629.86</td>
<td>14549.68</td>
</tr>
<tr>
<td>24</td>
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<td>0.00</td>
<td>2.50</td>
<td>9530.85</td>
<td>14385.07</td>
</tr>
<tr>
<td>25</td>
<td>0</td>
<td>0.00</td>
<td>2.34</td>
<td>9387.49</td>
<td>14176.13</td>
</tr>
<tr>
<td>26</td>
<td>0</td>
<td>0.00</td>
<td>2.66</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
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<td>29</td>
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<td>0.00</td>
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</tr>
<tr>
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<td>0.00</td>
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<td>0.00</td>
<td>0.00</td>
</tr>
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<td>1.88</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>33</td>
<td>0</td>
<td>0.00</td>
<td>4.06</td>
<td>0.00</td>
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Performance Analysis of developed DWB Model is divided into 3 basic steps.

- Data Collection and Development of DWB Model
- Testing of DWB Model

For performance measurement, data collection, data transformation and data visualization is carried out. Data is collected in log files during the execution of DWB model for four different counters. The log file can be on or off. Performance data is stored in specified drives. Collected performance data is exported into the Excel file. The built-in Excel data transformation techniques are used to reduce the size of experimental data.

For data visualization, Microsoft Excel built-in graph tool is used. Performance is presented in graphical format against sample intervals.

Fig. 4.55 shows the performance graph of DWB model by using the performance tool for the counter “Current Disk Queue Length” against sample intervals.
Fig. 4.55: Performance Graph for Current Disk Queue Length

For intervals 15 and 16 there are requests. And according to the standard it is approximately equal to 2 for other cases it is zero. DWB model does not give load on the Queue length.

Fig. 4.56 shows the graph of Pages/sec. against the intervals. It is observed that the size of the pages/sec. is aprx. remains same. But at the start and end of interval it shows some spikes. It is seen that additional bits are required for starting and ending of process.

Fig. 4.56: Performance Graph for Pages

Fig. 4.57 shows the performance graph of % Processor time. It is seen that, the processor is not overloaded. Initially % Processor Time is 100.
Fig. 4.57: Performance Graph for Processor Time

Fig. 4.58 shows the performance graph for Server object. The server performance is measured with Bytes transmitted/sec and Bytes received/sec. From sample interval 19 to 25, Bytes transmitted/sec and Bytes received/sec are higher. Bytes received rate is more as compared to Bytes transmitted. Same is situation for the interval 35 to 42 and so on.

Fig. 4.58: Performance Graph for Bytes

c) Security of DWB Model:

In order to provide safety to the healthcare and patients data which will be exchanged on the network which is sensitive and highly confidential in nature. The confidentiality must be maintained. In the view of this, the information generated is in the form of Reports that is in the grid view formats. So that any unauthorized user
who wants to make the illegal manipulations, may not able to make such alterations, overwriting of data which will violate the property of Confidentiality. This property should be maintained. For secure communication by the protocols such as SSL (Secure Socket Layer). The SSL allows the users to conduct and maintain secure communication for web applications. This provides us to safely exchange healthcare related information across the network [Andre Kushnirule, 2002].

When the users i.e. Doctors performs the data exchange, they must adhere to the medical science protocol that defines the rules to be followed during this process. In addition to this, the Distributed Systems network and involved server should be protected by firewall against external invader. Here the firewalls should be software applications for the better purpose of keeping digitals forms of viruses, worms and hackers out of the networks according to Elamsari Ramez and Navathe Shamakant, 2003. In our model, we have generated different user name and password to the different users of PHC, THO and DHO units.

4.8: Justification of Distributed Computing by using DWB Model

The DWB model comprises with four modules. The important users of these modules are:

1) PHC staff
2) THO staff
3) DHO staff
4) Administrator
5) Guest

The model is accessed from client side as well as server side. The PHC, THO, DHO users access the model as client users. Presently DHO staff and Administrator are the server side users.

**PHC, THO staff:**

The PHC staff as users inputs or load the data from their individual offices by accessing the PHC module, where as THO users are also accesses the module and inputs the data items. THO users also monitor the data filled by the PHC users. The model produces the PHC data entered from various geographically distributed locations as sub centers.
This data has been collected and produced in required format as per the query formed. These data items are processed as query and it retrieves data from Server.

**DHO Staff/Admin:**

DHO staff login in the model from his office for data processing and administration type of tasks. The information can be produced by the model which is based on the data submitted by the various client users of PHCs, THOs from the different tahsil as well as villages within a district. This depends upon the type of report accessed by the DHO users.

**Guest/Visitors:**

The Guests which are not regular users but they are the web site visitors can access the web model and read the information and submit their feedback or suggestions.

All these illustrates that, there is Distributed Computations which is performed by using the individual computer i.e. client computers and server.

It shows that, DWB model fulfills the requirements of Distributed Computing. Hence we mention that, the DWB model is one of the Web Based Distributed System for healthcare communication between PHC, THO and DHO as one of the application.

**4.9: Conclusion**

If we compare DWB models design, development and implementation issues with wired and wireless NBDS and DLBDS system, we found following aspects of DWB model that

1) DWB model is much better, portable and user friendly.
2) It requires minimum time for data transfer and processing tasks.
3) Not only DWB model record the data but also the data is communicated between PHC, THO and DHO units.
4) This is useful to educate the users by sharing the medical information and it may keep also in touch to the users with other resources such as Research Institutes.
5) It is also a feasible platform for information access, exchange and accumulation.
Presently this communication module helps the users as a part of rural society to be well versed with latest schemes by assisting medical experts in 24x7 manner in emergency.

We suggest that, the DWB model is one of the optimum and efficient solution in all the ways amongst other solutions of Distributed Computing with PHC, THO and DHO communication tool.

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