SURGERY MANAGEMENT SOFTWARE CASE STUDY OF A LARGE-SIZE HOSPITAL

[1]THANAWADEE PEDYOD,[2]SAEREE SVETASRENI, [3]PEERAYUTH CHARNSETHIKUL

[1,2,3]Industrial Engineering Department Bangkok Thailand
E-mail: [1]thanawad@eng.buu.ac.th

Abstract- This article is about making software to manage the data and method, of surgery activity, case study of a large-size hospital. Three main topics : Operating Room Scheduling, Bed Reservation, and Patient Referral System. The functions are Time Scheduling,Room Scheduling, Human Utilization (Surgery Staffs), Blocking Time in Advance, Bed Allocation, Referring a Patient,Recording of Personnel Information, and Recording of Patient Detail. Output is suitable for any hospitals that are interested in economical healthcare managing system, as this program is mainly created by PHP Language, andMySQL Database. Both are free of Charge.

Keywords- Surgery Management Software, Operating Room Scheduling, Bed Reservation, Patient Referral, PHP, MySQL

I. INTRODUCTION

This case study is a large-size hospital in Bangkok Thailand. The 3 study areas are Surgery Unit, Admission Unit, and Referral Unit. The problems mostly are filing systems that are paper-based that can be lost, not recording the person in charge of his activity, data defects, and data inconsistency. So this projectmakes database program that can solve these issues such as avoiding data duplication,avoiding inconsistent records, easily managing data uniquely in one database (e.g. adding, removing, editing, and searching), and easily to maintain security.

The Surgery Management System (SMS) of this project shows its working system in picture ;Fig.1. Diagram of SMS System, and flowchart;Fig.2. Process Flow Chart of SMS. The description is as follows.

At start point, the patient comes to the hospital or enters the system (A1). After passing steps of the hospital tothe diagnosis step.In case the patient does not need surgery, after passing the remaining steps of the hospital, the patient can back home or gets out of the hospital or system. The step finishes.

In case the patient need surgery, and does not want to move to the other hospital. The patient are sent to Operating Room (OR). After finishing surgery, if the patient need not to recover at hospital, the patient can back home or gets out of the hospital or system, after passing the remainingsteps of the hospital. The step finishes.

In case the patient need surgery, and want to move to the other hospital.The relative of the patientwill ask for refering at referral unit of this hospital. If the referring is allowed, the patient is transferredto the other hospital. The step finishes. If the referring is not allowed, the relative of the patient can decideagain to move or not (may be to the same hospital or to the other new hospital). Then back to the previous steps.

After finishing surgery, if the patient need to recover at hospital, the relative of the patient will ask
for reserving bed. If gaining bed, the patient are sent toAdmission Department to use bed for recovering after surgery. If the doctor allows to back home, the patient can back home or gets out of the hospital or system, after passing the remaining steps of the hospital. The step finishes. If the doctor does not allow to back home, the patient has tocontinue to stay for recovering.

In case the patient does not gain bed, there are 3 ways to continue ;1) Back home, 2) Reserving bed again, 3) Move hospital.

When having the want to move a patientto this hospital. The relative of the patient will ask for referringat referral unit of the other hospital. Next, referral unit of the other hospitalasks for referring a patientto this hospital. If the referring is allowed,a new patient are transferredfrom the other hospitalto the diagnosis step of this hospital. The step finishes. If the referring is not allowed, the relative of the patient can decide again to move or not. Then back to the previous steps.

II. DETAILS EXPERIMENTAL

2.1. Tools
1) PHP 5.5.24
2) Dream CS5
3) MySQL 5.6.24
4) PhpMyAdmin4.3.11
5) Apache 2.4.12
6) XAMPP Control Panel 3.2.1

The topics above are 1) Open source general-purpose scripting language, 2) Web design tool, 3) Open source database, 4) A free and open source tool written in PHP, intended to handle the administration of MySQL with the use of a web browser, 5) HTTP Server, 6) An easy to install Apache distribution containing MySQL, PHP, and Perl, respectively.

2.2. Procedures
1) Database Design
- Entity Relationship Diagram,

E-R Diagram

Fig.3. E-R Diagram of SMS

- Data Flow Diagram, DFD

Fig.4. Data Flow Diagram of SMS

- Database,3NF

Fig.5. Database of SMS

2)Program Design

- Process Flow

Fig.6. Process Flow Chartof SMS Program

- Screen Design
- Program Coding

3) Output / Report Design

Fig.7. Output from SMS Program

2.3. Example of Reading

Fig.3. E-R Diagram of SMS

Table 2) t_or_teamhas relationshipM:1 (Many to one) to Table1) t_or_schedule. It means one surgery can have more than 1 person (or 1 item/record/line) to be team staff in surgery. But 1 record of Table 2) t_or_team can have only 1 record in table 1) t_or_schedule

Table2) t_or_team has thedata ;hnisPK (Primary Key)and FK (Foreign Key) , hp_code_teamis FK, and hp_code_record is FK.

Fig.4. Data Flow Diagram of SMS

At Circle named :4. Setting SurgeryAppointment ; firstly surgeon setssurgery resources for setting surgery appointment, then the data of OR schedule andteam goes into the database in the part of operation room scheduling.

Fig.5. Database of SMS

Table1) t_admin_user has the data ;username is Primary Keyand Foreign Key (PK,FK), hp_code is Foreign Key (FK). And hp_code_recordis Foreign Key (FK).

III. RESULTS AND DISCUSSION

3.1. Five Modules

There are 5 modules in this SMS Program

1) Personnel Information
2) Patient Detail
3) Operating Room Scheduling
4) Bed Reservation
5) Patient Referral

3.2. Component

Two main modules

- Operating Room Scheduling
- Bed Reservation

These below 3 moduleshas only one screen page, and operating normally or programaticallythe same.

- Personnel Information
- Patient Detail
- Patient Referral

3.3. Function

Login Page can log in and register in the same page, and textbox position.

Function of Main Page

1) Personnel Information

For recording personal data of new personnel.

2) Patient Detail

For recording personal data of new patient.

3) Operating Room Scheduling

- For arranging the surgery by setting resources ; time, human, and room. Done by surgeon.
- For setting available time for work. Done by staff.
- For confirming time for work. Done by staff.

4) Bed Reservation

- For checkingavailable beds in each ward in a day.
- For borrowing bed.
- For lending,giving, and returning bed.

5) Patient Referral

For moving patient to the other hospital.Done by the relative of the patient.

3.4. Program Management System

OR Module

All tabs are used when …

- Tab : Patient Details

For adding patient data, with the Upper Part of OR Screen

- Tab : OR Team

For selecting humans, by position and staff ’savailable timeto form surgery team.

- Tab : Confirm

For selected staff to confirm the appointment plan to be ready plan for work.

- Tab : Free Time

For each staff to set his own available time for work.

The screen of this OR part is divided into 3 parts ; Upper, Middle, and Lower part. This OR module is used when the surgeon wants to use resources(time, human, and room) for arranging surgery. The output or report from this program has only one type that isindividual OR scheduling appointment (like in the Middle Part of OR Screen).

At Upper Part of OR Screen ;

Using searching word ; Date (Appointment) for specifying the wanted date. And then push the search button to operate. The line of the selected date in OR Timetable (At the Middle Part of OR Screen) is highlighted.Then the surgeon clicks at wanted box in OR Timetable (Date*Time crossing) or inputting time data in textboxes for selecting interval for surgery planning for 1 case (a patient).

For the 2 interesting data in this area ;
1) "HN" is hospital number of patient. After inputting HN, the program will pop up "Patient Name" automatically that includes "prename", "firstname", and "Surname".
2) "Status of Data" will show current step of the record (data item of a patient). There are 4 steps ; A (in the appointment time), O (already operated / surgery), X (cancel the appointment), B (blocking time for surgery in advance).

At Middle Part of OR Screen ;

The table is for reserving surgery time. It lets 2 weeks for reserving time in advance. For one click of a cross-box is a data item per patient. One table is for only one operating room. This table is open at 07:30 A.M. to 17:30 P.M., and the span is half an hour. In table has 4 letters ; A (normal color), O (green), X (blue), and B (yellow).

At Lower Part of OR Screen ;

Thereare 4 tabs ; Patient Details, OR Team, Confirm, and Free Time. "Patient Details" is for inputting the additional data detail from the Upper Part of OR Screen. The others left three tabs are for arranging human for operating team.For Free time tab, if staff does not input his available time in a day, the program will draw the previous data from the prior week in the same day.

Process Flow Chart of OR Module
When surgeon wants to use resources
(time, human, and room) for setting surgery team (OR Team). He comes to OR Module. At the upper part of Screen, the surgeon selects wanted date.Then he selects intervals at the middle part of screen.The surgeon inputs his patient data at the upper part, and the lower part of screen (Patient Details tab). At Free time Tab, staff inputs his own available time for preparing to form surgery team (OR Team). The surgeon selects staffs by using ORTeam tab. This tab is used only by surgeon. By selecting the wanted position, the program pops up all staffs in that position and that have available time in that day. The surgeon can select only one person (item) or many ones in his team at the same time. After that each selected staff confirms his own time to ensure joining OR team at Confirm tab. The confirmed dataare green, cancel data are red, and not confirmed data are normal color. Finally, gaining the confirmed surgery team, and that team canbe cancel or doing surgery. The end.

BED Module
There are 3 tabs ; Check Free Bed, Borrow Bed, and Lend to Return. The other page is "Whole Bed" for recording all beds in each ward. The button for linking to this whole bed page is on "Check Free Bed" tab. Checking whole bed tab is used only one time per year to check all beds in each ward.

All tabs are used when …

- Tab : Check Free Bed
  Nurse evaluates the amount ofavailable beds in each ward
- Tab : Borrow Bed
  Nurse specifies the amount of the wanted beds
- Tab : Lend to Return
  Nurse allocates the available beds to the asker

For an interesting data in this area ;
The data on screen "Status of Bed" or "status_bed" in database table6) t_bed_lend has 5 types ; Wait, Yes, No, Received, and Returned.

- Wait
  (not yet making decision to lend)
- Yes, No
  (alreadymade a decision, whether to lend ornot)
- Received
  (the asker has got beds already)
- Returned
  (thelender has got beds already)

"Lend to Return"tab ;
There are 3 small tables inside this screen. The first screen is "Check Free Bed" that is the same screen in the Check Free Bed tab. The second one is "Borrow Bed" that is the same screen in the Borrow Bed tab, and the last one is its own screen of "Lend to Return". The referential date for this screen (searching word) is "Borrow Date". The output or report from this program has2 types that is shown in Fig.8. Output of SMS Program.

"Check Free Bed" tab ;
Everyday has to check available beds at 9:30 A.M..Each ward has many available beds from many surgery fields. The rule of borrowing beds is asking in the prior 1 day beforelending.

In this hospital case study, there are 10 surgery fields and 7 wards.

Example of Calculation in BED Module
1) At date A, 9:30 A.M. ;
A nurse or the asker uses "Borrow Bed" tab to ask for beds on tomorrow.
2) At date B, 9:30 A.M. ;
Each nurse checks available beds in her own ward.
3) At date B, 9:30 A.M. ;
Nurse uses "Lend to Return" to allocate beds for all ask items in Date A (yesterday). After knowing theamount and the location (ward) of current available beds from topic #2. And the ask items from topic #1, that main dataare borrowing field,bed owner filed of asker, and wanted amount.

4) Lending by looking at “Borrowing item” or “Borrow Date” which sometimecan not lend equal to the asked amount (less than or equal, ≤), and bed owner may be not the bed owner in asker’s mind (in the ask item).
5) Bringing the “lending amount” out of the “whole bed amount”, and then put it in variable. For example, x13 = 27 beds (variable x of field number 1, and ward number 3, x is whole bed amount in ward i). Lending 4 beds, so remaining x13 = 23 beds.
6) Then the process of lending, giving, and returning bed will be continue all day. By using “Lend to Return” tab.
7) All variables in a day are 70 variables, as having 10 surgery fields and 7 wards.
8) At date C, 9:30 A.M. ;
Each nurse checks available beds in her own ward, and the program will check whether the amount of available beds in each ward will equal to the 70 variables in topic #5 (Date B), to ensure the correct amount of free bed.
9) At date C, 9:30 A.M.
Borrowing, Lending, Giving, and Returning go on all day normally.

CONCLUSIONS

Gaining surgery management software for a specific hospital case study. The product is made of freeware, so it is suitable for economical organization. It can be the pilot program for adaptinginto an appropriate software for any individual one.

ACKNOWLEDGMENTS

Special Thank you for the ones as follows
Ratanattaya Vandana

Thank you for the ones as follows
Assoc.Prof. Dr. SaereeSvetasreni
Assoc.Prof.PeerayuthCharnsethikul
Head of Industrial Engineering department at Kasetsart University
Department at Kasetsart University(KU), Bangkhen Campus, Thailand
Family
Friends
I

REFERENCES

[1]. Lorna Mitchell, Davey Shafik, Matthew Turland. Composed byทวิธ พานิชสมบัติ, “เขียนโค้ดPHP อย่างมืออาชีพ”, ISBN : 978-616-08-1396-4, pp. 25-60, 141-175, 2013.
[2]. โอภาส เอี่ยมสิริวงศ์, “Database Systems”, ISBN:978-616-08-2235-5, pp.67-75, 169-190,243-333, 2015.
[3]. โอภาส เอี่ยมสิริวงศ์, “Systems Analysis and Design”,ISBN : 978-616-08-1005-5, pp.187-206, 2012.
[4]. บัญชา ปะสีละเตสัง, “HTML5 CSS3 และjQuery”, ISBN : 978-616-08-1879-2, pp. 39-81, 1994.
[5]. บัญชา ปะสีละเตสัง, “PHP ร่วมกับMySQL และ JQuery”, ISBN : 978-616-08-2219-5, pp. 205-248, 2014.
[6]. ชาญชัย ศุภอรรถกร, “MySQL”, ISBN : 978-616-262-260-1, pp. 1-68, 95-114, 237-289, 1994.
[7]. จีราวุธวารินทร์, “HTML5 CSS3 + jQuery”, ISBN : 978-616-262-242-7, pp. 1-96, 263-318, 1994.

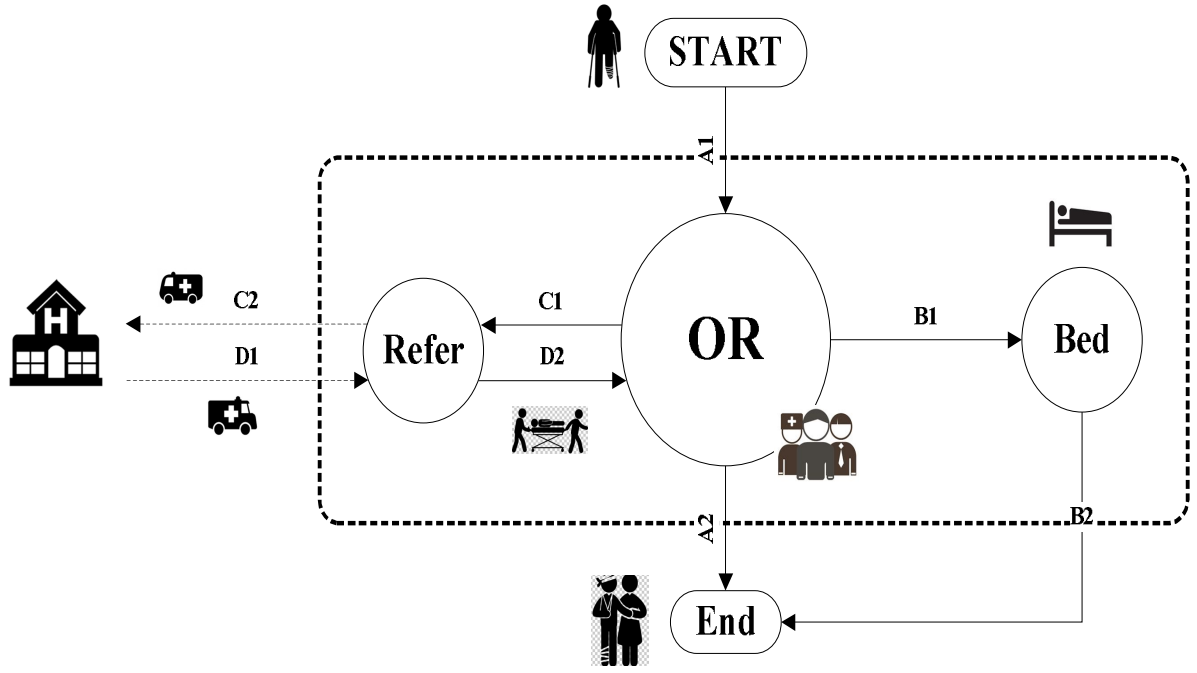


Fig.1. Diagram of SMS System

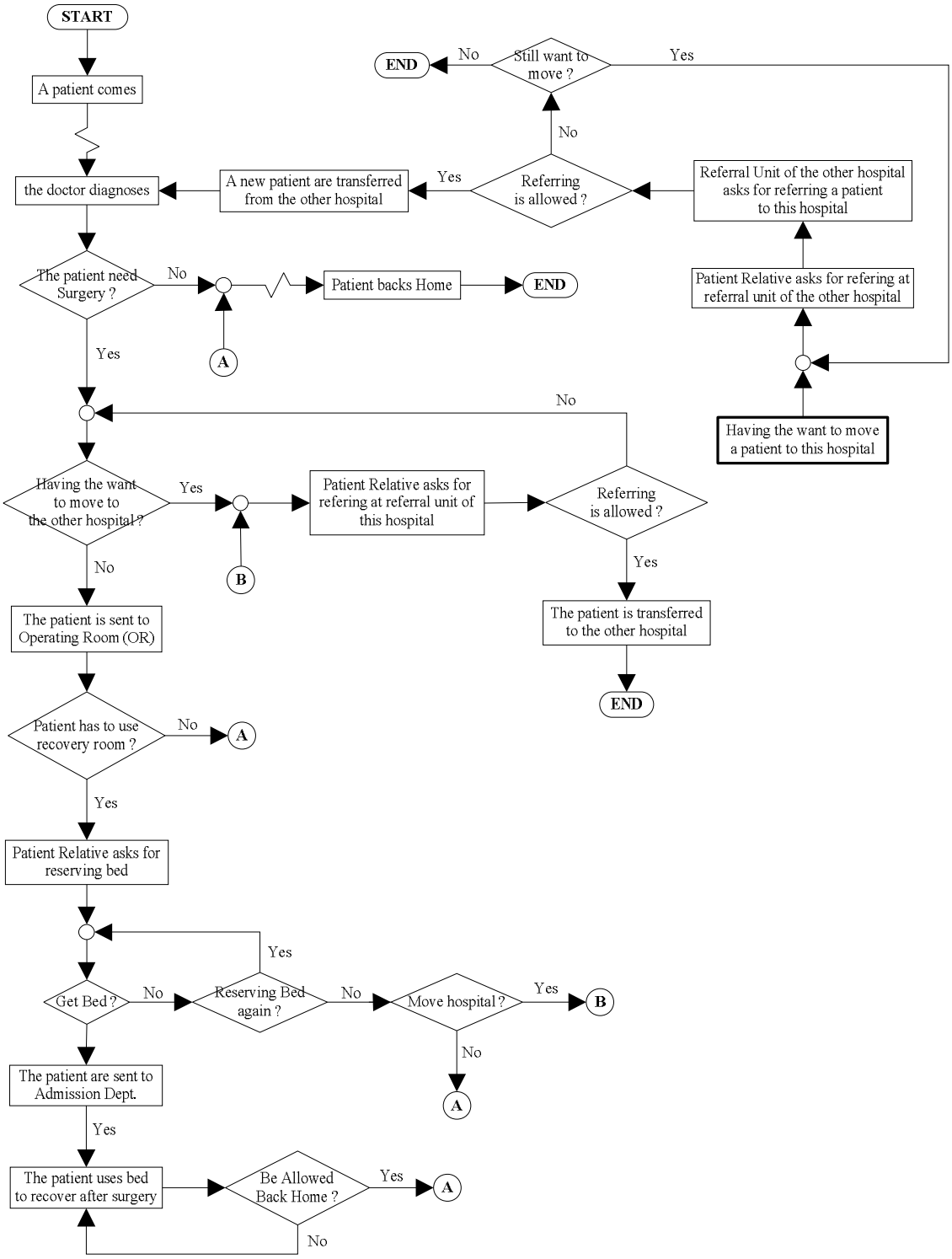


Fig.2. Process Flow Chart of SMS

Abbreviation

OR : Operating Room / Operating Theatre / Surgery Room
Refer : Referral Unit
Bed : The Admissions Department / Hospital Admissions
A1 : A Patient comes
A2 , B2 : Discharge Patient (After finishing checking ,or recovery room)
C1 : Refer Out (Making transfer requirement at Referral Unit)
C2 : Refer Out (Sending patient to another hospital)
D1 : Refer In (Receiving patient from the other hospital)
D2 : Refer In (After checking by doctor , sending patient to OR)
B1 : To Borrow Bed (Making bed reservation at the Admissions Department

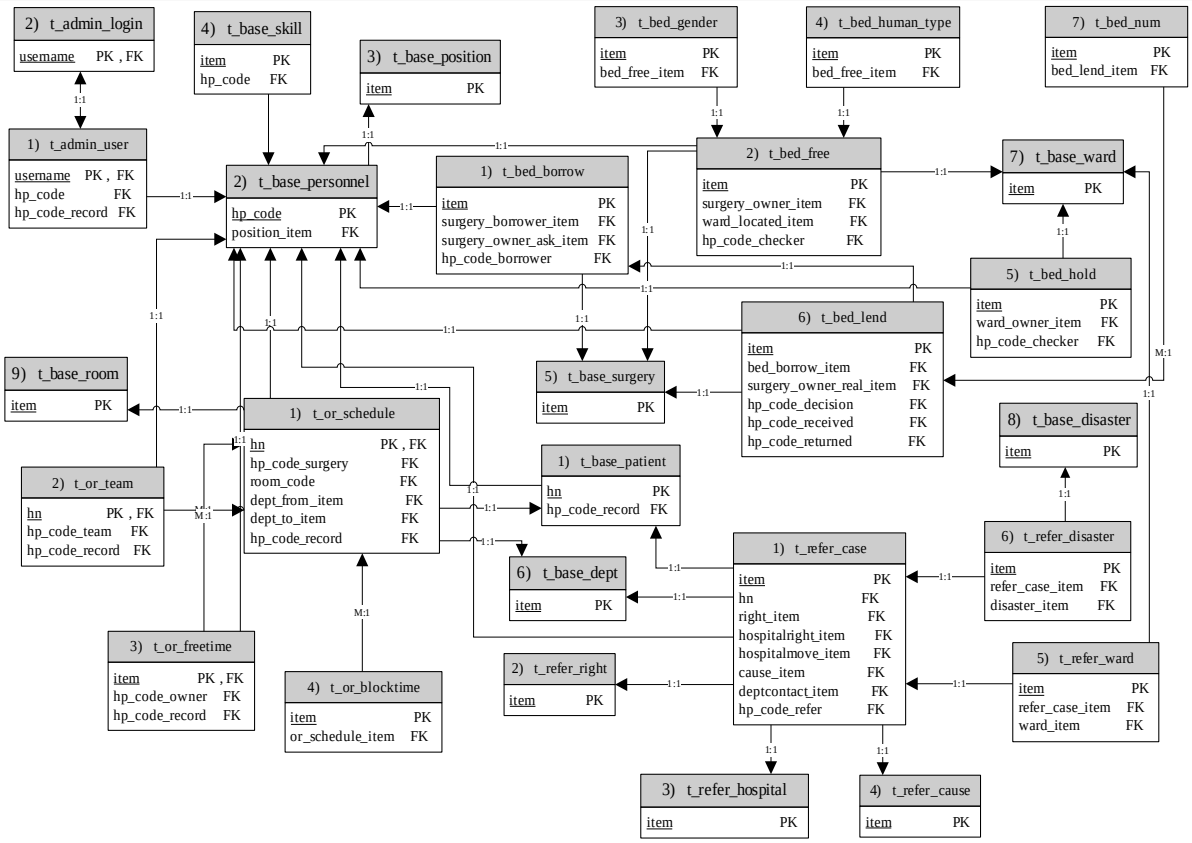


Fig.3. E-R Diagram Of SMS

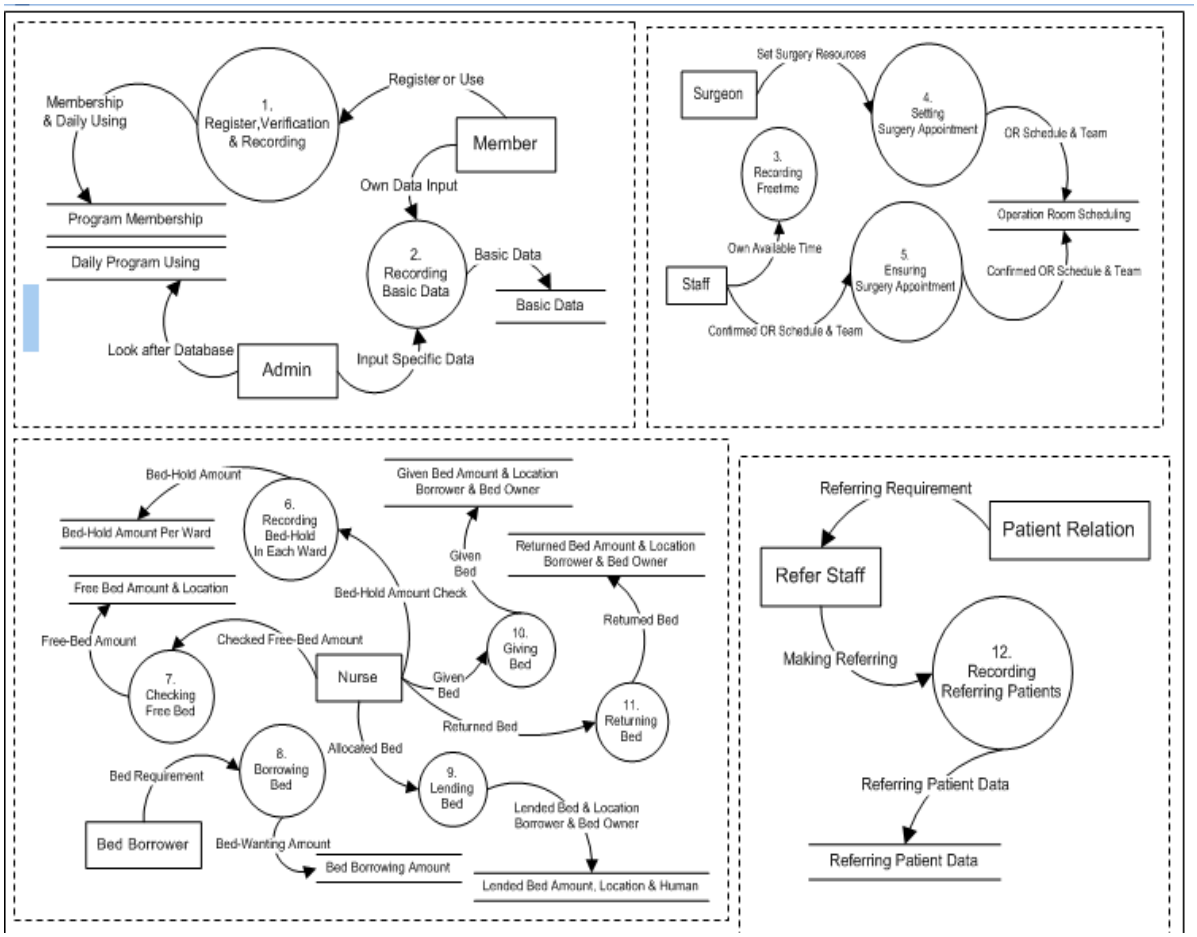


Fig.4. Data Flow Diagram of SMS

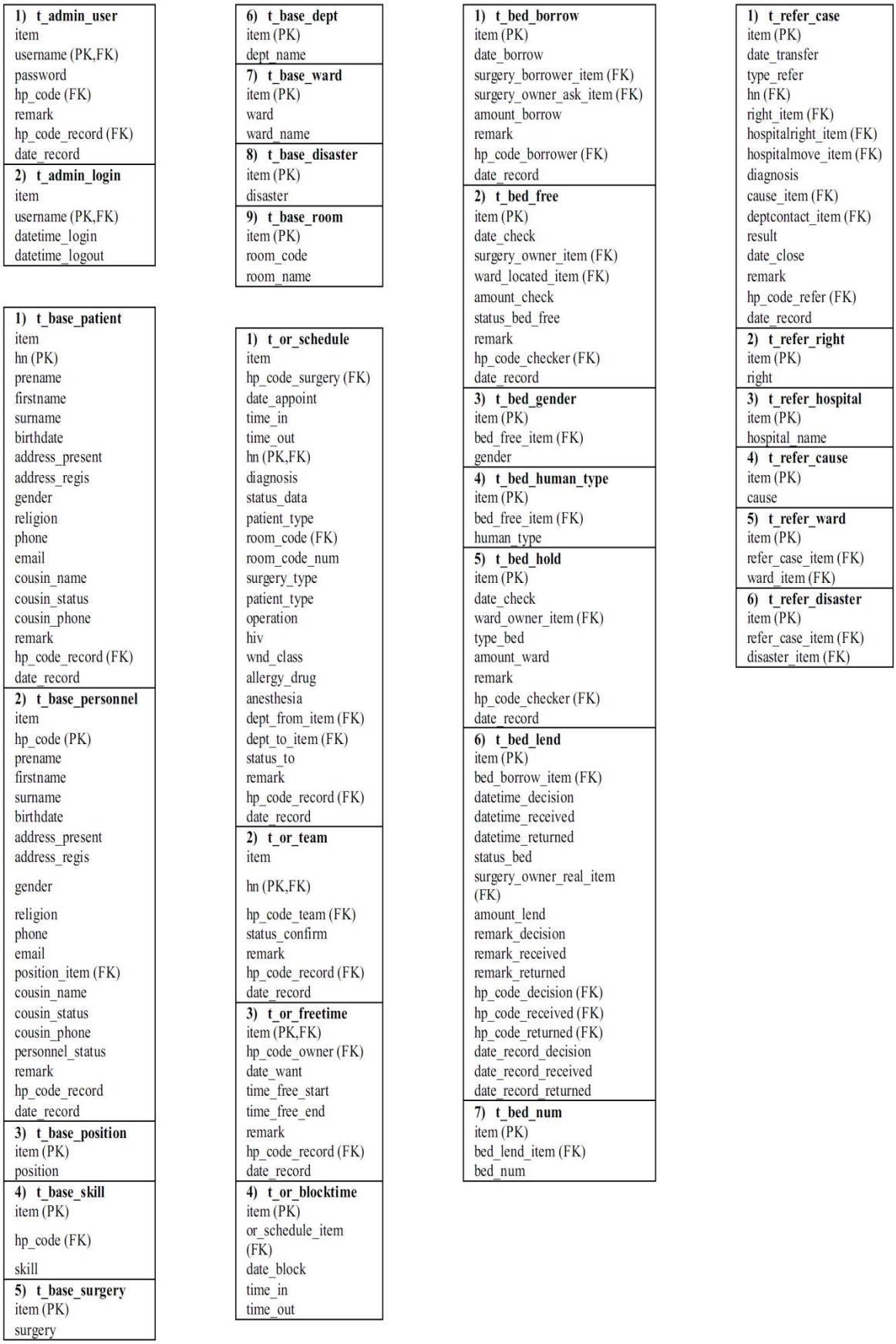


Fig.5. Database of SMS

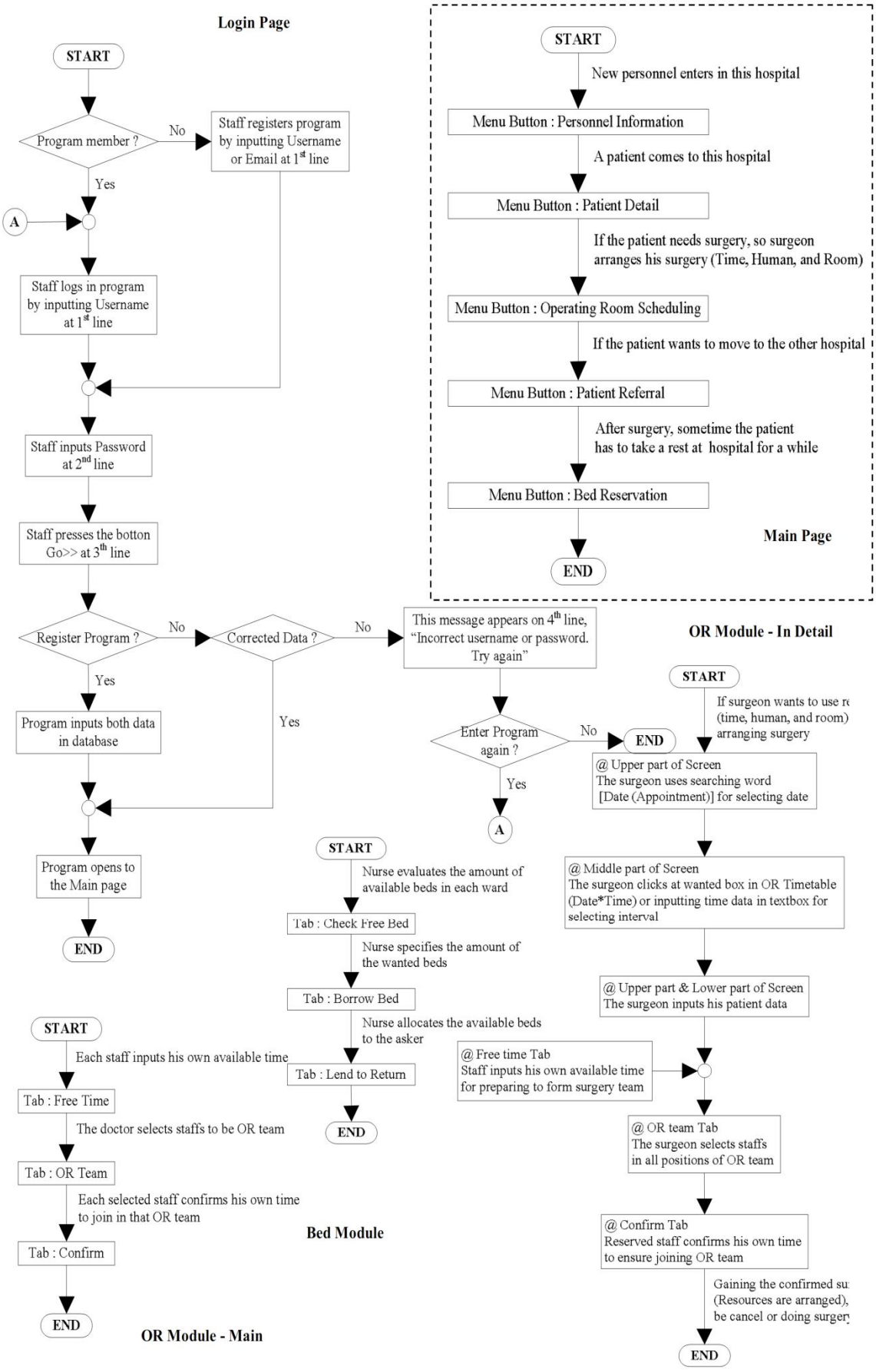


Fig.6. Process Flow Chart of SMS Program

Status of Free Bed (IPD)

At Date/Month/Year

Ward / Owner Field	Ward 1		Ward 2		Ward 3		Ward 4				Ward 5		Ward 6			
							Male		Female				Male		Female	
	Free	Wait	Free	Wait	Free	Wait	Free	Wait	Free	Wait	Free	Wait	Free	Wait	Free	Wait
GEN																
VASCULAR																
HPB																
BREST																
PLASTIC																
NEURO																
URO																
CVT																
TRAUMA																

Bed Borrowing Item

1	2	3	4	5	6	7	8	9

* The order is writing a Borrowing Item up to down in a column, then begins the new column

Ward 7

Free	Wait

The Number of Patient Bed , and Cribs (baby bed) classified by Ward

At Date / Month / Year

Item	Ward		Bed Type			Cribs	Total
			Basic	Extra	Extra / Critical		
1	Full Name of the Ward	#ward					
2	Full Name of the Ward	#ward					
3	Full Name of the Ward	#ward					
4	Full Name of the Ward	6NW ENT					
5	Full Name of the Ward	3NW EYE					
27	Full Name of the Ward	OW1					
28	Full Name of the Ward	OW2					
29	Full Name of the Ward	8SW					
30	Full Name of the Ward	4SE					
31	Full Name of the Ward	8SC					
32	Full Name of the Ward	3SE					
33	Full Name of the Ward	9SW					
Total							

★★★