DESIGN SYSTEM FOR PREVENTION OF PATIENT BASED ON INTERNET OF THINGS

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ABSTRACT

Queues are a common thing in everyday life. Queues are done in many ways one of them a queue in health checks at a hospital or clinic. However, in the queue there is always a problem such as long queue occurrence. Long queues can happen because the number of people who come to wait exceeds the expected limit of a room. This needs to be noted that people queuing up does not make a long time in the queue. This is similar to the existing queue at a Prima Jaya Clinic. Prima Jaya Clinic is a health facility built as a clinic for the community. Patient buildup often occurs in the Clinic. This is due to the lack of information facilities for both patients and for physicians working on the spot. Therefore the Clinic requires a system that can manage the number of visitors who come, limit the patient, and provide good facilities for patients and for doctors. The system will be built using the People Counter where each patient is made into an object, then the object can be counted. Detection of objects using IR sensors calculations are made and can be displayed in a web where later doctors can set the boundaries of patients who can visit. Restrictions are also not only in counting the numbers, but the system is made to limit the patient absolutely by using a smart door lock. This smart door lock will close automatically if the patient who is in the room is up, and will also open automatically if the patient in the purple room has not reached the maximum.

Keywords: People Counter, Door Lock, Queue, Infrared Module, Arduino

1. INTROCUCTION

The patient's waiting room is the patient's place to wait for the examination. The waiting room is made wider than the examination room due to the prevention efforts of patient queuing queuing for examination. Just like in the Prima Jaya clinic located on Jl. Tubagus Ismail 2 No. 6. This clinic has a larger waiting room than the examination room, but the waiting patient turns out to exceed the capacity of the waiting room. The waiting room at Prima Jaya Clinic provides 10 seats for patient waiting, while the patients who come per day reaches approximately 50 people. The capacity of patients who can wait in the waiting room a maximum of 12 to 15 people, but the number of patients making the waiting room accommodates 18 to 20 people. This resulted in the room becoming full and crowded.

The absence of a system that can limit waiting patients in the waiting room becomes an issue of the above statement. Limiting the patient waiting in the waiting room should be done because the patient's accumulation occurs because the patient who keeps coming into the waiting room, this is also because the patient does not know the information about the order in the existing queue.

After conducting an interview with Mr. Tedja Rukmana as a physician working in the clinic, the clinic still uses manual procedures in the case of patient queue. Most patients are new patients, this is obtained from the clinical population of 354 patients for 6 days, then taken sample data as much as 246 or 65%. The new patient does not know the prevailing queuing system, the queue system that applies here is FIFO (First In First Out). The FIFO queue is a queuing system whose order is the first person to enter into the first person out. A FIFO queue can be applied if the patient inside the clinic knows the order of the actual patient with or without the queue number, while many patients still do not know who was the first person to arrive. Therefore, making a sequence number needs to be held so that other patients can find out who is the first person to arrive.

The absence of information systems that provide the means to the patient to be one of the problems taken from the above statement. Means of information about the order of examination to the patient should be created, this is because patients who visit the clinic still use the old queue sequence which makes the patients do not know who came not know the actual sequence in the examination. If the means of information about the order in terms of inspection is not created then it will affect the services available in the clinic. Therefore, this clinic is in need of a system that makes the queue much more tidy and structured so that the services received by patients much better.

From the interviews conducted with Mr. Tedja Rukmana as a working doctor, the examination room is a closed room, the doctor does not know how many

waiting patients are in the waiting room. In case of examination, the doctor only calls the patient into the examination room. Doctors do not name or sequence numbers. Usually doctors make an examination call after a patient who waits for 10 people, but because the examination room is a closed room then the doctor was forced to do the monitoring by getting out of the examination room and see the number of patients who have come.

The absence of a means of information to the doctor about the number of patients who are in the waiting room to be a problem of the above problems. Information to the doctor about the number of patients who are in the waiting room needs to be created, this is because doctors who are in the room did not know the number of patients who are in the waiting room. This is because doctors do not conduct direct examination of the first patient. If this continues then the doctor's working hours will be more cut off, because doctors must first go out to see the number of patients who come. Therefore doctors need a means of information so that doctors know the number of patients who wait is enough to do the examination and the doctor can perform a quicker examination without waiting for patients to reach 10 people.

With these considerations, the authors view the important problems that have been explained by building a smartroom system using arduino microcontroller. The discussion will be written into the thesis by taking the title " **DESIGN SYSTEM FOR PREVENTION OF PATIENT BASED ON INTERNET OF THINGS** " which is expected to help the doctor to prevent the accumulation of patients again and to help the patient to know the order of examination and the limit of patients who can be examined and also for provide better service to patients.

2. CONTENT OF THE PAPER

2.1 Theoretical Basis

2.1.1 The Queuing System

The queuing system is the result of the development of queuing theory, which regulates sequential services according to arrival, to achieve effective and efficient performance, as queuing problem solutions in various places using queue procedures. The queuing system will have its own distinctive features from every existing system in the company, in accordance with the existing service waiting room, and will never exist elsewhere [1].

2.1.2 Patient

About Medical Practice explains the definition of a patient is any person who conducts health care consultations to obtain the necessary health services either directly or indirectly to the doctor [2]

2.1.3 Arduino

Arduino is an electronic device that functions like a microcontroller and is open source. Arduino has an Atmel AVR family processor. Arduino has software with a specific programming language. Arduino also has its own compilation software which is open source and can be downloaded at arduino.cc website. So users can develop their own arduino board according to their wishes [3].

2.1.4 IR *Module*

Infra red (IR) detector or infrared sensor is an electronic component that can identify infrared light (infra red, IR). Infrared or infrared detectors are currently specially made in one module and are named as IR Detector Photomodules. IR Detector Photomodules is a digital infrared detector chip in which there is a photodiode and amplifier (amplifier). Shape and Configuration of IR Detector Photomodules TSOP Pin [4].

2.1.5 *LED*

LED light or extension Light Emitting Diode is an indicator light in an electronic device that usually has a function to show the status of the electronic device. LED lamps are made of plastic and semiconductor diodes that can be lit when powered by low voltage (about 1.5 volts DC). Various colors and shapes of LED lights, tailored to their needs and functions [5].

2.1.6 LCD

Electronic display is one component of electronics that serves as a display of data, either characters, letters or graphics. LCD (Liquid Cristal Display) is one type of electronic display made with CMOS logic technology that works by not producing light but reflecting the surrounding light on the front-lit or transmitting light from the back-lit. LCD (Liquid Cristal Display) functions as a data viewer either in characters, letters, numbers or graphics [6].

2.1.7 Ethernet *Shiled*

Ethernet Shield is a module that works to connect Arduino board with internet network, because it is based on Wiznet W5100 ethernet chip to connect and use module to get connected internet quite easy, only takes few minutes. In the ethernet it self there is a micro SD slot that serves as a file storage while to access the micro SD card using the SD library, for the type of arduino board that can be paired with W5100 shield ethernet arduino uno and mega [7].

2.1.8 Motor *Driver*

Motor Driver is a DC motor equipped with a control circuit with closed feedback system that is integrated in the motor. In the motor driver position rotation of the axis of the motor will be informed back to the control circuit that is in the servo motor. Motor drivers

are composed of a DC motor, gearbox, variable resistor (VR) or potentiometer and control circuit. Potentiometer serves to determine the maximum limit of axis rotation (axis) servo motor. The angle of the driver motor axis is adjusted based on the pulse width on the servo motor control pin [8].

2.1.9 *Printer Thermal*

Thermal printers are one of the printer types of impact printer families, where impact printers are commonly used as printers for groceries and fax machines. The printing process of this thermal printer using a roll of paper. Where the process works by taking the paper roll then turns dark when heated. When printing paper will be drawn adjacent to the print head that contains electronic heats [9].

2.2 Analysis dan Implementation

2.2.1 Method Of Collecting Data

Method of data clumping conducted in this research are as follows:

1. Interview with doctor working in Prima Jaya clinic.
2. Questionnaires distributed to the public to see whether the problem matches the hypothesis made
3. Collecting data by studying journals and books as reference in conducting research..

2.2.2 Software Development Model

1. Communication: This stage is the stage done by communicating with doctors who are in the clinic to define the overall purpose of the system and identify and analyze needs.

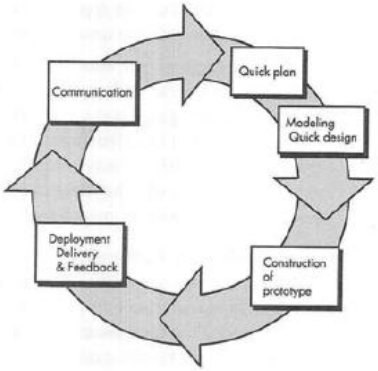
2. Quick Plan: This stage is the stage of rapid planning by analyzing the necessary needs in building a preventive system for the accumulation of patients at the clinic.

3. Modeling, Quick Design: At this stage the design is done quickly to create an overview of the tools to be built.

4. Construction of Prototype: Quick design: This stage is the step that leads to the manufacture of prototype that has been designed in the previous stage.

5. Deployment, Delivery & Feedback: Prototype: The last stage is the stage done by sending and presenting the system that has been built and then evaluated by the clinic, then to filter the needs of what is needed by the clinic.

Repetition occurs so that the prototype is improved to satisfy the needs of the clinic, while at the same time allowing doctors and clinicians to understand what is needed to complete a system.



Gambar 1. Model *Prototype*

2.2.3 Analysis

Problem analysis is an assumption of the problem that will be described in the design of prevention system stacking patient using microcontroller. Problem analysis of the current system is a queue system that is still very manual and can not provide good service and satisfactory for the patient.

Based on the results of questionnaires to patients who visited Prima Jaya clinks and interviews conducted with Mr. Tedja Rukmana as a doctor who worked at Prima Jaya Clinic, found several problems namely:

1. The queuing system prevailing in prime clinics of jaya still can not be understood by some new patients, so the buildup in the waiting room is not controlled.
2. Doctor parties do not know the number of patients waiting outside the room because the examination room is a closed room so that doctors must perform monitoring manually, ie look directly into the waiting room.

Therefore it takes a solution to handle the problems that are going on that is required a system that serves to:

1. To limit patients who can wait in the waiting room and to limit the patient per day, as well as to provide a means of information to patients in order to know the number of patients within and the number of quota of patients who can be checked per day.
2. To provide a means of notification to the doctor for the number of patients in the waiting room, so doctors do not need to check manually.

2.2.4 Analysis Of Running System

Analysis of the running system is the stage to provide an overview of the system currently running. The purpose of this analysis is to provide a more detailed picture of how the system works. The main subject of this research is the queuing procedure applicable at Prima Jaya clinic and the procedure of summoning the patient to enter the examination room following the scenario of the patient queue procedure:

1. Patient enters the waiting room.
2. The patient sits in the waiting room.
3. The patient waits for the patient who is in the waiting room.
4. The patient glances at another patient if the patient in the examination room is out.
5. Patients enter the examination room with the approval of other waiting patients.

Here is the applicable patient call scenario :

1. Doctors enter the examination room.
2. Doctors wait while getting ready for the examination.
3. If the doctor is ready, then the doctor comes out of the examination room and checks the waiting room.
4. Doctors call patients, do not call names or serial numbers.

2.2.5 Analysis of The System To Be Built

Analysis of the system to be built is a system analysis that will be applied to the system. Where in this analysis has been built so that the system can solve the problems that occur in clinics prima jaya. Here is a scenario from pengantrian :

1. Patient takes queue number.
2. The patient enters the waiting room.
3. The patient sits and waits in the waiting room.
4. Patient enters the examination room if no queue is called.

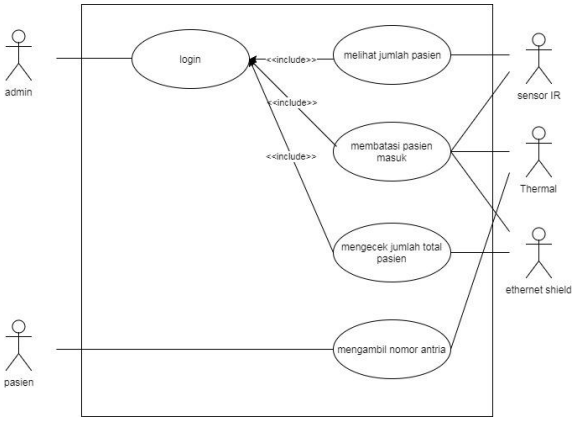
Here is a scenario of a patient call:

1. Doctors enter the examination room.
2. Doctors see the number of patients through the system.
3. If the patient is waiting there, the doctor starts calling the patient from the first sequence number.

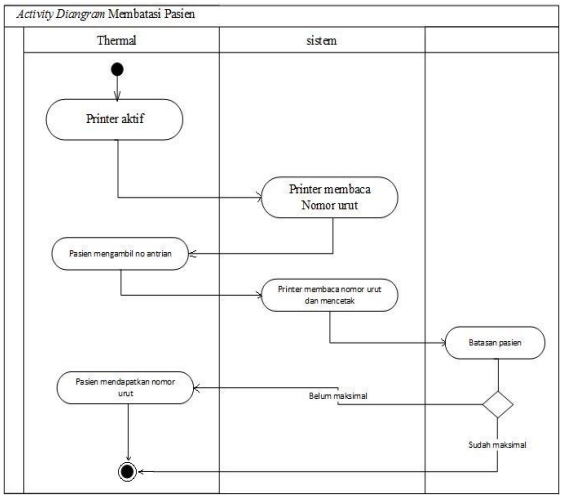
2.2.6 Functional Requirements Analysis

The analysis of functional requirements discussed in the form of usecase, activity, class and squence diagram can be seen in Figures 2, 3, 4 and 5.

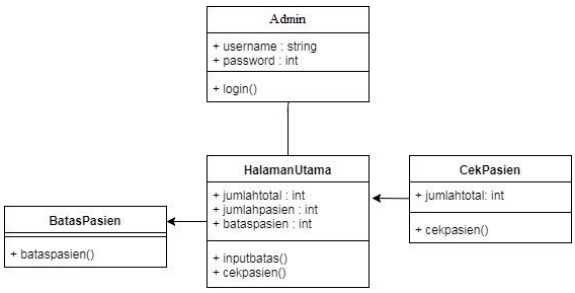
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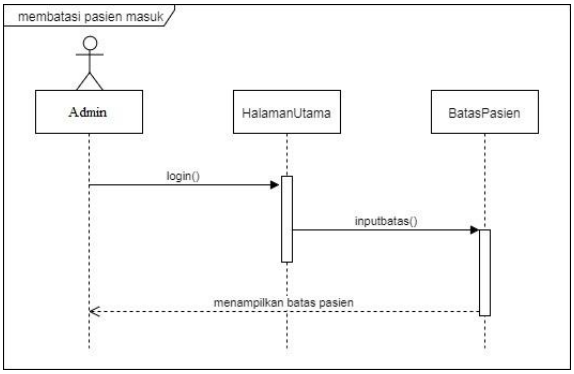
Gambar 2. Usecase Diagram of Patient Prevention System



Gambar 3. Activity Diagram of Patient Prevention System



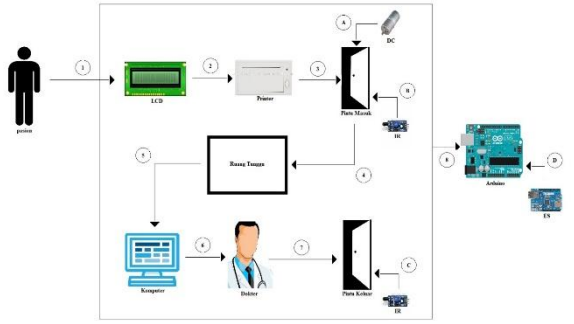
Gambar 4. Class Diagram of Patient Prevention System



Gambar 5. Squence Diagram Patient Prevention System

2.2.7 System Architecture Analysis

Analysis of system architecture is a process to describe the physical system to be built and also the components of the supporter. Here is a description of the system architecture to be built as in the picture The picture of the system architecture can be seen in Figure 6.



Gambar 6. Architecture of Patient Prevention System

The following is an explanation of the system architecture as shown in Figure 6, there are several paths namely, to calculate admission patients, to inform the number of patients, to calculate outgoing patients.

The process for limiting and checking the number and status of patients is as follows:

1. The patient first sees the condition of the room and the number of queue tickets available through the LCD screen. The LCD screen displays the number of people in the waiting room and the remaining tickets available.
2. After making sure the remaining tickets are still available then the patient is welcome to take the queue number through the printer.
3. After getting the queue number, then the patient must pass through the entrance.
4. After passing through the entrance then the patient will wait in the waiting room.
5. The number of people in the waiting room can be seen by the doctor also through the computer that has been provided in the examination room.
6. From the computer also the doctor can monitor and limit the number of patients who can visit.
7. After the patient has done the examination, then the patient will pass the exit.
8. All systems are connected with arduino. Arduino itself works as a brain in the data transmission that occurs on the system to be built.

A. DC motors are placed in the doorway which serves as a means to close the door automatically by looking at the number of patients.

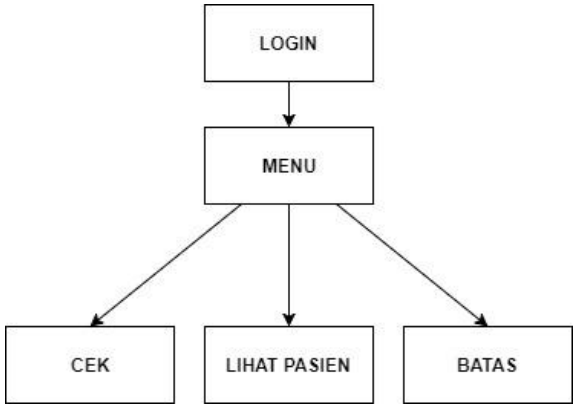
B. IR sensors placed in the entrance door are useful for calculating the rise of patients entering the waiting room and later visible through the LCD screen and computer.

C. IR sensors placed in the entrance door are useful for counting down patients entering the waiting room and later visible through the LCD screen and computer.

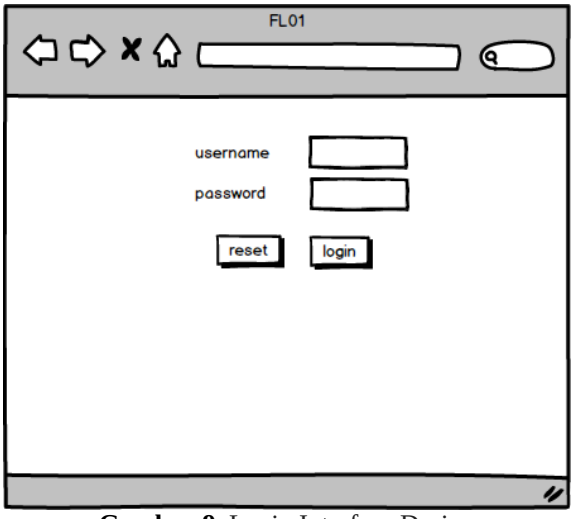
D. Ethernet Shield is used as data transmission which will connect between arduino and computer, so that computer can do monitoring on condition of waiting room.

2.2.8 System Design

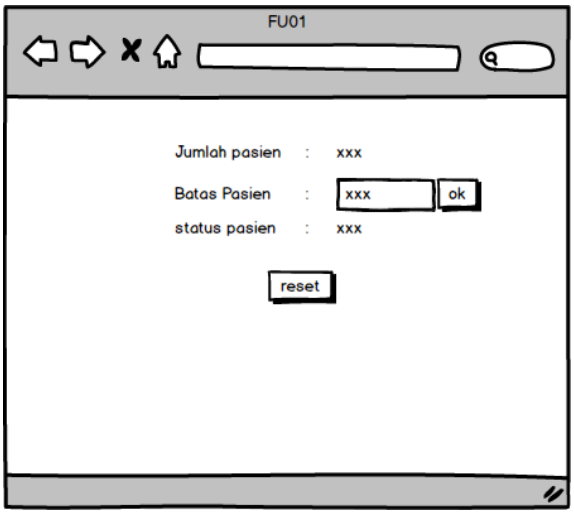
The stages are done in the design of this system discusses the purpose of menu design and interface made on the prevention of this patient's stacking system. System design can be seen in Figure 7, 8, 9, 10 and Figure 11.



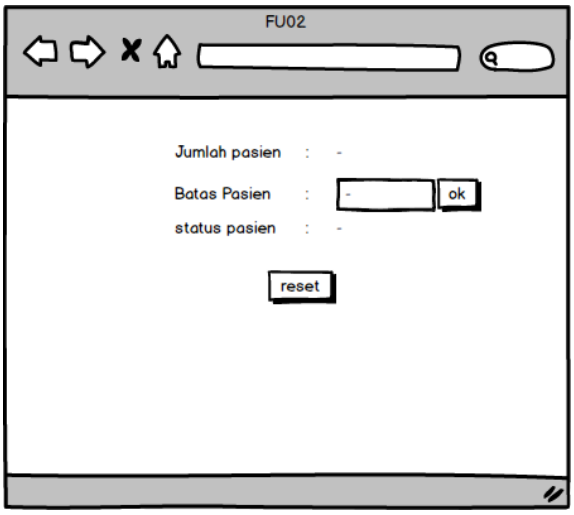
Gambar 8. Menu Structure



Gambar 9. Login Interface Design



Gambar 10. Interface Design Main Page



Gambar 11. Interface Design Checking the patient

2.2.9 Implementation

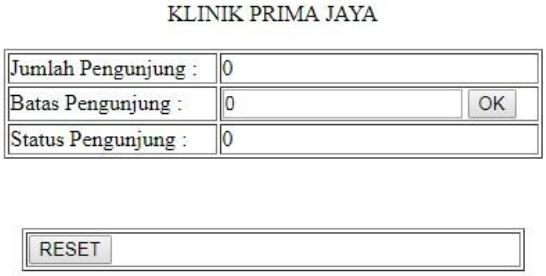
The system implementation stage is the next stage of the interface stage. At this stage the system will be tested and will show results. So it can lead to a solution. At this stage will be discussed is the implementation of the interface and test results of hardware on the syste.

2.2.10 Interface Implementation

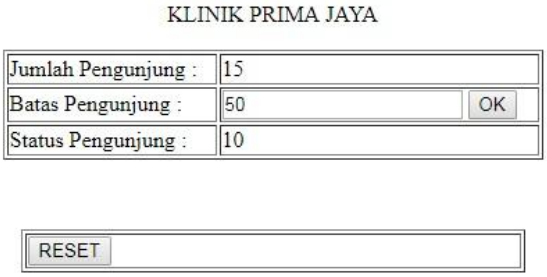
The following is the implementation of the interface of the patient stack prevention system.



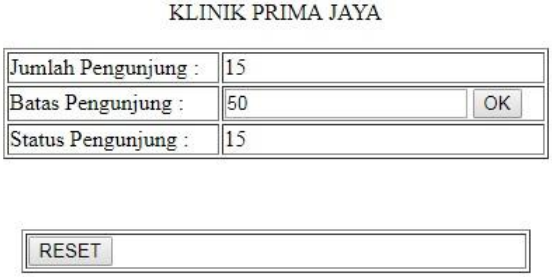
Gambar 12. Implementation of Login Interface



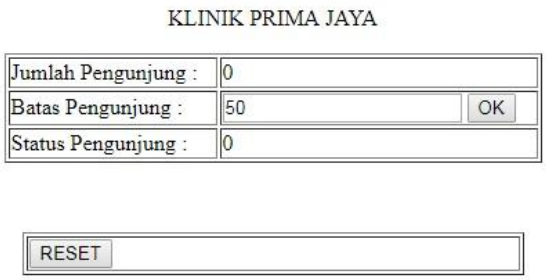
Gambar 13. Home Page Interface Implementation



Gambar 14. Home Page Interface Implementation Show Number of Patients



Gambar 15. Home Page Interface Implementation Show Maximum Patient Amount



Gambar 16. Main Page Interface Implementation Shows Patient Limit

2.2.11 Hardware Implementation

The following is an implementation of the results displayed by existing hardware on the patient's stack prevention system.

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Gambar 17. Preliminary Hardware Implementation



Gambar 18. Hardware Implementation Display Patients who are in the waiting room



Gambar 19. Hardware Implementation Maximum Display of Patients in the waiting room



Gambar 20. Hardware Implementation Patient Limits

3. CLOSING

3.1 Conclusions

Based on the results of software and hardware testing that has been made as a prevention system of patient accumulation then obtained the following conclusions:

1. The system has been built that can limit the patient through a door that closes automatically following the number of patients in the waiting room.
2. The established system can arrange queues and can also restrict patients to visit through a queue machine that has been set amount of spending by doctors by using the internet.
3. The system has been built to monitor the number of patients who are in the waiting room making it easier for doctors to know patients waiting.

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