A MEDBOX USING MICROCONTROLLER

INTERNSHIP / PROJECT REPORT

Submitted by

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in partial fulfillment for the

award of the degreeof

BACHELOR OF COMPUTER APPLICATIONS WITH SPECIALIZATION IN INTERNET OF THINGS

DEPARTMENT OF COMPUTER SCIENCE & IT

JAIN KNOWLEDGE
CAMPUS JAYANAGAR
9TH BLOCK
BANGALORE - 560069

APRIL - 2023

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This is to certify that the project entitled

A Medbox using microcontroller

is the bonafide record of project work done by

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BCA with Specialization in Internet of Things during the year
2020 -2023

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Name	**Name**
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CERTIFICATE

This is to certify that Sharanya N, Smruthi S Bejwadi, Saakshi N S, Likith K S, Charan J, 20BCAR0234,20BCAR0236,20BCAR0072,20BCAR0230,20BCAR0227 for the program of BCA in the Department of Computer Science and IT, School of Computer Science and IT has fulfilled the requirements prescribed for the BCA degree of the of JAIN (Deemed-to-be University).

The Project entitled, "A MEDBOX USING MICROCONTROLLER" was carried out under my direct supervision. No part of the dissertation was submitted for the award of any degree or diploma prior to this date.

_____

Name
Guide / Mentor
JAIN (Deemed-to-be University)

Name of the Examiner	**Signature with Date**
1.	.....
2.	.....

JAIN DEEMED-TO-BE UNIVERSITY | School Of Computer Science and IT

DECLARATION

I affirm that the project work titled "A Medbox Using Microcontroller", being submitted in partial fulfillment for the award of BACHELOR OF COMPUTER APPLICATIONS WITH SPECIALIZATION IN Internet of things is the original work carried out by me. It has not formed the part of any other project work submitted for award of any degree or diploma, either in this or any other University.

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ABSTRACT

Medicine boxes equipped with Internet of Things (IoT) technology are revolutionizing the way medication management is done. These smart medicine boxes are designed to provide enhanced safety, convenience, and adherence to medication regimens for patients and caregivers. With IoT-enabled features, these medicine boxes offer numerous benefits and are transforming the healthcare landscape.

The IoT-enabled medicine box typically consists of a physical box or container with built-in sensors, connectivity capabilities, and a user-friendly interface. These features allow the medicine box to interact with other devices, such as smartphones, tablets, or smartwatches, via wireless communication protocols like Wi-Fi or Bluetooth.

The introduction of IoT technology in medicine boxes has brought about several key advancements:

Medication Reminders: IoT-enabled medicine boxes can send timely reminders to patients or caregivers to take medications on schedule. These reminders can be sent via SMS, email, or push notifications to connected devices, ensuring that medications are taken at the right time, in the right dosage, and with the right instructions.

Medication Tracking: IoT-enabled medicine boxes can track medication usage, providing real-time data on when medications are taken, missed, or skipped. This helps patients and caregivers monitor medication adherence, and provides valuable insights into patient behaviour and medication effectiveness.

Remote Monitoring: IoT-enabled medicine boxes can transmit data to healthcare providers, allowing them to remotely monitor patient's medication usage, adherence, and potential adverse events. This enables proactive interventions and personalized care, leading to better health outcomes.

Medication Storage and Safety: IoT-enabled medicine boxes can monitor temperature, humidity, and other environmental factors, ensuring that medications are stored under optimal conditions. They can also alert users in case of medication expiration or potential interactions with other medications, enhancing medication safety.

Emergency Alerts: IoT-enabled medicine boxes can detect emergency events such as falls or sudden health emergencies, and automatically send alerts to caregivers or emergency services for prompt assistance.

Data Analytics: IoT-enabled medicine boxes generate valuable data on medication usage patterns, patient behaviour, and medication effectiveness. This data can be analysed to derive insights, identify trends, and optimize medication management strategies.

In conclusion, IoT-enabled medicine boxes are revolutionizing medication management by providing enhanced safety, convenience, and adherence to medication regimens. These smart devices offer a range of features including medication reminders, tracking, remote monitoring, storage and safety, emergency alerts, and data analytics. With the potential to improve patient outcomes and reduce healthcare costs, IoT-enabled medicine boxes are transforming the way medications are managed in the healthcare industry.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 01

INTRODUCTION

The category of patients involves all human beings-teachers, students, businessmen, housewives, children, and all of us have a busy hectic schedule. Today's life is full of responsibilities and stress. So, people are prone to diseases of different types and it is our duty to make ourselves stay fit and healthy. If the patient stays at home, then he or she might get someone to look after him/her but when one is not at home, is out of the city or state away from home then it is hard for the family members to call them and remind them their dosage timings every time.

Individuals disregard about their wellbeing. Individuals think that it's troublesome in recollecting the drugs to be taken. Indeed, even today guardians still uses the manual strategy to give the medicine to the patients. Point of the framework which has been proposed is to move restorative check-ups from clinics to home. The framework proposed causes the patients to take pills at the specific time. The carelessness of the patient with respect to legitimate prescription, that is taking medications at standard interims taking overdose than recommended and sporadic check- ups may prompt a few symptoms and beat restorative carelessness of the patients by cautioning them every now and again in regards to the admission of meds at appropriate time and interims. It likewise helps in telling the patients with respect to the check-up plans and the archives to be conveyed for the following check-ups [4].

The medical negligence of the people suffering from long-term diseases are quite common. They consult doctor for the treatment of the diseases and they do not follow the medication procedure suggested by the doctor. The negligence of the patients regarding the medication may be because of several reasons like work schedules, lethargy towards medication, consulting different doctors for opinions and not following any of the medication procedures, some because of superstitious beliefs regarding the modern medication and memory related problems. They often show negligence's like taking medicines at irregular intervals that is not taking the medicines at the proper time suggested by the doctor, taking overdose than prescribed, irregular check-ups. All these negligence's shown by the patients will have several side-effects on them resulting in the failure of the entire medication process

and causing serious harm to them. This implementation helps them to follow the routine medication procedures by providing notifications regularly [7].

The proposed model has a smart medicine box that offers alarms to patients for their medicine at opportune time. IR sensor detects the event triggered and camera is setup to capture images and send notification to the mobile phone. It is associated with in web to make auspicious updates about medication to patient's cell phone through notice in android application. With this we get an opportunity to use technology in a better way so that it can be made useful to us. And it plays an important part in our daily life and helps us staying fit in many ways.

Motivation

Most of times patients may forget to take the medicines at proper time as per the specified in the prescription which may cause in late recovery from the disease/illness. So it is necessary to take proper medicines in proper quantity at proper time.

The remarkable problem is that patients forget to take the proper medicines in proper proportion and in proper time. Medication adherence, which refers to the degree or extent to which a patient takes the right medication at the right time according to a doctor’s prescription, has recently emerged as a serious issue because many studies have reported that non-adherence may critically affect the patient, thereby raising medical costs. Medication no adherence is a common, complex, and costly problem that contributes to poor treatment outcomes and consumes health care resources [5].

CHAPTER 02

LITERATURE REVIEW

The system works on remind and consumption functionality regarding the intake of medicines. The pill that has to be consumed pops out of the container at the particular set time thus reducing the confusion as to which medicines has to be consumed, which also reduces the burden of caretakers regarding the proper medicines that has to be given from time to time to the elderly people. It also sends a purchase order to the medical shop when the medicines are over. The alert sound that will be given helps the patient to consume the medicines at right time without fail and also without anyone's help [8].

Monitoring the health of large number of patients suffering from various chronic diseases especially in the case of elderly people has become a tedious task with rapid population growth. The elderly people find it difficult to manage with medicines and the paper comes up with a smart system that monitors the dosage as well as their health. The Arduino board will receive continuous readings of the patient from smart sensor. Each pill container has its prescribed timing and it is interfaced with real clock time. When the time comes the alarm rings and reminds the patient for consumption. The system helps doctors in keeping track of large number of patients and their medical dosages as well as routines [1].

The aged people are often the victims of chronic diseases and should be taking medicines without fail are also suffering from dementia and forget their daily routines of medication. Reminding about the medication schedule and monitoring the patients and updating of medicines from remote places by the doctor through web. The paper has been focused on to be beneficial for improved efficiency of prescribed drug. The system can be implemented with sensing and wireless modules and these should be secured so that the data containing information about health of the patient should not turn up corrupt. IoT plays a major role in communication between two devices. With the usage of messaging standard and communication protocol, the important messages regarding health can be transferred safely [10].

The project is designed for the people who are under continuous medication and also for elderly people who should never neglect medication. The negligence can have serious effect on people with diseases like blood pressure, heart problems, diabetes, cancer, breathing problems etc. The medicine box is set up with a time table of prescribed medicines with a push button. RTC module saves present time and notification time is stored in EPROM. At the time of intake, the system generates a notification sound and LED display light on certain pill box. The system provides an effective and easy way for people who take medicines regularly at costs which are easily affordable [2].

The proposed system is used for improvising to reduce risks regarding health and also costs in healthcare services by collecting, recording, analyzing and sharing large data streams efficiently. The system reduces the patient's efforts of visiting the doctor to every time to get blood pressure, heart rate etc. checked. The vision of the project is to provide proper and efficient medical services to patients by connecting and collecting data by health status monitors that would comprise of various information regarding patient's health. A better and efficient services to the patients can be provided by implementation of a networked information cloud. From this information the doctor can make use of the information and monitor the patient from remote places at any given time. A mobile application can also be deployed for the same so that the information can be accessed as and when required in case of emergency [11].

The system is to provide help for the people suffering from chronic diseases in their medication routines to stabilize their health conditions. Consumption of the medicine at right time and dosage becomes crucial. The smart pill box is implemented with a camera that is based on medicine bag concept. A matrix code is printed on medicine bag interacts with pill box to perform remind and confirm functions. A family member or a caretaker's responsibility may also be reduced. Remind and confirm function can also work without internet, hence reducing the cost of the implementation [3].

The system is designed keeping in mind of the aged people who live alone on their own. Some of them who are suffering from disability find it difficult to take care of themselves. Any negligence or delay in medication will raise certain health issues. The medicine box can be used by the patients as well as caretakers to monitor the health.

It is implemented with visual and audio notifications to alert the patient regarding the medicine intake and refilling of the box when the medicines get over. A mobile application is also designed to send SMS and E-mail alerts to patient's caretaker. The box helps the patient or the guardian regarding the required pill quantity to be consumed and the exact time when it has to be taken [7].

Many systems have been proposed to shift medication process from hospital to home environment. An intelligent medicine box implemented with sensors for monitoring and diagnosis of health is proposed here. The medicine box is wireless and integrated with a mobile application helps the doctor and patient to interact in closer manner. The system alerts the patients for medicine intake at the prescribed time. An alert will also be given to the guardian of the patient if any signs of negligence is shown. The doctor can have direct monitoring over the patient in the system. In the proposed system magnetic reed switches are used in operation. The operation is carried by means of stepper motors which have controlled signals given from Arduino [4].

The monitoring system takes care of patient's personalized medication and also monitor the activeness of the patient and notifying if any vital signs is observed. An experimental idea of patient's health conditions will be given and the monitoring of environmental condition can be done based upon that. It is an open-platform based medicine box with enhanced connectivity and interchange ability for integration of devices and services. The box is integrated with communication capability enabled by ZigBee and actuation capability enabled by flexible and wearable bio-medical sensors. SMS alerts will be given to the caretakers if any vital signs is found. Monitoring the conditions of the patient is continuously done with an IP address of WIFI. The daily activities of an elderly person is observed and based upon that, medication is given and keep track of their daily activities [12].

The trend in IoT has brought a significant improvement in healthcare sectors. The combination of IoT-cloud plays a vital role in healthcare by providing a better way to support affordable and quality patient care. In the model, the system senses the patient's symptoms. The sensed data is collected and sent to the gateway via Bluetooth and then to the cloud server through Docker container using internet. Thus, the doctor can diagnose

and monitor the patient from any location. Lifesaving application has been invented by the rise in in the field of IoT. The proposed system tells us how data is integrated with healthcare system based on IoT with the help of a Raspberry Pi and a Docker container. The medical data is collected and stored by the Raspberry Pi through the attached sensors. The data received is transferred to the mobile application of the users. Thus the patients can improve their health based upon the data provided through the application [9].

An in-patient monitoring system is being introduced here. The system implements two sub-systems: The physical states of patient with data acquisition and communication system on ZigBee technology and the monitoring by hospital control centre. The patients' movements and physical parameters are observed continuously. The information from data acquisition system is conveyed to the control centre monitored by hospital. The hospital database receives information of each patient from data acquisition system and updates to database. The doctor can analyse and diagnose the patient from the data that has been recorded continuously. A wireless sensor technology is used. For the convenient features it provides, patient can use it effectively. The real time system can record and monitor the physical state and movement parameters thus providing correct way for the diagnosis by the doctor. With an intelligent diagnosis software, early stages of the disease can be detected and helps the patient in-time and prevent the sudden demise of the patient. ZigBee can be implemented within short range of distance say about 200m and is best suited for in-patient monitoring [13].

The system proposed is implemented with three parts: a smart sensor, a mail processing unit, and the network communication unit. The system gathers bio-signals in real time: analyze those, display and store the data. The doctor at a remote location can access these data, diagnose it online and update the data for further diagnosis with the internet. As it is easy to use, cost efficient and provide satisfying functionalities, people in rural areas and towns can make use of it. As the healthcare facilities is getting costlier each day, reliable solutions have to be found so that medication procedure can be relocated from hospital to home environment. The monitoring process is shifted to home environment with reduced cost and also in more reliable manner [14].

Medicines are the basic remedy for the prevention and curing of almost all the diseases. A proper medication can cure many of the risky diseases. Improper intake of medicines can have side and adverse effects. The system helps in overcoming the negligence regarding the intake by providing intimation that is alerts about the right medication to be taken at the prescribed time. A buzzer and LED are implemented to provide audio and visual alerts respectively. An E-mail will be also sent to a caretaker or a family member to remind the patient in case if it is forgotten despite of the alerts given. A report of patient's weekly intake of medicine routine is sent through mail to the concerned doctor [15].

In the system, the readings from the Arduino board is sent to the database via ESP8266 module and this data stored in the servers can be accessed by doctors and the registered patients. The system helps in independently monitoring the patients' health all by themselves and IoT system gives direct alerts to the concerned medical assistants at the hospital. A mobile application can also be created for efficient personal monitoring system. The data can be retrieved and information from the user and also the database can be accessed through mobile app and user can keep track of medication in an interactive way [16].

The system is designed to help elderly people who are under continuous medication procedure. It helps them in taking medicine in an easier manner without any possibility of missing the intake of pills. It monitors and reduces the risk of over or under dosages by accident. The negligence regarding medicine intake can cause serious issues such as long time for recovery, illness and even demise of the patient. Such things are prevented by giving proper alerts, it also gives an alert to the caretaker if the patient does not consume the medicine. The system increases the effectiveness of medication procedure and save lives [6].

CHAPTER 03

SYSTEM ANALYSIS

Existing System

In the existing System is an application for the Android platform mobiles and the IoT medicine box which are designed to give alert to the patient about the medicine intake. The android application will remind their user about the medicine in-take schedule. This reminder will be set in the mobile with the help of the reminder application. The reminders will be automatically set as per the prescription.

IoT medicine box is designed with Arduino board, the alerts for medication is set manually by the patient. And there is no connection between hospital people and the IoT medicine box patient taken that box privately for their own use.

The patient is not alerted automatically by the hospital regarding intake of medicines and their dosages. Periodic visit for check up by the patient is also monitored manually.

Limitations of Existing System

- Reminders are not automatically sets. So every existing system requires manual work of setting the reminder.
- Existing systems are time consuming because of manually setting the reminders.
- There is no facility of storing the original prescription in any of the existing system.
- There is no facility of reminding the doctor's next appointment in the existing system.
- There is possibility of hanging down the existing systems due to the normal work.

Proposed System

We are designing our system in more effective way to overcome the problem in the existing system. In our proposed system the alert from the hospital is sent to the cell phone of the patient and the Smart Medicine Box gets automatically updated without any manual intervention.

Medicines are the basic remedy for the prevention and curing of almost all the diseases. A proper medication can cure many of the risky diseases. Improper intake of medicines can have side and adverse effects. The system helps in overcoming the negligence regarding the intake by providing intimation that is alerts about the right medication to be taken at the prescribed time. A buzzer and LED are implemented to provide audio and visual alerts respectively.

The patient can take the medicine with the specified dosage at regular interval of time without any other's guidance. The medical reports and the prescription of the patient will be updated automatically to the patient database. Acknowledgement will be received from the patient for the confirmation of the intake of tablet.

The IR sensor is placed to detect medicine box. When patient tries to reach the medicine box, the medicine consuming action is considered as event trigger factor. An image is captured while this action is performed, by FTP load, notification is sent to the mobile phone of the caretaker.

Applications of Proposed System

- It helps the hospital to have continuous monitoring over the patient's health and management of patient information.

Smart medicine box can also be used at places like old age home, rural health centres

CHAPTER 04

SYSTEM DESIGN AND ARCHITECTURE

Systems design is the process of defining the architecture, components, modules, interfaces, and data for a system to satisfy specified requirements. Systems design could be seen as the application of systems theory to product development.

High Level Design

High-level design (HLD) explains the architecture that would be used for developing a software product. The architecture diagram provides an overview of an entire system, identifying the main components that would be developed for the product and their interfaces. The HLD uses possibly nontechnical to mildly technical terms that should be understandable to the administrators of the system.

System Architecture

A system architecture or systems architecture is the conceptual model that defines the structure, behavior, and more views of a system. An architecture description is a formal description and representation of a system, organized in a way that supports reasoning about the structures and behaviors of the system.

The architecture of the proposed system is shown in the Fig 5.1. The system architecture can be divided into two modules,

Hospital Module: It deals with the website that provides facility to manage the patient records and in this module receptionist and doctor are two sub modules.

Receptionist: Receptionist adds an appointment for the doctor for the patient who is already registered and even for the new patient. He or she can also update the patient reports to the database and can also add new specialists among the doctor if any.

Doctor: The doctor can view the current day's appointments and the patient details. He or she can also view the reports of the patients which was updated by the receptionist and updates the prescription page based on the box number.

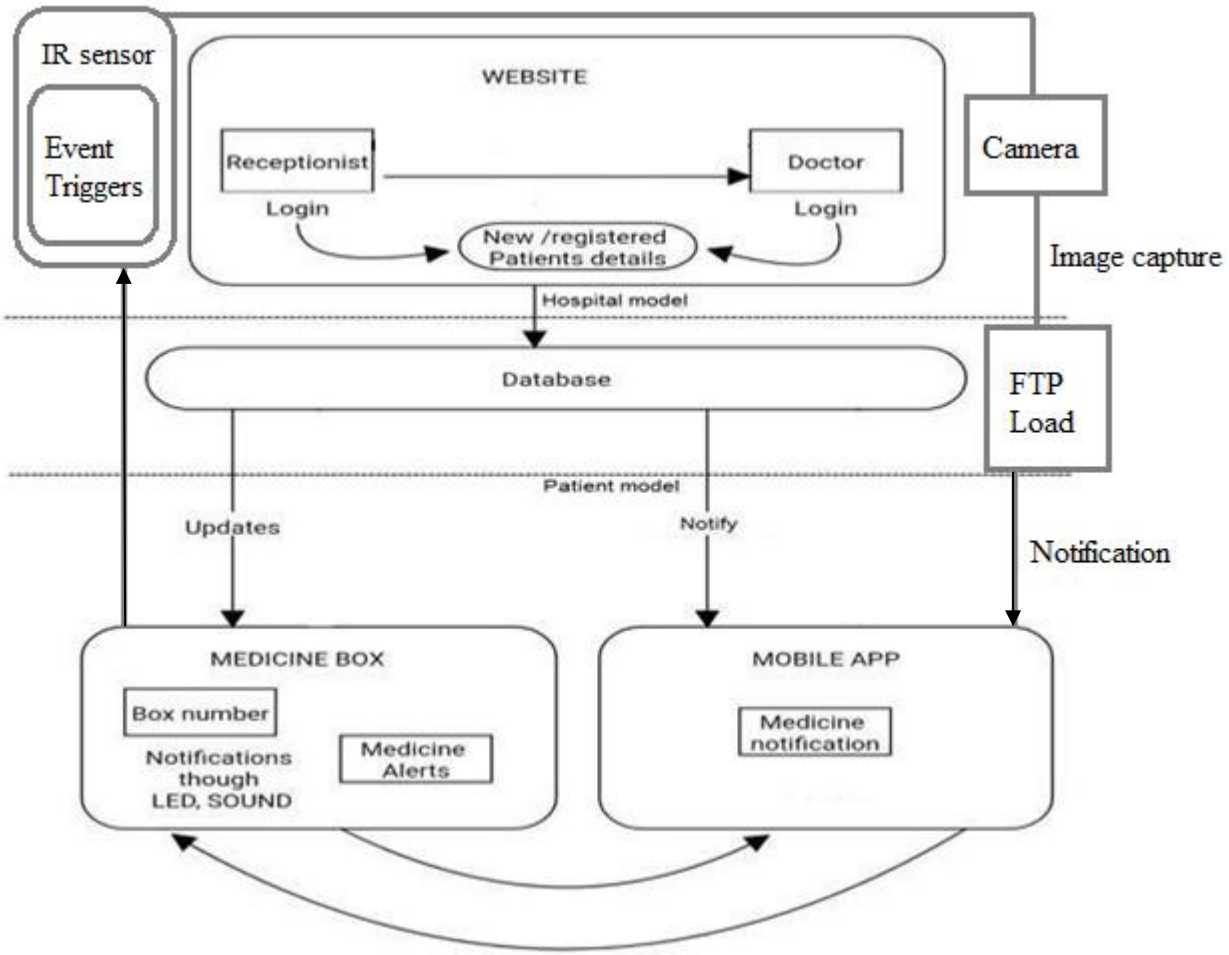


Figure 5.1: System Architecture of Proposed System

Patient Module: It deals with the application that notifies the patient to take medicine at regular intervals. It consists of Smart Medicine Box and Android Application as the two sub modules.

Smart Medicine Box: This medicine box is linked to the cloud where the complete patient data will be stored, from which the prescription data will be fetched and the medicine box will be updated automatically and also the timely alerts will be given. It notifies the patient to take the medicine at regular interval of time with the help of LED light and the sound notification from the speaker.

IR Sensor Module

The IR sensor is placed to detect medicine box. When patient tries to reach the medicine box, the medicine taking action is considered as event trigger factor. An image is captured

while this action is performed, by FTP load, notification is sent to the mobile phone of the caretaker.

Android Application: As the patient may not be near the medicine box all the time, so this android application helps in notifying the patients to take medicine at the regular intervals.

Control Flow Diagram

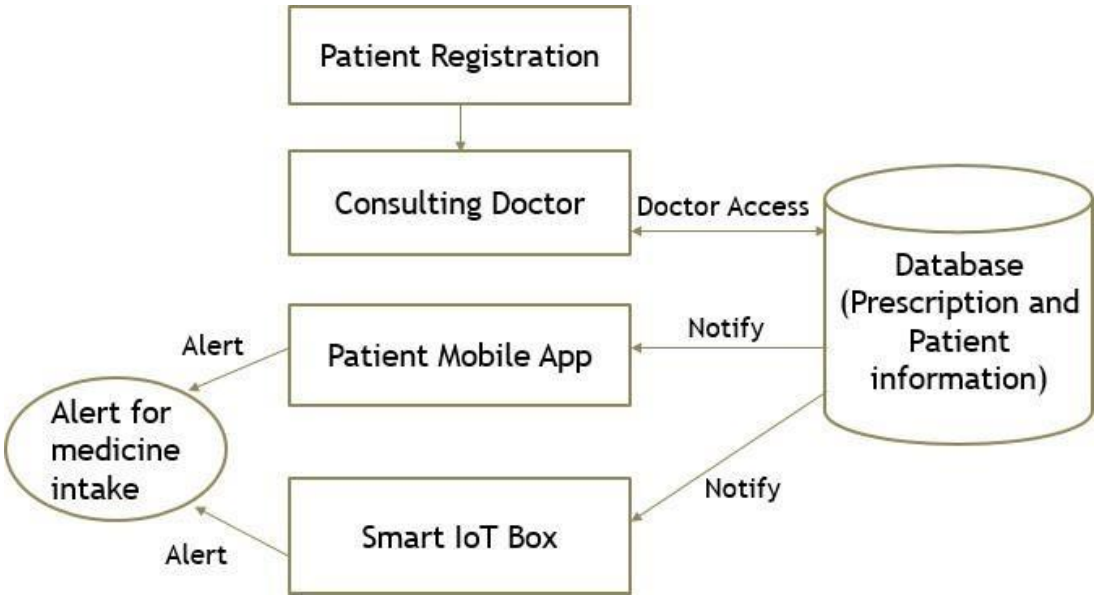


Figure 5.2: Control Flow Diagram of Proposed System

- Initially the receptionist logins and adds the types of specialist and new doctors using the hospital website.
- Then the receptionist adds an appointment for the concerned doctor based onthe patient requirement.
- The receptionist can also upload the report of the patient which will be viewed by the concerned doctor.
- When the doctor logins into the hospital website he can view the current day appointments. Then he treats the patients as per the order of the appointment and updates the prescription page based on the patient report.
- All these complete details of the patient will be stored the cloud database.

- The IoT medicine box and the android application will get updated from this cloud database.
- The IoT box will notify the patient at the regular intervals by glowing the LED light of the specific box and by the speaker sound.
- At the same time the notification will be sent to the patient's mobile application as it is time to take the medicine.

Low Level Design

Low-level design (LLD) is a component-level design process that follows a step-by-step refinement process. This process can be used for designing data structures, required software architecture, source code and ultimately, performance algorithms. Overall, the data organization may be defined during requirement analysis and then refined during data design work. Post-build, each component is specified in detail.

The LLD phase is the stage where the actual software components are designed. During the detailed phase the logical and functional design is done and the design of application structure is developed during the high-level design phase.

Sequence Diagram

A sequence diagram in a Unified Modelling Language (UML) is a kind of interaction diagram that shows how processes operate with one another and in what order. A sequence diagram shows object interactions arranged in time sequence. It depicts the objects and classes involved in the scenario and the sequence of messages exchanged between the objects needed to carry out the functionality of the scenario.

A sequence diagram shows, as parallel vertical lines (lifelines), different processes or objects that live simultaneously, and as horizontal allows, the messages exchanged between them, in the order in which they occur. This allows the specifications of simple runtime scenarios in a graphical manner.

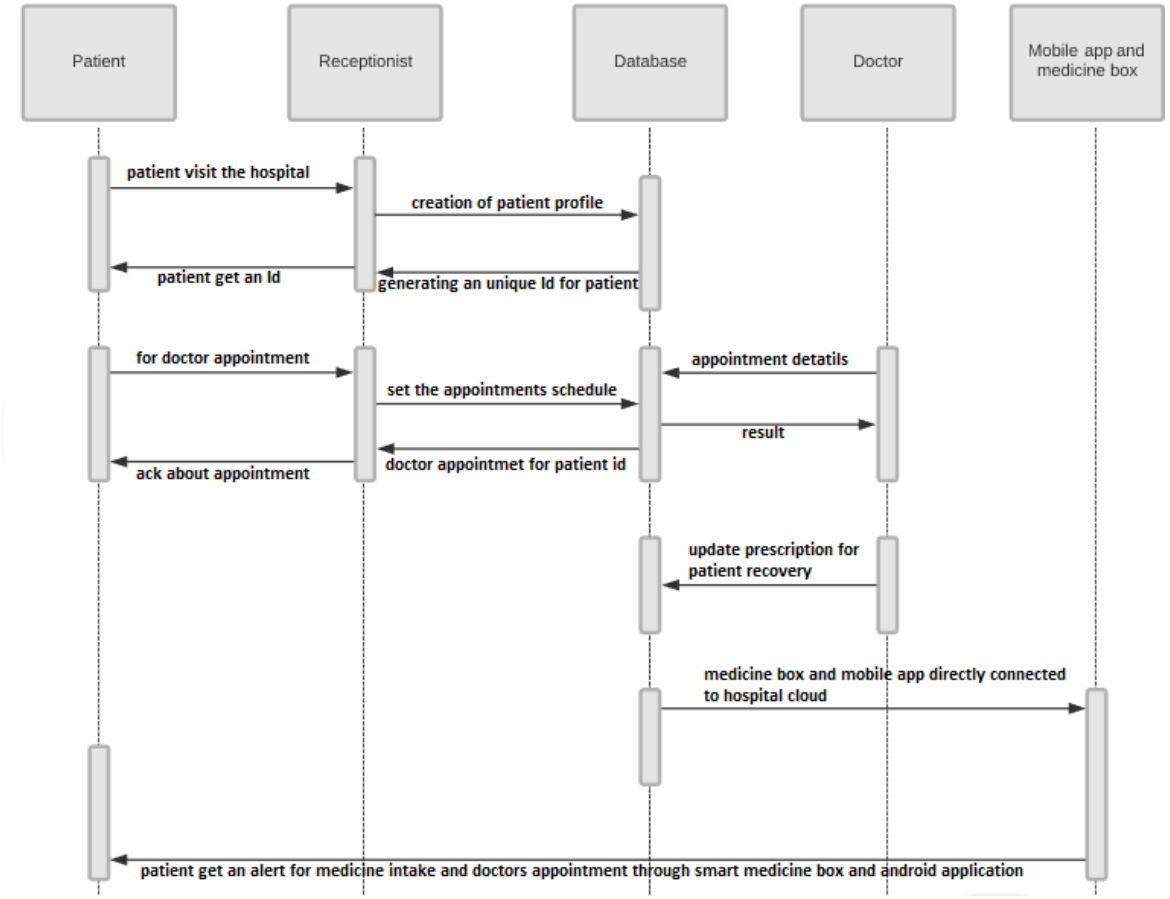


Figure 5.3: Sequence Diagram of Proposed System

Data Flow Diagram

A data flow diagram (DFD) is a graphical representation of the "flow" of the data through an information system, modelling its process aspects. Often they are a preliminary step used to create an overview of the system which can later be elaborated. DFDs can also be used for the visualization of data processing (structured design). For each data flow, at least one of the endpoints (source and destination) must exist in a process. The refined representation of a process can be done in another data-flow diagram, which subdivides this process into sub-processes.

A DFD show what kinds of information will be input to and output from the system, where the data will come from and go to, and where the data will be stored. It does not show information about the timing of processing, or information about whether processes will operate in parallel.

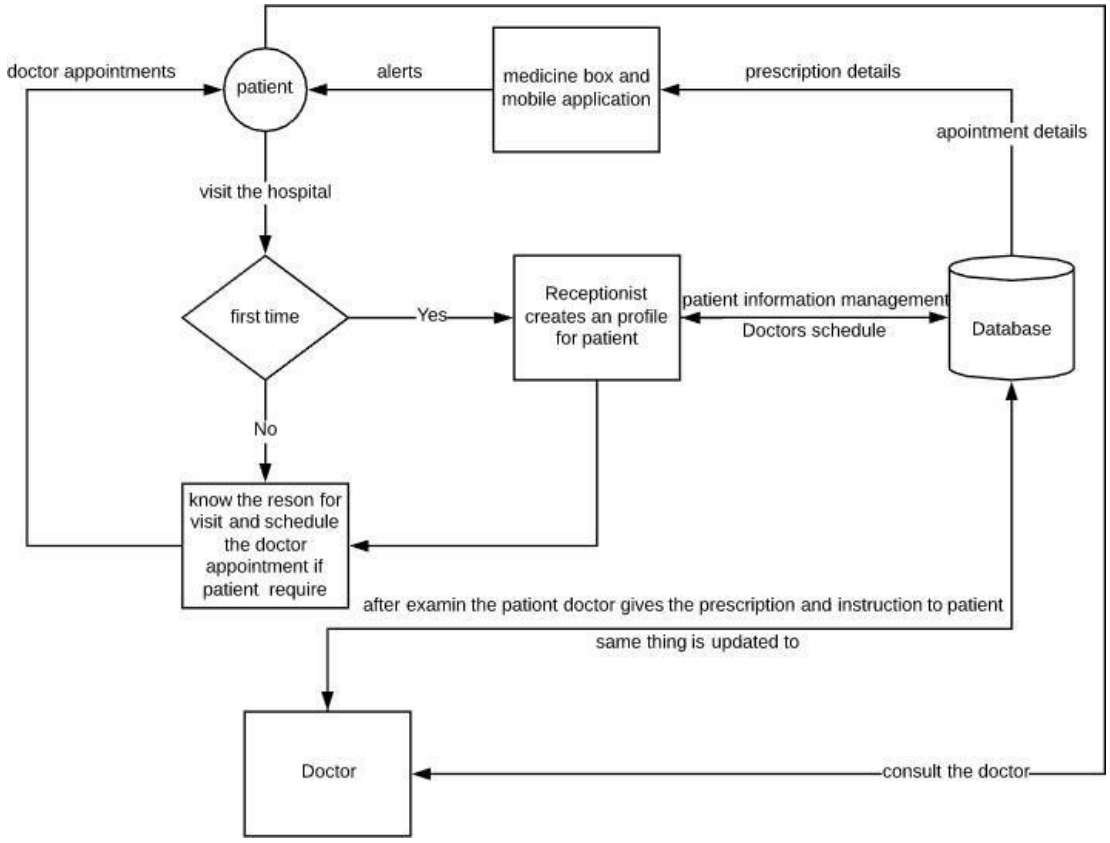
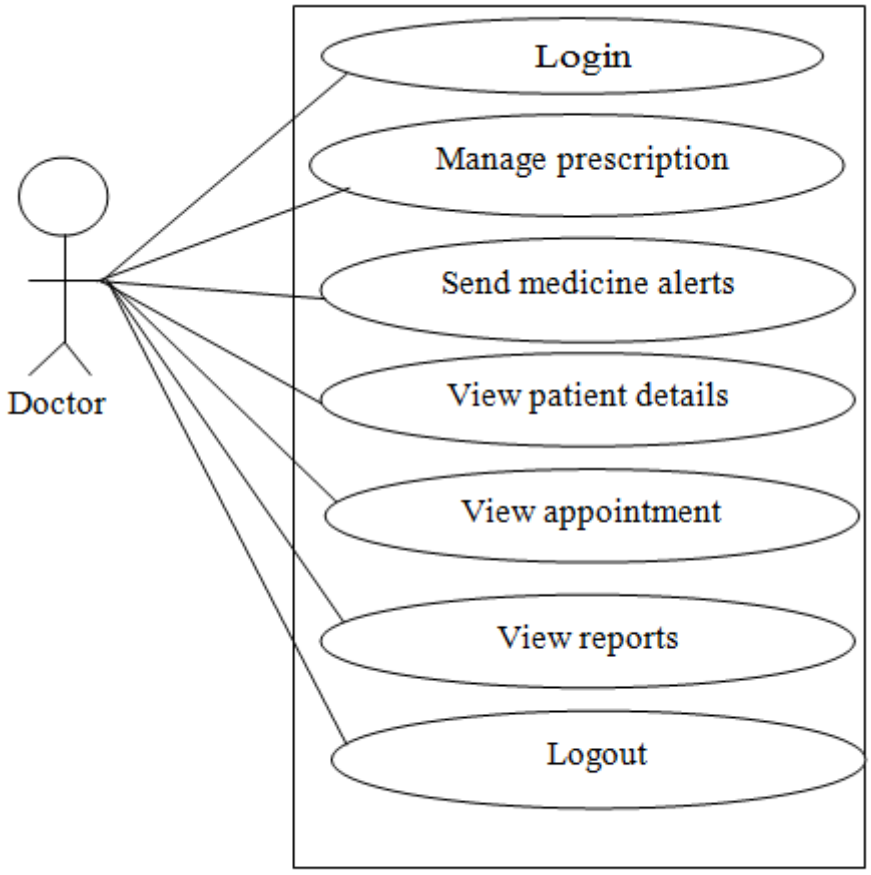


Figure 5.4: Data Flow Diagram of Proposed System

Use case diagrams

Use case diagrams model the functionality of a system using actors and use cases. Use cases are services or functions provided by the system to its users. Use case diagrams are usually referred to as behaviour diagrams used to describe a set of actions (use cases) that some system or systems (subject) should or can perform in collaboration with one or more external users of the system.

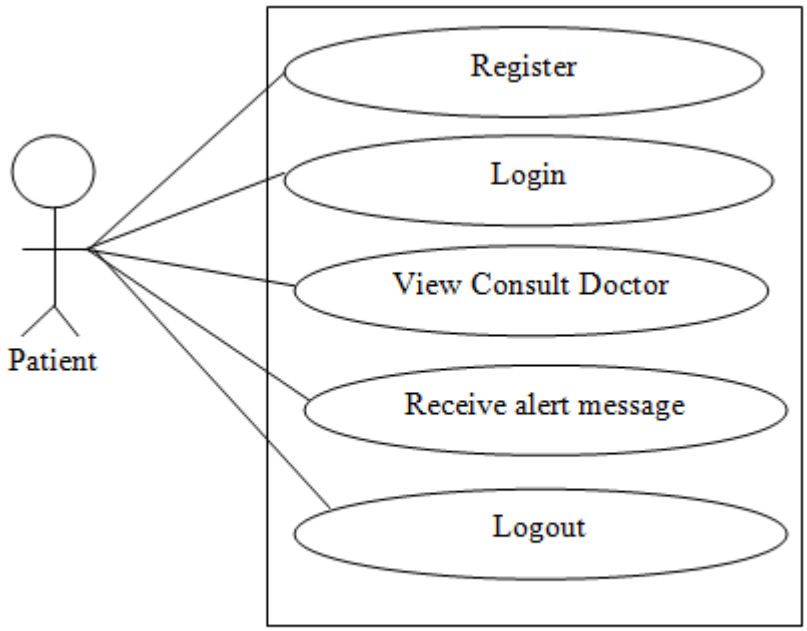


Doctor Use Case Diagram

Use Case Name: Doctor Module functionalities

- **Goal:** Processing of data and storing it in database.
- **Actors**: Doctor.
- **Pre-Condition:** Login

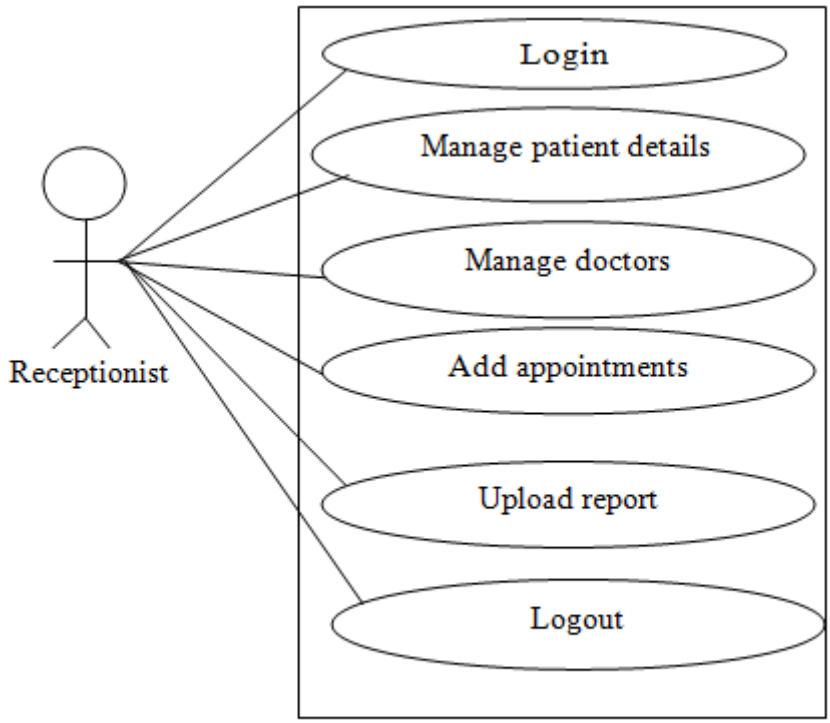
- **Normal Flow:**
  - Manage prescription
  - Send alerts regarding medicine
  - View patient details, appointments, reports
- **Post condition:** Logout



Patient Use Case Diagram

Use Case Name: Patient Module functionalities

- **Goal:** Processing of data and storing it in database.
- **Actors**: Patient.
- **Pre-Condition:** Login
- **Normal Flow:**
  - View consult doctor option
  - Receive alert messages
- **Post condition:** Logout



Receptionist Use Case Diagram

Use Case Name: Receptionist Module functionalities

- **Goal:** Processing of data and storing it in database.
- **Actors**: Receptionist.
- **Pre-Condition:** Login
- **Normal Flow:**
  - Manage patient details, doctors
  - Add appointments
  - Upload report
- **Post condition:** Logout

CHAPTER 05

SYSTEM REQUIRMENTS

Software Requirements and Specification

Software Requirements Specification (SRS) provides an overview of the entire SRS with purpose, scope, definitions, acronyms, abbreviations, references, and overview of the SRS. A software requirements specification (SRS) is a comprehensive description of the intended purpose and environment for software under development. The SRS fully describes what the software will do and how it will be expected to perform the various gestures and determining its accuracy. The SRS is a requirements specification for a software system, is a description of the behavior of a system to be developed and may include a set of use cases that describe interactions the users will have with the software. In addition, it also contains non-functional requirements. Nonfunctional requirements impose constraints on the design or implementation. Software requirements specification establishes the basis for agreement between customers and contractors or suppliers on what the software product is to do as well as what it is not expected to do. Software requirements specification permits a rigorous assessment of requirements before design can begin and reduces later redesign. It should also provide a realistic basis for estimating product costs, risks, and schedules. An SRS minimizes the time and effort required by developers to achieve desired goals and it will also minimizes the development cost. A good SRS defines how an application will interact with system hardware, other programs, and human users in a wide variety of real-world situations.

Functional Requirements

A functional requirement defines a function of a software system or its components. A function is described as a set of inputs, the behavior, and outputs. Functional requirements may be calculations, technical details, data manipulation and processing and other specific functionality that define what a system is supposed to accomplish. Behavioral requirements describing all the cases where the system uses the functional requirements are captured in use cases. Functional requirements are supported by non-functional requirements (also known as quality requirements), which impose constraints on the design or implementation (such as performance requirements, security, or reliability).

In some cases, a requirements analyst generates use cases after gathering and validating a set of functional requirements. The hierarchy of functional requirements is: user/stakeholder request → feature → use case → business rule. Each use case illustrates behavioral scenarios through one or more functional requirements. Often, though, an analyst will begin by eliciting a set of use cases, from which the analyst can derive the functional requirements that must be implemented to allow a user to perform each use case.

Our project helps the patient to follow the routine medication procedures by providing notifications regularly.

In our project, we mainly focus to notify the patient about their intake of medicine at regular interval of time. Initially patient get registered to the hospital by filling all his/her details and a unique patient id is generated for patient. Patient consult the allotted doctor. Doctor access all the details of the patient through hospital database then treats the patient and updates the patient prescription to the cloud with that of the patient id. Patient is given with a smart medicine box and provided with android application. The medicine box alerts the patient to take the tablets at proper time and also the notification is sent to the patient's mobile.

Non-Functional Requirements

In systems engineering and requirements engineering, a non-functional requirement is a requirement that specifies criteria that can be used to judge the operation of a system, rather than specific behaviors. They are contrasted with functional requirements that define specific behaviors or functions. Non-functional requirements define how a system is supposed to be. Non-functional requirements are in the form of "system shall be <requirement>", an overall property of the system as a whole or of a particular aspect and not a specific function. The system's overall properties commonly mark the difference between whether the development project has succeeded or failed. Non-functional requirements are often called "quality attributes" of a system.

Software Requirements

Table 3.1: Software Requirements

Operating System	Windows 8 and above
Tools	Visual Studio 2010 and android studio
Back End	MYSQL
Android Software	SDK
Coding Language	C# and JAVA

Hardware Requirements

Table 3.2 Hardware Requirements

Processor	64-bit(x64) i3 processor (1.7GHz)
Memory	4GB RAM
Hard Disk	500GB
Speed	2.4 GHz+
App Version	Ice-cream Sandwich to Nougat
API level	15 to 25

CHAPTER 06

IMPLEMENTATION

An implementation is a realization of a technical specification or algorithm as a program, software component, or other computer system through computer programming and deployment. Many implementations may exist for a given specification or standard. For example, web browsers contain implementations of World Wide Web Consortium-recommended specifications, and software development tools contain implementations of programming languages.

About Tools

The tools which were used for implementation of the project are as follows

- Microsoft Visual Studio 2010
- Arduino IDE
- Android Studio
- MYSQL

Microsoft Visual Studio 2010

Microsoft Visual Studio is an integrated development environment (IDE) from Microsoft. It is used to develop computer programs for Microsoft Windows, as well as web sites, web applications and web services. Visual Studio uses Microsoft software development platforms such as Windows API, Windows Forms, Windows Presentation Foundation, Windows Store and Microsoft Silverlight. It can produce both native code and managed code.

Visual Studio includes a code editor supporting IntelliSense (the code completion component) as well as code refactoring. The integrated debugger works both as a source-level debugger and a machine-level debugger. Other built-in tools include a forms designer for building GUI applications, web designer, class designer, and database Schema designer. It accepts plug-ins that enhance the functionality at almost every level— including adding support for source-control systems (like Subversion) and adding new toolsets like editors and visual designers for domain-specific languages or toolsets for other aspects of the software development lifecycle (like the Team Foundation Server Client: Team Explorer).

Visual Studio supports different programming languages and allows the code editor and debugger to support (to varying degrees) nearly any programming language, provided a language-specific service exists. Built-in languages include C,[6] C++and C++/CLI (via Visual C++), VB.NET (via Visual Basic .NET), C# (via Visual C#), and F# (as of Visual Studio 2010[7]). Support for other languages such as Python, Ruby, Node.js, and M among others is available via language services installed separately. It also supports XML/XSLT, HTML/XHTML, JavaScript and CSS. Java (and J#) was supported in the past.

Arduino IDE

The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in the programming language Java. It is used to write and upload programs to Arduino compatible boards, but also, with the help of 3rd party cores, other vendor development boards. Arduino IDE is used to write and burn that code to the NodeMCU micro controller board.

NodeMCU

The NodeMCU (Node Microcontroller Unit) is an open source software and hardware development environment that is built around a very inexpensive System-on-a-Chip (SoC) called the ESP8266. The ESP8266, designed and manufactured by Espressif Systems, contains all crucial elements of the modern computer: CPU, RAM, networking (Wi-Fi), and even a modern operating system and SDK.

Hardware

The NodeMCU hardware has evolved through several versions that feature variations in memory capacity and peripheral-device support.

Figure 6.1: ESP8266

NodeMCU v3 is a development board which runs on the ESP8266 with the Espressif Non- OS SDK, and hardware based on the ESP-12 module. The device features 4MB of flash memory, 80MHz of system clock, around 50k of usable RAM and an on-chip Wi-Fi Transceiver. The USB port is connected directly to the system on a chip (SoC).

Power supply

The Nordic nRF52 DK is equipped with on-board Li-Po button cell to power-up the device. NRF52 DK can, also, be powered via external power supply through related connector, external Li-Po battery, or via USB Micro B connector.

When powered from a battery alone, the power management IC switches off the internal regulator and supplies power to the system directly from the battery. Power source (Debugger VDD, Li-Po, and USB) is selected by on-board switch SW9.

NodeMCU Supported Protocols

- **ADC:** Support for measuring analog input (voltage level) on the NodeMCU board's A0 pin.
- **HTTP:** Support for writing code to handle HTTP requests.
- **SSL / TLS:** Support for HTTPS secure connections.
- **MQTT:** Support for the MQTT protocol to send data to other devices or servers using a publish/subscribe model over TCP/IP.
- **Web socket:** A convenience library to access web socket-based web services.
- **DHT:** A convenience library to read data from DHT family of environmentalsensors.
- **End-user setup:** Support a "capture portal" to let the user enter her own Wi-Fi password, without having to hardcode Wi-Fi credentials in application code.

Android Studio

Android Studio is the official integrated development environment (IDE) for Google's Android operating system, built on Jet Brains' IntelliJ IDEA software and designed specifically for Android development. It is available for download on Windows, macOS and Linux based operating systems. It is a replacement for the Eclipse Android Development Tools (ADT) as the primary IDE for native Android application development.

Android Studio was announced on May 16, 2013 at the Google I/O conference. It was in early access preview stage starting from version 0.1 in May 2013, then entered beta stage starting from version 0.8 which was released in June 2014. The first stable build was released in December 2014, starting from version 1.0.

Android Studio supports all the same programming languages of IntelliJ (and CLion) e.g. Java, C++, and more with extensions, such as Go; and Android Studio 3.0 or later supports Kotlin and "all Java 7language features and a subset of Java 8 language features that vary by platform version.

The following features are provided in the current stable version,

- Cradle-based build support.
- Android-specific refactoring and quick fixes.
- Lint tools to catch performance, usability, version compatibility and other problems.
- ProGuard integration and app-signing capabilities.
- Template-based wizards to create common Android designs and components.
- A rich layout editor that allows users to drag-and-drop UI components, option to preview layouts on multiple screen configurations.
- Support for building Android Wear apps.
- Built-in support for Google Cloud Platform, enabling integration with Firebase Cloud Messaging (Earlier 'Google Cloud Messaging') and Google App Engine.
- Android Virtual Device (Emulator) to run and debug apps in the Android studio.

MySQL

MySQL is an open-source relational database management system (RDBMS). MySQL is free and open-source software under the terms of the GNU General Public License, and is also available under a variety of proprietary licenses. MySQL was owned and sponsored by the Swedish company MySQL AB, which was bought by Sun Microsystems (now Oracle Corporation). In 2010, when Oracle acquired Sun, Widenius forked the open-source MySQL project to create Maria DB.

MySQL is a component of the LAMP web application software stack (and others), which is an acronym for *Linux, Apache, MySQL, Perl/PHP/Python*. MySQL is used by many database-driven web applications including Drupal, Joomla, PhpBB and WordPress.

MySQL is also used by many popular websites, including Facebook, Twitter, Flickr, and YouTube. MySQL is written in C and C++. Its SQL parser is written in yacc, but it uses a home-brewed lexical analyzer. MySQL works on many system platforms, including AIX, BSDi, FreeBSD, HP-UX, e-ComStation, i5/OS, IRIX, Linux, macOS, Microsoft Windows, NetBSD, Novell NetWare, OpenBSD, OpenSolaris, OS/2 Warp, QNX, Oracle Solaris, Symbian, SunOS, SCO OpenServer, SCO UnixWare, Sanos and Tru64. A port of MySQL to OpenVMS also exists.

The MySQL server software itself and the client libraries use dual- licensing distribution. They are offered under GPL version 2, or a proprietary license. Support can be obtained from the official manual. Free support additionally is available in different IRC channels and forums. Oracle offers paid support via its MySQL Enterprise products. They differ in the scope of services and in price. Additionally, a number of third-party organizations exist to provide support and services, including MariaDB and Percona. MySQL has received positive reviews, and reviewers noticed it "performs extremely well in the average case" and that the "developer interfaces are there, and the documentation (not to mention feedback in the real world via Web sites and the like) is very, very good". It has also been tested to be a "fast, stable and true multi-user, multi-threaded SQL database server".

Programming Language Used

A programming language is a formal constructed language designed to communicate instructions to a machine, particularly a computer. Programming languages can be used to create programs to control the behavior of a machine or to express algorithms.
The programming languages which we used are,

- C#
- Java

C# (Backend)

C# is a multi-paradigm programming language encompassing strong typing, imperative, declarative, functional, generic, object-oriented (class-based) and component-oriented programming disciplines. It w a s developed by Microsoft within its .NET initiative and later approved as a standard by Ecma (ECMA-334) and ISO (ISO/IEC 23270:2006). C# is one of the programming languages designed for the Common Language Infrastructure.

Java (Android Studio)

Java is a popular general-purpose programming language and computing platform. It is fast, reliable, and secure. According to Oracle, the company that owns Java, Java runs on 3 billion devices worldwide. Considering the number of Java developers, devices running Java, and companies adapting it, it's safe to say that Java will be around for many years to come. This guide will provide everything you need to know about Java programming language before you learn it. More specifically, you will learn about features of Java programming, its applications, reasons to learn it, and how you can learn it the right way.

Features of Java Programming Language

Java is platform independent: Java was built with the philosophy of "write once, run anywhere" (WORA). The Java code (pure Java code and libraries) you write on one platform (operating system) will run on other platforms with no modification. To run Java, an abstract machine called Java Virtual Machine (JVM) is used. The JVM executes the Java bytecode. Then, the CPU executes the JVM. Since all JVMs works exactly the same, the same code works on other operating systems as well, making Java platform-independent.

An object-oriented Language: There are different styles of programming. Object-oriented approach is one of the popular programming styles. In object-oriented programming, a complex problem is divided into smaller sets by creating objects. This makes your code reusable, has design benefits, and makes code easier to maintain.

Many programming languages including Java, Python, and C++ has object-oriented features. If you are serious about programming, you should definitely learn object-oriented style of programming.

Java is fast: The earlier versions of Java were criticized for being slow. However, things are completely different now. The new JVMs are significantly faster. And, the CPU that executes JVM are also getting more and more powerful. Now, Java is one of the fastest programming languages. Well optimized Java code is nearly as fast as lower-level languages like C/C++, and much faster than Python, PHP etc.

Java is secure: The Java platform provides various features for security of Java applications. Some of the high-level features that Java handles are:

- Provides secure platform for developing and running applications
- Automatic memory management, reduces memory corruption and vulnerabilities
- Provides secure communication by protecting the integrity and privacy of data transmitted.

Large Standard Library: One of the reasons why Java is widely used is because of the availability of huge standard library. The Java environment has hundreds of classes and methods under different packages to help software developers like us. For example,

- java.lang - for advanced features of strings, arrays etc.
- java.util - for data structures, regular expressions, date and time functions etc.
- java.io - for file input or output, exception handling etc.

Working Process

Our project includes three modules, first one is the hospital website which stores complete details of the patient in the cloud, second is android application for the patient to obtain alert message regularly regarding the medicine intake from the data stored in the cloud and third module is the IoT module that is the smart medicine box which alerts the patient at proper time by switching on the LED light of the respective medicine to be taken and also by with the help of the speaker sound. The hospital website includes two logins that is the receptionist login and the doctor login. The receptionist can add the types of specialist and new doctors using the hospital website. The doctor can update the patient prescription. [5]

Initially the receptionist logins and adds an appointment for the concerned doctor by selecting the specialist type and then he selects the doctor among the selected specialist type. Then he enters the patient phone number, if the patient is already registered the details of the patient will be fetched from the cloud database automatically otherwise the receptionist as to enter the patient information manually and adds an appointment. The receptionist can also upload the reports of the patient into the cloud database which can be viewed by the concerned doctor of the respective patient.

When the doctor logins into the hospital website, he can view the current appointments on the starting page as he logins. Then he treats the patient and updates the prescription page by analyzing the patient report. In the prescription page the doctor enters the medicine name and selects the box number in which this medicine should be stored. The doctor can delete the medicine from the prescription and add new medicine.

The Smart medicine box and the android application gets updated from the prescription table which is stored in the cloud database. The IoT box will notify the patient at the regular intervals by glowing the LED light of the specific box and by emitting sound from the speaker. At the same the notification will be sent to the patient mobile application as it is the time to take the medicine.

The IR sensor is placed to detect medicine box. When patient tries to reach the medicine box, the medicine taking-action is considered as event trigger factor. An image is captured while this action is performed, by FTP load, notification is sent to the mobile phone of the caretaker.

CHAPTER 07

TESTING

7.1 Introduction

Software testing is performed to verify that the completed software package functions according to the expectations defined by the requirements/specifications.

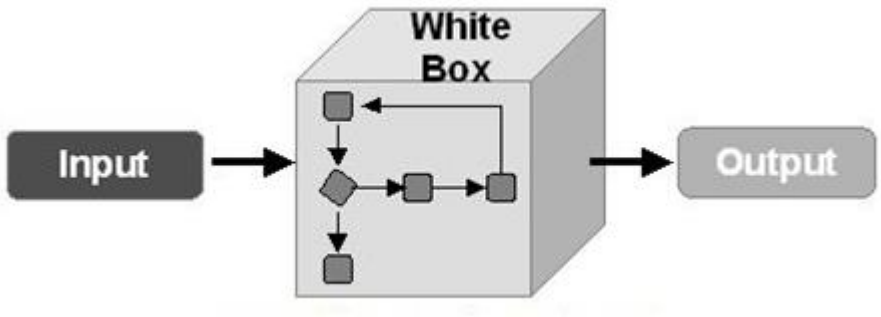
The major objectives of Software testing are as follows:

- Finding defects which may get created by the programmer while developing the software.
- To prevent defects.
- To make sure that the end result meets the business and user requirements.
- To ensure that it satisfies the BRS that is Business Requirement Specification and SRS that is System Requirement Specifications.
- To gain the confidence of the customers by providing them a quality product.

7.2 Types of Testing Performed

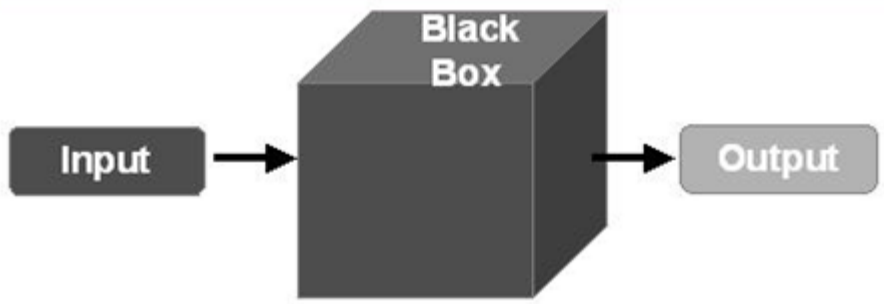
1) White box testing:

For the coding part of the **patient monitoring** application, the software testing method we use is white box testing in which the internal structure, design, implementation of all the modules are being tested. We provide inputs to exercise paths through the code and determine the appropriate outputs. Programming and the implementation knowledge is essential.



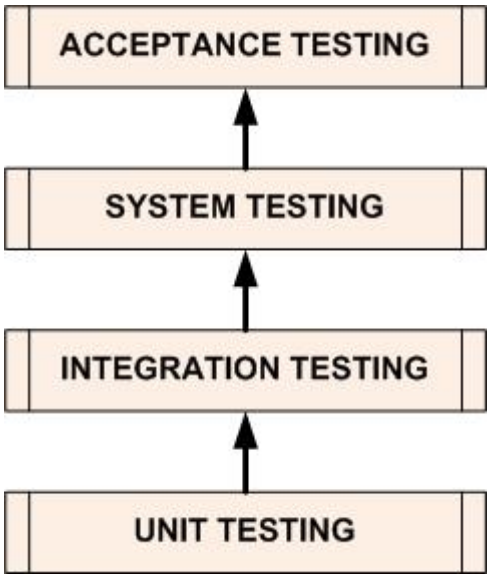
2) Black box testing:

In our project, we are going to adapt Black box testing which is a testing technique that ignores the internal mechanism of the system and focuses on the output generated against any input and execution of the system. It is also called functional testing since we are focusing on the functionalities of our developed application.



7.3 Levels of Testing

We are following **four levels of software testing in our project.**



Different Approaches of Testing

1. Unit Testing

Initially, individual units and components such as login pages, buttons, validation forms of each module of our application are tested. It is a level of the software testing process where the purpose is to validate that each unit of the software performs as it is designed.

2) Integration testing

After performing unit testing on our application, all the individual units of two or more modules are combined and tested as a group. The purpose of this level of testing is to expose faults in the interaction between integrated units.

3) System Testing

We go for a complete system (our application) checking. The purpose of this test is to evaluate the system's compliance with the specified requirements.

4) Acceptance Testing

Finally, we validate our whole system and then our application is tested for acceptability. The purpose of this test is to evaluate the system's compliance with the business requirements and assess whether it is acceptable for delivery.

7.4 Design of Test Cases

This chapter describes the different testing approaches concerned with this project. "System Testing" is a vital process to be carried out for the success of any system. The feedback of testing is of great importance because they precisely state what is lacking in the system and inclusion of which will result in a better one. Testing is a stage of implementation which is aimed at ensuring that the system works accurately and efficiently before live operations. For each phase of development, different techniques for detecting and eliminating errors that originates in that phase are used. This is done so that errors from a model do not carry on to the

system effecting to the further development.

7.5 Test Cases

We write test cases which have components that describe input, action and an expected response, in order to determine if a feature of our application is working correctly.

Test Case 1:

Step	Description	Input	Expected result	Actual result	Status
1	Open the application	N/A	Patient Monitoring Application Web page must be Displayed	Patient Monitoring Application Web page must be Displayed	Pass
2	Click on login Login as receptionist	N/A	Login form must be displayed	Login form is displayed	Pass
3	Enter Id and password, Click on login	user Id: receptionist @gmail.com Password: 123	Home page for receptionist must be displayed	Home page for receptionist is displayed	Pass
4	Add New Doctors	Doctors details	Receptionist must be able to add doctors details	Doctors details added successfully	Pass
5	Add specializatio n	Specializatio n	Receptionist must be able to add specializatio n details	Specializatio n details added successfully	Pass
6	Upload Patients Report	Patients Report	Receptionist must be able to upload patient report	Receptionist successfully uploaded patient report	Pass

Test Case 2:

Step	Description	Input	Expected result	Actual result	Status
1	Open the application	N/A	Patient Monitoring Application Web page must be Displayed	Patient Monitoring Application Web page must be Displayed	Pass
2	Click on login Login as Doctor	N/A	Login form must be displayed	Login form is displayed	Pass
3	Enter Id and password, Click on login	user Id: doctor @gmail.com Password: 123	Home page for doctors must be displayed	Home page for doctors is displayed	Pass
4	Add prescription	Patient, Prescriptions	Doctors must be able to add prescriptions details based on patients	Doctors successfully uploaded prescriptions details based on patients	Pass
5	View appointment	N/A	Doctors must be able to view appointment details	Doctors can view current appointment information's	Pass
6	View report	N/A	Doctors must be able to view patient report based on the patients he chooses	Doctors can view patient report based on the patients they choose	Pass

Test Case 3:

Step	Description	Input	Expected result	Actual result	Status
1	Open the application	N/A	Patient Monitoring Application Web page must be Displayed	Patient Monitoring Application Web page is Displayed	Pass
2	Click on login Login as receptionist	N/A	Login form must be displayed	Login form is displayed	Pass
3	Enter user Id and password, Click on login	user Id: 11 Password: 122fsfs3	'Invalid username/password' message must be displayed	'Invalid username/password' message is displayed	Pass

Test Case 4:

Step	Description	Input	Expected result	Actual result	Status
1	Alert patient using iot smart medicine box	Patient prescription report	Smart medicine box must display the alert to patients at specific interval of times	Smart medicine box successfully displays the alert to patients at specific interval of times	Pass
2	Getting LED light ON	Patient prescription report	The LED light of the respective medicine box should get ON as the current time and the medication time matches.	The LED light of the respective medicine box gets ON as the current time matches with the medicine intake time.	Pass
3	Play sound	Patient prescription report	Smart box must be able to alert patients by playing some sound	Smart box successfully send alert to patients by playing sound	Pass

Test Case 5:

Step	Description	Input	Expected result	Actual result	Status
1	Android Application	N/A	Android app must successfully run on patients mobile	Android app successfully running on patients mobile	Pass
2	Get notification	Patient prescription report	Android application must be able to receive notification at particular interval of time when patients need to intake medicines	Android application successfully Able to receive notification at particular interval of time when patients need to intake medicines	Pass
3	Track patients medicine intake	N/A	Android application must be able to track medicine intake	Android application can track medicine intake	Pass
4	IR sensor	N/A	Event must be triggered	Event triggered	Pass
5	Set up camera	Capture images	Notification must be sent	Notification sent success	Pass

Table 7.1 Test Cases

CHAPTER 08

RESULTS AND ANALYSIS

Medicine Box

When the doctor updates the prescription, it get stored into the database. Accordingly, at the given specified time the medicine box will notify the patient to take the medicine by glowing the LED lights and also a buzzer sound will be given.

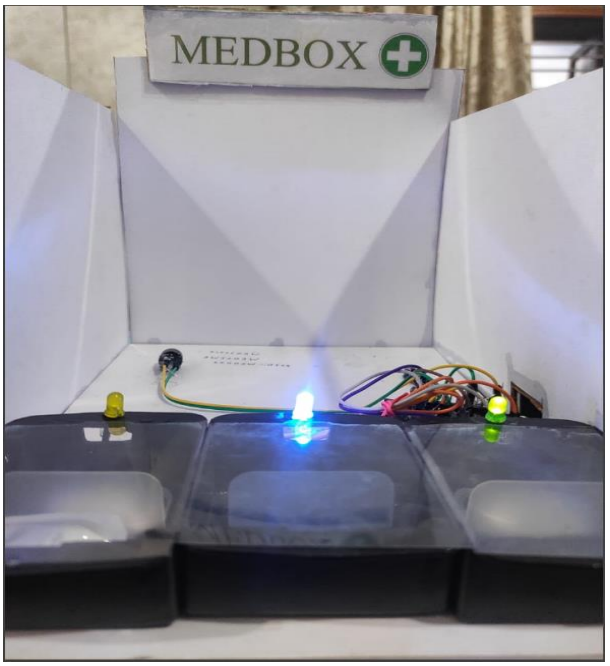


Figure 8.1: LED Notification

After the specific time the LED will automatically get turned off till the next specific time arrives for the medicine intake.

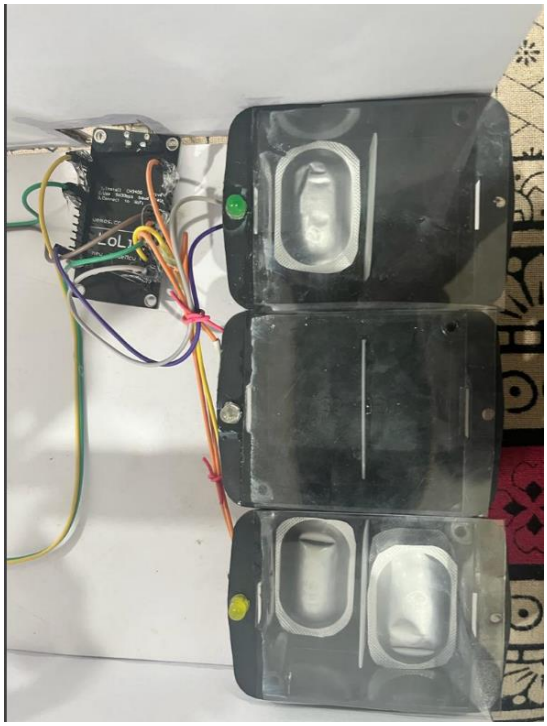


Figure 8.2: No Notification

Mobile App Notification

An alerting notification will also be sent to the patient's phone telling that he needs to take the medicine from that particular box that is glowing.

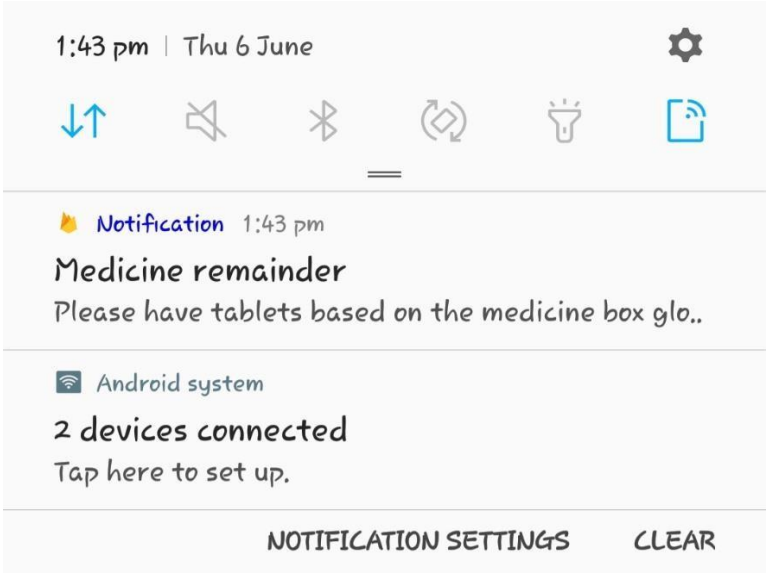


Figure 8.3: Notification by the App

Receptionist Login Functions Output

A receptionist will be given separate login credentials using which they can perform the following tasks.

- Add appointments of the patients. If the patient is already registered with the hospital they can directly add the appointments for them with the concerned specialist. If not they have to register the patient with the hospital and then add appointments for them.
- If a new doctor joins the hospital, the receptionist adds them to the hospital database so they can allot appointments for them in the future.
- They can also add various medical reports and records of the patients into the hospital so that it helps the doctor to have a direct view of those records and reports.

Doctor Login Function Output

Every doctor at the hospital will be given separate login credentials through which they can manage the patient's consultations.

They can perform the following tasks:

- They can view the appointments that has been allotted for the day.
- Issue prescription for the patients using their patient ID.
- View the previous prescription details and add, remove or edit if needed.
- View the Patient's medical records and reports.

CHAPTER 09

SNAPSHOTS

Home Page

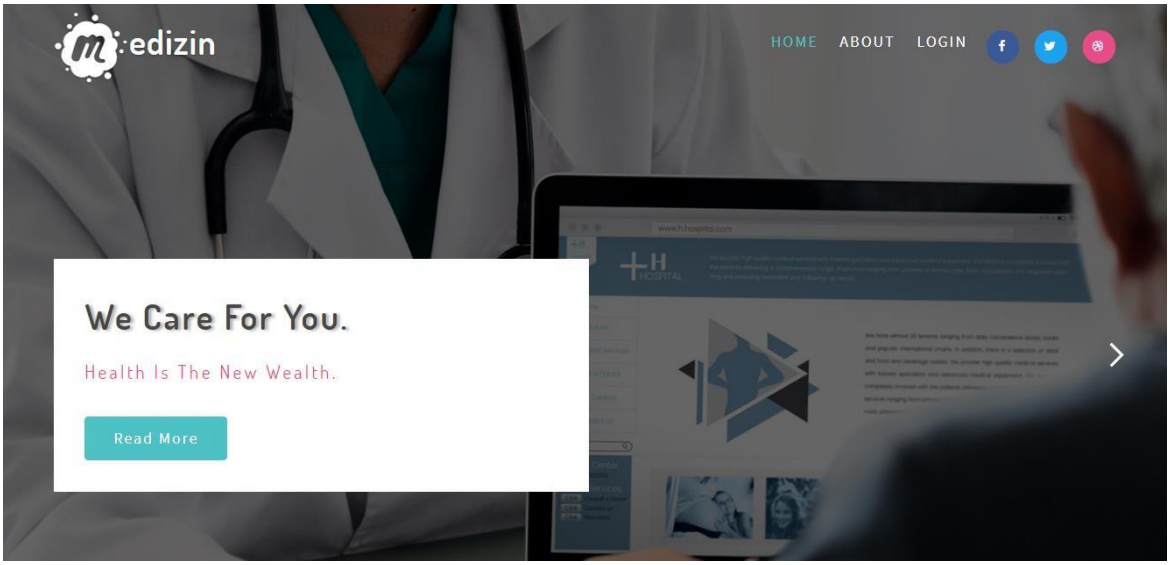


Figure 9.1: Home Page

Login Page

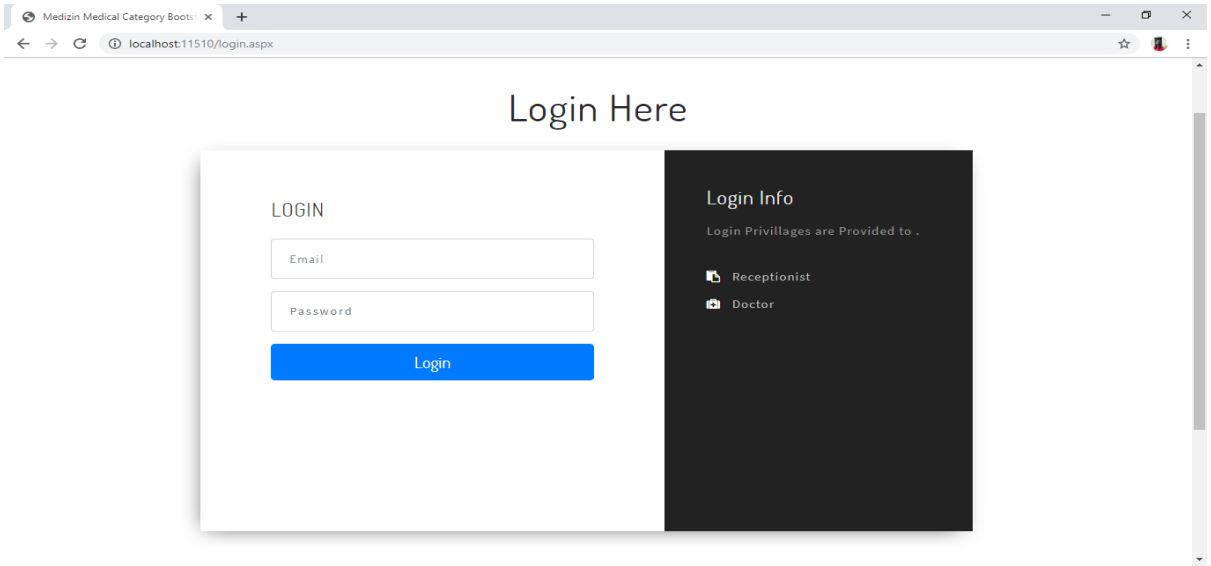


Figure 9.2: Login Page

Receptionist Login

Add Appointments and Register New Patients

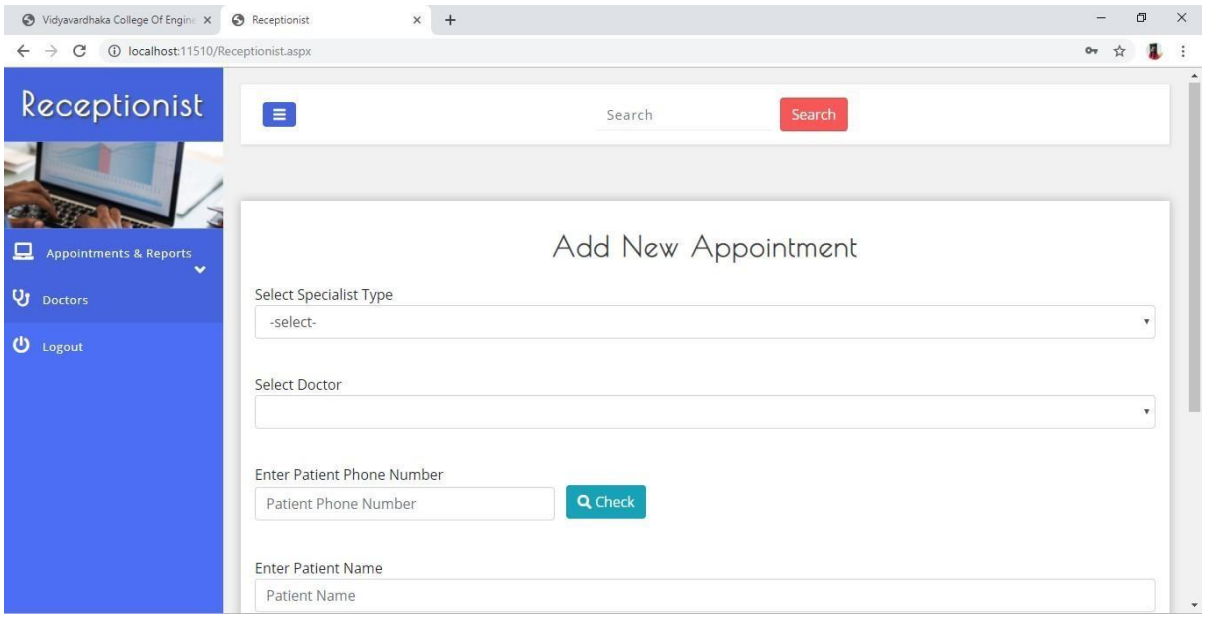


Figure 9.3: Add appointments and register new patients

Add and View the Newly Added Specialist

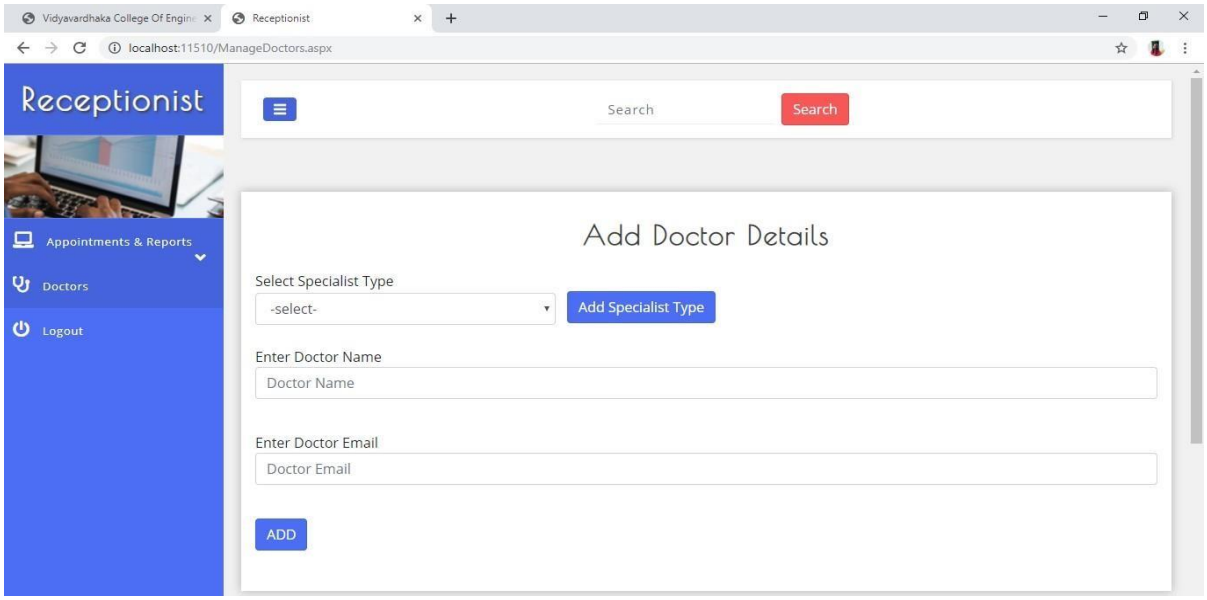


Figure 9.4: Add new specialist

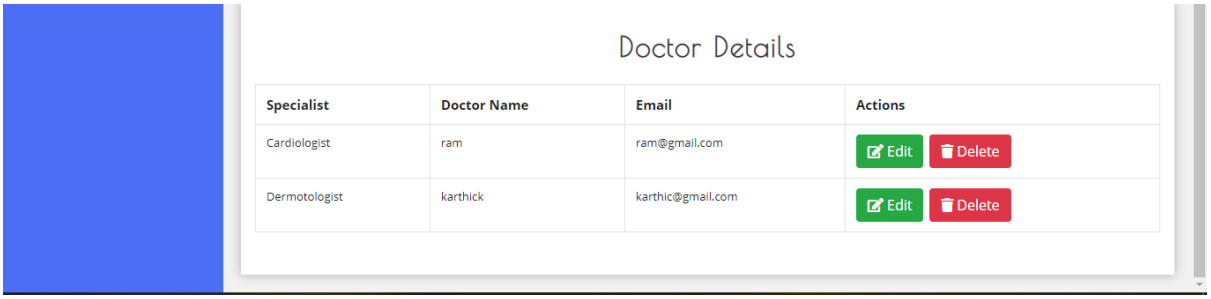


Figure 9.5: View Added Specialist

Add Reports and Records of the Registered Patients

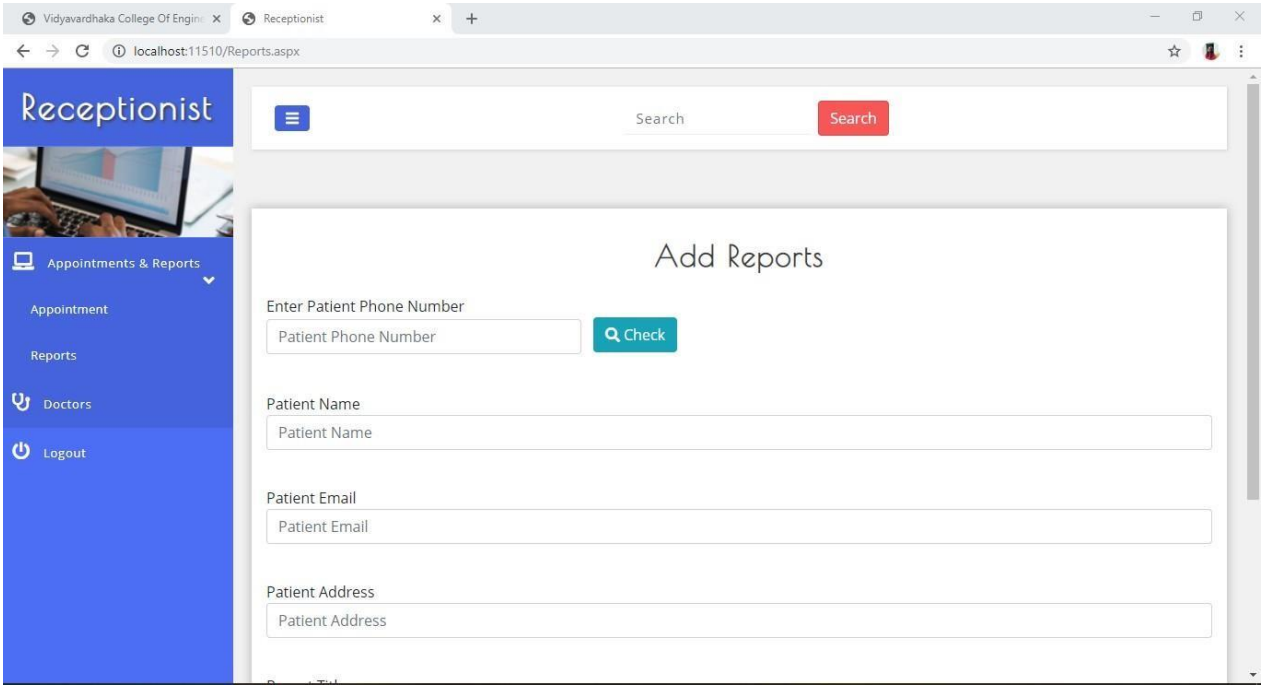


Figure 9.6: Add reports

Doctor Login

Appointments

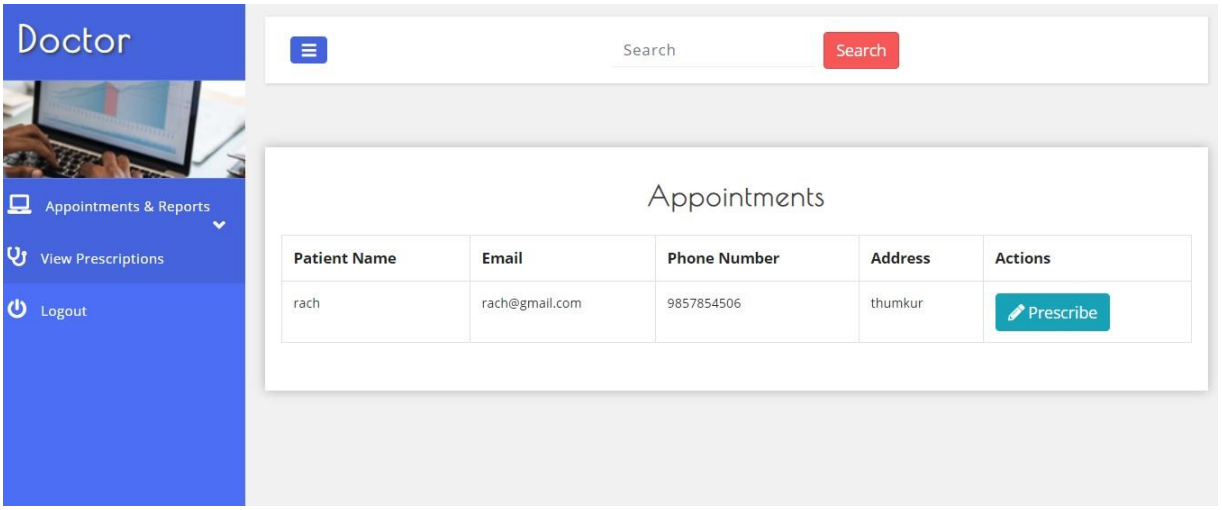


Figure 9.7: View Added Appointments

View Reports

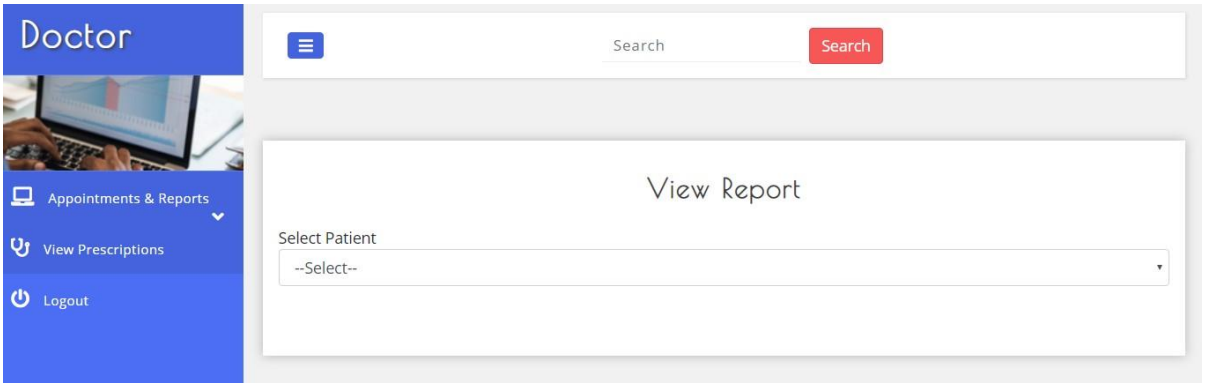


Figure 9.8: View Reports

Add Prescriptions

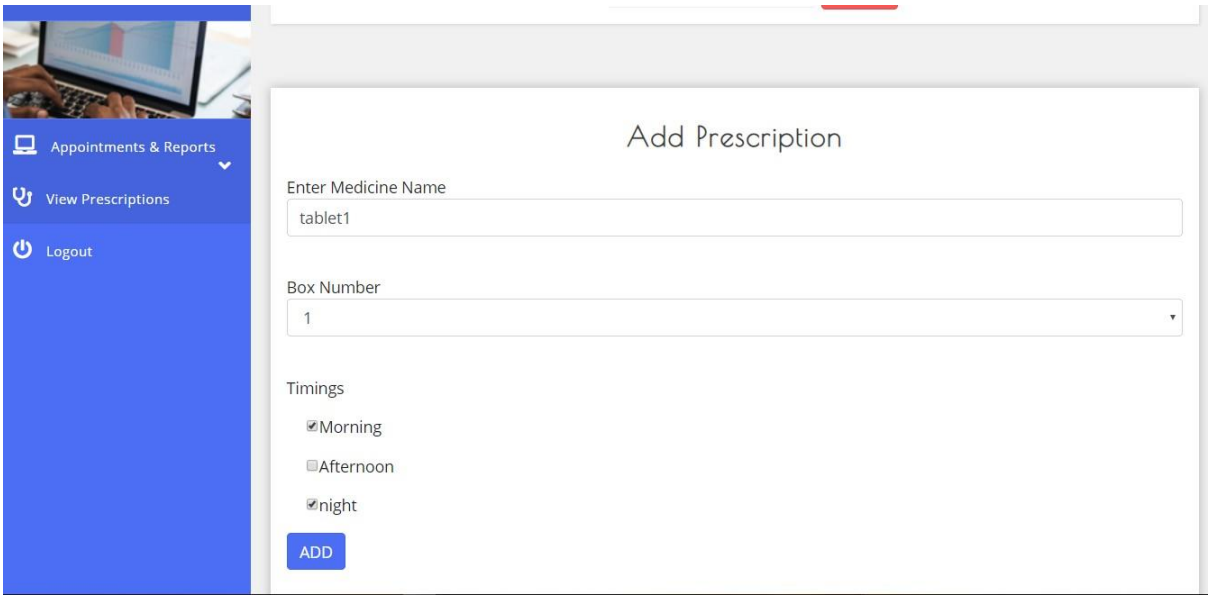


Figure 9.9: Add Prescriptions

View Prescriptions

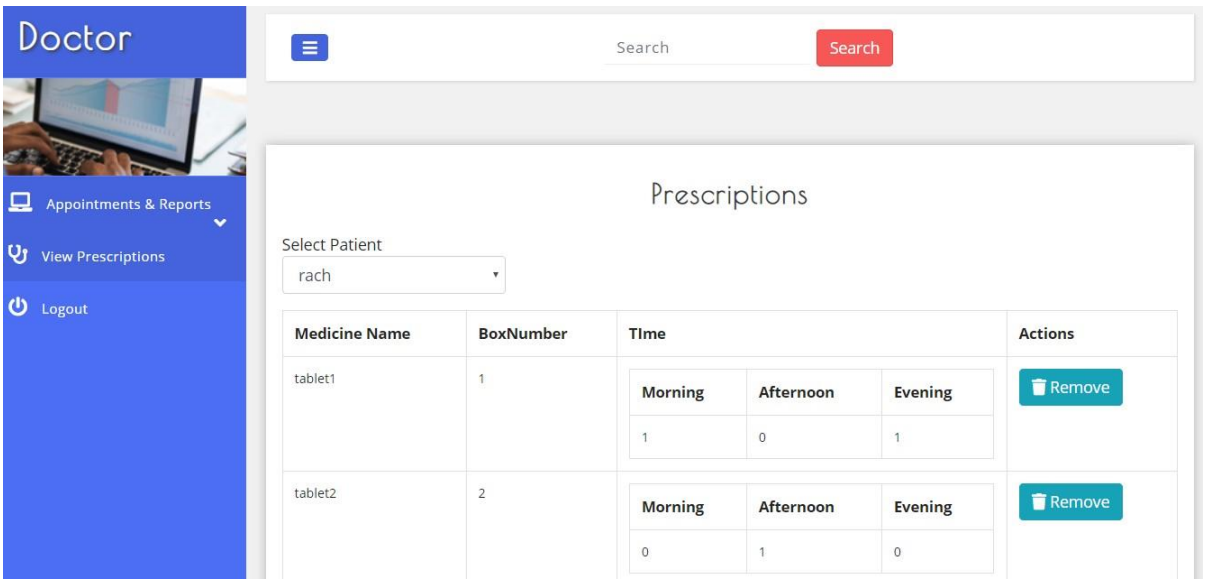


Figure 9.10: View Added Prescriptions

CONCLUSION

In this project, we have proposed a system that is an IoT integrated web and mobile application that helps in the efficient monitoring of the patients. This system helps the patients to overcome their negligence regarding the medication process by notifying them frequently. An alerting system has been given for the patient with the integration of a smart medicine box that alerts the patient to take prescribed medicines at proper time by getting notified when event is triggered while IR sensor detection is done. The patients will also be guided by the box to take this specific medicine at the proper time with the help of LED and buzzer. The cloud which stores the details of the hospital database sends timely alerts to the mobile application of the patients regarding the medicine in take. The system provides an effective way of improving a patient's health in the easiest way possible. The system is feasible and is a cost-effective way for monitoring the medication process of a patient

FUTURE ENHANCEMENT

We have made the maximum utilization of our potential and zest in developing this project. But gaining knowledge is a continuous process and so is this new technology. Therefore, in this section we present some of the ideas which can be used to enhance the functionalities of our project to widen its applications.

QR code Implementation

During the patient's registration at the hospital for the first time along with the unique patient ID, a QR code for that particular patient can be generated. With the help of this QR code it is possible to fetch any prescription, medical reports and records at any preferred place and time.

Weight Sensors

Sensors can be implemented with the box to measure the weight of the tablets. With the help of this measurements, it might be possible to acknowledge if the patient has consumed medicine or not. Along with this a system can be implemented where in a notification to the nearby medical store regarding the need of new medicines.

Automatic Closing and Opening of the Box

The box can be implemented with the help of proximity sensors that will help in monitoring the medicine in take by opening at a particular specified time of a particular box. This helps in avoiding the intake of wrong medicines and taking over dosage.

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"2nd International Conference On Recent Developments in Science, Technology, Engineering and Management (ICRDSTEM-2023)" on 24th and 25th, March 2023.

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Sharanya N , Saakshi N S , Smruthi S Bejwadi , Charan J , LIKITH K S

This is to certify for the paper titled **A MEDBOX USING MICROCONTROLLER**

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A MEDBOX USING MICROCONTROLLER

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Abstract: An advanced medicine box monitoring, analysis and control system is proposed. This system is based on a smart and safe medical box that assists patients in taking their pills treatment on time. This system can also be monitored by the patient parents as it will be linked to a phone application by sensing alert message. The IR sensor is placed to detect medicine box. When patient tries to reach the medicine box, the medicine acting is considered as event trigger factor. An image is captured while this action is performed, by FTP load, notification is sent to the mobile phone of the caretaker. There is a need of an alerting system that informs about taking medicines without fail thereby reducing manual work and stress to the caretaker

Keyword: MQTT Sever, NodeMCU, Buzzer, Led, Wi-Fi

1.INTRODUCTION

The category of patients involves all human beings-teachers, students, businessmen, housewives, children, and all of us have a busy hectic schedule. Today's life is full of responsibilities and stress. So, people are prone to diseases of different types and it is our duty to make ourselves stay fit and healthy. If the patient stays at home, then he or she might get someone to look after him/her but when one is not at home, is out of the city or state away from home then it is hard for the family members to call them and remind them their dosage timings every time.

Individuals disregard about their wellbeing. Individuals think that it's troublesome in recollecting the drugs to be taken. Indeed, even today guardians still uses the manual strategy to give the medicine to the patients. Point of the framework which has been proposed is to move restorative check-ups from clinics to home. The framework proposed causes the patients to take pills at the specific time. The carelessness of the patient with respect to legitimate prescription, that is taking medications at standard interims taking overdose than recommended and sporadic check- ups may prompt a few symptoms and beat restorative carelessness of the patients by cautioning them every now and again in regards to the admission of meds at appropriate time and interims. It likewise helps in telling the patients with respect to the check-up plans and the archives to be conveyed for the following check- ups [4].

The medical negligence of the people suffering from long-term diseases are quite common. They consult doctor for the treatment of the diseases and they do not follow the medication procedure suggested by the doctor. The negligence of the patients regarding the medication may be because of several reasons like work schedules, lethargy towards medication, consulting different doctors for opinions and not following any of the medication procedures, some because of superstitious beliefs regarding the modern medication and memory related problems. They often show negligence's like taking medicines at irregular intervals that is not taking the medicines at the proper time suggested by the doctor, taking overdose than prescribed, irregular check-ups. All these negligence's shown by the patients will have several side-effects on them resulting in the failure of the entire medication process and causing

serious harm to them. This implementation helps them to follow the routine medication procedures by providing notifications regularly [7].

The proposed model has a smart medicine box that offers alarms to patients for their medicine at opportune time. IR sensor detects the event triggered and camera is setup to capture images and send notification to the mobile phone. It is associated with in web to make auspicious updates about medication to patient's cell phone through notice in android application. With this we get an opportunity to use technology in a better way so that it can be made useful to us. And it plays an important part in our daily life and helps us staying fit in many ways.

2. LITERATURE REVIEW

The system works on remind and consumption functionality regarding the intake of medicines. The pill that has to be consumed pops out of the container at the particular set time thus reducing the confusion as to which medicines has to be consumed, which also reduces the burden of caretakers regarding the proper medicines that has to be given from time to time to the elderly people. It also sends a purchase order to the medical shop when the medicines are over. The alert sound that will be given helps the patient to consume the medicines at right time without fail and also without anyone's help [8].

Monitoring the health of large number of patients suffering from various chronic diseases especially in the case of elderly people has become a tedious task with rapid population growth. The elderly people find it difficult to manage with medicines and the paper comes up with a smart system that monitors the dosage as well as their health. The Arduino board will receive continuous readings of the patient from smart sensor. Each pill container has its prescribed timing and it is interfaced with real clock time. When the time comes the alarm rings and reminds the patient for consumption. The system helps doctors in keeping track of large number of patients and their medical dosages as well as routines [1].

The aged people are often the victims of chronic diseases and should be taking medicines without fail are also suffering from dementia and forget their daily routines of medication. Reminding about the medication schedule and monitoring the patients and updating of medicines from remote places by the doctor through web. The paper has been focused on to be beneficial for improved efficiency of prescribed drug. The system can be implemented with sensing and wireless modules and these should be secured so that the data containing information about health of the patient should not turn up corrupt. IoT plays a major role in communication between two devices. With the usage of messaging standard and communication protocol, the important messages regarding health can be transferred safely [10].

The project is designed for the people who are under continuous medication and also for elderly people who should never neglect medication. The negligence can have serious effect on people with diseases like blood pressure, heart problems, diabetes, cancer, breathing problems etc. The medicine box is set up with a time table of prescribed medicines with a push button. RTC module saves present time and notification time is stored in EPROM. At the time of intake, the system generates a notification sound and LED display light on certain pill box. The system provides an effective and easy way for people who take medicines regularly at costs which are easily affordable [2].

The proposed system is used for improvising to reduce risks regarding health and also costs in healthcare services by collecting, recording, analyzing and sharing large data streams efficiently. The system reduce the patient's efforts of visiting the doctor to every time to get blood pressure, heart rate etc. checked. The vision of the project is to provide proper and efficient medical services to patients by connecting and collecting data by health status monitors that would comprise of various information regarding patient's health. A better and efficient services to the patients can be provided by implementation of a networked information cloud. From this information the doctor can make use of the information and monitor the patient from remote places at any given time. A mobile application can also be deployed for the same so that the information can be accessed as and when required in case of emergency [11].

The system is to provide help for the people suffering from chronic diseases in their medication routines to stabilize their health conditions. Consumption of the medicine at right time and dosage becomes crucial. The smart pill box is implemented with a camera that is based on medicine bag concept. A matrix code is printed on medicine bag interacts with pill box to perform remind and confirm functions. A family member or a caretaker's responsibility may also be reduced. Remind and confirm function can also work without internet, hence reducing the cost of the implementation [3].

The system is designed keeping in mind of the aged people who live alone on their own. Some of them who are suffering from disability find it difficult to take care of themselves. Any negligence or delay in medication will raise certain health issues. The medicine box can be used by the patients as well as caretakers to monitor the health. It is

implemented with visual and audio notifications to alert the patient regarding the medicine intake and refilling of the box when the medicines get over. A mobile application is also designed to send SMS and E-mail alerts to patient's caretaker. The box helps the patient or the guardian regarding the required pill quantity to be consumed and the exact time when it has to be taken [7].

Many systems have been proposed to shift medication process from hospital to home environment. An intelligent medicine box implemented with sensors for monitoring and diagnosis of health is proposed here. The medicine box is wireless and integrated with a mobile application helps the doctor and patient to interact in closer manner. The system alerts the patients for medicine intake at the prescribed time. An alert will also be given to the guardian of the patient if any signs of negligence is shown. The doctor can have direct monitoring over the patient in the system. In the proposed system magnetic reed switches are used in operation. The operation is carried by means of stepper motors which have controlled signals given from Arduino [4].

The monitoring system takes care of patient's personalized medication and monitor the activeness of the patient and notifying if any vital signs is observed. An experimental idea of patient's health conditions will be given and the monitoring of environmental condition can be done based upon that. It is an open-platform based medicine box with enhanced connectivity and interchange ability for integration of devices and services. The box is integrated with communication capability enabled by ZigBee and actuation capability enabled by flexible and wearable bio-medical sensors. SMS alerts will be given to the caretakers if any vital signs are found. Monitoring the conditions of the patient is continuously done with an IP address of WIFI. The daily activities of an elderly person are observed and based upon that, medication is given and keep track of their daily activities [12].

The trend in IoT has brought a significant improvement in healthcare sectors. The combination of IoT-cloud plays a vital role in healthcare by providing a better way to support affordable and quality patient care. In the model, the system senses the patient's symptoms. The sensed data is collected and sent to the gateway via Bluetooth and then to the cloud server through Docker container using internet. Thus, the doctor can diagnose

and monitor the patient from any location. Lifesaving application has been invented by the rise in in the field of IoT. The proposed system tells us how data is integrated with healthcare system based on IoT with the help of a Raspberry Pi and a Docker container. The medical data is collected and stored by the Raspberry Pi through the attached sensors. The data received is transferred to the mobile application of the users. Thus, the patients can improve their health based upon the data provided through the application [9].

An in-patient monitoring system is being introduced here. The system implements two sub-systems: The physical states of patient with data acquisition and communication system on ZigBee technology and the monitoring by hospital control Centre. The patients' movements and physical parameters are observed continuously. The information from data acquisition system is conveyed to the control center monitored by hospital. The hospital database receives information of each patient from data acquisition system and updates to database. The doctor can analyze and diagnose the patient from the data that has been recorded continuously. A wireless sensor technology is used. For the convenient features it provides, patient can use it effectively. The real time system can record and monitor the physical state and movement parameters thus providing correct way for the diagnosis by the doctor. With an intelligent diagnosis software, early stages of the disease can be detected and helps the patient in-time and prevent the sudden demise of the patient. ZigBee can be implemented within short range of distance say about 200m and is best suited for in-patient monitoring.

The system proposed is implemented with three parts: a smart sensor, a mail processing unit, and the network communication unit. The system gathers bio-signals in real time: analyze those, display, and store the data. The doctor at a remote location can access these data, diagnose it online and update the data for further diagnosis with the internet. As it is easy to use, cost efficient and provide satisfying functionalities, people in rural areas and towns can make use of it. As the healthcare facilities is getting costlier each day, reliable solutions have to be found so that medication procedure can be relocated from hospital to home environment. The monitoring process is shifted to home environment with reduced cost and in more reliable manner [14].

Medicines are the basic remedy for the prevention and curing of almost all the diseases. A proper medication can cure many of the risky diseases. Improper intake of medicines can have side and adverse effects. The system helps in overcoming the negligence regarding the intake by providing intimation that is alerts about the right medication to be taken at the prescribed time. A buzzer and LED are implemented to provide audio and visual alerts respectively. An E-mail will be also sent to a caretaker or a family member to remind the patient in case if it is forgotten despite of the alerts given. A report of patient's weekly intake of medicine routine is sent through mail to the concerned doctor [15].

In the system, the readings from the Arduino board is sent to the database via ESP8266 module and this data stored in the servers can be accessed by doctors and the registered patients. The system helps in independently monitoring the patients' health all by themselves and IoT system gives direct alerts to the concerned medical assistants at the hospital. A mobile application can also be created for efficient personal monitoring system. The data can be retrieved and information from the user and also the database can be accessed through mobile app and user can keep track of medication in an interactive way [16].

The system is designed to help elderly people who are under continuous medication procedure. It helps them in taking medicine in an easier manner without any possibility of missing the intake of pills. It monitors and reduces the risk of over or under dosages

by accident. The negligence regarding medicine intake can cause serious issues such as long time for recovery, illness and even demise of the patient. Such things are prevented by giving proper alerts, it also gives an alert to the caretaker if the patient does not consume the medicine. The system increases the effectiveness of medication procedure and save lives [6].

3. METHODOLOGY

Our project includes three modules, first one is the hospital website which stores complete details of the patient in the cloud, second is android application for the patient to obtain alert message regularly regarding the medicine intake from the data stored in the cloud and third module is the IoT module that is the smart medicine box which alerts the patient at proper time by switching on the LED light of the respective medicine to be taken and also by with the help of the speaker sound. The hospital website includes two logins that is the receptionist login and the doctor login. The receptionist can add the types of specialist and new doctors using the hospital website. The doctor can update the patient prescription. [5]

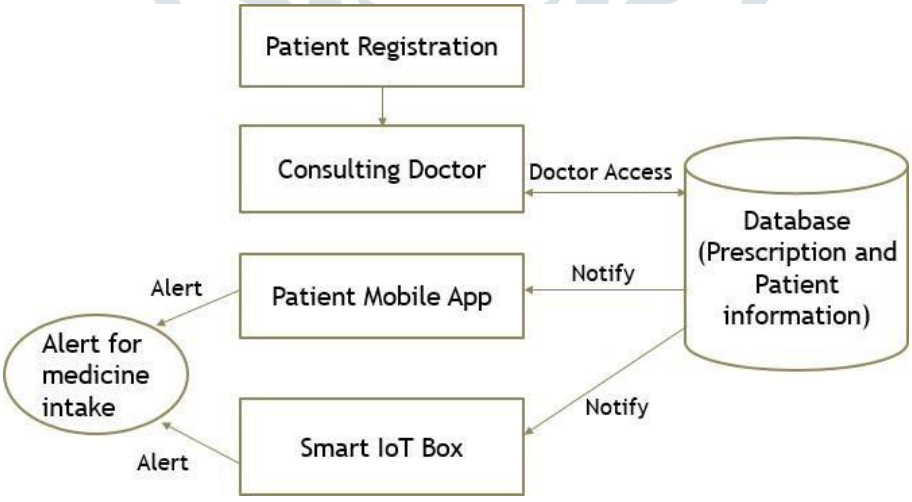
Initially the receptionist logins and adds an appointment for the concerned doctor by selecting the specialist type and then he selects the doctor among the selected specialist type. Then he enters the patient phone number, if the patient is already registered the details of the patient will be fetched from the cloud database automatically otherwise the receptionist as to enter the patient information manually and adds an appointment. The receptionist can also upload the reports of the patient into the cloud database which can be viewed by the concerned doctor of the respective patient.

When the doctor logins into the hospital website, he can view the current appointments on the starting page as he logins. Then he treats the patient and updates the prescription page by analyzing the patient report. In the prescription page the doctor enters the medicine name and selects the box number in which this medicine should be stored. The doctor can delete the medicine from the prescription and add new medicine.

The Smart medicine box and the android application gets updated from the prescription table which is stored in the cloud database. The IoT box will notify the patient at the regular intervals by glowing the LED light of the specific box and by emitting sound from the speaker. At the same the notification will be sent to the patient mobile application as it is the time to take the medicine.

The IR sensor is placed to detect medicine box. When patient tries to reach the medicine box, the medicine taking action is considered as event trigger factor. An image is captured while this action is performed, by FTP load, notification is sent to the mobile phone of the caretaker.

4. ARCHITECTURE



Initially the receptionist logins and adds the types of specialist and new doctors using the hospital website.
Then the receptionist adds an appointment for the concerned doctor based on the patient requirement.

The receptionist can also upload the report of the patient which will be viewed by the concerned doctor.

When the doctor logins into the hospital website he can view the current day appointments. Then he treats the patients as per the order of the appointment and updates the prescription page based on the patient report.

All these complete details of the patient will be stored the cloud database.

The IoT medicine box and the android application will get updated from this cloud database.

The IoT box will notify the patient at the regular intervals by glowing the LED light of the specific box and by the speaker sound.

At the same time the notification will be sent to the patient's mobile application as itis time to take the medicine.

5. HARDWARE DESCRIPTION

Microsoft Visual Studio 2010

Microsoft Visual Studio is an integrated development environment (IDE) from Microsoft. It is used to develop computer programs for Microsoft Windows, as well as web sites, web applications and web services. Visual Studio uses Microsoft software development platforms such as Windows API, Windows Forms, Windows Presentation Foundation, Windows Store and Microsoft Silverlight. It can produce both native code and managed code.

Visual Studio includes a code editor supporting IntelliSense (the code completion component) as well as code refactoring. The integrated debugger works both as a source-level debugger and a machine-level debugger. Other built-in tools include a forms designer for building GUI applications, web designer, class designer, and database Schema designer. It accepts plug-ins that enhance the functionality at almost every level— including adding support for source-control systems (like Subversion) and adding new toolsets like editors and visual designers for domain-specific languages or toolsets for other aspects of the software development lifecycle (like the Team Foundation Server Client: Team Explorer).

Visual Studio supports different programming languages and allows the code editor and debugger to support (to varying degrees) nearly any programming language, provided a language-specific service exists. Built-in languages include C,[6] C++and C++/CLI (via Visual C++), VB.NET (via Visual Basic .NET), C# (via Visual C#), and F# (as of Visual Studio 2010[7]). Support for other languages such as Python, Ruby, Node.js, and M among others is available via language services installed separately. It also supports XML/XSLT, HTML/XHTML, JavaScript, and CSS. Java (and J#) was supported in the past.

Arduino IDE

The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in the programming language Java. It is used to write and upload programs to Arduino compatible boards, but also, with the help of 3rd party cores, other vendor development boards. Arduino IDE is used to write and burn that code to the NodeMCU micro controller board.

NodeMCU

The NodeMCU (Node Microcontroller Unit) is an open-source software and hardware development environment that is built around a very inexpensive System-on-a-Chip (SoC) called the ESP8266. The ESP8266, designed and manufactured by Espressif Systems, contains all crucial elements of the modern computer: CPU, RAM, networking (Wi-Fi), and even a modern operating system and SDK.

Hardware

The NodeMCU hardware has evolved through several versions that feature variations in memory capacity and peripheral-device support.

Figure; ESP8266

NodeMCU v3 is a development board which runs on the ESP8266 with the Espressif Non- OS SDK, and hardware based on the ESP-12 module. The device features 4MB of flash memory, 80MHz of system clock, around 50k of usable RAM and an on-chip Wi-Fi Transceiver. The USB port is connected directly to the system on a chip (SoC).

Power supply

The Nordic nRF52 DK is equipped with on-board Li-Po button cell to power-up the device. NRF52 DK can, also, be powered via external power supply through related connector, external Li-Po battery, or via USB Micro B connector.

When powered from a battery alone, the power management IC switches off the internal regulator and supplies power to the system directly from the battery. Power source (Debugger VDD, Li-Po, and USB) is selected by on-board switch SW9.

Android Studio

Android Studio is the official integrated development environment (IDE) for Google's Android operating system, built on Jet Brains' IntelliJ IDEA software and designed specifically for Android development. It is available for download on Windows, macOS and Linux based operating systems. It is a replacement for the Eclipse Android Development Tools (ADT) as the primary IDE for native Android application development.

MySQL

MySQL is an open-source relational database management system (RDBMS). MySQL is free and open-source software under the terms of the GNU General Public License, and is also available under a variety of proprietary licenses. MySQL was owned and sponsored by the Swedish company MySQL AB, which was bought by Sun Microsystems (now Oracle Corporation). In 2010, when Oracle acquired Sun, Widenius forked the open-source MySQL project to create Maria DB.

MySQL is a component of the LAMP web application software stack (and others), which is an acronym for Linux, Apache, MySQL, Perl/PHP/Python. MySQL is used by many database-driven web applications including Drupal, Joomla, PhpBB and WordPress

Programming Language Used

A programming language is a formal constructed language designed to communicate instructions to a machine, particularly a computer. Programming languages can be used to create programs to control the behavior of a machine or to express algorithms.

The programming languages which we used are, C# and Java

5.ADVANTAGES

The following are some of the advantages of the proposed project;

- It helps in notifying the patients regarding the check-up schedules and the documents to be carried for the next check-ups.
- The proposed model has an intelligent medicine box that gives alerts to patients for their medication at right time.
- It is connected to internet to make timely updates about medicine to patient's smartphone through notice in android application
- It helps the hospital to have continuous monitoring over the patient's health and management of patient information.
- Smart medicine box can also be used at places like old age home, rural health centres

6. RESULTS

When the doctor updates the prescription, it gets stored into the database. Accordingly, at the given specified time the medicine box will notify the patient to take the medicine by glowing the LED lights and even a buzzer sound will be given. After the specific time the LED will automatically get turned off till the next specific time arrives for the medicine intake. An alerting notification will also be sent to the patient's phone saying that he needs to take the medicine from that specific box that is glowing.

Receptionist Login Functions Output

A receptionist will be given separate login credentials using which they can perform the following tasks.

Add appointments of the patients. If the patient is already registered with the hospital, they can directly add the appointments for them with the concerned specialist. If not, the receptionist must register the patient with the hospital and then add appointments for them.

If a new doctor joins the hospital, the receptionist adds them to the hospital database so they can allot appointments for them in the future.

The receptionist can also add various medical reports and records of the patients into the hospital so that it helps the doctor to have a direct view of those records and reports.

Doctor Login Function Output

- Every doctor at the hospital will be given separate login credentials through which they can manage the patient's consultations.
- The doctor can perform the following tasks:

- He/she can view the appointments that has been allotted for the day.
- Issue prescription for the patients using their patient ID.
- View the previous prescription details and add, remove, or edit if needed.
- View the Patient's medical records and reports.

7. CONCLUSION

In this project, we have proposed a system that is an IoT integrated web and mobile application that helps in the efficient monitoring of the patients. This system helps the patients to overcome their negligence regarding the medication process by notifying them frequently. An alerting system has been given for the patient with the integration of a smart medicine box that alerts the patient to take prescribed medicines at proper time by getting notified when event is triggered while IR sensor detection is done. The patients will also be guided by the box to take this specific medicine at the proper time with the help of LED and buzzer. The cloud which stores the details of the hospital database sends timely alerts to the mobile application of the patients regarding the medicine in take. The system provides an effective way of improving a patient's health in the easiest way possible. The system is feasible and is a cost-effective way for monitoring the medication process of a patient.

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