



SMART MEDICINE DISPENSER FOR ELDERLY AND VISUALLY IMPAIRED

V Manohar Nelli

Assistant Professor, CSE, JNNCE, Shivamogga, India

Abstract: Poor medication adherence is one of the major causes of illness and of treatment failure. The main purpose of our project is to help the elderly and visually impaired, take their medications on time in an easy way without the possibility of missing pills, also reduce the risk of over or under dosing accidentally. It provides direct communication between the system and the caregiver as it will immediately notify the care giver in case the patient missed his/her pill. In this project we have developed a mobile application wherein caregivers have to register to track their patient's medical adherence. They will be notified when their patient misses a dose or they can also track the complete history.

Keywords: medication adherence, SMD architecture, Medication Dispensing Device

I. INTRODUCTION

Overview of Medicines: Medicines are biological preparation that provides active acquired immunity to a particular disease. Medicines typically contains an agent that resembles a disease-causing microorganism and is often made from weakened or killed forms of the microbe, its toxins, or one of its surface proteins. The agent stimulates the body's immune system to recognize the agent as a threat, destroy it, and to further recognize and destroy any of the microorganisms associated with that agent that it may encounter in the future. Medicines are used in health care centers that mainly focus on prevention of diseases.

Importance of Medicines: At first the natural way of treatment was the most preferable one by people, but in rare cases the natural way of treatment delivers favourable changes in body and also promotes health although most of the cases, natural way of treatment doesn't help. The present stages of medicine is entirely different, but it follows the same ancient concept with some chemical advantages. These medicinal ways relate the most common curable diseases. These medicinal ways of treatment doesn't have much regimen and it is a well-established standard of leading life in a certain manner. Therefore, these medical ailments don't make any trouble to human beings. These achievements are a boon of medical science. Medicine is not only mean tablets but also is knowledge in health science. Its sole aim is to prevent and alleviate the ill effect of a disease.

Role of IT in Medicines: New avenues in diagnosis and therapy are today increasingly being opened up as a result of sophisticated and advanced technology, and at the forefront of this are evolutionary developments in existing technology. Many medical devices and pieces of equipment are developing at lightning speed as a result of digital technologies, which enable new medical concepts, strategies, and visions to be implemented faster than ever before. This means that developments which previously took a decade to implement are now being introduced at a rate of one a year. Technology thus not only has a dynamic interrelationship with medicine; it influences and shapes modern medical science on the basis of new technical possibilities. First-class health care would be inconceivable without progress and innovation in the field of medical technology.

II. PROBLEM SPECIFICATION

India has experienced impressive improvements in its economic status and population health during the past two decades. However, survey reports 76% discrepancy rate between what medicines patients were prescribed, and what medicines they actually took. In day-to-day life most of the people need to take medicines which was not there in past couple of years and the reason behind this is diseases are increasing in large amount. So sooner or later many people come in contact with these diseases. Some diseases are temporary diseases while many are permanent life threatening diseases. Life threatening diseases gets mixes with the human body in such a way that they can't leave the body ever and they increases in rapid time. Life span of humans became less because of such diseases and to overcome or to live a better life we need to take medicines regularly and also in large amount. We need to be in advice of Doctor who tells us to take desired pills in desired way and also when Doctor changes the prescription of medicine, patients have to remember the new schedule of medicine. This leads to problem of forgetting to take pills at right time, taking wrong medicines and accidentally taking of expired medicine causes health issues of patient and this leads to suffer from unhealthy life. Poor medication adherence is one of the major causes of illness and of treatment failure. Thus, accurate assessment of medication adherence is important to patients, caregivers, and researchers.



Problem Statement: Patients not taking their medicines correctly and on time is referred to as the “Medication Adherence” problem. Common reasons for the medication adherence problem are related to patient behaviors such as forgetfulness, running out of medication, and carelessness. “Out of the three, the most commonly reported means of non-adherence was forgetfulness”. Complex medication schedules can lead to mistakes like missing doses, taking incorrect amounts, or taking medicines at the wrong times. The negative effects of the lack of medication adherence include high healthcare costs, increased patient discomfort, and shorter lifespans. Hence there is a need to design a Medication Dispensing Device that can help to take medication on schedule.

Objectives

- The web application represents the working of a pillbox.
- The application has a pill scheduling system that allows users to add and remove alarms by selecting the day and also show the upcoming alarms.
- The web application sends e-mail notification to the patient as well as their caregiver(s) about the pill status.

This database will be real-time based and updated as soon as the medication is taken or missed.

III. REQUIREMENT ANALYSIS

Requirements Analysis is the process of defining the expectations of the users for an application that is to be built . It involves all the tasks that are conducted to identify the needs of different stakeholders. Therefore requirements analysis means to analyze, document, validate and manage software or system requirements *System requirements: When a software is purchased for a computer, one should first make sure that computer supports the system requirements. These are the necessary specifications that computer must have in order to use the software. Functional Requirements: Functional requirements describe system behavior under specific conditions and include the product features and functions which web & app developers must add to the solution. Such requirements should be precise both for the patient and caregiver .The following are the functional requirements to be met in this research, *Authentication:

Authenticates caregivers with their email addresses and passwords. The Firebase Authentication SDK provides methods to create and manage users that use their email addresses and passwords to sign in. *Historical Data:In SMD App, “Show history” contains the detailed information of missed and taken pills of the patient. *Schedule: SMD App in the project allows the caregiver to schedule the time(morning,noon, night) and day to alert the patient. *Reporting Requirements: Web application reports the patient status through mails and it also displays the pop up message.

Non –Functional Requirements: Non-functional requirements are requirements that specifies criteria that can be used to judge the operation of the system, rather than specific behaviors.Functional requirements define what a system is supposed to do whereas non-functional requirements define how a system is supposed to be. The non-functional requirements are the constraints or the environment in which the software is developed.The different non–functional requirements are listed below:

*Timeliness:In the web application, the alarm rings at scheduled time and day.

*Reliability:The system should be reliable. The output i.e, the pill status is sent through mail to respective caregiver and patient.

*Android App: A mobile application is provided which is an interface for the patientsand caregiver. The application allows the caregiver to schedule the reminder according to the requirement of the patient.

Software requirements: Programming Language used: Kotlin, Xml, HTML and CSS, Kotlin in Android Studio, Operating System: Windows 10, BackEnd: Firebase

IV. DESIGN AND IMPLEMENTATION

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. High level design is the design which is used to design the software related requirements. In this chapter complete system design is generated and it contain the SMD app , web application and database.

A. System Architecture: Figure 1 represents the system architecture. The user interacts with the android application. The android application is connected and synchronized to the database. This database is also connected to the web application. Therefore both the anroid and web application have the same database.

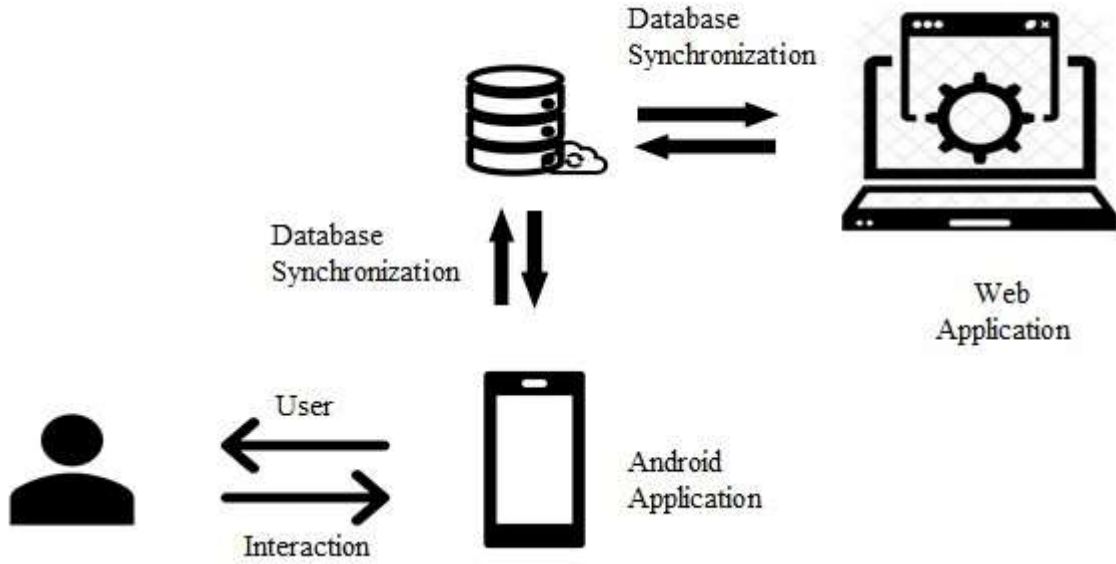


Figure 1: SMD Architecture

A. SMD Application:

This flowchart reflects the overview of the Android Application named SMD, which is helpful for the caregiver(s) to monitor the pill schedule of their patient(s). The caregiver should register to the application and provide all the necessary information and that collected data will be stored in the firestore-database. The application shows the history of the patient’s pill status and also the upcoming alarms. Input to the system is the information entered by the patient which includes name, age, gender, email and history. The output of the system focuses on take their medications as prescribed (eg, twice daily), as well as whether they continue to take a prescribed medication. Medication nonadherence is informed to respective caregive through mail. patient history consist of taken pill and missed pill informations.FAQs contains the questions asked by the patients and caregiver.



Figure 2. SMD App

Figure 2 depicts the flowchart of the application. When the user opens the application, it shows caregiver login screen, if the user is not registered as caregiver, then user can register in the caregiver registration screen. If the user is registered, then user can provide valid credentials to login to the application. Once user is authenticated, application checks whether the user is registered as caregiver for any patient, if not then add patient screen will be enabled. Navigation bar has information about caregiver FAQ’s and it provides an option to signout from the application. If the user is registered as caregiver, then the patient details will be displayed which includes name, age, gender and e-mail. User can add another



caregiver e-mail id, if the caregiver is registered. It shows the pill history which has information about pill taken/missed. User can also schedule the pill based on day. The application also shows information about upcoming alarms.

B. Web application design:

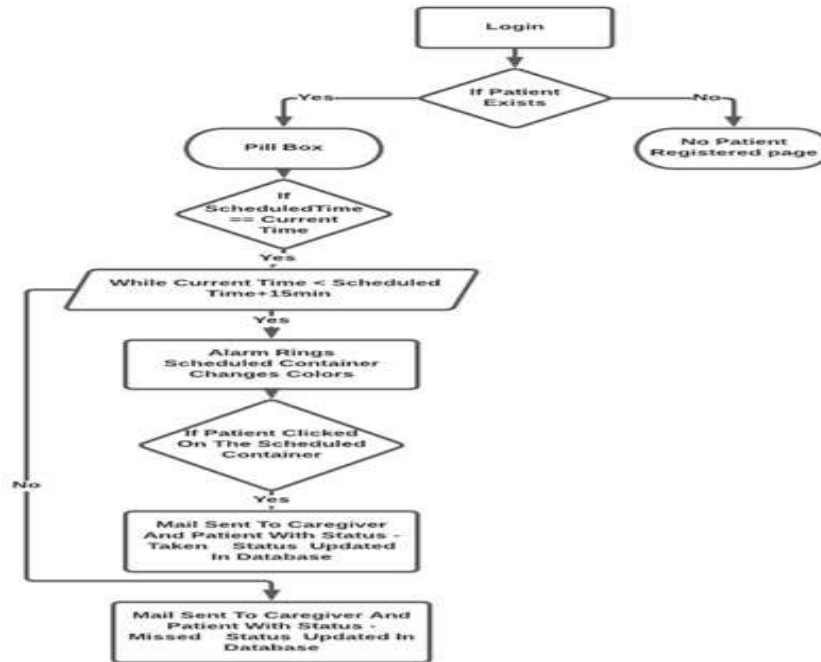


Figure 3: SMD Web Application

Figure 3 reflects the overview of the web application. In the login page caregiver has to provide proper credentials. If the caregiver is not registered for a patient in the SMD application, he will be redirected to the “no patient registered” page, else he will be directed to the home page. According to the schedule set in the android application, the alarm rings at the scheduled time for 15 minutes and the scheduled container changes colors. If the patient clicks on the scheduled container within 15 mins, then e-mail is sent to the caregiver and patient with status as taken and the status will be updated in the database else e-mail is sent to the caregiver and patient with status as missed.

C. Database

Firestore

1)Firestore is a backend platform for building Web, Android and IOS applications. It offers real time database, different APIs, multiple authentication types and hosting platform. Firestore can power your app’s backend, including data storage, user authentication, static hosting, and more. Focus on creating extraordinary user experiences. We will take care of the rest. Build cross-platform native mobile and web apps with our Android. You can also connect Firestore to your existing backend using our server-side libraries or our REST API.

2)Firestore Features: Real-time Database – Firestore supports JSON data and all users connected to it receive live updates after every change, Hosting – The applications can be deployed over secured connection to Firestore servers. 3)Firestore Advantage: It is simple and user friendly. No need for complicated configuration., The data is real-time, which means that every change will automatically update connected clients, Firestore offers simple control dashboard, There are a number of useful services to choose.

4)Firestore Limitation: Firestore free plan is limited to 50 Connections and 100 MB of storage.



V. RESULTS AND ANALYSIS



Figure 4: Caregiver Login



Figure 5: Caregiver Registration

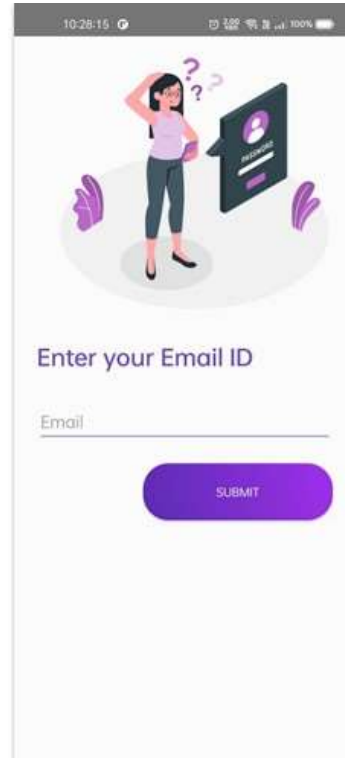


Figure 6: Forgot Password

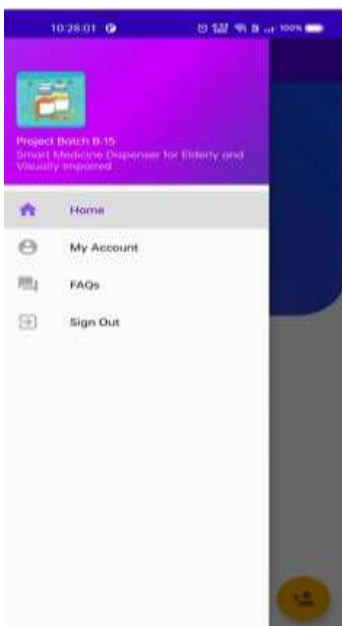


Figure 7: Navigation Bar

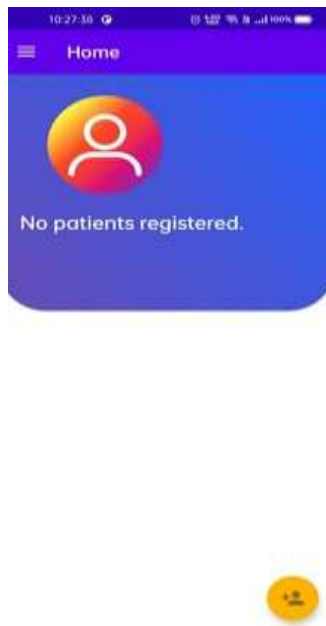


Figure 8: Add patient



Figure 9: Patient Registration



Figure 10: HomePage

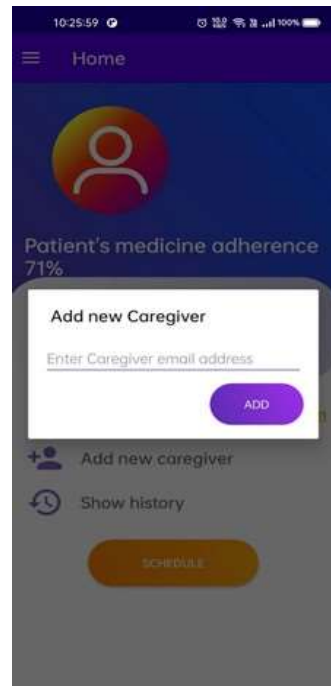


Figure 11: Add caregiver

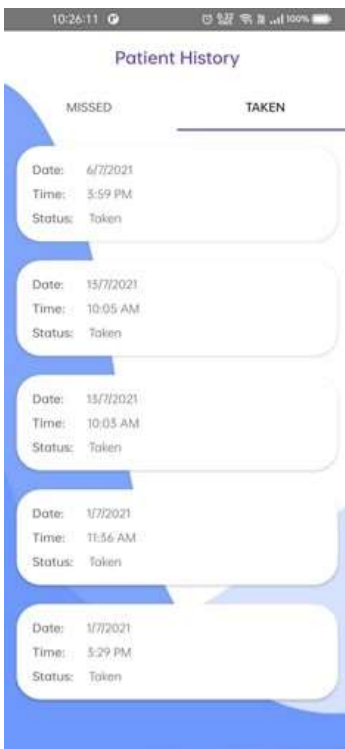


Figure 12: Pill Taken History



Figure 13: Pill Missed History



Figure 14: Schedule



Figure 15: FAQ's



Figure 16: SignOut



Figure 17: Login Page

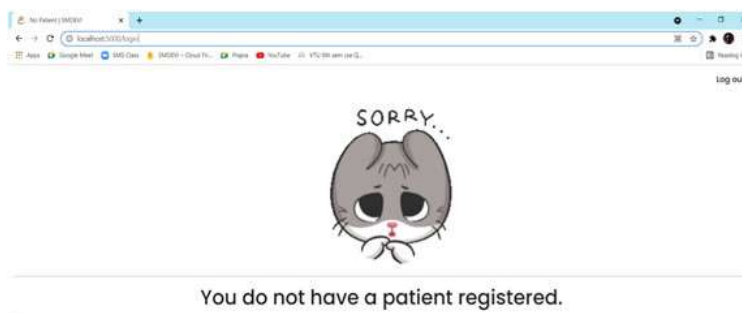


Figure 18: No Patient Registered

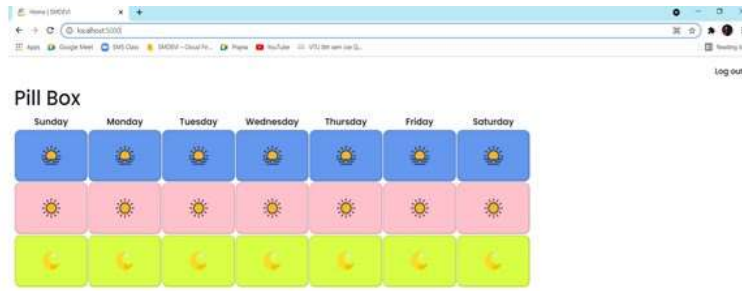


Figure 19: Web PillBox

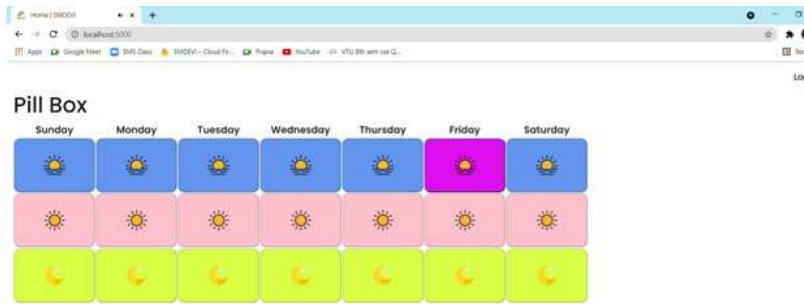


Figure 20: Web Pill Reminder



Figure 21: Web Pill Status



Figure 22: E-mail notification of Status - Missed sent to caregiver and patient respectively

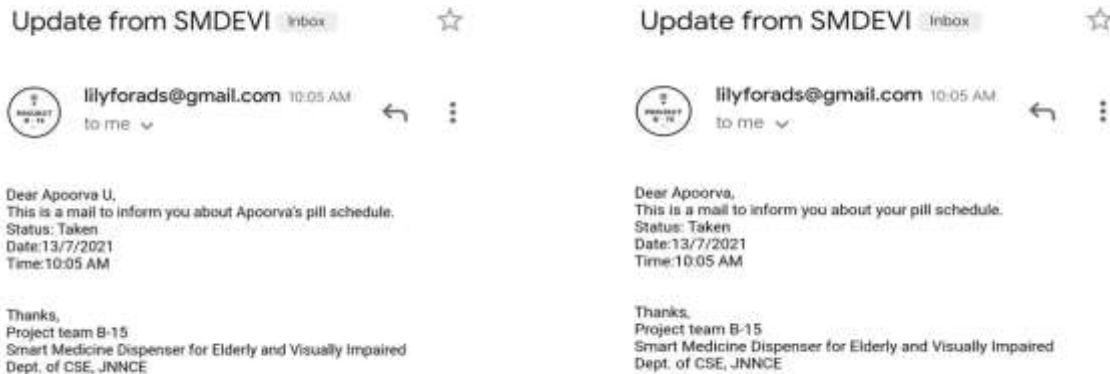


Figure 23: E-mail notification of Status - Taken sent to caregiver and patient respectively

VI. CONCLUSION

Elderly patients, especially ones with chronic and periodic medicine, will benefit the most from the SMD, since it will greatly increase their medicine adherence which will ensure a better treatment effectiveness or even save their lives. There are many systems that are serving the same purpose. But these systems are difficult to use, non-mobile, expensive and a complex process. The proposed system overcomes all of the above problems, and it is simply affordable with better accuracy. This system is helpful to every age group. It is helpful for tracking regular medicine intake and reduces manual supervision and human effort. With the simple circuitry and low cost device comes as a boon for the young and elderly, a simple solution for mothers for their adolescents and caretakers for the elderly and visually impaired. It can find its use in every household or hospital that has medical supervision and can be marketed as an efficient solution for all patients. The main goal of the system is to provide healthy, tension free life to those who are taking pills regularly and to provide it at an affordable cost.

REFERENCES

- [1]. Tamara. L. Hayes, Member, IEEE, John M. Hunt, Member, IEEE, Andre Adami, and Jeffrey A. Kaye, Member, IEEE, "An Electronic Pillbox for Continuous Monitoring of Medication Adherence", Proceedings of the 28th IEEE EMBS Annual International Conference New York City, USA, Aug 30-Sept 3, 2006.
- [2]. Samir V. Zanjala, Girish. R. Talmale, "Medicine Reminder and Monitoring System for Secure Health Using IOT", International Conference on Information Security & Privacy (ICISP2015), 11-12 December 2015, Nagpur, INDIA.
- [3]. Nurmiza Binti Othman and Ong Pek Ek, "Pill Dispenser with Alarm Via Smart Phone Notification", 2016 IEEE 5th Global Conference on Consumer Electronics.
- [4]. Shaantam Chawla, "Research Directions for the Internet of Things".
- [5]. A. Jabeena, Animesh Kumar Sahu, Rohit Roy, N.Sardar Basha, "Automatic Pill Reminder For Easy Supervision", Proceedings of the International Conference on Intelligent Sustainable Systems (ICISS 2017).
- [6]. Sanjay Bhati, Harshid Soni, Vijayrajsinh Zala, Parth Vyas, Mr. Yash Sharma, "Smart Medicine Reminder Box", IJSTE - International Journal of Science Technology & Engineering, Volume 3, Issue 10, April 2017.
- [7]. Jabeena.A,Shivam Kumar, "SMART MEDICINE DISPENSER", International Conference on Smart Systems and Inventive Technology (ICSSIT 2018).
- [8]. Wissam Antoun, Ali Abdo and Suleiman Al-Yaman, Abdallah Kassem, Mustapha Hamad and Chady El-Moucaray, "Smart Medicine Dispenser (SMD)", 2018 IEEE 4th Middle East Conference on Biomedical Engineering (MECBME).
- [9]. Mohammed Azad Fasahate, "Smart Medicine Box Using IOT", International Journal of Scientific & Engineering Research, Volume 9, Issue 2, February-2018.
- [10]. Purnendu Shekhar Pandey, Sanjeev Kumar Raghuvanshi, Geetam Singh Tomar, "The real time hardware of Smart Medicine Dispenser to Reduce the Adverse Drugs Reactions", 2018 International Conference on Advances in Computing and Communication Engineering (ICACCE-2018) Paris, France 22-23 June 2018.
- [11]. Viral Doshi, Shrishti Dey, Nirav Mehta, Rajesh Prasad, "An IoT based smart medicine box", International Journal of Advance Research, Ideas and Innovations in Technology.
- [12]. Amena Jassim Al-haider, Sakina Mansour Al-sharshani, Hamean Salem Al-sheraim, Nandhini Subramanian, Somaya Al-maadeed, Mohamed zied Chaari, "Smart Medicine Planner for Visually Impaired People" J. Padhye, V. Firoiu, and D. Towsley, "A stochastic model of TCP Reno congestion avoidance and control," Univ. of Massachusetts, Amherst, MA, CMPSCI Tech. Rep. 99-02, 1999.