# CHAPTER 1

# INTRODUCTION

In present society, busy life has influenced individuals to overlook numerous things in everyday life. In upcoming days, digitalized favors, technologies and updated data factors are considered to play a crucial scenarios to give the best [1]. Some industries are trying their best to provide beneficial facilities in this field, with an preferable cost with modernized techniques and digital ways to combat the health recoveries [2]. But the associations that are ready to deal with this criteria are very few and supporting features are limited. At present, few medicine boxes are in use, but those are static which are not automatic [3]. In case of critical situation, places where there is no feasible opportunities to entrance the need in terms of capsules at apparent instance [4]. Hence the smart medication reminder and dispensing system is designed to enhance medication adherence.

The main aim is to make a Smart Automated Medicine Box for those users who regularly take medicines, as they tend to forget to take medicines due to some circumstances . The pill dispenser offers users a sense of comfort [5] knowing that their medications are conveniently organized and that they will be gently prompted to take them at the appropriate times [6].

Smart Medicine Kit using Voice Enabling Feature is an tablet dispensing specialized unit with an preferable cost, modernized techniques and digital ways to combat the health recoveries. This kit is generally applicable for all generation people who regularly take medicines and mainly dedicated for old and blind ones.

The kit mainly works through raspberry pi [7]. The kit beeps at the prescribed time, the patient listening to it will come near the kit and ask the kit to give the medicine. At that time the box with the medicine opens automatically with the help of a motor. The person can make further conversation with the kit which acts as a two way communication.

## 1.1 Objective

The Objective of this system is to help the users of all age specially aged and blind ones to follow a prescribed routine of their medicines. Because maintaining a good health [8] matters a lot to achieve anything. The voice enabling helps them to take the pills especially for elderly people and blind people who are unable to remind their drugs that might cause certain health issues, which can be resolved with this medicine kit. The process starts with the care taker. Where the care taker should fix the time in the module or may be using keypad. The kit beeps at the prescribed time, the patient listening to it will come near the kit [9] and ask the kit to give the medicine. At that time the box with the medicine opens automatically with the help of a motor. The person can make further conversation with the kit which acts like a two way conversation. The IR sensors will sense whether the patient has taken the tablet or not and will send the message to the intimated person. If there is no medicine in the box then the authorized person will get an intimated message like the user has taken the tablet, for secured purpose.

## 1.2 Motivation

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. A patient in-need, is the main motive for ideation and development of this project. By validating this idea, that helped in determining a solution to serve the medicine who are in need [10]. This is a new world trend where men and women stand up alone towards work and there are no one to take care of their old ones. And to be a supportive to these people the idea of developing the medicine kit was motivated. The kit will guide the people to take tablets according to prescription. Further this smart tool can detect whether the user or the patient has taken the tablets or not using IR sensors and sends an sos or intimating message to the caretaker or the concerned person.

# CHAPTER 2

# LITERATURE SURVEY

Several medication reminder systems have been built upon different concepts and on different platforms. Many people have started using healthcare related apps and their popularity has been growing, but there are still several issues that have to be answered by them. By keeping this in consideration they developed different ideas to enjoy the fruitfulness.

The **Medicine Remainder and Monitoring System for Secure Health Using IOT** says, generally home based health care system requires interaction technologies, treatment and monitoring. It is possible reach this by development of a low cost medical sensing, communication and analytics device that is real-time monitoring internet allowed to check patients physical conditions. Internet of Things (IOT) network will provide active and real-time appointment of patient, hospitals, caretaker and doctors apart from this the secured data transmission from source point to destination for the purpose of remote monitoring.

The distant monitoring is made possible by using various biomedical devices, they measure and transmit data via Bluetooth or ZigBee to a unit that manages them (PC, iTV). The collected information may be stored on the device or sent to a collection centre that provides a complete monitoring. Firstly they thought of taking care of a person from far off place by making use of medical equipments, they measure and transfer data via Bluetooth or Zig Bee and that will intimate the user. In response the grouped data is been sent to the information unit or it might be saved on some device in turn helps in maintaining a record for respected purpose. The information unit manages the gathered data obtained from the module and accordingly checks the progress and monitors in a systematic way. Thus overall gist must be summarized to view the techniques that has been implemented how well they co-operate to carry out process in an principled way. Amongst these a intimation module and changes with respect to determining pill presence, voice process and analytical modules can be prepared with low cost in order to sense the patients physical condition. In order to carry out the process the components used are UI system to display the content, Development board, alarm system to intimate the person, sensors and an wireless device to access the monitoring system. The one amongst the best is internet of

things will provide an opportunity to have an consultation or some arrangements to meet or contact the needed one which could be an helper and caretaker. With all these facilities it is even possible to have an information regarding the patient from top to bottom for the purpose of quality observation [1].

In the **Smart Medicine Time Indication Box**, the medicine box is programmable that allows nurses or users to specify the pill quantity and day to take pills, and the serve times for each day. Smart medicine time indication box contains separate sub-boxes. Therefore, nurses or users can set information of these sub-boxes for different pills. When the pill quantity and time have been set, the medicine box will remind users or patients to take pills using sound and light. The specific number of pills needs to be taken will be displayed by a seven segment led display placed on the corresponding sub-box. Compared with the old-fashioned pill box that needs user or nurse to load the box every day or every week. This smart medicine time indication box would significantly reduce nurses or user's burden on frequently preloading pills for patients or users. In later stages there is urge for the identification of the concerned user to the Smart Medicine Kit. In cope upwith this an smart card been introduced. Which works as an identity to the respected user. This process helps in making an two way functioning with the device. With the help of the card the user themselves to the device and gets the respected pill. It is an programmable device in which the time set at the time the medicine needs to be taken, and the device beeps and buzzers at that particular time intimate the respect user to take the pill. For the proper functioning of the device the components included are arduino board, real time clock, and sensors for sensing purposes [2].

The **Smart Medicine Box** says that the failure of taking medicine at prescribed time leads to life threatening scenarios. So to overcome this developed an Smart Medicine Box which keep tracks of the dosage and duration between each consumption for senior citizen patient. Next the process of fixing the drug accordingly to the storage space available in the pillbox on an regular basis. In these situations there are chances of combining varieties or kinds of drugs into the available compartment might lead to some dangerous scenarios. To overwhelm this an Smart Medicine Kit which maintains an tape record to calculate the timely intake of pill at the mentioned period. For this an box like storage is required to hold the pills which needs an regular

refilling. It is an programmable device, like the count of the tablet and period to intake is been prefixed at the beginning by doing manual settings to overcome the crisis of over dosage and to avoid taking at the wrong time using sounds modulation. In order to differentiate the storage compartments colors are been included along with the emitting device to specify the intake from specific box and to produce the count of remaining tablets in the sub boxes. To make the process more fruit full different colored indication are been suggested. The Smart Medicine Box which also keeps track of the dosage and duration between each consumption for senior citizen patient and an reminder to beep at particular time when the medicine needs to be taken as mentioned earlier. Hence, this Smart Medicine Box will track their medication and inform patient to take right dosage of right medicine at the right time [3].

The **IOT based Smart HealthCare Kit** will speaks about the idea of this project is to reduce the headache of patient to visit to doctor every time they need to check blood pressure, heart beat rate, temperature etc. With the help of this kit the time of both patients and doctors are saved and doctors can also help in emergency scenario as much as possible. The proposed outcome of the project is to give proper and efficient medical services to patients by connecting and collecting data information through health status monitors which would include patient's heart rate, blood pressure and ECG and sends an emergency alert to patient's doctor with his current status and full medical information. Objects which use various sensors and actuators that are able to perceive their context, and via built in networking capabilities they could communicate to each other, access the open source Internet services and interact with the human world. It consists of a system that communicates between network connected systems, apps and devices that can help patients and doctors to monitor, track and record patients' vital data and medical information.

Sometimes the user may feel uncomfortable with the prescribed medicine routine due to their sickness. And as usual it will be difficult for the aged ones to visit doctor by themselves. In order to overcome this, an idea of application is being developed. This reduces the headache of patient to visit to doctor every time they need to check blood pressure, heart beat rate, temperature etc. With the help of this kit the time of both patients and doctors are saved and doctors can also help in emergency scenario as much as possible. The proposed outcome of the

project is to give proper and efficient medical services to patients by connecting and collecting data information through health status monitors which would include patient's heart rate, blood pressure and ECG and sends an emergency alert to patient's doctor with his current status and full medical information. Objects which use various sensors and actuators that are able to perceive their context, and via built in networking capabilities they could communicate to each other, access the open source Internet services and interact with the human world. It consists of a system that communicates between network connected systems, apps and devices that can help patients and doctors to monitor, track and record patient's vital data and medical information [4].

In **Smart Medicine Remainder Box**, they developed smart medicine box which solves problems by setting up time table of prescribed medicines through push buttons as given in prescription. Present time will be saved in RTC module and notification time will be saved in EEPROM. Therefore at the time of taking medicine system generate notification sound and display the Bright light in certain pill boxes. Another advantage of our system includes of Sensing capability if the patient tries to postpone the time of taking medicine by suddenly opening and closing the medicine boxes to stop the sound. Compare to other devices available in market are capable to generate sound at one time and afterwards it stops.

There are chances of misleading to automated devices by the user by tricking as taken the medicine. To overwhelm this an Smart Medicine Kit with a sensing capability is been incorporated which identifies if the patient tries to switch off the beep or opening/closing at wrong time. Thus an RTC modules will be connected to firmly relied storage areas where the capsules is been fixed. At the time of start, clock and occasion will be made to appear in the displaying unit. In particular with a clock an beep kind of noise are set and the displaying unit will display the box to be chosen to consume the drug. Due to the usage of RTC and beep noise the displaying monitor keeps notifying till it finds the set time is greater then the mentioned. In case if the operator tries to mishandle the device, it starts to make an louder noise and puts compulsion to consume the pill [5].

**Medicine Dispensing Machine Using Raspberry Pi and Arduino Controller** has developed the kit is developed to operate in situations like where they is no medical store nearby

in rural areas .This kit helps in allowing the user to select a medicine, and pay the required amount, after which it verifies the amount received and dispenses the medicine. The amount is authenticated and identified using an image processing unit controlled by a Raspberry Pi. Due to the physical and infrastructural limitations in establishing a medical store at remote areas, this machine has been designed to be a standalone unit, requiring minimum supervision to operate for long periods of time. Sometimes there occurs scenarios where there is no proper facilities to visit pharmaceuticals specially in areas which are under development. So they developed a kit to help in allowing the user to select a medicine, and pay the required amount, after which it verifies the amount received and dispenses the medicine. The amount is authenticated and identified using an image processing unit controlled by a Raspberry Pi. Due to the physical and infrastructural limitations in establishing a medical store at remote areas, this machine has been designed to be a standalone unit, requiring minimum supervision to operate for long periods of time [6].

The **Review Paper for Smart Medicine Kit**, here in some scenarios there is an emergency situations which cannot be handled by the user itself , thus by considering that in mind an Smart Medicine Kit with a panic button is been incorporated . And in order to improvise the system the instruction that would be displayed on the LED heard by the user would be made as the instruction and transmitted as a voice by the speech synthesizer software .The required settings are made according to the need with the help of an keypad or module. The speech synthesizer is made work on its own in the system. An VCV Viewer enables to transfer the duplication of computers display screen to viewer [7].

**Smart drugs: Improving healthcare using Smart Pill Box for Medicine Reminder and Monitoring System.** This application will be used to configure the medical box by calculating the weight of each pill, setting the schedule of medical intake, alarming the user of the number of remaining pills, generating alarms whenever the patient does not take the required number of pills or doesn't take them at all, and so on. Two main functionalities characterize this system: safety which assures the wellbeing of the patient and the good functioning of the system by duplicating the electrical components and the security that helps keeping the medication out of the reach of the children by automatically looking the medical box whenever the patient takes his pills by linking it to a phone application.

On surveying all these informations the thought of making the smart medicine kit by using the key concept as the voice enabling and automatic opening of the box at the set time helps the patients especially the blind ones in providing proper instruction to carry perfect action at required time. The kit reminds the patient and intimates the caretaker by sending the message if the medicine is not taken. The purpose is to build the platform which is mainly useful for medication field. And to make the kit available and affordable for all kind of needy people with the low cost [8].

**All Time Medicine and Health Device** will develop a device comprises of an automatic medicine vending machine to dispense drugs as per a doctor's prescription. The vending mechanism is controlled by the raspberry pi which is a single board computer and the second aspect of it is the online portal for a user to check his prescriptions, and for the doctor to generate an e-prescription. The device dispenses out the prescribed medicines by the doctor when the user credentials of patients are validated from the database. The online portal is built on two fronts - a webpage and an android application which are linked to the same database. And provides an facility for the patient to view their details and prescriptions through the android application or webpage by logging in with appropriate credentials.

To be updated, further another smart medicine kit was developed by Pruthvesh Desai, Biswamoy Pattnaik, Sreya Dey, TS Aditya, Karthik Rajaraman, M. Aarthy. The prototype of this paper is to provide the use for every person who requires tablets and medical assistance. Thus it acts as an vending machine to avail the pills at the specified time with an extraordinary working features by considering the schedule. It is controlled by raspberry pi and aspect of it is the online portal for a user to check their written instruction .It even feasible for maintain a single written instruction for the referral purpose. It makes clear vision of it only when the user credentials of patients are validated from the database. The filled documents can be manipulated or sorted with an android application. This venture is mainly like an app where the users can login through their credentials and can see their details and can get the direct contact with the doctor and can find out his prescriptions there only. But the disadvantage is that not every person is well versed with

that app. And especially the old ones and blind ones are not able to use it. May be it could be said as, it is not user friendly or it is not applicable for every individuals [9].

In **Smart Medicine Kit** when the quantity of the pills and time to take it have been set, this medicine box will remind patients to take pills using signals of sound and light. Along with a sound, displaying the message and the same would be heard by translating it into speech by the E-speak software. A Smart Medicine Kit with a panic button is been set to alert the respected one in case of emergency and Sub boxes to store the pills.

In some scenarios there is an emergency situations which cannot be handled by the user itself, thus by considering that in mind an Smart Medicine Kit with a panic button is been incorporated. And in order to improvise the system the instruction that would be displayed on the LED heard by the user would be made as the instruction and transmitted as a voice by the speech synthesizer software. The required settings are made according to the need with the help of an keypad or module. The speech synthesizer is made work on its own in the system. An VCV Viewer enables to transfer the duplication of computers display screen to view [10].

# CHAPTER 3
# SYSTEM ANALYSIS

## 3.1 Problem Statement

In developed and metro cities , several trends suggest that incidences of oral medication non-compliance and its attendant consequences have increased. And now a days old and blind people are unable to take medicines on a regular basis according to the specified time as they tend to forget due to some circumstances. It is also mandatory that always there should be a person to look after the old ones just for giving the tablets in time. Hence in order to improve medication compliance we decided to work on a project which will be very helpful to older and geriatric people. The main objective of this research is to design and implement a medicine box using embedded platform which is capable of controlling the proper medication facilities. This is mainly related to a machine performing task in the absence of human beings.

## 3.2 Existing System

We found several different pillbox products available in the market. The cheapest one was the traditional pillbox, which contained seven boxes for seven different days of a week. Such pillbox normally cost around 200 INR. However, user had to load the pills to the boxes every week. Mixing different pills in the same box would increase the risk of making mistakes. We also found another type of pillbox, which had the sound reminder, and was able to remind the user to take medicine at user specified time. However, the users still have to put different kinds of pills in the same box, and reload the boxes every week. Additionally, it could only remind the user to take pills once a day. The average costs of this type of pillbox were about 1000 INR, Therefore, we think it was necessary to build a cheap and functional smart Medicine box that could bring more convenience for the user. We then defined the specifications of our device based on the user needs. From the literature cited, the research proposed an idea of Smart Medicine Box that will adapt the features of time tracking and as compared to the existing system, It will remind the user to take medicine not for once per day but thrice per day.

## 3.3 Proposed System

The existing established systems primarily works by just intimating a user to take a medicine at particular time. The developed kits like The Smart Reminder, The Tablet dispenser are all mainly concentrated on building more boxes for storage purpose, that is to store pills for a week and so on.

The currently proposed system that is the voice operated prescription manager and medicine dispenser provides much more friendly functionalities in its working process. The proposed system is a programmable device that will remind the user about the medicine or pill to be taken at specific day and time. Since just by keeping all the medicine in the same box might leads to confusion for aged ones and not feasible for the blind ones. So the developed Kit consists of three different boxes to store pills to take at three different times that is morning, night and afternoon if it is required. When the pill quantity and time have been set, the medicine box will remind users or patients to take pills using sound. And the box gets automatically opened at the set period. Along with different compartments to store the pills it provides an voice message to intimate an user to take the tablet at particular time.

Thus by including this voice feature, it makes one feel that there is someone to take care of them and in turn it is feasible to ask further queries if they have any. And mainly it clarifies specifically conveying a message to take medicine rather just by intimating through beep sound.

An IR Sensor is been fixed to each of the boxes. Thus once the box gets opened at the specified period, IR sensor starts to sense whether the person has taken the tablet or not. If the tablet is not taken, the box will not close and waits for few seconds and then sends an alert message to the concerned one that the tablet from the box one is not taken. Therefore an specific action can be taken in this regard. Thus it is been set to overcome all the possible situations.

## 3.4 Advantages of Proposed System

### 1. Cost efficient:

Our product cost is affordable compare to other product available in market. And failure of some of the parts or the system can also be retrieved at the least expenditure.

### 2. User Friendly:

The concerned person or the User can set time of medicine by them self. And kit provides message through voice and user can interact with the kit.

### 3. Reliability:

Good in quality and performance; able to be trusted for patients, old age people and blind ones.

### 4. Provide comfort and health:

Comfortable to use for old age and blind ones, since tablets are been stored in different boxes for discrimination and box gets opened automatically at time. And provide healthy life for patients by helping them to follow specified routine who regularly take medicines.

### 5. Long – Lasting:

The product can be used for long time.

### 6. Accurate result:

Intimation message will be conveyed at the proper time which is set by user previously.

### 7. Easy to maintain:

It needs less Maintenance. It is one time investment afterwards it can be used continuously.

## 3.5 Summary

The research was carried out based on the idea of developing the medicine dispenser and reminder to the people who are in need of reminding their prescriptions at the particular time. And hence forth by keeping this problem statement in mind, the kit voice operated prescription manager and medicine dispenser was designed. The kit provides the user an efficient and secured reminder, where the intimating message will be send to the authorized person if the medicine is not taken.

So keeping in mind about the various techniques available and components required for developing the kit. Chapter 1 has been exclusively utilized to understand the objective of voice operated prescription manager and medicine dispenser.

The survey of the supporting literature and the details of the supporting material are listed in Chapter 2, which provides an overview about various models such as arduino board, Raspberry Pi, and the process that are made.

In over all there are 9 chapters. The contents of the remaining chapters are as follows:

Chapter 3 depicts the system analysis, which includes problem statement, existing system, proposed system, advantages and the summary of it.

In Chapter 4, the requirement specifications like functional, non-functional, hardware and software requirements.

In Chapter 5, the proposed methodology is discussed.

In Chapter 6, System design is discussed.

In Chapter 7, the implementation details of the project which includes details of algorithm and their implementation are also discussed in this chapter.

In Chapter 7, testing is discussed.

Finally, in Chapter 8 and 9, experiments and results are discussed and finally the report is concluded and extension of the developed technique is discussed.

# CHAPTER 4
# SYSTEM REQUIREMENTS

## 4.1 Functional Requirements

A function of software system is defined in functional requirement and the behavior of the system is evaluated when presented with specific inputs or conditions which may include voice input and other specific functionality. The functional requirements of the project are one of the most important aspects in terms of entire mechanism of modules.

- The minimum requirement for the user is to know how to operate the system.
- In order to intimate the user, the voice message must be conveyed at the specified time.
- The user should give their consent by notifying their presence in front of the system by in turn replying or asking for the medicine.
- The system should be capable enough to recognize the voice provided.
- Foremost thing is, after recognizing the voice it should open the preferred box by specifying it.
- The IR sensor should be in proper working condition to detect or sense the presence of the tablet after few seconds of intimation.
- The IR sensor should send message to the concerned person, if the tablet is not taken.
- The same working procedure should be followed for the rest of the boxes according to the requirement.

## 4.2 Non - Functional Requirements

Nonfunctional requirements describe how a system must behave and establish constraints of its functionality. This type of requirements is also known as the system's quality attributes. Attributes such as performance, security, usability, compatibility are not the feature of the system, they are a required characteristic. They are "developing" properties that emerge from the whole arrangement and hence we can't compose a particular line of code to execute them. Any attributes required by the customer are described by the specification. We must include only those requirements that are appropriate for our project.

Non-Functional Requirements are as follows:

- **Real Time Tracking**

The action of the user in taking the tablet at the prescribed period can be tracked with the help of the IR sensors. Since the IR sensor detects the presence of the tablet after few seconds of the intimation and sends the message to the respected one. Thus live tracking is possible which acts like an GSM.

- **Two Way Process**

The user and the medicine dispensing system are authenticated to each other in order to execute the process of two way communication. This is a kind verification process in order to grab the presence of the user in front of the system at the intimated time and helps to solve other queries if any by means of communication.

- **Reliability**

It is highly impossible to trick the system by forcefully stopping the box by opening. It is an inbuilt function, that automatically opens at the set time and the message will be sent to the respected one after sensing and the box will not get closed until the tablet is been taken. Thus it works consistently well.

## 4.3 Hardware Requirements

- Raspberry Pi 3 b+
- Micro SD Card
- IR Sensors
- Mike and speaker
- Ethernet connection (LAN) OR a wireless adapter (Wi-Fi)
- Motor Driver
- DC Motors
- Power Bank
- Power Supply

In our "voice operated prescription manager and medicine dispenser", these are the basic needed hardware requirements that leads to get a good and secured result. So here we need an internet connection to take an NTP internet time to schedule the prescriptions time. The IR Sensors also play a major role in this venture. Where the sensors will sense whether the user has taken the tablets or not. The user can communicate with the kit through the usb web camera which acts as a mike and the earphones which can be treated as a speaker.

So let's see further in detail of all these hardware requirements:

### 4.3.1 Raspberry Pi

The Raspberry Pi 3 Model B+ is the latest product in the Raspberry Pi 3. range, boasting a 64-bit quad core processor running at 1.4GHz, dual-band 2.4GHz A tiny Raspberry Pi that's affordable enough for any project.

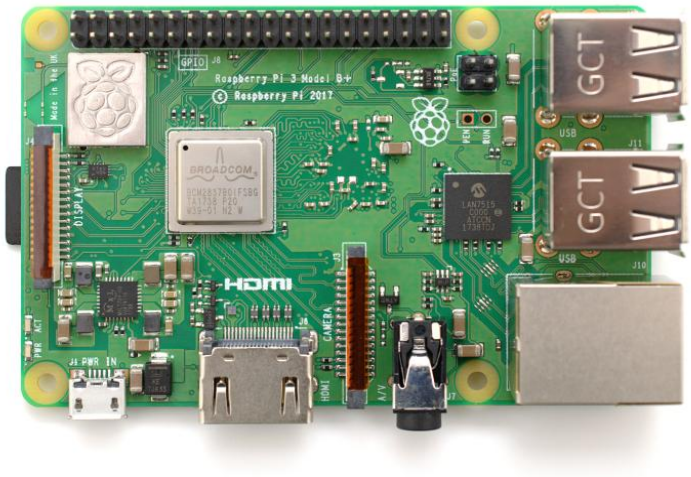



Figure 1: Raspberry Pi 3 model b+

The specification of Raspberry Pi 3 model b+ are as follows,

- Broadcom BCM2837B0, Cortex-A53 (ARMv8) 64-bit SoC @ 1.4GHz
- 1GB LPDDR2 SDRAM
- 2.4GHz and 5GHz IEEE 802.11.b/g/n/ac wireless LAN, Bluetooth 4.2, BLE
- Gigabit Ethernet over USB 2.0 (maximum throughput 300 Mbps)
- Extended 40-pin GPIO header
- Full-size HDMI
- USB 2.0 ports
- CSI camera port for connecting a Raspberry Pi camera
- 4-pole stereo output and composite video port
- Micro SD port for loading your operating system and storing data
- 5V/2.5A DC power input
- Power-over-Ethernet support (requires separate PoE HAT)

- **GPIO Pins of Raspberry Pi**

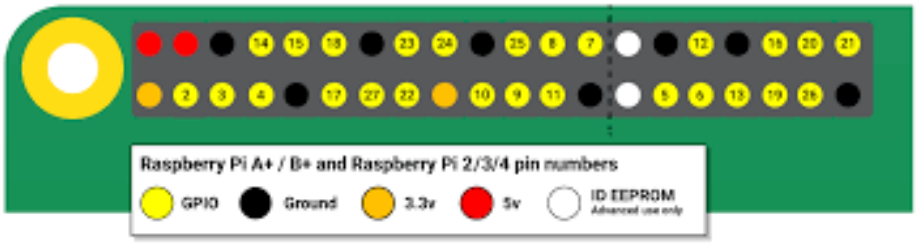



Figure 2: GPIO Pins of Raspberry Pi 3 model b+

A **GPIO** (general-purpose input/output) port handles both incoming and outgoing digital signals. As an input port, it can be used to communicate to the CPU the ON/OFF signals received from switches, or the digital readings received from sensors. Sometimes you can use a SINGLE pin for 'analog' values, by configuring the GPIO pin to be used by other onboard devices like an 'analog to digital' (ADC) converter. A 40-pin GPIO header is found on all current Raspberry Pi boards (unpopulated on Pi Zero and Pi Zero W). Prior to the Pi 1 Model B+ (2014), boards comprised a shorter 26-pin header. That can be used to turn devices on and off. For example, a LED. I2C (Inter-Integrated Circuit) pins allow you to connect and talk to hardware modules that support this protocol (I2C Protocol). This protocol will typically take up two pins. GPIOs have no predefined purpose and are unused by default. When used for input they are able to read voltages. When used for output they may be set to +3.3V (high) or 0V (low). There are 4 different types of GPIO pins on the Raspberry Pi. Of these, three may be used as GPIO or special purposes.

### 4.3.2 Micro SD card


Figure 3: Micro SD card

The micro SD card is a key part of the Raspberry Pi, provides the initial storage for the Operating System and files. Storage can be extended through many types of USB connected peripherals. 16 GB SD card is used for our Project.

The SanDisk has designed this Micro SDHC card with superior transfer rates in a high-quality design. The micro size makes it perfectly suitable for the tiny supercomputers, i.e., Raspberry Pi boards. Due to its ultra-small size, it consumes little power and thus saves your electricity bills & makes the battery life longer.

Features of the **SanDisk Ultra Micro SDHC Card for Raspberry Pi 3** are as below:

- It is a UHS-1 Class 10 certified Micro SDHC card.
- It has a storage capacity of 32GB.
- It comes with a superb **transfer speed** of up to 80 MB/s.
- This Micro SDHC card is specifically designed for the Raspberry Pi 3 Model B+.
- You can easily share the contents with your friends, family, colleagues while saving and archiving the data on the card.

### 4.3.3 IR Sensors

Figure 4: IR Sensor

An infrared sensor is an electronic device that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. This sensor is analogous to human's visionary senses, which can be used to detect obstacles and it is one of the common applications in real-time.

IR Sensors emit and receive Infrared radiation. They are often used as Proximity Sensors i.e. detect and alarm if an object is close to the sensor. Let me help you understand better about IR Sensors by giving two real life applications of IR Sensors. The first one is Mobile Phones. Almost all mobile phones nowadays have IR Sensors in them. Usually, they will be placed near the earpiece on the phone. When the user make or receives a phone call, the IR Sensor detects how far the phone is from the user's ear. If it is close to the ear, the phone's display will be turned off so that you do not touch anything on the screen accidently.

Another important application is in automobiles. All modern cars are equipped with reverse parking sensor that sense how far you can reverse your car without hitting anything. These reverse sensors are implemented using IR Sensors.

- **Schematic of IR Sensor Module**

The following image shows the circuit diagram of the IR Sensor Module. It consists of the following components.

- IR LED
- Photo Diode
- 150Ω Resistor
- 10 KΩ Resistor
- 10 KΩ Potentiometer
- LM358
- LED
- 1 KΩ Resistor

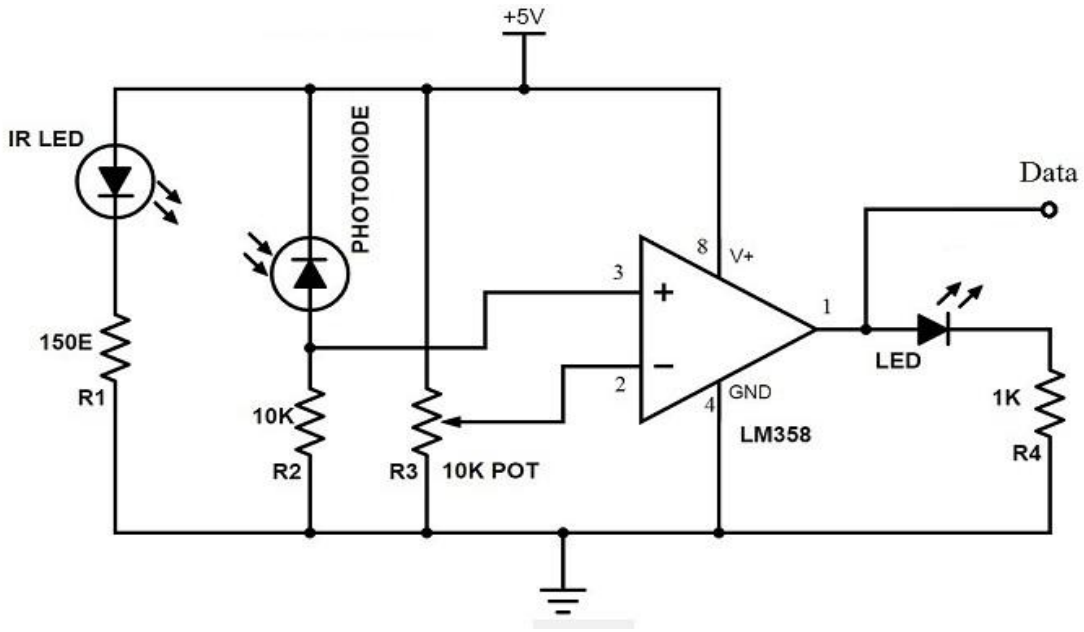



Figure 5: Schematic of IR Sensor

- **Circuit Diagram**

The following image shows the connection diagram of Interfacing IR Sensor with Raspberry Pi. You have already seen the circuit diagram of the IR Sensor Module.

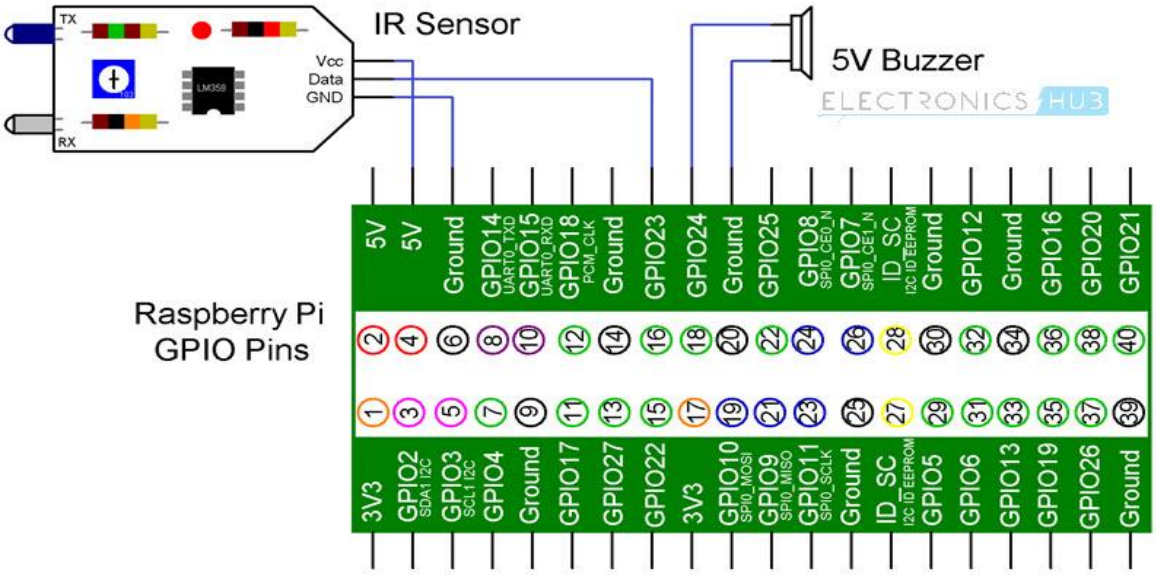



Figure 6: Circuit diagram of IR Sensor

### 4.3.4.1 Mike


Figure 7: An USB Web Camera

A webcam is a video camera that feeds or streams an image or video in real time to or through a computer to a computer network, such as the Internet. Webcams are typically small cameras that sit on a desk, attach to a user's monitor, or are built into the hardware. Webcams can be used during a video chat session involving two or more people, with conversations that include live audio and video. For example, Apple's iSight camera, which is built into Apple laptops, iMacs and a number of iPhones, can be used for video chat sessions, using the iChat instant messaging program (now called Messages). Webcam software enables users to record a video or stream the video on the Internet. As video streaming over the Internet requires much bandwidth, such streams usually use compressed formats. The maximum resolution of a webcam is also lower than most handheld video cameras, as higher resolutions would be reduced during transmission. The lower resolution enables webcams to be relatively inexpensive compared to most video cameras, but the effect is adequate for video chat sessions.

- **Webcam Interface On Raspberry Pi**

Figure 8: Web Cam Interface on Raspberry Pi

Raspberry PI persists in its pride stage due to its relevance in performing image processing applications. Real time image processing schemes can be developed using a Raspberry Pi, as it supports the webcam interface, and thereby we can process the algorithms for detection, recognition, segmentation, surveillance etc.

### 4.3.4.2 Speaker

Figure 9: earphones

Headphones are small speakers that can be worn in or around your ears. Smaller headphones, often called ear buds or earphones, are placed inside the outer part of your ear canal. Like speakers, headphones contain transducers that convert an audio signal into sound waves. Headphones are a pair of small speakers used for listening to sound from a computer, music player or other such electronic device. Headphones originally consisted of one speaker for each ear, connected by a band over the head.

### 4.3.5 Ethernet or LAN

Figure 10: Ethernet or LAN Cable

Ethernet is a communication protocol for Local Area Network (LAN) using same media interfaces (mainly RJ45 or fiber). Ethernet is the technology that is commonly used in wired local area networks (LANs). A LAN is a network of computers and other electronic devices that covers a small area such as a room, office, or building. It is used in contrast to a wide area network (WAN), which spans a large geographical area. LAN are independent networks but may be linked within a WAN through Internet devices such as Routers. A LAN is a network of connected devices that exist within a specific location. A LAN may be wired, wireless, or a combination of the two. A standard wired LAN uses Ethernet to connect devices together. Wireless LANs are typically created using a Wi-Fi signal. A WiFi connection transmits data via wireless signals, while an Ethernet connection transmits data over cable. An Ethernet connection is generally faster than a WiFi connection and provides greater reliability and security.

### 4.3.6 Motor Driver


Figure 11: motor driver

This L293D driver module is a medium power motor driver perfect for driving DC Motors and Stepper Motors. It uses the popular L293D motor driver IC. It can drive 4 DC motors in one direction, or drive 2 DC motors in both the directions.

Features of Motor Driver Board:-

- L293D motor driver IC.
- Male burg stick connectors for supply, ground and input connection
- Screw terminal connectors for easy motor connection
- On Board LM7805 Voltage Regulator

We used L293D Motor Driver IC for controlling a DC Motor with Raspberry Pi. It is a very common motor driver IC which is capable of driving two motors with individual currents up to 600mA.

- The Pin diagram of the L293D Motor Driver IC, along with the pin description is shown in the following image.

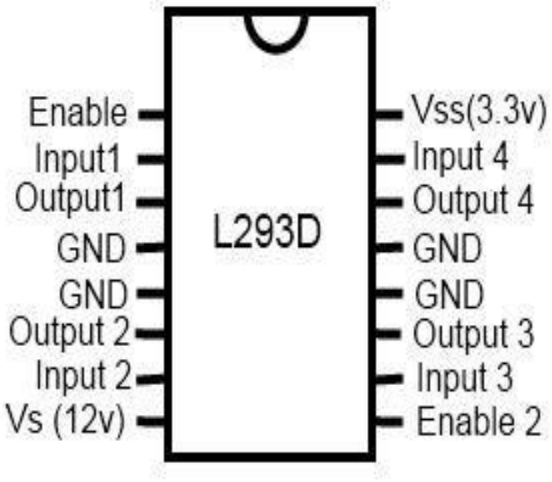



Figure 11: motor driver

The design of the circuit for controlling a DC Motor with Raspberry Pi is very simple. First, connect the pins 8 and 16 (VCC2 and VCC1) of L293D to external 5V supply (assuming you are using a 5V Motor).

There are four ground pins on L293D. Connect pin 4 to the GND of supply. Also, connect the ground pin of L293D to GND pin of the Raspberry Pi.

Finally, we have the enable and control input pins. Connect the pin 1 of L293D (1,2EN) to GPIO25 (Physical Pin 22) of Raspberry Pi. Then connect control input pins 2 and 7 (1A and 2A) to GPIO24 (Physical Pin 18) and GPIO23 (Physical Pin 16) respectively. How different will it be for controlling a DC Motor using Raspberry Pi with L293D and L298N? Well, there won't be much of a difference as essentially both these modules serve the same purpose.

But it is always nice to learn about something new and implement it into a project. So, first, let me take you through a simple introduction to L293D Motor Driver Module.

### 4.3.7 DC Motors(30 RPM)

Figure 12: Dc motor

Dc motor-30 RPM -12volts geared motors are generally a simple dc motor with a gearbox attached to it. DC Geared motors with robust metal gearbox for heavy-duty applications, available in the wide RPM range and ideally suited for robotics and industrial applications. Very easy to use and available in standard size. Nut and threads on the shaft to easily connect and internally threaded shaft for easily connecting it to the wheel.

- **Interfacing Raspberry Pi with DC Motors**

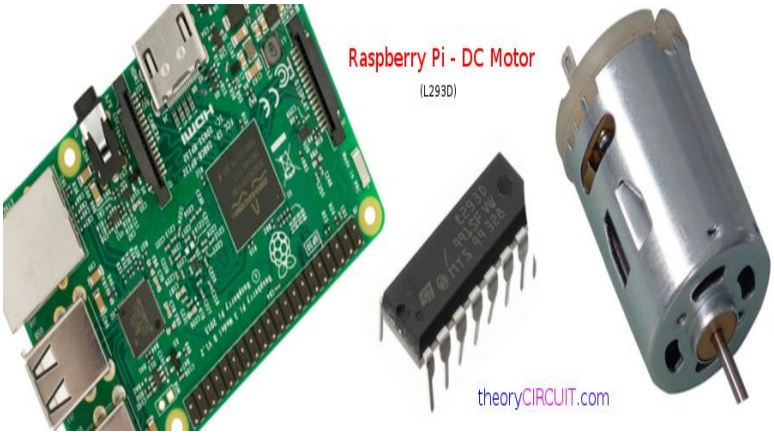



Figure 13: Interfacing Raspberry Pi with Dc motor

It is Very easy to Interface DC Motor with Raspberry pi by using L293D motor driver IC. As we know the motor converts electrical energy into rotating mechanical energy hence, it has been implemented in different applications. Mostly the DC motor requires more energy and power source than the micro controllers so we can not directly interface the motors with low power controllers.

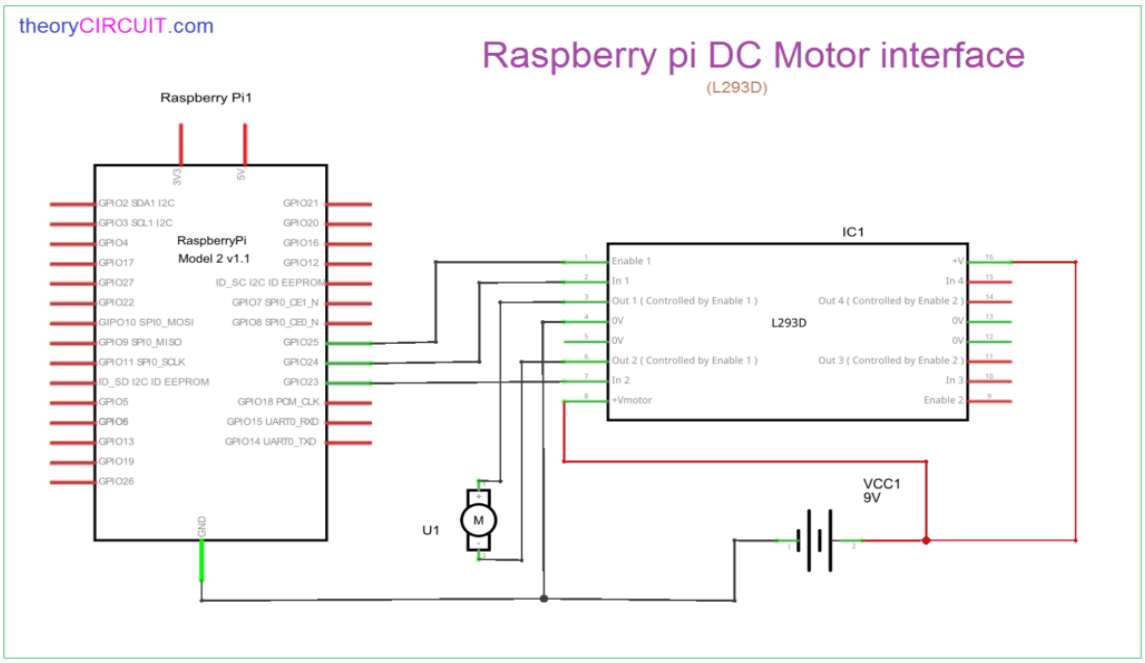



Figure 14: DC Motor Raspberry pi Interfacing

- **Connection details**

Connect GPIO 23 to IN2 of IC L293D and connect GPIO 24 pin to IN1 of IC L293D, then connect GPIO 25 pin of Raspberry pi to Enable 1 of motor driver L293D.

Output out1 and out2 are connected to the DC motor terminals, separate DC power supply (9V) is connected to the Motor driver IC. Gnd (ground) pin of L293D and Raspberry pi is connected commonly with DC power supply, You can use power supply to motor driver IC from Raspberry pi if you are using 5V or lower than 5V DC motor.

### 4.3.8 Power Bank

Figure 15: Power bank

Raspberry Pi zero can work without the main connection by using power bank that can be connected to Raspberry Pi zero using an USB cable.

### 4.3.9 Power Supply


Figure 16: Power supply

Raspberry Pi three can work without the main connection by using power supply that can be connected to Raspberry Pi three. Input Voltage AC 0-12 Output Voltages: +5V, +12V DC, Inputs and output connected to Terminal blocks, Maximum Load 0.75amps

## 4.4 Software Interfaces

- Raspbian OS
- Python

### 4.4.1 Raspbian OS


Figure 13: Raspbian Desktop

The Raspberry Pi's operating system is closer to the Mac than Windows, it's the latter that the desktop most closely resembles. It might seem a little alien at first glance but using Raspbian is hardly any different to using Windows (barring Windows 8 of course). Raspbian is an unofficial port of Debian Wheezy arm with compilation settings adjusted to produce optimized "hard float" code that will run on the Raspberry Pi. This provides significantly faster performance for applications that make heavy use of floating point arithmetic operations. All other applications will also gain some performance through the use of advanced instructions of the ARMv6 CPU in Raspberry Pi.

### 4.4.2 Python


Figure 14: Python

Python is an interpreted, object-oriented, high-level programming language with dynamic semantics. Its high-level built in data structures, combined with dynamic typing and dynamic binding, make it very attractive for Rapid Application Development, as well as for use as a scripting or glue language to connect existing components together. Python's simple, easy to learn syntax emphasizes readability and therefore reduces the cost of program maintenance. Python supports modules and packages, which encourages program modularity and code reuse. The Python interpreter and the extensive standard library are available in source or binary form without charge for all major platforms, and can be freely distributed. This compact modularity has made it particularly popular as a means of adding programmable interfaces to existing applications. Python strives for a simpler, less-cluttered syntax and grammar while giving developers a choice in their coding methodology. Python is meant to be an easily readable language. Its formatting is visually uncluttered, and it often uses English keywords where other languages use punctuation.

Unlike many other languages, it does not use curly_brackets to delimit blocks, and semicolons after statements are optional. It has fewer syntactic exceptions and special cases. Python uses whitespace indentation, rather than curly_brackets or keywords, to delimit blocks. An increase in indentation comes after certain statements; a decrease in indentation signifies the end of the current block.

- Python is used extensively in the information_security industry, including in exploit development.

- **Python is Interpreted** − Python is processed at run-time by the interpreter. You do not need to compile your program before executing it. This is similar to PERL and PHP.
- **Python is Interactive** − you can actually sit at a Python prompt and interact with the interpreter directly to write your programs.
- **Python is Object-Oriented** − Python supports Object-Oriented style or technique of programming that encapsulates code within objects.
- **Python is a Beginner's Language** − Python is a great language for the beginner-level programmers and supports the development of a wide range of applications from simple text processing to WWW browsers to games.

- **Python Features:**

- **Easy-to-maintain** − Python's source code is fairly easy-to-maintain.
- **A broad standard library** − Python's bulk of the library is very portable and cross-platform compatible on UNIX, Windows, and Macintosh.
- **Interactive Mode** − Python has support for an interactive mode which allows interactive testing and debugging of snippets of code.
- **Extendable** − you can add low-level modules to the Python interpreter. These modules enable programmers to add to or customize their tools to be more efficient.
- **Databases** − Python provides interfaces to all major commercial databases.
- **GUI Programming**− Python supports GUI applications that can be created and ported to many system calls, libraries and windows systems, such as Windows MFC, Macintosh, and the X Window system of Unix.

# CHAPTER 5
# SYSTEM DESIGN

## 5.1 Block Diagram

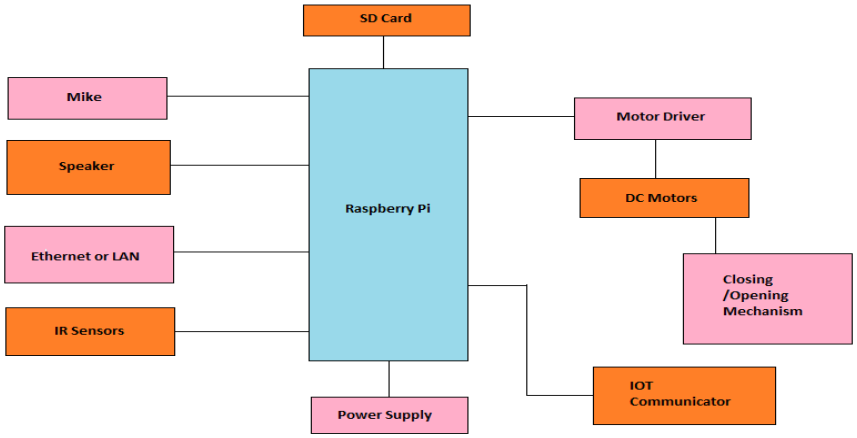



Figure 15: Block Diagram of Medicine Kit

The block diagram of the proposed system is represented in this figure. The components required are mentioned in the figure and all the components are connected to Raspberry Pi through the normal wires and cables.

The block diagram also depicts that the Raspberry Pi is connected to the mike and speaker for communication purpose. And connected to a power supply to boot or to start the Raspberry Pi. The SD card is inserted only after formatting and installing it with an operating system. The majorly and latest used OS is the Rasbian. Through LAN cable we can connect the Pi to the laptop or also we can connect via SSH. Three DC motors is been used separately to run three times i.e, morning, afternoon and night. IR sensors are used to detect whether the user has been taken the tablets or not. And motor drivers are used to control the motors.

## 5.2 Data Flow Diagram

A flowchart is one of the seven basic quality tools used in project management and it displays the actions that are necessary to meet the goals of a particular task in the most practical sequence. Also called as process maps, this type of tool displays a series of steps with branching possibilities that depict one or more inputs and transforms them to outputs.

A data flow diagram (DFD) is a graphical representation of the "flow" of data through an information system, modeling its process aspects. A DFD is often used as a preliminary step to create an overview of the system without going into great detail, which can later be elaborated. The flow diagram of the kit is shown in the given below figure.

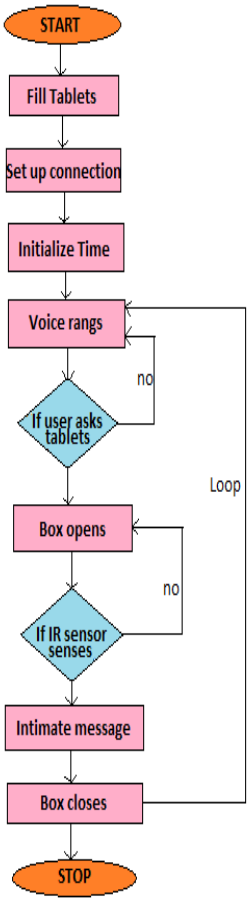



Figure 16: Flow chart of Medicine Kit Process

# CHAPTER 6
# IMPLEMENTATION

In current days, pathological states are common in one to one lives which requires an long lasting effects at some point of their journey, but not everyone is under surveillance and lagging to get an organized anesthetics. Now a days it is mandatory for keeping a caretaker or nurse for the patients to give medicines. That there should be a person to look after the old ones or blind ones just for giving the tablets in time. And not only the disabled but also the normal people fail to remember things in certain circumstances, especially for the person who has to take many medicines per day. There are also some apps which controls the kind of helping people to take the tablets in time and also there are some tablet kits that are already present in the market, but the old ones and the blind ones can't or may don't know to use the mobiles or the software's and also the tablet kit is a static thing which is not automatic (go and pick concept), which doesn't maintain any smartness in it.

To overcome this problems the thought of developing the smart medicine kit using voice enabling was developed. The voice operating requires an local environment or framework to feed the input output actions trough some built in codes. To further deal with, it requires an mike and speaker to listen and to give speech as a input for it. According to the situation further required functionalities is been added to get an fruitful outcome in terms of speech. In the sense that it will be in an capable position to answer for the general patient questions. This is the implementation part of voice enabling.

When we come to the hardware implementation, the major role that plays here is the Raspberry Pi 3 model b+. Before starting with the Raspberry Pi, we need to know that it doesn't have a special storage sector. Hence we are using an micro SD card for storage purpose. To set up an OS card we need an SD card with minimum capacity of 8GB. We are using an 16GB SD card. The majorly used OS is the rasbian.

To install Operating System into SD card the following steps need to be followed:

- Firstly we need to format the SD card through adapter in PC.
- Install NOOBS file (that also contains rasbian).
- All these necessity files will be transformed to the SD card.
- When the process has finished, safely remove the SD card and insert it into Raspberry Pi.
- Then boot.
- Plug in all the necessity cables or components.
- Rasbian will then run through its installation process.

We can Connect Raspberry Pi to a laptop through LAN or Ethernet cable.

We can also connect laptop with Raspberry Pi via SSH (secure shell).

The steps involved in connecting:

- Set up your local network and wireless connectivity.
- Enable SSH.
- Enable SSH on a headless Raspberry Pi (add file to SD card on another machine).
- Set up your client.

Raspberry Pi runs linux and supports python out of the box. Henceforth you can run any python program that runs on a normal computer. However it is the general purpose input/output capability provided by the GPIO pins on Raspberry Pi that makes it useful device for internet of things. After all these connections the motor code and the voice enabling feature code is instructed in python ide. The IR sensors are also connected to the respective GPIO pins and the free trial twillo application has been used to send the intimating message to the respective caretaker.

## 6.1 Working

The smart medication reminder and dispensing system is designed to enhance medication adherence. The main aim is to make a Smart Automated Medicine Box for those users who regularly take medicines, as they tend to forget to take medicines due to some circumstances. The pill dispenser offers users a sense of comfort knowing that their medications are conveniently organized and that they will be gently prompted to take them at the appropriate times. This kit is generally applicable for all generation people who regularly take medicines and also mainly for old people and blind ones, where the voice enabling helps them to take the pills especially for elderly people and blind people who are unable to prepare their drugs that might cause certain health issues, which can be resolved with this medicine kit. The process starts with the care taker. Where the care taker should fix the time in the module or may be using keypad. The kit mainly works through raspberry pi. The kit beeps or give a sound at the prescribed time, the patient listening to it will come near the kit and ask the kit to give the medicine. At that time the box with the medicine opens automatically with the help of a motor. The person can make further conversation with the kit which acts as a two way communication. The IR sensors will sense whether the patient has taken the tablet or not and will send the message to the intimated person. Also if there is no medicine in the box then the authorized person will get an intimated message, for secured purpose. Accordingly it will send an intimating message to the responsible person.

The goal of the venture is to build up a framework or a platform to convey prescription 24x7 to the general population. The machine can convey mostly Over the Counter (OTC) drugs, torment executioner, first help items and so forth, so it will be extremely valuable to the general public people. Pharmaceutical administering process is done in five stages. Firstly, Confirmation of time through the code itself. Secondly, reminding the person by conveying through voice according to the prescribed time. Thirdly, giving the medication at regular time. And finally, sending the intimated message to the authorized person. So this is the platform or the framework that can be used for any field, but mainly developed for the medication field.

# CHAPTER 7
# CHALLENGES FACED

### 1 Finding an appropriate methodology to make system a kind of automated

We wanted to develop an kit especially for the blind ones where they face lot of challenges. Since by making the box get open automatically would help them to take correct medicine instead of dragging some other box at the intimated time.

To carry out the process, first we developed an module by connecting DC motor to an rolling spring. So that the tablet strip could be fixed at the wanted string and that would roll once the power supply was given and would reach the end. But it did not happen, since the tablet strip use to get struck over there.

Then we developed another module by making use of canver belt with the help of an wheel. So the tablet strip should be placed on the belt and would rotate accordingly when power supply was given as soon as possible. But even this did not fetch the result expected, it use make lot of sound and due to pressure the belt use to get cut sometimes.

### 2 To select an voice platform

We wanted to intimate an user through voice message. For that first we thought of developing an alexa module using alexa skill development. And we were able to develop an small interface conveying hello message. And any of same could be developed. But in order to host this to connect with hardware using lambda function requires an amazon account holder with sufficient credentials and also we were unable to handle with lambda function conversions.

### 3 To find an proper routing program

Since our project is based on voice, it has to support for two way communication. In order to implement this we opted python as base language since with many inbuilt functions. First we wrote an program to integrate hardware and software. But it use to convey only messages, the box was not opening. Again we tried, at that time only first box use to get open

after the voice. Then due to some changes made to the program, accordingly all the boxes use to get open one after the other just for one voice message. We wanted the boxes to get open after each separate message for each prescribed box.

### 4 In choosing the sensor

First we opted touch sensor to sense whether the user has taken the tablet or not. But it could not respond properly with twillo application. Sometimes it use to react for loud noises and use to send message.

### 5 In choosing platform for sending message

Along with the sensing functionality, the respected message needs to be sent to the concerned one. For this we choose GSM, which would automatically send message to the preferred number by making use of Bluetooth. But this did not work with the hardware properly and requires many measures to implement. Finally we found out the tool for it called twillo.

# CHAPTER 8

# SOFTWARE TESTING

## 8.1 Test Cases

The proposed system was tested around while taking into account different kinds and forms of pills weighting less than 500mg. Various dosage and timing schedules were considered and the system was tested for several hours and some days .

| **TEST CASE NO : 01** | **TEST CASE NAME :** Authentication |
|---|---|
| **INPUT:** The user should provide voice as input. | |
| **OUTPUT:** Box Dispenses Tablets. | |
| **RESULT: PASS** | |

| **TEST CASE NO : 02** | **TEST CASE NAME :** Sensing |
|---|---|
| **INPUT:** If the pill box is empty. | |
| **OUTPUT:** IR Sensor send messages to the registered number. | |
| **RESULT: PASS** | |

| TEST CASE NO : 03 | TEST CASE NAME :<br>User Access |
|---|---|
| **INPUT:**<br>User should take the tablet out of the box. | |
| **OUTPUT:**<br>Box gets closed automatically. | |
| **RESULT: PASS** | |

Results show that about 85% were satisfied. At the end, concerning the ease of use, more than 90% considered that this medicine box is simple when being used.

## 8.2 Incremental Testing

In this testing, we test each module individually in unit testing phase, and then modules are integrated incrementally and tested to ensure smooth interface and interaction between modules.

In this approach, every module is combined incrementally, i.e., one by one till all modules or components are added logically to make the required application, instead of integrating the whole system at once and then performing testing on the end product. Integrated modules are tested as a group to ensure successful integration and data flow between modules.

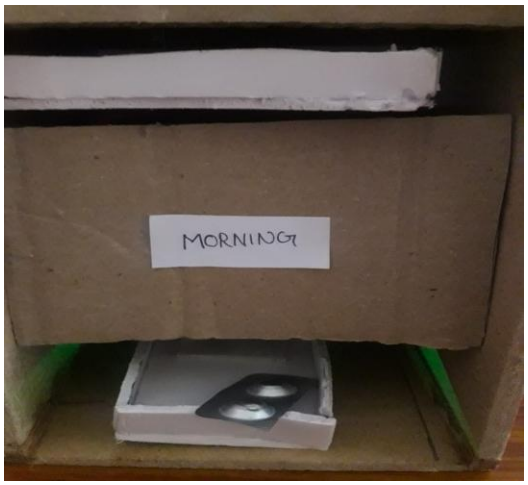
As in integration testing, the primary focus of doing this testing is to check interface, integrated links, and flow of information between modules. This process is repeated till the modules are combined and tested successfully.

# CHAPTER 9

# RESULT ANALYSIS


Figure 17: Medicine Dispenser Kit

The Kit contains all the components behind it. The three slots are made for three schedules i.e, morning, afternoon and night. It open the tray or the box using DC motors connected to it. It closes back only when the user takes the tablets. This could be sensed by IR sensors.




(a)


(b)


(c)

Figure 18: Medicine Dispenser Kit of respective schedule

The kit will open accordingly to the time set to it. Each slot has its own DC motor and IR sensor. When the first box opens, until the user takes the tablet the box doesn't close. When the user put his hand to take tablet into the box the sensor senses and gives the message through twillo application and closes the box. This repeats for all respective slots.

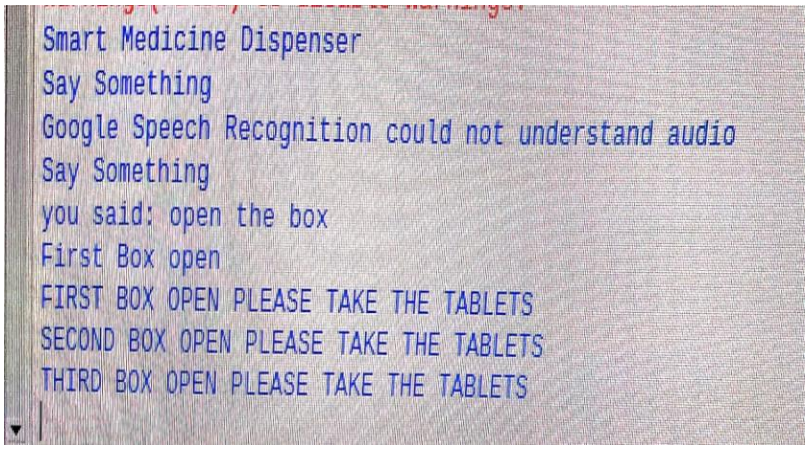



Figure 19: The output that we listen in earphone

The speaker we are using as for now is the earphone. The speech that could be listen through the microphone will also be displayed in the console.

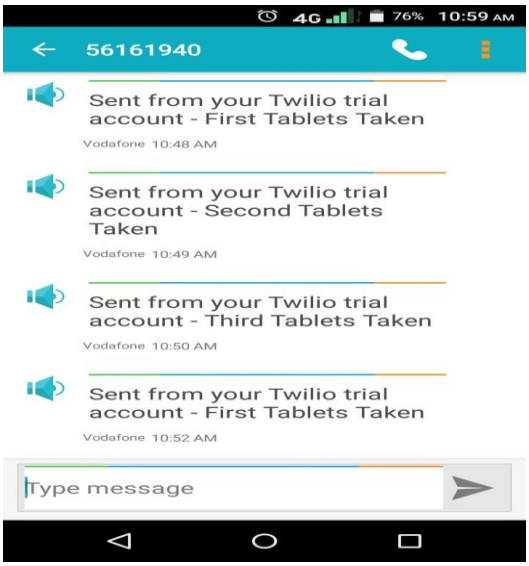



Figure 20: The intimating message sent to the caretaker

The twillo is an application that provides the user to perform many roles. The application we choosed in this twillo is to send an SMS to the care taker that might fell like a secured. And it uses an internet for sending the message.

# CHAPTER 10

# CONCLUSION & FUTURE SCOPE

## 10.1 Summary

Many Medication Reminder Systems have been developed on different platforms with different frameworks. Many of these systems require special hardware devices to remind the patients about the medicine in-take timings. Purchasing new hardware devices becomes costly and more time and money consuming. So in the given work an attempt has been made to implement a system which is economical, easily accessible and improves medication adherence. The proposed pill dispenser box can reduce family member's responsibility towards ensuring the correct and timely consumption of medicines.

The medicine dispensing box using embed platform has been experimentally proven to work satisfactorily. Here we presented an interactive model along with medicine dispensing unit. This medicine box is a sort of automatic that is, each boxes will be fixed with an specified tablets. And the box gets opened automatically at the preferred period been programmed. Before this process an voice message will be provided to alert the user about the time of medicine. And once the user confirms about their presence by conveying some message, the box gets open and dispenses the tablet. It is practical in the morning, afternoon and can also be used at night depending upon the number of boxes been attached. And the respective message regarding the intake of tablet will be sent to the registered number. And assures the safety of the patient and also will avoid consumption of wrong dosages. And proved to be useful and user friendly tool.

## 10.2 Future Enhancements

There are several aspects we need to work on our device in the future to meet the future revolution.

- **Enhancement of kit with image sensing sensors**

Enhancement of the kit with and image sensing sensor. That is by including this sensor by programming in such a way that it would recognize the action of the user while in take medicine. This assures advanced feature if an user tries to trick the IR sensor by just taking tablet out of the box and not consuming.

Figure 21: The Image Sensing

- **Software Update**

In further enhancements of the software application the voice interaction can be made more functional by including ALEXA features. That is instead of pre feeding of requirements an ALEXA module can be developed using alexa skill development. This will provide an customized way of interaction and avoids the usage of speaker and mike.

The enhancement in setting up of an time can be made more realistic by including RTC module. Thus just by programming the prescribed time along with the RTC module overcomes the failure of taking tablet at wrong time.

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