

# **Medical Prescription Detection and Health Guidance System Using Machine Learning**

Permanent ID: 22\_23-J-73

Project Proposal Report

L.L.Hewapathirana – IT19025322

Supervisor: Mr. Ravi Supunya

Co – Supervisor: Ms. P.K.Suriya Kumari

BSc (Hons) in Information Technology Specializing in  
Information Technology

Department of in Information Technology

Sri Lanka Institute of Information Technology  
Sri Lanka

February 2021

# **Medical Prescription Detection and Health Guidance System Using Machine Learning**

Permanent ID: 22\_23-J-73

Project Proposal Report

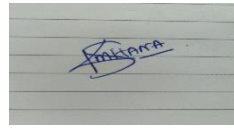
BSc (Hons) in Information Technology Specializing in  
Information Technology

Department of in Information Technology  
Sri Lanka Institute of Information Technology  
Sri Lanka

February 2021

## DECLARATION

I declare that this is my own work and this proposal does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other university or Institute of higher learning and to the best of my knowledge and belief, it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

Name	Student ID	Signature
L.L.Hewapathirana	IT19025322	

The above candidate is carrying out research for the undergraduate Dissertation under my supervision.

Signature of the supervisor

Date

.....

.....

(Mr.Ravi Supunya)

Signature of the Co-supervisor

Date

.....

.....

(Ms. P.K.Suriya Kumari)

## ABSTRACT

Machine learning (ML) is progressively becoming integrated into human life as technology advances, and its beneficial influence has been remarkable. Many real-world scenario-based applications are collaborating with machine learning to speed up implementation. [1] Machine learning is an approach which consists of different techniques and algorithms. And also this approach being used for many healthcare activities to solve clinical problems such as revolutionary clinical decision making. [2] Medical drug adherence is a major issue on nowadays because of how busy people are, In this study we analyzed that most of the arthritis patients which may forget to take correct medicine on specified time, skip the medicine because they have to spend more time to check the medicine from the drug covers, leads to over dosage and no idea about the medicine they have to take. If the patient untreated to arthritis it will may worsen and affects to the patient day-today-life. To overcome this situation most of the people use traditional pill boxes to manage their medications.

According to the individual research component study, to implement a graphical medication box for patients struggle with arthritis. This component is focused on efficient and secure medical boxes that help arthritis patients take their medication on time. This part of the research will be used to detect medical covers given by the pharmacy, remainder the schedule of medical dosage, alert the remaining amount of drugs in each container, and monitor the patient to determine whether or not the medication is taken.

**Keywords:** Machine learning, mobile application, prescription detection, medicine box.

## TABLE OF CONTENTS

DECLARATION .....	i
ABSTRACT.....	ii
TABLE OF CONTENTS .....	iii
LIST OF FIGURES .....	v
LIST OF TABLES .....	vi
LIST OF ABBREVIATIONS.....	vii
1 INTRODUCTION .....	1
1.1 Background.....	1
1.2 Literature Review.....	3
1.3 Research Gap .....	8
1.4 Research Problem .....	11
2 OBJECTIVES .....	13
2.1 Main Objectives .....	13
2.2 Specific Objectives .....	13
3 METHODOLOGY .....	15
3.1 User Research .....	15
3.2 Feasibility Study .....	16
3.3 System Overview .....	18
3.4 Software Solution.....	19
3.5 Work Breakdown Structure .....	20
3.6 Gantt Chart.....	21
4 PROJECT REQUIREMENTS .....	22
4.1 Functional Requirements .....	22
4.2 Non-Functional Requirements .....	23
5 DESCRIPTION OF PERSONNEL AND FACILITIES.....	24
5.1 Tasks assigned to the component .....	24
5.2 Resource Personnel for development.....	25
5.3 System and Software Requirements for development .....	25
6 COMMERCIALIZATION PLAN.....	26
6.1 Targeted Audience .....	26

6.2	Benefits to the end-users .....	26
6.3	Advertising and Communication .....	26
7	BUDGET AND BUDGET JUSTIFICATIONS .....	27
	REFERENCE LIST .....	28

## LIST OF FIGURES

FIGURE 3.1. 1: SUMMARY OF RESPONSE REGARDING USE AN AUTOMATED PILL BOX TO MONITOR DAILY DRUG ROUTINE .....	15
FIGURE 3.3. 1: SYSTEM OVERVIEW OF INDIVIDUAL COMPONENT .....	17
FIGURE 3.4. 1: WORK BREAKDOWN STRUCTURE .....	18
FIGURE 3.5. 1: GANTT CHART .....	19

## LIST OF TABLES

TABLE 1.3. 1: RESEARCH GAP.....	10
TABLE 5.1. 1: THE TASK ALLOCATED TO THE INDIVIDUAL COMPONENT.....	21
TABLE 5.2. 1: RESOURCE PERSONNEL.....	22
TABLE 7. 1: BUDGET PLAN .....	24

## LIST OF ABBREVIATIONS

Abbreviation	Description
ML	Machine Learning
IP	Image Processing
NLP	Natural Language Processing

# **1 INTRODUCTION**

## **1.1 Background**

Arthritis is the most popular disease that causes joint problems, but it is not a single disease; there are over 100 different forms of arthritis and associated disorders. Most kinds of arthritis affect elderly people more than younger people. The most frequent symptoms of arthritis include joint swelling, pain, stiffness, and limited range of motion. Arthritis affects not just the joints but also the heart, eyes, lungs, kidneys, and skin. [3]

Rheumatoid arthritis, psoriatic arthritis, and osteoarthritis are the three most common kinds of arthritis. Rheumatoid arthritis are cause from joint inflammation and pain. When the immune system doesn't work properly and attack the lining of the joints, called the synovium. Psoriatic arthritis affects people's skin and causes affected joints to become swollen, stiff, and painful but it often affects the knees, ankles, hands and feet. [3] [4] Osteoarthritis is another prevalent form that can affect practically any joint but most commonly affects the hands, spine, hips, and knees.

Technology plays an important role not only in the ease of communication, but also in the fields of science and healthcare. With the Technological advancements, machine learning has allowed the identification of various diseases as well as helped to identify the cures for others. The availability of technology to people has increased over the years and the world is now moving onto a more technological advanced era. Despite the existence of ML technologies, there will still be limited use of mobile application to extract the medicine name, dosage and duration on the medicine covers which are given by the pharmacy. It is common practice for pharmacist to read the doctor's handwriting on the prescription and curate the necessary medication.

Even though the chance of these pharmaceuticals reading the prescription wrong or writing a dosage wrong or the person who is buying the medication misunderstanding the instructions given by the pharmacist as to how to take the medicine is correct most of the time, there are still some instance is can happen or even the patient forgetting to take the medication or taking them in the wrong dosages, leading to unwanted problems and prolonged periods of recovery.



Therefore the aim of this research is to develop a mobile application on the Android platform for the use of arthritis patients and to introduce an automated medicine box to help monitoring the correctness of the medicine cover and checking if the patients picked up their medicine on time. With this, people can use a mobile camera to take the images of their pharmaceutical covers supplied by the pharmacy, and then upload it to extract the drug name, dosage and drug intervals from the covers.

## 1.2 Literature Review

According to Kader *et al.* (2018), the increase of different vascular diseases, diabetes and others that are genetically inherited diseases among the older generations mean that taking medicine as prescribed is a massive priority to lead a relatively healthy life. [5] Kader *et al.* (2018) and Gali, R. L *et al.* (2020) move on to say that of these people, around 40-60% face the problem of not taking the prescribed medicine at the right time in the correct amounts, which in turn means that people who are ill have a difficult time getting better. [5] [6] This situation worsens at times when older people take the wrong medications in the wrong doses, resulting in unwanted trouble (Kader *et al.* 2018)(Gali, R. L *et al.*, 2020), [5] [6] further proving the fact that it is essential for individuals to take the prescribed medicine in the stated quantity. The author, Kader *et al.* (2018) further moves on to state that in today's era of technology, it is efficient and effective to develop an electronic device to help reduce these problems. [5] Kader *et al.* (2018) identified several purposed designs for a smart remainder medicine box. Salgia, A. S, Ganesan, K and Raghunath, A. came up with the proposal of using the Keil Software along with UART and GSM systems to design the smart pillbox. [7] However, the system faced trouble as it had several network problems and communication. Mukand. S and Srinath, N.K.'s design which used a microcontroller interface, had a keypad, motor controller, pill container, display and an alarm system along with an additional 12V was not only costly but not portable as well. [8] Huang, S.C, *et al.* also developed a smart pillbox, that required a specific type of packaging on the medication, meaning that people needed to pay extra to get the specific packaging and it was not easily accessible to people everywhere in the world. [9] The authors of the article, Kader *et al.* (2018), propose their idea of a smart pillbox. One that is automated, uses an airtight pillbox with LCD lights and a voice alert system to indicate the times the medication needs to be taken. The purpose of their research was to design a low-cost automated smart pillbox using a microcontroller base to act as an assistant to those in need, looking into both hardware and software. [5]

Zeidan *et al.* (2018), states in the article that 'the autonomy of patients' is a trending topic as of now. [10] According to Gali, R. L *et al.* (2020) automation in technology has enabled several sectors to eradicate of their errors and to become highly efficient. [6] Many types of research are being carried out not only to improve autonomy but also to make the process of monitoring patients much easier, more efficient and more effective. The author further states that even though several automatic pillbox systems have been implemented, most lack safety and lack a sense of reliability (Zeidan *et al.* 2018). [10]

According to Zeidan *et al.* (2018), it is essential to connect the gap between easy and simple technology with bit more complicated ones to make it more beneficial to all, as the author states that connecting medical systems to mobile phones is becoming more and more important due to benefits such as easy to monitor and high level of accuracy. [10]

The mobile phone is the best device for this as a large percentage of the people of the world have access to it. Along with the creation of a simple application which can then be downloaded onto anyone's phone for easy access to information (Zeidan *et al.* 2018). The design proposed by Zeidan *et al.* (2018), is one that will alert the patient through s phone application. Things such as the time to take the medication, the number of remaining pills, and the proper dosage are those that will be alerted to the users of the application. [10]

Zeidan *et al.* (2018), further stated that this system is 'human-related' and there is a consideration that needs to be taken into account regarding reliability. Meaning that if the human enters the wrong data, the application will give instructions accordingly as it does not know what the correct data is. [10]

Taking the advancements of both technology and medicine into account, as stated by both Kader *et al.* (2018) and Gali, R. L *et al.* (2020) it is important to create a method where older people and others that need frequent monitoring are able to love both healthily and independently. [5] [6] Although some may argue that human services are better, it is both expensive and there are situations where certain mishaps may happen and cause more damage, for example, if the person taking care of a patient forgets a critical medicine, the patient may then have to face a situation between life and death (Gali, R. L *et al.* 2020). Thereby, meaning that an automated system is much more effective. [6]

Gali, R. L *et al.* (2020) explains the following reasons for the ease of an automated medicine tracking system: [6]

- It is more efficient, easily customizable and budget-friendly.
- As the system can be either used by the patient or by another person (for the data entering process), it is more comfortable, and easier for both parties and gives the patient a sense of independence and confidence in themselves.
- The design and simple application make it user-friendly.
- In the case where the patient has missed their medication, the emergency contact will be notified. Making it safer for both the patient as well as their loved ones.

The research conducted in this article also looks into the creation of such a system. One that is more efficient, and effective and caters to the needs of the Arthritis patients using Machine Learning (ML).

### 1.3 Research Gap

During my study of the literature, I discovered numerous methods for detecting doctors' handwriting in prescriptions and analyzing systems. The relevant research on existing prescription detection systems is discussed and compared in this section.

Table 1.3. 1: Research Gap

	Research -A	Research -B	Research- C	Research- D	Proposed System
Visualized Medicine box option suggest for Arthritis patients	No	No	No	No	Yes
Alarms the user through the pharmacy cover to take a certain medicine	No	No	No	No	Yes
Count the number of pills in each container	Yes	Yes	Yes	No	Yes
Alert the user before two days if a certain medicine needs to be refilled	No	Yes	No	No	Yes
Notify the family member	Yes	Yes	No	Yes	Yes

Finding errors in Pharmaceutical covers	No	No	No	No	Yes
Set the alarming notification to remind the next doctor visit	No	No	No	No	Yes
Uploading pharmacy drug covers to app	No	No	No	No	Yes
The remind and confirm function	Yes	Yes	Yes	Yes	Yes
Compare the pharmacy covers with the relevant prescription and confirm	No	No	No	No	Yes

**Research A** – Automated Medicine Box for Geriatrics [6]

**Research B** - Smart Medicine Box [10]

**Research C** - Smart Medicine Planner for Visually Impaired People [7]

**Research D** - Design & Implementation of an Automated Reminder Medicine Box for Old People and Hospital [5]

The proposed mobile application displays the identified drug names, dose, and duration from the prescription, as well as the detected drug names on medicine covers provided by a pharmacy. Additionally, imagine the medicine container pill organizer option, with the patient receiving a remainder before their drugs run out in two days and displaying the remaining amount of pills in each container. A list with relevant medicine names will be given to the patient to confirm whether or not he has taken them.

## **1.4 Research Problem**

When considering the literature review, study the main problem identified as the patients may forget to take the right medicine in right time, lead to over dosage, sometimes the patient have not idea about the medicine which have to take. There are some studies that has been developed to let the patient inform which drug to be taken in one intake using the text notifications. Though it is an optimal solution for the above issue, reading a text message difficult for a person who is not having much English literacy and not much user friendly for a person who is in a tight work schedule. Also for elderly people this is not much attractive and equally people who are handling a huge stress in their daily activities are also facing many difficulties when reading text messages.

Therefore if the developing application can provide the patient with a picture description is the patient feel more ease in use, it is more user friendly and the application will be efficient and effective.

## **2 OBJECTIVES**

### **2.1 Main Objectives**

The major goal of this component is to introduce an innovative mobile application to arthritis patients in order to convert their traditional medication box management into an automatic graphical medical box. This component will extract prescription text in order to effectively compare it to the pharmacy's medical covers. As a result, only a mobile camera should be used to detect drug names, and this component is more reliable for patients with arthritis as well as patients who struggle to read English literature. The app will verify whether the medications given by the pharmacy are the right drug names, dose, and duration based on image recognition. As a result, the patient can determine whether they are receiving the correct medication from the pharmacy.

### **2.2 Specific Objectives**

The following particular objectives are supposed to be achieved during this research component:

- Implement a Smart Pill Box.

The smart pill box can help monitoring and checking if the patients picked up their medicine on time. Pill box will remind the patients which drugs should be taken before and after meals according to the drug is prescribed for, via an alert message with relevant medicine cover image. The app notifies a family member if the patient misses a scheduled medication. The patient will be provided a sheet with relevant drug names to confirm whether or not he has taken them. Then the quantity of drugs in the bottles will automatically change when the patient takes the pills on a regular basis. As well as the patient getting a remainder before the two days that their drugs are to run out and displaying the remaining amount of drugs in each container.

- Pharmacy Medical Cover Detection

Patients should upload photo of pharmaceutical covers supplied by the pharmacy in this sub-component, and the system will extract the medication names, dose, and duration, contained in the medicine covers to ensure the correctness of the medicine cover by comparing the pharmaceuticals prescribed in the prescription. Then the system will then store the uploaded photos to the database.

### **3 METHODOLOGY**

I propose a system for creating a mobile application feature that acts as an automated graphical pill box to track the daily medicine intake of people with arthritis. In order to participate in this study, the patient must upload images of medicine covers provided by the pharmacy. The uploaded image data is then compared to the prescribed prescription, which was recorded in the cloud database using the IP technique. We will move to the next phase by verifying the accuracy of the medication coverage data (drug name, dosage, and duration). The uploaded photos are then recorded in the system, and the pill box is automatically filled with the appropriate tablets. In addition, the user needs to choose the time for the reminder and the next doctor's appointment.

#### **3.1 User Research**

The initial stage of the product development process is requirements gathering. We gathered information by making a survey on the medications used by people with arthritis. The domain research was also examined in order to identify user desires and requirements that need to be fulfilled.



Figure 3.1. 1: Summary of response regarding use an automated pill box to monitor daily drug routine

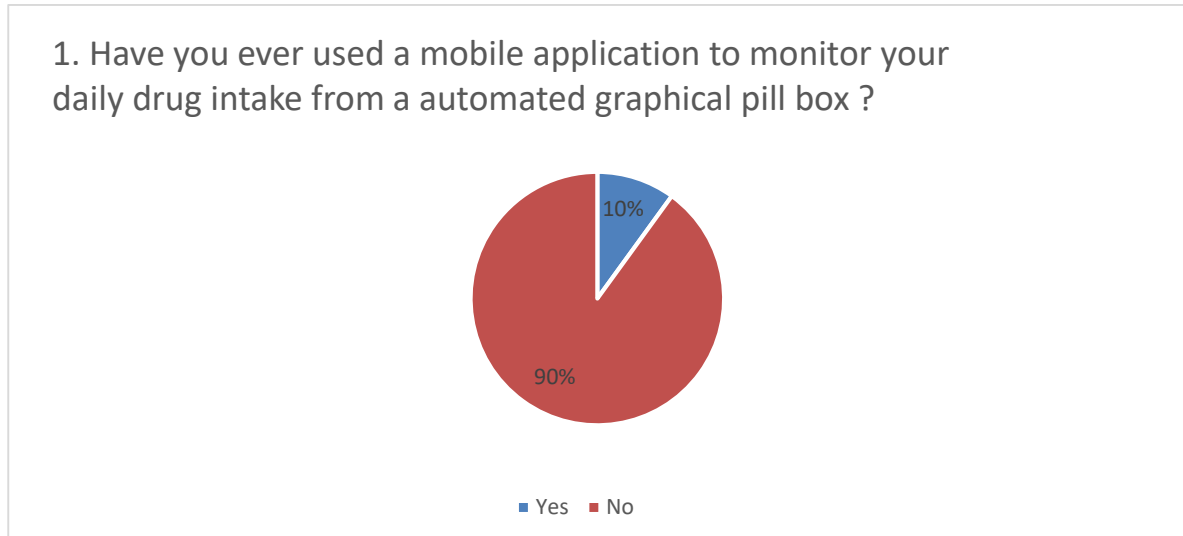


Figure 3.1.1 shows that more than 90% of survey respondents had never used an automated graphical pill box to track their daily drug intake.

### 3.2 Feasibility Study

- Technical Feasibility

We considered the most recent technological stack and the project's technical feasibility when analyzing previous research articles. The newest technological stack and the suggested framework make it possible. However, as it is essential to the entire product creation process development, we must improve our understanding of component development.

- Economic Feasibility

To successfully finish the project with all the functions integrated, the application's components are given among the colleagues. The system's effective development will depend heavily on the extraction of the prescription data. Additionally, the system will be more helpful and lower the number of people who take the wrong drugs if it can extract the medical benefits provided by the pharmacy.

- Schedule Feasibility

The suggested system must also be finalized before the deadline. We review the schedule feasibility and assign tasks by the timeframe. They are also in responsible for delivering the finished product on time.

- Software Implementation

In this part the mobile application will be presented and the following are the functional development,

- ✓ Implement a smart pill box
- ✓ Implement a medicine cover identification
- ✓ Implement correctness of medical covers.
- ✓ Implement customized medication schedule
- ✓ Implement a responsive reminder
- ✓ Implement the family member notification.
- ✓ Implement to calculate number of remaining pills in the box.

The aforementioned are the features that will be included in the mobile UI.

- Software Testing

The suggested system must first be tested on around 10 patients, and as it is a mobile application, we must test it on a variety of platforms to see if they are all run by Android OS. Then you must test various doses and time patterns on different patients.

- Operational Feasibility

The suggested mobile application would prevent users from forgetting to take their prescribed medicine at the time specified, ignoring medication due to having to spend more time reading the medicine from the medicine cover, which leads to overdose as well as a lack of knowledge about the medicine they need to take.

### 3.3 System Overview

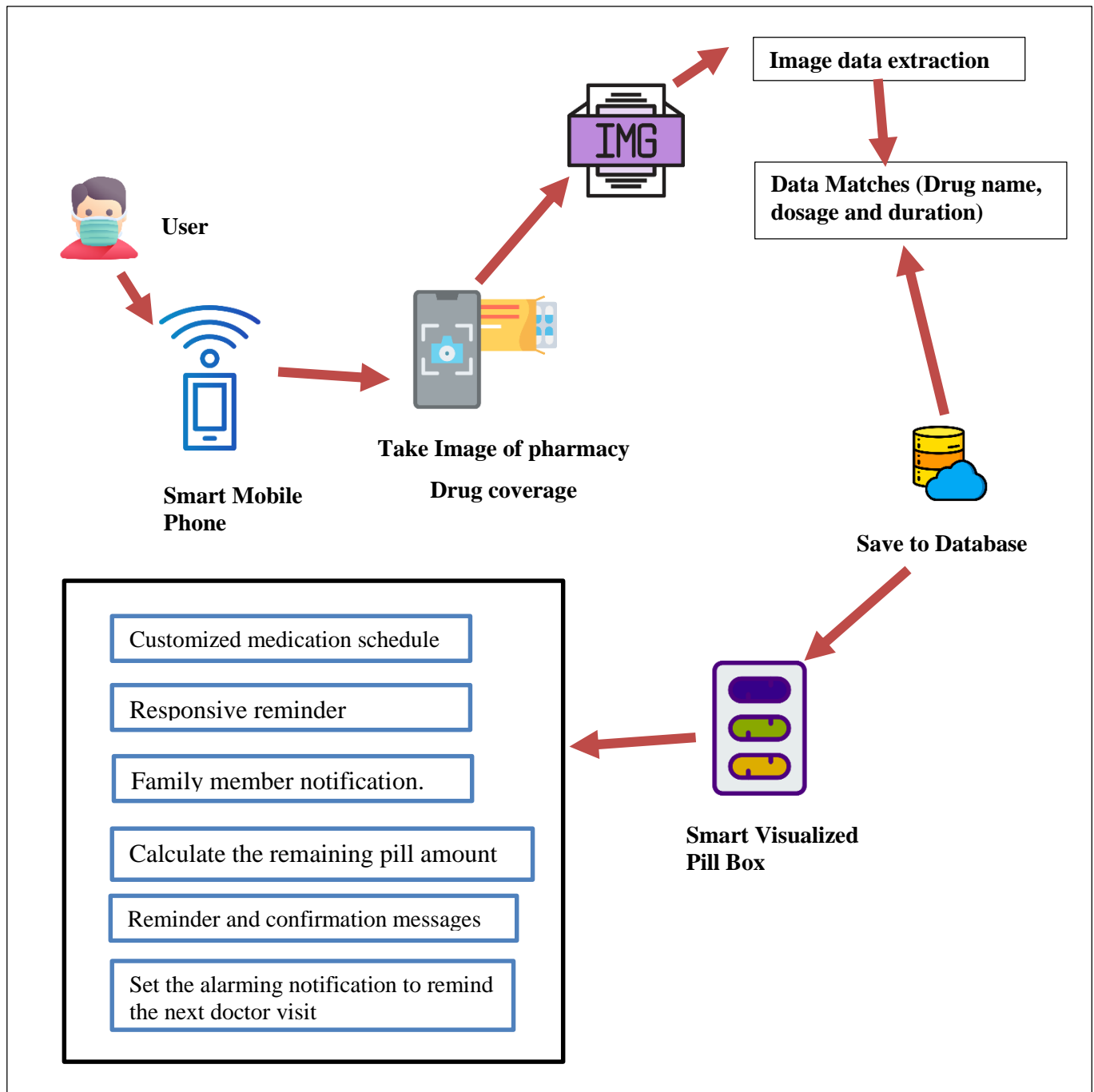


Figure 3.3. 1: System Overview of Individual Component

### 3.4 Work Breakdown Structure

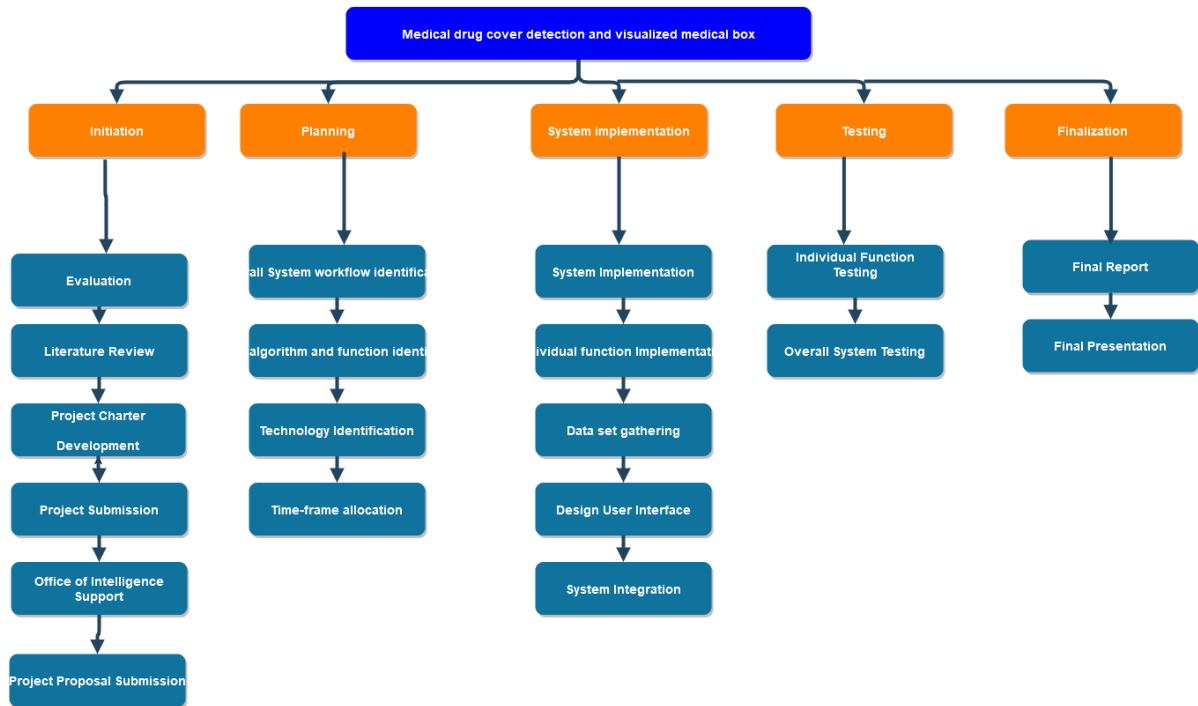


Figure 3.4. 1: Work Breakdown Structure

### 3.5 Gantt chart

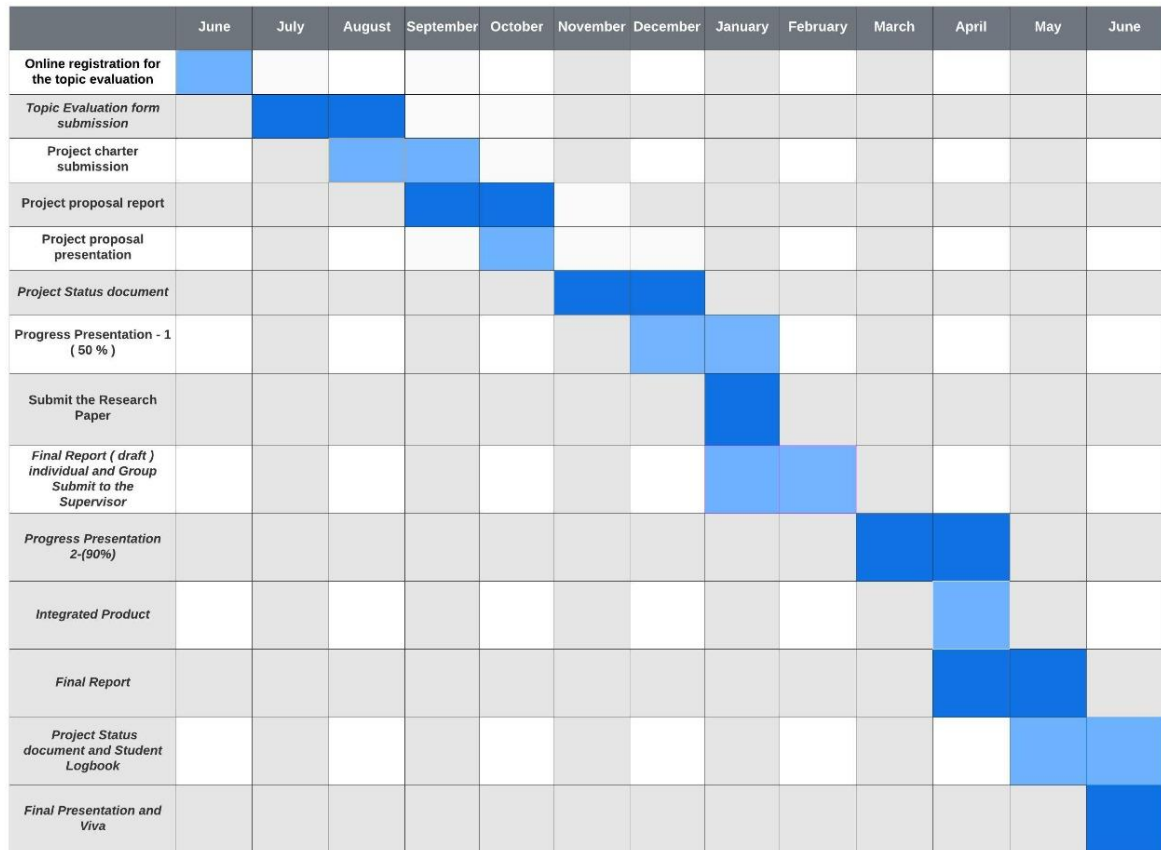


Figure 3.5. 1: Gantt chart

## **4 PROJECT REQUIREMENTS**

### **4.1 Functional Requirements**

- System should be able to extract the drug name, dosage and duration accurately from the medicine covers supplied by the pharmacy.
- System must be able to compare the extracted data with the records stored in the database for confirm right drug
- System must be able to provide alerts to the patients within the specified time.
- System must be able to provide proper automated visual medical box with relevant data.

### **4.2 Non Functional Requirements**

- High accuracy
- Easy to use interface
- Portability
- Confidentiality
- Availability

## 5 DESCRIPTION OF PERSONNEL AND FACILITIES

### 5.1 Tasks assigned to the component

The task allocated to the component are shown in the table.

Table 5.1. 1: The task allocated to the individual component

Registration No	Name	Functions
IT19025322	L.L.Hewapathirana	<ul style="list-style-type: none"><li>• Implement a smart pill box</li><li>• Implement a medicine cover identification</li><li>• Implement correctness of medical covers.</li><li>• Implement customized medication schedule</li><li>• Implement a responsive reminder</li><li>• Implement the family member notification.</li><li>• Implement to calculate number of remaining pills in the box.</li></ul>

## 5.2 Resource Personnel for development

The table shows the resource personnel who assist in providing the datasets for the development of the system.

Table 5.2. 1: Resource Personnel

Name	Designation	Company
Mrs. Charuni Pinnaduwa	Doctor	District Base Hospital-Theldeniya
Mr. Namal Pathirana	Doctor	General Hospital - Badulla

## 5.3 System and Software Requirements for development

To properly implement the proposed system, we must first understand the software and system requirements. The necessary information is provided below.

- System Requirements
  - ✓ Android Phone
  - ✓ Android Version: Below 10.0
  - ✓ Memory: 1GB
  - ✓ Free Space: 256MB
  - ✓ Back Camera: Minimum 5MP
- Software Tools
  - ✓ Machine Learning
  - ✓ Image Processing
  - ✓ Deep Learning
  - ✓ Natural Language Processing
  - ✓ Python
  - ✓ JavaScript
  - ✓ Firebase



## **6 COMMERCIALIZATION PLAN**

### **6.1 Targeted Audience**

- All arthritis patients, doctors, and pharmacists are targeted for by the proposed system.

### **6.2 Benefits to the end-users**

- This system effectively controls the patients' medication regimens.
- Avoid giving medications at a misleading dosage.
- Prevent confusion about the doctor's next appointment.
- Sending reminders to restock the medicine containers two days in advance.

### **6.3 Advertising and Communication**

- Social media may be used primarily to advertise the proposed app.
- To promote the app, it might be sent to pharmacies, hospitals, and other public places.
- Can broadcast a live video on a YouTube channel to thoroughly promote the mobile app.
- Can even run seminars for arthritis patients and then thoroughly present the app to them, explaining how it functions and other relevant information.

## 7 BUDGET AND BUDGET JUSTIFICATION

This is the estimated budget plan that we have created: With the progress of the project, this plan can change.

### 7.1 Budget Plan

The following is a list of the estimated costs for creating the proposed system for the research.

Table 7. 1: Budget Plan

Description	Amount (LKR)
AWS S3 Cloud Service	2000.00
Hosting Cost	4000.00
Server Cost	5000.00
Internet Cost	4000.00
Document printing	1000.00
<b>Total</b>	<b>16000.00</b>

## References

- [1] A. M. a. M. R. Azghadi, "Automated Machine Learning for Healthcare and Clinical," 2021.
- [2] S. M. D. A. C. J. G. U. Ganegoda1, "Involvement of Machine Learning Tools in Healthcare Decision Making," *Journal of Healthcare Engineering*, no. 27 January 2021, p. 20, 2021.
- [3] "Centers For Disease Control and Prevention," [Online]. Available: <https://www.cdc.gov/arthritis/basics/types.html>.
- [4] S. Senthelal, J. Li, S. Ardeshirzadeh and M. A. Thomas., "National Library of Medicine," 19 June 2022. [Online]. Available: <https://www.ncbi.nlm.nih.gov/books/NBK518992/>.
- [5] M. N. U. M. A. I. a. M. A. Mohammed Abdul Kader, "Design & Implementation of an Automated Reminder," 27-October-2018, Chittagong, Bangladesh, 2018.
- [6] G. M. V. S. S. a. T. N. N. V. S. Rama Lakshmi Gali, "AUTOMATED MEDICINE BOX FOR," 2020.
- [7] P. D. S. B. a. P. v. Dr.Sivakumar Sabapathy Arumugam, "Automated Medicine Dispenser in Pharmacy," *International Journal of Advances in Computer and Electronics Engineering*, India, 2019.
- [8] K. G. a. A. R. Aakash Sunil Salgia, "Smart Pill Box," *Indian Journal of Science and Technology*, vol. 8, no. January 2015, 2015.
- [9] S. M. ., J. M. S. M. M. R. T. T. Mohammed Abdul Kader, "Development of an Assistive Device for Elderly," IEEE, Dhaka, 2019.
- [10] K. K. R. A. Z. D. A. H. J. B. Hiba ZEIDAN, "Smart Medicine Box System," IEEE, Lebanon, 2018.
- [11] <https://www.ncbi.nlm.nih.gov/books/NBK518992/>.



