DISTRIBUTED HEALTH CARE FRAMEWORK FOR PATIENT HEALTH RECORD MANAGEMENT AND PHARMACEUTICAL DIAGNOSIS

Project ID: TMP-22-010

Project Proposal Report

U.L.V.M. Lekamalage – IT19111766

B.Sc. (Hons) Degree in Information Technology

Department of Software Engineering

Sri Lanka Institute of Information Technology

Sri Lanka

January 2022

DISTRIBUTED HEALTH CARE FRAMEWORK FOR PATIENT HEALTH RECORD MANAGEMENT AND PHARMACEUTICAL DIAGNOSIS

Project ID: TMP-22-010

Project Proposal Report

U.L.V.M. Lekamalage – IT19006994

Supervised by – Mr. Jeewaka Perera

Co – Supervisor: Ms. Laneesha Ruggahakotuwa

B.Sc. (Hons) Degree in Information Technology

Department of Software Engineering

Sri Lanka Institute of Information Technology

Sri Lanka

January 2022

Declaration

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

Name	Student ID	Signature
Lekamalage U.L.V.M	IT19111766	

The above candidates are carrying out research for the undergraduate Dissertation under my supervision.

Name of supervisor:

Name of co-supervisor:

…….. ……

Signature of the supervisor: Date

(Mr. Jeewaka Perera)

…….. ……

Signature of the Co–Supervisor: Date

(Ms. Laneesha Ruggahakotuwa)

Abstract

In this day-to-day life, the Doctors are creating an impact on society. The reasons could be quite an enormous number. Doctors are viewed as the main pieces of the community. However, sometimes Doctors are being accused because of the Patient’s carelessness. In case of those circumstances, Doctors have become vulnerable, and those situations cause them to lose their profession. So, we are going to develop a component to a mobile app to overpower those issues. based on this, the patient, who is completely obscure or uneducated, can get all the data of the drug that as its utilization, aftereffects, and so on; regardless of whether the individual is insensible about the drug's name. With the goal that it makes mindfulness among the individuals and decreases clashes. Uneducated individuals as well as it additionally helps the informed ones. The individual who is mistaken for the doctor's prescription, in the event that Patient’s not sure what tablet to take for what issue, this procedure is not limited with just name, even its shape, the color could be sufficient to tell its characteristic. It fabricates a straightforward and reasonable connection between a doctor and a patient. Utilizing this application individuals can get data close by themselves. So, there would be no fault and questions. Furthermore, the component has been created, as indicated by this, the patient, who is completely obscure or ignorant can get all the data in regard to the drug. By taking the tablet's picture and uploading it, it is focused on helping individuals by giving separate data. What is more, this component does not recommend the drugs for the users however gives a fundamental thought regarding the prescription given by doctors.

Keywords - Image Processing, Pill images, Imprints, Color histogram

Table of Contents

Declaration i
List of Figures iv
List of Tables v
List of Abbreviations ..... **Error! Bookmark not defined.**
List of Appendices vi
1 Introduction 1
1.1 Background Study 1
1.2 Literature Survey 2
1.3 Research Gap 4
1.4 Research Problem 5
2 Objectives 8
2.1 Main Objective 8
2.2 Specific Objectives 8
3 Methodology 10
3.1 Project Overview 10
3.2 System Overview 13
3.3 Development Phase 15
3.4 Feasibility Study 16
3.5 Work Breakdown Structure and Gantt Chart 18
3.5.1 Work Breakdown Structure 18
3.5.2 Gantt Chart 19
4 Project Requirements 20
4.1 Functional Requirements 20
4.2 Non-Functional Requirements 20
5 Business Potential 21
5.1 Targeted Audience 21
5.2 Benefits from the system 21
6 Description of personnel and facilities 22
7 Budget and budget justification (if any) 23
8 References 24
Appendices 25

List of Figures

1.4.1: Summary of the responses to "Are you taking medication frequently" 5

1.4.2: Summary of the responses to "Do you think it's important to know medication details before you take the medicine?" 5

1.4.3: Summary of the responses to ""Since health solution has not yet proposed for pharmaceutical diagnosis, it is a must to visit the doctor even during COVID-19". Do you agree with this statement?" 6

3.2.1 full system overview diagram 13

3.2.2 system overview diagram of particular component 14

3.3.1: Agile Software Development Lifecycle 1 15

3.5.1.1: Work Breakdown Structure 1 18

3.5.2.1: Gantt Chart 1 19

List of Tables

Table 1.3.1: Summary of the related research papers and sources *4*

Table 6.1: Resource personnel for Development 1 ..... *22*

Table 7.1: Budget and Budget Justification 1 ..... *23*

List of Appendices

Appendix Description Page

*Appendix - A Additional Survey Responses gathered during the Research Survey.*24

Appendix B – Supervisor and Co-supervisor's Endorsement …… 27

1 Introduction

1.1 Background Study

In our regular routines and current Covid-19 pandemic situation, many medications utilized in hospitals, emergency clinics, and essential consideration places are hard to recognize. Furthermore, those utilized might be oppressive to distinguish on an everyday premise except if they are self-evident.

Meds are one of the most significant medical services advances for further developing wellbeing what is more personal satisfaction for the ages. Tragically, meds are a two-sided deal. Meds will result from the after-effects additionally and other undesired results. Large numbers of these medication-related issues are unsurprising and hence can be forestalled. In this proposal, the component is suggested for the recognizable proof of the drug using a portion of the image processing techniques.

The proposal is contained as follows. Section 1 includes Introduction, Background Study and Literature survey, Research gap, and overview of the Research Problem. Section 2 contained an overview of the objectives. Section 3 will provide the Methodology. The final sections will contain the business requirements and budget justification and conclude the document with the Reference List and Appendices.

1.2 Literature Survey

As a first model in pills identification and recognition was proposed by, Lee and associates [1]. The gathering fostered a computer vision answer for distinguishing illicit medications using tablet design, given size, shape, and imprint. In this arrangement, a given question picture is contrasted with a bunch of pictures put away in a display, following 3 principal steps: preprocessing, edge recognition, and component vector development.

As a next endeavor, Shilpa and Arun Bhatia [2] (June 2016) proposed a technique to distinguish harmed and missing tablets with an edge recognition strategy. This technique says that tracking down edges of tablets by taking their Center. The no of tablets in the vesicle is determined by the edge recognition strategy.

Later Hart [3] and collaborators fostered a framework fit for perceiving pills utilizing cell phones what is more a web-based public database. The cycle begins with picture securing followed by a marker identification. Then, at that point, the pills inside the marker area are recognized given size, shape, and shading. The size of the drug is determined by using the minor and significant axis crossing. At that point, it is utilized a white balance algorithm to manage light varieties, aiming for color determination. The shading results from the examination of the Histogram with a pre-constructed lookup table based on the Ident data set. Finally, the shape is assessed by looking at the pairwise geometric histogram of Ident class shapes and the segmented pill.

Yet another component focusing on this topic was proposed by Ramya.S, Suchitra. J, Nadesh R. [4] which distinguishes the deficient tablets after creation utilizing“Detection of Broken Pharmaceutical Drugs using Enhanced Feature Extraction Technique”. This technique includes many picture handling procedures to distinguish the faulty tablets. Because of tablets, they propose an include extraction method to see as the faulty one.

As a next endeavor, Dr. H.B. Kekre, Dr. Dhirendra Mishra,[5] proposed strategies for image handling for determining the inadequate tablets and presence of class deformities. This strategy has been taken to recognize various potential kinds of tablet abandons, like absent and broken, and numerous other potential deformities.

Later Jesus J Caban, Adrian Rosebrock,[6] propose a model for recognizing the remedy of medications. This paper says a straightforward but solid categorization strategy that can be used to naturally recognize the remedies of medications within images. The framework utilizes distinctive image handling strategies. The proposed strategy has effectively resulted in 568 of the most related tablets in the United States and has shown 91.13% precision in naturally recognizing the right drug.

As a final example, A pill recognizer programming known as MedSnap ID [7] created for iPhone devices is fit for recognizing pills utilizing image handling strategies and a local database without network association. Specialized specs are not revealed yet the interaction is quite easy to understand. The versatile gadget must be accurately lined up with the marker to capture the picture. After the right arrangement, the programming snaps a photo consequently and processes the picture. The outcome is a rundown of fragmented pills with pertinent
Pieces of information for patients or guardians.

1.3 Research Gap

In below figure is a summary of the accessible research papers and sources,

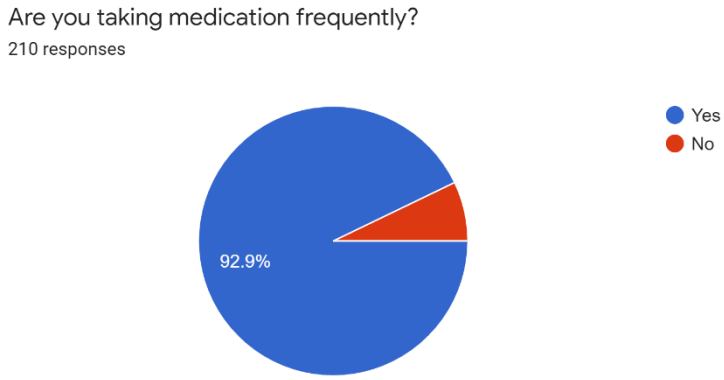
Reference ID	Identify medication	Provide Summary of Medication	Can use for Civilians
Research [1]	✓	✗	✗
Research [2]	✓	✗	✗
Research [3]	✓	✗	✗
Research [4]	✓	✗	✗
Research [5]	✓	✗	✗
Research [6]	✓	✗	✓
Research [7]	✓	✗	✓
Our Solution	✓	✓	✓

Table 1.3.1: Summary of the related research papers and sources

According to those different endeavors to carry out a part to distinguish a medication or a drug utilizing image handling anyway as indicated by specific sources there is a typical issue that is neither one of the created parts could be effective, given the circumstances, only for identifying drugs using various methods, we can be resolved these singular procedures concentrate just for distinguish drugs utilizing different techniques and not a give a point-by-point outline regarding those. As medication consuming people, inquisitive with regards to what is meds we are consuming, what is the primary explanations behind consuming them, and on the off chance that there are any delayed consequences. As an answer for these disappointments, we can get thoughts from recently utilized carried out parts and produce an alternate arrangement from existing arrangements, which ought to further develop ease of use and be more useful than past variants.

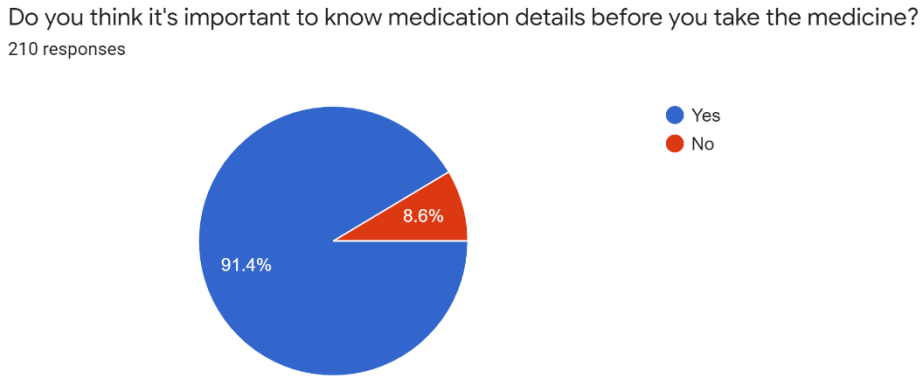
1.4 Research Problem

A public survey was conducted to gather information on the healthcare problems that emerged during the covid19 epidemic. According to the survey, about 92.9% say that they consume medication frequently in that specific duration.



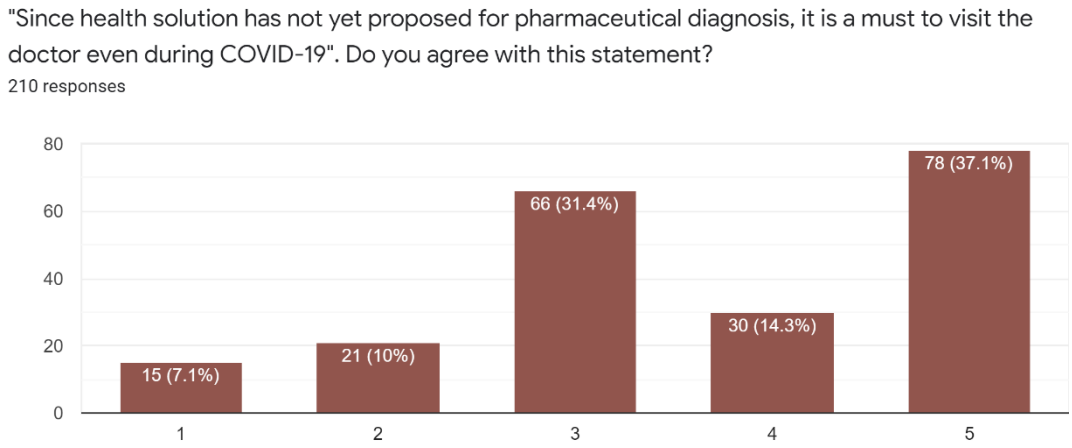
1.4.1: Summary of the responses to "Are you taking medication frequently"

And, 91.4% says that they would prefer to know about their medication before consuming it,



2.4.2: Summary of the responses to "Do you think it's important to know medication details before you take the medicine?"

Not only that, but the Majority of percentage think also visiting the doctor to pharmaceutical diagnosis during a pandemic is the only method to overcome that problem,



3.4.3: Summary of the responses to ""Since health solution has not yet proposed for pharmaceutical diagnosis, it is a must to visit the doctor even during COVID-19". Do you agree with this statement?"

According, to these details we can make a conclusion that many individuals battle when they consume drugs about the well-being course their absence of information on meds. The applications we have today just assistance to just distinguish the medicine, yet some could not use by typical residents. However, to distinguish the prescription given by specialists they needed to go back to a specialist or drug store. Yet, under these pandemic circumstances, those choices are not reasonable.

Furthermore, on the off chance that a specialist committed some error and gave some unacceptable drug those will affect consumers' life. In this age, everything is on the cell phone, so they ought to have a method for beating that issue utilizing a straightforward application.

The aim should be to assist clients with distinguishing drugs and get a definite outline, for example, the secondary effect, uses about specific prescription utilizing just a picture of the medicine. As further development increases the usefulness and

Encourages advancement this component should be incorporated with versatile applications.

2 Objectives

2.1 Main Objective

The fundamental goal of carrying out the Drug identification component is to take care among the people diminishing conflicts about consumable meds just as assist the educated ones with expanding their insight about prescription. for that, reason, this part will be not difficult to use with any level of the informed individual with a couple of button clicks. Furthermore, clears a path for development, increases usefulness, and Encourages advancement this part going to be consolidated with adaptable applications utilizing REST APIs (Application Programming Interface). Not just that utilizing this Drug identification component plan to assist every person with further developing their wellbeing, knowledge, diminish drugs abuse and save a lot more living soul. And as a scope, we are going to train a module to identify diabetes medications and general consumable meds within one year period.

2.2 Specific Objectives

- Create an application to carry out an easy-to-understand interface that incorporates the core functions of uploading drug images, showing the summary of drugs coming to the servers, and balancing the load according to a suitable load balancing algorithm.

- Gather Information on consumable medication
    - People who are hoping to utilize this component need to get precise and solid insights concerning their prescription to satisfy that evenhanded as developers we should find reliable information sources or informational datasets.

- Implement a dependable communication strategy between the application and cloud base server.
    - An appropriate communication strategy is going to be implemented in the application to connect to the cloud base server with APIs and gather useful information such as the drug's color shape and imprint.

- Train a model to separate information from uploading pictures.
    - At the point when a client transfers pictures of medicine the model ought to have the option to extricate information, for example, the shape of the drug, color, and the engraving those are the most compelling thing to distinguish the right prescription, so the specific model ought to be prepared to remove that information.

- Create A solid decision-making process in the cloud base server.
    - When the user uploads an image rapidly to the server, there should be a good solid decision-making process to extract the data from the uploaded image, get the matching data, and send it to the application.

- Clear a path for new designers and developers to reuse the particular component and make REST API (Application Programming Interface) endpoints to compatible with other platforms.
    - This sort of part can be useful to everyone with additional fostering their prosperity, information, reducing drugs misuse, and saving significantly additional living spirits. So, this should open to improve more and incorporate with a lot more platforms.

3 Methodology

3.1 Project Overview

The proposed system for drug identification is a mobile application component that will be communicated with cloud base server with REST APIs. Commonly, there are three qualities that any strategy to naturally distinguish pills should extract shape, color, also imprint.

However, developing an enhanced and user-friendly drug identification component that interacts with the mobile application and identifies the previously mentioned qualities is a challenging task to succeed since there are many areas to cover to provide an ideal solution.

So that the component should divide into significant parts according to functionality.

1. Gathering Data set for training the image processing module

2. Implement a dependable communication strategy between the application and cloud base server.

3. Create A solid decision-making process in the cloud base server.

4. Create an application to Carry out all the related functions to the image processing component

1. Gathering Data set for training the image processing module

- Catching different images and extracting information from that specific image utilizing computer vision is a particularly troublesome task. For playing out that task with next to no mistake the image handling model should prepare very well utilizing various kinds of images with various resolutions. So, assembling a sample dataset act as the primary job in this component. for satisfying that we should accumulate numerous and more drug images and related information for that specific medicine utilizing beforehand perform research or get information from the related sites.[8][9] And as a scope, we are going to train a particular module to identify diabetes medications and general consumable meds within one year period.

2. Implement a dependable communication strategy between the application and cloud base server.

- In this project correspondence among application and cloud base servers is one of the significant errands. At the point when a client transfers a picture from a versatile application that picture should move to the server right away without any mistake so to make a solid and dependable association, we will make REST APIs on related technology or framework.

3. Create A solid decision-making process in the cloud base server.

- In the current world, there have different sorts of medicine that have comparable color and comparative shapes so distinguishing the right drug without any confusion cloud base server ought to have a solid decision-making process. To

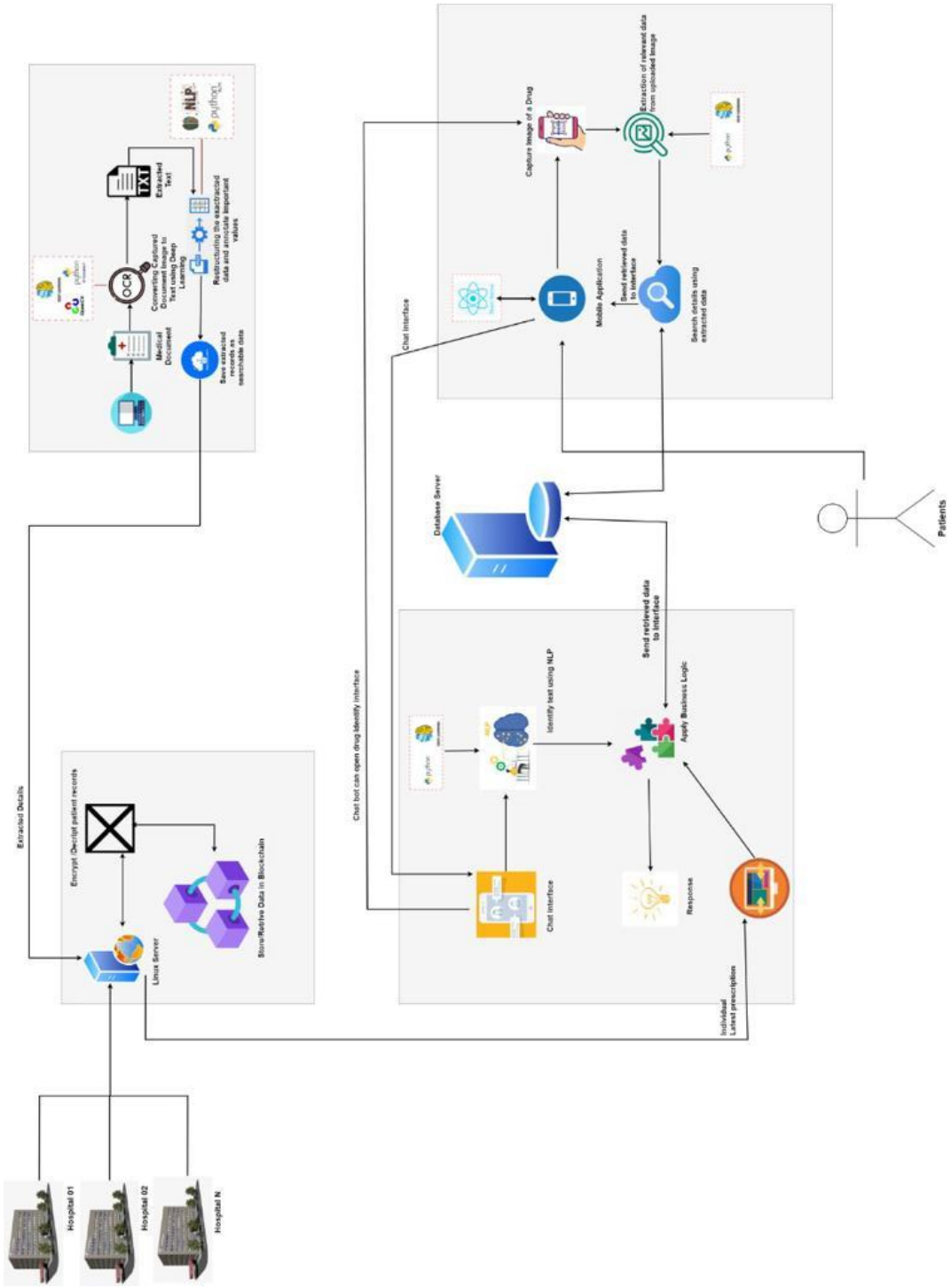
satisfy that task we going to make a procedure which is when the image handling module separates information from an image. The framework contracts that information with the current data set and finds a similitude with a higher rate so that will be useful to give precise and solid results to the client.

4. Create an application to Carry out all the related functions to the image processing component.

- Our society contained educated and uneducated people so while giving this drug identification system to society there ought to have easy to understand applications that assist any educated level client with utilizing without any platform difficulty. To overcome that, we are going to develop an app to Carry out an easy-to-understand interface that incorporates the core functions of uploading drug images, showing the summary of particular drugs coming to the servers, and using a cross-platform mobile development framework to develop to break platform barrier.

3.2 System Overview

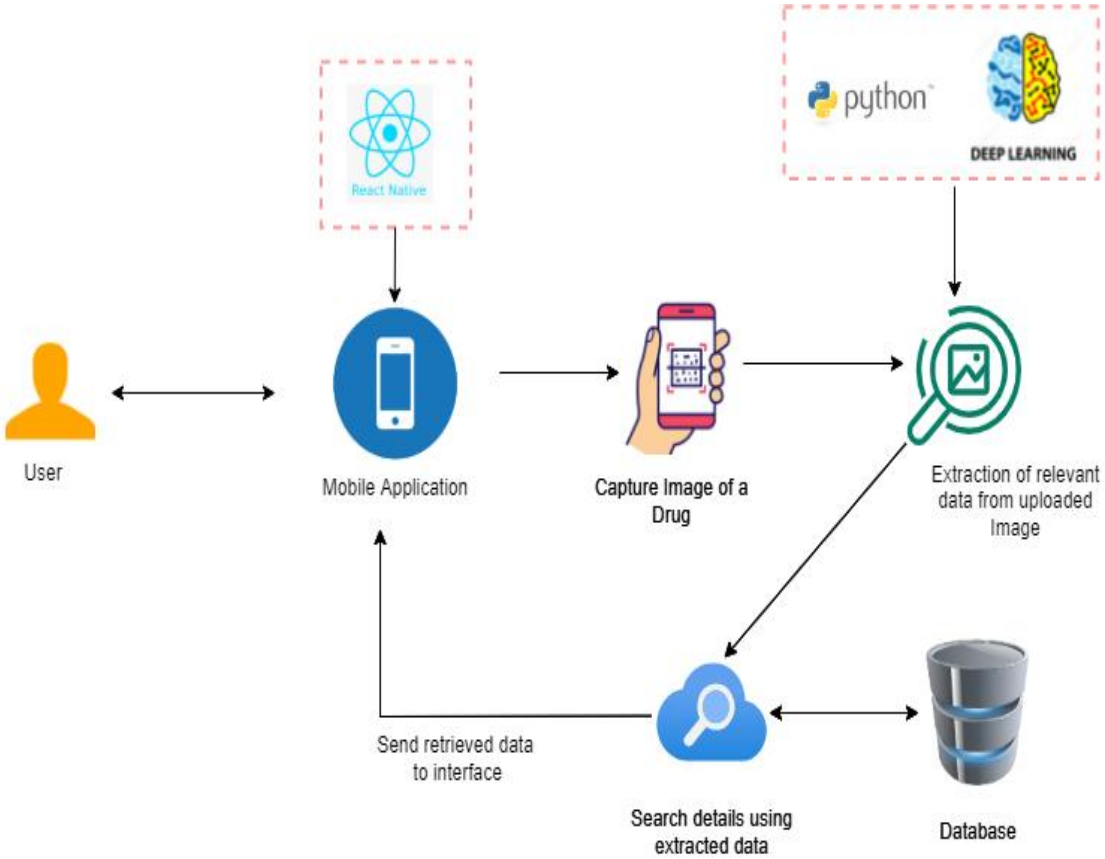
In below Figure 3.2.1. shows a Full system overview diagram of all components and their relationship with other components.



3.2.1 full system overview diagram 1

As shown in Figure 3.2.2, there will be a sub-component related to image processing and drug identification component. The technology stack and usages of them are as follows.

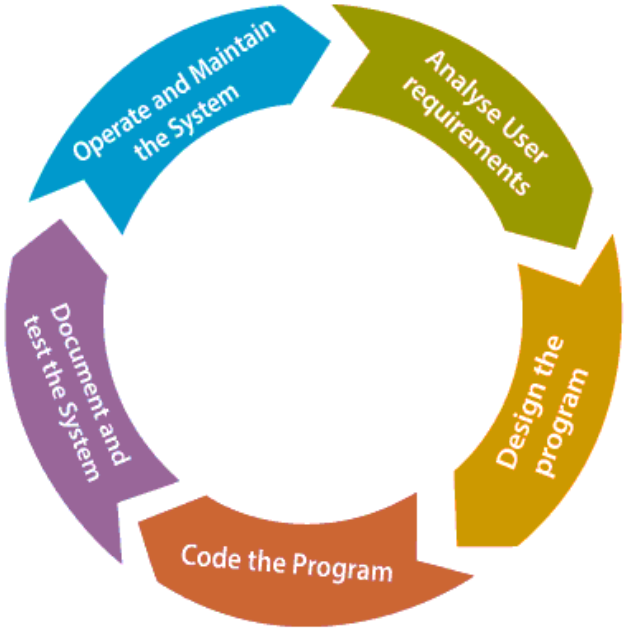
- Image Processing and machine learning- Build the Drug identification model.
- For image Processing– OpenCV
- For mobile application- React Native and Node Js
- AWS (Amazon web service) EC2(Elastic Compute Cloud) service - Cloud Server to host the component.
- Node.JS, Express.JS – to implement REST API.



3.2.2 system overview diagram of particular component 1

3.3 Development Phase

The Agile software development will be used throughout the product creation life cycle (Figure 3.3.1). Agile software development enables responding to changes in an efficient manner [10]. As also in agile, Scrum will be used. Scrum is capable of handling and controlling a variety of iterative and incremental projects [11]. Since Scrum has the capability of checking and adjusting to changing requirements, The team will have daily stand-up calls to receive a daily update on the project's development do the necessary implementations.



3.3.1: Agile Software Development Lifecycle 1

3.4 Feasibility Study

- ✓ Technical Feasibility

  Image processing and machine learning will be utilized to extract the data from the image uploaded by the user, while react-native and node JS will be used to implement a mobile application to carry out client-side operations and all the sub-components will be combined in the hosted server. To ensure the successful implementation and provide the proposed technical solution every member should go through the latest research about modern technologies before implementation.

- ✓ Economic Feasibility

  The proposed solution is aimed at all the hospitals across the country and physicians and patients would all benefit upon the system's completion. The usage of drug identification will utilize to identify and get more details about the consumable medication. As a result of that more users will use it for improving their well-being. Not only that to utilize this particular component users only have to install an application on their mobile phone. So that proposed solution will be a low cost and successful solution.

- ✓ Operational Feasibility

  The proposed solution will be utilized effectively in the field of healthcare, and the system will benefit both healthcare professionals and patients. The current limitations in the healthcare domain will be reduced by this solution. The drug identification component will help to eliminate the lack of knowledge of medication among every individual.

- ✓ Scheduling Feasibility

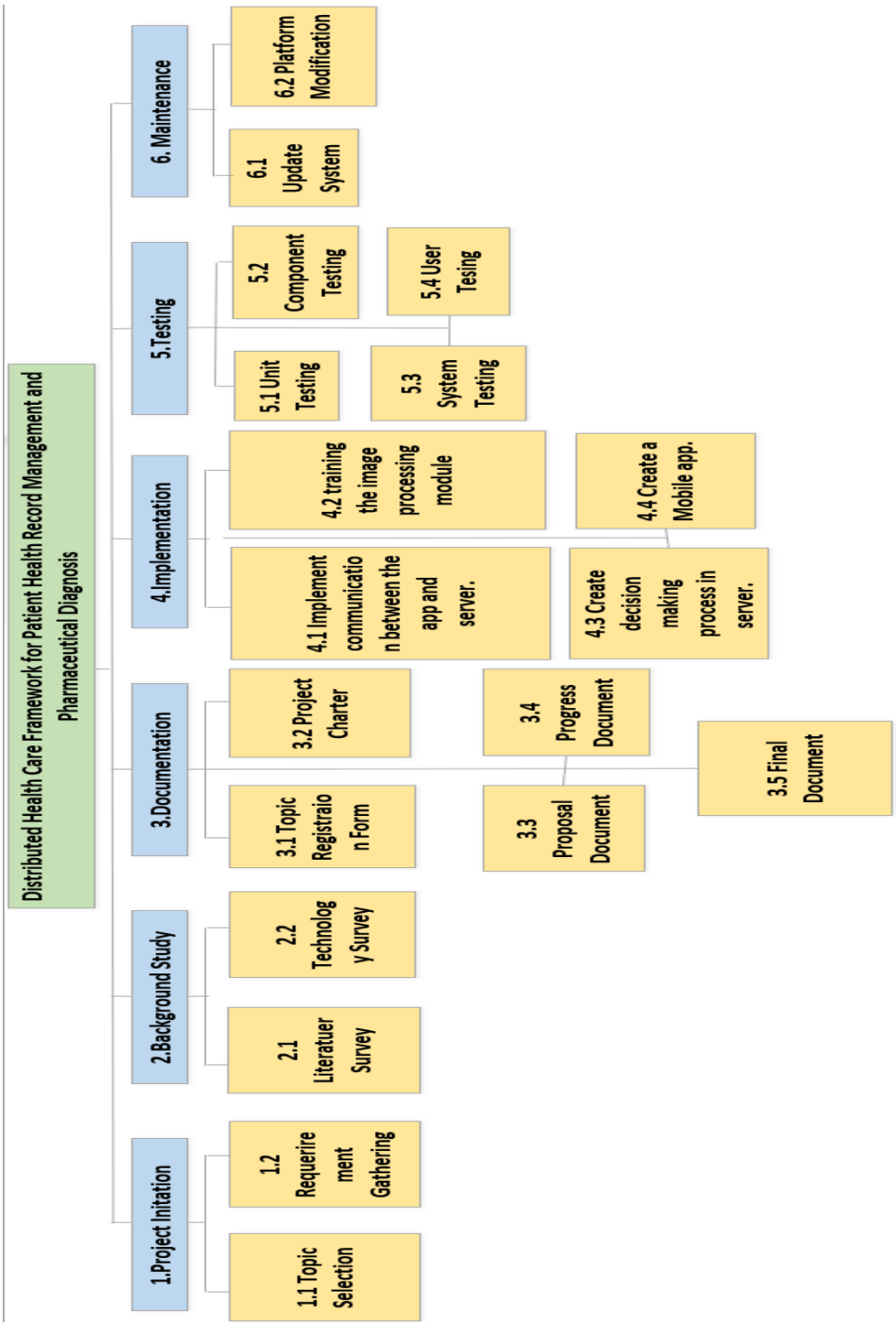
  The proposed solution is expected to be completed within a year. The scope of the study and its sub-components have been narrowed accordingly. The system

will be implemented on time, and the system will be feasible according to the schedule.

3.5 Work Breakdown Structure and Gantt Chart

3.5.1 Work Breakdown Structure

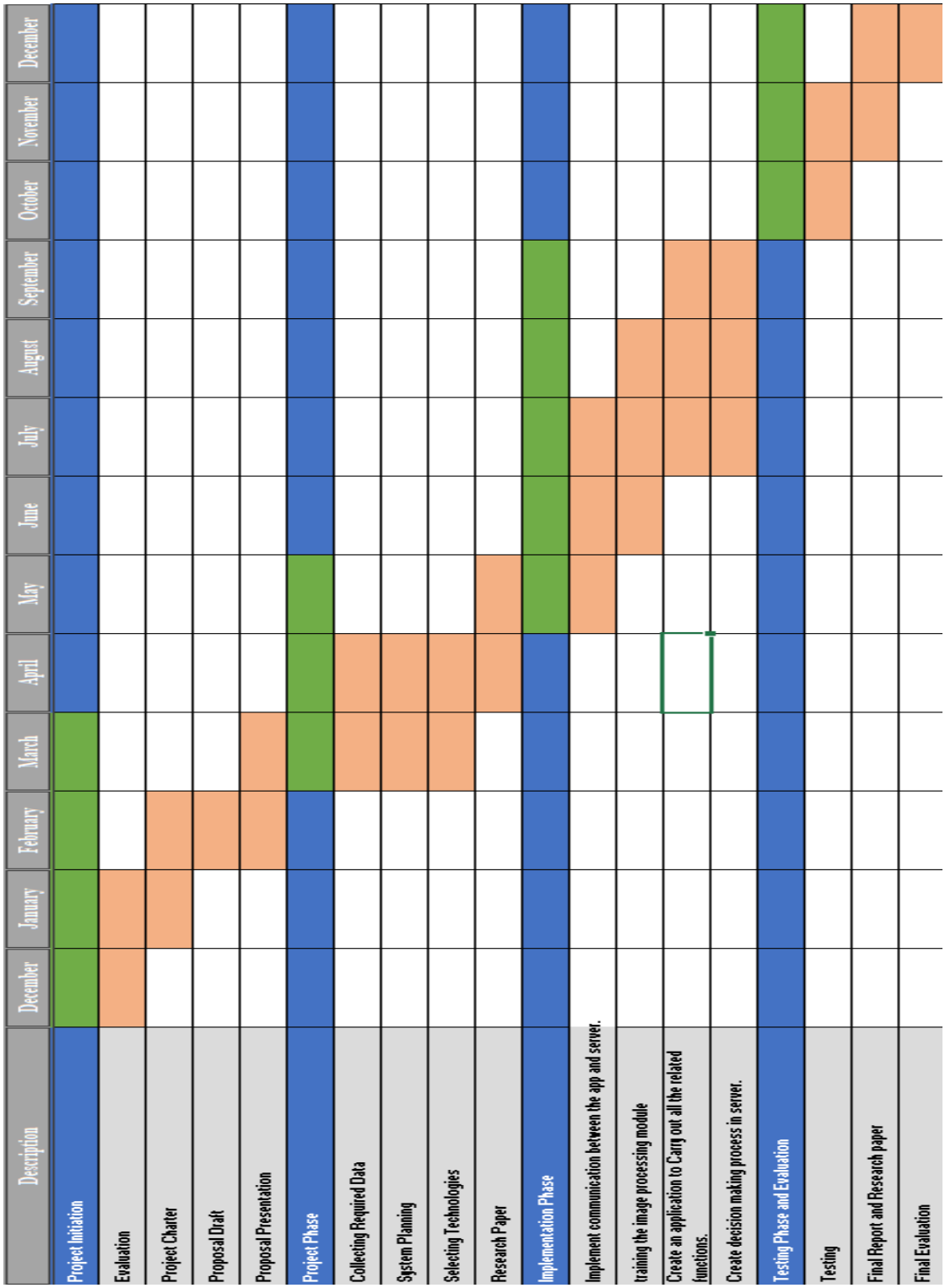
The Work Breakdown Structure of the development process is depicted in Figure 3.5.1.1.



3.5.1.1: Work Breakdown Structure 1

3.5.2 Gantt Chart

The Gantt chart of the development process created according to the tentative deadlines is depicted in Figure 3.5.2.1.



3.5.2.1: Gantt Chart 1

4 Project Requirements

4.1 Functional Requirements

- The component should be able to Extract data from the uploaded drug's image
- The component should be able to identify a medication using extracted data
- The component should be able to generate a summary according to identified medication
- The component should be able to provide the generated summary to the user.

4.2 Non-Functional Requirements

- Availability
    - This proposed system will be deployed every individual can access it from anywhere without any restriction using a mobile phone.
- Usability
    - Every individual will benefit from the proposed solution. Therefore, the system will consider the usability aspects such as satisfaction and efficiency.
- Accuracy
    - The proposed component would provide accurate details about medication, as a result, will ensure the well-being of users.
- Performance
    - This proposed component will be implemented to provide a quick response within a specified period and to function at an elevated level of efficiency.

5 Business Potential

5.1 Targeted Audience

The proposed solution is aimed at the field of healthcare, and the proposed system's target audience is every individual who likes to identify and get more details about their consumable medication.

5.2 Benefits from the system

- Identify medication using the image and provide a summary of information such as side effects and usages.
- Secure storing patient data across several EHRs (Electronic Health Record)
- Medical Document Scanner to extract text from medical documents
- Virtual conversational medical chatbot to communicate with patients while giving daily reminders to maintain the user’s well-being.
- 24/7 service and no downtime.
- Provide service to end-users across the island.
- High data security to access the system

6 Description of personnel and facilities

Resource personnel for the development team and the tasks assigned to them are as follows:

Registration Number	Name	Assigned Task
IT19004778	Wickramarathna W.G.M.S.	• Development and Testing for subcomponent based on Blockchain • Integration of the relevant component to the final system
IT19006994	De Silva K.H.K.L	• Development and Testing of Medical Document Scanner Subcomponent • Integration of the relevant component to the final system
IT19111766	Lekamalage U.L.V.M.	• Development and Testing of Drug Identifier subcomponent • Integration of the relevant component to the final system
IT19043388	Chathuranga S.J	• Development and Testing of Virtual Chatbot subcomponent • Integration of the relevant component to the final system

Table 6.1: Resource personnel for Development 1

7 Budget and budget justification (if any)

Table 7.1 shows the Budget allocation for the research and associated tasks and that includes Project Planning, Document Preparation, Internet charges, Hosting charges, and other expenses.

Resource type	**Amount (LKR)**	**Amount (USD (US dollar))**
Document Preparations (Hard Copy)	Rs. 500	$2.48
Internet usage for research	Rs. 2000	$9.91
Hosting Charges (Server)	Rs. 3800	$18.83
Other Expenses (Travelling)	Rs. 1500	$7.43
Total	Rs. 7800	$38.65

Table 7.1: Budget and Budget Justification 1

8 References

[1] Lee, Y.B., Park, U., and Jain, A.K., 2010, August. Pill-id: Matching and retrieval of drug pill imprint images. In *2010 20th International Conference on Pattern Recognition* (pp. 2632-2635). IEEE.

[2] Bhatia, A., 2016. Enhanced Center of Mass Technique for Detection of Missing & Broken Pharmaceutical Drugs. *IJIRST-International Journal for Innovative Research in Science & Technology*, *3*(01).

[3] Hart, A., 2010, May. Computer-vision-based pharmaceutical pill recognition on mobile phones. In *Proc. 14th Central European Seminar on Computer Graphics* (p. 5).

[4] Ramya, S., Suchitra, J. and Nadesh, R.K., 2013. Detection of broken pharmaceutical drugs using enhanced feature extraction technique. *International Journal of Engineering and Technology*, *5*(2), pp.1407-1411.

[5] Kekre, H.B., Mishra, D. and Desai, V., 2014, March. Detection of defective pharmaceutical capsules and its types of defects using image processing techniques. In *2014 International Conference on Circuits, Power and Computing Technologies [ICCPCT-2014]* (pp. 1190-1195). IEEE.

[6] Caban, J.J., Rosebrock, A. and Yoo, T.S., 2012, September. Automatic identification of prescription drugs using shape distribution models. In *2012 19th IEEE International Conference on Image Processing* (pp. 1005-1008). IEEE.

[7] MedSnap ID | MedSnap. Available at https://medsnap.com/medsnap-id. Last access: April 2014.

[8] “The National Library of Medicine Data Distribution,” U.S. National Library of Medicine. [Online]. Available: https://www.nlm.nih.gov/databases/download/data_distrib_main.html. [Accessed: 29-Jan-2022].

[9] “DrugBank online: Database for Drug and Drug Target Info,” DrugBank Online | Database for Drug and Drug Target Info. [Online]. Available: https://go.drugbank.com/. [Accessed: 29-Jan-2022].

[10] AGILE ALLIANCE, "What is Agile?", [Online]. Available: https://www.agilealliance.org/agile101/. [Accessed: 20- March- 2021]

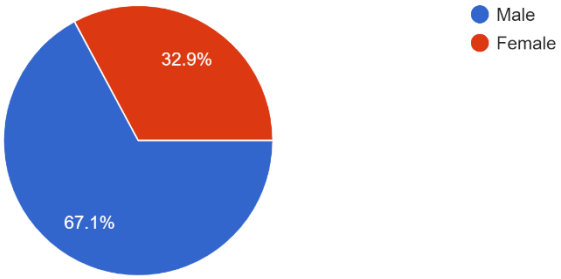
[11] Scrum.org, "WHAT IS SCRUM?", [Online]. Available: https://www.scrum.org/resources/what-is-scrum. [Accessed: 20- March- 2021]

[12] J. M. D. Santos, "Agile Development Methodology & Principles for 2021," Project, 2021. [Online]. Available: https://project-management.com/10-key-principles-of-agile-software-development/. [Accessed: 20-Mar-2021].

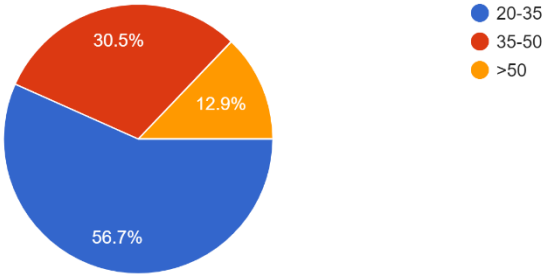
Appendices

Appendix A – Additional Survey Responses gathered during the Research Survey

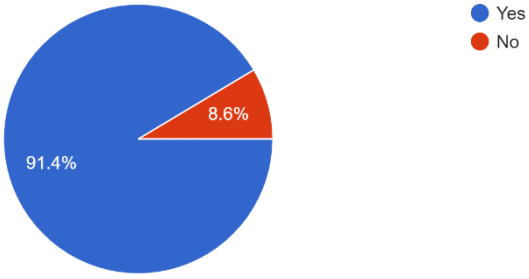
Gender
210 responses



Age Group
210 responses

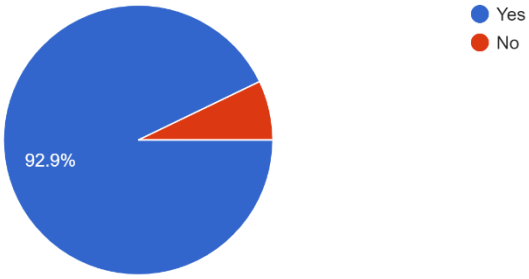


Do you have any healthcare issues as a result of the COVID-19 pandemic?
210 responses



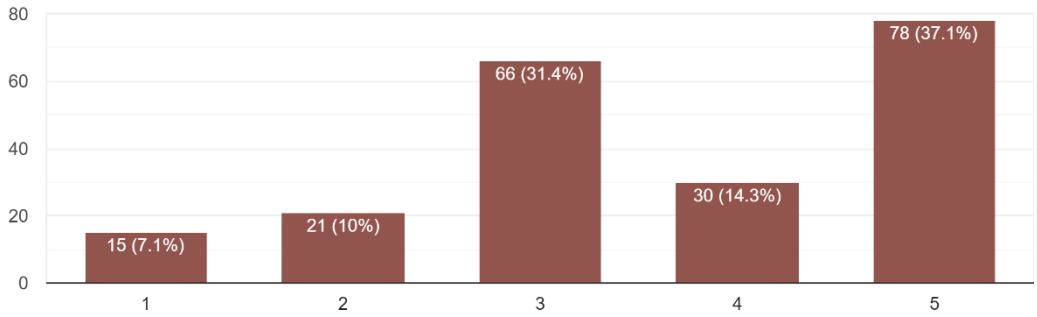
Are you taking medication frequently?

210 responses



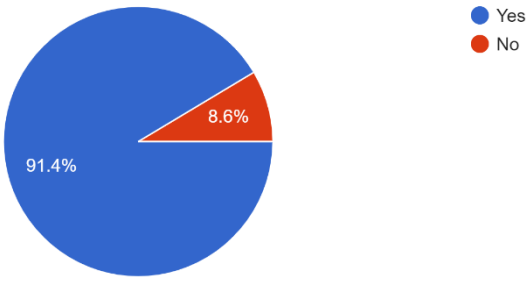
"Since health solution has not yet proposed for pharmaceutical diagnosis, it is a must to visit the doctor even during COVID-19". Do you agree with this statement?

210 responses

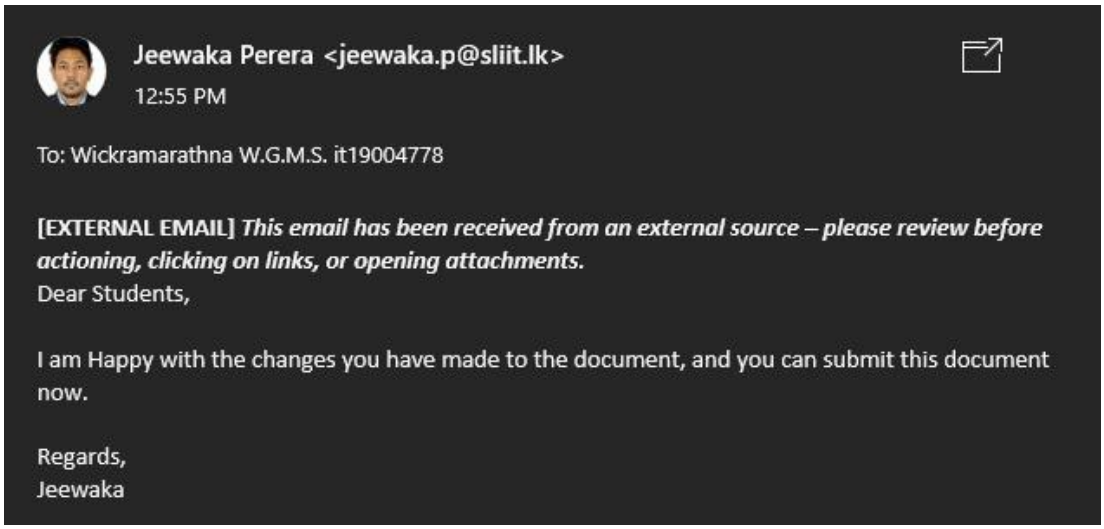


Do you think it's important to know medication details before you take the medicine?

210 responses



Appendix B – Supervisor and Co-supervisor's Endorsement



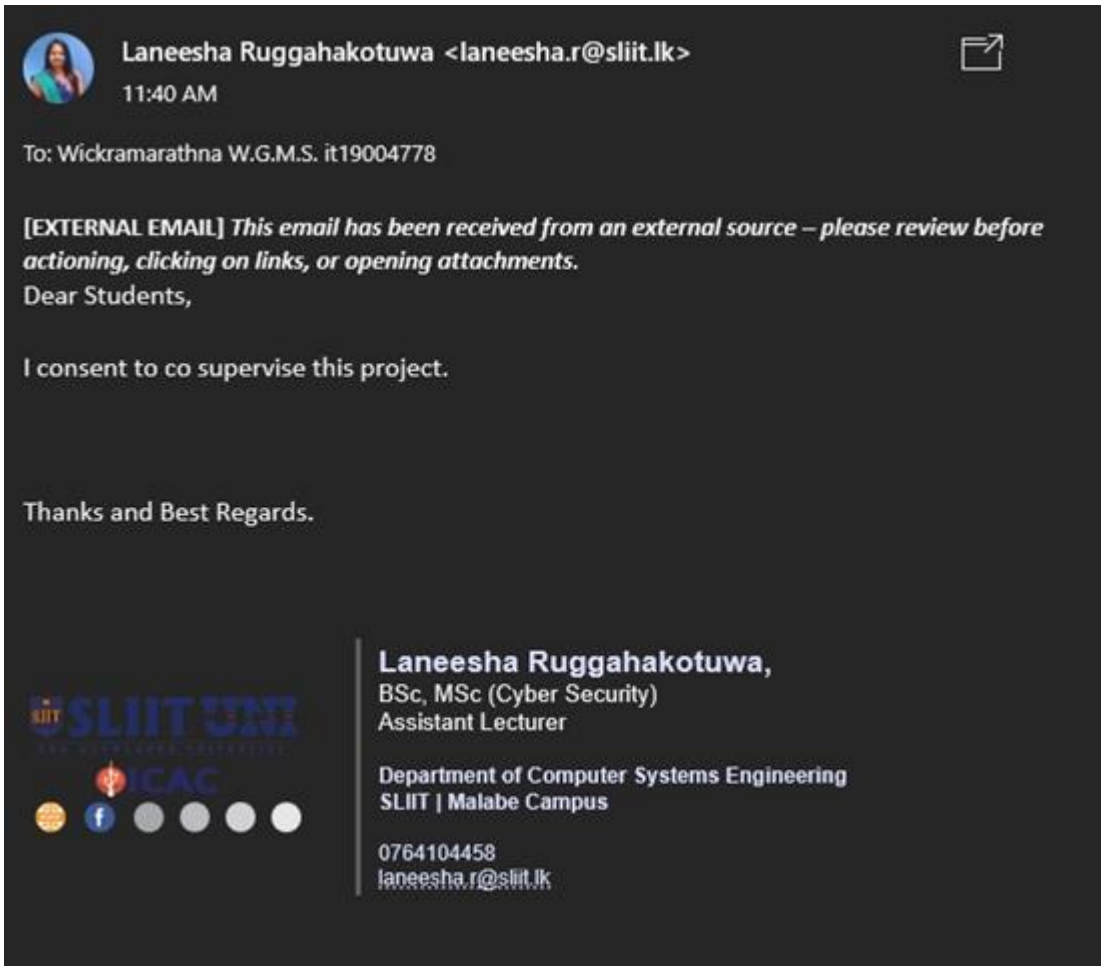
Jeewaka Perera <jeewaka.p@sliit.lk>
12:55 PM

To: Wickramarathna W.G.M.S. it19004778

[EXTERNAL EMAIL] ***This email has been received from an external source – please review before actioning, clicking on links, or opening attachments.***
Dear Students,

I am Happy with the changes you have made to the document, and you can submit this document now.

Regards,
Jeewaka



Laneesha Ruggahakotuwa <laneesha.r@sliit.lk>
11:40 AM

To: Wickramarathna W.G.M.S. it19004778

[EXTERNAL EMAIL] ***This email has been received from an external source – please review before actioning, clicking on links, or opening attachments.***
Dear Students,

I consent to co supervise this project.

Thanks and Best Regards.

Laneesha Ruggahakotuwa,
BSc, MSc (Cyber Security)
Assistant Lecturer

Department of Computer Systems Engineering
SLIIT | Malabe Campus

0764104458
laneesha.r@sliit.lk