

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

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Dissertation submitted in partial fulfilment of the requirements for the BSc (Hons) in
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Declaration

I declare that this is our 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.

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

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(Mr. Jeewaka Perera)

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Date:.....

Signature of the supervisor:

(Ms. Laneesha Ruggahakotuwa)

Abstract

In this day-to-day life, 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 accused because of the Patient's carelessness. In the 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 of 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, if the Patient's not sure what tablet to take for what issue, this procedure is not limited to just name, even its shape, the colour 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 to themselves. So, there would be no faults and questions. Furthermore, the component has been created, and as indicated by this, the patient, who is completely obscure or ignorant can get all the data concerning 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, Colour histogram

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Dedication

The author would like to dedicate this material to the research community, which is working tirelessly to discover solutions to sustain better outcomes in the field of healthcare.

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List of Abbreviations

1. Introduction

1.1 Background Study

In our regular routines and the current Covid-12 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 well-being which 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 an 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

The first model in pill 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: pre-processing, edge recognition, and component vector development.

As a next endeavour, 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 the 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 which is more of 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 colour 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 faulty tablets. Because of tablets, they propose an included extraction method to see as the faulty one.

As a next endeavour, Dr. H.B. Kekre, and 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 and 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 Med Snap 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 the below figure is a summary of the accessible research papers and sources,

Reference ID	Identify medication	Provide a Summary of the 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

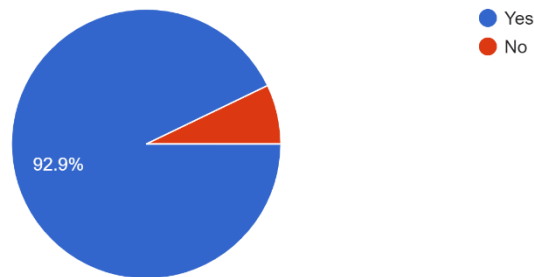
According to those different endeavours to carry out a part to distinguish a medication or a drug utilizing image handling anyway as indicated by specific sources there is a typical issue that is neither one of the created parts could be effective, given the circumstances, only for identifying drugs using various methods, we can be resolved these singular procedures concentrate just for distinguishing drugs utilizing different techniques and not a give a point-by-point outline regarding those. As medication-consuming people, inquisitive concerning what is meds we are consuming, what is the primary explanations behind consuming them, and 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.

Are you taking medication frequently?

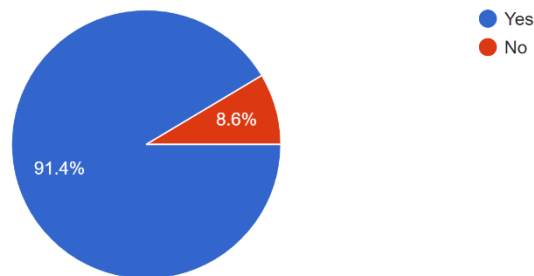
210 responses



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

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

210 responses

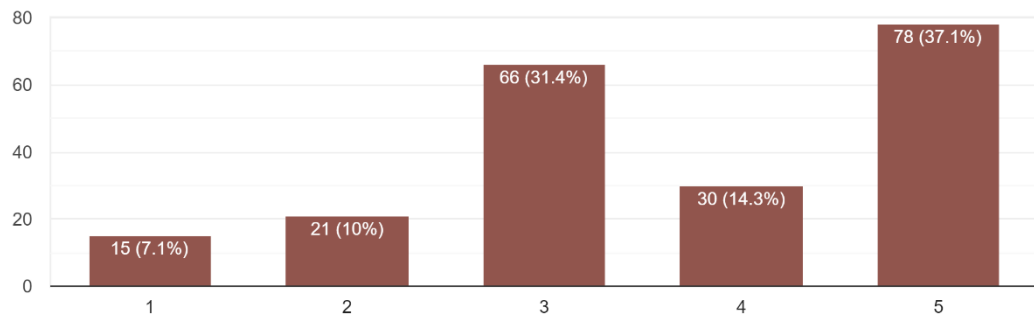


2.4.2: Summary of the responses to “Do you think it's important to know medication details before you take the medicine?”

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

"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



3.4.3: Summary of the responses to "Since health solution has not yet been 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 conclude that many individuals battle when they consume drugs their well-being course their absence of information on meds. The applications we have today just assist 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 that will affect consumers' life. In this age, everything is on the cell phone, so they ought to have a method for beating that issue by utilizing a straightforward application.

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

Encourages advancement this component should be incorporated with versatile applications.

1.5 Research Objectives

1.5.1 Main Objective

The fundamental goal of carrying out the Drug identification component is to take care of the people diminishing conflicts about consumable meds just as assisting 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) (Application Programming Interface) (Application Programming Interface). Not just that utilizing this Drug identification component plan assists every person with further developing their well-being, and knowledge, diminishing drug abuse, and saving a lot more living souls. And as a scope, we are going to train a module to identify diabetes medications and general consumable meds within one year period.

1.5.2 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 even-handed 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 colour 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, colour, 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 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, and information, reducing drug misuse, and saving significantly additional living spirits. So, this should open to improving more and incorporating a lot more platforms.

2. Methodology

2.1 Project Overview

The suggested system is designed to meet the challenges that the healthcare domain confronts during the COVID-19 pandemic, as well as to provide healthcare solutions that ensure service continuity while people remain at home and maintain social distancing. The proposed distributed healthcare framework would include secure patient health record management and pharmaceutical diagnostic capabilities.

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, colour, 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, 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 mistakes 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 getting 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 between 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 colours 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 that 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 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 drugs coming to the servers, and using a cross-platform mobile development framework to develop to break platform barrier.

2.2 System Overview Diagram

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

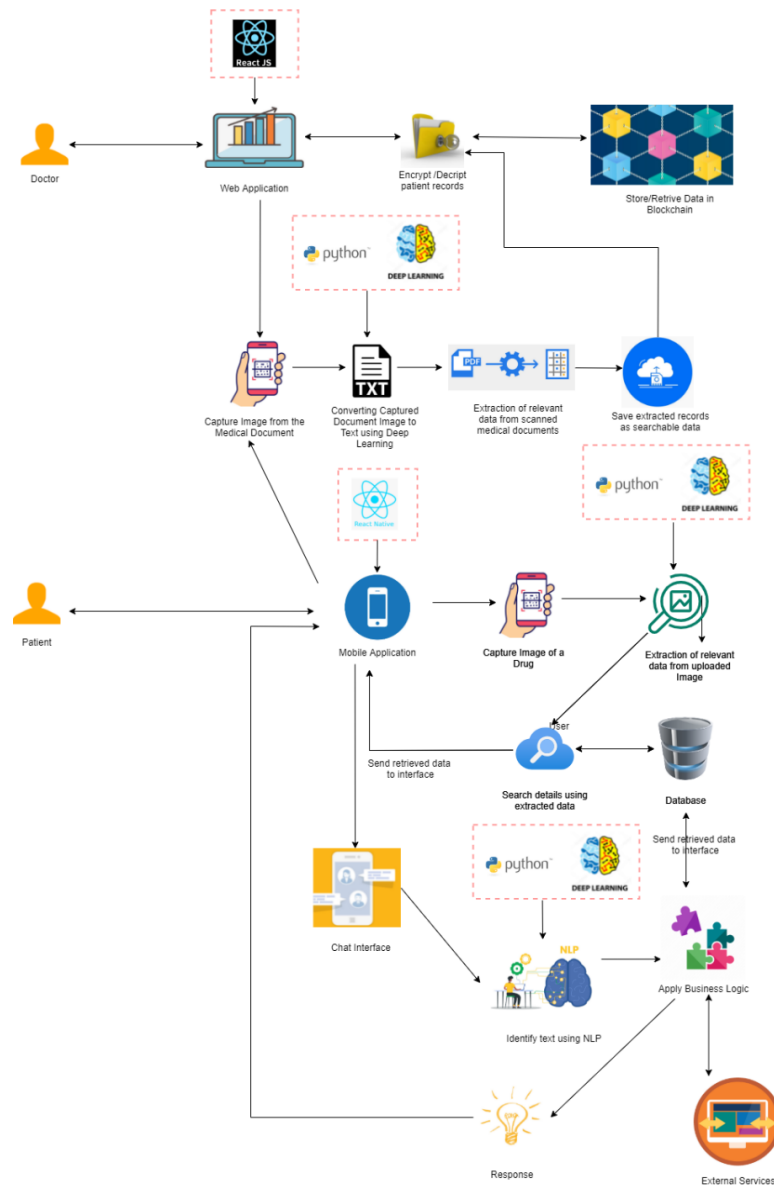


Figure 2.2.1: Project Overview Diagram

2.3 System Overview

As shown in Figure 2.2.1, 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 applications- 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.

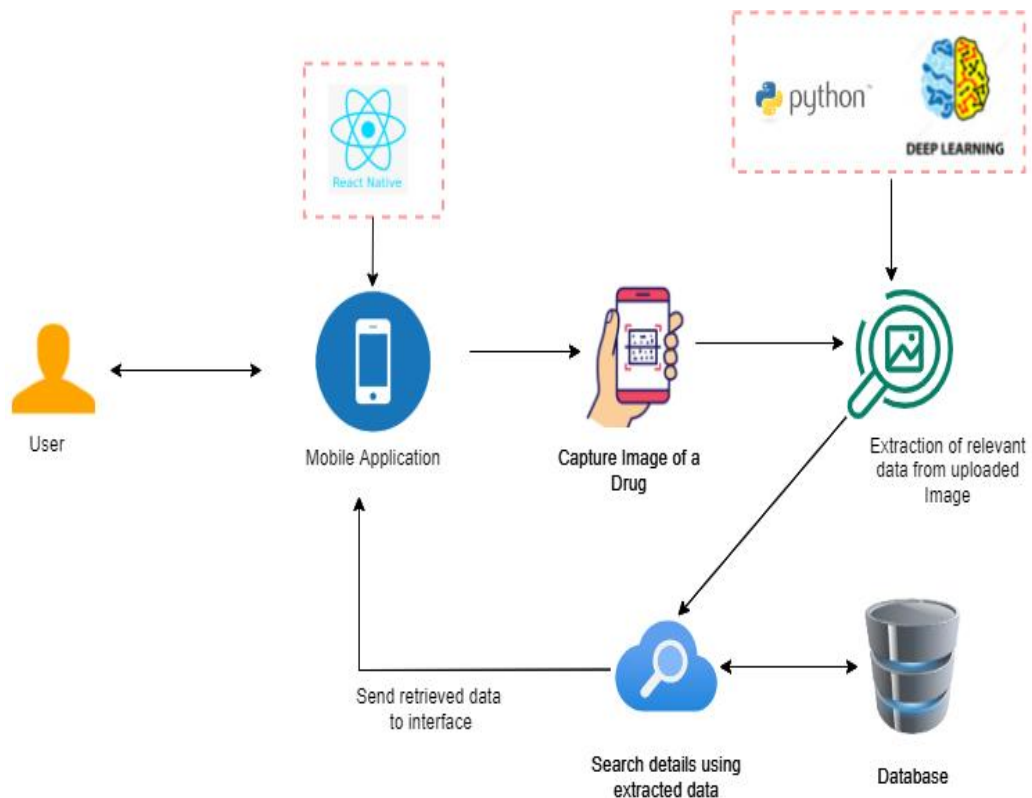
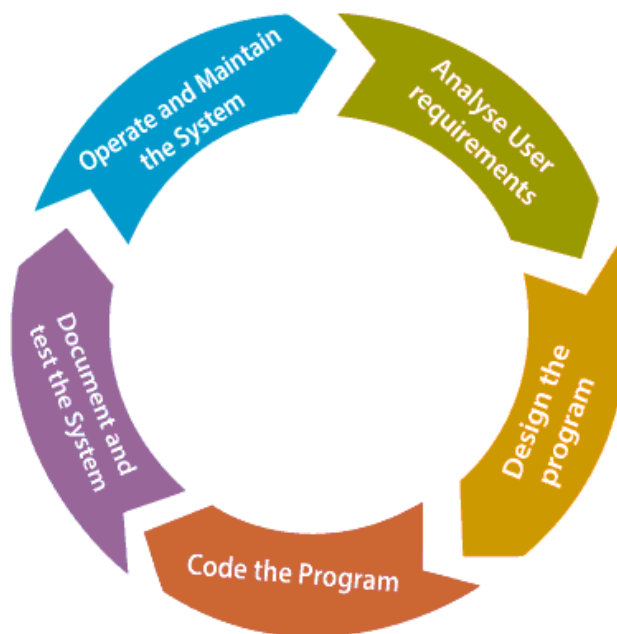


Figure 2.2.1: System Overview Diagram

2.4 Software Development Process

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 and do the necessary implementations.



2.4.1: Agile Software Development Lifecycle 1

2.5 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 from the system's completion. The usage of drug identification will utilize to identify and get more details about the consumable medication. As a result, more users will use it for improving their well-being. Not only that to utilize this component users only must install an application on their mobile phone. So, the 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.

2.6 Requirement Gathering

2.6.1 Functional Requirements

1. Extract data from captured drugs images:
Data such as imprints, shapes, and colors should be extracted from the captured images to identify the medication.
2. Extract the imprint of the medication:
To fulfill that requirement, we use Amazon Rekognition software which is provided by amazon company. For we use the boto 3 python library as well.
3. Identify the color of the medication:
To fulfill that requirement, we use Colorgram and WebColor python library for identification.
4. Identify the shape of the medication:
To fulfill that requirement, we use the OpenCV library and the statistics python library for identification. Here we capture the edges of the images and get the average value of the edges and determine the shape of the medication.

2.6.2 Non-Functional Requirements

1. Availability

This proposed system will be deployed in an individual server and will be accessible 24/7 and anyone can access it from anywhere without any restriction.

2. Usability

Patients will benefit from the proposed solution. Therefore, the system will consider the usability aspects such as satisfaction and efficiency.

3. Accuracy

The proposed method will give accurate medication-related data and it will help the users.

4. Performance

This proposed solution will be implemented to provide a quick response within a specified period and to function at an elevated level of efficiency.

2.7 Technology Selection

In the Computer Vision module, the image of the medication is first scanned, and data will be extracted from the image. For data extraction textual we use Python libraries such as

1. Boto3,
2. WebColor, Colorgram,
3. Flask
4. NumPy
5. OpenCV
6. Pandas
7. Statistics

are used to achieve this. Using OpenCV technology, the image of the drug was loaded, and using WebColor, Colorgram libraries we extract the colour of the pill and using Statistics we extract the shape of the pill as well.

Not only open-source software such as Amazon Rekognition Was used for the extraction of an imprint of the drug. The front-end mobile application is developed using technologies like react-native and JavaScript.

2.8 Commercialization aspects of the product

2.8.1 Targeted Audience

The proposed solution is aimed at the field of healthcare, and the proposed system's target audience includes physicians, healthcare workers, and patients.

2.8.2 Benefits of the system

1. Identify drugs using the image and provide adequate information such as dosage, side effects, and many more
2. 24/7 service with no or minimum downtime

2.9 Implementation

The developed system is a drug identification component that extracts data from drug images and provides a detailed summary of medication. This project makes use of Computer Vision and Machine Learning. As the project combines two important technologies, it has been broken down into multiple stages of development for ease of understanding. Each of the steps that make up the stages of development is given below and will be covered in more detail in separate subsections.

1. Imprint Extraction
2. Colour Extraction
3. Shape Extraction
4. Identification and provide a detailed summary
5. Develop a Mobile application to carry out the process

2.9.1 Imprint Extraction

To fulfil that requirement, we use Amazon Rekognition software which is provided by amazon company. For we use the boto 3 python library as well.

```
s3 = boto3.client('s3',
    ....aws_access_key_id="aws_access_key_id",
    ....aws_secret_access_key="aws_secret_access_key",
    ....region_name="us-east-2")

bucket = 'drugidentificationbucket'
s3.upload_file(photo, bucket, photo)

client = boto3.client(
    ...."rekognition",
    ....aws_access_key_id="aws_access_key_id",
    ....aws_secret_access_key="aws_secret_access_key",
    ....region_name="us-east-2"
)

response=client.detect_text(Image={'S3Object':{'Bucket':'drugidentificationbucket','Name':photo}})
.....
textDetections=response['TextDetections']
imprint = ""
for text in textDetections:
    ....if text['DetectedText'] not in imprint:
    ....    imprint = imprint + text['DetectedText']
imprint = ''.join(imprint.split())
```

Figure 2.9.1.1: Imprint Extraction

2.9.2 Colour Extraction

To fulfill that requirement, we use Colorgram and WebColor python library for identification.

```
def color(file):
    ... colors = colorgram.extract(file, 2)
    ... first_color = colors[1]
    ... rgb = first_color.rgb
    ... return (rgb)

def closest_colour(requested_colour):
    ... min_colours = {}
    ... for key, name in webcolors.CSS3_HEX_TO_NAMES.items():
    ...     r_c, g_c, b_c = webcolors.hex_to_rgb(key)
    ...     rd = (r_c - requested_colour[0])**2
    ...     gd = (g_c - requested_colour[1])**2
    ...     bd = (b_c - requested_colour[2])**2
    ...     min_colours[(rd + gd + bd)] = name
    ... return min_colours[min(min_colours.keys())]

def get_colour_name(requested_colour):
    ... try:
    ...     closest_name = webcolors.rgb_to_name(requested_colour)
    ... except ValueError:
    ...     closest_name = closest_colour(requested_colour)
    ... return closest_name
```

Figure 2.9.2.1: Color Extraction

```
... requested_colour = color(photo)
... closest_name = get_colour_name(requested_colour)
```

Figure 2.9.2.2: Calling Color Extraction functions

2.9.3 Shape Extraction

To fulfill that requirement, we use the OpenCV library and the statistics python library for identification. Here we capture the edges of the images and get the average value of the edges and determine the shape of the medication.

```
img = cv2.imread(photo)
gray = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)
gray = cv2.Canny(np.asarray(gray), 50, 250)

contours = cv2.findContours(gray, 1, 2)
avgArray = []
for cnt in contours[0]:
    approx = cv2.approxPolyDP(cnt, 0.01 * cv2.arcLength(cnt, True), True)
    avgArray.append(len(approx))
edges = statistics.median(avgArray)
```

Figure 2.9.3.2: Shape Extraction

2.9.4 Identification and provide a detailed summary

To fulfill that requirement, we use web scraping technology to get data from a medical website and provide it to a user.

```
const url =
'https://www.medicines.com/pill-finder/search?imprint=' +
imprint +
'shape=' +
shape +
'&color=' +
color
request(url)
.then(function (html) {
  $ = cheerio.load(html)
  const article = $('article').text()
  if (article) {
    const titles = []
    const imprints = []
    const figures = []
    const links = []
    $('div > h4').each((i, data) => {
      const name = $(data).text()
      titles.push(name)
    })
    $('div > div > ul').each((i, data) => {
      const imprint = $(data).text()
      imprint2 = imprint
      .replace(/\s+/g, '')
      .replace('Imprint:', '')
      .split('NDCcode')
      imprint2.pop()
      imprints.push(imprint2)
    })
    $('a > figure > img').each((i, data) => {
      const figure = $(data).attr('src')
      if (figure.includes('https')) {
        figures.push(figure)
      }
    })
    $('ul > li > .mdc-card').each((i, data) => {
      const link = $(data).attr('href')
      if (link.includes('/pill-finder')) {
        links.push(link)
      }
    })
    pills = {
      titles,
      imprints,
      figures,
      links,
    }
  }
  res.json(pills)
```

Figure 2.9.4.1: Identifications and provide a detailed summary

2.9.5 Develop a Mobile application to carry out the process

For full fill this we utilized react-native and JavaScript to develop an application.

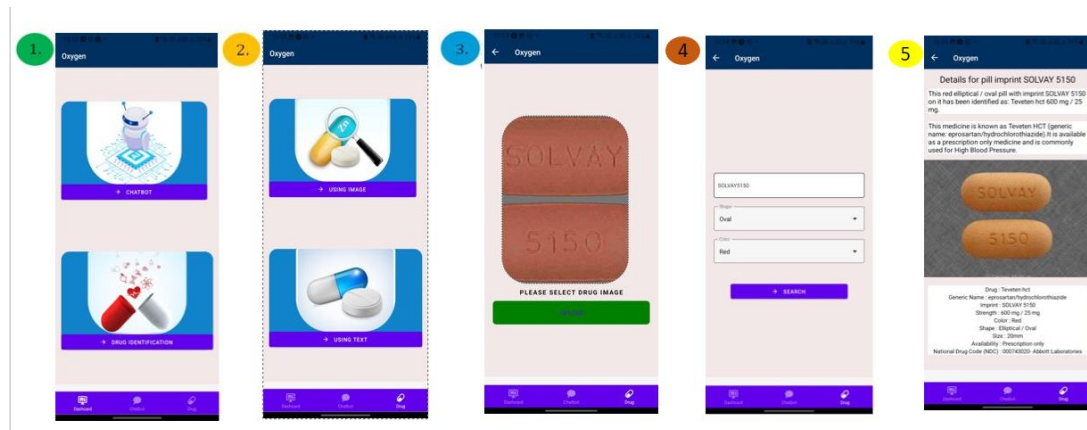


Figure 2.9.5.1: Mobile application's interfaces

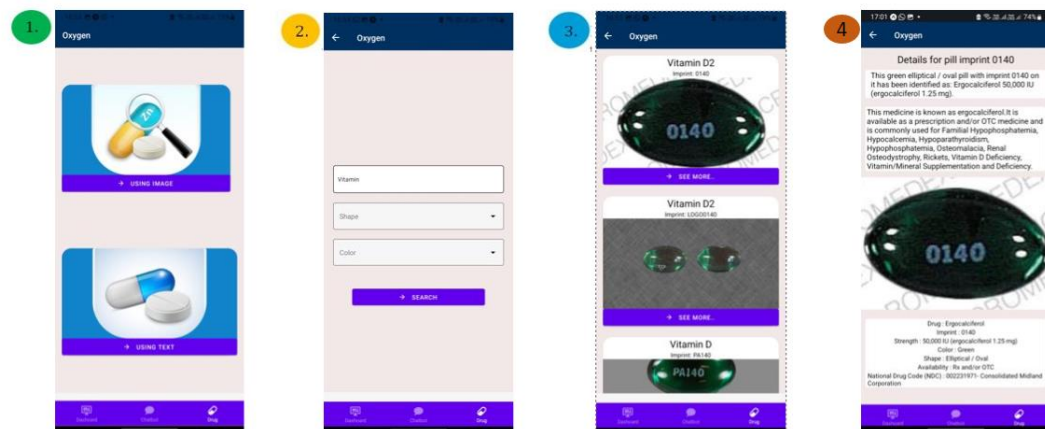


Figure 2.9.5.2: Mobile application's interfaces

2.10 Testing

This section highlights the test results for the created application. At various stages of the development life cycle, the system needs to be tested using a variety of methodologies. These tests assist in identifying any system flaws. A difficult and important phase of the application development process is testing. Application testing covers both functional and non-functional components as well as usability, performance, and security. Testing will improve the product's quality, and it is important to identify any flaws in the system as soon as possible. The test cases for each function should be created to address bugs and problems.

2.10.1 Unit Testing

Each module is separately assessed to make sure it satisfies all requirements and performs all relevant tasks. If the components are error-free, they can be easily combined with other modules. Under unit testing, individual activities like uploading a picture, identifying contours, extracting data, and model training are all tested separately.

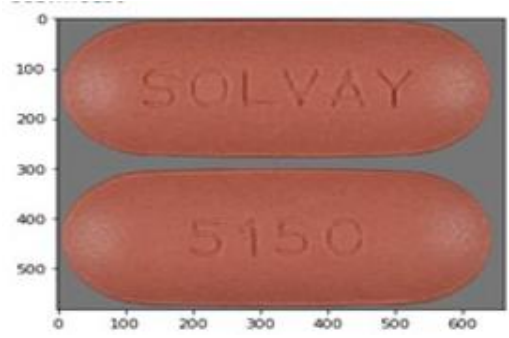
2.10.2 Integration Testing

During integration testing, each component is connected and examined as a whole. Once all the components have been integrated, integration testing is necessary to check that all capabilities operate as intended.

2.10.3 System Testing

To check whether the system's actual outputs match what was expected, testing is done. Here, system testing is done for photographs of different quality levels. The following is a list of the test cases used for system testing.

Table 2.10.3.1: Test Case 01

Test Case No	Test Case 01
Pre-requirements	PC (Program Complexity) or a laptop with an internet connection
Description	Testing whether the system extracts data from an image of medications
Test Procedure	1. Select upload image and test using postman
Input	The image of drug 
Expected Output	Automatically extract data and provide extracted data

Actual Result	<pre> 1 2 "Imprint": "SOLVAY5150", 3 "color": "RED", 4 "shape": "OVAL" 5 6 </pre>
Result of Test Case	Pass

Table 3.10.3.2: Test Case 02


Test Case No	Test Case 02
Pre-requirements	PC or a Laptop with an internet connection
Description	Testing whether the system extracts data from an image of medications
Test Procedure	1. Select upload image and test using postman
Input	The image of drug 
Expected Output	Automatically extract data and provide extracted data
Actual Result	<pre> "Imprint": "L403", "color": "WHITE", "shape": "CIRCLE" </pre>
Result of Test Case	Pass

Table 4.10.3.3: Test Case 03





Test Case No	Test Case 03
Pre-requirements	PC or a Laptop with an internet connection
Description	Testing whether the related data is provided according to the uploaded image.
Test Procedure	<ol style="list-style-type: none"> 1. Click on choose file 2. Upload the image and hit the search
Input	<p>The image of the drug.</p> 
Expected Output	Automatically extract data and provide a detailed summary of a particular medication
Actual Result	
Result of Test Case	Pass

Table 5.10.3.4: Test Case 04

Test Case No	Test Case 04
Pre-requirements	PC or a Laptop with an internet connection
Description	Testing whether the related data is provided according to the uploaded image.
Test Procedure	<ol style="list-style-type: none"> 1. Click on choose file 2. Upload the image and hit the search
Input	<p>The image of the drug.</p> 
Expected Output	Automatically extract data and provide a detailed summary of a particular medication
Actual Result	

Result of Test Case	Pass
---------------------	------

2.11 Work Breakdown Structure and Gantt Chart

2.11.1 Work Breakdown Structure

The following Figure 3.8.1.1 depicts the work breakdown structure for the development of the Medical Document Scanner.

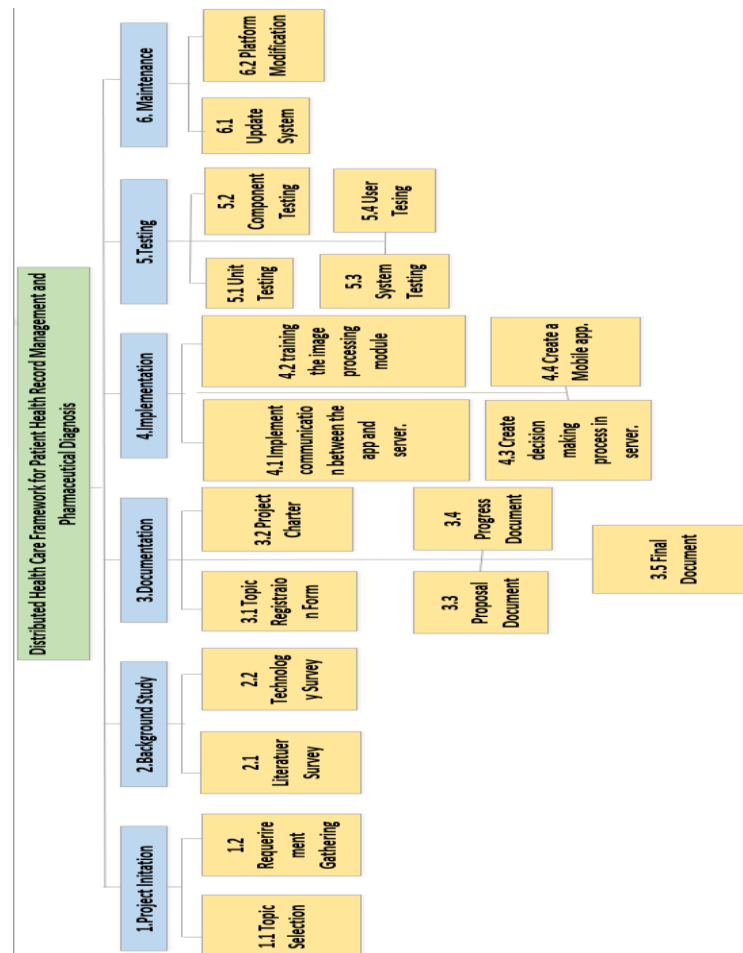


Figure 2.11.1.1: Work Breakdown Structure

2.11.2 Gantt Chart

The following Figure 3.8.2.1 shows the Gantt Chart for the development of the Medical Document Scanner component.

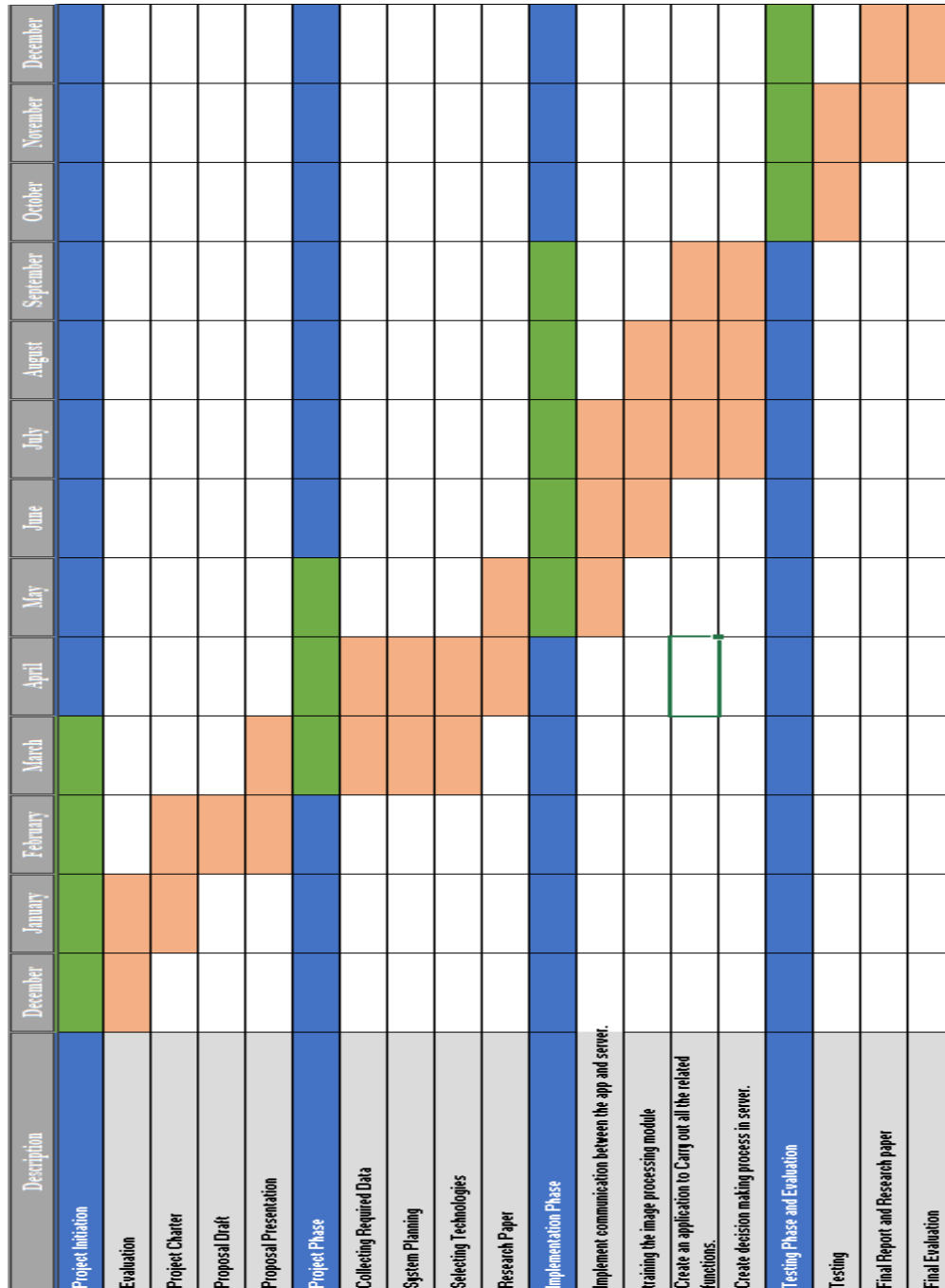


Figure 2.11.2.1: Gantt Chart

3. Results and Discussion

3.1 Results

The research that was done to use image processing to implement a drug identification component is summarized in this section. The accuracy of the results ought to be of extremely high value given that the application was designed for the healthcare industry. This feature will be utilized by every user to identify and learn about their medication. As a result, the collected data should be handled with care. Consequently, the accuracy of the results must be highly valued.

3.1.1 Outputs of the Drug Identification Component

The outcomes of the drug identification component are displayed below. When an image of a drug is uploaded the data will extract and show the related detailed view.

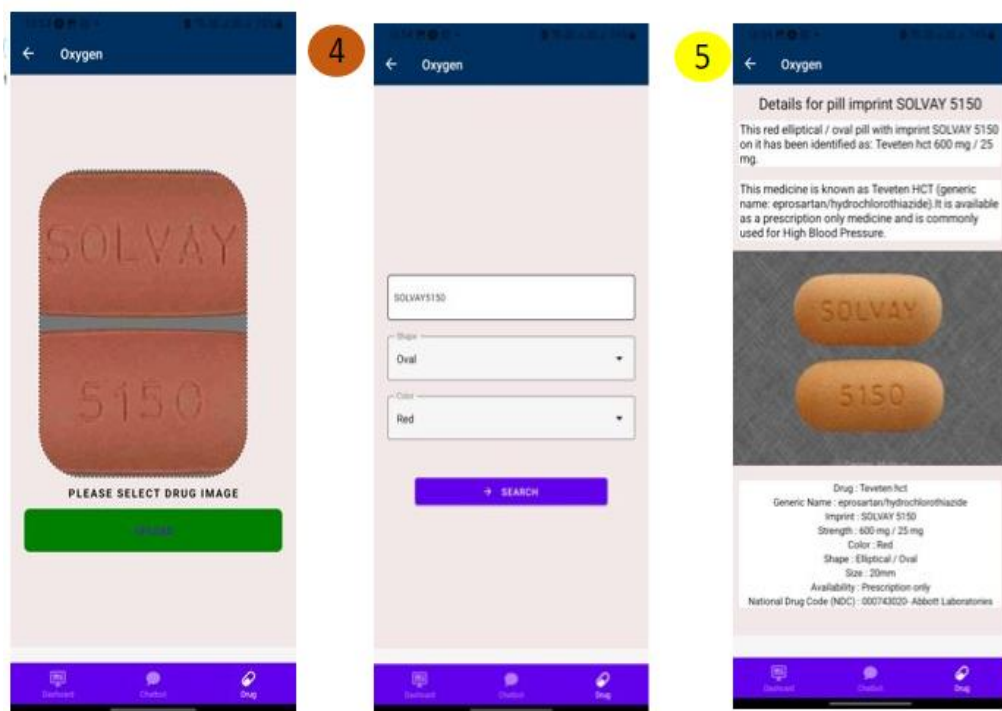


Figure 3.1.1.1: Detailed View

3.2 Research Findings

This section highlights the conducted research study's findings. The study's findings show that the accuracy of the model is significantly influenced by the following two factors:

1. The amount of data used in the training
2. The image's quality when uploaded

The total accuracy of the predicted outcomes will rise as more training data are utilized to train the model. More training data increase the system's accuracy. Like this, the image's quality has a considerable influence on how accurate the predictions are. The accuracy of the textual data which is extracted from the high-quality images is higher compared to that of the low-quality images. Here, image pre-processing techniques are used to improve image quality to increase the model's capability to do predictions

3.3 Future Work

As part of our development plan, we can include additional training data in the dataset in the future. The model's accuracy can be improved by using the same framework and adding new training data. The accuracy of the models is significantly influenced by the quality of the uploaded image. The model can incorporate additional image pre-processing techniques to enhance the quality of the image. Several additional data preparation frameworks can be utilized, particularly during the data cleaning phase. With these additions, it is anticipated that prediction accuracy will improve in the future.

4. Conclusion

The pandemic has brought to light the limitations of healthcare and the significance of automating the sector. Public surveys and research on current literature have demonstrated the value of a healthcare framework.

A distributed healthcare framework that secures the storage, access, and sharing of patient health records across multiple hospitals and provides home healthcare to patients is the proposed solution. Based on the most recent prescription stored in the Blockchain, a Virtual Conversational chatbot, for instance, might send regular reminders to take medications and help identify medications based on pictures taken.

Users will improve their knowledge and well-being because medication information is only known to doctors and other medical professionals.


Consequently, a drug identification model will be developed that will automatically extract data by utilizing Machine Learning and Image Processing methods. The significant entities will be extracted, and the data will be annotated. The user of this feature will save time and avoid loss of life.

This solution will, of course, fill the gap in healthcare and address the issues that arise during a global pandemic by combining all the components into a single system.

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Appendices



Distributed Health Care Framework for Patient Health Record Management and Pharmaceutical Diagnosis

We are final year Software Engineering Undergraduates at the Sri Lanka Institute of Information Technology, New Kandy Road, Malabe, Sri Lanka. We are conducting this research to gather information on health care problems confronted by medical practitioners during COVID-19. Please spare 5 minutes of your valuable time to participate in the survey. The information is being gathered solely for research purposes, and your responses are greatly welcomed.

 vihangamalshan12346@gmail.com (not shared) 
[Switch account](#)

* Required

Gender *

☐ Male

☐ Female

Age Group *

☐ 20-35

☐ 35-50

☐ >50

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

☐ Yes

☐ No

Do you believe that healthcare automation is critical in the occurrence of a pandemic? *

☐ Yes

☐ No

Do you maintain a personal medical log book? *

☐ Yes

☐ No

If Yes, Have you ever misplaced your medication history logbook? *

☐ Yes

☐ No

Do you like to keep track of your medication history in an electronic format? *

☐ Yes

☐ No

Which problem do you think will occur if we propose an automated solution to store patient data in digital format? *

- ☐ Storing sensitive data will lead to data breaches
- ☐ Unauthorized individuals can access the data
- ☐ All of the above mentioned

What are the Disadvantages of the Paper-Based Medical Records? (Ex: Printed Lab Test Reports) *

- ☐ Lack of Backup and Security
- ☐ Time Consuming and Error-Prone
- ☐ No Clear Audit Trails
- ☐ All of the above

What are the drawbacks of manually entering data and transferring it to an electronic health record (EHR)? *

- ☐ Manually entering data can cause human errors
- ☐ It is Time Consuming
- ☐ All of the above mentioned

What is the importance of introducing a medical document scanner? Please rate ^{*} your preference on a scale of 1 to 5.

1 2 3 4 5

Not important ☐ ☐ ☐ ☐ ☐ Very important

Are you taking medication frequently? ^{*}

☐ Yes

☐ No

"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?

1 2 3 4 5

agree ☐ ☐ ☐ ☐ ☐ Disagree

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

☐ Yes

☐ No

Do you usually take your medication on time? ^{*}

☐ Yes

☐ No

If the answer is not, what was the reason for that? *

- ☐ Busy with day to day activities
- ☐ Negligence
- ☐ Forgetfulness
- ☐ All above

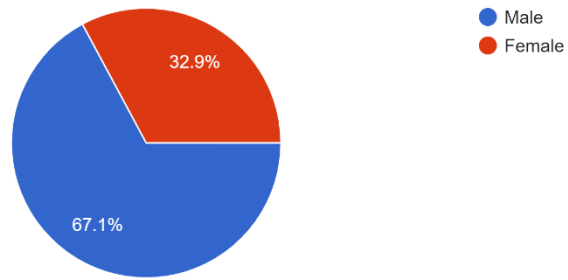
Do you think you need a virtual assistant to remind you of medication time and to know your prescription?

- ☐ Yes
- ☐ No

The survey was conducted among Medical Practitioners to gather information about healthcare issues faced during COVID-19

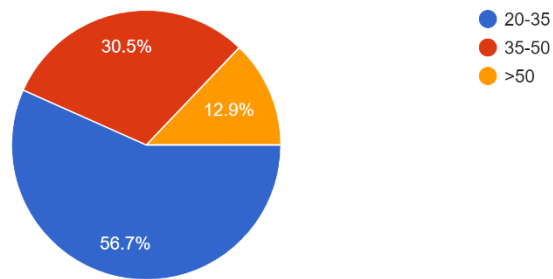
Gender

210 responses



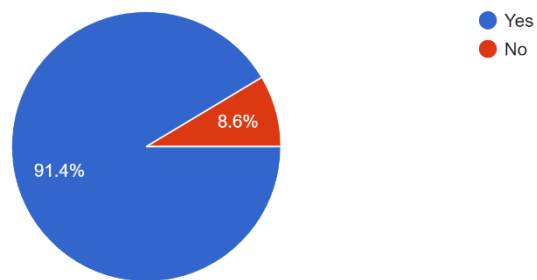
Age Group

210 responses



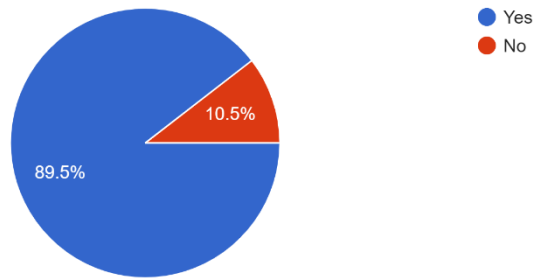
Do you have any healthcare issues as a result of the COVID-19 pandemic?

210 responses



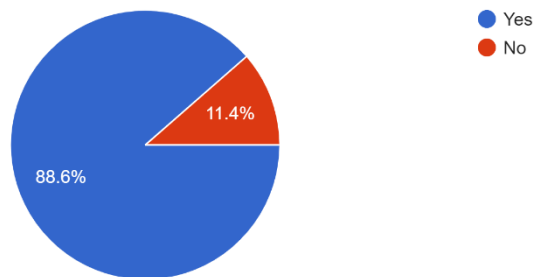
Do you believe that healthcare automation is critical in the occurrence of a pandemic?

210 responses



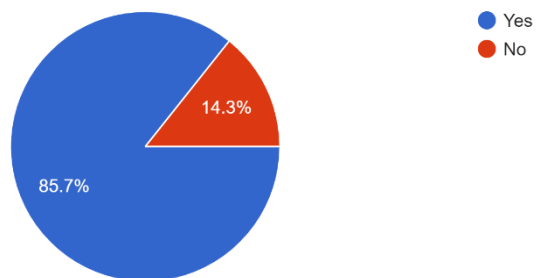
Do you maintain a personal medical log book?

210 responses



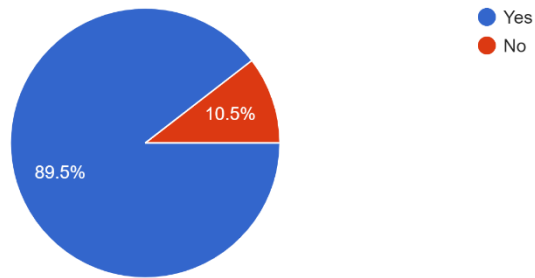
If Yes, Have you ever misplaced your medication history logbook?

210 responses



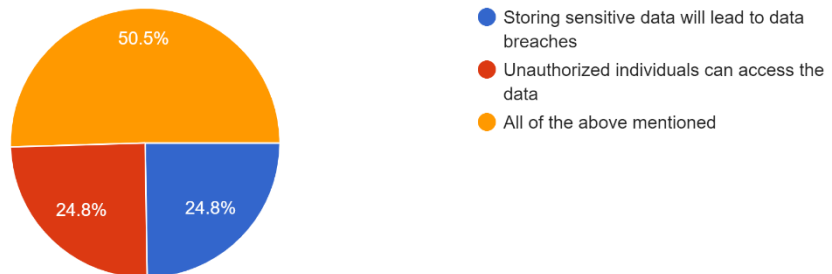
Do you like to keep track of your medication history in an electronic format?

210 responses



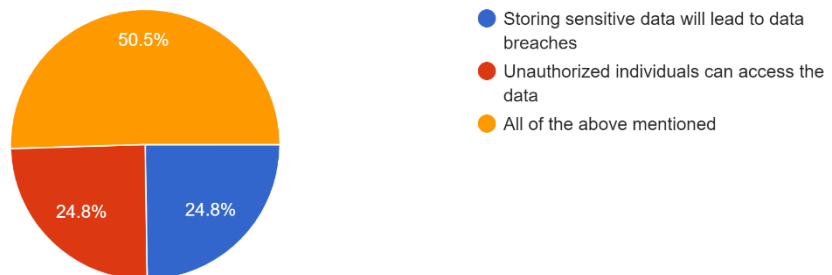
Which problem do you think will occur if we propose an automated solution to store patient data in digital format?

210 responses



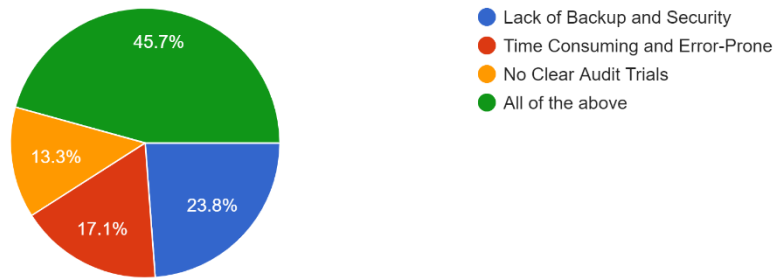
Which problem do you think will occur if we propose an automated solution to store patient data in digital format?

210 responses



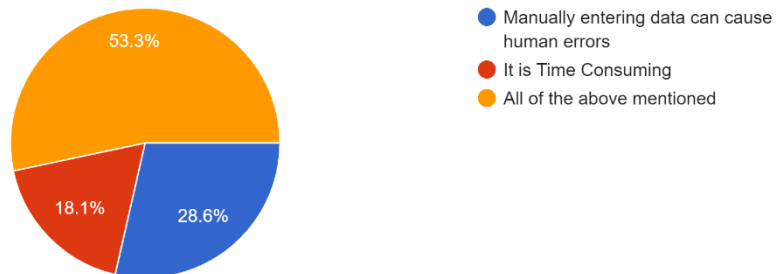
What are the Disadvantages of the Paper-Based Medical Records? (Ex: Printed Lab Test Reports)

210 responses



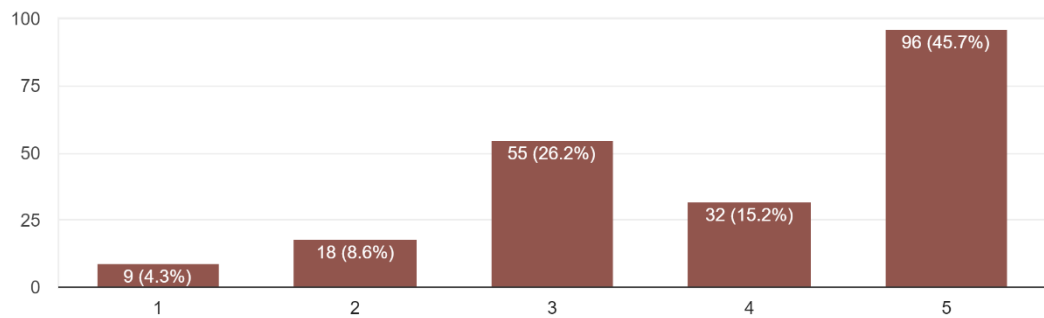
What are the drawbacks of manually entering data and transferring it to an electronic health record (EHR)?

210 responses



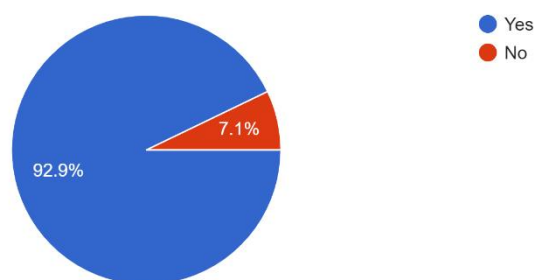
What is the importance of introducing a medical document scanner? Please rate your preference on a scale of 1 to 5.

210 responses



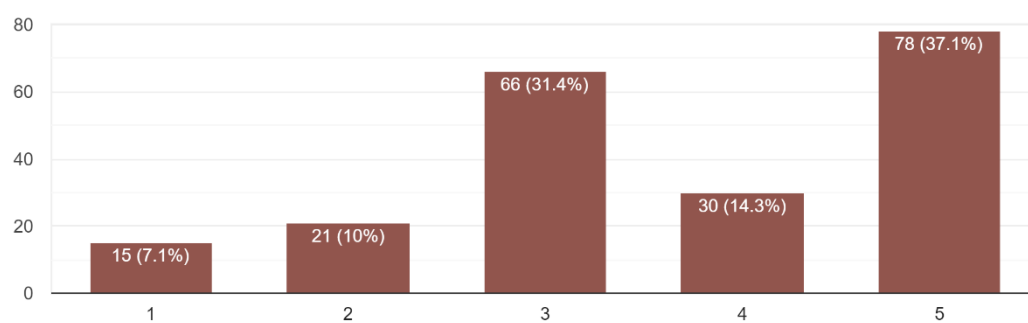
Are you taking medication frequently?

210 responses



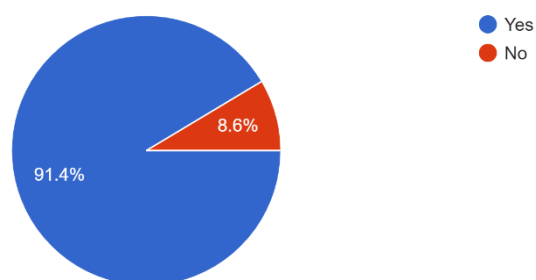
"Since health solution has not yet proposed for pharmaceutical diagnosis, it is a must to visit the doctor even during COVID-19". Do you agree with this statement?

210 responses



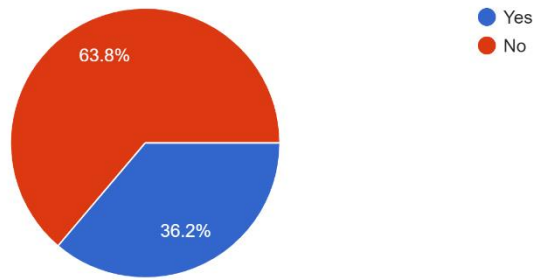
Do you think it's important to know medication details before you take the medicine?

210 responses



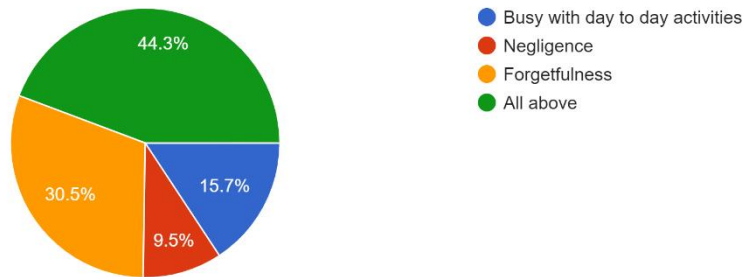
Do you usually take your medication on time?

210 responses



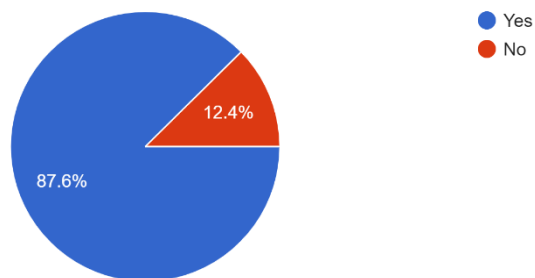
If the answer is not, what was the reason for that?

210 responses



Do you think you need a virtual assistant to remind you of medication time and to know your prescription?

210 responses



Responses gathered by Medical Practitioners about the importance of the drug identification system



Low Fidelity wireframe designed for interface to drug identification component