THE FUTURE OF AYURVEDA: HARNESSING THE POWER OF ARTIFICIAL INTELLIGENCE FOR PERSONALIZED TREATMENT AND DIAGNOSIS

23-252

Project Proposal Report

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March 2023

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.

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Date

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ABSTRACT

The rapid and busy nature of contemporary living often results in an uneven distribution of daily activities, inadequate dietary habits, insufficient physical exercise and leisure time, and excessive work-related stress, which can lead to poor health and dissatisfaction. While Ayurveda provides alternative solutions for many diseases. But people may have difficulties identifying the appropriate herbs and treatments and consulting with doctors in a timely and cost-effective manner. Additionally, the high cost of Western medicine may be a barrier, and not all illnesses are treatable. The proposed solution aims to assist users in discovering interactive Ayurvedic-based treatments for various symptoms. This solution is anticipated to be beneficial for those seeking alternatives to conventional medicine.

The identification of Ayurvedic medical herbs is a critical step in the treatment of various diseases. Traditional methods of identification involve physical examination and experience, which can be time-consuming and prone to errors. To address this issue, this study proposes a new approach that uses image processing and machine learning techniques to identify Ayurvedic medical herbs for the treatment of diseases such as diabetes, arthritis, and asthma. The study then collected and processed large amounts of image data from various geographical areas to map the distribution of herbal plants. Finally, the model was implemented in a software application for practical use. As a novelty improvement, the study incorporated continual learning/transfer learning to improve accuracy and auto-machine learning to make it easier to add new plants. The proposed approach has the potential to significantly improve the accuracy and efficiency of Ayurvedic medical herb identification and treatment, making it a valuable tool for the healthcare industry.

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LIST OF ABBREVATIONS

Abbreviation	Description
AI	Artificial Intelligence
ML	Machine Learning
EHR	Electronic Health Records
AML	Auto Machine Learning
CNN	Convolutional Neural Network
SVM	Support Vector Machine
SDLC	Software Development Life Cycle
HOG	Histogram of Oriented Gradients
SIFT	Scale-Invariant Feature Transform
WBS	Work Breakdown Structure

1. INTRODUCTION

1.1 Background & Literature survey

Ayurveda is a traditional medical practice with Indian roots that places a strong emphasis on a holistic view of health and wellness. It uses organic treatments, dietary adjustments, and individualized care based on a person's dosha, or body type. Because of its efficacy and focus on prevention and individualized care, Ayurveda has become increasingly well-known on a global scale. A more specialized and individualized approach to treatment is needed for non-communicable diseases like diabetes, heart disease, and cancer because of the fast-paced modern lifestyle. In order to provide individualized and efficient therapy, this has led researchers and practitioners to investigate how Ayurveda principles might be combined with cutting-edge technology like Artificial Intelligence (AI).

Our research indicates that Sri Lankans have a long-standing cultural and traditional connection to Ayurveda. The history of the nation dates back more than 3,000 years, and Sri Lankan culture is firmly rooted in the practice of ayurveda. In Sri Lanka, different ailments have been treated and prevented through Ayurveda practices for thousands of years. The popularity of Ayurveda in Sri Lanka can be ascribed to its all-encompassing method of healthcare, which places an emphasis on the harmony of the mind, body, and spirit. The natural and organic aspects of Ayurveda, which uses herbs and other natural therapies to address a variety of health conditions, have long been valued by Sri Lankans. For minor ailments and long-term health concerns, Sri Lankans favor Ayurveda therapies over contemporary medicine.

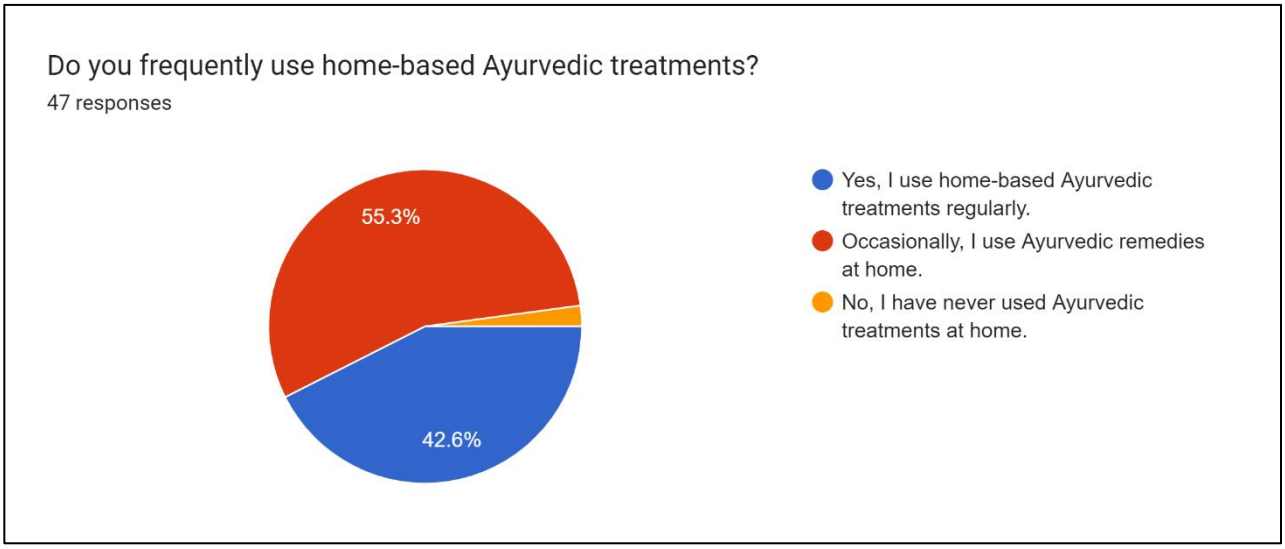


Figure 1: Survey on how frequently people use home based ayurvedic treatments.

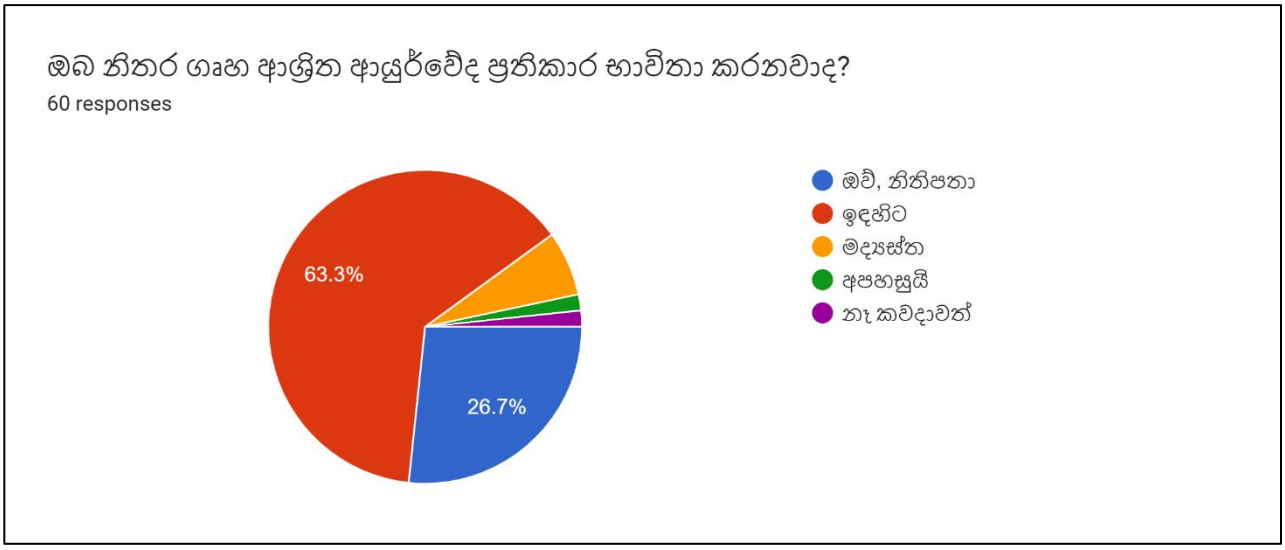


Figure 2:Survey in Sinhala on the frequency of home based ayurvedic treatments usage

Based on the survey results, it can be concluded that more than half of the respondents are frequently using ayurvedic treatments.

Ayurvedic hospitals and clinics may be found all over Sri Lanka, and Ayurveda has a significant influence on the country's healthcare system. The people of Sri Lanka have access to skilled and knowledgeable Ayurveda medical professionals who offer their patients individualized care and therapies. These medical professionals treat a variety of illnesses, from the ordinary cold to more serious disorders like cancer and diabetes, using Ayurveda treatments and conventional healing methods. As people in Sri Lanka become more health-conscious and explore for natural and organic alternatives to modern medicine, there has been a resurgence in interest in Ayurveda recently. Ayurveda is a crucial component of Sri Lanka's healthcare system, and the government has taken steps to promote and advance it.

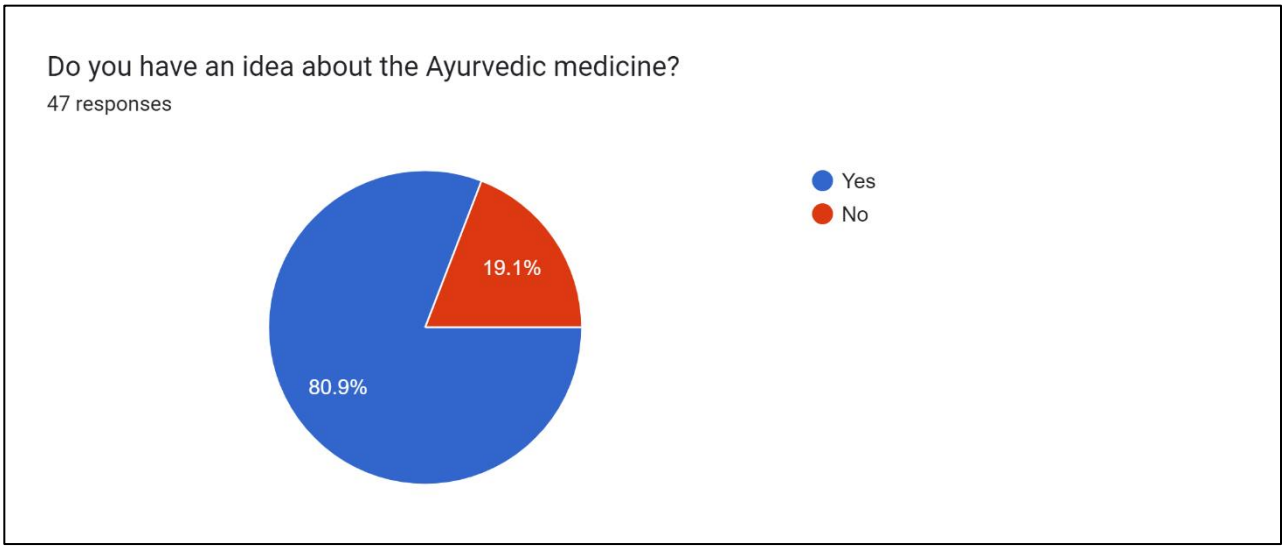


Figure 3: Survey on the idea of people about ayurvedic medicine

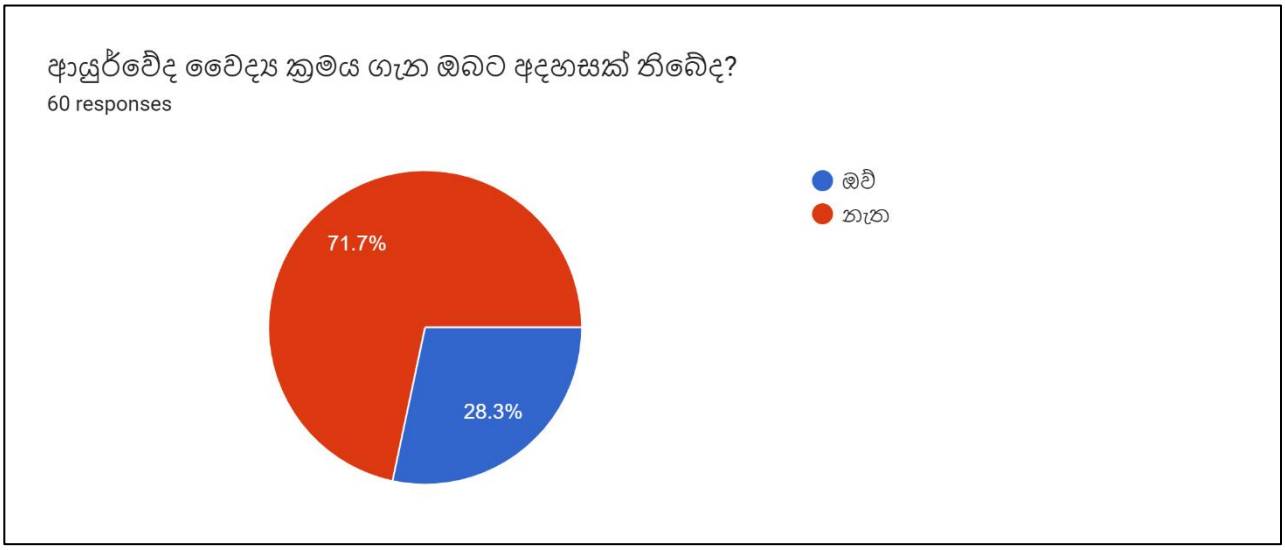


Figure 4:Survey in Sinhala on the idea of people about ayurvedic medicine

From the above two survey results it shows that most of the people in Sri Lanka are aware about the ayurvedic medicine and most people had used them even once in their lifetime. Considering the percentages, more than 80% of people are aware of ayurvedic medicine.

Overall, our research shows that Sri Lankans deeply value Ayurveda and its all-encompassing approach to healing. As more individuals look for natural and organic alternatives to contemporary medicine, Ayurveda is anticipated to gain popularity in Sri Lanka.

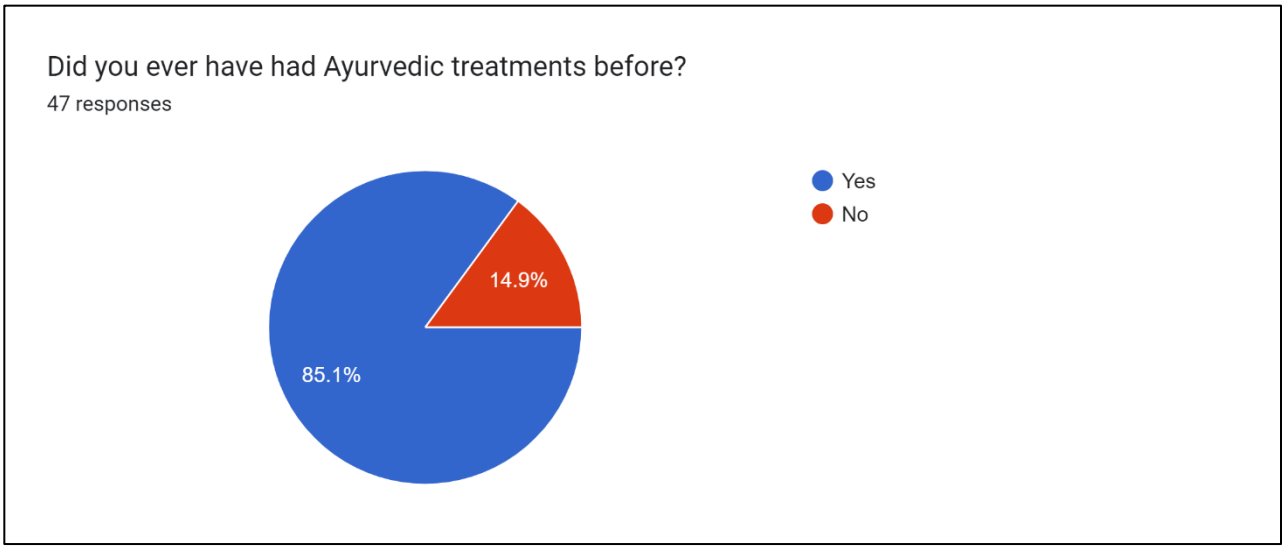


Figure 5: Survey on the people about do they had ayurvedic treatments before.

From the above two survey results it shows that most of the people in Sri Lanka had used them even once in their lifetime. Considering the percentages more than 70% of people are aware of ayurvedic medicine.

The healthcare sector is undergoing a change thanks to artificial intelligence (AI), which is providing fresh and creative approaches to the detection, treatment, and monitoring of diseases. [1] The ability of AI to evaluate enormous volumes of patient data and medical records to assist in illness detection is one of the most important benefits of AI in healthcare. Radiologists can be helped by AI algorithms in spotting potential anomalies or diseases in medical pictures like CT scans, MRIs, and X-rays. Additionally, by examining data on previous treatment outcomes and patient health records, AI can assist clinicians in developing individualized treatment regimens for patients based on their particular traits and medical history. By examining massive datasets to find trends and provide insights, AI can also help in the search for new pharmaceuticals and therapies. Moreover, chatbots and voice assistants powered by AI can offer a preliminary diagnostic and suggest next measures. Moreover, AI can be used to scan electronic health records (EHR) to find possible problems, remotely monitor patients and notify clinicians of any problems, and give individualized health advice and suggestions via virtual assistants. Overall, AI has great promise for enhancing patient outcomes and delivering more individualized and effective healthcare solutions.

Ayurveda could undergo a revolution thanks to artificial intelligence (AI), which would allow for individualized care based on each patient's particular traits, background, and symptoms. AI algorithms may find trends and offer insights by analyzing enormous volumes of patient data, which enables practitioners to make wise treatment decisions. There are already a number of Ayurveda-

based applications that make individualized therapy recommendations using AI. AyurMana is one such software that employs AI algorithms to examine a patient's pulse, tongue, and symptoms in order to offer individualized treatments. Wealthy is a different program that uses AI-powered chatbots to offer individualized health tips.

The use of AI in Ayurveda offers many advantages. First of all, it gives medical professionals the ability to tailor treatment to each patient's particular needs, which can improve outcomes and lower medical expenses. Second, AI can assist in finding patterns and insights that can enhance disease diagnosis and therapy. Finally, apps and solutions driven by AI can improve patient engagement and treatment adherence. Ayurveda may make use of a number of AI technologies, including computer vision, natural language processing, and machine learning. Patterns can be found and recommendations for individual treatments can be made using machine learning. Chatbots and voice assistants can offer individualized health advice and recommendations thanks to natural language processing. Images of patients can be examined using computer vision to find symptoms and offer insights.

Here are a few of the ayurvedic apps that are already available. Yes, these smartphone applications offer Ayurveda remedies. [2]

- E-procto
- MocDocHMS
- MocDoc Clinic Management System
- MyOPD
- Vaidya Manager
- Healcon Practice
- Easy Clinic
- OptiMantra

Here are a few of the plant identification apps that are already available. [3] [4] [5]

- WhatIsThisPlant
- PlantID

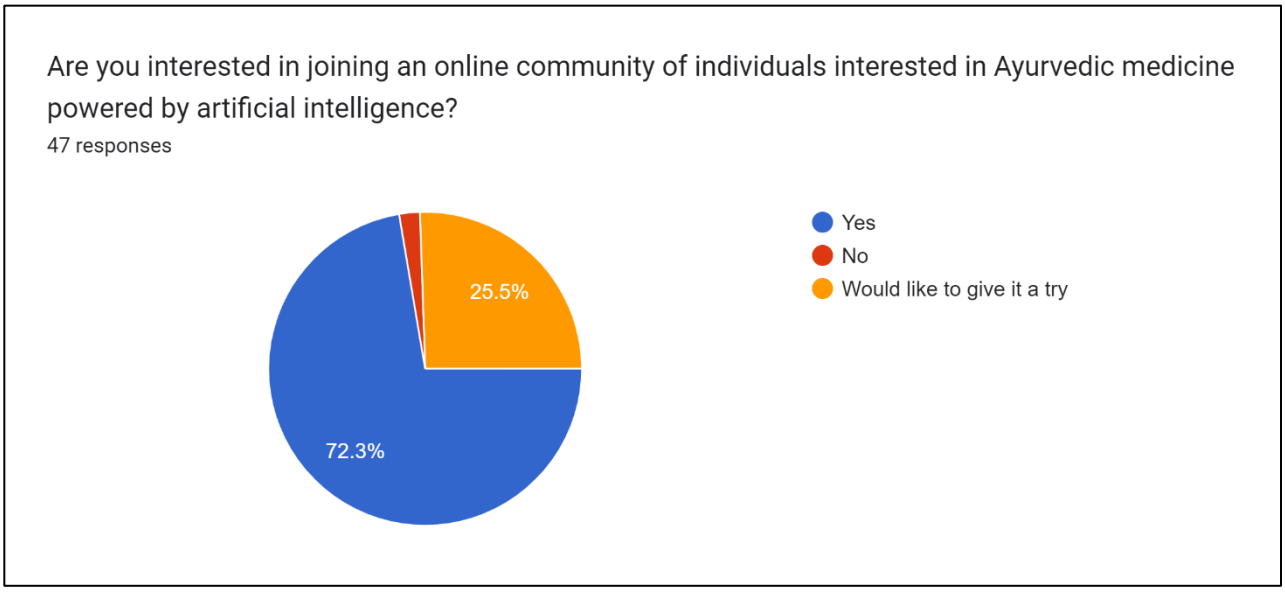


Figure 6: Survey on the interest of people to Ayurveda through AI

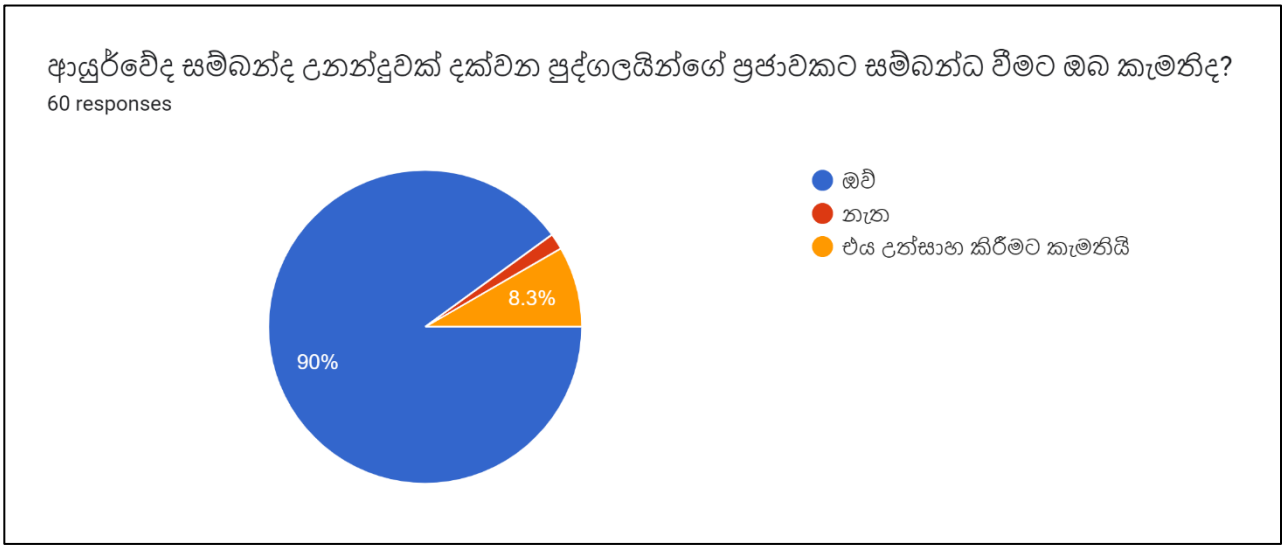


Figure 7: Survey in Sinhala on the interest of people to Ayurveda through AI

From the above two survey results it shows that most of the people in Sri Lanka are willing to join on an ayurvedic online platform.

As said in the preceding section, we suggest an original way to encourage a better lifestyle through Ayurveda in light of the **study background and survey presented above**. [6] [7]For specific problems including arthritis, blood sugar, hair loss, infertility, obesity, paranasal sinusitis, wounds, scrapes, and swellings, our solution attempts to address Ayurvedic therapies as well as general healthy principles. A conversational AI chatbot will be part of our solution, offering a user-friendly platform for people to obtain tailored solutions and guidance via text, based on knowledge about

these symptoms and their treatments.

Our suggested approach will include a chatbot in addition to an image processing element that can recognize the herbal plants required for treating various conditions. The locations of these plants will be mapped out by a geometry library, which will also link patients to Ayurvedic practitioners in a particular geographic region. Users can rate doctors to aid in the search for trustworthy medical professionals.

A social network will also be a part of our solution, allowing users to discuss information about health. Health-related content supplied by users will be gathered and kept in the knowledgebase as community knowledge for the chatbot to refer to. Auto-machine learning will keep the social network current and assist users with any new symptoms, assisting in maintaining the consistency of the solution.

We will need resources with extensive Ayurvedic-related expertise if we are to guarantee the accuracy and efficacy of our solution. For supervised machine learning algorithm-based solutions like herb identification, chatbot implementation, and social network implementation, we expect to gather data through publicly accessible social network communities relating to health and images of herbs, as well as details of Ayurvedic doctors with their locations from relevant backgrounds.

Finally, the use of AI to Ayurveda has the potential to revolutionize the industry of individualized healthcare. By utilizing AI, medical professionals can improve disease detection and treatment while also delivering tailored care. Better health outcomes can result from the creation of AI-powered apps and solutions that encourage patient participation and treatment compliance. The incorporation of AI in Ayurveda is taking on greater significance and has enormous promise for the future of healthcare as non-communicable diseases become more prevalent. [6] [7]

1.2 Research Gap

There is currently a lack of an AI-based solution that can accurately identify and map ayurvedic medical herbs needed for treatments of non-communicable diseases using image processing and machine learning models. While some image recognition models have been developed to identify herbs in general, they are not specifically trained to recognize ayurvedic medical herbs and are not optimized for identifying the herbs needed for specific non-communicable diseases. Furthermore, there is limited research on mapping the herbal plants with their respective locations, which is crucial for sustainable cultivation and conservation of these plants. Therefore, there is a need for a comprehensive AI-based solution that can accurately identify ayurvedic medical herbs needed for treatments of non-communicable diseases and map their locations for sustainable cultivation and conservation.

Existing research on the identification of medicinal herbs using image processing and machine learning has largely focused on the recognition of individual plants, with a particular emphasis on species recognition and classification. However, there is a lack of research specifically focused on the identification of Ayurvedic medical herbs that are needed for the treatment of diseases using image processing and machine learning. Furthermore, there is a lack of research that combines image processing and machine learning techniques with geographic mapping to identify the location of medicinal plants. This is a significant research gap since it would be useful to have an accurate database of the locations of Ayurvedic medical herbs for treatment purposes.

The research “A” depicts that the recognition of plants and human existence are strongly intertwined. The conventional plant identification approach operates in a convoluted manner that is unfriendly to its spread. Automatic computer recognition of plant species based on image processing is now possible thanks to the quick development of pattern recognition and computer image processing technologies. In recent years, an increasing number of academics have focused on the computer's automatic identification technology based on plant photos. We have conducted extensive study and analysis on the plant identification approach based on image processing in recent years because of this. The main technologies and steps of plant recognition are reviewed, followed by an introduction to the research significance and history of these technologies. After that, more than 30 leaf features—including 16 shape features, 11 texture features, and 4 color features—were evaluated using SVM, and 8 commonly used classifiers were described in detail. The report concludes with a finding that plant identification technologies are inadequate and a forecast for future advancement. [8]

The research “B” represents that study, they used a pattern recognition approach to demonstrate baseline automatic identification capabilities of three Ficus species based on herbarium leaf

photos. To create identification models, ANN and SVM, two machine learning techniques, were employed. Both models produced results that were satisfactory, proving their utility in identifying tasks.

According to the study described here, automated classification of certain Ficus species with similar-looking leaves is possible using leaf photos. Although the created system is not meant to take the role of human taxonomists, it may offer a quick and simple method to quickly and accurately identify plants. Since Ficus is a huge genus and species identification can be challenging, especially for non-taxonomists, we decided to focus on its species. Future expansion of the Ficus species could increase the system's resiliency. [9]

The research “C” presents evaluated automatic plant identification as a fine-grained classification challenge using the largest plant recognition datasets, up to 10,000 plant species, from the LifeCLEF [10] and CVPR-FGVC workshops.

The comparison of deep neural network classifiers demonstrates the advancement in classification accuracy attained by current CNN architectures. State-of-the-art classifiers. The best model, ViT-Large/16, achieves recognition scores of 91.15% and 83.54% on the PlantCLEF 2017 and ExpertLifeCLEF 2018 test sets, respectively, before any additional post-processing like test-time augmentations and prior shift adaptation. Prior shift adaptation: The prior shift in datasets, or the distinction in the class distribution of training and test data, is an important and pervasive phenomenon. We investigate the effects of several prior shift adaptation techniques on classification precision. Approach to fine-grained categorization using retrieval: A competitive alternative that outperforms direct classification is to train an image retrieval system and then classify the results using nearest neighbors.

Overall, there are definite benefits to employing image retrieval, such as recovering pertinent nearest-neighbor labeled samples, offering ranking class predictions, and enabling users or experts to visually confirm the species based on the k-nearest neighbors. Additionally, the retrieval approach naturally accommodates open-set recognition problems, allowing for the extension or modification of the collection of recognized classes following the training phase. The list of classes could alter, for instance, as a result of changes to biological taxonomy. In contrast to the conventional approach, which requires retraining the classification head, the introduction of new classes only requires the addition of training images with the new label. On the downside, the retrieval strategy necessitates the efficient execution of the nearest neighbor search in addition to running the deep net to extract the embedding, raising the overall complexity of the fine-grained recognition system. [11]

Features	Research A	Research B	Research C	Proposed System
Ayurvedic Plants Identification	X	X	X	✓
Usage of image processing	✓	✓	✓	✓
Plant Identification	✓	✓	✓	✓
Representative datasets	X	X	✓	✓
Noise sensitivity	X	X	✓	✓
Using of auto machine Learning	X	✓	✓	✓
Technology Used	SVM [12]	SVM/ANN [12] [13]	KNN/DNN [14]	CNN/SVM [12] [15]

Therefore, there is a need for further research that focuses specifically on the identification of Ayurvedic medical herbs for the treatment of diseases using image processing and machine learning, while also incorporating geographic mapping and addressing the challenges posed by variable plant morphology, environmental conditions, and lighting conditions.

1.3 Research Problem

The research problem is the lack of an efficient and accurate solution for identifying Ayurvedic medical herbs that are required for treating diseases using image processing and machine learning models. The current research gap lies in the lack of studies that combine the principles of Ayurveda with modern AI techniques to develop a robust solution for identifying medicinal plants. [3] [4] [5]

Based on the limited availability of herbal plants and medicines, combined with the lack of knowledge and resources for identifying and locating these plants, there is a need for an AI-based solution that can accurately identify Ayurvedic medical herbs used for the treatment of non-communicable diseases through image processing, while also mapping their locations. Additionally, to improve the accuracy of the system, continual learning and transfer learning techniques can be employed, and the system can be made more accessible through the use of Auto Machine Learning to enable the addition of new plants. Therefore, the research problem is to develop an AI-based solution that can accurately identify Ayurvedic medical herbs and their locations while utilizing continual learning and Auto Machine Learning (AML) techniques to improve accuracy and accessibility.

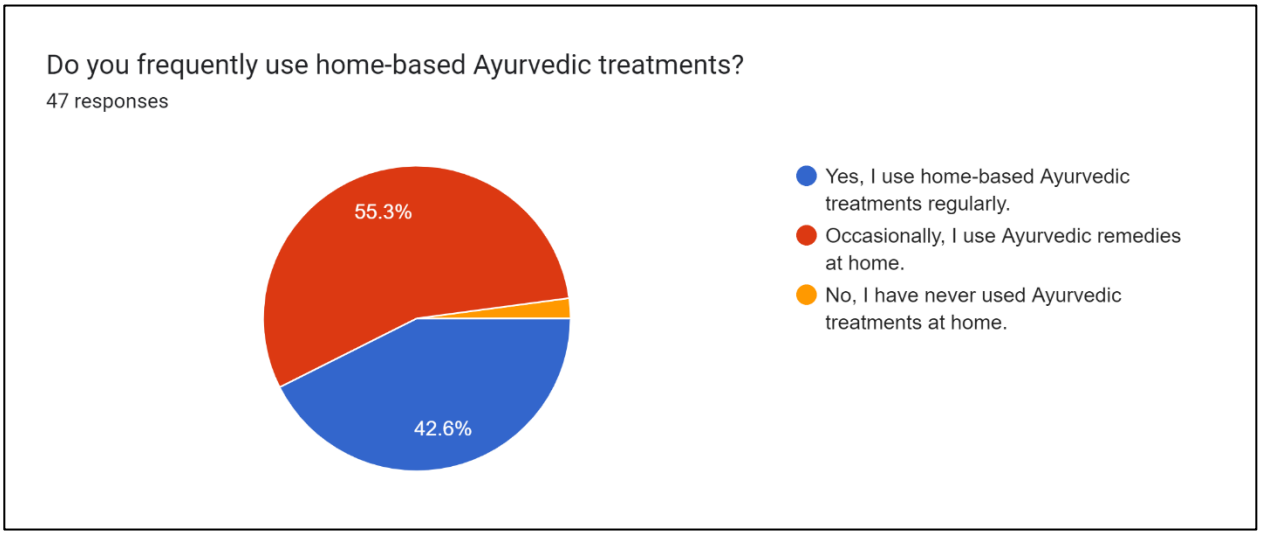


Figure 8:Survey on how frequently use ayurvedic treatments.

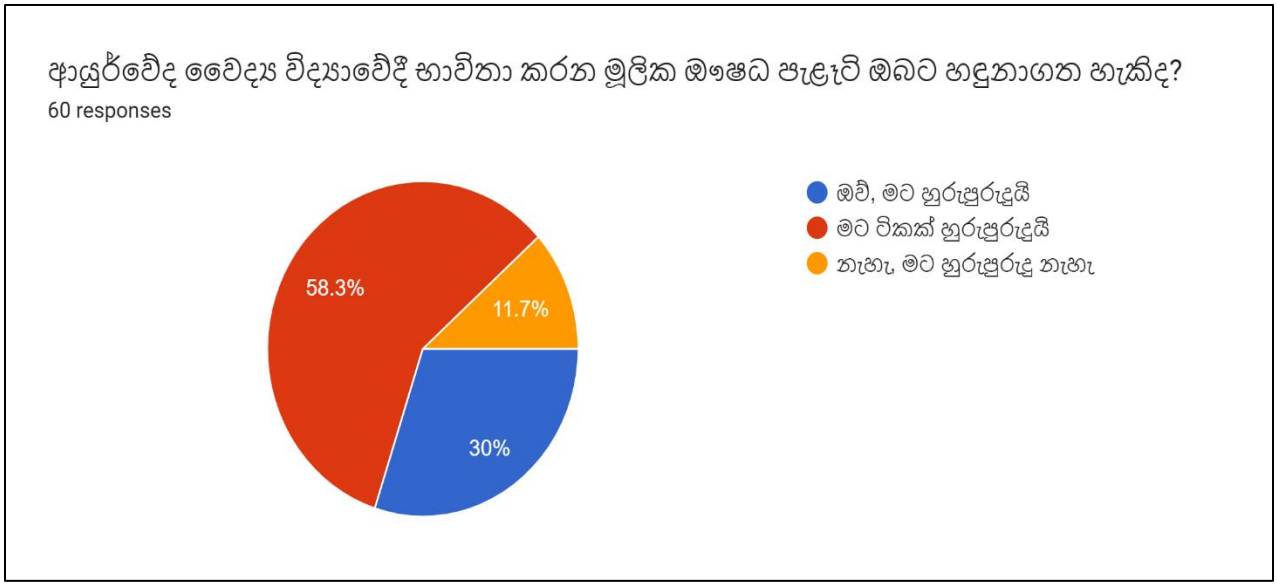


Figure 9:Survey in Sinhala on how frequently use ayurvedic treatments.

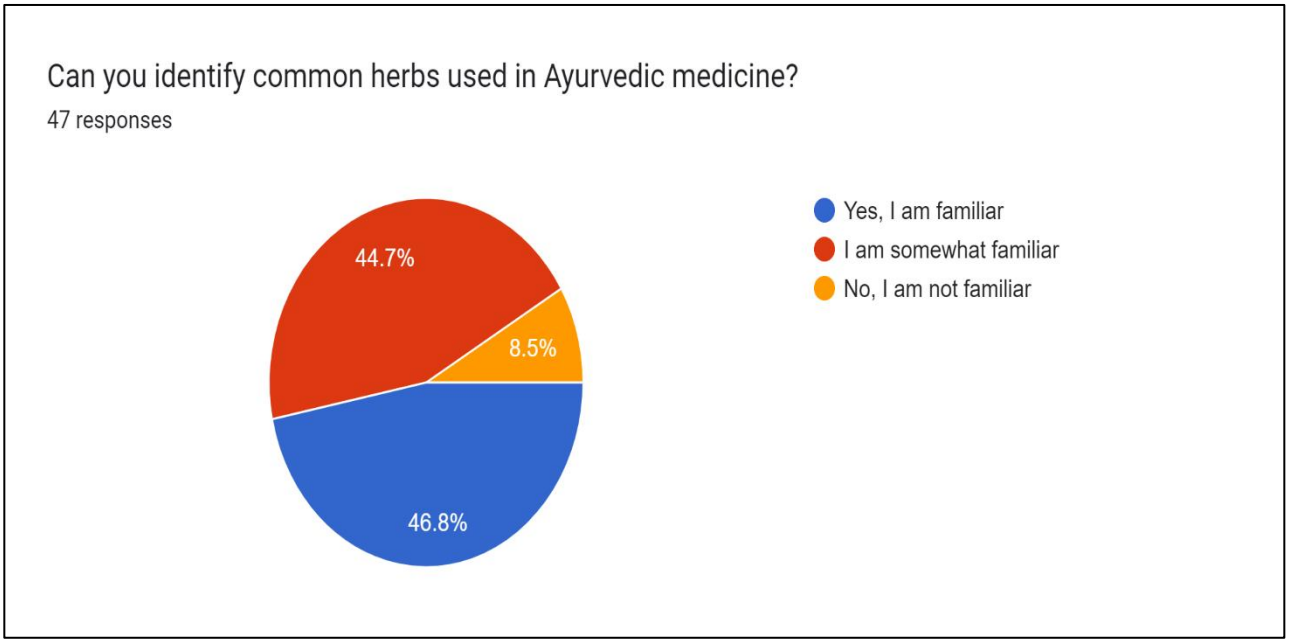


Figure 10: Survey on the capability of people to identify medicinal home plants.

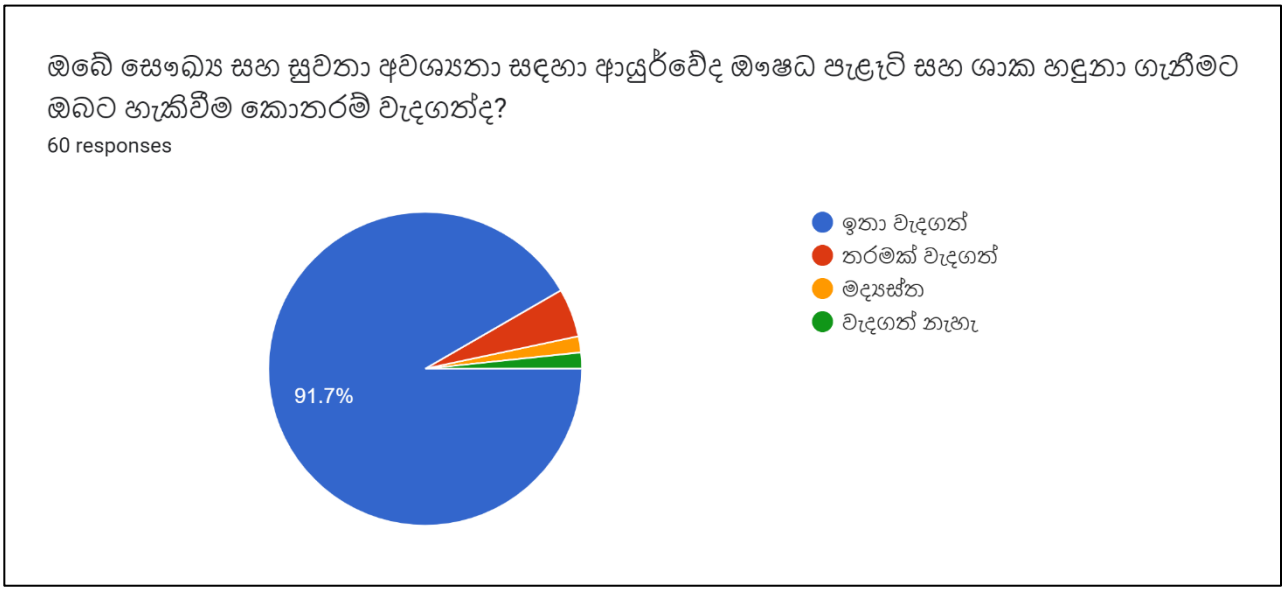


Figure 11:Survey in Sinhala on the capability of people to identify medicinal home plants

2. OBJECTIVES

2.1 Main Objectives

The main objective of this research is to develop a creative solution to promote a healthier lifestyle by utilizing the principles of Ayurveda by addressing the common symptoms for

- Blood Sugar (Glycemia)
- Hair Loss
- Infertility
- Obesity
- Paranasal Sinusitis (Peenasa)
- Cuts/Scratches/Swellings

through identifying appropriate Ayurvedic medical herbs. Additionally, a component based on a geometry library will be implemented to map out the locations of these identified herbs which will make easier for the patient to find herbs.

To achieve this objective, the proposed solution will consist of an image processing-based component to identify the necessary herbal plants for treating these diseases. Furthermore, the solution will incorporate continual learning/transfer learning techniques to enhance the accuracy of the system, and an Auto Machine Learning component to facilitate the addition of new plants to the system. Ultimately, the objective of this research is to provide individuals with a more accessible and comprehensive approach to achieving a healthier lifestyle through Ayurveda.

2.2 Specific Objectives

Collection of images of different ayurvedic herbs and labeling them.

- Pre-processing of the collected images, such as resizing and normalization
- Splitting the data into training, validation, and testing sets.
- Training a machine learning model using pre-processed image data.
- Evaluating the model on the validation set to identify areas of improvement.
- Collecting and processing large amounts of image data from various geographical areas to map the distribution of herbal plants.
- Fine-tuning the model based on the evaluation results.
- Testing the final model on the testing set to measure its accuracy and robustness.
- Implementing the model in a software application for practical use.

As novelty improvement,

- Using continual learning/transfer learning to improve accuracy. (**Also, can incorporate Auto Machine Learning to make it easier to add new plants.)**

3. METHODOLOGY

The methodology to achieve these objectives involves:

- Collect a dataset of plant images: You will need a dataset of labeled images of plants for training your machine learning model.

- Preprocess the data: You will need to preprocess the data by resizing the images, normalizing the pixel values, and splitting the dataset into training and validation sets.

- Feature extraction: You will need to extract features from the images that can be used to train your machine learning model. There are several feature extraction techniques available, such as Histogram of Oriented Gradients (HOG), Scale-Invariant Feature Transform (SIFT), and Convolutional Neural Networks (CNNs).

- Train the machine learning model: Once you have extracted the features, you can train your machine learning model. There are several algorithms you can use for classification, including Decision Trees, Random Forests, Support Vector Machines (SVMs), and Neural Networks.

- Test and Evaluate: After training the model, you will need to test it using a separate dataset and evaluate its performance. You can use metrics such as accuracy, precision, recall, and F1 score to evaluate the performance of the model.

- Deploy the system: Finally, you can deploy the system and make it accessible to users.

3.1 System Architecture

Users can add image or take a capture and ask the system that is this the correct herb, what are the places that herb can be identified. The added images are uploaded to the cloud and then the user's current location and the images will be combined and passed to the data layer. Here all the uploaded images are transferred to the temporary database at first, and images are filtered and verified here. After all the images are transferred to the plant information database the images are reading the training images. Then it subjects to preprocessing, validating the deep learning model. Finally, the user can view the response (true false and percentage of the plant variety) and get

longitudes and latitudes to find them.

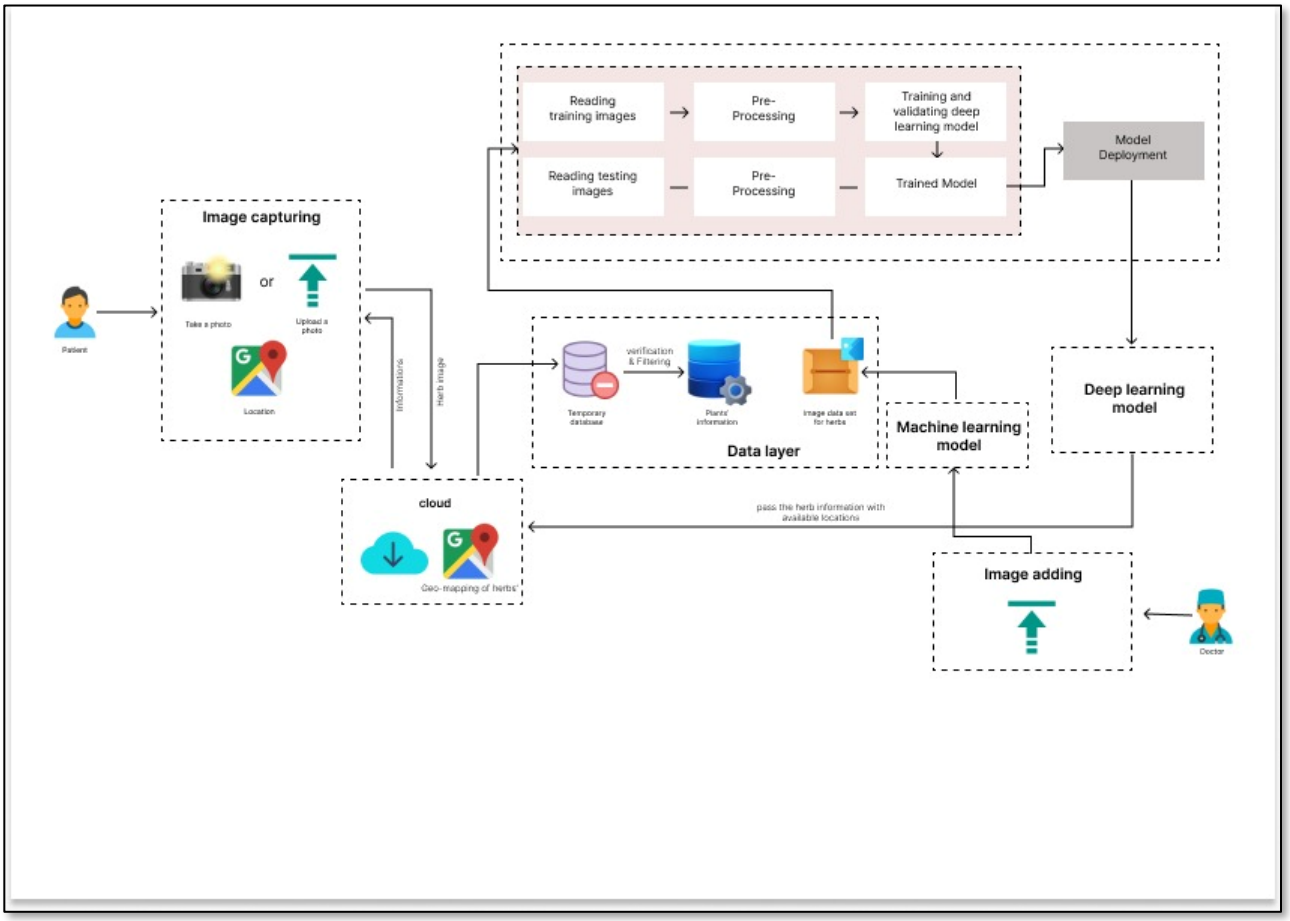


Figure 12:System architecture diagram

Technologies	• React Native • Python • Expo • Node Server • Google Map
Techniques	• Image processing • Auto Machine Learning (AML)
Algorithms	• Support Vector machine (SVM)/Random Forest
Architectures	• ResNet

Table 1: Technologies and Techniques used.

3.1.1 Software solution

The Software Development Life Cycle (SDLC) [16] is a structured and systematic approach to software development that aims to ensure code accuracy and consistency. In the conventional approach to software development, when requirements change, developers are often unable to go back to earlier steps and are therefore forced to carry out all the remaining steps in the correct order. However, by using agile methodology in SDLC, developers have more flexibility to adapt to changes.

Agile methodology is all about embracing change and allowing for more flexibility in the development process. Scrum is thought to be superior to other agile frameworks in terms of effectiveness. Compared to other agile frameworks, Scrum is considered the most effective. It is a portable framework for agile project management that may be used to handle and resolve tricky adaptation issues. Scrum emphasizes teamwork, transparency, and continuous improvement.

This shows the six essential Scrum processes. Product backlog, sprint planning, sprint backlog, daily scrum, sprint review, and sprint retrospective are some of these procedures. A prioritized list of features that need to be produced is called a product backlog. The process of choosing items from the product backlog and establishing the work to be completed within the sprint is known as sprint planning. The team commits to finishing each item on the sprint backlog before moving on to the next one. At a daily stand-up meeting called a "scrum," the team reviews progress and plans for the next day. The team presents the work produced during the sprint during the sprint review, a meeting held at the conclusion of the sprint. The team gathers for a sprint retrospective meeting to discuss the sprint and pinpoint areas for improvement. [17] [16]

Figure 13:Software development life cycle.

In conclusion, developers may more readily react to changing needs and have more flexibility in the development process by implementing agile techniques in SDLC. The most effective agile framework, Scrum, provides a structured method for managing projects that places an emphasis on collaboration, openness, and continuous improvement. A framework for managing and resolving complex adaptive issues in software development is provided by Scrum's six core processes.

1.Requirement gathering

- **Collecting information from Gampaha Wickramarachchi Ayurvedic University**

To collect information on ayurveda and diseases we met **Dr. Janaki Wickramarachchi**, who is the Dean of Chikisthsaka Faculty at **Gampaha Wickramarachchi Ayurvedic University** and had conducted some online meetings conducted with her, with participation of our group members. She agreed to provide us the necessary information related to the ayurveda and the research gap which is having when connecting with modern technologies such as Artificial Intelligence and Machine Learning. She highlighted several main diseases which are fine for the research. She gave us legal approval for the continuation of the research and gave advice about the things we need to focus on in the future while continuing the project.

- **Data gathering**

Firstly, we read a dozen published research for initial understanding and got some basic idea by reading and browsing through few articles. Our supervisors had few meetings with us to discuss the initial methods for data gathering and the external supervisor connected us with a few ayurvedic specialties and pointed out the diseases and the data we are needed continue with. In future the other necessary data and images will be collected from the University of Gampaha as necessities.

- **Conducting a survey**

To get an idea about the knowledge of people about ayurvedic treatments and diseases and their knowledge about the connection between AI/ML with it, we have conducted a survey was conducted with both closed and open-ended questions by distributing a questionnaire.

2.Feasibility study (Planning)

- **Economic feasibility**

Economic feasibility is a critical aspect of any project's success, as it determines whether or not the project is financially viable. The economic feasibility report analyzes the development costs and benefits of the project, and if a proper economic feasibility plan is not in place, the project is likely to fail. Therefore, it is crucial that the proposed system is both cost-effective and efficient in order to ensure its success. [18]

- **Scheduled feasibility.**

Scheduled feasibility is another essential factor to consider when undertaking a project. A schedule feasibility assessment examines the timelines for the planned project, and any delays or missed deadlines can have a significant impact on the project's success. Therefore, it is vital that the proposed system completes each task within the allotted time period as specified to ensure that the project stays on schedule. [18]

- **Technical feasibility**

Technical feasibility planning is also crucial in the development of any system. It involves evaluating the

required skills and expertise necessary for mobile and web application development, as well as the ability to understand software architectures and communicate effectively with stakeholders to obtain the necessary information. Without proper technical feasibility planning, it is unlikely that the proposed system will be successfully developed and implemented. Therefore, it is essential to have the necessary technical skills and communication abilities to move forward with the system's development. [18]

3.Design (system and software design documents)

After the planning phase, system and software design documents are created which contributes to the overall system diagram.

- **Use case Diagram.**

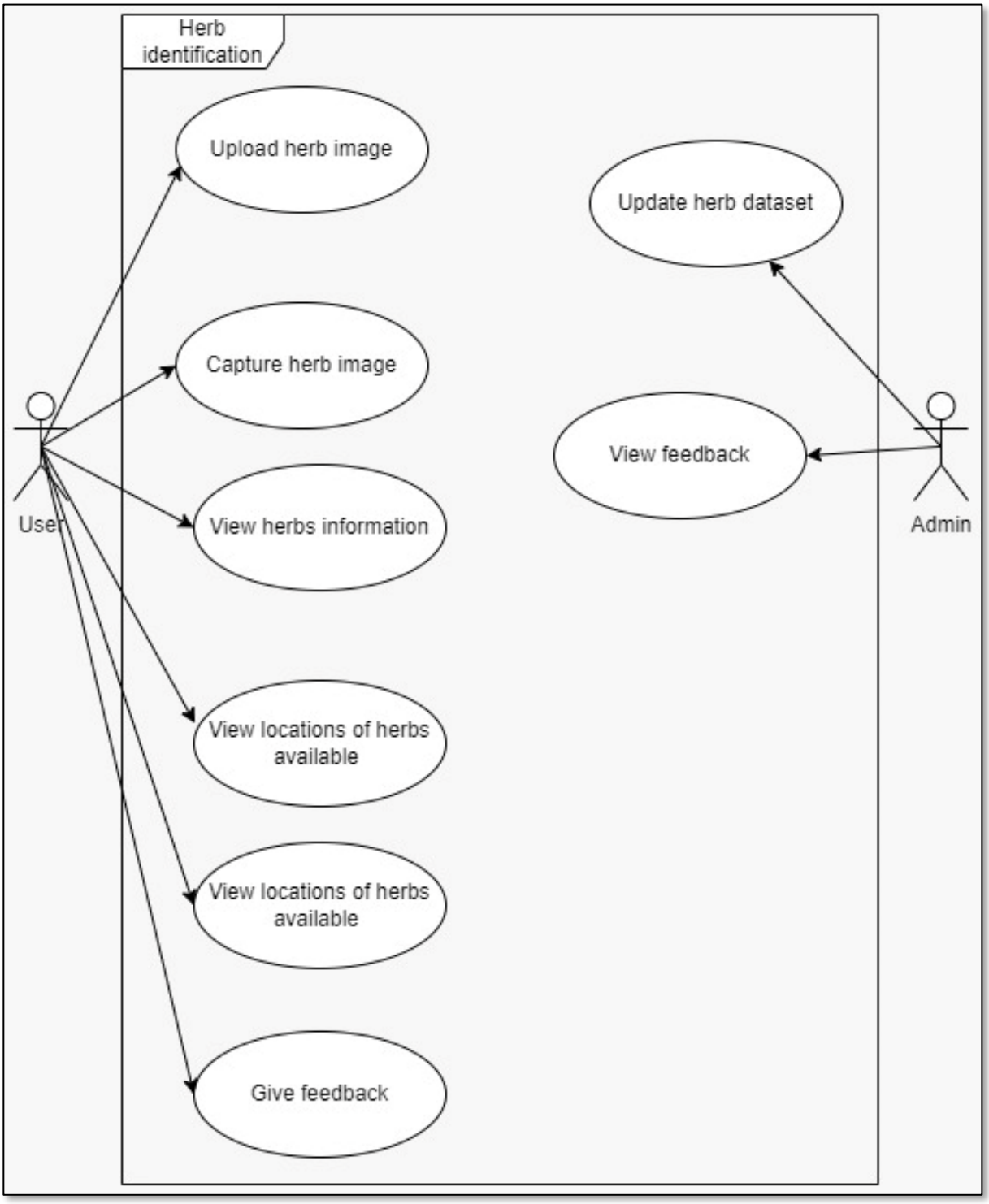


Figure 14:Use Case Diagram

- **Sequence Diagram**

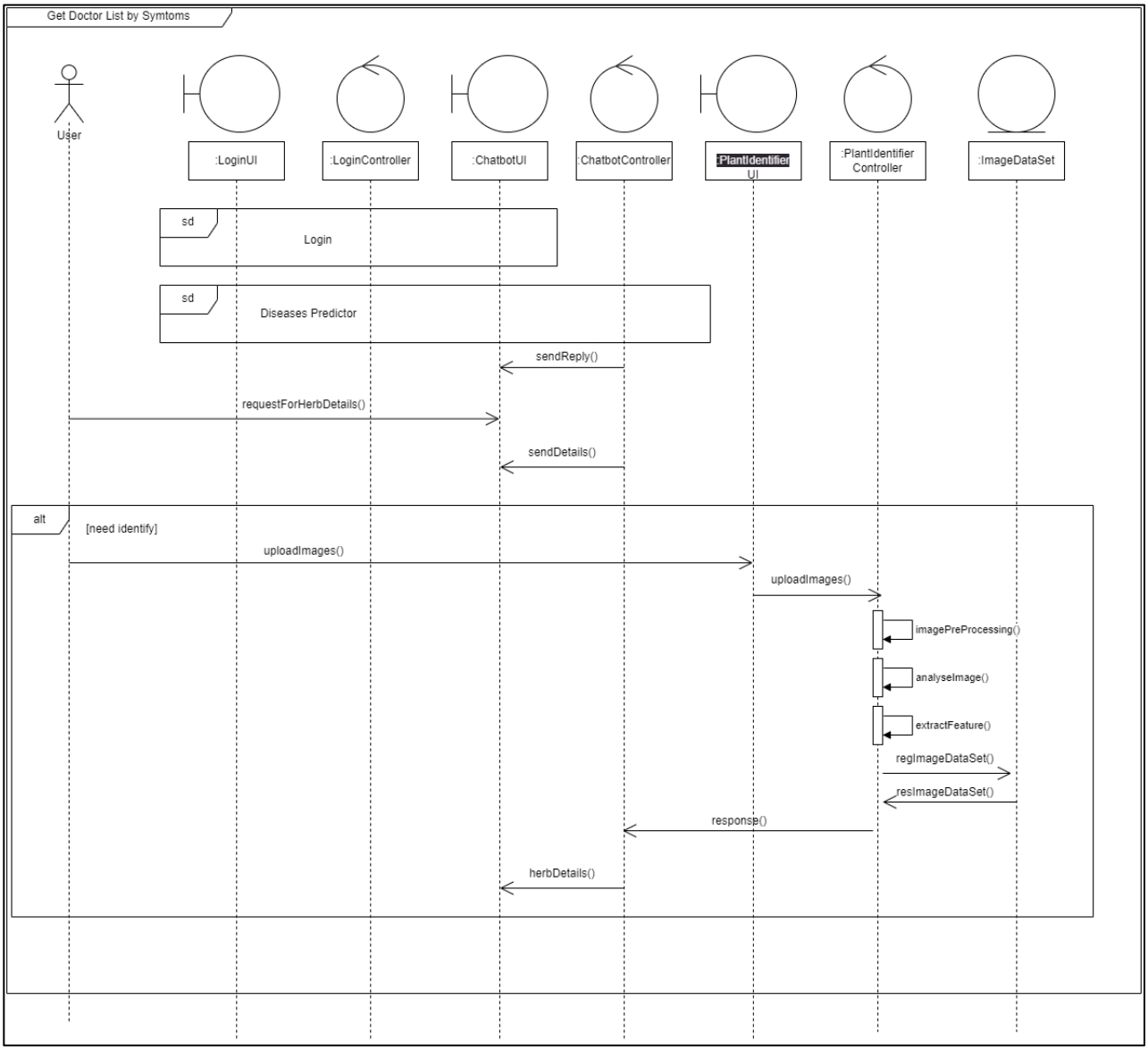


Figure 15: Sequence diagram

4.Implementation (Development)

The implementation process, as discussed in the methodology, includes the development of below functionalities to satisfy user requirements providing the ultimate solution with high accuracy and reliability.

- Collection of images of different ayurvedic herbs and labeling them: This involves gathering images of different ayurvedic herbs and labeling them with their corresponding names. The images should be of high quality, with good lighting and minimal noise.

- Pre-processing of the collected images: The collected images need to be pre-processed to ensure that they are suitable for training the machine learning model. This can involve resizing the images to a uniform size, normalization to reduce the effects of variations in lighting, color, and contrast, and data augmentation to increase the amount of training data.
- Splitting the data into training, validation, and testing sets: To evaluate the performance of the machine learning model, the data needs to be split into training, validation, and testing sets. The training set is used to train the model, the validation set is used to evaluate the performance of the model during training and adjust the hyperparameters, and the testing set is used to evaluate the final performance of the model.
- Training a machine learning model using pre-processed image data: A deep learning model such as a convolutional neural network (CNN) can be trained on the pre-processed image data to classify the different ayurvedic herbs.
- Evaluating the model on the validation set: The model is evaluated on the validation set to identify areas of improvement. This can involve adjusting hyperparameters, changing the architecture of the model, or incorporating new features into the model.
- Collecting and processing large amounts of image data: Collecting and processing large amounts of image data from various geographical areas can help to map the distribution of herbal plants and improve the accuracy of the model.
- Fine-tuning the model based on the evaluation results: The model is fine-tuned based on the evaluation results to improve its performance.
- Testing the final model on the testing set: The final model is tested on the testing set to measure its accuracy and robustness.
- Implementing the model in a software application: Once the model is trained and tested, it can be implemented in a software application for practical use.
- As a novelty improvement, you can use continual learning/transfer learning to improve accuracy. Continual learning allows the model to learn from new data as it becomes available, which can help to improve its performance over time. Transfer learning involves using a pre-trained model and fine-tuning it on a new task, which can save time and improve accuracy.

5.Testing (Track and Monitor)

During the software development lifecycle, the testing phase is a crucial stage that ensures the quality and effectiveness of the software. This phase involves a comprehensive evaluation of the software to identify any system gaps, missing requirements, errors, and bugs that need to be fixed. The primary objective of this testing phase is to improve the overall quality of the software and ensure that it meets the intended purpose. The testing phase consists of various testing processes that are carried out to achieve the desired outcome. These processes include unit testing, component testing, integration testing, system testing, and

user acceptance testing. Each of these testing processes focuses on a specific aspect of the software and is designed to identify any issues that may arise in that area.

Unit testing involves testing each module or component of the software individually to ensure that it functions correctly. Component testing is done to check the software's functionality by combining various individual components. Integration testing evaluates the interactions between different software components and identifies any issues that may arise from their integration. System testing examines the entire software system to ensure that it meets the specified requirements and performs as expected. User acceptance testing evaluates the software's usability and ensures that it meets the user's requirements and expectations. Through these testing processes, the software is thoroughly evaluated and tested to identify any issues that may affect its performance, usability, or functionality. By fixing these issues, the software's quality is improved, and its effectiveness is assured.

3.1.2. Commercialization

Target Audience

- Patients
- Ayurvedic Doctors
- Ayurvedic Herbal Stores/Medicinal stores

Market Space

- No need for advanced knowledge in technology.
- No age limitation for users.
- No need for prior knowledge regarding ayurveda.

Future scope

- For the future scope the application will be extended to give solutions to more plant herb identification for diseases, adding more easily and improve the user experience.

4.PROJECT REQUIREMENTS

1. **Functional requirements**

- The system should allow users to upload images of plants for identification.
- The system should allow users to capture images of plants for identification.
- The system should be able to identify plants based on the uploaded images and provide information about the plant's name, family, genus, species, and other relevant details.
- The system should be able to identify plants based on the uploaded images and provide information about the plant's location.
- The system should have a high accuracy rate in identifying plants.
- The system should integrate with a database of plant information to provide accurate and up-to-date information about the identified plants.
- The system should allow users to provide feedback on the accuracy of plant identification.
- The system should allow us to make it easier to add new plants.

2. **Non-functional requirements**

- Performance: The system should be able to handle a large number of requests simultaneously, without significant delay or response time degradation.
- Usability: The system should be easy to use and navigate, with clear instructions and feedback provided to the user.
- Reliability: The system should be always reliable and available, with minimal downtime for maintenance or upgrades.
- Security: The system should be secure, with appropriate measures in place to protect user data and prevent unauthorized access.
- Compatibility: The system should be compatible with a range of devices and platforms and be able to operate seamlessly with other software applications.
- Maintainability: The system should be designed and built with maintainability in mind, with clear documentation and easily maintainable code.
- Scalability: The system should be designed to scale up or down as needed, with minimal impact on performance and functionality.
- Accessibility: The system should be accessible to all users, regardless of their physical abilities or disabilities.
- Regulatory compliance: The system should comply with relevant laws and regulations, such as data protection and privacy laws.

3. **System requirements**

- Image processing capabilities: The system should be able to process images of plants uploaded by users and extract relevant features for plant identification.
- Machine learning algorithms: The system should use machine learning algorithms, such as deep neural networks or decision trees, to identify plant species based on the extracted features.
- Database integration: The system should be able to integrate with a database of plant information to provide accurate and up-to-date information about identified plants.
- Mobile compatibility: The system should be accessible on mobile devices as well as desktops, and the user interface should be optimized for mobile devices.
- Scalability: The system should be designed to handle a large number of plant identification requests, with the ability to scale up or down as needed.
- Performance: The system should be able to provide fast and accurate plant identification results, with minimal delay or response time degradation.
- Usability: The system should have a user-friendly interface that is easy to use and navigate, with clear instructions and feedback provided to the user.
- Security: The system should have appropriate security measures in place to protect user

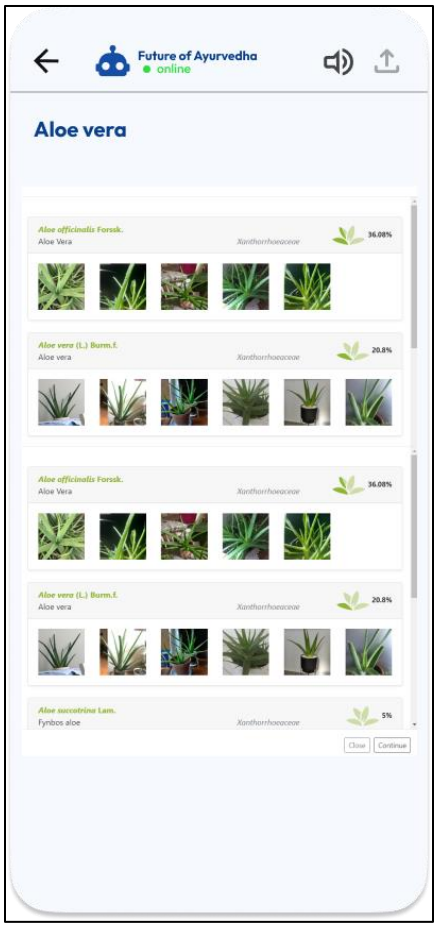
data and prevent unauthorized access.

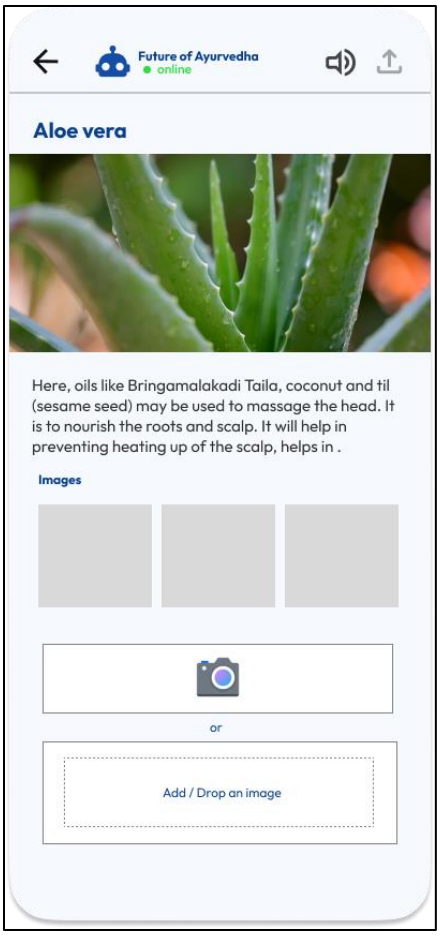
- Reliability: The system should always be reliable and available, with minimal downtime for maintenance or upgrades.
- Integration with third-party APIs: The system should be able to integrate with third-party APIs for image processing, data storage, or other functionalities.
- System backups and data recovery: The system should have regular backups and data recovery procedures in place to ensure the safety and availability of user data.

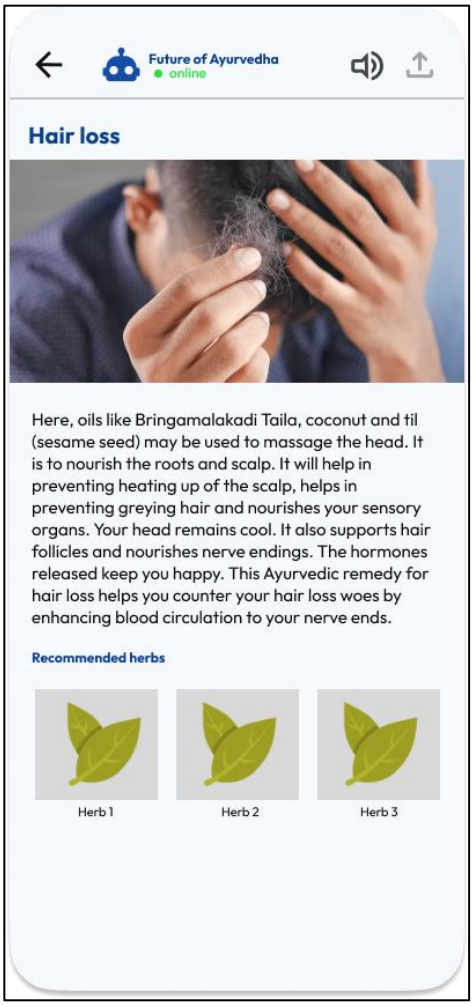
4. User requirements

- User interface: The system should have a user-friendly interface that is easy to navigate and understand.
- Image uploading: The system should allow users to easily upload images of plants for identification.
- Plant identification accuracy: Users expect the system to have a high accuracy rate in identifying plants based on uploaded images.
- Plant locations identification: Users expect the system to find location based on uploaded images.
- Information display: The system should display relevant information about identified plants, such as the name, family, genus, species, and other relevant details.
- Feedback mechanism: The system should allow users to provide feedback on the accuracy of plant identification to improve the system's performance.
- Search functionality: The system should provide a search functionality that enables users to search for plants by name, family, genus, or other relevant parameters.
- Mobile compatibility: Users expect the system to be accessible on mobile devices as well as desktops.
- Speed and responsiveness: Users expect the system to be fast and responsive, with quick loading times and minimal delays.

5. Wire Frames







5.GANTT CHART

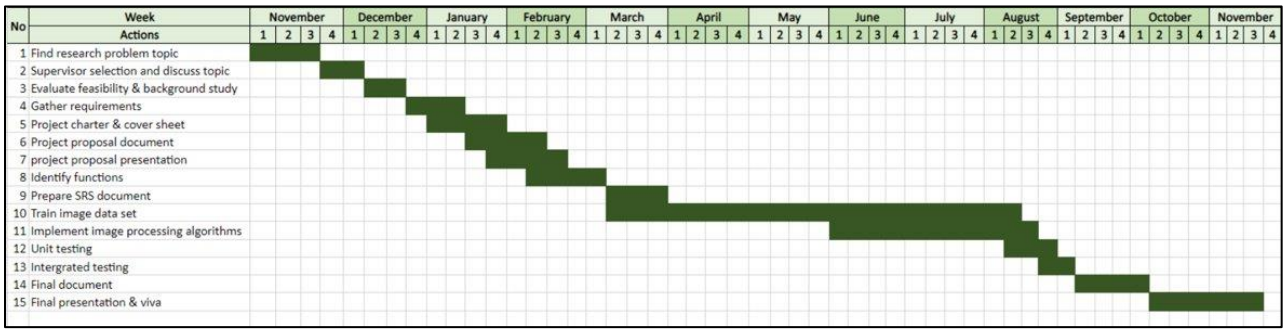


Figure 16: Gantt Chart

6.WORK BREAKDOWN STRUCTURE(WBC)

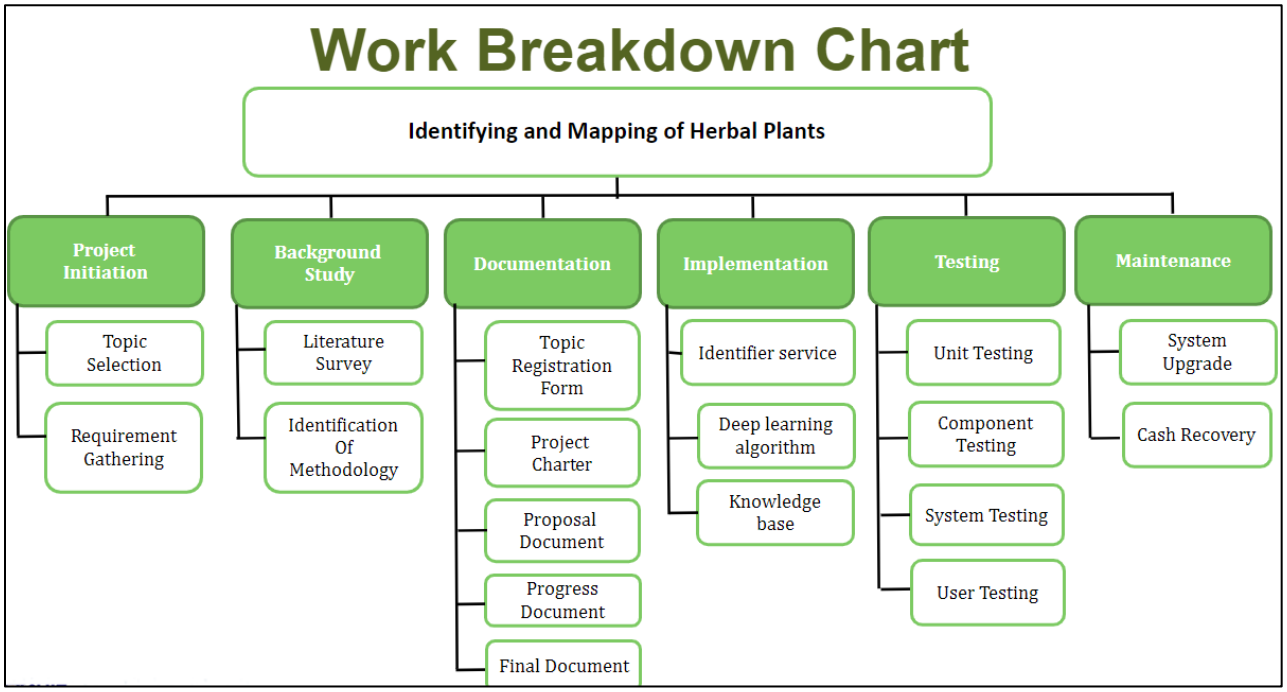


Figure 17:Work Breakdown Chart

7.BUDGET AND BUDGET JUSTIFICATION

	Expenses
Requirement	**Cost ($)**
Travelling cost for data collection	
Cost of Deployment	
Cost of hosting in Play Store (one-time registration fee)	25
Cost of hosting in App Store (annual developer account fee)	99
Google NLP (per 1,000 units of sentiment analysis)	1
Google Maps Distance Matrix API charges (per request for up to 100,000 elements)	0.005
Mongo DB	-

Table 2: Budget plan

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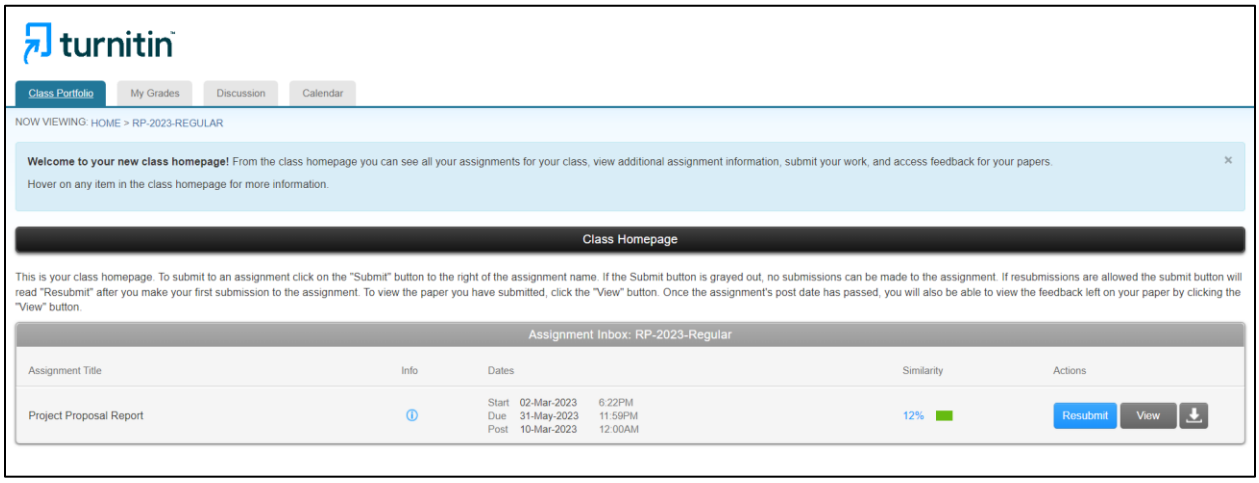
9.APPENDICES

Appendix A -PLAGARISM REPORT



Appendix B -SURVEY LINK

https://forms.gle/JQcxdPGPtDa6SiBY9

Responses:

https://docs.google.com/forms/d/13Rjfbu-B7r50Zy5zklPnpfU1K_gx6JShNNVXtkGflqM/edit#responses