IT4010 Research Project – 2025 July

Topic Assessment Form

Project ID : **2025-26J-166**

1. Topic (12 words max)

Smart agriculture support system for Aloe Vera

2. Research group the project belongs to

CoEAI - Centre of Excellence for AI

3. Specialization of the project belongs to

Information Technology (IT)

4. If a continuation of a previous project:

Project ID	
Year	

5. Brief description of the research problem including references (200 – 500 words max) – references not included in word count.

Aloe Vera is an increasingly valuable crop in Sri Lanka, with strong demand in the herbal, cosmetic, and pharmaceutical industries. In 2022, Sri Lanka exported 2,080 metric tons of Aloe Vera and its derivatives, generating approximately USD 15.06 million in revenue [1]. This highlights the crop's potential to support rural livelihoods and contribute to the national economy. However, Aloe Vera cultivation in Sri Lanka still faces significant challenges due to the absence of modern farming tools and limited access to expert knowledge.

The most pressing problems include plant diseases caused by pests and pathogens, poor soil and nutrient management, climate unpredictability, and volatile market prices. These factors reduce both the quantity and quality of Aloe Vera yields, directly affecting the profitability and sustainability of farming operations. Diseases such as bacterial soft rot, mealybug infestations, and leaf spots are common, yet early detection remains difficult for farmers with limited technical expertise [2]. In addition, unpredictable weather patterns due to climate change disrupt planting cycles, and farmers often lack data to make informed cultivation decisions [3].

Market instability further complicates matters. Many small-scale farmers are unaware of market price trends and end up selling their harvests at suboptimal times, reducing income. The absence of predictive tools for yield and pricing also prevents effective farm planning and resource allocation.

To address these challenges, a Smart Agriculture Support System is proposed. This system integrates four core components: (1) Crop Disease Detection using Deep Learning and NLP to identify plant issues through images and farmer symptom descriptions, (2) Weather-Based Crop Recommendation using predictive models to align planting with climate forecasts, (3) Yield

Prediction using soil and nutrient data analyzed by machine learning models such as Random Forest and (4) Market Price Trend Forecasting using ARIMA or LSTM models to guide optimal selling times based on historical and real-time market data.

By leveraging artificial intelligence, image recognition, and climate analytics, this support system will provide Aloe Vera farmers with real-time, localized, and user-friendly tools to make informed decisions. This not only enhances crop quality and yield but also contributes to the long-term sustainability and economic growth of the Aloe Vera industry in Sri Lanka.

References

[1] Department of Export Agriculture, "Annual Performance Report 2022," Ministry of Agriculture, Colombo, Sri Lanka. [Online]. Available: https://www.dea.gov.lk [Accessed: May 15, 2024].

[2] A. Gunaratne, S. Seneviratne, and M. Kumari, "Assessment of growth performance and quality characteristics of Aloe vera under different agro-climatic zones in Sri Lanka," *Journal of Tropical Agricultural Research*, vol. 31, no. 2, pp. 201–210, 2021.

[3] K. A. C. S. Perera and W. G. I. U. Kumari, "Integrated pest management practices for Aloe Vera cultivation in Sri Lanka," *Proceedings of the 15th Annual Research Symposium, Uva Wellassa University*, pp. 78–82, 2022.

[4] H. M. R. Herath and R. J. Liyanage, "Adoption of modern agricultural technologies by herbal farmers in Sri Lanka," *Sri Lankan Journal of Agricultural Economics*, vol. 23, no. 1, pp. 45–55, 2020.

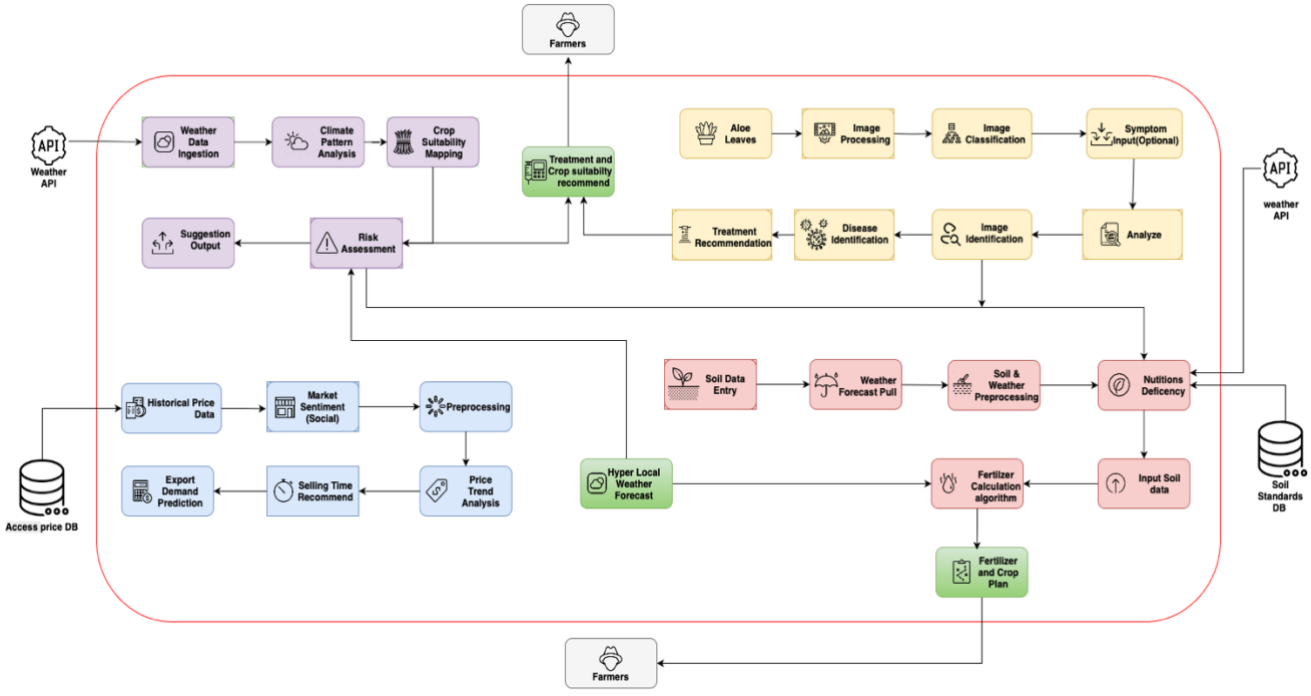
[5] R. K. Shastr et al., "An Automatic Detection of Citrus Fruits and Leaves Diseases Using Enhanced Convolutional Neural Network," *Computers and Electronics in Agriculture*, vol. 202, p. 107378, 2023.

6. Brief description of the nature of the solution including a conceptual diagram (250 words max)

The proposed solution is a Smart Agriculture Support System specifically designed for Aloe Vera cultivation in Sri Lanka. It is a mobile-based AI application that empowers farmers with intelligent, localized, and actionable insights across the crop lifecycle. The system consists of four core modules:

1. **Crop Disease Detection:** Utilizes Convolutional Neural Networks (CNN) to analyze leaf images for disease symptoms. Natural Language Processing (NLP) enhances diagnosis by processing farmer-reported symptoms via text or voice in native languages.
2. **Weather-Based Crop Recommendation:** Integrates real-time and historical weather data using machine learning (e.g., ARIMA, Prophet) to suggest optimal planting times and strategies suited to regional climate conditions.
3. **Yield Prediction:** Employs machine learning models like Random Forest to forecast Aloe Vera yield using soil nutrient levels (NPK), pH, and climate data, enabling better resource planning.
4. **Market Price Trend Forecasting:** Uses LSTM/ARIMA models to predict Aloe Vera market prices based on historical trends and external economic indicators, guiding farmers to sell at peak value.

All modules are integrated into a unified mobile interface, ensuring usability for farmers regardless of technical background. The app delivers visual cues, voice support, real-time alerts, and personalized recommendations.



7. Brief description of specialized domain expertise, knowledge, and data requirements (300 words max)

The successful development of the Smart Agriculture Support System for Aloe Vera requires interdisciplinary expertise across agriculture, artificial intelligence, and data science domains.

From the **agricultural domain**, specialized knowledge is needed in Aloe Vera cultivation, pest and disease management, soil science, and irrigation practices. Local expertise from agricultural officers, researchers, and Aloe Vera farmers will be essential to understand region-specific plant diseases, nutrient deficiencies, and seasonal growth patterns. This domain input is crucial to train and validate AI models with real-world relevance.

The **technical domain** demands proficiency in machine learning (ML), deep learning (DL), computer vision, natural language processing (NLP), and time series forecasting. Expertise in CNNs for image classification, Random Forest for yield prediction, and LSTM/ARIMA for price and weather trend forecasting will be required. Additionally, NLP expertise is necessary to interpret symptom descriptions in local languages (e.g., Sinhala/Tamil).

In terms of **data requirements**, the project will need:

- A curated dataset of Aloe Vera leaf images (healthy and diseased) for training the disease detection model.
- Historical weather data (temperature, rainfall, humidity) from the Meteorological Department of Sri Lanka.
- Soil test data including NPK levels, pH, and moisture from agricultural research institutes or local labs.
- Historical Aloe Vera market price data from economic or trade departments.
- Farmer-reported text/voice symptom data for NLP model training.

Collaboration with local universities, the Department of Export Agriculture, and farmer cooperatives will help source domain-specific data and validate the solution's effectiveness in real farming conditions.

8. Objectives and Novelty

Main Objective To develop a smart mobile application for Aloe Vera cultivation that leverages artificial intelligence (AI) and machine learning (ML) to enhance agricultural productivity, disease detection, and economic decision-making. The system will empower farmers through four integrated modules: disease detection, weather-based crop planning, yield prediction, and market price forecasting — thereby supporting sustainable Aloe Vera farming in Sri Lanka.			
Member Name with Registration No	Sub Objective	Tasks	Novelty
Rajapaksha H B IT22909664	Detect Aloe Vera diseases using leaf images and farmer-given symptoms.	• **Build a comprehensive database** Collect and document Aloe Vera leaf images (healthy and diseased) along with farmer-reported symptoms from different regions. Include disease names, visible signs, causes, and common treatments. • **Develop a simple symptom-reporting feature** Allow farmers to describe leaf issues using Sinhala, Tamil, or English—through typing or voice. Convert their inputs into usable symptom descriptions. • **Analyze leaf images for disease signs** Identify patterns such as color	• **Combines multiple detection methods** Incorporates visual analysis (leaf images) with farmer-provided symptoms descriptions (text or voice) to ensure a diagnostic can always be made even if the images are unclear/unusable. • **Knowledge of local languages and farmer terminology** Can accept Sinhala and Tamil voice/text input, allowing farmers to use their own word choices, making it possible to be used by farmers with low literacy, language skills, or technical knowledge. • **First of its kind in Sri Lanka**

		changes, spots, rot, or damage in leaf images and match them to known disease categories using the image database. • **Compare farmer symptoms with visual findings** Match the farmer's description of the issue with visual symptoms from the image to improve accuracy in identifying the disease. • **Provide real-time feedback and treatment advice** Display the most likely disease name and a step-by-step treatment guide in the farmer's preferred language. Use icons and simple words for clarity. • **Track and measure treatment success** Allow farmers to give follow-up info after treatment (e.g. leaf getting better or worse) to monitor the effectiveness and improve future suggestions. • **Continuously expand and improve the database** Update the disease list and treatments regularly based on new	This is the first Aloe Vera disease detection system that combines image data with spoken/local symptom descriptions (other tools mainly utilize photo elements or English input). • **Inclusive voice-based use** Farmers can simply speak into the system through the app, therefore making it easier for an older generation of farmers, or others who are less tech-savvy, to use it without using their own system in typing or navigating menus. • **Real-time feedback with realistic recommendations** Provides immediate treatment recommendations in easy-to-understand local languages; therefore, helping farmers respond quickly to not spread disease. • **Incrementally improves** Learns from additional images and symptom reports, improving diagnostic accuracy, treatment recommendations, and its ability to understand localized dialects and farming terminology.

		reports, farmer feedback, and agricultural expert inputs.	
Megasooriya G.M.M.A.E. IT22337962	Recommend the best Aloe Vera planting time based on weather predictions.	• **Collecting local climate history** Reliable historical and modern climate information (rainfall, temperature, humidity, wind) is to be gathered for various Aloe Vera farming sites around Sri Lanka. • **Finding trends in seasonal climate** The historical record can be searched for trends, for example, dry spells, too much rain, and temperature range, and so on that will affect the development of Aloe Vera. • **Forecasting the climate it is likely to continue** Using historical records can help forecast the coming weeks or months anticipated weather and present climate patterns before the season starts. • **Compare forecast with ideal conditions for Aloe Vera**	• **Sri Lanka's First Dedicated Weather Advisory Tool for Aloe Vera Farming** This tool is designed to specifically to support Aloe Vera farming, connecting both historical, and real-time weather information to Aloe Vera contextualized daily, monthly, or seasonal growth requirements, to go beyond the capability of widespread resource applications. • **More than just a weather application** We provide more than general forecasts and daily updates; the system creates understandable recommendations for the user, which tells them what to do and when to do it. The application takes into account the tropical climate and the shape of weather patterns. • **Decision-support that is region-specific** Localized weather data provides planting recommendations with specificity, based on district or

		Note expected climatic trends in accordance with the Aloe Vera requirements, for example moderate rains, temperatures, dry periods, etc., and find an ideal time for planting. • **Provide field preparation recommendations based upon future forecast** Provide recommended preparations, (early preparation for beds, likely to have drainage if heavy rain is anticipated, mulching if the predicted season is dry) to assist the farmer in advance of future challenges to their intended activity from climate or seasonal changes. • **Informing farmers of seasonal planting timelines** Provide generally recognisable different planting timeline recommendations based on local conditions and the forecast weather patterns.	region because of micro-climates in every region of Sri Lanka. • **Built-in climate-risk prevention** Farmers receive alerts prior to events that would trigger risky growing conditions like drought or floods, to avoid losses by providing farmers the opportunity to delay planting or change schedules. • **Makes complex forecasts understandable for farmers** The application converts high-level meteorological meaning into understandable language and visuals for farmers, including those with minimal or no education enabling them to make better decisions. • **Learning and adapting as new data accumulates** The application improves and refines predictions season by season based on supported variables that are weather patterns, farmer actions, and planting outcomes.

		• **Informing farmers of potential risks before they can occur.** Let farmers know of possible environmental threats, for example drought, too much rain, flooding, etc, that may help them.	• **Enables farmers to implement smart climate-resilient agriculture** The application helps farmers practice sustainable agriculture by producing better quality crops with less wasted resources due to poor timing.
Bandara H.M.A.I. IT22338020	Predict Aloe Vera yield using soil quality and farm environment data.	• **Collect information on soil** conditions, such as nitrogen, phosphorus and potassium values, the level of pH, soil type and moisture level in the soil at multiple times. • **Learn how the weather impacts the farm** Combine the soil characteristics with past weather conditions- rainfall, temperature and sunlight- to understand how these factors relate to the productivity of Aloe Vera. • **Assess how much Aloe Vera is likely to produce** Based on the available soil and weather data, anticipate the expected produce of Aloe Vera from the farming activities undertaken. This will help to determine how much a farmer can potentially	• **First system in Sri Lanka to predict Aloe Vera yield using actual farm-level data** Most Aloe Vera farmers plant without any idea of what their eventual yielding will be. This is the first system at the farm/farmer level that leverages real soil and environmental data to estimate yield before planting has even started. • **Gives farmers a heads up** This system allows farmers to discover things potentially wrong immediately, such as poor soil, nutrient poor soil or whatever they may be missing, rather than waiting and finding out during harvest season.

		expect from harvest and help to justify the farm inputs. • **Alert farmers quickly if a poor harvest is suggested** If the system indicates expected low yield from the farm operations, it should alert the farmer quickly to allow the farmer to take corrective actions (if required), and if possible, before it is too late. • **Provide options to address poor soil** Suggestions should include possible remedies to alleviate poor soil conditions by informing the farmer of what fertilizers can be used, what pH level to achieve, if there is a need for additional or less irrigation. • **Display all information clearly and helpfully.** Clear and easy to understand predictions and suggestions should be displayed for the farmer in a dashboard reporting format; utilizing visuals, numerical data, and language that the average farmer can understand quickly.	• **Turns complex data into simple advice** Farmers don't have to worry about understanding science or figuring out numbers. The system examines the soils and weather data and then suggests easy-to-follow, clear recommendations, what and how much fertilizer to apply, when to irrigate and how to enhance the land. • **Facilitates better planning and reduces waste** By knowing the expected yielding ahead of time, farmers can plan their budget, labor and fertilizer usage more accurately and waste less time, money and physical effort. • **Warns before it's discovered** If the system thinks the farmer is at risk of a poor yielding season it sends the farmer an early warning so they can act before it potentially becomes too late to act.

		• **Improve over time** The final component of the project is to use the actual results and lessons from the previous season to develop and revise future predictions and advice appropriately to meet the needs of each farm.	• **Propels smart, new era of farming** This system helps transition out of a historically data-free guessing game and empowers Aloe Vera farmers to make data-informed decisions.
Yasodara S.A.D.S IT22360946	Predict future Aloe Vera market prices to help farmers sell at the best time.	• **Gather transplant Aloe Vera price history .** Collect past Aloe Vera price data from local transactions, exports and reliable government agencies such as Hector Kobbekaduwa Institute. • **Clean and rearrange the prices data** Data prepare the price records by fixing some missing or wrong values, reorganize the price records, chronologically (daily or monthly), with ready made for analysis. • **Recognize trends in price fluctuations** Evaluate how the Aloe Vera price changes over time—trends, seasonality spikes/drop such as	• **First price forecasting system designed specifically for Aloe Vera farmers in Sri Lanka** While other price platforms only report on current market prices, this will be the first online service that forecasts future Aloe Vera prices – helping farmers decide not only when to sell, but make decisions based on where prices are headed, not just what the price may be today. • **Combines real-time data sources with smart forecasting.** The system does not only collect price history. The price forecasting system collects signals related to demand as well such as news articles, Google searches and social

		demand cycles and market behaviors. • **Apply advanced forecasting methods to forecast future prices** Train models forecast future prices by studying the past, applying smart, time-series forecasting techniques to detect price changes in advance. • **Integrate external signals related to price effect** Brand other relevant information, like festivals, export demand, social media, and news releases that might trigger Aloe Vera price fluctuations. • **Notify farmers when seller prices may spike or drop** Communicate timely notifications to farmers, notifying them when prices reflect a selling opportunity or when it is more ideal to wait. • **Indicate price forecasts in a useful manner.**	media posts tying into predicted price changes. Incorporating multiple sources, it can follow market demand more accurately. • **Acts as a personal market adviser for each farmer.** Each farmer will be prompted well prior to the anticipated price rise, signifying when to sell, thereby, lowering losses during periods with low prices. • **Worked on a fast growing, but under supported crop.** The majority of online price-projection tools devote their services to popular cropping, such as rice or vegetables, while this has been built specifically for Aloe Vera growers. With forecasted prices that matched the growth cycles of your Aloe, as well as local or export market representation. • **Turns price watching into price planning.**

		Display well-defined graphs, whilst also giving price essay warnings in the app, like next week is good timing to sell, or prices are likely to reduce, wait if possible.	Instead of simply waiting and guessing, farmers will be able to plan the harvest, transport to market or potential sale based upon useful forecasts, maximizing their profits and minimizing risk. • **Helps farmers be more financially intelligent.** The price forecasting system will be useful as it will provide farmers with good tidiness and foresight towards market price changes.

9. Individual component description of how it is complied with the specialization.

Member Name with Registration No	Description
Rajapaksha H.B. IT22909664	**Crop Disease Detection** This component leverages AI and deep learning models to accurately detect Aloe Vera diseases using both leaf images and farmer-reported symptoms. It involves building a comprehensive image database annotated with disease types, symptoms, and treatments. Farmers can describe symptoms in Sinhala, Tamil, or English, either through typing or voice input. NLP techniques are applied to understand these local language inputs and match them with image-based signs like rot, discoloration, or leaf damage. This dual-mode approach increases diagnostic accuracy. Real-time recommendations are then presented in the farmer's language with simplified treatment steps. The system also tracks treatment success and continuously learns from new data and farmer feedback. This complies with the specialization as it integrates deep learning (CNNs) for visual recognition, NLP for processing multi-lingual symptom descriptions, and real-time AI response mechanisms—all tailored to support local farmers in disease detection and intervention.
Megasooriya G.M.M.A.E. IT22337962	**Weather-Based Crop Recommendation** This module collects and analyzes local weather data, such as temperature, wind, humidity, and rainfall, as well as historical seasonal patterns. The system uses regression models and time-series forecasting to predict future climate trends. These projections are then compared with the optimal aloe vera growing conditions to generate crop planting recommendations. The tool also suggests pre-season field preparation activities and alerts farmers to climate hazards like drought and heavy rains. This component adheres to the specialization by converting raw weather data into practical planting recommendations through the use of machine learning regression and forecasting techniques to address real-world agricultural problems. Climate-resilient agriculture is advanced by using data-driven tools to improve seasonal decision-making for aloe vera farming.
Bandara H.M.A.I. IT22338020	**Yield Prediction** By examining soil characteristics like pH, moisture, type, and soil nutrition types such as Phosphorus, Nitrogen , Potassium as well as historical weather data, this module forecasts aloe vera yield prior to planting. It forecasts how

	these factors affect harvest results using ensemble machine learning models. The system recommends remedial measures like fertilization or soil treatment if a low yield is expected. The information is presented in a way that is easy for farmers to understand through dashboards and clear visuals. By using suitable machine learning and predictive analytics for environmental modeling, this component enables farmers to better plan, budget inputs, and maximize land use. Using real-time data, it is the first localized yield prediction tool for aloe vera in Sri Lanka, encouraging intelligent, sustainable farming. .
Yasodara S.A.D.S. IT22360946	**Market Price Trend Forecasting** In order to predict future price trends, this function reorganizes and analyzes historical Aloe Vera price data. To increase accuracy, it incorporates outside signals (such as export demand, social media, and seasonal festivals). Farmers are promptly informed when price increases or decreases are expected. Farmers can make well informed sales decisions that are in line with expected market conditions with the aid of visual aids and locally relevant messaging. By integrating data from dynamic sources, market behavior modeling, and AI-powered forecasting, this aligns with the specialization. By facilitating proactive decision making as opposed to reactive price watching, it promotes financially intelligent farming by increasing profitability and lowering risk.

10. Supervisor details

	Title	First Name	Last Name	Signature
Supervisor	Ms	Jenny	Krishara	Jenny 2025/06/25
Co-Supervisor	Dr	Dinuka	Wijendra	2025/06/23
External Supervisor				
Summary of external supervisor's (if any) experience and expertise				

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Topic Assessment Form

<u>This part is to be filled by the Topic Screening Staff members.</u>

a) Does the chosen research topic possess a comprehensive scope suitable for a final-year project?

Yes		No	

b) Does the proposed topic exhibit novelty?

Yes		No	

c) Do you believe they have the capability to successfully execute the proposed project?

Yes		No	

d) Do the proposed sub-objectives reflect the students' areas of specialization?

Yes		No	

e) Supervisor's Evaluation and Recommendation for the Research topic:

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Topic Assessment Form

Acceptable: Mark/Select as necessary

Topic Assessment Accepted	
Topic Assessment Accepted with minor changes*	
Topic Assessment to be Resubmitted with major changes*	
Topic Assessment Rejected. Topic must be changed	

* Detailed comments given below

Comments

Staff Member's Name	Signature

*__Important__:

1. According to the comments given by the evaluator, make the necessary modifications and get the approval by the **Evaluator**.
2. If the project topic is rejected, identify a new topic, and request the RP Team for a new topic assessment.