IT4010 – Research Project - 2024

Topic Assessment Form

Project ID: [24-25J-193]

1. Topic (12 words max)

AI and Data-Driven Agriculture Platform

2. Research group the project belongs to

Software Systems & Technologies (SST)

3. Research area the project belongs to

Machine Learning (ML)

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.

In today's rapidly evolving technological landscape, agriculture faces significant challenges that threaten both productivity and sustainability. These challenges include fluctuating market prices, unpredictable weather patterns, and the increasing need for sustainable crop management practices. Farmers often struggle with making informed decisions due to the lack of accurate, real-time data on market trends, crop growth rates, and viable alternatives. Traditional methods of market price prediction and crop management are often inadequate, failing to consider the complex interplay of various factors such as soil moisture, weather conditions, and market demand and supply dynamics.

Furthermore, unpredictable weather patterns and climate change exacerbate the uncertainty in farming, leading to inconsistent yields and financial instability for farmers. There is also a pressing need for sustainable farming practices that not only enhance productivity but also ensure long-term soil health and environmental conservation.

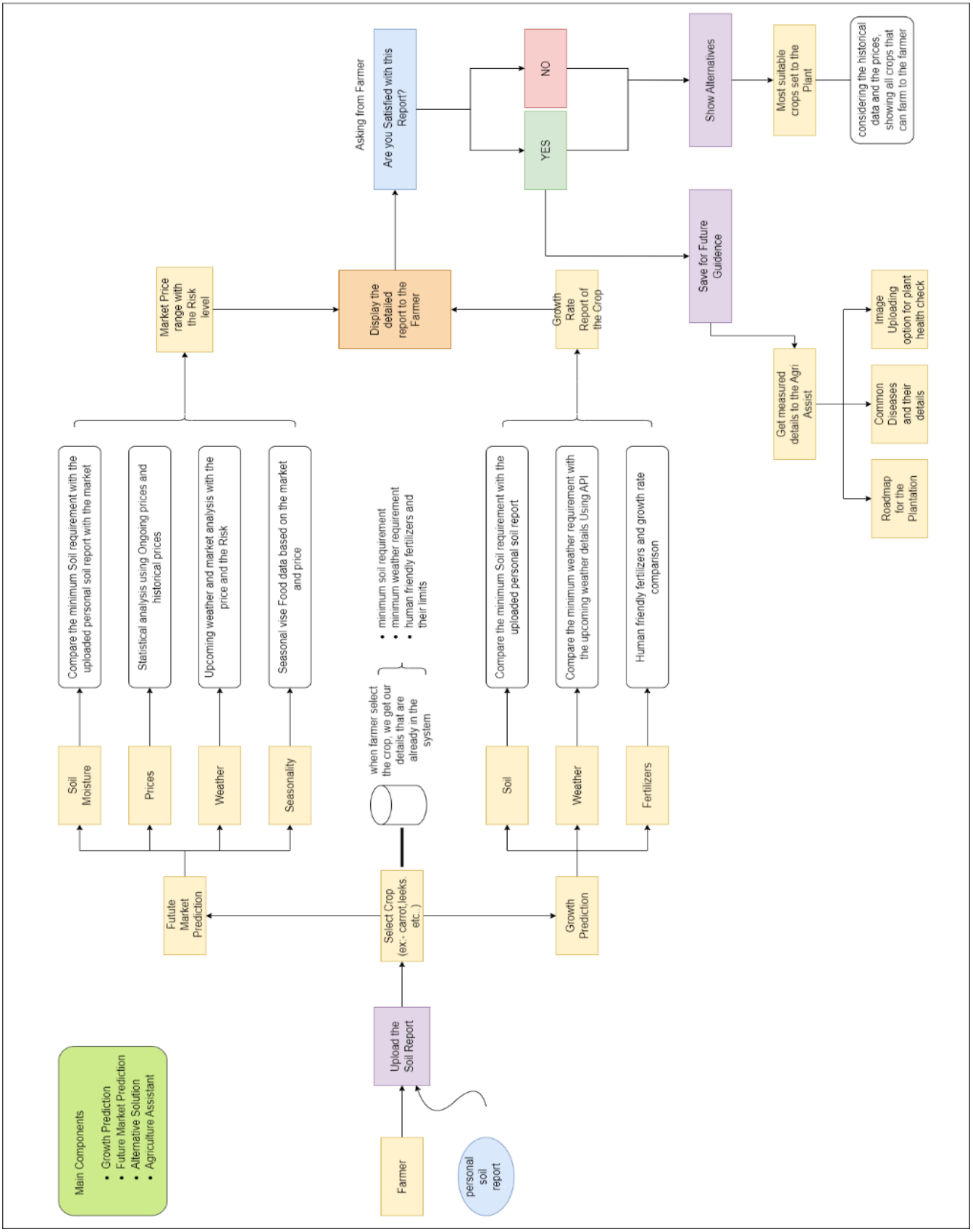
This research focuses on addressing these challenges by targeting a specific farm that grows multiple crops. The aim is to develop a comprehensive, data-driven solution that provides farmers with accurate predictions and actionable insights, enabling them to choose the best crops for their land based on various factors, including soil moisture. By integrating diverse data sources and employing advanced machine learning algorithms, the system will offer precise market price forecasts, predict crop growth rates, and suggest optimal crop rotations. This approach is crucial for improving agricultural efficiency, ensuring food security, and supporting sustainable farming practices in the face of dynamic environmental and market conditions.

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

The proposed solution is a comprehensive AI-driven platform designed to support farmers by predicting market trends, identifying potential crises, and suggesting alternative crops. The platform consists of four main components:

1. **Growth Rate Prediction**: By analyzing environmental data, weather patterns, and historical crop performance, this component predicts the growth rate of a crop, considering weather, fertilizer information, and soil moisture as input parameters. The inclusion of soil moisture as a key parameter adds a novel aspect, enhancing the accuracy and relevance of the predictions to real-world farming conditions.
2. **Market Price Prediction**: Using historical data and machine learning algorithms, this module forecasts future market prices for various crops, helping farmers plan their planting and selling strategies. By integrating soil moisture data alongside traditional factors such as historical prices, weather conditions, soil health, seasonality, and market demand and supply, the model provides more precise and contextually relevant predictions.
3. **Crop Rotation Suggestion**: With the output from the market price and success rate predictions from the aforementioned modules combined with additional factors such as the previous crops that were grown in the field and other historical data, this module makes suggestions for the most optimal crop/set of crops that can be grown adhering to crop rotation principles in order to preserve soil quality while also maximizing profit.
4. **Agri Assist**: This component serves as an intuitive and interactive platform for farmers, offering a seamless user experience. It enables farmers to effortlessly engage with the system by asking questions, seeking advice, and receiving tailored recommendations. Leveraging advanced AI and machine learning algorithms, AgriAssist provides real-time, personalized guidance on various farming activities. By understanding and analyzing the unique needs of each farmer, AgriAssist ensures that users receive actionable insights and a customized roadmap to optimize their agricultural practices and enhance crop growth.

A conceptual diagram of the system shows the interaction between these components, illustrating how data flows from user inputs and external sources into the prediction algorithms and back to the user via the AI chatbot.


Asking from Farmer
Are you Satisfied with this Report?
NO
YES
Show Alternatives
Most suitable crops set to the Plant
considering the historical data and the prices, showing all crops that can farm to the farmer
Save for Future Guidence
Market Price range with the Risk level
Display the detailed report to the Farmer
Growth Rate Report of the Crop
Get measured details to the Agri Assist
Image Uploading option for plant health check
Common Diseases and their details
Roadmap for the Plantation
Compare the minimum Soil requirement with the uploaded personal soil report with the market
Statistical analysis using Ongoing prices and historical prices
Upcoming weather and market analysis with the price and the Risk
Seasonal vise Food data based on the market and price
minimum soil requirement
minimum weather requirement
human friendly fertilizers and their limits
when farmer select the crop, we get our details that are already in the system
Compare the minimum Soil requirement with the uploaded personal soil report
Compare the minimum weather requirement with the upcoming weather details Using API
Human friendly fertilizers and growth rate comparison
Soil Moisture
Prices
Weather
Seasonality
Soil
Weather
Fertilizers
Futule Market Prediction
Select Crop (ex:- carrot,leeks etc.)
Growth Prediction
Upload the Soil Report
Farmer
personal soil report
Main Components
Growth Prediction
Future Market Prediction
Alternative Solution
Agriculture Assistant

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

The development of this AI-driven agricultural platform requires specialized expertise in several domains:

Artificial Intelligence and Machine Learning: Knowledge of AI and ML is crucial for developing the prediction algorithms used in market price forecasting, growth rate calculation, and alternative crop suggestions. Expertise in natural language processing is also necessary for creating an effective AI chatbot.

Agricultural Science: Understanding agricultural practices, crop biology, and environmental factors is essential for accurate data analysis and prediction. Collaboration with agricultural experts will ensure the platform's recommendations are practical and relevant.

Data Science and Analytics: The platform relies on large datasets, including historical crop prices, weather data, and environmental conditions. Proficiency in data collection, cleaning, and analysis is required to build reliable prediction models.

Software Development: Developing a user-friendly interface for the AI chatbot and integrating the various components of the system require strong software engineering skills. Knowledge in web and mobile development is also necessary for creating accessible platforms for farmers.

User Experience Research: Understanding the needs and behaviors of farmers is critical for designing an intuitive and effective user interface. This involves conducting user interviews, surveys, and usability testing.

Data requirements include historical market prices, weather data, soil conditions, crop yields, and other relevant agricultural information. Access to this data can be obtained through governmental agricultural databases, research institutions, and collaborations with local farming communities. Ensuring data accuracy and reliability is paramount for the success of the prediction models.

8. Objectives and Novelty

Main Objective

The primary objective of this research is to develop a comprehensive, data-driven AI prediction platform for agriculture that equips both farmers and agriculture officers with accurate, timely, and actionable insights. This platform aims to predict future market prices of crops, assess the growth rate rates of different crops, and suggest viable alternative crops when necessary. Additionally, it will offer a user-friendly interface, including an intelligent assistant for farmer interactions and a notification system to alert users about critical agricultural information. By providing these features, the system will enable informed decision-making, optimize agricultural practices, and enhance overall productivity and sustainability in farming.

Member Name	Sub Objective	Tasks	Novelty
Dissanayake D M A P	**Intelligent, Interactive Assistant**: Provides personalized guidance and answers to common agricultural questions. • **Advanced Algorithms**: Utilizes natural language processing and machine learning for tailored advice. • **Comprehensive Farming**	• **Data Collection**: Gather comprehensive data on various agricultural topics, including crop management, pest control, soil health, weather conditions, and best farming practices. This information will form the knowledge base for the assistant.	• **Personalized Real-Time Guidance**: Delivers tailored agricultural advice using advanced natural language processing and machine learning algorithms. • **Dynamic Interaction**: Provides interactive, personalized

	Support: Offers advice on crop management, pest control, soil health, and other farming practices. • **Knowledge and Best Practices**: Ensures access to a wealth of agricultural knowledge and best practices. • **Informed Decision-Making**: Empowers farmers to make informed decisions and enhance crop productivity and sustainability.	• **Natural Language Processing (NLP) Integration**: Implement advanced NLP algorithms to enable the assistant to understand and respond to farmer queries accurately and contextually. • **Machine Learning Model Training**: Train machine learning models using the collected data to provide personalized recommendations and solutions based on specific user inputs and conditions. • **UI/UX Design**: Design and implement a user-friendly web and mobile application	recommendations on crop management, pest control, soil health, and other farming practices. • **Intelligent Escalation Mechanism**: Directs complex queries to agriculture officers or experts, enhancing reliability and effectiveness. • **Continuous Learning**: Learns from user interactions and feedback, continually refining recommendations and expanding its knowledge base.

		interface that adheres to UI/UX principles, ensuring a seamless and intuitive user experience for farmers. • **Real-time Assistance**: Develop functionalities for real-time interaction, allowing farmers to receive immediate answers and advice on various agricultural issues. • **Escalation Protocol**: Create a mechanism for escalating complex queries to agriculture officers or experts when the assistant cannot provide adequate information.	

		• **Feedback Mechanism**: Integrate a feedback option within the assistant to collect user suggestions and problems, providing valuable insights for continuous improvement and refinement of the system. • **Data Visualization**: Develop engaging data visualization tools to help users easily understand and interpret complex agricultural data and recommendations.	
Jagoda H S	• **Data-Driven Recommendations**: Provide users with recommendations on	• **Data Integration**: Combine outputs from the market price prediction and success	• **Predictive Model Configuration**: Forecasts potential profits and yields of

	the most suitable crops to grow based on current conditions and inputs. • **Analysis of Predictions**: Analyze outputs from the market price prediction and success rate prediction components to assess the suitability of initially selected crops. • **Crop Rotation Suggestion**: Suggest crops that adhere to crop rotation principles and maximum profitability upon user prompt. • **Context-Sensitive Factors**: Consider soil moisture, weather conditions, previous crops, and other relevant factors in recommendations. • **Profitability and Resilience**: Ensure	rate prediction modules, along with additional relevant data such as soil health, previous harvest, and available alternatives. • **Algorithm Development**: Develop and implement algorithms that analyze the combined data to identify the most suitable crops that can lead to an optimum yield. • **User Interface Design**: Create an intuitive interface that presents alternative crop suggestions to the user in a clear and actionable manner. • **Feedback Mechanism**: Integrate a feedback option to collect user input on the effectiveness of the suggested crop rotations, enabling	user-determined crops. • **Comprehensive Analysis**: Uses aforementioned forecasts, historical data and other data made available in the session log to make a selection among the crops that can be considered. • **Integration with Crop Rotation Suggestion Engine**: Suggests best possible crop rotation under existing conditions such that the suggested crops adhere to crop rotation principles while also maximizing profit. • **Context-Sensitive Recommendations**: Incorporates factors such as soil moisture, weather conditions, and market trends for

	suggested crops are likely to be more profitable and resilient. • **Tailored Solutions**: Deliver the most effective and sustainable crop options tailored to farmers' specific circumstances.	continuous improvement of the recommendation algorithms. • **Continuous Learning**: Implement machine learning techniques to refine the prediction models over time based on user feedback and new data, ensuring the system remains accurate and relevant.	accurate and relevant suggestions.
Sewwandi P B	• **Predictive System Development**: Develop a system to predict the growth rate of crops by analyzing various factors. • **Key Factors Analysis**: Analyze weather conditions, fertilizer usage, and soil moisture data. • **Notification System**: Notify farmers and agriculture officers	• **Data Collection**: Use web crawlers to extract data from agricultural reports and integrate this with historical yield data, soil moisture data, weather conditions, and fertilizer usage information. • **Model Development**: Implement ARIMA for trend analysis, BP network for non-linear	• **Comprehensive Data Integration**: Incorporates soil moisture data, weather conditions, fertilizer usage, historical yield information, and uses additional soil moisture data as a novelty. • **Advanced Machine Learning Techniques**: Utilizes

	about potential growth rates. • **Advanced Machine Learning Models**: Integrate advanced machine learning models for accurate predictions. • **Improved Crop Yield and Quality**: Assist in improving crop yield and quality through optimized practices. • **Novel Parameter Inclusion:** Incorporate soil moisture as a key parameter, adding precision and relevance to real-world farming conditions.	relationships, and RNN for sequential dependencies to develop a robust predictive model for crop growth rates. • **Training and Validation**: Train the models using historical data and optimize them for accuracy, ensuring reliable predictions of crop growth rates under varying conditions. • **Growth Rate Detection**: Develop algorithms to analyze predictions and detect potential growth rates, considering the integrated data from various sources. • **Report Generate**: Generate a report system for farmers and agriculture officers about	a hybrid modeling approach combining ARIMA, BP network, and RNN for robust predictions. • **Context-Sensitive Predictions**: Provides highly accurate and relevant predictions tailored to specific farming conditions.

		predicted growth rates.	
Priyankara S A D S A	• **Comprehensive System Development**: Develop a system that accurately forecasts future market prices of crops. • **Advanced Data Collection**: Utilize advanced data collection techniques to gather diverse data sources. • **Machine Learning Algorithms**: Analyze data using machine learning algorithms. • **Diverse Data Sources**: Incorporate historical market prices, weather conditions, soil health, seasonality, crop health, and soil moisture data. • **Precise and Reliable Predictions**: Provide	• **Data Collection**: Use web crawlers to extract relevant market data from various online sources, including agricultural websites, market reports, and social media. Integrate this data with historical market prices, weather conditions, soil health, crop health, and soil moisture data. • **Data Preprocessing**: Clean and preprocess the collected data to ensure accuracy and consistency, preparing it for effective use in predictive modeling. • **Model Development**: Implement ARIMA for initial time series analysis, BP network for capturing non-	• **Expanded Predictive Parameters**: Incorporate a broader range of factors, including soil moisture, historical price data, weather data, seasonality, market demand and supply for more accurate predictions. • **Advanced Data Collection**: Use web crawlers to continuously update data from diverse online sources, ensuring real-time, comprehensive datasets. • **Hybrid Modeling Approach**: Combine ARIMA, BP network, and RNN methods to leverage their strengths,

	precise and reliable price predictions. • **Informed Decision-Making**: Enable farmers to make informed decisions about planting and selling strategies. • **Novel Parameter Inclusion**: Include soil moisture as an additional parameter to enhance the accuracy of predictions. • **Profitability and Sustainability**: Ensure that farmers can optimize their profitability and sustainability in agricultural practices.	linear relationships, and RNN for understanding sequential dependencies in time-series data. • **Model Training and Validation**: Train and validate the models using historical data, optimizing parameters to achieve high accuracy in predictions. • **Feature Selection**: Identify and incorporate critical parameters that influence market prices, including soil moisture as a novel parameter. Additionally, use historical price data, weather data, seasonality, and market demand and supply. Employ feature selection techniques to determine the most	resulting in robust and accurate market price predictions. • **Adaptive Learning**: Implement adaptive mechanisms to improve model accuracy over time with new data, ensuring sustained performance in dynamic market conditions.

		significant factors affecting market prices.	

9. Supervisor checklist

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:

10. Supervisor details

	Title	First Name	Last Name	Signature
Supervisor				
Co-Supervisor				
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 Panel members.</u>

Acceptable: Mark/Select as necessary

Topic Assessment Accepted	
Topic Assessment Accepted with minor changes (should be followed up by the supervisor)*	
Topic Assessment to be Resubmitted with major changes*	
Topic Assessment Rejected. Topic must be changed	

* Detailed comments given below

Comments

Member's Name	Signature

*__Important__:

1. According to the comments given by the panel, make the necessary modifications and get the approval by the **Supervisor** or the **Same Panel**.

2. If the project topic is rejected, identify a new topic, and follow the same procedure until the topic is approved by the assessment panel.