FARMezy

Capstone Project Proposal

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BE Third Year- COE

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Mentor Consent Form

I hereby agree to be the mentor of the following Capstone Project Team

Project Title:		
Roll No	**Name**	**Signatures**
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SIGNATURE of Mentor: . . . . . .

Project Overview

- FARMezy is a Smart Farming based system that will provide the farmers with all the necessary tools required for good production. From monitoring the pollution levels to sensing the amount of irrigation required, it will provide all the details at one location.

- This system will help manage the crop health efficiently by using the combined applications of Information and Communication Technologies (ICT).

- It promotes precision agriculture which will enable reduction of overall costs and the improvement of the quality and quantity of products, the sustainability of agriculture and the experience for the masses.

- The project will incorporate effective solution to crop vandalism[1]. As the limitation of protecting crops from animals becomes a major concern for yield, a powerful neural network using computer vision is planned to be developed to curb the issue.

- The project will also include the concept of Blockchain Technology to ensure that the farmers are paid fairly. The amount of supply of the produce from the farmers along with the details including the price at which it was sold as well as the MSP at that particular time will be stored in a hashnode in a blockchain. This will ensure the financial stability of the farmers.

Need Analysis

- Smart Farming has completely revolutionized the agricultural industry and the applications of Internet of Things (IoT), sensors and actuators, Big Data, geo-positioning systems, robotics, Unmanned Aerial Vehicles (UAVs, drones), etc. have lead to major changes in the agricultural world.

- The ability to search for defects in crop growth helps in eliminating the risk of losing yields. Through the use of smart devices, parallel processing is achieved and multiple processes can be executed at once.

- Precision farming has reduced the ecological footprint of farming. Minimized or site-specific application of inputs, such as fertilizers and pesticides has mitigated leaching problems as well as the emission of greenhouse gases.

- It has made agriculture more profitable for the farmer. Decreased resource inputs will save the farmer money and labor, and increased reliability of spatially explicit data will reduce risks related to yield.

- All farming-related data can be recorded by automated sensors, therefore, the time needed for prioritizing the application of resources and for administrative surveillance can also be decreased.

Literature Survey

Farming has been practiced from ancient times, and farmers are the backbone of farming. Farmers are working hard for producing food in the fields for the whole world. In earlier times, farming was a total labour intensive technique that involved huge amounts of time and effort. As time changes, these labour intensive techniques turn into capital intensive, that provide high production with less effort. In India, Smart Farming is necessary due to its potential to help farmers to enhance their production and income. In India, even in the 21st century, most of our farmers depend on monsoon, which determines whether they can sow their crop or not. This shows our farmers are heavily dependent on the randomness of the nature for their livelihood, the reason being limited number of affordable solutions available to them.

This implies an extreme need to elevate the level of Indian farming techniques. "Smart Farming" is an emerging concept that refers to managing farms using technologies like IoT, robotics, drones and AI to increase the quantity and quality of produce while optimizing the human labour required for production.

Existing System and Solutions

One Water – Smart Irrigation

Indian startup One Water is an Internet of Things (IoT) based smart irrigation system for agriculture. Excess water, apart from wastage of a precious resource, can cause the destruction of crops and spur the growth of weeds. The changing seasons have a great impact on agricultural activities. Prolonged drought conditions during the summer months and devastating floods during the monsoon season affect crop yields all over the world. Some regions in the world are facing years-long drought conditions with minimal rainfall.

- Smart irrigation provides optimal water delivery to crops while ensuring there is minimal to no wastage in water used for agriculture.
- One Water can sense soil moisture, humidity, and temperature to automatically execute drip irrigation on the farm, saving valuable resources.

Intellia IoT solution

Intellia IoT solution for Smart Farming technology offers complete details in all the spectrums of agriculture. It will help provide insights and stats for crops and livestock. Smart Farming systems uses modern technology to increase the quantity and quality of agricultural products. They are offering a complete hardware and software package to farmers to monitor their fields.

- They are using Light, Soil Temperature& Moisture, Soil NPK sensor to collect the data. All the data is sent via their installed gateway to their cloud from which each farmer can monitor his/her fields.
- Tracking livestock and Geo fencing
- Climate monitoring and forecasting
- Remote crop and soil monitoring

Smartfarm

SmartFarm is a robust and flexible farm management solution that incorporates end-to-end solutions for data-driven decision making for multiple stakeholders in the agri-ecosystem.

- It provides real-time satellite and weather-based advise to farmers which provides them with accurate output predictability making businesses and farm operations exceedingly efficient.
- Keeps track of the process involved in the pre and post-harvest and it also provides insights for easy reporting on the go.
- Recommends a customized package of practices for each crop to increase their produce by giving valuable information about that particular crop.

AgriApp

It is an online farming marketplace bringing Kisan, farming input/output, government service on an online platform. Farmers can sell their crops directly on this platform avoiding the hassle of going through middle men.

- It provides chat option for farmers.
- Kisan can easily chat with an expert of agriculture using this app.
- This mobile application provides diversified videos of agriculture work.

The Problem That Has Been Identified

While there are many products available to farmers around the world, there are a few that are available and affordable for small scale farmers. In India there are more small-scale farmers than large-scale ones, and most of them have no access to newer and modern solutions available for smart farming. Cost is a major factor behind this, since these farmers are already indebted to banks for their little farming needs, moreover most of them are not aware about the upcoming technologies that are being implemented in agriculture sector to produce high yield crops by the large-scale farmers.

All the solutions that are available today are mostly employed by large-scale farmers who have a huge capital to invest and can afford these products and services.

Some of the features incorporated in the applications that are available on the market are not necessarily useful for small-scale farmers. For instance, tracking of livestock, or to use a particular fertilizer as recommended by an app is not that useful and feasible due to cost limitations and majorly because farmers don't have huge lands to fully utilize these advanced techniques. Hence it becomes very critical for them to utilize those few handful of resources that are at their disposal very effectively to increase their yield, instead of experimenting with an entirely new method which might not be a financially viable decision for them in the long run.

Objectives

- To assemble various atmospheric and soil sensors and camera, and link them with Raspberry Pi microcontroller. This will further link these to a centralized database.
- To fetch the data from the database, run ML prediction models on the data, display the relevant information and trends to the user via a mobile app as a user interface.
- To run object detection models to detect crop vandalism by stray animals and send alert to the farmer.
- To build a blockchain based solution to store the transaction information between farmers and the buying agency.

Methodology

- Our initial intention was to use NPK sensor to determine the precise amounts of nutrients to be added to soil, but its costly (above Rs 10,000) hence inefficient. So, we have a workaround of using a dataset for the analysis work.
- An extensive study of various datasets is done through use of relevant sources like Kaggle, etc.
- Soil moisture sensor is used to determine the precise amount of water irrigation required by the crops in a given season and at any particular time.

- Temperature and Humidity Sensor is used to determine the humidity and temperature in the surrounding environment.

- Air Quality sensor is used to determine the amounts of pollutants like PM2.5 in the surrounding environment.

- Camera is used to detect crop vandalism by stray animals.

- All the data from various sensors and the camera is sent to the Raspberry Pi microcontroller, which sends all this data to the centralized database through a Wi-Fi module.

- Machine Learning Models are used to predict the yield/produce trends from the data received from the sensors.

- Computer Vision and Deep Learning Algorithms are used to detect the crop vandalism by stray animals from the data received by the camera.

- The final output is shown to the User through a Mobile App Interface (Android and IOS) which fetch all the important presentable data from the centralized database and display to the User.

- The transaction information including the amount of supply of the produce from the farmers along with the details including the price at which it was sold as well as the MSP at that particular time is all stored in a hash-node in a blockchain which is immutable and accessible at all times through the mobile app.

Work Plan

Sr. No.	Activity	Month	March			April				May				June				July			
		Week no.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	Project Proposal & Literature Survey	Plan																			
		Actual																			
2	Designing Model and Sensor Testing	Plan																			
		Actual																			
3	Hardware Interfacing	Plan																			
		Actual																			
4	ML Model	Plan																			
		Actual																			
5	Mobile Application	Plan																			
		Actual																			
6	Learning and Implementing Object Detection using Neural Networks	Plan																			
		Actual																			

Sr. No.	Activity	Month	August				September				October				November				December			
		Week no.	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
7	Learning and Implementing Object Detection using Neural Networks	Plan																				
		Actual																				
8	Integration	Plan																				
		Actual																				
9	Testing and Debugging	Plan																				
		Actual																				
10	Learning Blockchain	Plan																				
		Actual																				
11	Implementing and integration	Plan																				
		Actual																				
12	Testing and Debugging	Plan																				
		Actual																				
13	Performing Modifications	Plan																				
		Actual																				
14	Result Evaluation	Plan																				
		Actual																				
15	Final Report	Plan																				
		Actual																				

Project Outcomes & Individual Roles

- The main outcome of the project is a complete farming aid digital solution which can be accessible to the common farmer with a smartphone and network connection in distant villages.
- The product will comprise of a hardware unit made of the microcontroller and various sensors and camera, along with a mobile application (supported on Android and IOS) that can be installed on smartphone and will act as an interactive user interface for the farmer.
- On the backend, the product is supported by ML models for trend prediction, and Computer Vision with Neural Networks for object detection, lastly the blockchain technology with immutable hashnodes storing MSP of crops, for ensuring economic safety of farmer in selling to buyers.

Individual Roles

Name	Role Played
Kulpreet Singh	• Implementation of project • Assembly of hardware unit • Predicting trends using ML • Implementing Blockchain for supply chain management • Project Report
Sajjal Tiwari	• Implementation of project • Assembly of hardware unit • Design and Development of mobile application • Object Detection using Neural Networks • Project Report
Arshnoor Batra	• Implementation of project • Assembly of hardware unit • Predicting Trends using ML • Implementing Blockchain for supply chain management • Project Report
Vishrut Agrawal	• Implementation of project • Assembly of hardware unit • Design and Development of mobile application • Object Detection using Neural Networks • Project Report

Course Subjects

- The course subjects that will be used during the successful execution of our capstone project are in given in table below.

Subject Code	Subject Name	Description
UCS301	Data Structures	The subject helped us understand the organization of data in data structures along with the need for efficiency and its quantification. This helped design the application using optimized code along with the appropriate data structures whenever required.
UCS415	Design and Analysis of Algorithms	The subject helped us understand the organization of data in data structures along with the need for efficiency and its quantification. This helped design the application using optimized code along with the appropriate algorithms and techniques whenever required.
UCS310	Database Management Systems	The subject inculcated an understanding about the necessity for organizing data and the operations to be done on it. Helping us to choose the right kinds of database for the use cases along with designing an efficient database schema to optimize all database operations.
UCS503	Software Engineering	Software Engineering is one of the most important subjects that preached the phases of software development life cycle. The UML diagrams and other requirement diagrams are extremely essential for planning the software lifecycle.
UCS409	Probability and Statistics	The subject helped us understand the various probability distributions supporting the machine learning models used in our project, along with the need for quantification through appropriate integral formulae.

Subject Code	Subject Name	Description
UEC001	Electronics Engineering	Electronics engineering gave the basic knowledge which is required to any person dealing with circuits and electronic components.
UTA015	Engineering Drawing	The subject preached the scientific method of specification and drawing of complex mechanical parts required in the process of hardware model construction for our project.
UTA013	Engineering Design – I (Mangonel Project)	Basics of Arduino were explained, along with interfacing with various types of components. This helped to interface the Arduino with the given modules, namely sensors and GPS module.
UTA014	Engineering Design – II (Buggy Project)	Advanced skills of electronics along with algorithmic coding for Arduino was used to create a buggy. This contributed to writing exhaustive code in the microcontroller used.
UEN002	Energy and Environment	The subject helped us understand about the environment and various natural and man-made causes of pollution, with the need and methods of quantification, and containment as well.

References

[1] Sai Siddartha Maram, Tanuj Vishnoi, Sachin Pandey (2018, April 7). “Neural Network based Object Detection Design for Crop Vandalism” . Available : https://www.researchgate.net/publication/324278748_Neural_Network_based_Object_Detection_Design_for_Crop_Vandalism