Capstone mid sem report sources doc
ProfParadox .7. Started = 13 07 2021 . Target = 19 07 2021
----- where is the section for use case?!
Chapters
Ch 1 intro

- 1 = merge inno report 1.1 + proposal overview
- 2 = merge need analysis + inno report 1.3 uniqueness of solution + 1.4 + 1.6
- 2,4,5,7,8,9 = inno ppt/report
- 3,6 = surf net & make-do
- 10 = use the language template pasted inline, and use inno report - 1.3 uniqueness of solution

Ch 2 reqmt
Ch 2.1 lit survey

- 1 intro 2 audience = inno report 1.5 customers
- 2,4 = proposal doc - done
- 3 = surf net
- 5 = survey of tools + tech used ? surf net

Ch 2.2 SRS

- Make it by comparing with SE app SRS/ use mentor eval 1 folder items
- 3rd interface reqmt = use mentor eval 1
- 4th non-func reqmt = use mentor eval 1

Ch 2.3 2.4

- Cost = making cost of one farmezy unit+app+cloud
- Risk = surf net / maybe inno docs can help

Ch 3 method

- 2 = inno report 1.2 + expand with methodology + elaborate each step + use func reqmts from mentor eval 1
- 3 = copy from mentor eval 1 / proposal doc
- 4 = proposal ppt
- 1 = surf net

Ch 4 design

- **What is difference between pt 3 & 4?**
- All = copy from mentor eval 2 items
- 3rd, 4th = paradox for writing steps of prototype(app, not ML models)

Ch 5 conc

- Firstly agree **which point of time is taken** for drawing out said conclusions
- 1 = use objectives & say accomplished “--”
- 2 = use inno report ch 4
- 3 = make-do / use inno report 1.6 user value + add env benefit points
- 4 = use (mentor eval 1) gantt chart/subtasks list/etc to list remaining work

Leave out other sidelined sections for now.
Paste the editing written pieces below in orderly manner and later copy paste into main report doc.

ABSTRACT (completed)

Smart Farming is an emerging concept that refers to managing farms using modern Information and Communication Technologies which leads to an increase in the quantity and quality of products while optimizing the human labor required. By this process, farmers can monitor field conditions without even going to the field and make strategic decisions for the whole farm.The driving force of smart farming is IoT—connecting smart machines and sensors integrated on farms to make farming processes data-driven and data-enabled. To optimize the farming process, IoT devices installed on a farm should collect and process data in a repetitive cycle that enables farmers to react quickly to emerging issues and changes in ambient conditions. Importantly, IoT-based smart farming doesn't only target large-scale farming operations, it can add value to emerging trends in agriculture like organic farming as well as family farming. Therefore, smart farming has a real potential to deliver a more productive and sustainable form of agricultural production, based on a more precise and resource-efficient approach. New farms will finally realize the eternal dream of mankind. It will feed our population, which may explode to 9.6 billion by 2050.

INTRODUCTION

1.1 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.

Technical Terminology

- **Machine Learning -** ML allows software applications to become more accurate at predicting outcomes without being explicitly programmed to do so.
- **Deep Learning** - Deep learning imitates the workings of the human brain in processing data and creating patterns for use in decision making
- **Object Detection** - It is a subset of computer vision that deals with locating interesting objects in an image with respect to the background.
- **Blockchain Technology-** Blockchain is a system of recording information in a way that makes it difficult or impossible to change, hack, or cheat the system. A blockchain is essentially a digital ledger of transactions that is duplicated and distributed across the entire network of computer systems on the blockchain.

Problem Statement

1.2 Need Analysis = (completed)

- 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.

1.3 Research Gaps = min 5 with ref's (is this complete?)

- NPK sensor should be used ideally to get the accurate values of soil nutrients throughout the field, but it being expensive and cost being a constraint we are not able to inculcate that into our project as of now.

- We can run the crop recommendation and yield prediction model on a selected list of

crops and for the states of India only as we have used the dataset which has crops that grow in India only.

- One part of our project which is auto soil irrigation focuses on providing ideal water conditions to the crops but it cannot remove the excess water due to heavy rainfall.

- Our project can only notify the farmer about the pollution levels around his fields but cannot do anything by itself to remove the pollution.

- Smart Contract System for buying and selling of crops can only ensure the security of transactions which have been done digitally by storing the transaction info, but can do nothing about the transactions which are done in cash.

1.4 Problem Definition and Scope (completed)

Farming has been practiced from ancient times, and farmers are the backbone of farming. Farmers are working hard to produce 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.

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 led 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 labour, 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. With all these technological advancement farmers will benefit a lot and for our country where a majority of farmers are still practicing the traditional ways to farm, smart farming is going to revolutionize that.

1.5 Assumptions and Constraints (completed)

S. No.	Assumptions
1	There will be Wi-Fi (or maybe some other network) connectivity available in the fields.
2	There will be continuous power supply available in the fields for our product to operate.
3	Camera would be placed in a secured position such that no animal can harm it.
4	The farmer who wants to use our product is already an android or IOS smartphone user (to use our mobile app).

S. No.	Constraints
1	The NPK nutrient sensor is quite expensive (above Rs 10,000) making it infeasible to be included in the product for now as budget is a constraint.
2	We do not have the skill set to develop a mobile app for other mobile OS (other than android or IOS) like Kai OS (used in jio phones).

1.6 Standards

Need Analysis go here…

1.7 Approved Objectives (completed)

- 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.

- To create a user-friendly interface to interact with the hardware product and get meaningful results from sensors data & models processing.

1.8 Methodology (completed)

- 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 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 fetches all the important presentable data from the centralized database and displays it 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.

1.9 Project Outcomes and Deliverables (completed)

- 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 hash nodes storing MSP of crops, for ensuring economic safety of farmer in selling to buyers.

1.10 Novelty of Work

Need Analysis go here…
Resource link =
https://www.linkedin.com/pulse/how-highlight-novelty-you-research-work-makemyassignments-hub#:~:text=Novelty%20of%20a%20research%20work%20is%20not%20about,start%20writing%20is%20to%20write%20the%20first%20sentence.

Image template =

- According to the author's knowledge, no comprehensive work was dedicated to ***[research objective]***.
- As far as the authors are aware, there is no published analysis of the factors effecting the ***[properties]*** of ***[material/process system]*** using the ***[type of method]***.
- As far as the authors are aware, there is no work carried out on ***[research work]***
- Although it is accepted that the effectiveness of ***[previous work]***, none have assessed the ***[research work]***.
- Indeed, at present, general research in ***[material/process system]*** is still in its infancy.
- Although this type of ***[material/process system]*** is well established for ***[application]***, its effect on ***[factor]*** for used in ***[application]*** has not been extensively studied.
- However, little work has been carried out to ***[research work]*** and previous works have not comprehensively considered ***[research work]***.
- Therefore, it is sensible to modify the ***[material/process component]*** in order to improve ***[purpose]*** in order to realise the full potential of ***[material/process system]***.

REQUIREMENT ANALYSIS

2.1 Literature Survey

2.1.1 Theory Associated With Problem Area

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.

2.1.2 Existing Systems and Solutions

2.1.2.1 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.

2.1.2.2 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

2.1.2.3 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.

2.1.2.4 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.

2.1.3 Research Findings for Existing Literature

2.2.1.1 P

Need Analysis go here…

2.1.4 Problem 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.

2.1.5 Survey of Tools and Technologies Used

2.2.1.1 P

Need Analysis go here…

2.2 Software Requirement Specification

2.2.1 Introduction

2.2.1.1 Purpose

Need Analysis go here…

2.2.1.2 Intended Audience and Reading Suggestions

Our customers and users would be the small-scale farmers who want to increase their crop yield within constraints of fixed capital inputs, to be able to generate enough profit for sustainable living. Apart from them, there are many landlords that hire daily wage workers to do farming on their lands, they can use and benefit from our product too. Lastly, Large Agricultural Companies, like Frito Lay, can be a potential client of ours as well.

2.2.1.3 Project Scope

Need Analysis go here…

2.2.2 Overall Description

2.2.2.1 Product Perspective

Need Analysis go here…

2.2.2.2 Product Features

Need Analysis go here…

2.2.3 External Interface Requirements

2.2.3.1 User Interfaces

The User Device Requirements are listed below :

- Android v8.0 and higher
- iOS v11.0 and higher
- RAM 3GB and higher
- Stable internet connection

2.2.3.2 Hardware Interfaces

A- FARMezy Hardware Unit

- Raspberry Pi Microcontroller
- Various Sensors
- Camera Unit

B- Software Development PC

- Processor : Intel i7 9th gen 9750H CPU @ 2.60 GHz (6 cores, 12 threads, 12 MB)
- RAM : 16 GB DDR4 @ 2667 MHz
- Storage : 256 GB SSD NVME + 1 TB HDD SATA
- Graphics : NVIDIA GeForce GTX 1650 - 4 GB GDDR5
- OS : Microsoft Windows 10 Home Version 20H2 Build 19042.985

2.2.3.3 Software Interfaces

- Front end : (app) Flutter Framework with Dart programming language
- Back end : (app) FireBase + (ML models) Python + Blockchain + (rasp pi) Ubuntu

2.2.1 Other Non-functional Requirements

2.2.1.1 Performance Requirements

- All the user details are stored locally also, so user details and processed information are always available.
- Fetching and storing data from the database should be done in less than 2 seconds.
- All the processing should be done at the database (server) side to achieve peak efficiency.

2.2.1.3 Safety Requirements

- Backup of farmer database at regular intervals to avoid any data loss
- Hardware Unit installed in a secured/concealed spot

2.2.1.3 Security Requirements

- Secured access of farmer records
- Adding and removal of farmers is accessible by administrator only
- All the data to be sent via HTTP protocol for better encryption
- User details that are stored locally are to be encrypted to avoid data leak
- Strict adherence to authorised blockchain tampering

2.3 Cost Analysis

Need Analysis go here…

2.4 Risk Analysis

Need Analysis go here…

METHODOLOGY ADOPTED

3.1 Investigative Techniques = 2-3 page - insert table

Project Overview goes here…

3.2 Proposed Solution = 2-3 page = expand

Keeping the situation of farmers in our country mostly small-scale farmers, we propose a cost-effective solution to install webcams and various sensors in fields to monitor pollution levels and the amount of water required for crops.
Webcams will be used to detect any stray animal that might cause harm to the crops.

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.

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 app will also provide a platform for farmers to sell their crops directly and we'll use BlockChain to ensure that the farmers are paid fairly.

3.3 Work Breakdown Structure

Need Analysis go here…

3.4 Tools and Technology

Need Analysis go here…

DESIGN SPECIFICATIONS

3.1 System Architecture

Project Overview goes here…

3.2 Design Level Diagrams

Need Analysis go here…

3.3 User Interface Diagrams

Need Analysis go here…

3.4 Snapshots of Working Prototype = app ss' sajjal illustrator + steps

Need Analysis go here…

CONCLUSIONS AND FUTURE SCOPE

5.1 Work Accomplished

Project Overview goes here…

5.2 Conclusions

During the course of the project we discovered that there is an advantage of working as a group. Group work allows us to develop skills such as communication, leadership and coordination. We learned that good teamwork is the key to success in design activities when time and resources are limited and that the capability of a team is greater than the collective abilities of the individuals within it.

We discovered that our simplest idea was turned into something amazing after putting enough creativity and effort while working on it. Everyone had their own point of view; many different ideas came up which led to disagreement among the group members. All the disagreements were resolved, and we worked together harmoniously.

Our team faced some problems such as lack of knowledge in certain domains, no availability of certain data, less published research papers regarding our project but all of the group members did not lose the enthusiasm and worked jointly to overcome the hurdles. Many times, there was a problem in coordinating the time but all of the members somehow managed and the problem was tackled.

Working on this project was a great experience as it was different from the rest of the projects. It helped in the development of knowledge for pursuing an entrepreneurial career, its downsides, confrontations, management, concerns and finance; this gave us the experience of running a business and decision-making tasks that could lead to its success or failure. This project offered a great insight into our strengths and weaknesses when it comes to running a business and working in a team.

5.3 Environmental (/ Economic/ Social) Benefits = add env points

- Our product aims to be a one stop solution for farmers and brings a lot of value to them owing to its multi-domain interspersed features.

- The product packs almost every assistance needed by a farmer from sowing to selling of crops, and aims to save a lot of time on the farmer's end, as they don’t have to go to

different places to get things done.

- The product is a one time investment and requires minimal maintenance after installation, This leads to saving a lot of financial value in terms of the corresponding tests and surveys the farmer has to otherwise pay for, out of his own pocket in every crop cycle.

- There's an element of peace of mind, i.e. if farmer has the feeling of safety that they'll have certain yield predicted in a crop cycle, and also that they won't be cheated by the buyers, then they can rest assured that in case of any problem, they don't need to worry about potentially losing their earnings, instead they can quickly pinpoint the cause of the problem.

5.4 Future Work Plan

Need Analysis go here…

APPENDIX

1.1 Project Overview

Project Overview goes here…

1.2 Need Analysis

Need Analysis go here…