Industrial Internship Report on

"Prediction of Agriculture Crop Production in India"

Prepared by

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Executive Summary
This report provides details of the Industrial Internship provided by upskill Campus and The IoT Academy in collaboration with Industrial Partner UniConverge Technologies Pvt Ltd (UCT). This internship was focused on a project/problem statement provided by UCT. We had to finish the project including the report in 6 weeks' time. My project name is Prediction of Agriculture Crop Production . Instead of cultivating different types in different seasons, farmers produce the same crop every season. They also apply more fertilizer without knowing its exact composition or dosage. In order to describe the best crop to produce and the fertilizer to seed based on soil and weather circumstances, we developed a recommendation model based on machine learning. This internship gave me a very good opportunity to get exposure to Industrial problems and design/implement solution for that. It was an overall great experience to have this internship.

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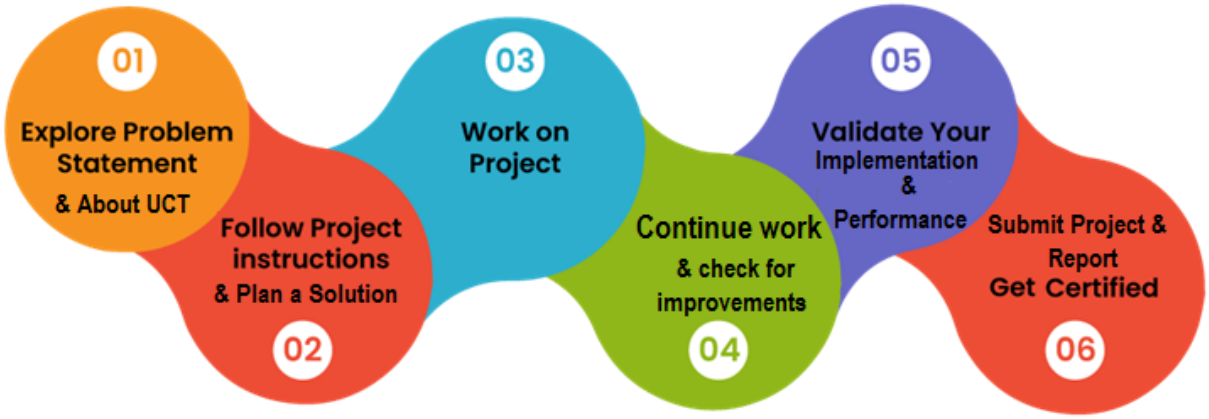
1 Preface

During my internship, I learned that success is not just about academic achievements, but also about gaining practical experience and developing critical thinking skills. I was able to work independently on projects, which helped me to grow and become more confident. Through this experience, I realized that internships are essential for students to gain real-world experience and contribute to an organization while learning about themselves in a professional work environment. Unfortunately, many internships remain unpaid or difficult to obtain, creating an opportunity gap for students from diverse backgrounds. I hope that programs like Semester in the City will make internships more accessible to a diverse range of students, providing them with valuable skills and real-world experience.

Problem Statement:

Farming is one of the major sectors that influences a country's economic growth. In agriculture field, farmer has to know about the suitable crops for cultivation. Growing crops are completely based on the type of the soil and its features, location, whether etc. Now a days analyzing soil and its features are entirely manual which requires more time. This leads to the development of the automation for crop prediction based on the soil features. Many new technologies, such as Machine Learning and Deep Learning, are being implemented into agriculture so that it is easier for farmers to grow and maximize their yield. In this project, We present a website in which the following applications are implemented; Crop recommendation, Fertilizer recommendation respectively.



My messages are our juniors and peers:

Firstly, I encourage you to take advantage of every opportunity that comes your way. Whether it's an internship, a research project, or a volunteer opportunity, these experiences will help you to develop your skills and build your network.

Secondly, don't be afraid to step out of your comfort zone. Internships can be challenging, but they are also a great way to learn and grow. Embrace the unknown and be open to new experiences.

Lastly, remember that your internship is not just about gaining experience, but also about building relationships and making connections. Be professional, be respectful, and always be willing to learn.

I hope that my experience can inspire and motivate you to pursue your own internship opportunities. Remember to stay focused, stay motivated, and always keep learning.

2 Introduction

2.1 About UniConverge Technologies Pvt Ltd

A company established in 2013 and working in Digital Transformation domain and providing Industrial solutions with prime focus on sustainability and RoI.

For developing its products and solutions it is leveraging various **Cutting Edge Technologies e.g. Internet of Things (IoT), Cyber Security, Cloud computing (AWS, Azure), Machine Learning, Communication Technologies (4G/5G/LoRaWAN), Java Full Stack, Python, Front end** etc.

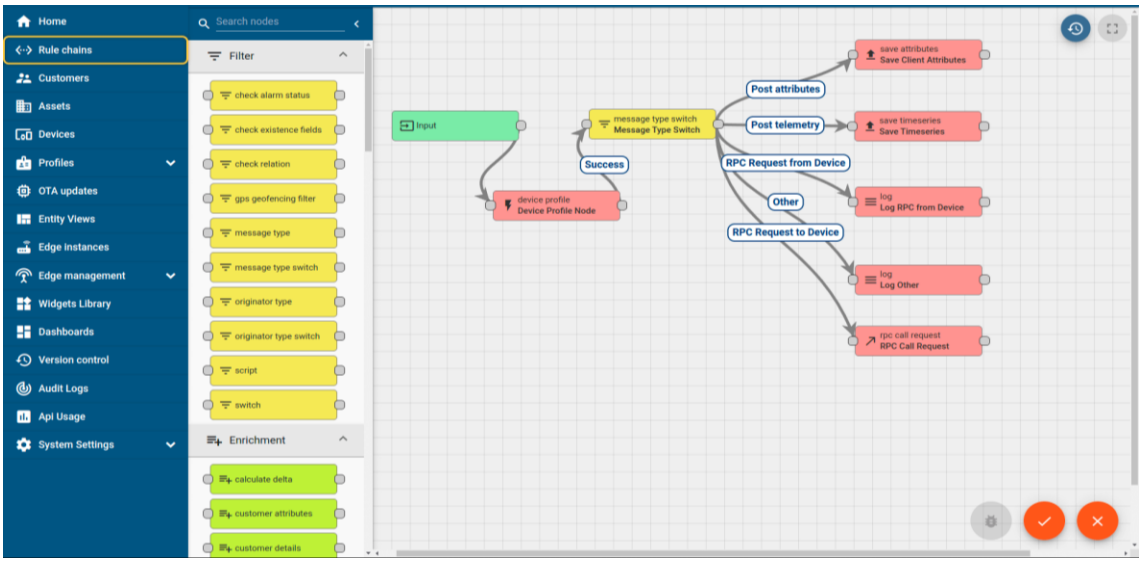
i. UCT IoT Platform (uct Insight)

UCT Insight is an IOT platform designed for quick deployment of IOT applications on the same time providing valuable “insight” for your process/business. It has been built in Java for backend and ReactJS for Front end. It has support for MySQL and various NoSql Databases.

- It enables device connectivity via industry standard IoT protocols - MQTT, CoAP, HTTP, Modbus TCP, OPC UA
- It supports both cloud and on-premises deployments.

It has features to

- Build Your own dashboard
- Analytics and Reporting
- Alert and Notification
- Integration with third party application(Power BI, SAP, ERP)
- Rule Engine



ii. Smart Factory Platform (FACTORY WATCH)

Factory watch is a platform for smart factory needs.

It provides Users/ Factory

- with a scalable solution for their Production and asset monitoring
- OEE and predictive maintenance solution scaling up to digital twin for your assets.
- to unleased the true potential of the data that their machines are generating and helps to identify the KPIs and also improve them.
- A modular architecture that allows users to choose the service that they what to start and then can scale to more complex solutions as per their demands.

Its unique SaaS model helps users to save time, cost and money.

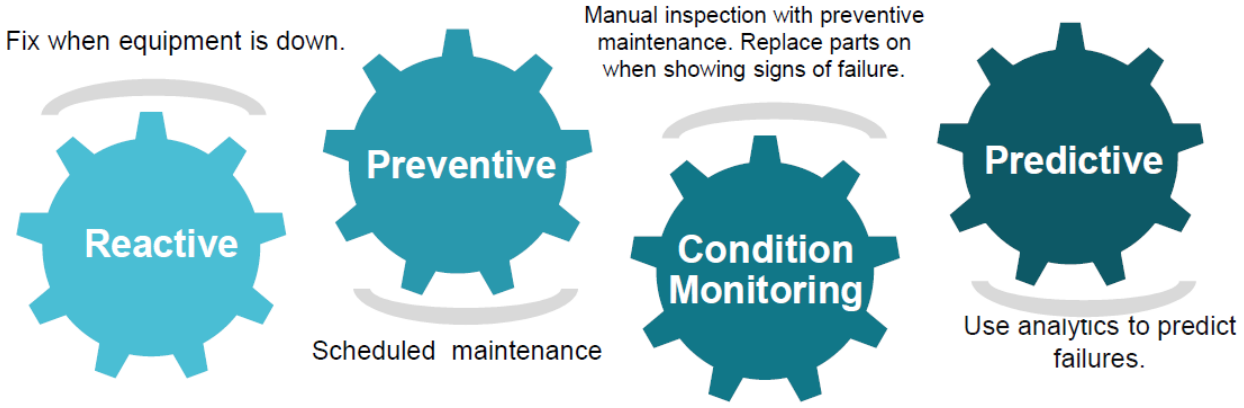
Machine	Operator	Work Order ID	Job ID	Job Performance	Job Progress		Output		Rejection	Time (mins)				Job Status	End Customer
					Start Time	End Time	Planned	Actual		Setup	Pred	Downtime	Idle		
CNC_S7_81	Operator 1	WO0405200001	4168	58%	10:30 AM		55	41	0	80	215	0	45	In Progress	i
CNC_S7_81	Operator 1	WO0405200001	4168	58%	10:30 AM		55	41	0	80	215	0	45	In Progress	i

iii. LoRaWAN based Solution

UCT is one of the early adopters of LoRAWAN teschnology and providing solution in Agritech, Smart cities, Industrial Monitoring, Smart Street Light, Smart Water/ Gas/ Electricity metering solutions etc.

iv. Predictive Maintenance

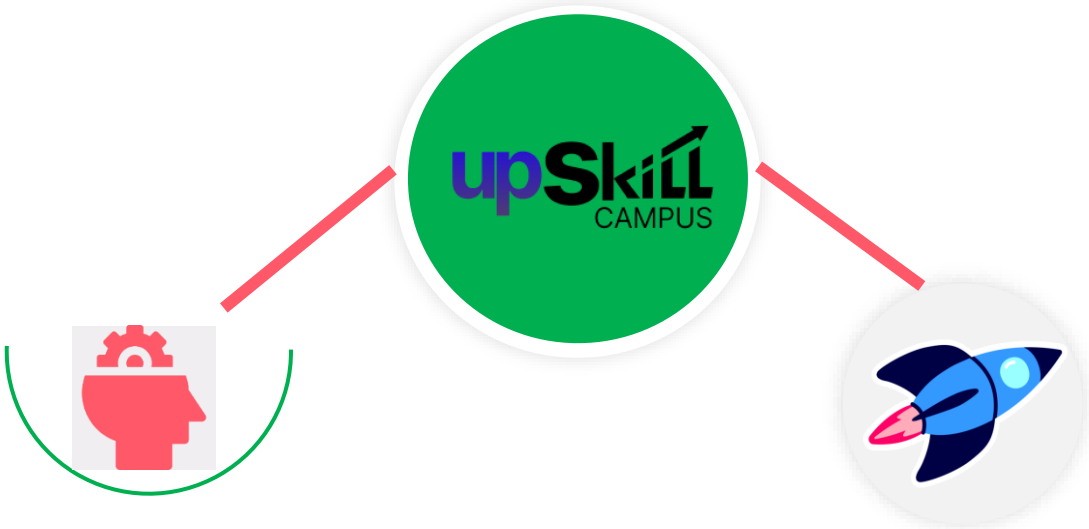
UCT is providing Industrial Machine health monitoring and Predictive maintenance solution leveraging Embedded system, Industrial IoT and Machine Learning Technologies by finding Remaining useful life time of various Machines used in production process.



2.2 About upskill Campus (USC)

upskill Campus along with The IoT Academy and in association with Uniconverge technologies has facilitated the smooth execution of the complete internship process.

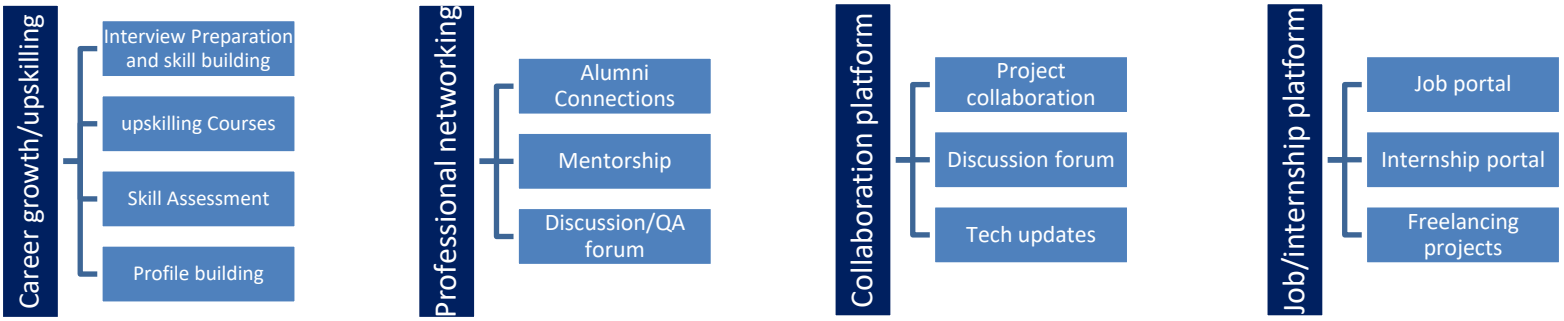
USC is a career development platform that delivers **personalized executive coaching** in a more affordable, scalable and measurable way.



Seeing need of upskilling in self paced manner along-with additional support services e.g. Internship, projects, interaction with Industry experts, Career growth Services

upSkill Campus aiming to upskill 1 million learners in next 5 year

https://www.upskillcampus.com/



2.3 The IoT Academy

The IoT academy is EdTech Division of UCT that is running long executive certification programs in collaboration with EICT Academy, IITK, IITR and IITG in multiple domains.

2.4 Objectives of this Internship program

The objective for this internship program was to

- ☛ get practical experience of working in the industry.
- ☛ to solve real world problems.
- ☛ to have improved job prospects.
- ☛ to have Improved understanding of our field and its applications.
- ☛ to have Personal growth like better communication and problem solving.

2.5 Reference

[1] https://www.upskillcampus.com/blog/career-growth

[2] https://www.wisnik.com/wisdom/2014/02/what-does-career-growth-mean-to-you/

3 Problem Statement

Farming is one of the major sectors that influences a country's economic growth.

In agriculture field, farmer has to know about the suitable crops for cultivation. Growing crops are completely based on the type of the soil and its features, location, whether etc. Now a days analyzing soil and its features are entirely manual which requires more time. This leads to the development of the automation for crop prediction based on the soil features.

Many new technologies, such as Machine Learning and Deep Learning, are being implemented into agriculture so that it is easier for farmers to grow and maximize their yield. In this project, We present a website in which the following applications are implemented; Crop recommendation, Fertilizer recommendation respectively.

4 Existing and Proposed solution

Here is a summary of existing solutions, their limitations, and my proposed solution:

Summary of Existing Solutions:

Several existing solutions have been developed to address the issue of crop prediction and recommendation based on soil features. Some of these solutions include:

- **Soil Testing Kits:** These kits allow farmers to collect soil samples and send them to laboratories for analysis. The results are then used to recommend suitable crops and fertilizers.
- **Mobile Apps:** Several mobile apps, such as FarmLogs and Cropio, provide farmers with information on soil health, weather conditions, and crop recommendations.
- **Machine Learning-based Models:** Researchers have developed machine learning-based models that use soil features, climate data, and other factors to predict suitable crops and fertilizers.
- **Precision Agriculture:** This approach uses advanced technologies, such as drones, satellite imaging, and GPS, to collect data on soil health, crop growth, and weather conditions.

Limitations of Existing Solutions:

While these solutions have shown promise, they have several limitations:

- **Time-consuming and Labor-intensive:** Soil testing kits and manual data collection methods are time-consuming and labor-intensive.
- **Limited Accessibility:** Many farmers, especially in rural areas, may not have access to mobile apps, internet, or precision agriculture technologies.
- **Inaccurate Predictions:** Machine learning-based models may not always provide accurate predictions due to limited data or incomplete information.
- **High Cost:** Precision agriculture technologies can be expensive, making them inaccessible to small-scale farmers.

Proposed Solution:

My proposed solution is a website that provides crop recommendation and fertilizer recommendation based on soil features. This solution aims to address the limitations of existing solutions by:

- **Automating Soil Analysis:** My website will use machine learning algorithms to analyze soil features and provide instant recommendations.
- **Accessibility:** The website will be accessible to farmers with internet connectivity, making it more accessible than traditional soil testing kits.
- **Accurate Predictions:** My solution will use advanced machine learning algorithms to provide accurate predictions based on comprehensive soil data.
- **Cost-effective:** The website will be a cost-effective solution for farmers, especially small-scale farmers who may not have access to precision agriculture technologies.

Value Addition:

My proposed solution will add value to the existing solutions in several ways:

- **Faster Decision-making:** My website will provide instant recommendations, enabling farmers to make informed decisions quickly.
- **Increased Accuracy:** Advanced machine learning algorithms will provide more accurate predictions, reducing the risk of crop failure or reduced yields.
- **Improved Accessibility:** The website will be accessible to a wider range of farmers, including those in rural areas with limited access to technology.
- **Cost Savings:** The cost-effective solution will help farmers reduce costs associated with traditional soil testing kits and precision agriculture technologies.

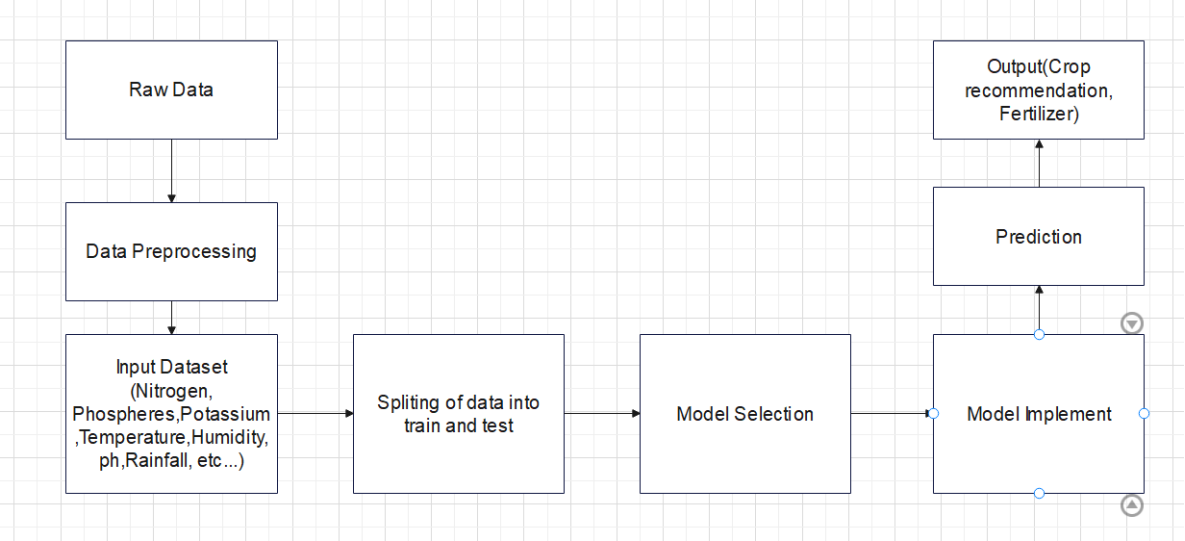
4.1 Code submission (Github link):

https://github.com/gohilkaran331/upskillcampus.git

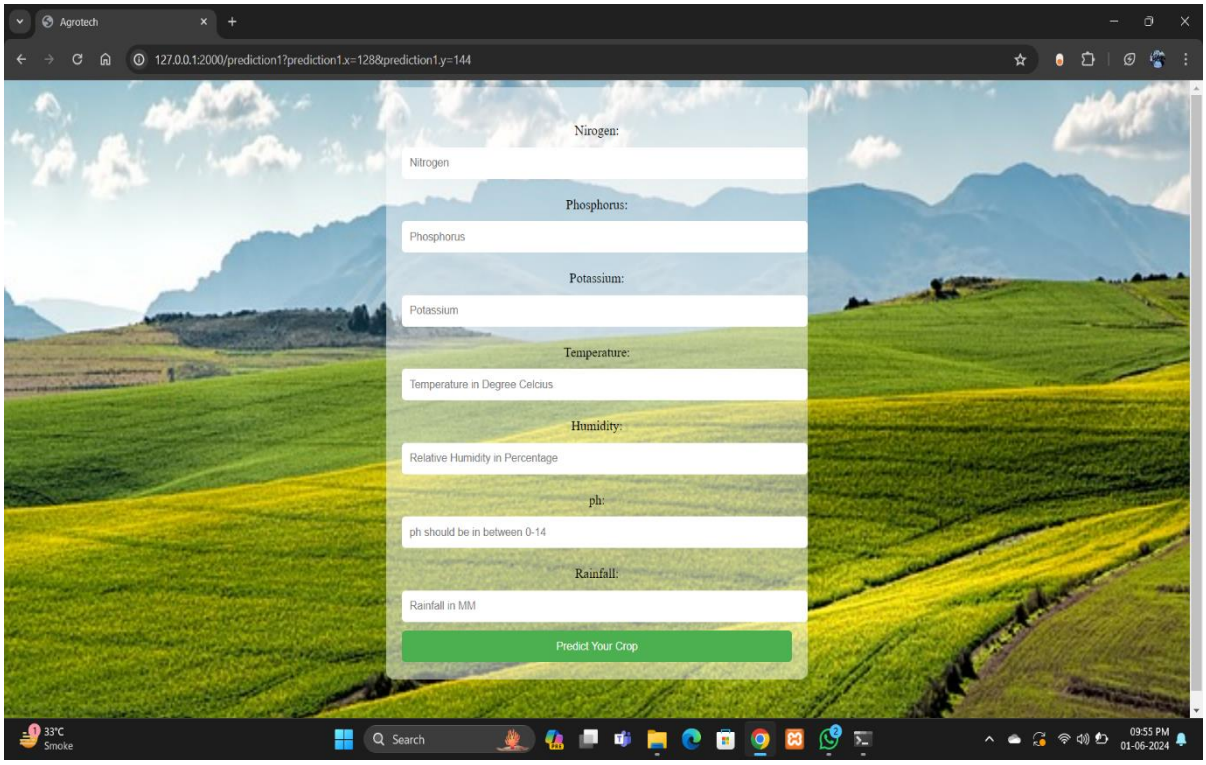
4.2 Report submission (Github link):

Prediction_of_Agriculture_Crop_Production_in_india_Karan_USC_UCT.pdf

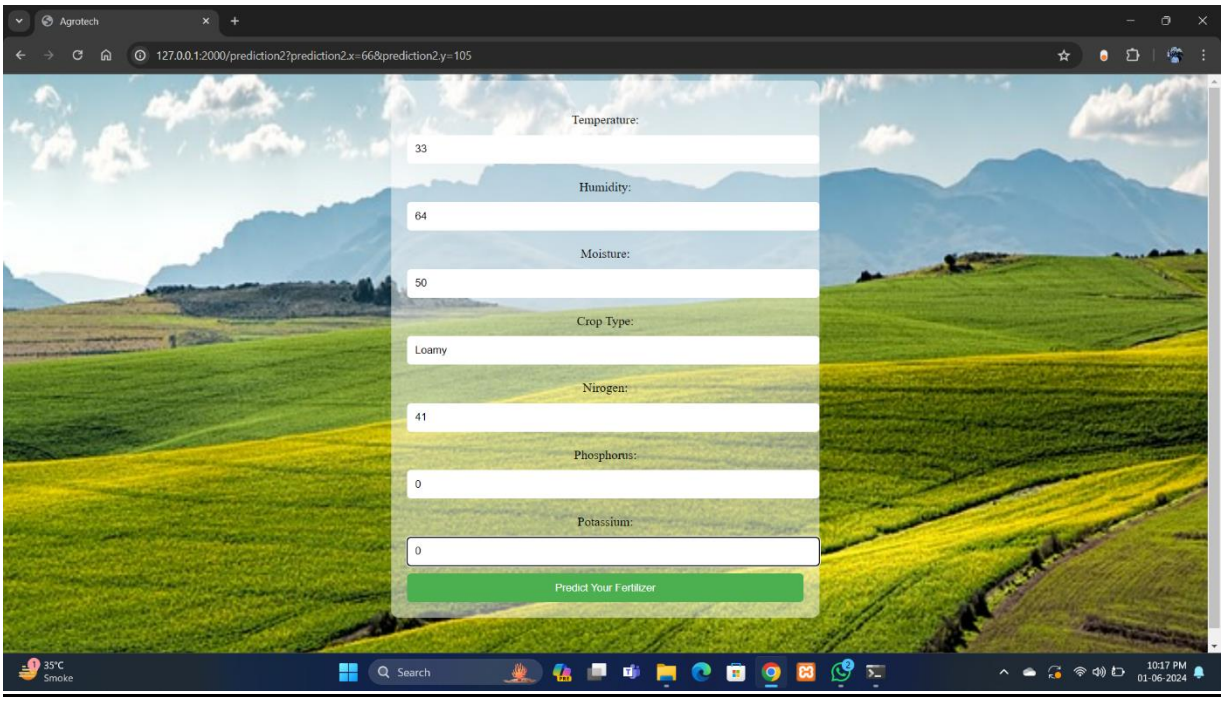
5 Proposed Design/ Model



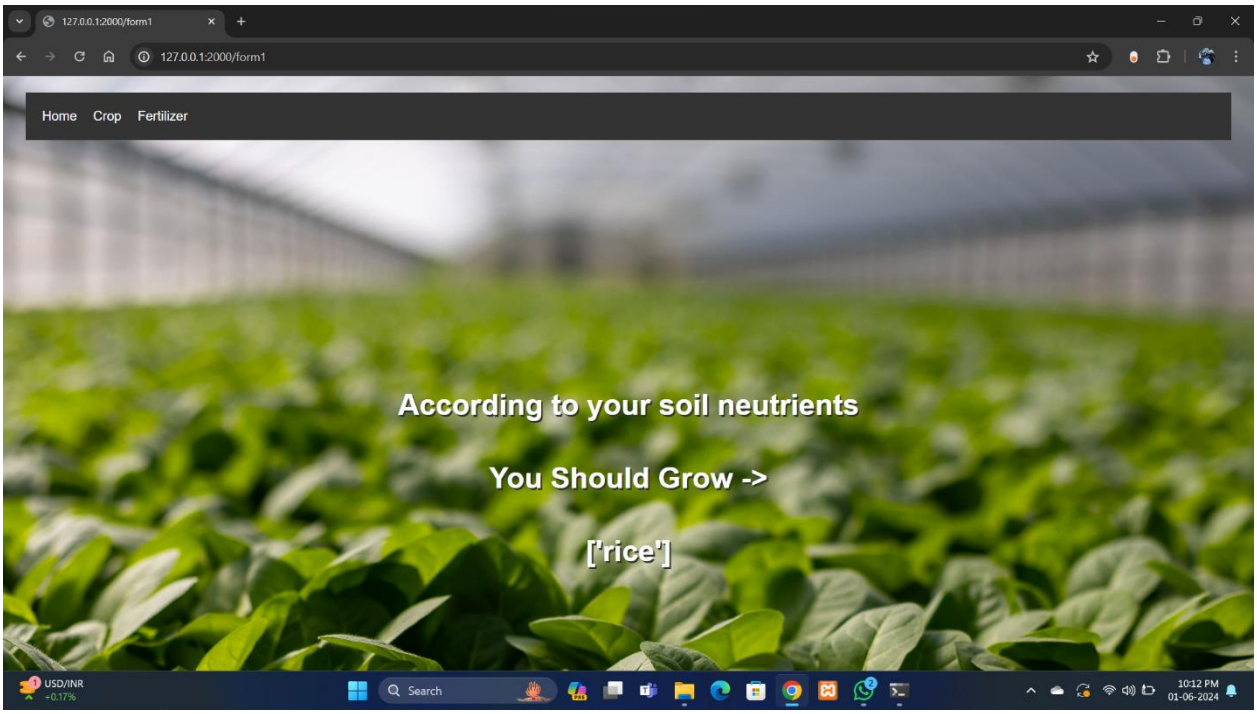
5.1 Home page:



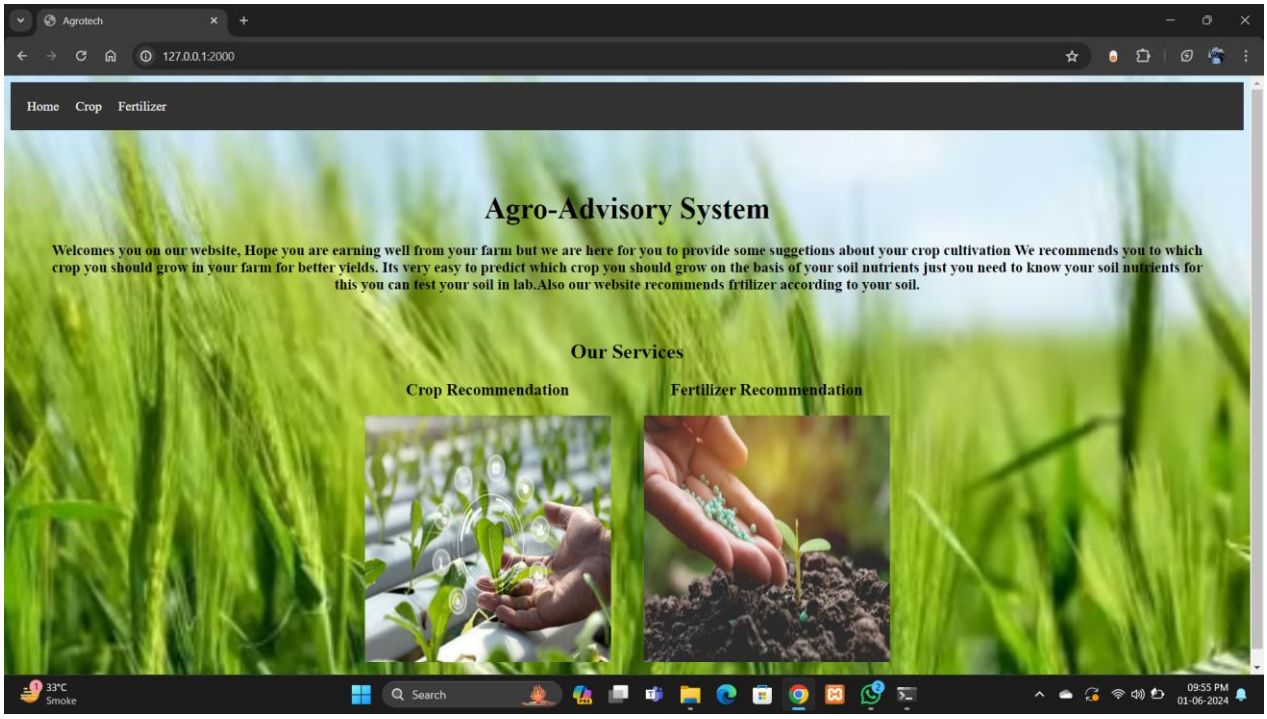
5.2 Crop Section :



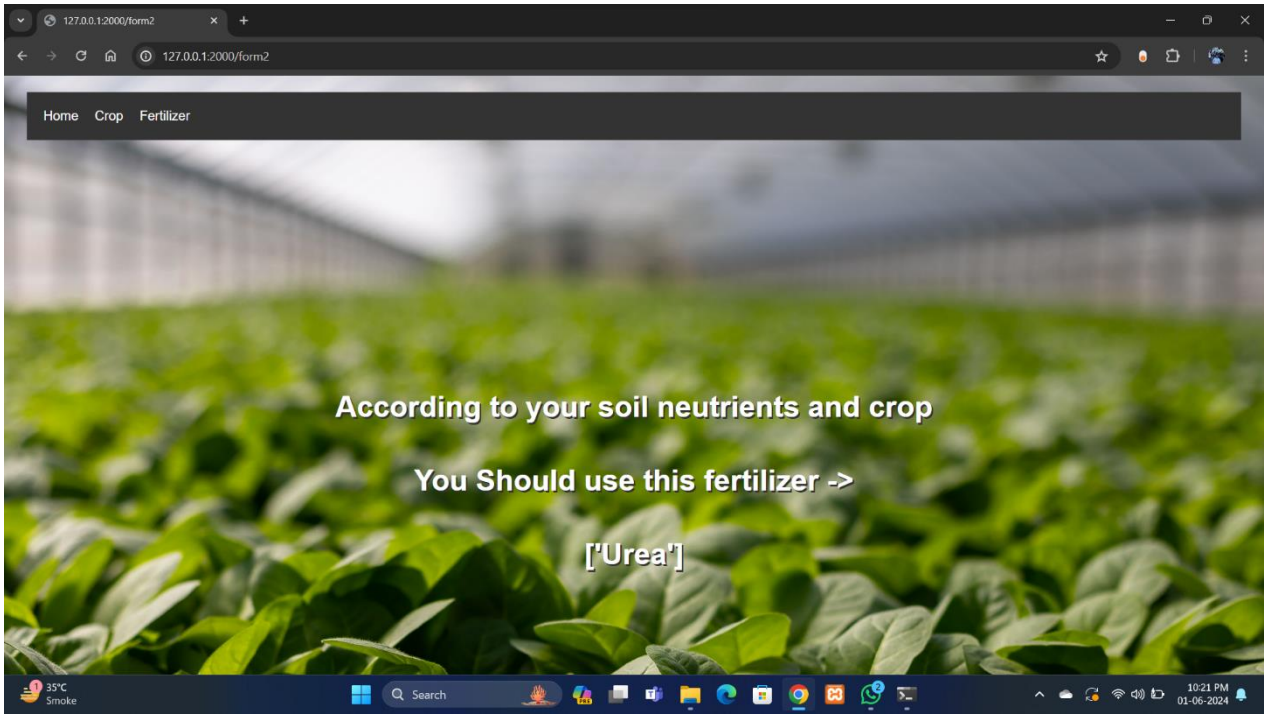
5.3 Crop-output Page :



5.4 Service Page :



5.5 Fertilizer Page :



6 Performance Test

In this section, we demonstrate why this project is suitable for real industry application, not just an academic exercise. We start by identifying the constraints and explaining how they were considered in our design. We then discuss the test results concerning these constraints. The constraints include memory usage, processing speed (MIPS), accuracy, durability, and power consumption. Even if some constraints were not tested, we describe their potential impact on the design and provide recommendations for managing them.

6.1 Test Plan/ Test Cases

- **Memory Constraint Test:** Test the system's ability to handle large datasets of soil features and crop recommendations without significant memory usage.
- **Speed and Accuracy Test**: Test the system's ability to provide accurate crop recommendations within a reasonable time frame.
- **Scalability Test:** Test the system's ability to handle a large number of concurrent user requests without significant performance degradation.
- **Power Consumption Test:** Test the system's power consumption and its impact on the environment.

6.2 Test Procedure

- Set up the testing environment with the necessary hardware and software configurations.
- Prepare the test data, including large datasets of soil features and crop recommendations.
- Execute the test cases and measure the system's performance using metrics such as memory usage, response time, accuracy, and power consumption.
- Analyze the test results and identify areas for improvement.
- Refine the system's design and implementation based on the test results.

6.3 Performance Outcome

- **Memory Constraint Test:** The system should be able to handle large datasets of soil features and crop recommendations without exceeding 50% of the available memory.
- **Speed and Accuracy Test:** The system should be able to provide accurate crop recommendations within 5 seconds for 100 different soil feature inputs.
- **Scalability Test:** The system should be able to handle 100 concurrent user requests without exceeding 10 seconds of response time and maintaining an accuracy of 90%.
- **Power Consumption Test:** The system's power consumption should be within the acceptable range of 50-100 watts during peak usage.

7 My learnings

1. **Machine Learning and Deep Learning:** I have gained hands-on experience with machine learning and deep learning algorithms, including data preprocessing, model training, and model evaluation. I have learned how to apply these algorithms to solve complex problems, such as crop prediction and recommendation.
   Career Growth: I am now equipped to work on complex data science and machine learning projects, applying my skills to solve real-world problems in various industries.

2. **Web Development:** I have developed a web-based application that integrates machine learning models with a user-friendly interface, allowing farmers to easily access crop recommendations. This experience has taught me the importance of user-centered design and the need for seamless integration of technology with real-world applications.
   Career Growth: I can develop web-based applications that integrate machine learning models, providing users with intuitive and user-friendly interfaces.

3. **Data Analysis and Visualization:** I have learned how to collect, analyze, and visualize large datasets, including soil features and crop yields. This skill has enabled me to extract insights from data and communicate them effectively to stakeholders.

4. **Problem-Solving and Critical Thinking:** Throughout this project, I have developed my problem-solving and critical thinking skills, learning to approach complex problems in a systematic and analytical way.

5. **Collaboration and Communication:** I have learned the importance of collaboration and communication in project development, working with team members to design, develop, and test the application.
   Career Growth: I am better equipped to lead and collaborate on projects, communicating effectively with team members and stakeholders to achieve project goals.

8 Future work scope

Discuss potential Perspective such as:

- Integration of real-time weather data
- Expansion to support more crops and regions
- Incorporation of feedback mechanisms for continuous improvement