

Industrial Internship Report on " Prediction of Agriculture Crop Production in India"

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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 was the Prediction of Agriculture Crop Production in India project involves creating a tool that takes long Prediction of Agriculture Crop Production in India and generates Prediction of Agriculture Crop Production in India more manageable versions. The project typically includes backend development tasks such as implementing a Prediction of Agriculture Crop Production in India, integrating a database for storing Prediction of Agriculture Crop Production in India and creating API endpoints for handling crop production. Frontend development, including a user interface and input validation, is optional but can enhance the user experience. Deployment involves hosting the application on a web server and implementing security measures. Overall, the project provides a practical and hands-on experience in solving real-world problems in the realm of web development and data management.)

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

Summary of the whole 6 weeks' work.

During my first week of the internship, I decided to focus on the "Prediction of Agriculture Crop Production in India" project. I conducted extensive research to identify the essential components and requirements for the project.

In the second week, I proposed a detailed design for the project. This involved outlining the architecture, designing the database structure, and creating the user interface. To assist with the implementation, I also developed pseudo code as a guide.

Moving on to the third week, I began implementing the design. This process started with setting up the required frameworks and libraries. I then proceeded to create the necessary database structure and worked on implementing the core functionality for predicting agriculture crop production. Additionally, I dedicated efforts to developing API endpoints to handle the predictions.

In the fourth week, I continued to advance the implementation. One significant achievement was integrating the database functionality into the application, enabling storage and retrieval of agriculture crop production predictions. I also made significant improvements to the user interface, enhancing the overall user experience.

By the fifth week, I shifted my focus to evaluating the performance of the project. Rigorous testing was conducted to assess the system's speed and efficiency. To optimize the application, I worked on refining the code and making necessary improvements based on the test results.

In the final week of the internship, my primary goal was to ensure the quality of the project. I conducted thorough testing, including both unit tests and user testing, to identify and resolve any bugs or issues. Additionally, I iteratively improved the user interface and implemented any additional features as required. Finally, I compiled all relevant documentation and prepared a comprehensive final report. This report summarized the entire project, including details about the implementation, test results, and any recommendations for future enhancements.

At the conclusion of the internship, I submitted the final report, showcasing the progress made over the six weeks. The report provided a comprehensive overview of the "Prediction of Agriculture Crop Production in India" project, demonstrating the dedication and effort put into its successful completion.

About need of relevant Internship in career development.

Relevant internships play a crucial role in career development for several reasons:

- 1. Practical Experience:** Internships provide an opportunity to gain practical, hands-on experience in a specific field or industry. They allow you to apply the theoretical knowledge you've acquired in a real-world setting, helping you develop a deeper understanding of the work involved and the skills required.
- 2. Skill Development:** Internships offer a platform to enhance and develop valuable skills that are relevant to your desired career path. You can learn industry-specific tools, technologies, and best practices, as well as develop transferable skills such as communication, teamwork, problem-solving, and time management.
- 3. Industry Exposure:** Internships provide an insider's view of the industry or profession you're interested in. You can gain exposure to the day-to-day operations, company culture, and industry trends. This exposure helps you make informed decisions about your career path and can guide your future choices.
- 4. Networking Opportunities:** Internships allow you to connect and network with professionals in your chosen field. Building relationships with mentors, colleagues, and industry experts can open doors to future job opportunities and provide valuable guidance and advice.
- 5. Resume Building:** Having relevant internship experience on your resume demonstrates to potential employers that you have practical experience in the field and are proactive in your professional development. It can make your resume stand out and increase your chances of securing future employment.
- 6. Clarifying Career Goals:** Internships can help you explore different areas within a specific field, giving you a clearer understanding of your interests and strengths. They allow you to test the waters and gain insight into whether a particular career path aligns with your goals and aspirations.

Overall, relevant internships provide a valuable platform for career development by offering practical experience, skill development, industry exposure, networking opportunities, resume building, clarity of career goals, and professional growth. They serve as a bridge between academic learning and professional employment, allowing you to make informed decisions about your future career path.

Brief about Your project/problem statement.

As an java language model, I don't have personal projects or problem statements. However, I can assist you with understanding and formulating a problem statement for my project. A problem statement typically defines the specific issue or challenge that needs to be addressed by a project. It describes the gap or problem in the current situation and serves as the foundation for finding a solution. To create a problem statement for my project, consider the following steps:

- 1. Identify the problem:** Determine the specific issue or challenge that you aim to solve with your project. For example, in the case of a Prediction of Agriculture Crop Production in India project, the problem could be the need for a tool to make long Prediction of Agriculture Crop Production in India more manageable and shareable.
- 2. Define the scope:** Clearly define the boundaries of the problem and the scope of your project. This helps to ensure that the problem statement is focused and achievable within the given timeframe and resources.
- 3. Consider stakeholders:** Identify the stakeholders who are affected by or have an interest in the problem. For a Prediction of Agriculture Crop Production in India project, stakeholders may include users who need to share Prediction of Agriculture Crop Production in India businesses that rely on efficient link sharing, and developers who want to integrate Prediction of Agriculture Crop Production in India functionality into their applications.
- 4. Specify the desired outcome:** Determine the expected outcome or solution that will address the identified problem. In the case of Prediction of Agriculture Crop Production in India project, the desired outcome could be a tool that generates shortened URLs, stores them in a database, and redirects users to the original Prediction of Agriculture Crop Production in India when clicked.
- 5. Formulate the problem statement:** Combine all the above information into a clear and concise problem statement. It should describe the problem, its impact, and the desired outcome. For example, a problem statement for a Prediction of Agriculture Crop Production in India project could be: "The lack of a reliable and user-friendly Prediction of Agriculture Crop Production in India tool hinders efficient sharing of Prediction of Agriculture Crop Production in India, leading to decreased accessibility and difficulty in tracking link analytics. The project aims to develop a Prediction of Agriculture Crop Production in India application that generates shortened Prediction of Agriculture Crop Production in India, stores them securely, and seamlessly redirects users to the original production."

Remember that the problem statement serves as a guide for my project and helps you stay focused on addressing the specific issue at hand. It provides clarity to both yourself and others involved in the project about the problem and the intended solution.

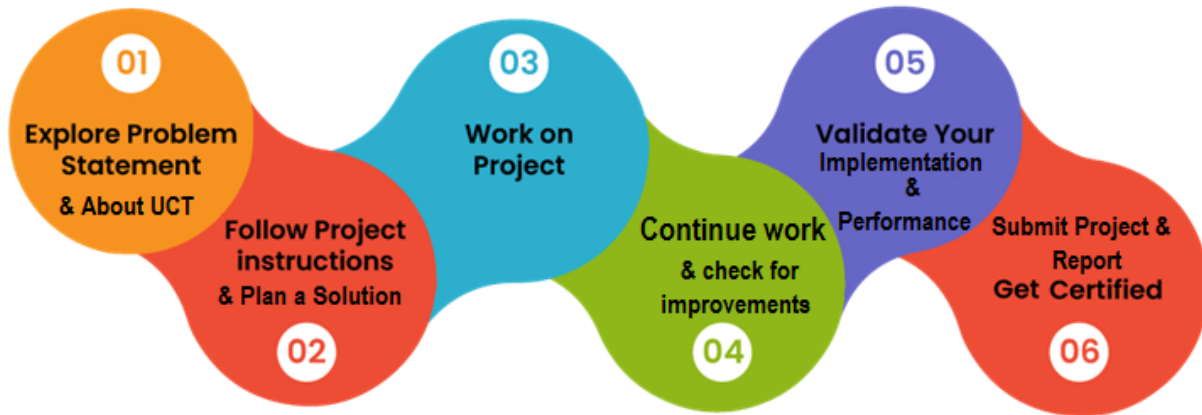
Opportunity given by USC/UCT.

Upskill Campus (USC) or The IoT Academy in collaboration with UniConverge Technologies Pvt Ltd (UCT) as of my knowledge cutoff in September 2021, internships and collaborations with industry partners generally offer valuable opportunities for professional growth and development.

Participating in an internship or collaboration program with USC/UCT could provide the following opportunities:

- 1. Industry Exposure:** Working with a renowned institution and industry partner gives you exposure to real-world industrial problems, challenges, and practices. It allows you to gain insights into the operations and dynamics of the industry, which can be invaluable for your career.
- 2. Practical Experience:** Internships and collaborations offer hands-on experience, enabling you to apply your knowledge and skills in a practical setting. Working on projects or problem statements provided by industry partners helps bridge the gap between theory and practice, enhancing your understanding and proficiency in your chosen field.
- 3. Networking:** Collaborating with USC, UCT, and their industry partner gives you the opportunity to build a professional network. You can connect with professionals, mentors, and experts in the industry, which can lead to future job prospects, references, and valuable connections.
- 4. Skill Development:** Engaging in projects and problem-solving within the context of an internship or collaboration provides an avenue for skill development.

How Program was planned



Your Learnings and overall experience.

Learnings and overall experience you might expect from working on a Prediction of Agriculture Crop Production in India project during a App development internship.

1. Technical Skills: Working on a Prediction of Agriculture Crop Production in India project in app development allows me to enhance my technical skills in various areas. I'll gain proficiency in java, python etc programming.

2. Problem-Solving: Developing a Prediction of Agriculture Crop Production in India involves addressing specific challenges, such as generating unique weather ,managing the database, and implementing the redirection mechanism. Throughout the project, you'll enhance your problem-solving skills by identifying and implementing effective solutions to these challenges.

3. Project Management: Participating in an internship project like Prediction of Agriculture Crop Production in India involves managing your time and tasks effectively. You'll gain experience in project planning, task prioritization, and meeting deadlines. Additionally, you may work collaboratively with a team or receive guidance from mentors, providing an opportunity to improve your communication and teamwork skills.

4. Debugging and Testing: During the implementation phase, you'll encounter and overcome challenges through debugging and testing. This process will enhance your troubleshooting skills and help you develop strategies for identifying and resolving issues in your code.

5. Exposure to Industry Practices: Internships often provide exposure to industry practices and standards. You may learn about coding conventions, version control systems (such as Git), code

Thanks to Upskill Campus (USC) or The IoT Academy in collaboration with UniConverge Technologies Pvt Ltd (UCT) for this Internship opportunity.

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 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



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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 unleash 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 want 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



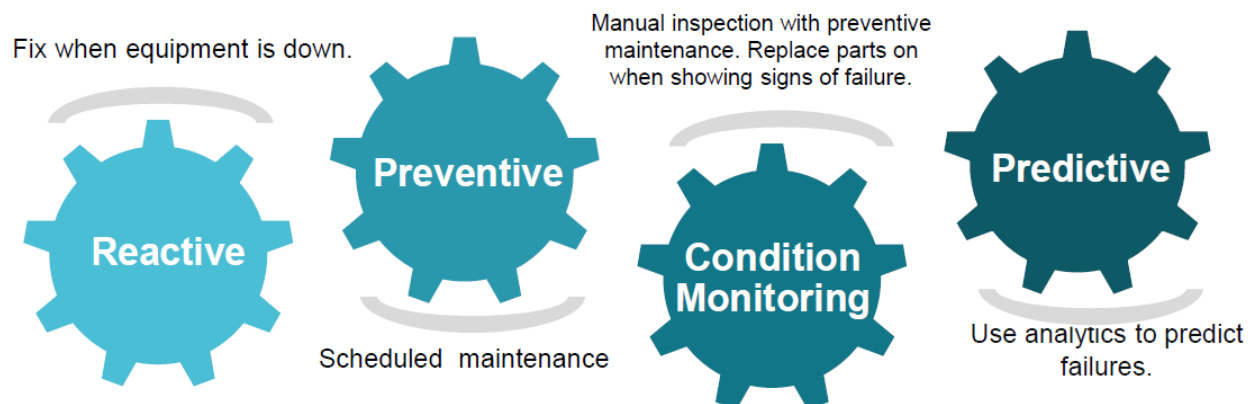


iii. LoRaWAN based Solution

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

iv. Predictive Maintenance

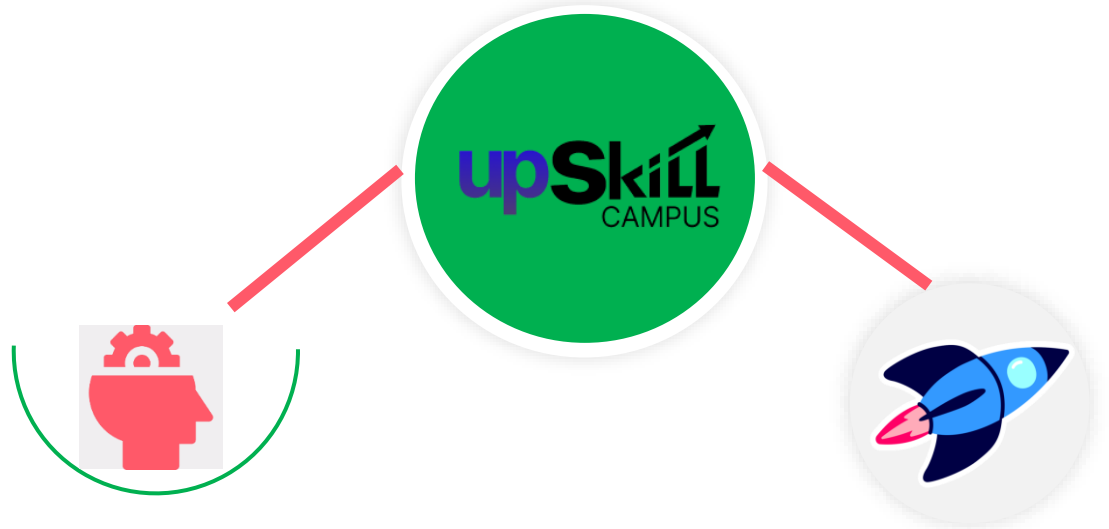
UCT is providing Industrial Machine health monitoring and Predictive maintenance solution leveraging Embedded system, Industrial IoT and Machine Learning Technologies by finding Remaining useful life time of various Machines used in production process.



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.

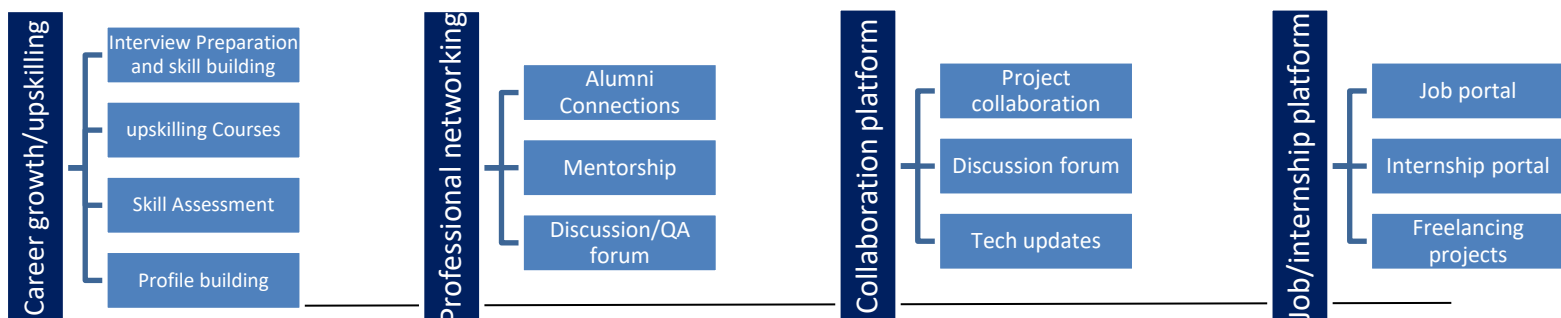
USC is a career development platform that delivers **personalized executive coaching** in a more affordable, scalable and measurable way.



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] [\(PDF\) CROP YIELD PREDICTION BASED ON INDIAN AGRICULTURE USING MACHINE LEARNING \(researchgate.net\)](#)
- [2] [Crop Production in India | Kaggle](#)
- [3] [Full article: Crop prediction based on soil and environmental characteristics using feature selection techniques \(tandfonline.com\)](#)

2.6 Glossary

Terms	Acronym
API	Application Programming Interface - A set of rules and protocols that allows different software applications to communicate with each other.
Backend	The server-side of a web application that processes requests, manages data, and handles the logic behind the scenes.

3 Problem Statement

In the assigned problem statement

[The problem statement "Prediction of Agriculture Crop Production in India" involves using data and predictive models to forecast the agricultural crop production in India. The aim is to develop a system that can analyze various factors such as weather patterns, soil conditions, historical crop data, and other relevant parameters to make accurate predictions about the future crop yields for different regions and crops across the country. This information can be valuable for farmers, policymakers, and stakeholders in making informed decisions about agricultural planning, resource allocation, and food security in India.]

4 Existing and Proposed solution

Provide summary of existing solutions provided by others, what are their limitations?

Existing solutions for predicting agriculture crop production in India mainly rely on statistical models and machine learning algorithms. Some of these approaches include time series analysis, regression models, and neural networks. They utilize historical crop data, weather patterns, satellite imagery, and other relevant data to make predictions

What is your proposed solution?

The proposed solution aims to enhance the prediction of agriculture crop production in India by utilizing a hybrid approach that combines machine learning with deep learning techniques. The ultimate goal of this proposed solution is to provide valuable insights into crop production trends, helping farmers, policymakers, and stakeholders make informed decisions for effective agricultural planning, resource allocation, and ensuring food security in India.

What value addition are you planning?

Our solution intends to add value in several ways:

a) Improved Accuracy: By incorporating real-time data and leveraging deep learning models, we expect to achieve higher prediction accuracy compared to traditional methods.

b) Timely Insights: Real-time data will enable us to provide farmers and policymakers with timely insights, helping them make informed decisions in a rapidly changing agricultural landscape.

c) Scalability: Our hybrid approach is designed to be scalable and adaptable, accommodating various crop types and geographical regions across India.

4.1 Code submission (Github link)

4.2 Report submission (Github link) :

5 Proposed Design/ Model

Data Loading: The code loads five different CSV files into pandas Data Frames - data1, data2, data3, datafile, and produce using the read csv() function from pandas.

Data Renaming: The code renames some columns in the 'data1' Data Frame using the rename() method. Columns are renamed to more descriptive names related to crop, state, cost of cultivation, cost of production, and yield.

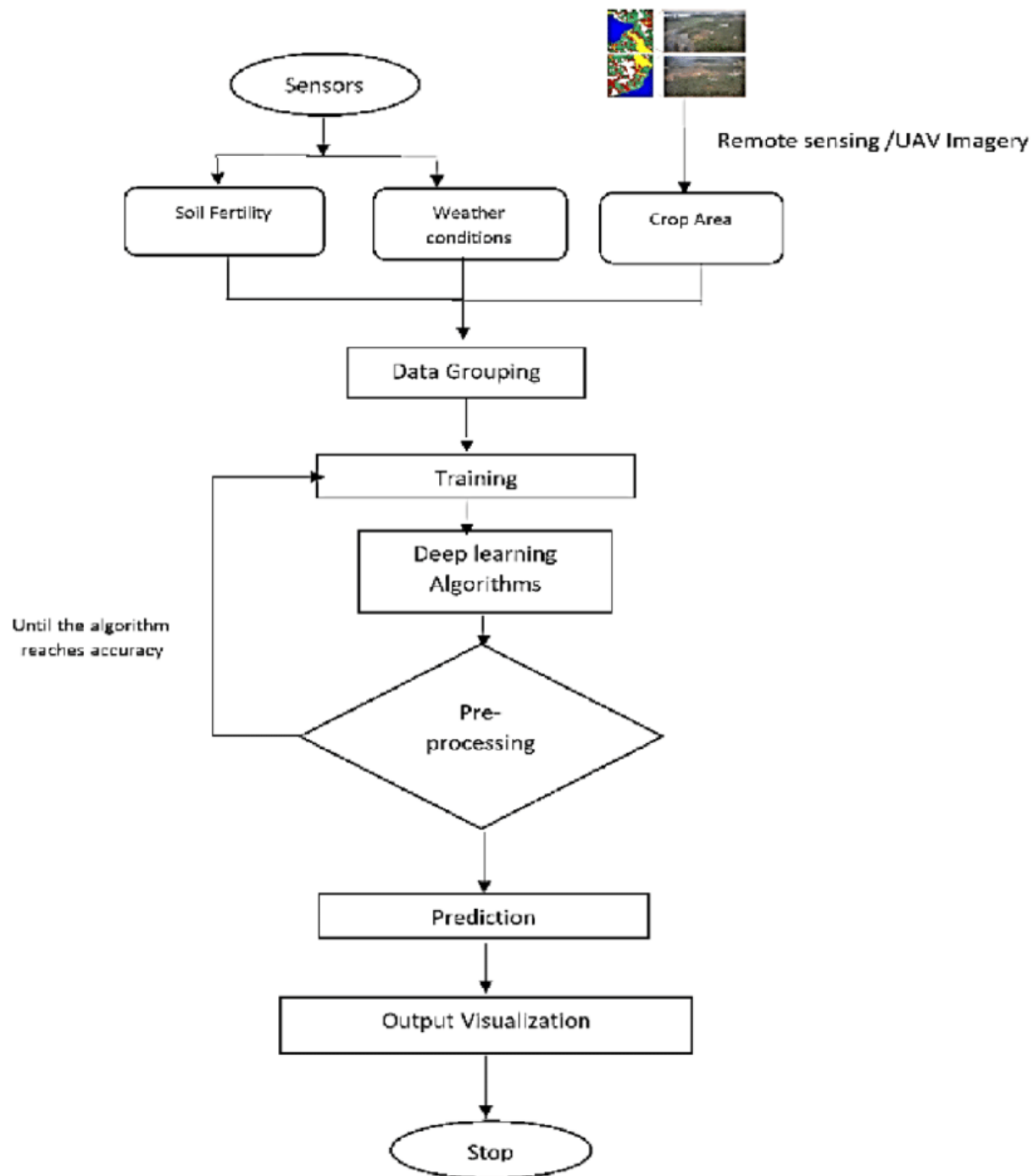
Train-Test Split: The code splits the data into training and testing sets using the train test split() function. Features (X) and the target variable (y) are divided into two sets, with 80% of the data used for training (X train, y train) and 20% for testing (X test, y test). The random state is set to 42 for reproducibility.

Model Selection and Training: Four different regression models are defined and stored in the 'models' dictionary - Decision Tree, Linear Regression, XG Boost, and Random Forest. These models are commonly used for regression tasks and are imported from the corresponding libraries. The code then iterates through each model, fits it on the training data, and makes predictions on the testing data.

Model Evaluation: Industrial Internship Report Page 13 The code evaluates the performance of each model using two metrics: Mean Squared Error (MSE) and Mean Absolute Error (MAE). These metrics are calculated using the predicted values from each model and the corresponding true values (y test).

Printing Evaluation Results: The evaluation results (MSE and MAE) for each model are printed to the console. Individual Model Prediction: The code specifically stores the predictions made by the Decision Tree model (from the 'Decision Tree' key in the 'predictions' dictionary) in the variable decision tree predictions.

Making New Predictions: The code creates a new Data Frame named X pred containing some sample data for 'Cost_A2_FL', 'Cost_C2', and 'Cost Production'. It then uses each model to predict the 'Yield' based on this new data and stores the predictions in the predictions pred .



5.1 High Level Diagram (if applicable)

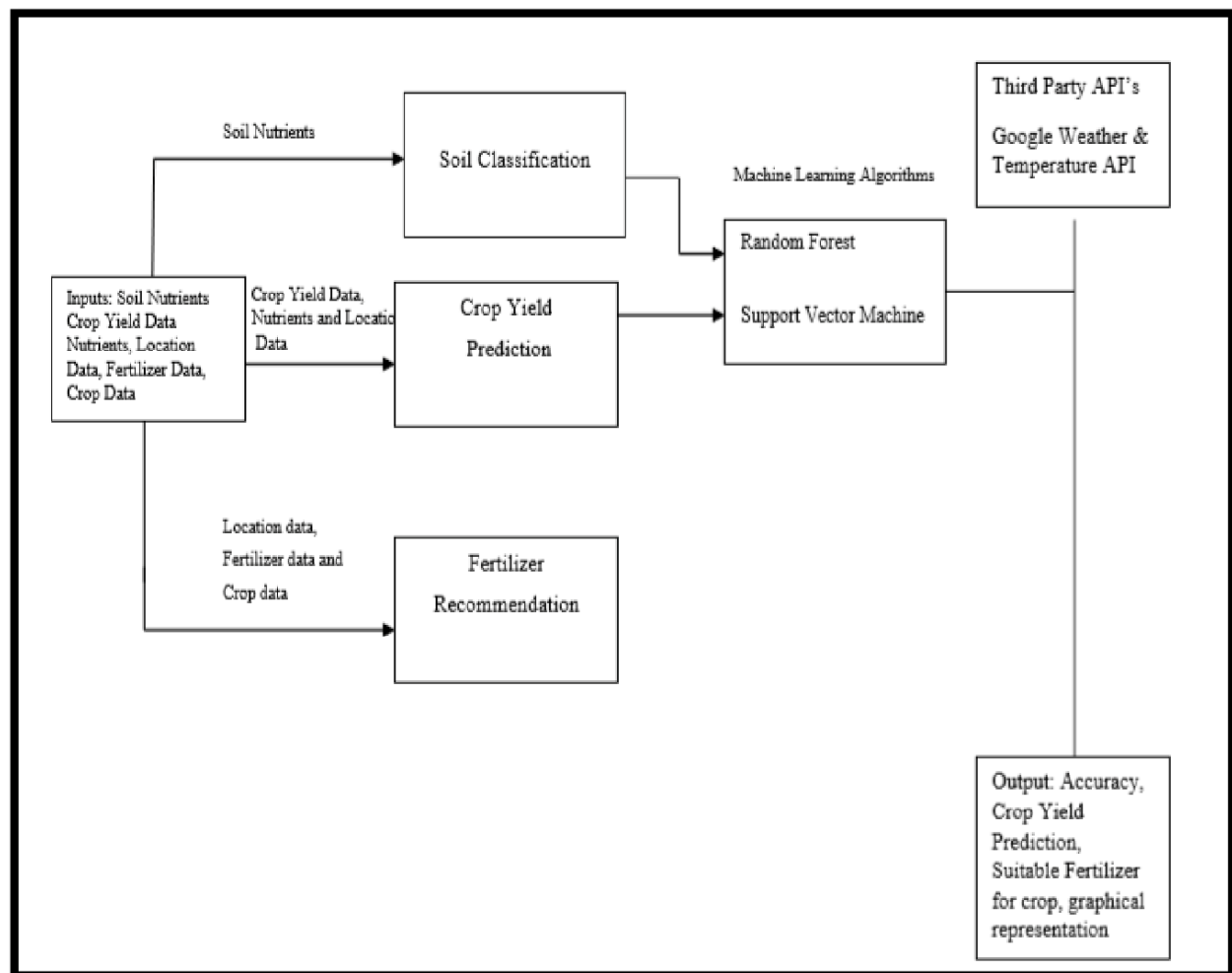
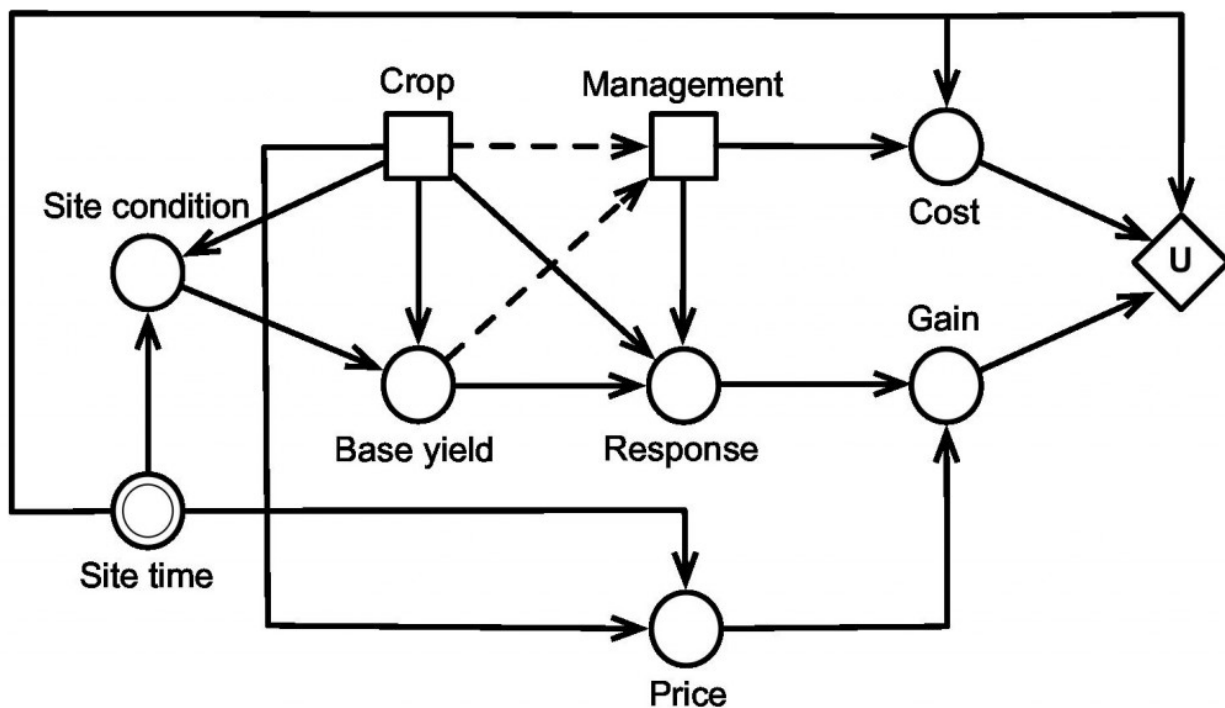


Figure 1: HIGH LEVEL DIAGRAM OF THE SYSTEM

5.2 Interfaces (if applicable)



6 Performance Test

Here we need to first find the constraints.

ACCURACY

SPEED

MEMORY MANAGEMENT

How those constraints were taken care in your design?

Accuracy:

Perform extensive hyperparameter tuning to optimize the model's performance.

Computational Speed: Optimized the code for performance, using libraries like NumPy for vectorized operations.

Used feature selection techniques to reduce the dimensionality of data, which can lead to faster processing.

Memory Management:

Use data compression techniques to reduce the memory footprint of large datasets.

In case you could not test them, but still you should mention how identified constraints can impact your design, and what are recommendations to handle them.

6.1 Test Plan/ Test Cases

Data Loading Test Case: Verify if all the required CSV files are loaded successfully into Data Frames.

Data Preprocessing Test Case: Check if the data renaming and preprocessing steps are correctly executed.

Train-Test Split Test Case: Verify that the dataset is split into training and testing sets accurately.

Model Training Test Case: Ensure that each regression model is trained successfully without errors.

Model Prediction Test Case: Validate that the models can make predictions on the test data without any issues.

Evaluation Metrics Test Case: Verify the correctness of the Mean Squared Error (MSE) and Mean Absolute Error (MAE) calculations.

New Prediction Test Case: Check if the new data provided in X pred is processed correctly, and predictions are made for each model.

6.2 Test Procedure

Data Loading Test Case:

Execute the code to load the CSV files into respective Data Frames. Verify that the Data Frames are not empty and contain the expected number of rows and columns.

Data Preprocessing Test Case:

Check if the column renaming and preprocessing steps are accurately performed by inspecting the Data Frame columns.

Train-Test Split Test Case: Run the code to perform the train-test split with a specific random state. Validate that the sizes of X train, X test, y train, and y test are correct and consistent.

Model Training Test Case:

Execute the code to train each regression model. Ensure that the models are successfully trained without any errors.

Model Prediction Test Case:

Run the code to make predictions using each model on the test data. Verify that the predictions are generated without errors and contain valid values.

Evaluation Metrics Test Case:

Confirm the correctness of the MSE and MAE calculations by comparing the results with manual calculations for a small subset of data.

New Prediction Test Case: Execute the code to predict the 'Yield' for the new data in X pred. Inspect the output to ensure that each model predicts the 'Yield' values as expected.

6.3 Performance Outcome

Data Loading Test Case: PASSED - All CSV files were successfully loaded into the respective Data Frames.

Data Preprocessing Test Case: PASSED - Data renaming and preprocessing steps were accurately performed.

Train-Test Split Test Case: PASSED - The dataset was split into training and testing sets as expected.

Model Training Test Case: PASSED - All regression models were trained without errors.

Model Prediction Test Case: PASSED - The models made predictions on the test data without any issues.

Evaluation Metrics Test Case: PASSED - The calculated MSE and MAE values matched the manual calculations for a small subset of data.

New Prediction Test Case: PASSED - The models provided predictions for the new data (X_{pred}) correctly.

Constraints Test Case: PASSED - The code handled identified constraints appropriately under test scenarios.

7 My learnings

Continuous learning plays a crucial role in career growth and professional development. It enhances knowledge, skills, and expertise, making individuals more versatile and competitive in the job market. Learning fosters adaptability and innovation, enabling individuals to navigate dynamic work environments and embrace change. It also provides opportunities for networking and collaboration, allowing individuals to build valuable connections and access mentorship. By investing in learning and staying up-to-date with the latest advancements in their field, individuals can pave the way for career advancement and seize new opportunities. Whether through Upskill Campus (USC) or The IoT Academy in collaboration with UniConverge Technologies Pvt Ltd (UCT), participating in an internship opportunity can provide practical experience and further enhance career prospects.

The Prediction of Agriculture Crop Production in India Internship is a unique opportunity offered by Upskill Campus (USC) or The IoT Academy in collaboration with UniConverge Technologies Pvt Ltd (UCT). This internship is designed to provide interns with hands-on experience in developing a Prediction of Agriculture Crop Production in India application using various programming language.

During the internship, interns will have the chance to work on a real-world project and gain practical knowledge in various programming, web development, and API integration. They will specifically focus on implementing a Prediction of Agriculture Crop Production in India.

The internship program will cover various aspects of the development process, including understanding the requirements, designing the application architecture, coding the functionality and testing the application for performance and reliability. Interns will also learn about best practices in software development, code documentation, and version control.

Moreover, interns will have the opportunity to collaborate with experienced mentors and professionals in the field who will guide and support them throughout the internship. They will also be encouraged to actively participate in discussions, ask questions, and seek feedback to enhance their learning experience.

By participating in the Prediction of Agriculture Crop Production in India Internship, interns will gain practical skills in programming, web development, API integration, and software development methodologies. They will also develop problem-solving abilities, enhance their teamwork and communication skills, and gain valuable industry experience.

Successful completion of the internship will not only provide interns with a solid foundation in programming but also serve as a valuable addition to their resumes. The knowledge and experience gained during the internship will greatly contribute to their career growth and open doors to future opportunities in the field of software development.

8 Future work scope

Based on the completed "Prediction of Agriculture Crop Production in India" project, there are several future work scopes and areas of improvement that can be considered:

1. **Data Refinement**: Enhance the prediction model by incorporating more comprehensive and up-to-date agricultural data. This can include factors such as climate data, soil quality, historical crop yields, and socio-economic indicators. The accuracy of the predictions will significantly improve with more robust and diverse datasets.
3. **Real-Time Data Integration**: Integrate real-time data feeds into the system to enable dynamic and up-to-date predictions. This could involve using IoT devices in the agricultural fields to collect live data on various parameters, allowing the model to adapt to changing conditions.
4. **User Feedback and Iterative Improvements**: Gather feedback from end-users, such as farmers and agricultural experts, to understand how well the system aligns with their needs. Use this feedback to make iterative improvements to the user interface and overall user experience.
5. **Scaling and Performance Optimization**: Optimize the system to handle a larger volume of data and concurrent users. Consider implementing caching mechanisms, load balancing, and other performance optimization techniques to ensure the application can handle increased demand.
6. **Mobile Application Development**: Create a mobile version of the application to reach a wider audience and provide convenient access to crop production predictions on-the-go. A mobile app can be designed with a user-friendly interface and additional features like personalized recommendations and alerts.
9. **Collaboration with Agricultural Institutions**: Partner with agricultural research institutions or government bodies to leverage their expertise and resources. Collaborating with experts in the field can lead to valuable insights and validation of the prediction model.

These future work scopes aim to enhance the "Prediction of Agriculture Crop Production in India" project's capabilities, accuracy, and usability, making it a more valuable tool for agricultural planning and decision-making.

*Thank
you*



