INDUSTRY INTERNSHIP REPORT

This industry Internship report is submitted to **Yeshwantrao**

Chavan College of Engineering

(An Autonomous Institution Affiliated to Rashtrasant Tukdoji Maharaj Nagpur University)

In partial fulfillment of the requirement For the award of the degree

Of

Bachelor of Engineering in Electronics and Telecommunication Engineering

Submitted By

RUTUJA SAHARKAR
(B-115)

Under the Guidance of
Saurabh Tembhurne & Veejay Gavali

Under the Supervision of
Dr. M.S. Dorle

NAME OF THE ORGANIZATION: EDUNET FOUNDATION

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DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Nagar Yuwak Shikshan Sanstha's

YESHWANTRAO CHAVAN COLLEGE OF ENGINEERING

(An autonomous institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur)

NAGPUR – 441 110

2024-2025

CERTIFICATE OF COMPLETION

This is to Certify that the Industry Internship Report entitled "**Green Skills and Artificial Intelligence under Skills4Future Program**" has been successfully completed by **Rutuja Saharkar** under the guidance of **Saurabh Tembhurne & Veejay Gavali** and in supervision of **Dr. M.S. Dorle** in recognition to the partial fulfilment for the award of the degree of Bachelor of Technology in Electronics & Telecommunication Engineering**, Yeshwantrao Chavan College of Engineering** ***(An Autonomous Institution Affiliated to Rashtrasant Tukdoji Maharaj Nagpur University)***

Dr. M.S.Dorle
College Internship/Faculty Supervisor
Associate Professor
Dept. of Electronics and Telecommunication
YCCE, Nagpur

Saurabh Tembhurne & Veejay Gavali
Industry Mentor
Edunet Foundation

ACKNOWLEDGMENT

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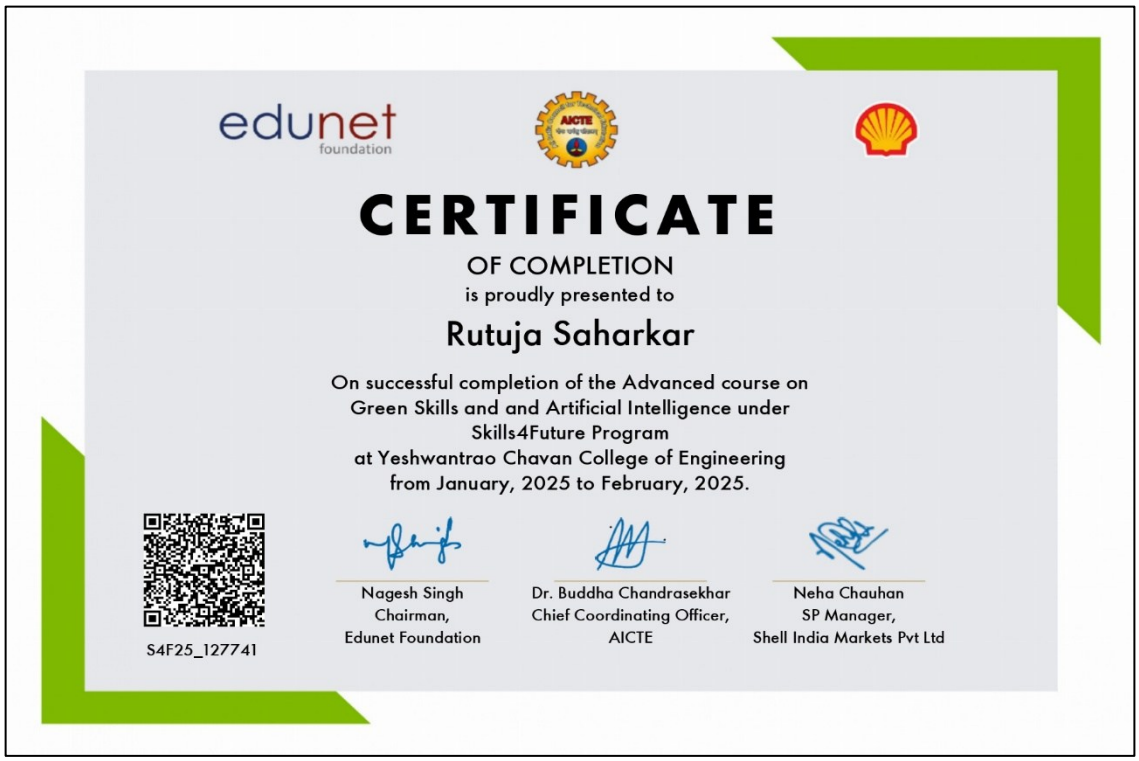
Finally, I thank God, our parents and friends for their moral support and constant encouragement.

INTERNSHIP COMPLETION CERTIFICATE



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OVERVIEW

Introduction

The pressing need to transition towards sustainable practices across all industries has become increasingly apparent in recent years. Skills4Future program is a collaboration between Shell India Markets Private Limited and the Edunet Foundation, aims to empower youth in higher and vocational education with Green skills through Artificial Intelligence (AI) technologies. With a youth unemployment rate of 29% and an expected increase in green jobs to 20 million by 2030, the program seeks to boost employability and equip students for emerging career opportunities that are often inadequately addressed by traditional curricula. The program prioritizes experiential learning and industry-relevant skills to cultivate a future-ready workforce that can drive innovation and sustainability. By addressing the gaps in conventional education, it equips students with the essential tools needed to succeed in a rapidly evolving job market.

Importance of Youth Environmental Sensitization: Educating youth on environmental issues fosters future eco-conscious leaders and sustainable practices.

Opportunities in AI: India's AI talent demand rising; youth need critical skills for industry growth.

Bridging Skills Supply-Demand Gap: The program addresses skill gaps in Green Skills and AI to meet industry expectations.

Fig.1. Logo

Objectives

1. Develop a Comprehensive understanding of green skilling and its importance in the context of sustainability.
2. Understanding of AI concepts, machine learning algorithms, and deep learning techniques and their contribution in sustainability efforts.
3. Gain hands-on experience with Python, the leading programming language for AI.
4. Use libraries like Pandas, NumPy, Scikit-learn, TensorFlow, and Keras for data manipulation, machine learning, and deep learning.
5. Understand how AI can be leveraged to solve problems related to energy efficiency, waste management, and sustainable agriculture.
6. Work on real-world datasets to model and predict environmental impacts using AI.
7. Learn how to develop interactive web applications using Flask, including integrating machine learning models and adding interactivity and customization features.
8. Understanding generative AI concepts and principles of LLMs.
9. Explore the ethical considerations and sustainability issues surrounding AI technology.
10. Discuss the impact of AI on society, focusing on fairness, transparency, and the environmental footprint of AI systems.
11. Apply all learned skills in a capstone project, solving a practical, real-world problem related to environmental sustainability using AI.
12. Demonstrate the ability to design, test, and deploy AI models in a real-world scenario.
13. Prepare for a career in the burgeoning field of AI, with a special emphasis on roles that contribute to sustainability and green technologies.

14. Hands-on experience: Gain practical experience through exercises, and real-world scenarios/case studies.

Type of Work

- Industry relevance: Stay up to date with current technologies, frameworks, and best practices.
- Understanding of Green Technologies and sustainable practices.
- Fundamental skills in Python programming.
- Proficiency in data handling, including manipulation, analysis, and visualization.
- Advanced programming concepts such as Object-Oriented Programming (OOP), error handling, and debugging.
- AI and Machine Learning: Competence in building, training, and evaluating models with Python, particularly for green initiatives.
- AI Application and Development Skills: Ability to create and deploy simple web applications.
- Basic Software Development Practices: Knowledge of version control systems that is Git and in building, testing and deploying an AI application.
- Basic understanding of Generative AI and Large Language Models (LLMs).
- Ethical Understanding of using AI in environmental contexts. Analytical and ProblemSolving Skills.
- Problem-solving with Algorithms: Skills in applying algorithmic thinking to break down problems and implement solutions. These skills prepare students to tackle real-world problems in domains like data analysis and artificial intelligence and their applications in sustainable practices.

TRAINING COMPONENT

Topics Covered

#	Description of the content to be covered	Duration (hrs.)
	Unit I- Foundation of Green Skilling, Sustainability and AI Contributions	**14**
1	**Green skilling and Sustainability** • Overview of sustainability: Definitions and Importance. • Green skilling and its importance in the context of sustainability. • Environmental challenges (climate change, pollution, deforestation, etc.) • Relevant Sustainable Development Goals (SDGs): SDG 7 (Affordable and Clean Energy), SDG 11 (Sustainable Cities and Communities), and SDG 13 (Climate Action) set by the United Nations.	4

2	**Green technologies in the context of global and Indian environmental challenges** • Renewable Energy Technologies. • Energy Efficiency and Management. • Sustainable Building and Smart Cities. • Waste Management and Recycling. • Jobs and Market Trends. **Case Study:** • Case studies on energy management in Indian industries.	5
3	**AI Contribution to Green Technologies** • Introduction to AI: Basics and its potential in addressing environmental issues. • Discussion on how AI is used globally and in India to enhance sustainability such as AI for precision agriculture, and AI in energy efficiency. **Case Study:** • Case studies on successful AI applications in green initiatives in India, such as AI for water management in agriculture and AI for pollution control.	5
	Unit II-Fundamentals of Artificial Intelligence, Machine Learning and Python Programming	23
4	**Fundamentals of Artificial Intelligence and Machine Learning** • Basics of AI: Definitions, history, and key concepts. • Introduction to machine learning. • Types of ML and its applications.	3
5	**Python Programming** • Basics of Python: Data types, variables, basic operators, and input/output • Control Structures: Conditional statements, loops. • Functions and Modules: Writing functions and importing modules. **Data Handling** • Data Structures: Lists, dictionaries, sets, tuples • File Handling: Reading from and writing to files.	6
6	**Object-Oriented Programming** • Classes and Objects: Understanding OOP, defining classes, and creating objects. • Inheritance and Polymorphism: Extending classes, using polymorphism.	5
7	**Advanced Python Concepts** • Exception Handling: Try, except blocks. • List Comprehensions and Generators • Decorators and Context Managers **Database programming with Python**: • SQL and Databases: Basic SQL queries, connecting SQL with Python	6
8	**Leveraging GitHub for AI Development** • Getting Started with GitHub for AI Projects • Understanding Git and GitHub for project development and repository creation. • Understand the application of GitHub Co-Pilot for AI-assisted coding within Python development environments to enhance collaboration and productivity in real-time coding sessions. **Hands-on:** Green Expense Tracker- Develop a console-based application to track expenses on environmentally sustainable products and services. This project will help students learn Python while focusing on green living and encouraging environmentally conscious budgeting and spending habits.	3
	Unit III- Applied Data Analytics with Python for Environmental Applications	**15**

9	**Data Processing and Analysis** • Introduction to data science and the data analysis process. • Data preprocessing techniques: Data cleaning, normalization, and transformation. **Hands-on:** • Analysing environmental datasets using Pandas and NumPy libraries in Python. • Visualizing data with Matplotlib and Seaborn, creating plots and charts to represent environmental data trends (e.g., pollution levels, temperature changes).	**7**
10	**Advanced-Data Analysis Techniques** • Advanced data analysis techniques: Time series analysis, correlation analysis, and hypothesis testing. • Statistical methods and their applications in environmental studies.	**4**
11	**Hands-on:** Applying statistical methods to real-world environmental datasets (e.g., air quality indices, weather data).	**4**
	Unit IV: Implementation and Deployment of Machine Learning and Deep Learning Algorithms	**20**
12	**Implementation and Deployment of Machine Learning** • Overview of different ML algorithms: Classification, regression, clustering. • Evaluation metrics for model performance of ML algorithm. **Hands-on:** • **Supervised Learning: Predicting Deforestation Risk with Decision Tree Classifier:** Use a Decision Tree classifier to predict the risk of deforestation in various geographic regions based on environmental and human factors. • **Unsupervised Learning: Segmenting Areas by Pollution Levels with K-means Clustering:** Use K-means clustering to segment a city into different areas based on pollution metrics like CO2 emissions, particulate matter, and noise levels to identify critical areas that need environmental interventions.	8

13	**Machine Learning Model Deployment with Flask and Heroku** • Introduction to Flask and Heroku for web application development and deployment. **Hands-on**: Developing a machine learning-powered web app using Flask and Deploying the Flask web app developed for Heroku.	2
14	**Deep Learning Techniques** • Introduction to neural networks and deep learning. • Convolutional Neural Networks (CNNs) for image processing and classification.	5
15	**Hands-on with Deep Learning Techniques:** • Creating AI models for waste segregation using OpenCV for image processing and CNNs for object classification and recycling optimization.	5
	Unit V: AI for Green Applications	**10**
16	**AI in Renewable Energy** • Overview of renewable energy sources: Solar, wind, hydro, and bioenergy. • Applications of AI in optimizing renewable energy systems. **Hands-on:** • Implementing AI algorithms to optimize energy production and consumption in smart grids.	**5**

17	**AI in Smart Cities and Sustainable Practices** • AI applications in smart city planning and development. **Hands-on:** • Implementing AI systems for energy management in smart buildings to optimize resource usage and reduce carbon footprints. • Implement an AI system to explore and identify potential buyers of Electric Vehicle in India.	**5**
	Unit VI: Generative AI and Large Language Models (LLMs) for Sustainable Solutions	**10**
18	**Introduction to Generative AI and LLMs** • Basics of generative AI: Definition, key concepts, and applications. • Overview of Large Language Models (LLMs) and their capabilities.	3
19	**Hands-on:** • Exploring pre-trained models like GPT-3/4 and their applications. • Fine-tuning LLMs on environmental datasets to perform specific tasks, such as generating climate reports or summarizing research articles.	7
	Unit VII: AI Ethics, Fairness, and Sustainability	**8**
20	**AI Ethics and Fairness** • Ethical considerations in AI development and deployment: Privacy, bias, transparency, and accountability. **Case Study:** • Case studies on ethical AI practices in different industries.	4
21	**Sustainable AI** • Sustainable AI practices and their importance. **Case Study:** Case studies on sustainable AI applications in sectors like agriculture and urban planning.	4
	Capstone Project	**40**
	Mentoring Framework: Integrating Design Thinking into AI for Green Applications Project Development	

Technologies/Tools Used

Hardware Requirement

- A Computer System (PC/Laptop) with Windows/Linux and compatibility with the required software(s) mentioned in the next section.
- High-speed internet connection.

Software and tools requirement:

- Visual Studio Code: https://code.visualstudio.com/download
- Anaconda Navigator: Anaconda Navigator :: Anaconda.org
- Git: For source code management. Git (git-scm.com)
- GitHub: For collaboration, backup, and other source control management features: https://github.com/

- GitHub Co-Pilot (https://github.com/features/copilot)
- Data Analysis and Machine Learning Libraries: NumPy, Pandas, Scikit-Learn, TensorFlow/ Keras, OpenCV.
- Python Web Framework: Flask Flask · PyPI

- Heroku Cloud Platform: Cloud Application Platform | Heroku
- Google Earth Engine: A cloud-based platform for planetary-scale environmental data analysis which uses Earth observation data combined with cloud computing, requires registration: Noncommercial – Google Earth Engine

PROJECT COMPONENT

Title: SUSTAINABLE CROP YIELD PREDICTION USING MACHINE LEARNING

Problem Statement: To build a predictive model for crop yield estimation using Soil Quality (pH), Weather Conditions, and Past Agricultural Data (past_crop_yield) to help in agricultural decision making.

Objectives & Scope: Agriculture plays a vital role in the global economy and food security, yet it faces numerous challenges due to climate change, soil degradation, and unpredictable weather patterns. Farmers often struggle with yield estimation, leading to inefficient resource allocation and potential financial losses. Sustainable Crop Yield Prediction using Machine Learning aims to address these challenges by leveraging data-driven insights for optimized agricultural productivity. Our project aligns with the United Nations' 17 Sustainable Development Goals (SDGs) specifically:

Zero Hunger (SDG 2) – By improving crop yield predictions, farmers can enhance food security and reduce the risk of shortages.

Climate Action (SDG 13) – Helps in sustainable farming practices by considering weather patterns and reducing envissronmental impact.

Responsible Consumption & Production (SDG 12) – Optimized yield predictions reduce wastage of agricultural resources.

Industry, Innovation & Infrastructure (SDG 9) – Uses Machine Learning & AI to bring technological advancement in agriculture.

By utilizing Machine Learning algorithms, specifically Linear Regression, we aim to predict crop yield efficiently based on soil quality, weather conditions, and past agricultural data. Our approach ensures sustainable farming, reduces environmental impact, and enhances decision making for farmers.

Methodology:

1. Dataset Description

The dataset used in this project consists of multiple features related to soil conditions, weather data, and past yield records. The dataset underwent preprocessing to remove missing values and ensure proper data formatting.

Feature Name	Description
Soil_Quality	A scale (1-10) indicating soil fertility
Temperature (°C)	Average temperature of the region

Rainfall (mm)	Rainfall received in the area
Past_Yield (kg/hectare)	Historical crop yield data
Crop_Yield (kg/hectare)	Target variable (Actual crop yield)

2. Data Preprocessing

- Handling Missing Values: Checked for null values and removed them.
- Feature Selection: Used relevant attributes for training the model.
- Data Splitting: The dataset was split into 80% training and 20% testing.

3. Machine Learning Models Used & Flow Chart

To ensure the best possible accuracy, multiple machine learning models were trained and compared:

Decision Tree Regressor

Random Forest Regressor

XGBoost Regressor

Linear Regression

Gradient Boosting Regressor

Support Vector Regressor (SVR) (without tuning)

Model Training & Evaluation Metrics:

Evaluation Metrics Used:

Mean Squared Error (MSE)

Root Mean Squared Error (RMSE)

Mean Absolute Error (MAE)

R-squared (R^2 Score)

Model Comparison Table

Model	R^2 Score (Accuracy)	RMSE	MAE
Linear Regression	82.44%	92.88	74.87
Random Forest	99.30%	18.54	8.05
Decision Tree	**99.62%**	**13.65**	**1.15**
Gradient Boosting	87.32%	78.92	64.69
XGBoost	99.33%	18.10	10.91

SVR (without tuning)	82.31%	93.21	74.50

After training the Decision Tree Regression model, we evaluated its performance using the following metrics: **Higher R-squared value (99.62%)** indicates that the model explains most of the variance in crop yield. **Lower RMSE (13.65) and MAE (1.15)** show that the model's predictions are close to actual values.

Best Suited Model: Decision Tree Regressor: Among all tested models, Decision Tree Regressor performed the best with an R^2 Score of 99.62%. This model is best suited for the crop yield prediction task due to:

- **High Accuracy:** The Decision Tree model captures non-linear relationships between features, making it well-suited for agricultural datasets.
- **Interpretability:** It provides clear decision-making steps, making it easier to understand the impact of each feature on the yield.
- **Efficiency:** The model runs quickly and effectively with structured numerical data.
- **Low Bias and High Variance:** Since Decision Trees can overfit, careful parameter tuning can further enhance performance while maintaining accuracy.

Visualization:

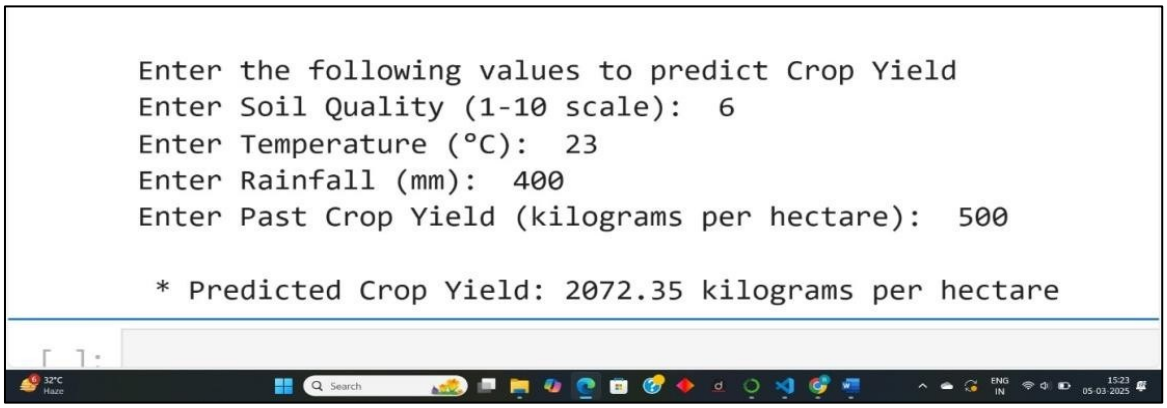
Actual vs Predicted Crop Yield: A scatter plot was generated to compare actual vs predicted crop yield values. The red dashed line represents the ideal prediction line, indicating where the predicted values should align perfectly with the actual values. The blue points in the scatter plot represent the actual vs predicted values for crop yield. A strong alignment of blue points along the red dashed line signifies that the model is making highly accurate predictions. Minimal deviation from the line indicates that the model generalizes well to unseen data.

Model Deployment: To deploy the trained model, it was saved using the Joblib library, allowing real-time predictions. Model (crop_yield_data.pkl). A user can input real-time data, and the model will predict the crop yield.

Implementation & Outcome:

```
[699]: print("\nEnter the following values to predict Crop Yield ")
soil_quality = float(input("Enter Soil Quality (1-10 scale): "))
temperature = float(input("Enter Temperature (°C): "))
rainfall = float(input("Enter Rainfall (mm): "))
past_yield = float(input("Enter Past Crop Yield (kilograms per hectare): "))
# Convert input into a DataFrame
input_data = pd.DataFrame([[soil_quality, temperature, rainfall, past_yield]],
                          columns=['Soil_Quality', 'Temperature', 'Rainfall', 'Past_Yield'])
# Predict crop yield
predicted_yield = model.predict(input_data)[0]
print(f"\n * Predicted Crop Yield: {predicted_yield:.2f} kilograms per hectare")
```

Among all tested models, the Decision Tree Regressor performed the best with an R^2 Score of 99.62%, making it the optimal choice for crop yield prediction.



Challenges & Solutions: No such challenges were faced while going through Internship as it was planned systematically such as how to conduct, where to conduct, what has to be covered in terms of syllabus all things were critically & efficiently organized and managed.

Skills Acquired:

Technical Skills:

- Understanding of Green Technologies and sustainable practices.
- Fundamental skills in Python programming.
- Proficiency in data handling, including manipulation, analysis, and visualization.
- Advanced programming concepts such as Object-Oriented Programming (OOP), error handling, and debugging.
- AI and Machine Learning: Competence in building, training, and evaluating models with Python, particularly for green initiatives.
- AI Application and Development Skills: Ability to create and deploy simple web applications.
- Basic Software Development Practices: Knowledge of version control systems that is Git and in building, testing and deploying an AI application.
- Basic understanding of Generative AI and Large Language Models (LLMs).
- Ethical Understanding of using AI in environmental contexts.

Analytical and Problem-Solving Skills

- Problem-solving with Algorithms: Skills in applying algorithmic thinking to break down problems and implement solutions.

CONCLUSION & FUTURE SCOPE

Summary of Learning Experience

The Skills4Future program, a collaborative initiative by Shell India Markets Private Limited and the Edunet Foundation, provided a comprehensive and transformative learning experience focused on integrating Artificial Intelligence (AI) with Green Skills. Throughout the internship, I gained a robust understanding of sustainability concepts, green technologies, and the critical role AI can play in addressing pressing environmental challenges. The structured curriculum, combining theoretical knowledge with extensive hands-on practice, facilitated skill development in Python programming, machine learning, data analysis, and web application deployment.

Exposure to tools and platforms such as Pandas, Scikit-learn, TensorFlow, Flask, GitHub, and Heroku, as well as engagement with real-world environmental datasets, significantly enhanced my technical competencies. Moreover, the emphasis on AI ethics, fairness, and sustainability helped me develop a socially responsible approach to technology use.

The program's capstone project, *Sustainable Crop Yield Prediction using Machine Learning*, offered practical experience in solving an authentic problem using data-driven methods. It highlighted how technology can be harnessed to support sustainable agriculture and contribute meaningfully to multiple Sustainable Development Goals (SDGs).

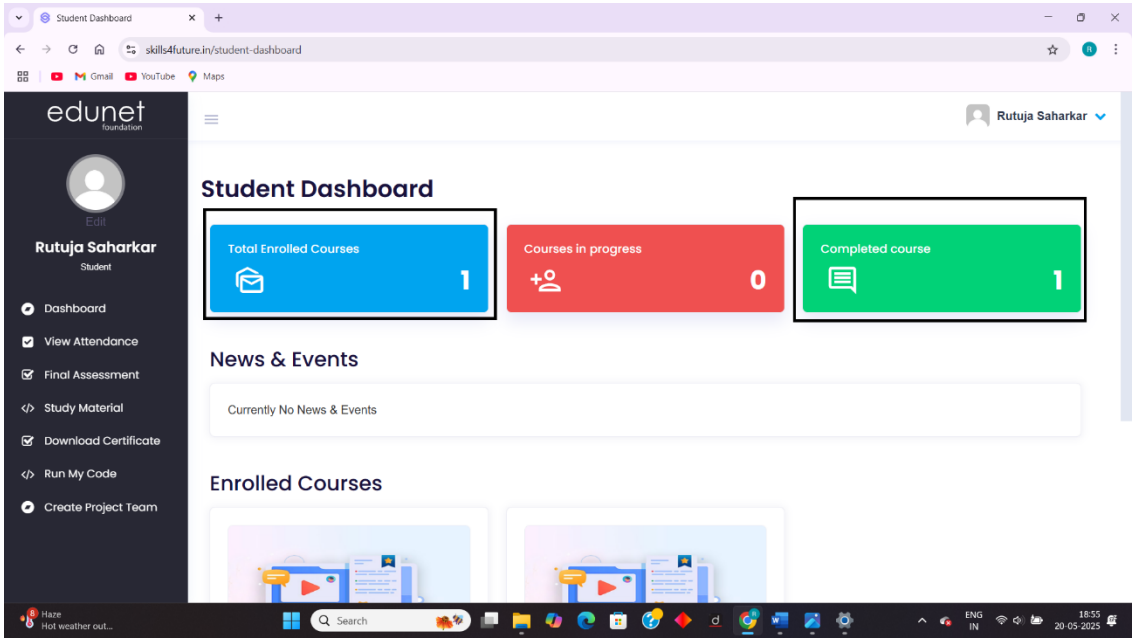
Outcome of Internship

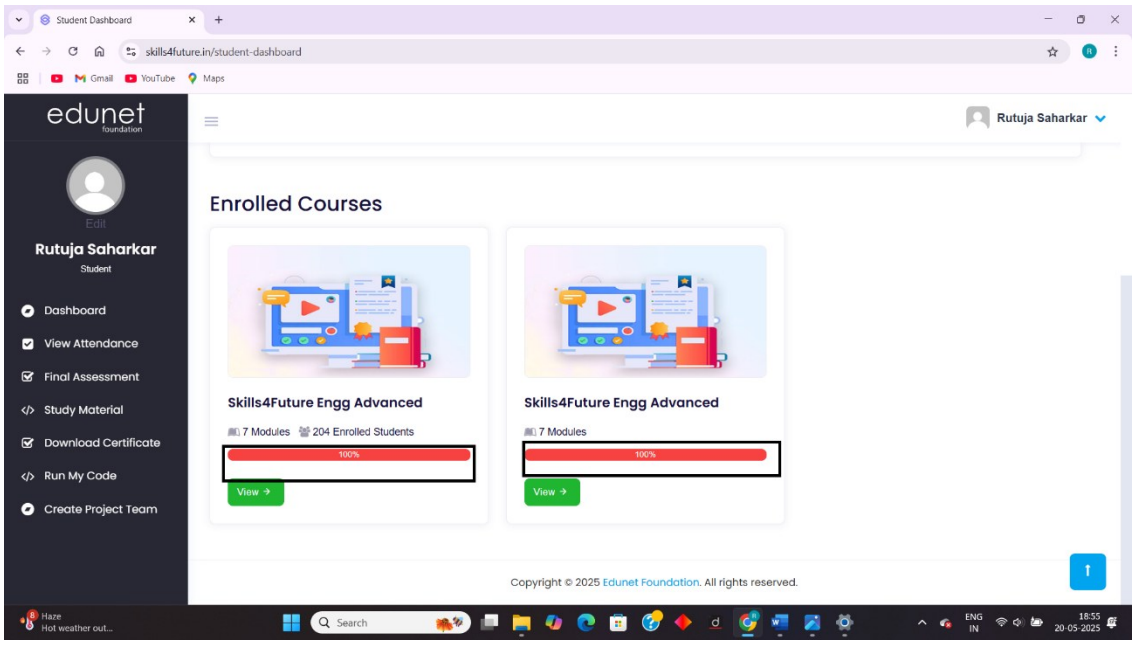
- Developed and deployed a machine learning model using the Decision Tree Regressor for crop yield prediction, achieving a high R^2 Score of 99.62%, which demonstrates strong model performance.
- Successfully implemented real-time prediction capabilities by deploying the model with Flask and Joblib, showcasing readiness for industry application.
- Acquired technical expertise in Python, AI/ML, data visualization, and application deployment.
- Gained a well-rounded understanding of environmental sustainability, green technologies, and the role of AI in promoting sustainable development.
- Improved problem-solving, analytical thinking, and project management skills through a structured and industry-aligned learning process.

Future Scope:

With the growing demand for green jobs and AI-driven solutions, the skills acquired during this internship open up strong career prospects in fields like smart farming, climate tech, and sustainable AI development. There is potential to improve the project further by incorporating satellite data, IoT-based sensors, and real-time weather updates, making it more scalable and robust for practical deployment.

ANNEXURES





REFERENCES

Advance Course Registration Link: https://skills4future.in/advanced-student-registration
Official Portal Link: https://skills4future.in/
For more details or to register Skills4Future official website