Mini Project Report

Entitled

"Environment Based Crop Detection"

Submitted to the Department of Electronics Engineering in Partial Fulfilment for the Requirements for the Degree of

Bachelor of Technology
(Electronics and Communication)

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CERTIFICATE

This is to certify that the Mini-Project Report entitled "**Environment Based Crop Detection**" is presented & submitted by Shanya Gupta (U21EC021), Shraddha Sidurkar (U21EC030), Raj Modh (U21EC044), of B.Tech. VI, 6^{th} Semester in the partial fulfillment of the requirement for the award of B.Tech. Degree in Electronics & Communication Engineering for academic year 2023-24.

They have successfully and satisfactorily completed their **Mini-Project** in all respects. We, certify that the work is comprehensive, complete and fit for evaluation.

Dr. Kishor Upla
Assistant Professor & Project Guide

Abstract

Identifying crop types accurately and promptly in accordance with environmental conditions is essential for effective agricultural management and resource optimization. In this project, we use machine learning techniques to propose a novel approach for crop detection based on the environment. By utilizing environmental data, including temperature, humidity, soil moisture, and light intensity, we create a predictive model that can accurately classify different crop types.

Our approach entails gathering environmental data from sensor networks positioned throughout agricultural lands. In order to extract pertinent features indicative of the environmental preferences of various crop types, we preprocess and analyze this data. We then train and validate our crop detection model using machine learning algorithm.

Table of Contents

List of Figures

List of Tables

Chapter 1
Introduction

1.1 Motivation

Our ”Environment Based Crop Detection” project is motivated by the demand for more sustainable and effective farming methods. Our goal is to create a system that can precisely detect and identify crop types based on environmental factors like temperature, humidity, soil moisture, and light conditions by utilizing machine learning and environmental data.

Crop monitoring and identification using traditional methods can be labor-intensive, time-consuming, and frequently dependent on subjective evaluations. We aim to improve and automate this process by machine learning, giving farmers and other agricultural stakeholders the ability to make data-driven decisions for the best possible crop, resource allocation, and general farm management.Our project’s ultimate goal is to further precision agriculture by providing farmers with useful information that they can use to increase output, save resources, and lessen their impact on the environment.

1.2 Benefits of Crop Detection

Some of the benefits of Detecting the crops are:

1. Optimized Resource Allocation: Farmers can more effectively use resources like water, fertilizer, and pesticides by precisely forecasting which crops are likely to flourish in particular environmental circumstances. Crop yields may rise as a result of this optimization, and resource waste may decline.

2. Risk Mitigation: Farmers can foresee and reduce risks related to unfavorable weather or environmental stressors by using environmental-based crop prediction. Farmers can reduce the effect of erratic weather on their harvests by choosing crop varieties that are tolerant of specific circumstances.

3. Better Crop Management: Crop prediction offers insightful information about planting dates, crop rotation, and pest control techniques. With predictive models and historical environmental data at their disposal, farmers can make well-informed decisions about when and where to plant specific crops.

4. Enhanced Sustainability: Environmentally-based crop prediction encourages sustainable agricultural practices by matching crops to their ideal environmental conditions.

Farmers that cultivate crops that are naturally suited to the local climate and soil conditions can minimize their impact on the environment and reduce their use of chemical inputs.

5. Enhanced Profitability: In the end, farmers may see an increase in profitability as a result of environmental-based crop prediction. Farmers can increase their profitability and the financial sustainability of their farming operations by optimizing crop yields, cutting input costs, and lowering crop failure risks.

Chapter 2
Algorithm Implementation

2.1 Accuracy Comparison between Algorithms

To classify crop types based on environmental parameters, a variety of machine learning algorithms were experimented with in the ”Environment Based Crop Detection” project. To ascertain which algorithms are most effective at accurately identifying crop types, a thorough evaluation of Support Vector Machine (SVM), Random Forest, Logistic Regression, and Decision Tree algorithms was conducted (as shown in Table 2.1). The Decision Tree algorithm outperformed the other algorithms, producing the highest accuracy(98.88 percent) in crop classification. This result emphasizes how crucial it is to choose the best algorithm for the particular task at hand and shows how decision tree-based technique is the best fit for environment based crop detection.

2.2 Decision Tree Classifier

A fundamental machine learning method called the Decision Tree algorithm builds a tree-like structure to represent decisions based on input features. At each node, the dataset is recursively divided into subsets, with the best feature and threshold chosen to maximize the purity of the resulting subsets. This process generates a tree where each leaf node represents a final choice or prediction, and it continues until a stopping criterion is satisfied. Because of their ease of use, interpretability, and efficacy, decision trees are popular and useful for both classification and regression tasks. Applications for them can be found in many different fields, such as spam detection, anomaly detection, feature selection, and medical diagnosis.

Sr no.	Classifier	Accuracy
1	SVM	87.77%
2	Decision Tree	98.88%
3	Logistic Regression	81.11%
4	Random Forest	97.77%

Table 2.1: Accuracy of Different Algorithms

2.2.1 Decision Tree Classifier Algorithm

Algorithm for creating a Decision Tree model that takes temperature, humidity, and rainfall into account when detecting crops:

1. Data Gathering: Gather historical information on crop varieties and the corresponding environmental factors (temperature, rainfall, humidity).Handle missing values in the preprocessed data, normalize features, and encode categorical variables if needed.

2. Dividing Standards: Select an information gain or Gini impurity splitting criterion to find the optimal feature and threshold for data splitting at each node.

3. Construct the Decision Tree: Start with a root node that has every sample in it. Choose the most advantageous feature and threshold to divide the data according to the selected criterion. Until a stopping criterion is satisfied, recursively divide the data into subsets at each node according to the chosen feature and threshold (e.g., maximum tree depth or minimum number of samples in a node). Make leaf nodes for each subset that contain the average value for regression or the majority class.

4.Training: Utilize the historical data to train the Decision Tree model by dividing it recursively into temperature, humidity, and rainfall, and continuing this process until the stopping criterion is met.

5. Prediction: Navigate the Decision Tree to predict the corresponding crop type at the leaf node reached, given new values for the environmental parameters (temperature, humidity, and rainfall).

An overview of the process of developing a Decision Tree model for crop detection based on environmental parameters is given by this algorithm. Specifics of the implementation, like the pruning method and splitting criterion, can change based on the machine learning framework or library selected.

2.3 Hardware Implementation

2.3.1 Arduino UNO

A popular microcontroller board based on the ATmega328P chip is the Arduino Uno. With its digital and analog input/output pins, it can communicate with a range of actuators, sensors, and other electronic parts. Because of its simplicity, affordability, and ease of use, the Uno is well-liked by both novice and seasoned electronics enthusiasts. It's frequently used to create interactive objects, robots, electronic devices, and more in prototyping and do-it-yourself projects. Because of its adaptability and robust community, it can be used for a variety of tasks, such as robotics, home automation, Internet of Things (IoT) projects, and teaching.' .

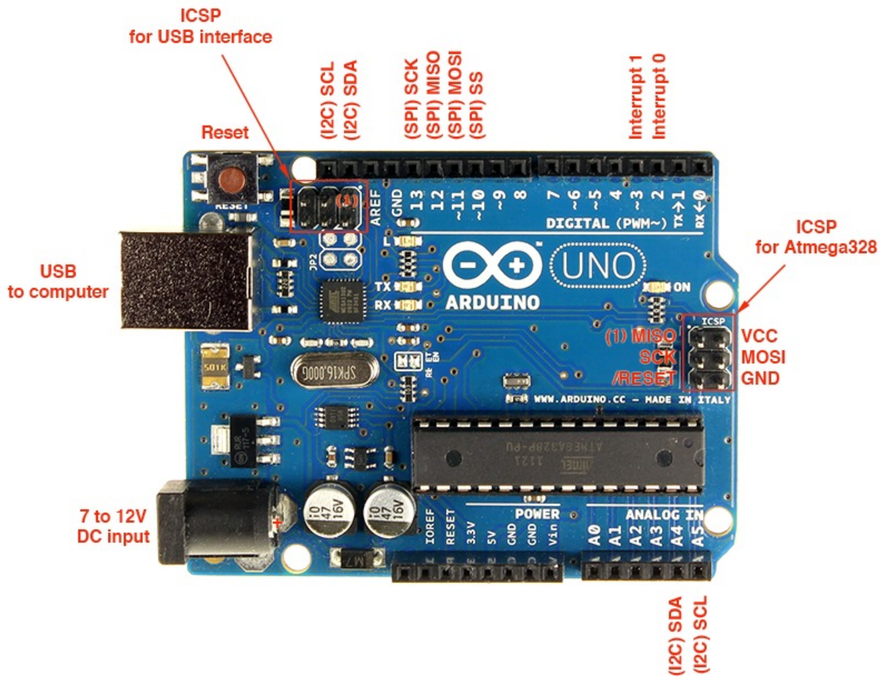

Figure 2.1: Arduido UNO

2.3.2 DHT 11

A simple, inexpensive digital temperature and humidity sensor is the DHT11. It generates a digital signal proportional to the temperature and humidity using a thermistor and capacitive humidity sensor to measure the ambient air. Due to its affordability and ease of use, the DHT11 is a popular choice for DIY electronics projects and is well-liked by enthusiasts and hobbyists. It is simple to integrate into a variety of projects for environmental condition monitoring because it communicates with microcontrollers like Arduino via a single-wire digital interface. .

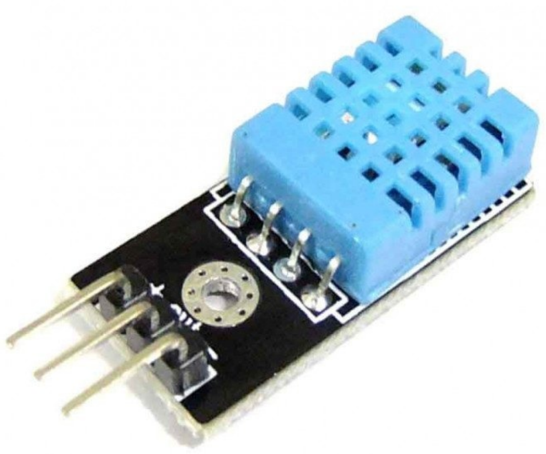

Figure 2.2: DHT 11 Sensor

2.3.3 Hardware Connections

To connect a DHT11 sensor, an Arduino Uno, and an LCD display for crop detection, we'll need to establish the following hardware connections:

DHT11 Sensor to Arduino Uno:
DHT11 Pin 1 (VCC) to Arduino 5V pin
DHT11 Pin 2 (Data) to any digital pin on the Arduino (pin ADC0)
DHT11 Pin 4 (GND) to Arduino GND pin

LCD Display to Arduino Uno:
LCD VSS pin (Ground) to Arduino 5V pin
LCD VDD pin (Power) to Arduino 5V pin

LCD VEE pin (Contrast) to a potentiometer's middle pin
LCD RW pin (Read/Write) to Arduino GND pin (if you are only writing to the display)
LCD RS pin (Register Select') to digital pin- PBS/SCK on the Arduino
LCD E pin (Enable) to digital pin- PB4/MISO on the Arduino
LCD D4, D5, D6, D7 pins to four consecutive digital pins on the Arduino - pins 9, 10, 11, 12

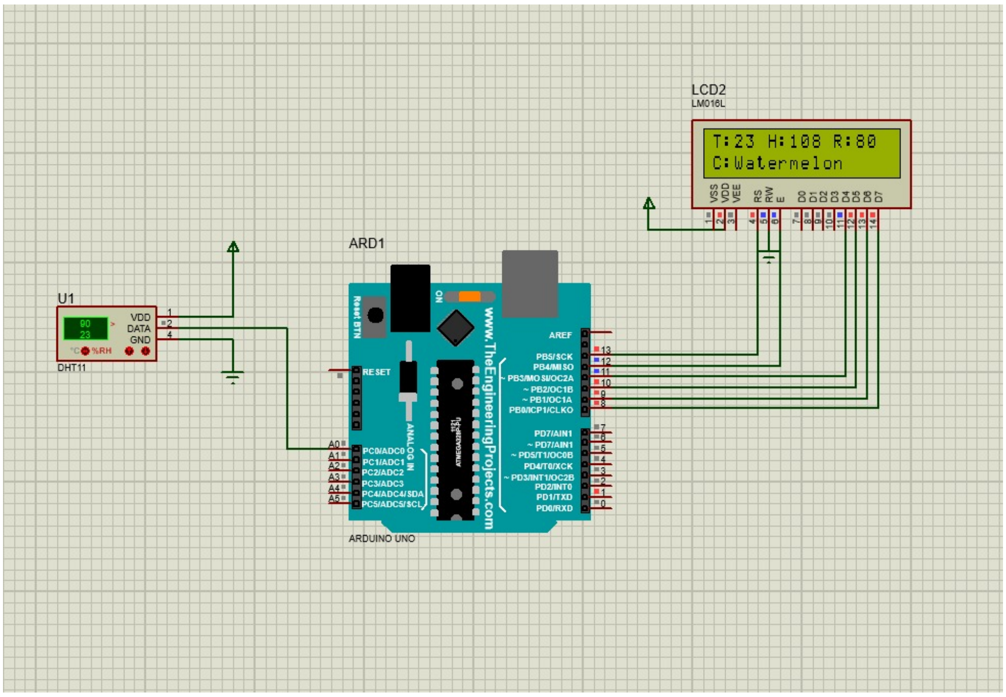

Figure 2.3: Project Hardware Connections

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2.3.4 Output

The following output image shows the successful prediction of crop depending on the input received from temperature, humidity and rainfall sensing. .

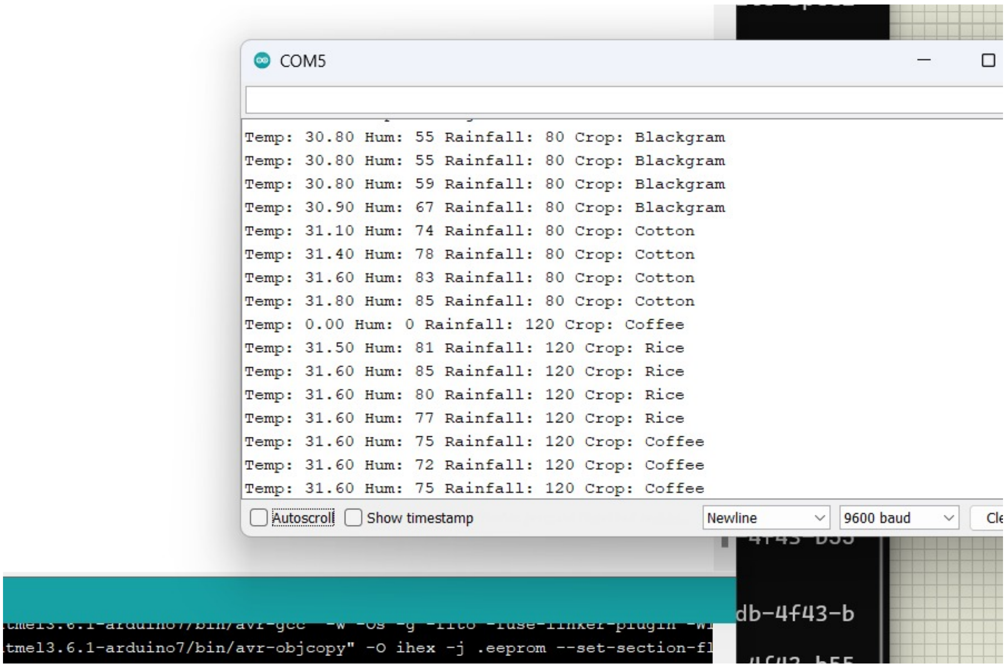

Figure 2.4: Result: Crop detected

Conclusion

The conclusion of ”Environment Based Crop Detection” project is that we can effectively identify and categorize crops according to environmental factors by using machine learning algorithms. Using a variety of algorithms, including Random Forest, Support Vector Machine (SVM), Logistic Regression, and Decision Tree, and comparing and contrasting them, it was found that Decision Tree performed the best, achieving an astounding accuracy of 98.88 Percent.

Given its high accuracy, Decision Trees appear to be especially useful for classifying crop types according to environmental factors. Its success here was probably due to its ability to design an understandable and transparent feature-importance-based decision-making process.

This project is important for reasons that go beyond agriculture. Better resource allocation, crop monitoring, and land management can all be facilitated by accurate crop detection. Using machine learning techniques, agricultural experts and farmers can optimize yields while minimizing resource waste and environmental impact by making well-informed decisions about crop selection, irrigation, fertilization, and pest control.

Furthermore, the accomplishment of this project using Decision Tree highlights the significance of algorithm selection in machine learning applications. Even though every algorithm has advantages and disadvantages, selecting the best one for a given task can have a big impact on the model’s effectiveness and accuracy. To sum up, the ”Environment Based Crop Detection” project shows how effective machine learning can be in agricultural settings, especially when it comes to crop detection. A highly accurate model was produced by applying the Decision Tree algorithm, opening the door for more exact and environmentally friendly farming methods. This project is evidence of how machine learning can be applied to solve practical problems and maximize resource use across a range of industries..

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