ELECTRONIC PRODUCT DESIGN PROJECT REPORT

on

EARLY DETECTION OF POSSIBLE DISEASE IN RICE

Submitted by

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in partial fulfillment of the requirement for the award of the degree of

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DIVISION OF ELECTRONICS ENGINEERING

SCHOOL OF ENGINEERING

COCHIN UNIVERSITY OF SCIENCE AND TECHNOLOGY

KOCHI-682022

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DIVISION OF ELECTRONICS ENGINEERING

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CERTIFICATE

Certified that the seminar report entitled ***"EARLY DETECTION OF POSSIBLE DISEASES IN RICE CROPS"*** *is a bonafide work of* ***JOEL ROY*** *towards the partial fulfillment of the award of the degree of B.Tech in Electronics and Communication of Cochin University of Science and Technology, Kochi-682022.*

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ACKNOWLEDGMENT

At the very outset of this report, I would like to extend my sincere thanks and heartfelt obligations to all personages who have helped me in this endeavor. I am extremely thankful and pay our gratitude to Assistant Professor. Mrs. Darsana Vijay, Assistant Professor Mrs. Deepa R, and Mrs Rinu Varghese, Mrs Lakshmi S Panickar for their valuable guidance and support on the completion of this project in its present. I deeply express my sincere thanks to the Head of the Department, Dr. Professor Anju Pradeep for encouraging us for doing this project. Lately, I would like to express deep apperception to my classmates, friends from Bsc. Agriculture, and family for their kind cooperation and encouragement which helped us in the completion of this project.

JOEL ROY

ABSTRACT

Rice is one of the most important staple crops in the world, feeding billions of people, especially in India. However, rice crops are susceptible to various diseases that can significantly reduce yield and quality. In this project, we aim to develop a system for early detection of the disease which the crop is prone to based on the weather conditions. By analyzing the weather conditions prevailing in an area, our system will be able to predict the chances of disease occurring and provide early warning to farmers, allowing them to take appropriate action to protect their crops. A present study was undertaken to understand the relationship of environmental factors in disease occurrence in paddy seedlings under agroclimatic conditions in India. The project mainly focuses on the prediction of the three major diseases; Blast, Sheath Blight, and Brown Spot. The weather and soil conditions like temperature, soil moisture, soil nutrients, light, air humidity, soil pollutants, soil pH, etc. influence the seasonal development and geographical distribution of plant diseases. When the crops are made to withstand such changes for more than 48 hours, the chances of crops getting affected cannot be neglected. There are some specific temperature and humidity ranges which when existing for a prolonged time can yield to crop failure. Thus our system checks for the time the crop remains in the disease-occurring temperature and once it goes beyond 48 hours, the system provides an alert message via Gmail to the farmer's phone. The message will be containing the possible disease and its precautionary measures at each stage. Thus any farmer with a mobile connected to the internet can get alerts. This project has the potential to significantly improve the productivity and sustainability of rice farming, helping to ensure food security for future generations and financial security for the farmers.

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LIST OF ABBREVIATIONS

1. V-Voltage
2. Hz-hertz
3. mm-Millimeter
4. cm- Centimeter

CHAPTER 1
INTRODUCTION

India is one of the largest rice producers in the world. About 44%of the total population in India is directly involved in farming and 86%household women of rural India practice rice cultivation. Despite being a widespread job, people still use the traditional methods of farming without using technology. But as climatic changes are now more prevalent in the Indian subcontinent such kind of predictions may be not helpful. Timely management of rice diseases is crucial to ensure optimal crop yield and quality. Traditional methods of disease detection rely on visual inspection, which is time-consuming and subjective. This project aims to develop a system for the detection of rice diseases using temperature and humidity and moisture data. By leveraging temperature and humidity data, we can develop an automated system to detect rice diseases accurately and efficiently.

1.1 Objectives:

The main objectives of this project are as follows: Develop a database of temperature and humidity profiles leading to unhealthy rice plants. Analyze the relationship between environmental conditions (temperature and humidity) and the occurrence of rice diseases. Design and implement an automatic model that alerts the farmer based on temperature and humidity inputs. Validate the accuracy and effectiveness of the developed system through traditional detection methods.

1.2 Expected Outcomes and Impact:

The successful completion of this project will have several significant outcomes and impacts: An automated system capable of accurately detecting rice diseases based on temperature and humidity inputs, providing an efficient and objective tool for farmers. Early detection of diseases will allow farmers to implement timely disease management strategies, reducing yield losses and minimizing the use of chemical treatments. Increased crop productivity and improved resource utilization through targeted disease management, leading to enhanced food security and economic sustainability.

The framework of the project can be extended to other crop systems, facilitating the development of similar disease detection systems for different agricultural contexts.

1.2 Advantages of the Project

- Reduces the loss of crops in large-scale cultivations
- It can be used for detecting any disease
- Reduces the overhead of monitoring crops daily
- Reduces the risk of being exposed to Pesticides

CHAPTER 2

SYSTEM BLOCK DIAGRAM AND EXPLANATIONS

BLOCK DIAGRAM :

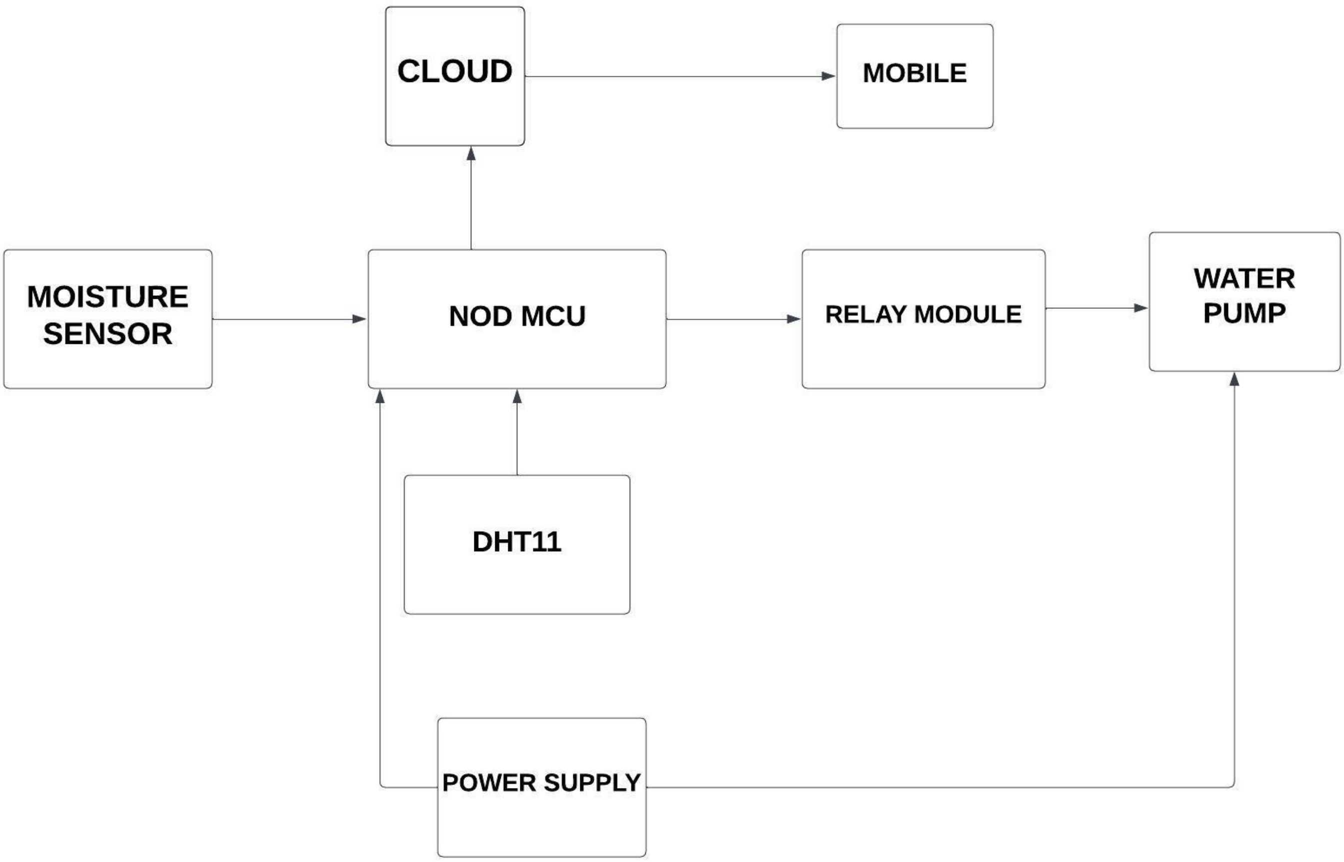


Fig 2.1 System Block Diagram

DHT11 checks the current humidity and temperature. When the disease occurs temperature - humidity conditions are detected, and the data is sent to Node MCU. Node MCU will store the data in the cloud and will push the notification to the Gmail provided in the code. Events for the three diseases have been created in the cloud.

When DHT11 identifies the required conditions it will call the particular event(Blast, Brown Spot, Sheath Blight) from the code, and the cloud will push data regarding the disease, and details of the precautionary measures. The moisture sensor will check the moisture and feed it to Node MCU. Therefore information regarding moisture content is also available to the farmer via Gmail.

If the farmer wishes to take precautions by spraying pesticides or pumping water then he can turn on the pump via mobile. This is achieved by using a 12v DC water pump. Since 12v cannot be derived from Node MCU, a 5v 2-channel relay module is used. The relay will act as a switch to switch ON the pump. Since we use IoT, the farmer can control their actions from any part of the world using a Mobile connected to the internet.

CHAPTER 3
CIRCUIT DESIGN AND WORKING

3.1.Components

3.1.1 DTH11 Humidity and Temperature Sensor

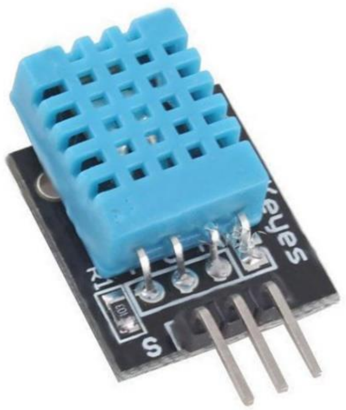


Fig 3.1 DTH11

DHT11 is a low-cost digital sensor for sensing temperature and humidity. The DHT11 sensor utilizes a capacitive humidity sensor and a thermistor to measure humidity and temperature, respectively. It measures the changes in capacitance and resistance caused by the surrounding air's humidity and temperature. The DHT11 uses a single-wire digital communication protocol to transmit data to a microcontroller or other devices. It sends the measured values in a 40-bit data packet. This sensor can be easily interfaced with any microcontroller such as Arduino, Raspberry Pi, etc to measure humidity and temperature instantaneously. The temperature range of DHT11 is from 0 to 50 degrees Celsius with a 2-degree accuracy. The humidity range of this sensor is from 20 to 80% with 5% accuracy. The sensor operates on a DC voltage of 3.3V to 5V and consumes very low power during operation. The DHT11 sensor typically has three pins for connection: VCC (power supply), GND (ground), and a digital output pin for data transmission. The sampling rate of this sensor is 1Hz .i.e. it gives one reading for every second. DHT11 is small in size with operating voltage from 3 to 5 volts. The maximum current used while measuring is 2.5 mA. This sensor is directly connected to the Node MCU through the pin numbers.

3.1.2.Jumper Wires

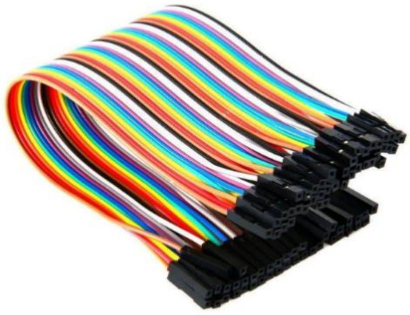


Fig 3.2 Jumper Wires

Jumper wires are simply wires that have connector pins at each end, allowing them to be used to connect two points to each other without soldering. Jumper wires are typically used with breadboards and other prototyping tools in order to make it easy to change a circuit as needed

All three types of jumper wires(Male to Male, Male to Female, and Female to Female) are used to connect the circuit.

3.1.3.Node MCU

Fig 3.3 Node MCU

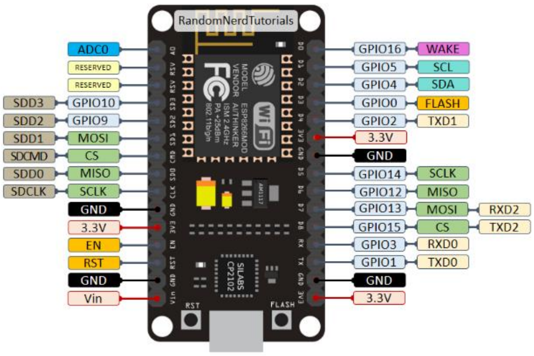


Fig3.4 Node MCU Pin Diagram

The Node MCU (Node Micro Controller Unit) is an open-source software and hardware development environment built around an inexpensive System-on-a-Chip (SoC) called the ESP8266. The ESP8266, designed and manufactured by Espressif Systems, contains the crucial elements of a computer: CPU, RAM, networking (Wi-Fi), and even a modern operating system and SDK. That makes it an excellent choice for Internet of Things (IoT) projects of all kinds. NodeMCU ESP8266 is a powerful and versatile development board that combines the ESP8266 Wi-Fi module with an easy-to-use programming environment.

NodeMCU provides multiple General-Purpose Input/Output (GPIO) pins, which can be used to connect and control external devices such as sensors, LEDs, relays, and more. These pins support digital input/output and analog input capabilities.

It offers a wide range of features and capabilities, making it an excellent choice for prototyping and developing IoT applications. Its support for Lua and Arduino programming languages, along with its extensive library ecosystem, makes it accessible to developers of all skill levels. The board operates at a voltage of 3.3V, and it is important to note that it is not 5V tolerant. Applying a voltage higher than 3.3V can damage the board.

3.1.4.5v 2Channel Relay

Fig 3.5 5VChannel Relay

A 5V 2-channel relay module is an electronic device that allows you to control high-power circuits or devices using low-power signals from microcontrollers, Arduino boards, or other control systems.

The primary purpose of a relay module is to provide electrical isolation and control between low-power control signals (such as 5V signals from microcontrollers) and high-power circuits or devices. It allows you to switch on or off the power supply to these high-power devices using a low-power control signal.

A 2-channel relay module consists of two independent relays within a single module. Each relay channel has its own input control signal and output contacts. This allows you to control and switch two separate high-power circuits or devices independently.

A relay is an electromagnetic switch that operates using an electromagnet. When a control signal (such as a 5V signal) is applied to the relay coil, it generates a magnetic field that attracts the relay contacts, closing or opening the circuit. This action allows the high-power circuit connected to the relay's output contacts to be turned on or off

The 5V in the relay module's name refers to the control voltage required to activate the relay coil. It means that you need to provide a 5V signal to the relay module's input control pins to energize the relays and switch the high-power circuits. The high-power circuits connected to the relay module can operate at different voltages, depending on the relay module's specifications

A 5V 2-channel relay module typically has multiple pins for power supply, ground, and control signals. It may also have separate pins for each relay's input control signal and output contacts. We have to connect the control signal pins to the control system or microcontroller's output pins. The high-power circuit or device you want to control is connected to the relay module's output contacts

3.1.5.12V DC Submersible Water Pump

Fig 3.6 12V DC Submersible Water Pump

A 12V DC submersible water pump is a device designed to pump water while being submerged in it. It operates using a direct current (DC) power supply at a voltage of 12 volts, making it suitable for various applications, including small-scale water transfer, irrigation, water circulation, and fountain systems

A submersible water pump is specifically designed to be placed underwater, typically in a water source such as a tank, well, or reservoir. It is fully sealed and waterproof to prevent any electrical components from being exposed to water. The pump draws water through an intake or suction port and then pumps it out through a discharge or outlet port.

A 12V DC submersible water pump operates using a low-voltage direct current power supply. This makes it compatible with a range of power sources, including batteries, solar panels, and low-voltage power systems.

The pumping capacity of a submersible water pump is typically measured in terms of flow rate, expressed in gallons per hour (GPH) or liters per hour (LPH). The flow rate indicates the volume of water that the pump can move within a given time. Different models offer varying flow rates, allowing us to choose a pump that meets your specific needs

The submersible nature of these pumps offers several advantages. Firstly, it allows for efficient water transfer, as the pump is submerged directly in the water source. This eliminates the need for priming or manual suction. Secondly, being underwater helps to cool the pump during operation, ensuring its longevity and preventing overheating.

Submersible water pumps are constructed using corrosion-resistant materials such as stainless steel, thermoplastics, or other durable materials that can withstand continuous exposure to water. This ensures their longevity and prevents damage caused by rust or degradation.

3.1.6.Soil Moisture Sensor

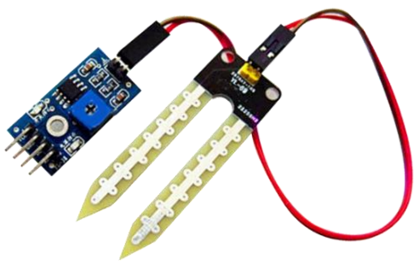


Fig 3.7 Soil Moisture Sensor

A soil moisture sensor is an electronic device used to measure the moisture content in the soil. It helps monitor the water levels in the soil, enabling efficient irrigation and ensuring optimal conditions for plant growth. These sensors are commonly employed in agriculture, gardening, and environmental monitoring applications. The basic principle behind a soil moisture sensor is the measurement of the electrical conductivity or dielectric constant of the soil, which varies with moisture content.

There are different types of soil moisture sensors available, including resistive sensors, capacitive sensors, and Time Domain Reflectometry (TDR) sensors. Resistive soil moisture sensors consist of two or more electrodes inserted into the soil. As the soil moisture changes, the electrical resistance between the electrodes also changes. By measuring this resistance, the sensor can determine the soil moisture level. Resistive sensors are cost-effective and simple to use, but they can be prone to corrosion and calibration issues.

Capacitive soil moisture sensors utilize the principle of capacitance. They consist of two electrodes, typically in the form of parallel plates, with the soil acting as a dielectric material between them. The capacitance between the plates varies with the soil moisture content. Capacitive sensors are more accurate and less affected by soil salinity compared to resistive sensors**.**

Applications of soil moisture sensors include automated irrigation systems, smart agriculture, precision farming, landscaping, and ecological research. By accurately monitoring soil moisture levels, farmers and gardeners can optimize watering schedules, conserve water resources, prevent overwatering or underwatering, and promote healthy plant growth.

3.1.7. Breadboard

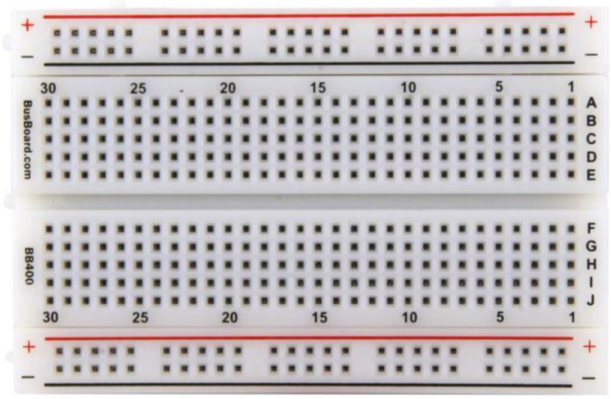


Fig 3.8BreadBoard

A breadboard, also known as a prototyping board or solderless breadboard, is a device used to create temporary electrical connections for electronic components. It consists of a rectangular plastic board with numerous holes or sockets arranged in a grid pattern.

The holes on a breadboard are arranged in rows and columns. The rows are typically labeled with numbers or letters for easy reference, while the columns are interconnected horizontally. These interconnected columns are called "rails" and are used for power and ground connections. The terminal strips run along the length of the breadboard, usually on both sides. They are used for connecting components and creating electrical connections. Each hole within a terminal strip is electrically connected to adjacent holes in the same strip, allowing for easy circuit construction

Breadboards typically feature two sets of vertically aligned columns known as power rails. One rail is used for the positive power supply (VCC or +) connection, while the other is for the ground (GND or -) connection. These rails provide a convenient way to distribute power and ground throughout the circuit

3.1.8. 9v Battery

Fig 3.9 9v Battery

9V batteries are compact and lightweight, making them ideal for powering small IoT devices that require mobility. 9V batteries are widely available and can be easily obtained, ensuring a convenient power source for IoT projects

3.2 Working

The Node MCU initializes and boots up, executing the program stored in its memory. DHT11 is connected to Node MCU using jumper wires. The Node MCU sends appropriate signals to the DHT11 sensor to request temperature and humidity readings. The DHT11 sensor responds by providing the data, which is then captured and stored by the Node MCU. Node MCU reads the Analog value from the soil moisture sensor, which corresponds to the moisture level in the soil. This value is converted to a percentage. The Node MCU uses its built-in Wi-Fi capabilities to connect to a Wi-Fi network. When a particular disease occurring temperature or humidity is detected say, temperature ranging between 25℃ to 28℃, the DHT11sensor will send a high value to the Pin. Once the Pin goes high, the Blynk software will push a notification to the mobile via Gmail(which has been initialized in the code)as;” Disease identified: Blast”. The code sends this message only if the temperature-humidity conditions remain constant for at least 48 hours. Therefore a variable has been declared inside the code to keep crosschecking on the hours a particular temperature prevails constantly without much higher variations. For healthy conditions, no alerts are pushed. An additional soil moisture sensor is provided to give information to the farmer regarding the moisture content of the soil. When moisture goes below 60percentage water is pumped. Also, it will spray pesticides on the plant.

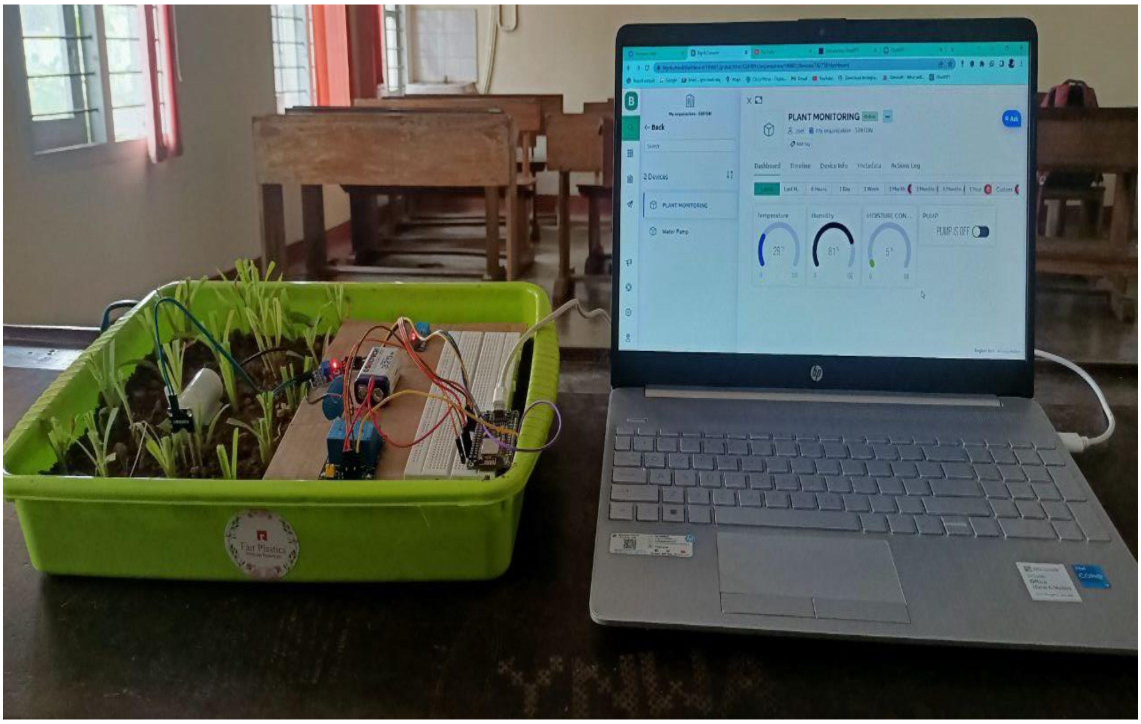


Fig 3.10 Full Setup

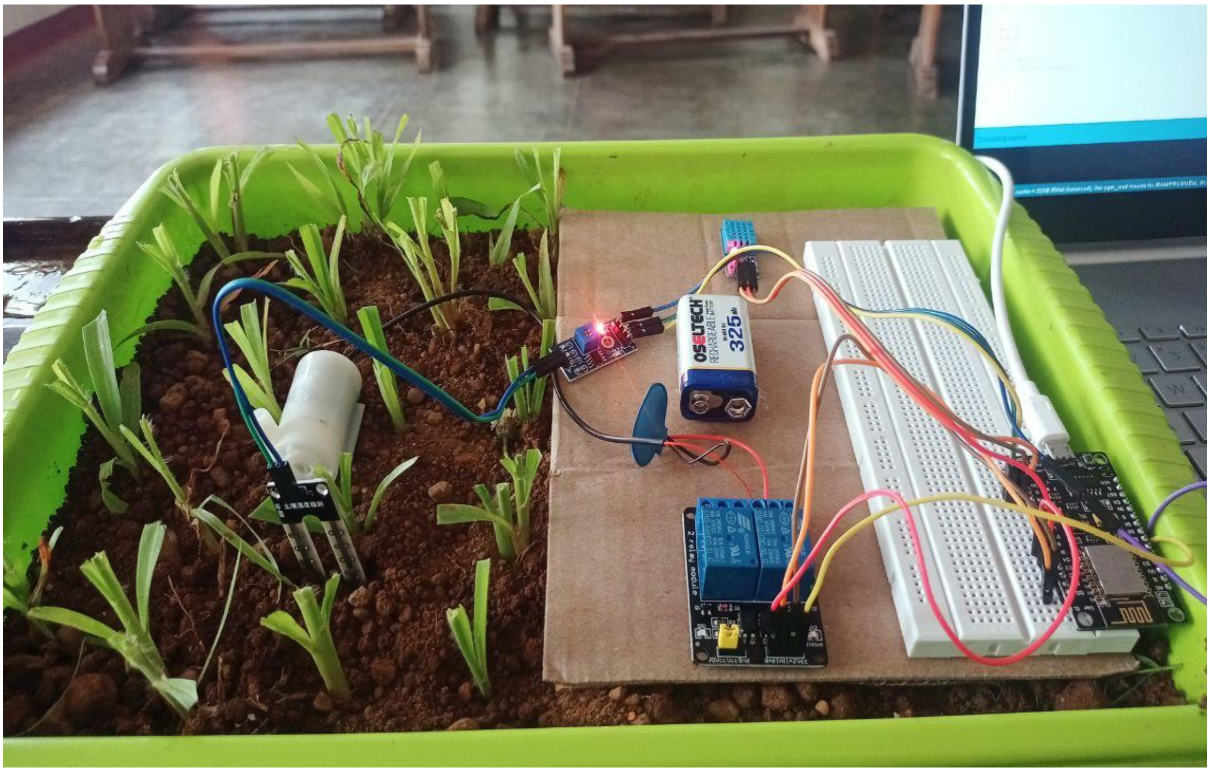


Fig 3.11 Circuit installed in the field

CHAPTER 4.
IMPLEMENTATION AND DEVELOPMENTS

4.1Hardware Implementations

The DHT11 temperature checks the current temperature and humidity. Digital Pin2 is assigned for this. Node MCU is connected to the laptop. The D4PIN of Node MCU is connected to the DATA PIN of DHT11. GND PIN of both components is connected to each other VCC of DHT11 is connected to the 3V3PIN (3.3v output pin) of Node MCU. Connect the data pin of the soil moisture sensor to an Analog input pin (e.g., A0) of the Node MCU. Connect the VCC pin of the soil moisture sensor to the 3.3V output pin of the Node MCU. Connect the GND pin of the soil moisture sensor to the ground (GND) pin of the Node MCU. The soil sensor connected to Node MCU gives information about moisture content in percentage. Node MCU uploads the data received from DHT11 and the soil moisture sensor to the cloud. Regarding this information, when the cut-off value for a disease is achieved and stays for about 48 hours the first alert is pushed from the cloud to the Mail and also a notification is popped to the handheld device for example-Mobile Phone. If the farmer wishes to water/spray pesticides she can opt to switch ON the pump via her mobile. To power it properly 5v 2-channel dc relay module is used. Even if the hardware is located in her field, she/he can operate and monitor it from any part of the world using Blynk app/ website on her mobile/Computer connected to the Internet.

Since we need to check temperatures below 100 $°C$ we choose the DTH11 sensor and for pumping a small amount of water 12v Submersible water pump is enough. These have to be replaced with more precision devices when used for a big purpose. The D4 PIN of Node MCU turns high when the moisture content of the soil goes below 60%. The D4 pin triggers the relay and turns the relay to normal ON condition. Now the pump will be turned ON.

Node MCU is powered by a 5v- 1Amp battery / Adapter.

4.2Software Implementations and Developments

4.2.1. Blynk App

To create an event on the Blynk website, an account was created in it. A new Template was added. Then, click on the name of the template that you want to add the event to. Next, on the Events tab, New Event was added. In the Event Code field, enter a unique identifier for the event. The Event Data field is optional. We can enter any additional data that you want to associate with the event. Finally, click on the Create button to create the event. We can create as many events as we needed. The description that is needed to be sent via Gmail is added in the description option of the event. Three gauges are added to see the values of temperature, humidity, and moisture from sensor in Blynk . Three virtual pins are taken; PIN V0 for temperature, PIN V1 for humidity, and V2 for moisture. The same pins are initialized in the code as follows:

```
Blynk.virtualWrite(V0, temp);
 Blynk.virtualWrite(V1, hum);
```

When these statements are executed, the temperature and humidity reading will be written to the VO, V1, and V2 virtual pins of Blynk.

Specifications of Blast, Brown-Spots, and Sheath-Blight have been included in the code. For repeatedly checking the diseases, we can call these events created in the cloud thus giving a smooth working. Code has been written to link the hardware. The algorithm is made under the concept that prolonged exposure to disease conditions can adversely affect diseases on the crops. To give clear speculation about the severity of the disease crop face different alerts (RED, ORANGE, YELLOW) are also given to the farmer

To reduce the size and cost of the circuit, the circuit has been implemented as IoT rather than using a GSM module which is costlier and bulkier. By using IoT, the size and cost are reduced drastically. The program is made as simple as possible so that if any authority wishes to modify it for other diseases, they can simply change the parameters in the event section and also in the cloud. To take preventive measures on a wide scale, a pump is given to pump water or for spraying pesticides. So the risk of farmers being exposed to chemicals can be reduced effectively.

CHAPTER 5

TESTING AND OBSERVATIONS

The purpose of testing and observations in a project is to assess the performance, functionality, usability, reliability, safety, and overall quality of a product or system. It involves systematically evaluating different aspects of the project to identify any issues, defects, or areas for improvement.

- Tested the compatibility of the Node MCU with Laptop models (Windows) to ensure functionality. Here, the various Laptop models used were hp and Acer.
- Tested the accuracy and reliability of the location DHT11 sensor and its integration with Node MCU and cloud. Compared the disease prediction with the current weather.
- The mail received about the disease is cross-checked with the current temperature conditions.
- Verified the notification access using different mobile phones

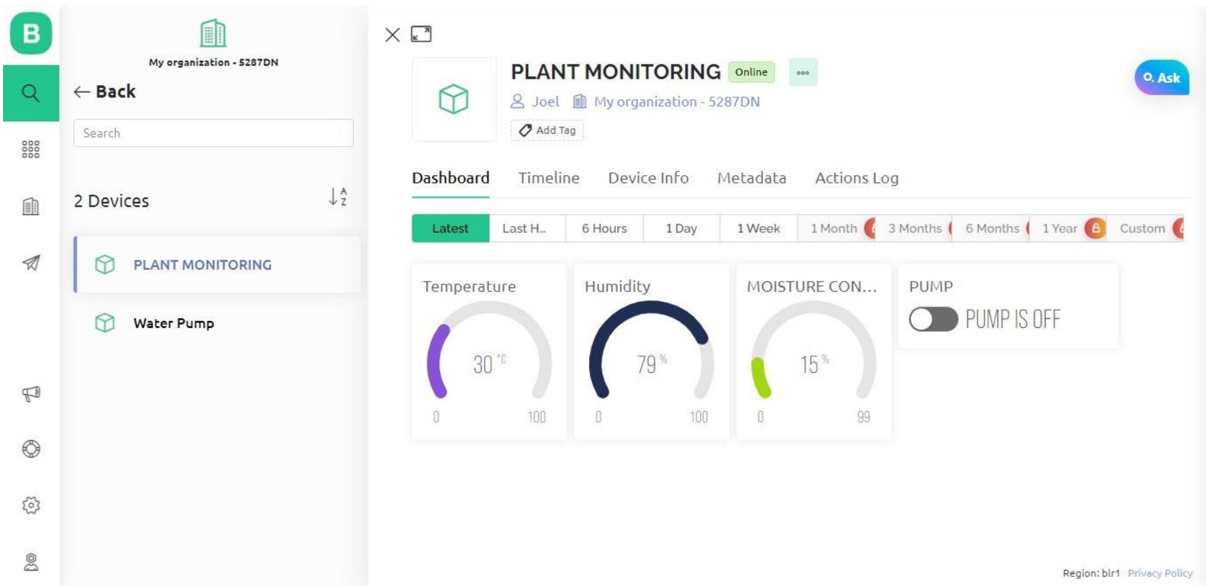
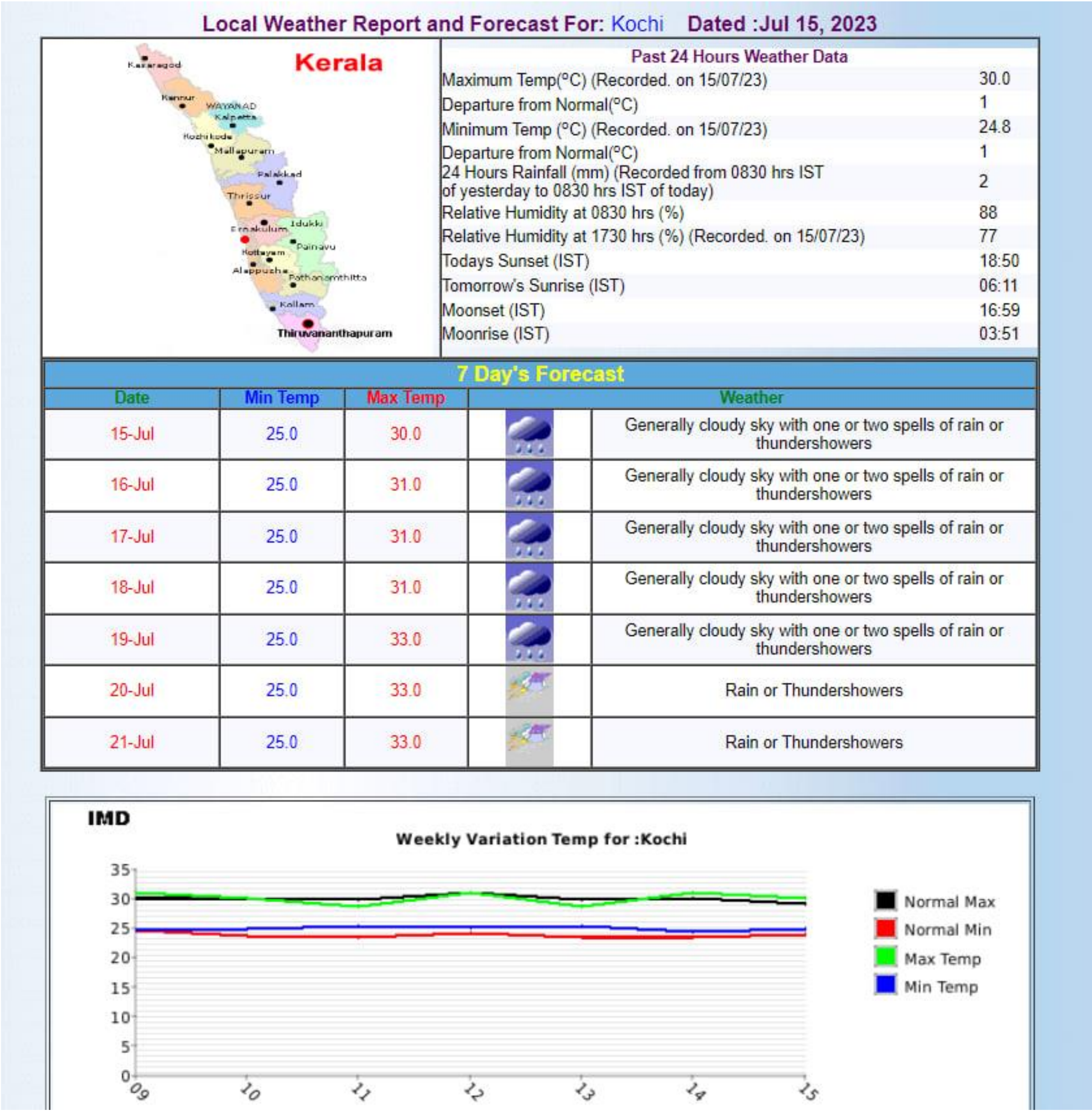


Fig 5.1 Data Read from the Sensors



Local Weather Report and Forecast For: Kochi Dated :Jul 15, 2023

Past 24 Hours Weather Data	
Maximum Temp(°C) (Recorded. on 15/07/23)	30.0
Departure from Normal(°C)	1
Minimum Temp (°C) (Recorded. on 15/07/23)	24.8
Departure from Normal(°C)	1
24 Hours Rainfall (mm) (Recorded from 0830 hrs IST of yesterday to 0830 hrs IST of today)	2
Relative Humidity at 0830 hrs (%)	88
Relative Humidity at 1730 hrs (%) (Recorded. on 15/07/23)	77
Todays Sunset (IST)	18:50
Tomorrow's Sunrise (IST)	06:11
Moonset (IST)	16:59
Moonrise (IST)	03:51

7 Day's Forecast

Date	Min Temp	Max Temp	Weather
15-Jul	25.0	30.0	Generally cloudy sky with one or two spells of rain or thundershowers
16-Jul	25.0	31.0	Generally cloudy sky with one or two spells of rain or thundershowers
17-Jul	25.0	31.0	Generally cloudy sky with one or two spells of rain or thundershowers
18-Jul	25.0	31.0	Generally cloudy sky with one or two spells of rain or thundershowers
19-Jul	25.0	33.0	Generally cloudy sky with one or two spells of rain or thundershowers
20-Jul	25.0	33.0	Rain or Thundershowers
21-Jul	25.0	33.0	Rain or Thundershowers

Fig 5.2 Real-time data- Temperature

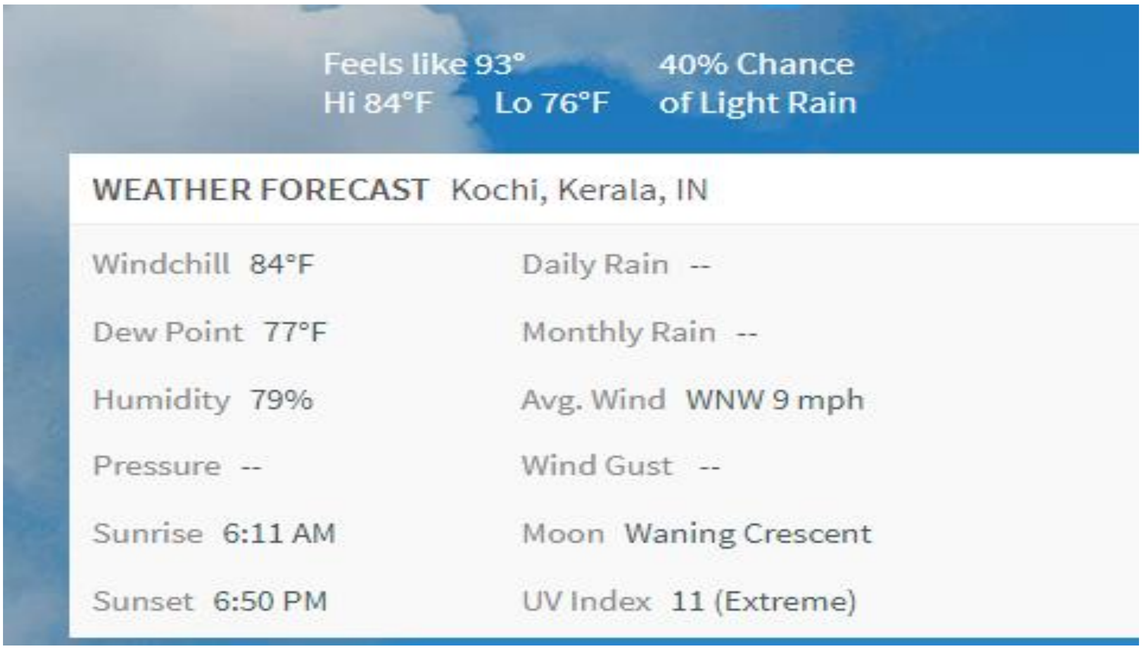


Fig 5.3 Real-time data Humidity

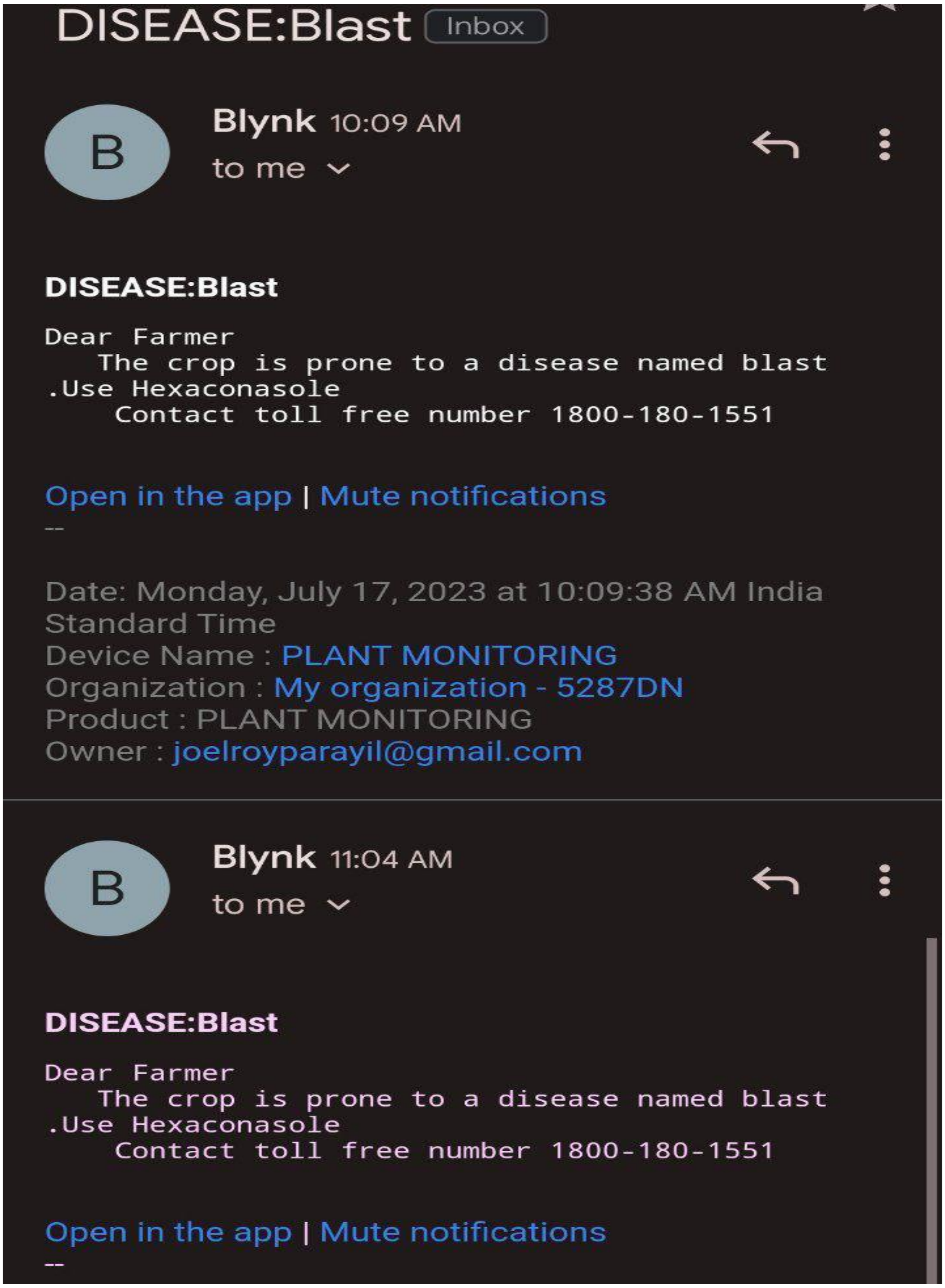


Fig 5.4 Received Notification via Gmail

CHAPTER 6

BILL OF MATERIALS AND TOTAL COST

Node MCU esp8266	- Rs 260
DHT11	-Rs200
Jumper Wires	-R200
5v 2channel relay	-Rs160
12v DC Waterpump (2)	-Rs740
Soil Moisture	-Rs150
Total amount:	-Rs1560

Table 6.1Total Cost

CHAPTER 7
RESULTS AND DISCUSSIONS

The main objectives of our project Early disease detection in rice crops is to prevent the rice crop from severe infection and avoid crop loss and by providing the pre-cautionary measures, they can overcome the crop loss. Accurate estimates of disease incidence, disease severity, and the negative effects of diseases on the quality and quantity of agricultural products are important for field crops.

Through this project, we came to know that climatic conditions mainly, temperature and humidity variations are the reason for major crop disease and yield loss. The diseases found using this device are:

1. Brown Spot

* Temperature of 25-30°C
* Relative humidity above 80%

2. Blast

* Temperature of occurence-25-30° C
* Relative moisture in the soil.

3. Sheath Blight

* Temperature 28-32°C
* Relative humidity 96-100%

The challenge encountered during the project was the time lag of 24 hours during the demo process. To compensate for this, we assumed 24 hours = 1 minute and checked for the combination of humidity and temperature remaining at that period of time.

Overall, our project is a great success and we are ready to help farmers with this adequate technology and attract more youth into agriculture by eradicating the chaos related to unpredictable climate changes and thus making agriculture profitable.

7.1 Limitation:

- It can only detect the conditions of the disease that will affect the crop but fails to detect the affected crops.
- Fails to predict which part of the disease will be affected.
- Automatic pump cannot select the pesticides on its own
- Software Blynk is slow sometimes.

CHAPTER 8

CONCLUSION AND FUTURE PROSPECTS

8.1 Future Aspects of the Project.

1. Enhanced Detection Algorithms: One area for future development is to improve the disease detection algorithms used in the project. This could involve exploring advanced machine learning techniques, such as deep learning or convolutional neural networks, to enhance the accuracy and efficiency of disease identification.

2. Mobile Application Development: Develop a mobile application that complements the crop disease detection system. This app could provide farmers with a user-friendly interface to view disease detection results, access historical data, and receive recommendations for appropriate treatments or preventive measures.

3. Big Data Analysis: Collecting a large dataset of crop disease information can open up opportunities for big data analysis. By analyzing trends and patterns in the data, it may be possible to identify correlations between environmental factors, crop characteristics, and disease outbreaks. This knowledge can contribute to the development of predictive models for early disease detection and prevention. By using such technologies alerts can be given for more diseases.

4. Image Processing: By using Image processing techniques, the detection of disease in affected crops can be found. Disease-affected crops will have color variations which could be found using Image processing. Such techniques will give a more clear idea to the farmers regarding the disease. This can be also used in Government agriculture offices to find diseases instead of conventional testing.

4. Collaboration with Agricultural Experts: Consider partnering with agricultural experts, researchers, or organizations specializing in crop disease management. Collaborative efforts can lead to a better understanding of specific diseases, improved accuracy of disease identification, and the development of targeted treatment strategies.

8.2 Conclusion

Agriculture is the major occupation in our country. Now, farmers are facing a lot of trouble. The integration of technology and agriculture is needed now more than in the past journal era. Our research has taken up the focus to ease the troubles of the farmers by monitoring the farm area for any changes and taking the required action. It also allows the farmer to automatically detect the probable disease that is present on the farm and saves valuable time, off the farmer's work. Also, it reduces the risk of being exposed to hazards.

Our mini project has successfully demonstrated the application of electronic principles and techniques in a practical setting which can help the farmers who feed each and every one of us. Through careful planning, research, and experimentation, we were able to achieve our project objectives and gain valuable insights into the field of both agriculture and electronics.

Throughout the project, we designed and implemented various electronic circuits, analyzed their behavior, and tested their functionality. We encountered challenges along the way, but with perseverance and problem-solving skills, we were able to overcome them and make significant progress.

In addition to technical knowledge, this project allowed us to develop essential skills such as teamwork, communication, and project management. We learned how to collaborate effectively, divide tasks efficiently, and communicate our ideas and progress to team members and mentors

REFERENCES

[1]. Study materials from Bsc. Agriculture students of Amrita Viswapeetam.

[2]. Rice disease epidemiology

[3]. Rice disease datasets.

[4].Building Arduino projects Textbook - Adeel Javed

[5]TamilNadu Agriculture University site -https://agritech.tnau.ac.in/

[6]Diseases of field crop management Book -TNAU agriculture university

[7]Supporting Documents

[7.1]Brown Spot

http://www.agritech.tnau.ac.in/expert_system/paddy/cpdisbrownspot.html#:~:text=The disease is common in,the development of the diseas

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Symptom of Damage

Identification of pathogen

Management Strategies

Brown Spot
(*Helminthosporium oryzae*)

Symptoms

- Brown Spot is called as sesame leaf spot or Helminthosporiose or fungal blight
- The fungus attacks the crop from seedling in nursery to milk stage in main field.
- The disease appears first as minute brown dots, later becoming cylindrical or oval to circular.(resemble sesame seed)
- Spots measures 0.5 to 2.0mm in breadth - coalesce to form large patches.
- Then several spots coalesce and the leaf dries up.
- Infection also occurs on panicle, neck with brown colour appearance
- Seeds also infected (black or brown spots on glumes spots are covered by olivaceous velvety growth)
- The seedlings die and affected nurseries can be often recognized from a distance by their brownish scorched appearance.
- Dark brown or black spots also appear on glumes.
- The infection of the seed causes failure of seed germination, seedling mortality and reduces the grain quality and weight.
- 50% yield reduction in severe cases .

Circular or Oval Spots on Leaves

Spots on leaves with brown margin

Dark Brown or Black Spots on Panicle Glumes and Grains

Brown Spot on Grains

Top

Identification of pathogen


Conidia

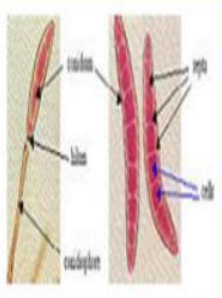

Fungal Pathogen

Brown Spot: *Helminthosporium oryzae—FUNGAL DISEASE*

(Syn: *Drechslera oryzae*) (Sexual stage : *Cochliobolus miyabeanus*)

The fungi causing the disease occur in two states or stages. These are the asexual stage, which is called anamorph or imperfect stage and the sexual stage, which is called teleomorph or the perfect stage.

The somatic structures of the fungus consist of black velvety mycelial mats which are made up of prostrate hyphae and erect sporophores. The hyphae are abundant, branching, and anastomosing. They are dark brown or olivaceous and measure 8-15 µm or more in diameter. The sporophores arise as lateral branches from the hyphae. The conidia measure 35-170 x 11-17 µm. Typical conidia are slightly curved, widest at the middle and tapering toward the hemispherical apex, where their width approximates half the median width. Mature conidia are brownish with a moderately thin peripheral wall.

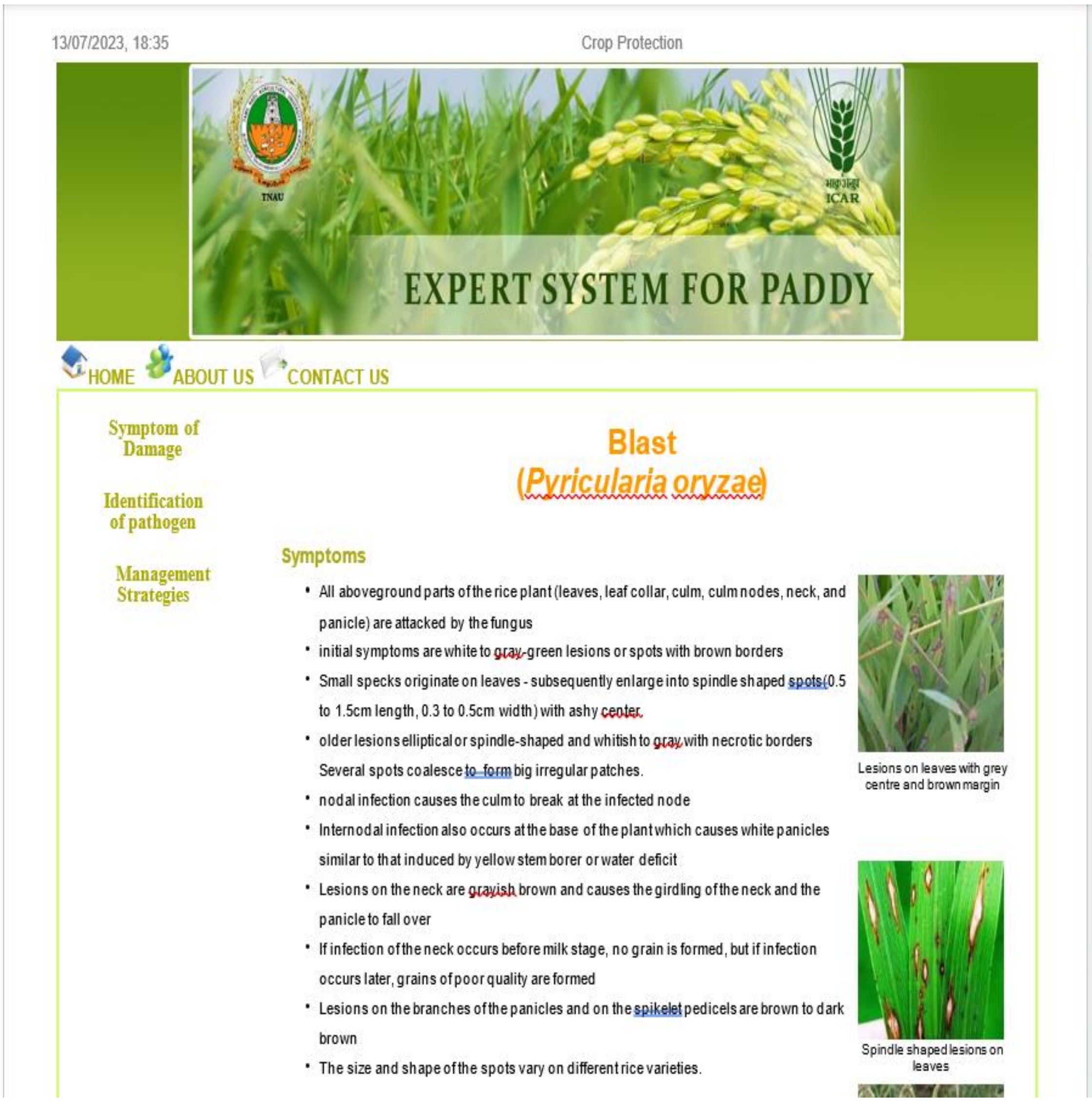

Fungus

Favourable conditions

- Temperature of 25-30°C
- Relative humidity above 80 per cent.
- Excess of nitrogen aggravates the disease incidence.
- Leaves must be wet for 8-24 hours for infection to occur.

[7.2]Blast

http://www.agritech.tnau.ac.in/expert_system/paddy/cpdisblast.html



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EXPERT SYSTEM FOR PADDY

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Symptom of Damage

Identification of pathogen

Management Strategies

Blast

(*Pyricularia oryzae*)

Symptoms

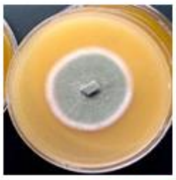
- All aboveground parts of the rice plant (leaves, leaf collar, culm, culm nodes, neck, and panicle) are attacked by the fungus
- initial symptoms are white to gray-green lesions or spots with brown borders
- Small specks originate on leaves - subsequently enlarge into spindle shaped spots(0.5 to 1.5cm length, 0.3 to 0.5cm width) with ashy center.
- older lesions elliptical or spindle-shaped and whitish to gray with necrotic borders Several spots coalesce to form big irregular patches.
- nodal infection causes the culm to break at the infected node
- Internodal infection also occurs at the base of the plant which causes white panicles similar to that induced by yellow stem borer or water deficit
- Lesions on the neck are grayish brown and causes the girdling of the neck and the panicle to fall over
- If infection of the neck occurs before milk stage, no grain is formed, but if infection occurs later, grains of poor quality are formed
- Lesions on the branches of the panicles and on the spikelet pedicels are brown to dark brown
- The size and shape of the spots vary on different rice varieties.

Lesions on leaves with grey centre and brown margin

Spindle shaped lesions on leaves

Top

Identification of pathogen



Colony of Pyricularia Oryzae

Conidia

- This disease is caused by a fungus named Pyricularia orizae, which overwinters in rice seeds and infected rice stubble.
- The fungus reproductive structures, spores, can spread from these two sources to rice plants during the next growing season and initiate new infections.
- Spores from these new infections can spread by wind to other rice plants over great distances.

www.agritech.tnau.ac.in/expert_system/paddy/cpdisblast.html 1/3

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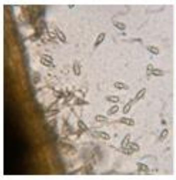
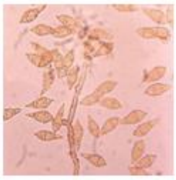


Conidia are pyriform (pear-like) in shape.



pyricularia oryzae microscopic

- The conidiophores of the pathogen are produced in clusters from each stoma. They are rarely solitary with 2-4 septa. The basal area of the conidiophores is swollen and tapers toward the lighter apex.
- The conidia of the fungus measure 20-22 x 10-12 µm. The conidia are 2-septate, translucent, and slightly darkened. They are obclavate and tapering at the apex. They are truncate or extended into a short tooth at the base.
- The perfect stage is rarely found in the field.

Favourable conditions

- presence of the blast spores in the air throughout the year
- upland rice environment and high elevation in the tropics
- cloudy skies, frequent rain, and drizzles
- high nitrogen levels like ammonium sulfate
- high relative humidity (90% and higher) and wet leaves
- temperature from 25-28°C

[7.3]Sheath Blight

http://cord.uok.edu.in/Files/4701b853-a330-4f94-a00e-01555a32a0ff/Custom/Sheikh%20Gulzar.pdf

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Sheath Blight

Causal organism: *Rhizoctonia solani* (Sexual stage: *Thanetophorus cucumeris*)

Symptoms:

- The fungus affects the crop from tillering to heading stage.
- Initial symptoms are noticed on leaf sheaths near water level.
- On the leaf sheath oval or elliptical or irregular greenish grey spots are formed.
- As the spots enlarge, the centre becomes greyish white with an irregular blackish brown or purple brown border.
- Lesions on the upper parts of plants extend rapidly coalesing with each other to cover entire tillers from the water line to the flag leaf.
- The presence of several large lesions on a leaf sheath usually causes death of the whole leaf,
- In severe cases all the leaves of a plant may be blighted in this way.
- The infection extends to the inner sheaths resulting in death of the entire plant.
- Older plants are highly susceptible.
- Plants heavily infected in the early heading and grain filling growth stages produce poorly filled grain, especially in the lower part of the panicle..

Pathogen

- The fungus produces septate mycelium which are hyaline when young, yellowish brown when old.
- It produces large number of spherical brown sclerotia.

Favourable conditions:

- Presence of sclerotia or infection bodies floating on the water
- Presence of the sclerotia in the soil
- Relative humidity from 96 to 100%
- Temperature from 28-32 °c
- High levels of nitrogen fertilizer
- High seeding rate or closing plant spacing
- Frequent rain

APPENDIX

I.Program Code

```
#define BLYNK_TEMPLATE_ID "TMPL3o1FOGQHf+"
#define BLYNK_TEMPLATE_NAME "PLANT MONITORING"
#define BLYNK_AUTH_TOKEN "P6TkTnEHCX-TyagzXlHtLKAxfQZ8ZGaL"
#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>
#include <DHT.h>
#define DHTPIN 2
#define DHTTYPE DHT11
DHT dht(DHTPIN, DHTTYPE);
char auth[] = BLYNK_AUTH_TOKEN;
char ssid[] = "JOEL ROY";
char pass[] = "098765432";
int a=0;
int b=0;
int c=0;
void setup()
{
 Serial.begin(9600);
  dht.begin();
```

```
 Blynk.begin(auth, ssid, pass);
}void loop()
{
 Blynk.run();
 float temp = dht.readTemperature();
 float hum = dht.readHumidity();
 if (isnan(temp) || isnan(hum)) {
 Serial.println("Failed to read from DHT sensor!");
 return;
 }
Blynk.virtualWrite(V0, temp);
 Blynk.virtualWrite(V1, hum);
  int i;
      for(i=0;i<=4;i++)
      {
          if(temp>=25&&temp<=28)
         {
          a=a+1;
          delay(60000);
         }
          else if(temp>=25&&temp<=30&&hum>=80)
         {
         b=b+1;
 delay(60000);  }
  else if(temp>=28&&temp<=32&&hum>=96&&hum<=100)
```

```
{
          c=c+1;
          delay(60000);
         }
      }
       if(a==4)
         {
          Blynk.logEvent("blast");
          a=0;
         }
          else if(b==4)
         {
          Blynk.logEvent("brown_spot");
          b=0;
         }
          else if(c==4)
         {
         Blynk.logEvent("sheath_blight");
          c=0;
         }
         a=0;
        b=0;
        c=0;
 //if(temp>=25)
  // Blynk.logEvent("blast");
```

```
//  }
 int moisture;
  moisture = (100 - ((analogRead(A0) / 1023.00) * 100));


  if (moisture < 60) {
    digitalWrite(3, LOW);
  }
  else {
  digitalWrite(3, HIGH);
   }
}
}
```

II.DATASHEETS

1Node MCU-https://www.espressif.com/sites/default/files/documentation/0a-

esp8266ex_datasheet_en.pdf

2.12VDCWaterPumphttps://5.imimg.com/data5/SELLER/Doc/2021/4/RH/JK/XD/18335

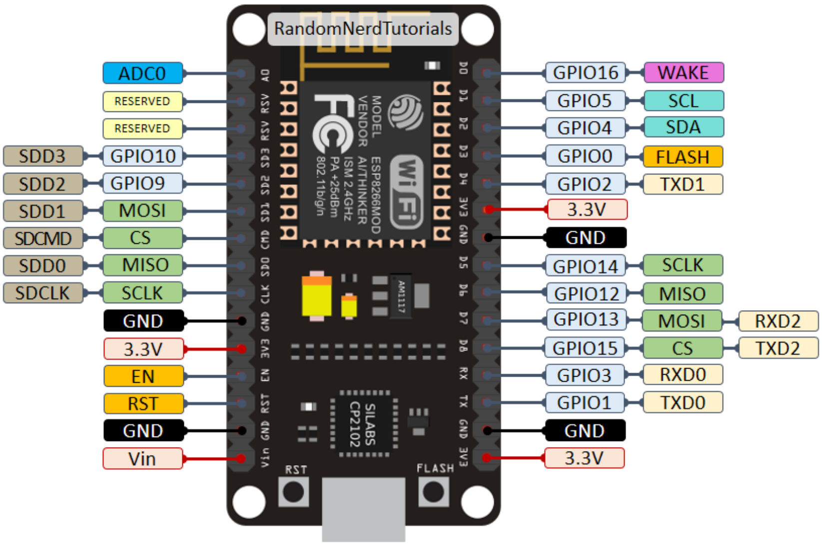
10/r385-dc-9-12v-water-pump-maximum-lift-3-meters.pdf

3.5V Dual-Channel Relay Module -https://components101.com/switches/5v-dual-channel-relay-module-pinout-features-applications-working-datasheet

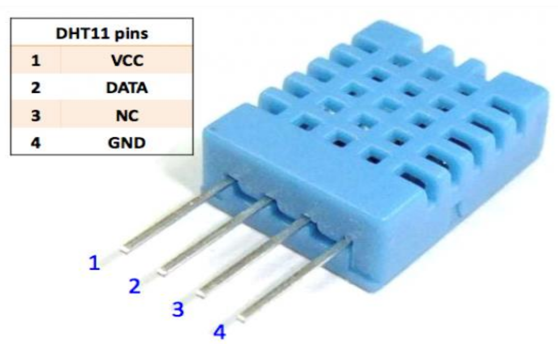
4)Soil Moisture Sensor https://datasheethub.com/fc-28-soil-moisture-sensor-module//

III. Pin Diagram

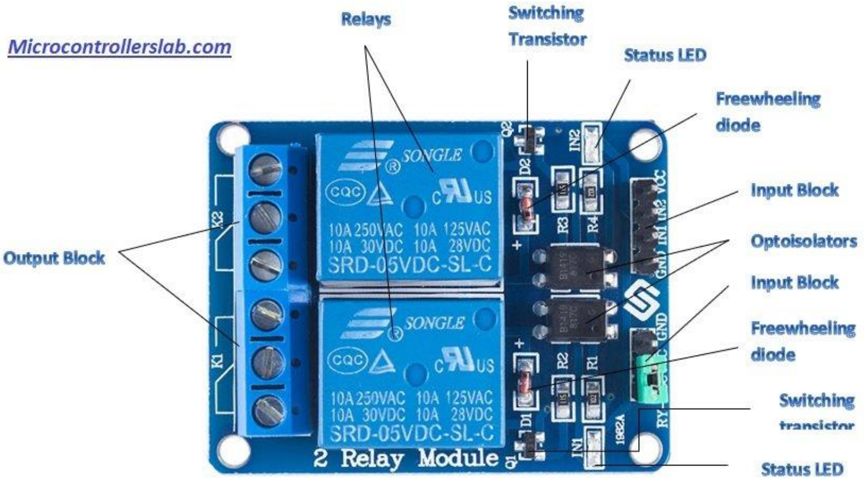
1.Node MCU



2.DHT 11



3. 5V 2Channel Relay Module



4.Soil Moisture Sensor