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SMART BIO MONITORING SYSTEM

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----------ABSTRACT----------

This paper introduces a project that aims to improve the efficiency and sustainability of agriculture by developing a plant monitoring system that utilizes the Internet of Things (IoT) technology. The system monitors the field area's parameters such as temperature, humidity, and moisture level using Node MCU and various sensors, including temperature, moisture, and humidity sensors, to gather data on various aspects of the plant. The collected data is used to provide valuable insights into the plant's health and optimize its growth and development. The project is designed to be scalable, making it adaptable to various types of plants and environments, and it can be integrated with other IoT-enabled devices to create a more comprehensive monitoring and control system. The system can detect and alert the user to any issues that may arise, such as over-watering or exposure to extreme temperatures. The project is expected to make significant contributions to the field of IoT-based agriculture and improve the way plants are grown and maintained. It offers an innovative solution for plant monitoring and maintenance that has the potential to benefit farmers, gardeners, and individuals who have plants in hard-to-reach or inaccessible locations, as well as those who are new to gardening or looking to optimize their cultivation efforts.

KEYWORDS – ***Internet of Things (IOT), Arduino, Temperature sensor, Humidity sensor, soil moisture sensor, ultrasonic sensor, water pump, Rely, web application.----------***

I. INTRODUCTION

The Internet of effects(IoT) is revolutionizing traditional technology in homes and the services like husbandry. However, farmers in India face numerous challenges such as small farm sizes, limited access to technology, unfavorable government policies, climate conditions, and more. Monitoring environmental factors such as soil and plant health, moisture and temperature is crucial, but it's not enough to increase crop yields. To overcome these problems, robotization needs to be enforced in husbandry. Therefore, developing an integrated system that can handle all factors affecting productivity in every stage is necessary.

The system will aim to automate and digitize agriculture, providing an affordable and efficient solution for monitoring and controlling the climatic conditions that affect plant growth and production. The use of automation will lead to more accurate and efficient monitoring, control of industrial machinery and processes, and improved water management through alarms and automatic irrigation modules. The system will use colorful factory detectors to cover soil humidity situations, air temperature, and soil temperature, which can be used to optimize factory growth and product.

Around the world, granges use 70% of all the water that's used annually on average. Poor water operation, evaporation, and poor irrigation systems affect in the loss of 40% of the 70% that growers use. By using an alarm system or automatic water irrigation module, this project will help in decreasing this number, thus helping in water management. the system will use various plant sensors to monitor factors such as soil moisture levels, air temperature, and soil temperature. These sensors will provide valuable data that can be used to optimize the growth and production of the plants [2]. Although this system is suitable for indoor potted plants, it can also be extended for use in outdoor gardens or larger areas by using Local Area Network (LAN) or Wide Area Network (WAN). Overall, the main goal of this project is to increase the efficiency and productivity of agriculture by automating and digitalizing the process, and to

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provide an affordable and efficient solution for monitoring and controlling the climatic conditions that affect plant growth and production.
The farm surveillance system implemented in this research paper utilizes wireless sensor networks to collect data from various sensors positioned at different nodes. The system we designed is based on Arduino controller fully. The sensors included in this smart agriculture system are a temperature sensor, a moisture sensor, a humidity sensor, and a DC motor. During operation, the system continuously monitors the water level, humidity, and temperature. Buzzer is also installed to cover the water level things so that will be inform us if it goes below certain level. When the sensors detect a decrease in water level, the water pump is activated automatically.

II. LITERATURE REVIEW

Increasing population growth and global climate change are putting more and more stress on agricultural yields. Crop performance monitoring is becoming increasingly important to address this issue. Using sensors and biosensors that are able to detect changes in plant fitness and predict the evolution of their morphology and physiology is one way to accomplish this. These sensors can be incorporated into wearable and on-plant convenient gadgets that give consistent and exact long haul detecting of morphological, physiological, biochemical, and natural boundaries. New fields in wearable and on-plant portable devices are being inspired by flexible sensors and nanomaterials. Long-term continuous and precise sensing of morphological, physiological, biochemical, and environmental parameters can be provided by these devices. Plant growth can be tracked with this Internet of things (IOT) technology, as can disease detection and crop yield optimization. The best in class detecting answers for every application situation are assembled by the plant organ on which they have been introduced. This makes it possible to gain a deeper comprehension of the technological advantages and characteristics of each solution. Farmers and plant scientists may benefit from more precise measurements if these technologies are implemented in agriculture. Farmers and scientists can optimize plant development through individualized treatments that improve overall plant health even in stressful conditions by monitoring crop performance in real time. In the end, this results in increased crop productivity in a way that is better for the environment. However, the application of these technologies is not without its difficulties and restrictions. For instance, the expense of these gadgets can be high and the information they gather might require critical handling furthermore, investigation before it very well may be utilized really. Furthermore, the gadgets might be impacted by natural factors, for example, temperature and stickiness, which could lead to mistakes in the information gathered. The application of these technologies in agriculture holds great promise for increasing crop yields and enhancing sustainability in spite of these obstacles. It is likely that as technology progresses, biosensors and sensors will become more affordable and accurate, making it easier for farmers and scientists to monitor crop performance and maximize yields.

1. The Tehran Water Treatment Plant analyzed the Anaerobic Digesters to increase methane production and waste reduction through the co-digestion process. The study used cattle manure, biowaste, and slaughterhouse flotation greases as co-substrate wastes, and the modified Anaerobic Digestion Model Number 1 (ADM1) was integrated with a co-substrate handling system to determine required feed stream rates. Results showed that adding co-substrate wastes, especially biowaste, increased biogas production and gas engine power output without affecting other equipment at the plant. Additionally, the efficiency of COD removal increased from 37% to 54% [2].

2. In order to ensure food safety and reduce crop loss, it is important to identify plant microorganisms in the early stages of disease. Thanks to recent advances in nanomaterials research, highly responsive and specific plant disease (bio)sensors have been developed. This review covers the different types of plant disease (bio)sensors that have been made possible by 0D, 1D, 2D, and 3D nanomaterials, highlighting their advantageous characteristics such as high surface area-to-volume ratio, tunable physical-chemical properties, and capacity to incorporate biomolecules. The review also includes examples of how nanomaterials can improve the performance of various types of sensors. Additionally, the use of nanomaterial-based (bio)sensors for on-site and quick detection of plant pathogens is discussed, as well as future trends, challenges, and opportunities in this field [3].

3. The unique features of carbon dots (CDs) such as low toxicity, biocompatibility, easy synthesis, high solubility, and surface functionality have created various potential applications in agriculture. This article highlights the preparative methods, structure, and physicochemical properties of CDs. The focus is on understanding the interaction between CDs and different plant species, including their absorption, transport, and storage in plants. Additionally, the article discusses the impact of CDs on plant growth and development, photosynthesis, nutrient uptake, and defense against biotic and abiotic stresses. The article also explores the recent attempts to utilize CDs for delivering bio-cargo into

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plant systems. A better understanding of this bio-nano interaction between CDs and plants may lead to sustainable agriculture practices [4].

4. Stem cells' ability to regenerate and differentiate into specialized cells is a critical feature in both plants and animals, regulated by similar epigenetic mechanisms. Recent studies suggest that the genome's three-dimensional structure plays a significant role in regulating gene expression during stem cell differentiation. However, research on the role of chromatin interaction in regulating gene expression in plant cells is still in its early stages and expected to be a significant focus in the future [5.] This review discusses recent findings on chromatin organization in plant cells and its role in gene expression regulation, along with the differences between animal and plant stem cell niches.

5. The team of A. Latifah, W. Ramdhani, and M.R. Nasrulloh has created an IoT system that monitors corn growth. The system includes an ultrasonic sensor, Raspberry Pi as the controller, and intranet connection for data transfer. The Raspberry Pi allows for monitoring multiple corn crops using a single ultrasonic sensor, unlike an Arduino or microcontroller, which has slower data processing speeds and requires additional devices for network access. The system measures plant height and displays processed data on a personal computer with the same IP address as the controller [6].

III. EXISTING SYSTEM

IOT based smart agriculture system proves to be very helpful for farmers. Limit values for climatic circumstances like humidity, temperature, moisture can be fixed in view of the natural states of that specific area. In the recent past days, agriculturists have been evaluating the freshness of the soil and controlling decisions on the type of crop to be grown. Agriculturists didn't even care for the moisture, the water level and, in particular, the temperature, which was terrible for the farmer. If the conclusion is incorrect, the use of pesticides, which is motivated by various concerns, can have a significant impact on yield. Productivity is dependent on the last period of harvest in which the farmer relies on.

IV. PROPOSED PROBLEM STATEMENT

A smart agriculture model will describe a real-time monitoring system for soil properties like humidity, temperature, water level, and crop difficulty detection in the proposed work. Additionally, via mobile devices and websites, it will be possible to remotely monitor the filing process at any time and from any location.

Based on real-time field data and weather repository data, this system creates an irrigation schedule. This framework can suggest rancher whether, is there a requirement for water system. We can easily check and monitor the water level thanks to a website that is always accessible on mobile devices.

V. PROPOSED WORK

This project focuses on creating a plant monitoring and smart gardening system using IoT with the help of a controller Arduino. The system will use various sensors such as a humidity sensor, moisture sensor, IR sensor, and temperature sensor to monitor and control the environmental conditions in a garden, such as temperature, humidity, moisture and IR sensor. The data collected by these sensors will be analyzed and used to provide valuable insights into the plant's health and optimize its growth and development.

The system will be able to detect and alert the user to any issues that may arise, such as over-watering or exposure to extreme temperatures, and enable the user to act [5]. The proposed system is designed for people who love gardening but are busy with their jobs or daily lives and cannot maintain their garden regularly. The system helps to solve this problem by automating the watering of plants and monitoring other environmental factors such as humidity, soil and air temperature, pH, and light intensity. The system will upload this information to a cloud database, where it can be accessed and analyzed by the user to make informed decisions about their garden.

The system will also automatically control the existing water system with the data collected from the garden sensors, this will help to conserve water by watering the plants only when necessary. Additionally, the system will also have the capability to monitor other environmental factors such as air quality, radiation levels and water pollution; this will help the user to take necessary action to maintain the healthy soil environment. This feature will also help the user to understand the real-time data on the environmental factors that are affecting the growth of their plants and make necessary adjustments. It will help users to easily monitor and maintain their garden, improve the efficiency of agriculture, and achieve sustainable growth by maintaining a healthy society. The system will also have the capability to send notifications to the user's mobile phone, reminding them to take necessary action or alerting them of any issues that may arise. This will ensure that the user is always aware of the status of their garden and can take necessary action in a timely manner [7]. Overall, this proposed system is an innovative solution that will greatly benefit gardeners and farmers by providing them with real-time data and control over their plants, helping them achieve optimal growth and productivity.

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ARDUINO

Arduino is an open-source electronics platform that lets people use a wide variety of sensors, actuators, and other electronic parts to make interactive projects. It is based on a microcontroller, which is a small computer that can be programmed to read inputs, process data and control outputs. Arduino boards come in various form factors, including the classic Arduino Uno, which is a small board with an ATmega328 microcontroller. They can be connected to a computer via USB to upload code and can also be powered by batteries or other external power sources. Arduino boards can be programmed using the Arduino IDE, a software that allows users to write, upload and debug code on the board. The programming language is based on C/C++, and it is easy to learn Arduino boards are widely used in various projects such as home automation, robotics, IoT, data logging and more.

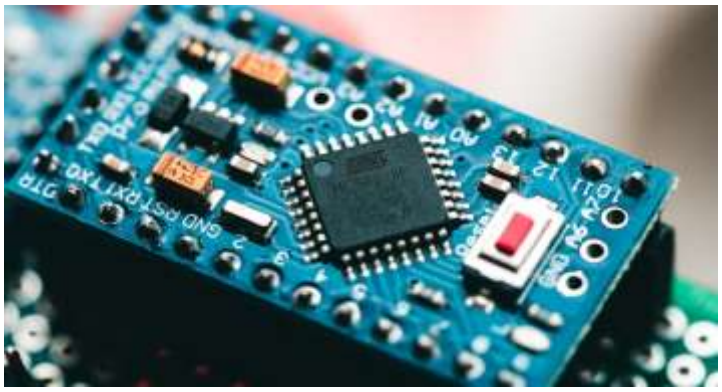

Figure 1. Arduino

SOIL MOISTURE SENSOR

A soil moisture sensor is a device that measures the amount of water present in the soil. It works by measuring the electrical resistance or capacitance of the soil, which changes as the soil becomes wetter or drier. The sensor typically consists of two electrodes that are inserted into the soil, and a circuit that measures the resistance or capacitance between the electrodes. The sensor will detect the moisture of the soil and inform the user through a mobile application, alerting them to take necessary action. It also automatically controls the existing water system with the data collected from the garden sensors, helping to conserve water by watering the plants only when necessary. Soil moisture sensors are commonly used in agriculture, horticulture, and landscaping to optimize irrigation and fertilization, and to improve crop yields [2].

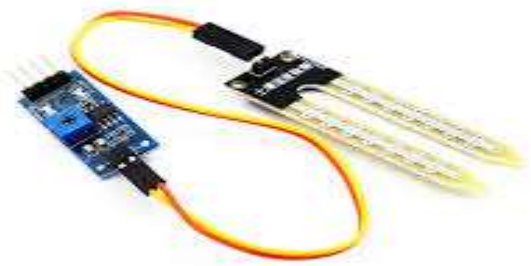

Figure 2. Soil moisture

TEMPERATURE AND HUMIDITY SENSOR

A humidity and humidity sensor is a tool that measures each humidity and temperature withinside the surrounding environment. These sensors typically consist of two main components: a temperature sensor and a humidity sensor. The temperature sensor measures the ambient temperature, usually with a thermistor or thermocouple, which changes resistance or voltage as the temperature changes. The humidity sensor measures the amount of water vapor in the air, usually with a capacitive or resistive sensor.

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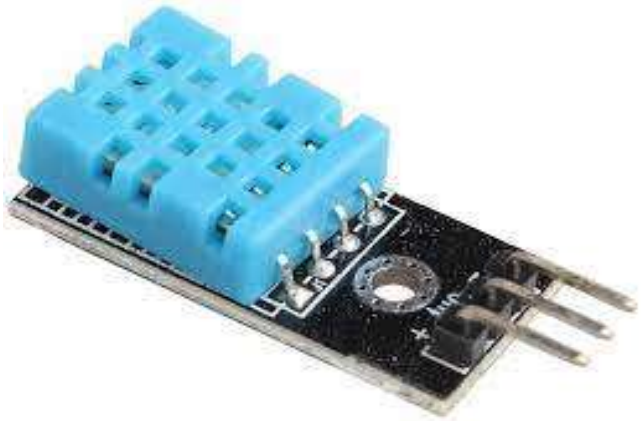

Figure 3. Temperature and Humidity Sensor

ULTRASONIC SENSOR

An ultrasonic sensor is a sensor that uses sound waves at frequencies above the range of human hearing (ultrasound) to measure distance, speed, or other properties of objects. These sensors work by emitting a high-frequency sound wave, and then measuring the time it takes for the sound wave to bounce back (the time of flight) to calculate the distance to the object. Ultrasonic sensors are commonly used in a variety of applications such as robotics, industrial automation, security systems, and transportation.

Figure 4. Ultrasonic Sensor

RELAY

Relays are versatile devices that find their use in a multitude of applications like telecommunications, control systems, and industrial automation. They are great for controlling various electrical devices, such as motors, lights, and more Another advantage of relays is that they can isolate different parts of an electrical circuit from each other, which helps to provide an additional level of safety and protection.

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Figure 5. Relay

WATER PUMP

A device that moves water from one location to another is called a water pump. It is a mechanical device that uses an impeller to force water through a pipe or other conduit. Water pumps can be powered by electricity, gasoline, diesel, or other means. They are commonly used in a variety of applications, including irrigation, water supply, and drainage. We have implemented an automated irrigation system that uses a water pump and a relay to control the watering of plants. The system is designed to provide the plants with the right amount of water at the right time, without wasting water or energy.

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Figure 6. Water Pump

INFRARED SENSOR

An Infrared sensors are digital gadgets that may feel infrared radiation, that's a sort of electromagnetic radiation that has an extended wavelength than seen mild however shorter than microwaves. These sensors discover a huge variety of applications, along with movement detection, temperature measurement, and far flung controls. For instance, in far flung controls, infrared sensors hit upon the infrared alerts emitted via way of means of the far flung manage and convert them into electric alerts that may be used to function the device.

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Figure 7. Infrared Sensor

V. TECHNOLOGY USED

IoT technology is used to collect and transmit data from various bio monitoring devices, such as sensors and wearables, to a central hub or cloud platform. This allows for real-time monitoring and remote access to the data, as well as scalability for future expansion. By using IoT technology, we are able to gather accurate and comprehensive data from the bio monitoring devices, which is crucial for the functioning of our system. Web technology is used to create a user interface for the system. A web application or mobile app is developed that allows users to view and interact with the collected data. We have used technologies such as HTML, CSS, JavaScript, and any frameworks or libraries to build the web interface [1]. The use of web technology has provided us with the benefits of accessibility and ease of use for the system, as it can be accessed from any device with internet access. By combining IoT and web technology, we were able to develop a smart bio monitoring system that is efficient, accurate and easy to use. The data collected by the system is stored and analyzed in real-time, allowing for quick and effective monitoring of the bio parameters.

IoT Technology

- The Internet of Things (IoT) era is all about the connectivity between physical devices, like cars, homes, and everyday objects that are embedded with electronics, software, sensors, and connectivity. This interconnectedness allows these devices to communicate and exchange data with each other and with the world around them. [2]. This technology helps to make our lives more convenient, efficient and secure. IoT technology is being used to develop smart cities, where various devices and sensors are used to monitor and control traffic, lighting, parking, and public safety. IoT technology is expected to continue to grow in the future, with an increasing number of devices and appliances becoming connected to the internet. However, the rapid growth in the number of connected devices also poses challenges for security, privacy and data management.

Web Technologies

- Web creation refers to the various tools, languages, and platforms used to create and maintain websites and Internet applications. Some popular internet technologies include HTML, CSS, JavaScript and PHP.

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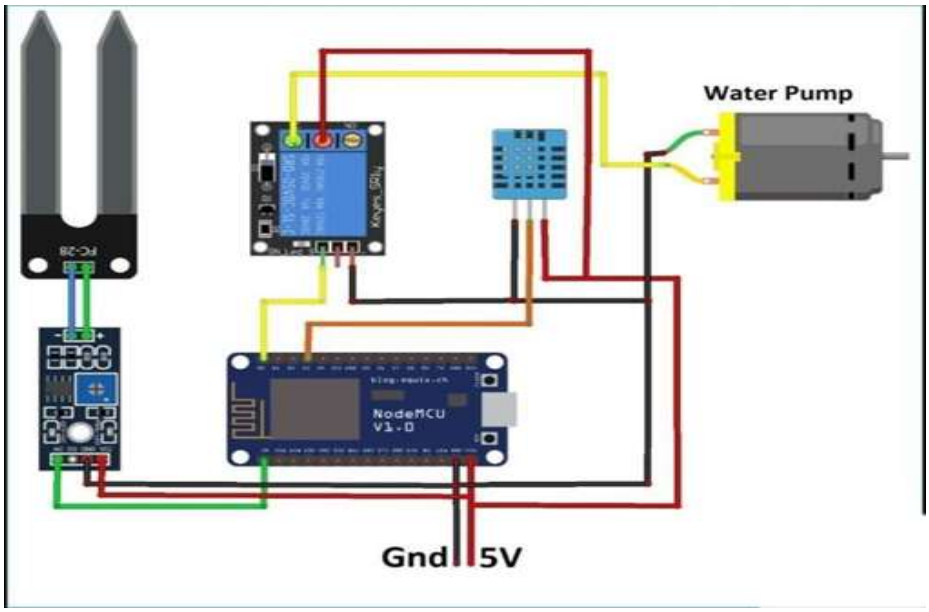

Figure 8. Circuit Diagram of Project

VI. Proposed Flow Chart

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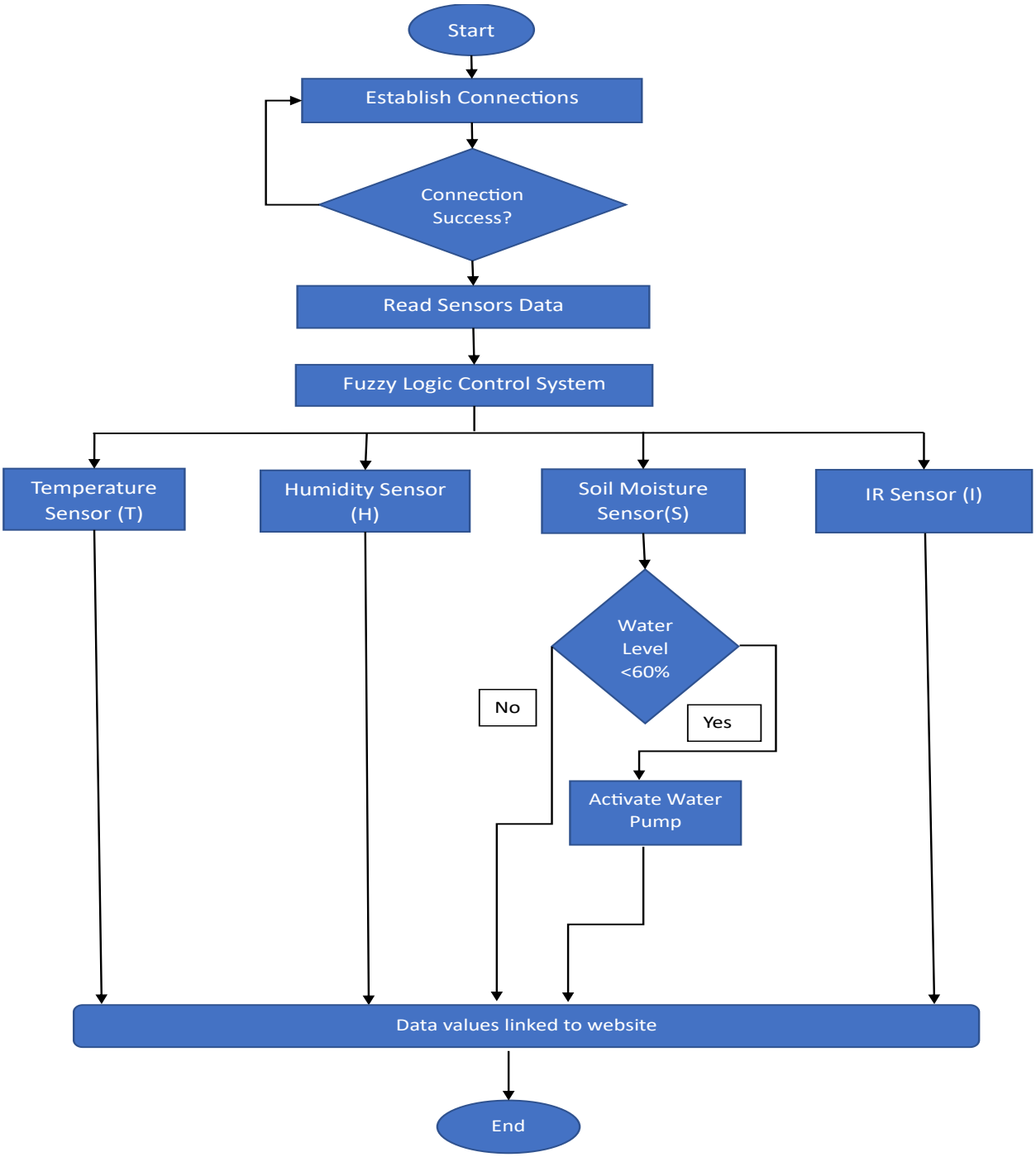

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VII. BENEFITS OF PROPOSED SYSTEM

Smart Farming benefits in the following ways:

1. Optimization of water use.
2. Energy resources optimization.
3. Improve crop yield and plant quality.
4. Save time and energy.
5. Overall reduction of Workload.

IX. RESULTS AND DISCUSSION

1. The plant monitoring system is helpful for watering the plants and to monitor few parameters for growth of plants.
2. This system is very used in few areas like nursery farms and in agriculture.
3. System not only reduces the wastage of water resources but also saves time and human effort.

X. EXPERIMENT RESULT WITH IMAGES

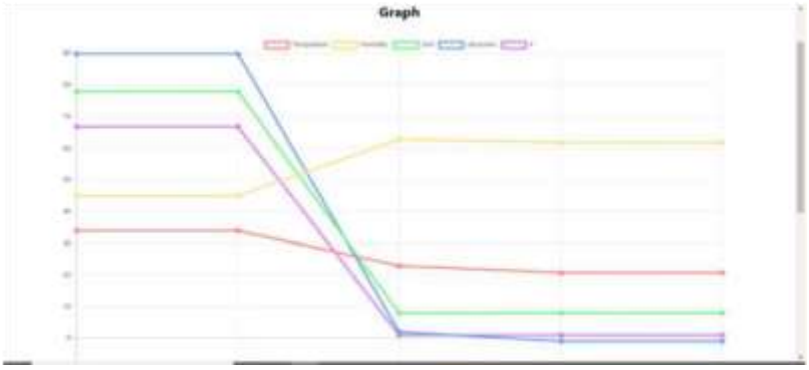

Figure 10. Readings

XI. CONCLUSION AND FUTURE SCOPE

This project was to design a system for monitoring various factors that impact plant growth, such as temperature, humidity, and moisture levels in the soil. The project also aimed to analyze existing systems and identify their strengths and weaknesses. One potential application of the proposed system is in agriculture, where irrigation is a critical but water-intensive process. By using sensor data to automatically turn the irrigation motor on or off, the system can help farmers optimize their use of water and avoid over or under-irrigation, which can damage crops. The owner of the farm can view and interact through the front-end user interface. By conserving water and reducing the power consumption of the irrigation motor, the system can help to sustainably support the growth of crops. Overall, the project highlights the potential of IOT and automation to improve farming practices.

XII. FUTURE SCOPE

1. Enhance the security of both the device and the owner's account.
2. Incorporate a sensor for detecting the amount of sunlight available to the plant.

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3. Utilize artificial intelligence to assess the health of the plant.
4. Reduce the size of the system and make it more versatile for different installations.
5. Design the system to be powered by a solar cell, eliminating the need for an electrical plug.

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