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Aeroponics System Using IoT for Smart Farming

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Abstract: Aeroponics is a new technology to make a high yield in less land space without using soil. These types of techniques are used in many countries and gain the high profit. But In our country there is still in a nascent stage. The main drawbacks are that the setup of a growing field is more complicated. It is so expensive comparing the normal agriculture. If any maintenance error, all the plants are spoil. Aeroponics is highly susceptible to power outages. People must have a certain level of technical knowledge. So the people are not taking the risk. These are the reasons why people are not coming forward to choose aeroponics. The merits of aeroponics is not possible to take over the diseases in plants and no need to take any pesticides and fertilizers. This project is going to be monitoring the plants growth, measuring the temperature levels and maintain the mist environment. Using aeroponics with the help of Internet of Things is possible to rectify the limitations. It is possible to monitoring the work and maintain the platform. If any error happening in the Platform immediately communicate to the user through the SMS and solve the problem instantly. This is possible to grow plant and get high yields. So the users are do not worry about the plant and the profit is also be a high.
Keywords: Aeroponics; Monitoring the plants; Sensors; SMS to the User;

I. INTRODUCTION

The Internet of Things (IoT) describes the network of physical objects equipped with sensors. As the technology evolves, it will bring great benefits to people in all aspects of life. In particular, the development of network technology is transforming many areas of our lives, such as smart homes, smart cities, smart power grids, autonomous cars, and the industrial Internet. Smart agriculture systems are one area that would benefit from this technology. By adapting recent technological innovations for agriculture, many benefits would accrue to farmers and our carbon footprint would be reduced. The main goal of this project is to improve the aeroponics process through IoT to achieve high yields. Farming should be easier to manage and higher profit should allow re-investment and expansion. Automatically monitor and measure the value, and communicate with users immediately in case of discrepancies. The high use of pesticides on crops affects both the soil and the health of the plants. This project aims to overcome the disadvantages of areoponics and make the cost of set up affordable by operators using IoT. The main focus of this project is to use easy to install and maintain systems that provide higher yields compared to normal systems.

II. LITERATURE REVIEW

In the paper [1], the authors developed a novel automated aeroponic system using IoT devices. This system consists of three main components. It consists of mobile applications equipped with sensors, service platforms and IoT devices. The graphical user interface was displayed to the user through the mobile application. To control and retrieve data, the IoT device uses the sensors within the aeroponic system. The main project is the development of a new agricultural application. It is a promising application to help farmers increase their yields while reducing their carbon footprint.

In this paper [2], the development of an automated control system for aeroponics is described. The main processing unit in this system was a lattepanda, and three main sensors were used. Temperature, light and humidity sensors are used, and the output is displayed on the LCD screen module. Green plants were used as an automatic control method in aeroponics. The main goal of this method is to minimize labor while increasing the economic value of yields. The aeroponic plant is a user-friendly interface and an excellent solution for automation.

In the article [3], it is stated that the improvements in new technologies in the present time have led to a reduction in the size of sensors. They are using Internet of Things (IoT) and cloud computing in all areas that lead to the concept of "smart", such as smart health care systems, smart cities, smart mobility, smart grid, and smart home, to name a few. The role of IoT and cloud computing in agriculture is to improve crop production by regulating costs, monitoring performance, and maintaining crops using cloud computing. The main topic of this study is the implementation of a smart drone for crop management and smart agriculture.

The study [4] states that smart agriculture using smart devices is transforming agricultural production by not only improving quality and yield, but also making agriculture more cost-effective using the Internet of Things (IoT). The main purpose of this application is to collect real-time data such as temperature, soil and humidity to monitor the environment. To collect the values, a microcontroller and various sensors are used in this research. In this paper, the values of ambient temperature, wetness and humidity are presented.

The article [5] shows the promise of wireless sensors and the Internet of Things in agriculture, but also the difficulties that can arise when combining this technology with traditional agricultural techniques. IoT devices and communication protocols for wireless sensors used in agriculture are briefly reviewed. The sensors available for specific agricultural applications, such as tillage, crop condition, irrigation, and insect and pest detection, are discussed. It details how this technology helps growers at all stages of farming, from seeding to harvesting, packing, and shipping.

The study [6] highlights the use of IoT sensors for technology development. To monitor the temperature and humidity in the agricultural field. They use a single CC3200 chip, and the camera is connected to the CC3200 to collect photos and transmit them to farmers' cell phones via MMS over Wi-Fi.

The article [7] is mainly about farmland and smart irrigation. It uses an Arduino board and three sensors to detect the moisture, wetness, and temperature of the plants. This article was created using an Arduino board, a voltage regulator, and a relay to control the motor. The WIFI module is primarily used to inform the user about the field conditions.

In the study [8], a traceability system and the Internet of Things (IoT) are proposed, as well as the use of numerous sensors to collect environmental data in the farm. TO provided users with information on the support and quality of the planting process by scanning a quick response code (QR) through a mobile application.

In [9], irrigation methods based on the Internet of Things (IoT) are proposed. Real-time monitoring of the irrigated field by operating it from anywhere and at any time. Temperature and moisture measurements in the fields are also possible. Sensor nodes are placed on the field to enable automatic irrigation. Users can easily perform irrigation at the right time.

In the work [10], new concepts for smart agriculture have been developed. Arduino is used to connect the IoT sensors. The main objective of this paper is to build smart agriculture using IoT and sensors. The cellular internet connection enables the review of data from the farm and the collection and monitoring of values.

In the study [11], the potential of the Internet of Things (IoT) to change agricultural practices and increase production is investigated. Sensors on farms are extremely capable of capturing and maintaining values. Agriculture using current information and communication technologies (ICT). In this study, the technology and software of IoT for smart agriculture is investigated.

In paper [12], in their article to improve the quality of agricultural goods by monitoring soil conditions and atmospheric conditions for plant growth. NodeMCU and sensors are used to monitor the temperature, humidity and soil moisture. The user receives notification of the status of the field via Wi-Fi.

In [13], their article investigated the development of aeroponic plants. By injecting a nutrient-rich liquid into the root system, plant development was exposed to a closed or semi-closed environment. It is important to maintain the plant, and the biggest advantage is a pesticide-free culture environment.

In paper [14], has developed a smart agriculture-based effective indoor cultivation method. To create a sophisticated automation system using the Arduino and many parameter monitoring devices.

In paper [15], in their paper to research hydroponics plant growth. Hydroponics is most similar to aeroponics. All of them are soil-free and deliver the nutrients with manual control to help users achieve high yield with less cost. And also reduce the manual labour and increase the automation with IoT for controlling the system via internet.

III. METHODOLOGY AND PROCEDURE

In the aeroponics plant setup to connect the monitoring kit is very easy to maintain for users. The monitoring kit is used to maintain the mist environment and detect the sensor values, which are displayed to the user through the Blynk cloud app on cell phones or Blynk websites. Users can monitor the plant setup anytime, anywhere. The main process to monitor the plant and any deviation or function that is not working immediately sends an SMS message to the user. Sensor readings are also shown on the digital display.

ESP32 is a stand-alone system and a low-cost chip. ESP32 is the main component to connect the sensors and also use the cloud. It is an important component to carry all the sensors and perform user-defined functions successfully.

The sensors are the most important element to collect the values. In this project, three main sensors are used. They are temperature sensors (DS18B20), humidity sensors (DHT11) and current sensors (ACS712-5A). Each sensor is used to calculate the temperature and humidity values in the environment of the plant. All sensors are connected to the ESP32.

Blynk Cloud is very easy to use and see the state of the plant setup. The temperature and humidity sensors are used to detect the ambient humidity and the data is calculated using ESP32. With the Blynk cloud, the sensor data is stored and displayed at the same time. This allows the user to view the sensor data through mobile apps and websites.

The GSM module is connected to the esp32 and the current sensor. The current sensor is used to detect the current flow of all systems. If the motor is not working or any problem occurs in the system, a warning message will be sent to the user immediately. So the user can easily detect and fix the problem.

The above content represents the hardware connection and the cloud. The main part is the connection of the sensors with the plant structure. In the areoponic process, a plant is grown from the plant leaves. In the plant leaves, the plant is made to grow with the help of rock wool. The rockwool helps to grow from the germinated seeds. Once the plant leaves are grown with the rock wool, the leaves are transferred from the leaves to the plant setup.

In the plant setup, inside the sprinkler nozzles are used to make a mist environment. A 12v DC battery sprinkler motor is used to pump the water to the nozzles. When the motor is not working, a message is automatically sent to the user.

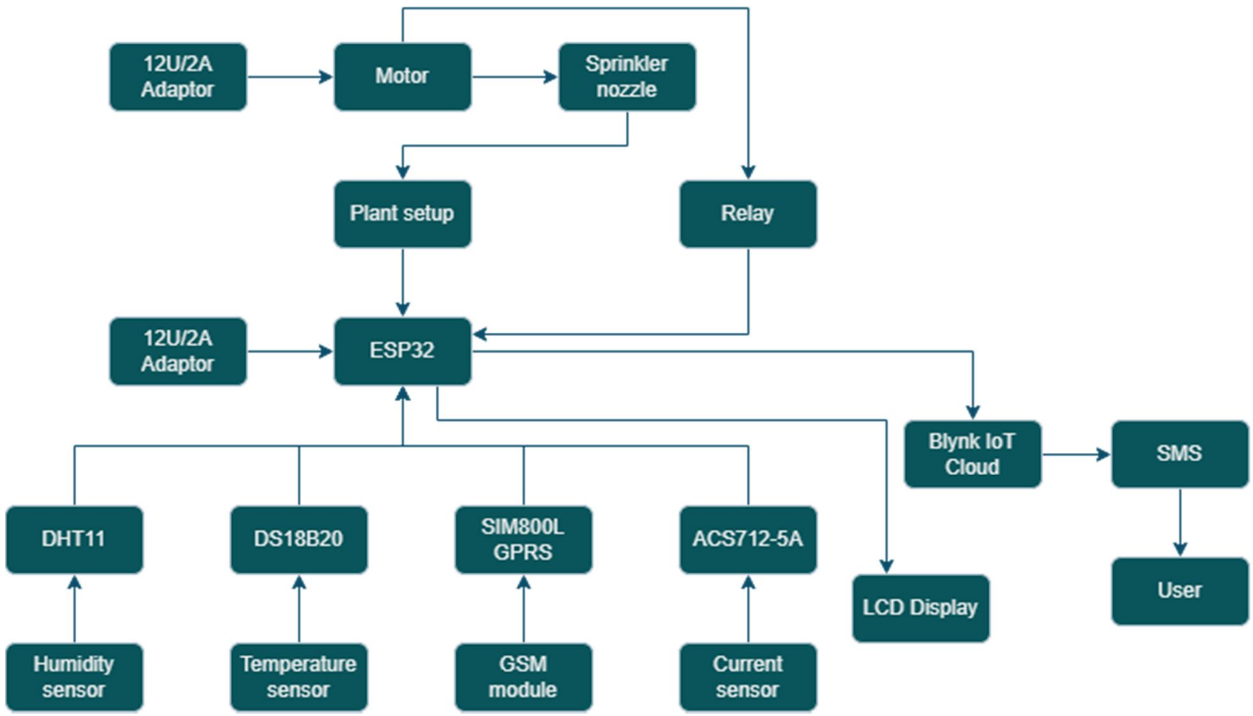

Figure 1. Block Diagram of Plant Setup

The Humidity sensor, current sensor and GSM module are set in the outside the plant setup and the Temperature sensor is set in the inside the plant setup.

Based on the plant breed the temperature will be differ. So setting the particular value in the to make a condition to the model from the user. After that any deviation in the values, automatically insist to the user through the message.

IV. RESULT AND DISCUSSION

The plant in aeroponics is grown healthy because of the correct amount of nutrients which is sprayed in the roots of the grown plant. Monitoring the values of temperature, humidity level of the plant setup. Aeroponics processes through IoT make high yield and make farming easier to manage increased profit allows for the re-investment and expansion.

ESP32 acts as a local server that transmits data to the blynk IoT cloud. This type of monitoring helps prevent the loss of plants and high yields. With this solution, it is easy to take care of the plants without any loss. When the temperature and humidity in the plant are too high or too low, the data from the sensor is automatically matched with the data in the cloud to maintain the stability of the plant. Monitoring temperature, controlling water sprinkling with the help of a motor. Measuring the pH and humidity of the plants and the fogging environment.

Figure 2. Temperature, Humidity, Current and motor readings from LCD display

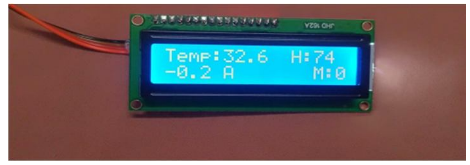

Figure 3. Readings are changing from LCD display

The display LCD is used to display the values of temperature, humidity and motor status. The relay is used to ON and OFF the motor. With the Blynk app, the motor can be controlled by a button and the user can control the motor within the Blynk app.
Aeroponics technology monitors each plant via the Internet of Things (IoT). When a deviation occurs, users are immediately notified via SMS. In the Aeroponics plant setup, to connect the monitoring kit is very easy for users to maintain. The monitoring kit is used to maintain the fog environment and detect the sensor values, which are displayed to the user through the Blynk cloud app on the cell phone or on the Blynk website. Users can monitor the plant setup anytime, anywhere. The main process to monitor the plant and any deviation or function that is not working immediately sends an SMS message to the user. The sensor values are also shown on the digital display. The message is stored in the Blynk cloud as well as on the user phone. This allows the user to easily monitor and perfectly maintain the plant.

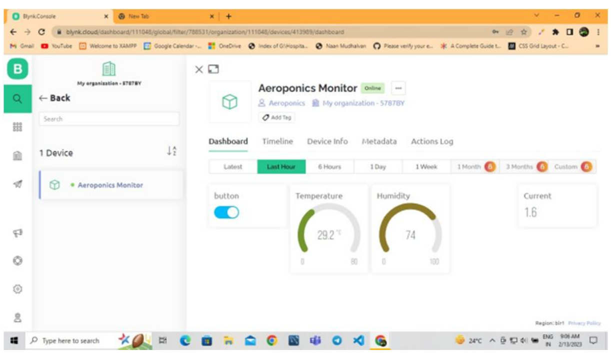

Figure 3. Readings are shown in blynk website and control the motor with the help of button.

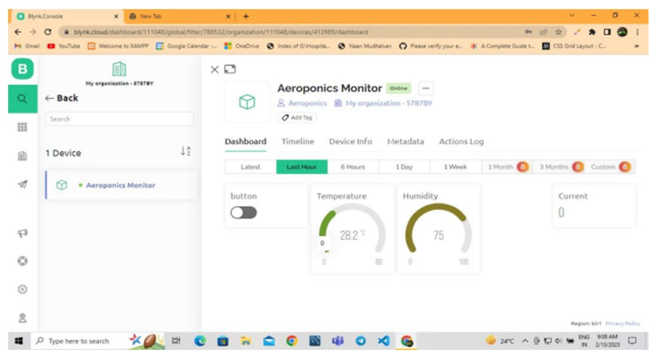

Figure 4. Readings are shown in blynk website Now the button is off, the motor should be off.

The message will be send both blynk notification and user mobile phone. It is very easy to communicate and take a action easily. Using the GSM module the message system is possible.

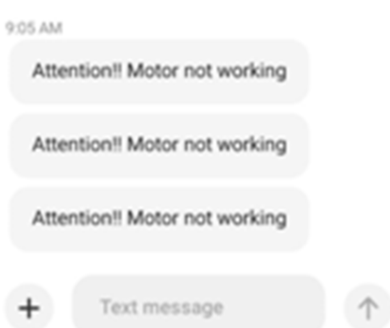

Figure 5. Alert message from the user mobile phone

Figure 6. Alert message from blynk app

V. CONCLUSION

Through the proposed project, we conclude that the new proposed system will support aeroponics technology. The main process of aeroponics is the cultivation of plants in small spaces and with high yields. It is about monitoring the plants and achieving high yield. Introducing a new technology to improve the automation process by using the cloud. To send an SMS to the user when there is a deviation in the sensor values. Using the Blink Cloud to display the sensor values anywhere through cell phones and websites and even through the digital display. Maintenance is very important to grow the aeroponic plants. In this way, the user can easily monitor the plant and grow the plant to high yield.

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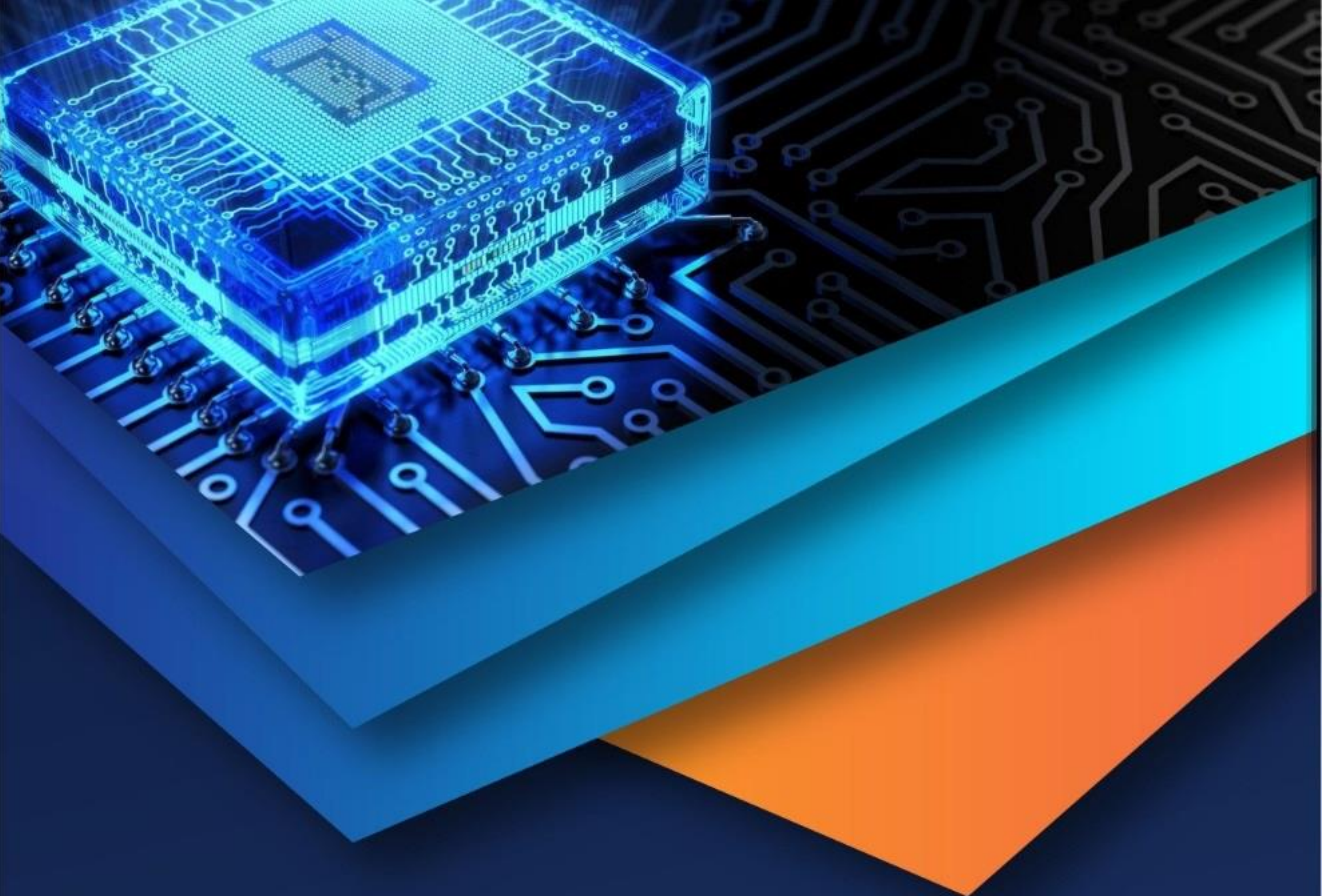

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