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IoT BASED SMART AGRICULTURE MONITORING AND CONTROLLING SYSTEM

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Abstract

Every nation has practiced agriculture for centuries. Plant cultivation is the science and practice of agriculture. The main innovation in the rise of sedentary human civilization was agriculture. Agriculture has always been done by hand. The goal of advancing agriculture is essential as the globe moves toward new technology and applications. Agriculture is currently being hampered by the migration of people from rural to urban areas. Therefore, we have suggested an IOT and smart agriculture solution to address this issue. IOT sensors are able to provide information on agricultural fields, which is where IOT plays a significant role in agriculture. This Internet of Things (IoT)-based agriculture monitoring system uses wireless sensor networks to gather data from various sensors placed at various nodes and transmit it via wireless protocol. And Arduino provides the electricity. It is made up of a GSM module, a PIR sensor, a water level sensor, a humidity sensor, and a temperature sensor. The water level, humidity, and moisture level are all checked when the IOT-based agriculture monitoring system starts up. It notifies the phone via SMS when the water level changes. And any remote device or internet services can be used to regulate these parameters. The operations are carried out by integrating sensors, Wi-Fi, and cameras with microcontrollers. The wellbeing of the farmer is served by the creation of this idea as a product.

Keywords: Sensors, Climate, Agricultural Productivity, Internet of Things, Smart Agriculture, Farm Automation, IoT

1. INTRODUCTION

The cultivation of food crops takes up the highest percentage in the total agricultural produce in India the goal of advancing agriculture is essential as the globe moves toward new technologies
and implementations. Because it is the primary source of food grains and raw resources, agriculture is regarded as the foundation of life for the human species. where it is crucial to the expansion of the nation's economy. Additionally, it offers people numerous, adequate job opportunities. Agriculture sector expansion is essential for the improvement of the nation's economic situation. Unfortunately, many farmers continue to cultivate their land using outdated techniques, which reduces crop and fruit yields. However, the yield has increased wherever automation has been used and humans have been replaced by autonomous machinery.

Therefore, in order to increase production, contemporary science and technology must be applied in the agricultural sector.

Even though technology advances quickly and new innovations are made daily, farmers continue to have many issues with their land. It is everyone's responsibility to establish an atmosphere that encourages farmers to produce well and feel comfortable, while also protecting their fields from various creatures.

2. LITERATURE SURVEY

Patil K. A et al. (2016) [6], offers an intelligent agriculture concept that incorporates ICT. ICT has always been important in the field of agriculture. As weather patterns, soil conditions, and epidemics of pests and illnesses changed over time, farmers were able to adapt to and even profit from these changes by receiving new information. Due to the very localized nature of agriculture information, in particular, distinct situations, it is a particularly difficult task to give such knowledge. It is possible to manage and use resources effectively thanks to the comprehensive real-time and historical environment information. The problem is that the method can establish an easy wireless connection over a short distance.

Joaquín Gutiérrez et al. (2014) [3], The goal of the study is to maximize the utilization of water for agricultural crops. To control the amount of water, a microcontroller-based gateway was designed with an algorithm based on temperature and soil moisture threshold values. Photovoltaic panels provided the system's energy, and it had a duplex communication link based on a cellular-Internet interface that allowed users to schedule watering and review data via a web page. The cost of investing in an electric power source is the problem.

Shakthi Priya N et al. (2014) [7], It examines cutting-edge wireless sensor technologies in agriculture, as was already mentioned. During times of water scarcity, the water sprinkler operates based on the reading from the soil moisture sensor. The water sprinkler is turned off once the field has received sufficient watering. Water can be saved in this way. Additionally, a GSM modem is used to send the farmer the results of the soil pH sensor through SMS. The problem is that it only offers precision figures, which are inaccurate and inefficient from a financial standpoint.

BezaNegashGetu et al. (2015) [1], It looks into how an electrical system could be designed and simulated to automatically control water pumps used to water plants or agricultural fields based on the amount of soil moisture being sensed. The motor runs at a lower speed when the soil is extremely wet and at a higher speed when the soil is dry. The speed of the motor varies according to the level of soil moisture content. A timer circuit manages the length of water pumping. Software for simulation called NI MULTISM is used to test the system. Techniques like DIAC and TRIAC are applied. The problem is that it employs outdated methods and cannot support various water levels.

G. Meena Kumari et al. (2014) [4], The method suggests that technology advancement in Wireless Sensor Networks has made it viable to utilize in greenhouse parameter monitoring and control in precision agriculture. To automate system performance and throughput, the Field bus concept controls data transfer primarily using hybrid systems (wired and wireless). For wireless systems, ZigBee protocols based on IEEE 802.15.4 are utilized. Using Ethernet IEEE 802.3, the atmospheric conditions are monitored and managed online. To conserve water, the partial root zone drying process is used. Hybrid networks including the Controller Area Network (CAN) are also utilized. It makes use of conventional communication methods. Future research may concentrate on wavelength routing networks for optical communication systems, as well as on energy conservation, data fusion, and other topics. It may also use improved ARM controllers and core processors.

Nikhil Agrawal et al. (2015) [5], It suggests a design for a home automation system employing pre-built, reasonably priced, and environmentally friendly gadgets like raspberry pi, Arduino microcontrollers, xbee modules, and relay boards. The implementation of the system is made overall more affordable, scalable, and reliable through the use of these components. The implementation of the system is made overall more affordable, scalable, and reliable through the use of these components. Utilizing a drip irrigation system is an efficient way to use fertilizer and water. The Arduino 4 Freedonia variant is utilized in this design. An email is sent to a specified account in order to start the drip irrigation system. The problem is that failure of any specific component or device is not detected and must be manually tested. For huge agricultural fields, ineffective

HemlataChanne1 et al. (2015) [2], It examines the application of contemporary techniques in the agricultural sector, including Internet of Things (IoT), sensors, cloud computing, mobile computing, and big data analysis. Through IoT, soil and environmental characteristics are detected and periodically relayed to AgroCloud (Beagle Black Bone). AgroCloud data is subjected to big data analysis for stock and market needs, best crop sequence analysis, overall production, and fertilizer requirements. Both the rise in agricultural output and the cost control of agriproducts are benefited. The system lacks many soil nutrient sensors and provides inaccurate data.

3. METHODOLOGY

Sensors, Processors, and Applications are the fundamental components of an IoT System. As a result, the block diagram below depicts our project's proposed model, which depicts the interconnectedness of these blocks. The sensors are connected to the microcontroller, and the data from the sensors is presented on the user's mobile app. A mobile app gives farmers access to continuous data from sensors and, as a result, enables them take action to meet the soil's needs. Farming is a time-consuming and labor-intensive task that necessitates a significant amount of time and effort. Typically, these duties are dull and repetitious. These labor-intensive chores can be delegated to robotics and automation-based solutions by farmers. Seeding, watering, harvesting, and sorting are just a few of the chores that such solutions may handle.

Eventually, this technological integration will lead to increased output while reducing resource waste.

Robotic machinery is also used to help farm machinery. It can be used to sow, harvest, and do other activities, as well as to prevent human errors. Robotic devices can be used to spray pesticides, harvest crops, grow crops, and do other activities on farms.

The block diagram of the proposed IoT-based Smart Agriculture Monitoring and Controlling System

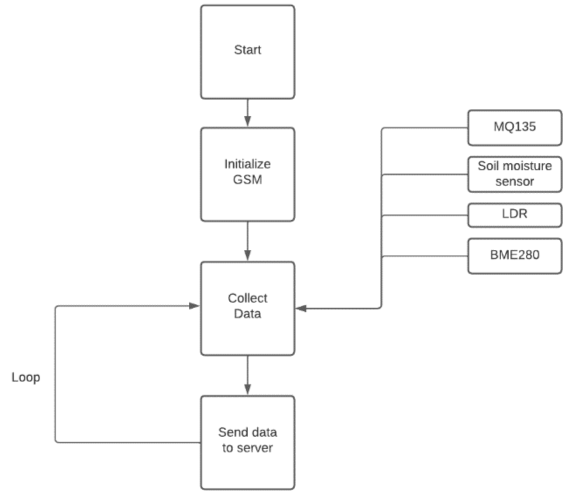

Fig.1.Data Flow Diagram

Sensors like the DHT 11, PIR sensor, and soil moisture sensor gather information from the field and relay it to the microcontroller. The microcontroller now compares the supplied data to previously recorded data, and if the values above the threshold, the necessary devices are turned on. The temperature in the farm is first compared to a pre-set value in the microcontroller, and if it is higher above the threshold, the application will be updated.

Later, the soil moisture inside the farm is compared to a predefined value in the microcontroller, and if it exceeds the threshold point, alert messages are transmitted to the PythonAnywhere IOT wed page through GSM module, where they are displayed in a KEY-VALU style. These devices turn off automatically once they reach the specified level. Each sensor's data is typically uploaded in 15 seconds, and this is a cyclic process. Where every report from the field is sent to the farmer through SMS alert on a regular basis.

4. PROPOSED METHOD

The Internet of Things is assessing agricultural operations involving farmers using a variety of strategic allocations, such as precision and conservation investments, to help the sector face its difficulties. Enhancements to the Internet of Things communicate with his home at any time and from anywhere. The farm is being monitored and controlled using a remote sensor architecture.

4.1 HARDWARE DESIGN

The Proposed design system is a Hardware of the module. The connectivity part will consist of the WIFI module. Node MCU is connected to the MQ4 methane gas sensor, MQ135 Ammonia gas sensor, and temperature sensor. Using MQ sensors to detect the gas. Users can use both digital or analog pins to power the module and when no gas has been detected at the output, the Power LED on the module will light. The LED will remain off, indicating that the digital output pin will be at 0V.

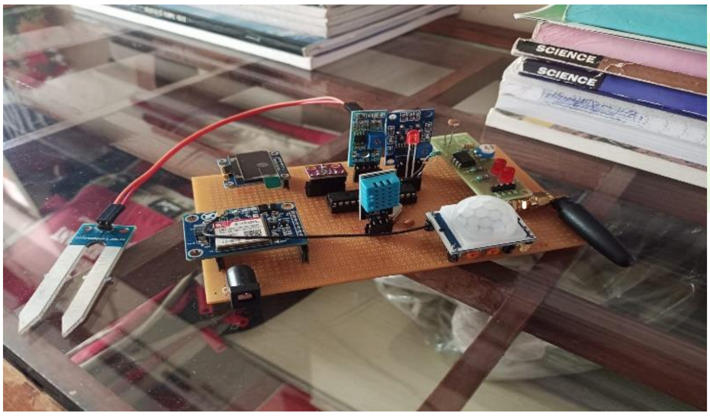

Fig.2.Hardware design

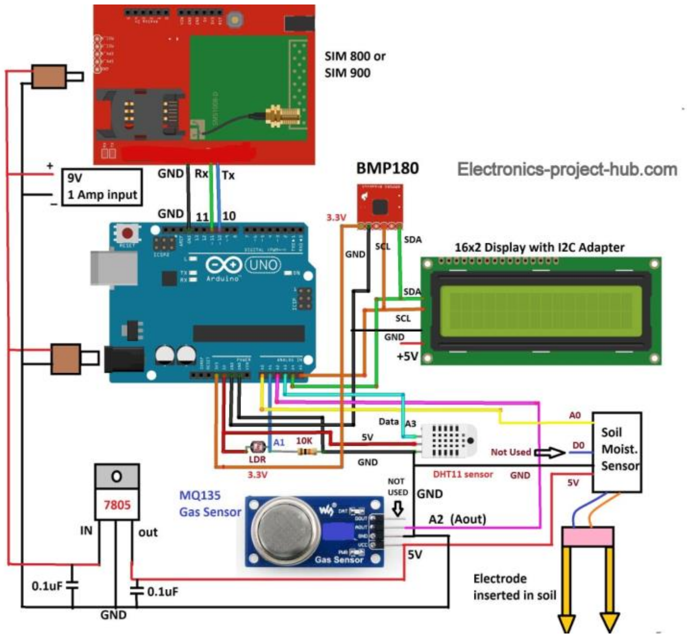

Fig.2.1. Circuit Diagram

4.2 SOFTWARE DESIGN

Arduino IDE is used for set and update the Values of connected sensors. Then it sends the data to PythonAnywhere server. On server data get separated in form of HashMap. After separating it will display on application. If the values of the sensor are greater than the threshold value then the color of that sensor box will change from white to red and user get notified. All the sensor values are uploaded to the SQL database. The PythonAnywhere is used and it is connected to the SQL database for

- Real-time value of all the sensor.
- Real-time value of temperature and humidity.
- Optimizing threshold value of Sensors.

PYTHONANYWHERE

Python programs may be easily written and executed in the cloud thanks to PythonAnywhere. In a web-based editor, we can create our own programs, or we can just launch a console session from any current web browser. We don't need to buy or set up our own server because there is storage space on our servers where we can store and access the status of a session.

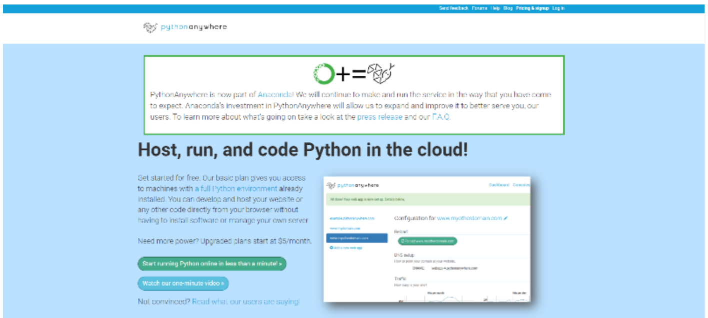

Fig 3. PythonAnywhere Website

5. RESULTS

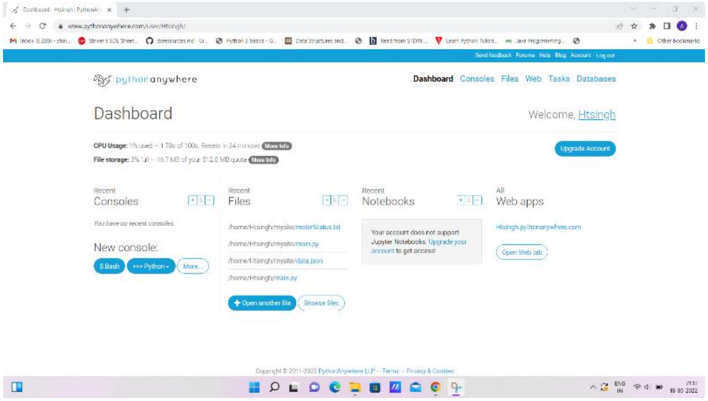

Fig.4. Dashboard

Server where we are uploaded all programs to fetch data and using this server displaying that data on app.

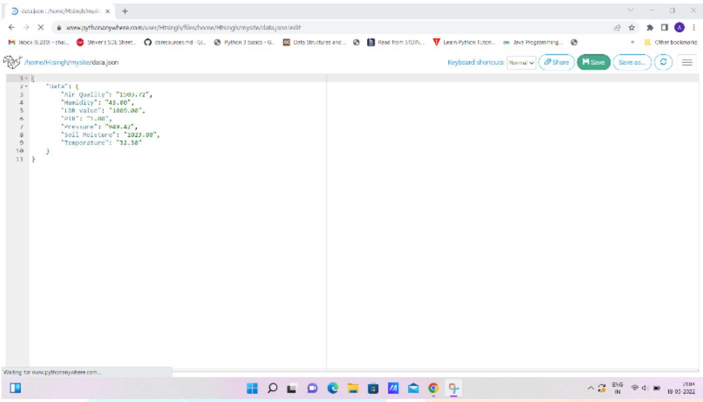

Fig.5.Program Window

Python Program to store and display data in Key-Value set.

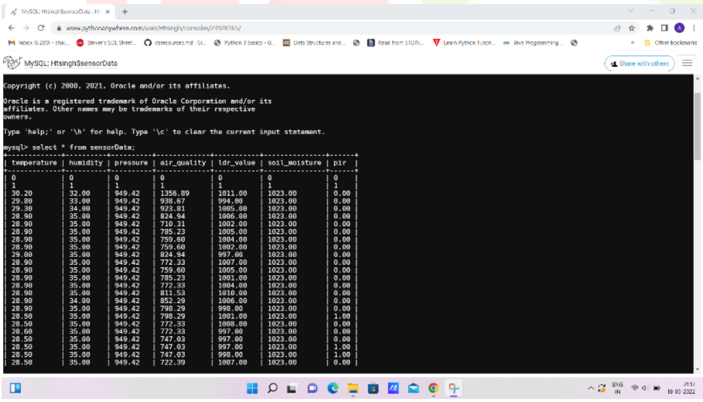

Fig.6. Database Window

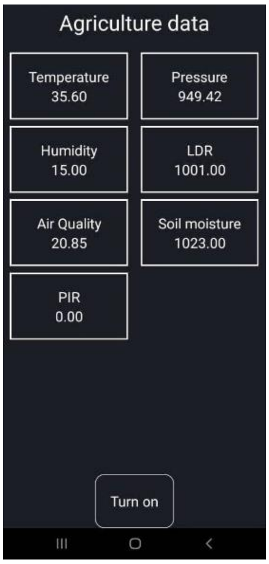

Fig.7.Application Window 1

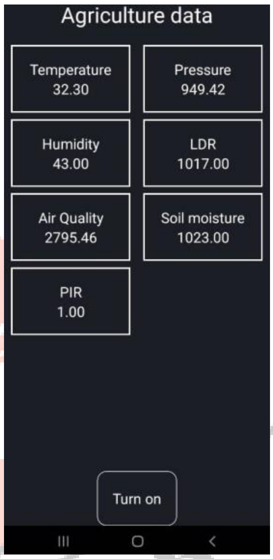

Fig.8. Application Window 2

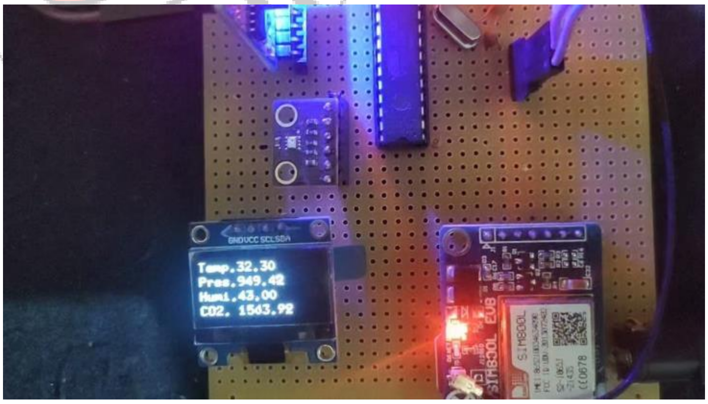

Fig.9. Hardware Working Kit

6. CONCLUSION AND FUTURE SCOPE

The "Internet of Things" is a network of connected electronic gadgets. This system for monitoring agriculture is dependable and effective, and it allows for the implementation of corrective measures. Field monitoring through wireless technology increases crop productivity while using less human labor. It costs less money and uses less energy. The system for smart agriculture has been carefully created and assembled. The newly designed method is more effective and advantageous for farmers because it provides them with information on the temperature and humidity of the air in the agricultural field. The use of such a technology in the field can undoubtedly aid in accelerating agricultural harvest and global production. Future upgrades to this system could include the addition of numerous cutting-edge techniques, such as solar energy consumption and irrigation methods. This technique can be improved to cover a wide region of land. Additionally, the system can be integrated to use sensors to assess the soil's quality and provide suitable crop recommendations. Successful link between the sensors and microcontroller allows for wireless communication between various nodes. All research and experimental tests prove that this project is a complete solution to field activities and irrigation. problems. Implementation of such a system in the field can definitely help to improve the yield of the crops and, overcome the problem.

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