International Journal of Recent Advances in Multidisciplinary Topics
Volume 2, Issue 4, April 2021
https://www.ijramt.com | ISSN (Online): 2582-7839

IoT Based Smart Farming (E-FARM)'S

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***Abstract*: Internet of Things (IoT) based smart farming is used to automate farming. It is used to monitor the level of environmental condition is the main key factor to improve the yield of efficient crops. The IoT system has a full-duplex communication link based on the internet interface that allows data irrigation and fertilizer schedule to be programmed through an android application ("BLYNK App"). It is used to automate the irrigation and fertilizer supply. Blynk application is used to control the hardware remotely and display the sensor values. ESP8266 is a Wi-Fi module controlled by the blynk application. Irrigation and fertilizer supply can control the two different types. One is automation through IoT and another one is manual. In automation, the whole system is controlled by blynk application through the phone. In manual type, humans can on/off the system. In this way, we also measure the field (or) farm temperature and humidity using IoT we can control anything everywhere. This method is used to improve crop yield. The proposed method is used to reduce manpower, time efficiency, and high cost.**

***Keywords*: Agriculture, Automatic, Blynk app, Irrigation, Nodemcu.**

1. Introduction

Agriculture is the main backbone of India's economic growth. The most important barrier that arises in traditional farming is climatic change. The number of effects of climatic change includes heavy rainfall, most intense storm and heat waves, less rainfall, etc. Due to these the productivity decreases to a major extent. The climatic change also raises environmental consequences such as seasonal changes in the life cycle of plants. To boost productivity and minimize the barriers in the agriculture field, there is a need to use innovative technology and techniques called the Internet of Things. Today, the Internet of Things (IoT) is transforming towards agriculture industry and enabling farmers to compete with the enormous challenges they face. Farmers can get huge information and knowledge about recent trends and technology using IoT.

IoT devices can be of great help in enhancing the production and yield in the agriculture sector since these devices can be used to monitor temperature, humidity, and other variables. Moreover, smart agriculture will help in monitoring livestock productivity and health as well. IoT sensors are capable of providing farmers with information about crop yields, rainfall, pest infestation, and soil nutrition are invaluable to production and offer precise data which can be used to improve farming techniques over time. Internet of things, with its real-time, accurate, and shared characteristics, will bring great changes to the agricultural supply chain and provide critical technology for establishing a smooth flow of agricultural logistics. NodeMCU is a LUA-based firmware. It is developed for ESP8266 Wifi chip. It is a reasonably priced, Wifi module chip that is capable of connecting to the Internet of Things (IoT). It is a 32-bit RISC microprocessor that operates between 80 to 160 MHZ at the variable clock frequency. Node MCU supports RTOS. Node MCU Development board is featured with the capability of connecting to the Wifi module, both analog and digital pins, and serial communication protocol. It has a total of 30 pins that can be interfaced with the external circuits which comprise Power pins, GND, I2C Pins, GPIO Pins, ADC channels, PWM Pins, UART Pins, SDIO Pins, UART Pins, and Control Pins. GPIO has 17 pins. The operating voltage range of this module is 2.5V to 3.3V. The ESP8266 Node MCU can be powered by using an onboard micro B USB connector. Node MCU can be powered using renewable sources like solar energy. It is widely used because of low energy consumption and very compact in size. The main disadvantage of Node MCU is it has only one analog pin and the number of output pins is low.

The DHT11 sensor is used to measure the relative humidity and temperature of the air. Its main advantage is that it is a low-cost digital sensor to measure relative temperature and humidity. Relative humidity changes with the temperature. If the weather is warmer, the air has better humidity than everyday conditions and vice versa. It can be easily interfaced with all the microcontrollers like Arduino, Node MCU, etc. It has a capacitive sensing element for measuring humidity and a thermistor for measuring temperature. The capacitor has two electrodes. The moisture-maintaining substrate is used as a dielectric between them. There will be a change in capacitance when the humidity changes. The corresponding resistance changes and can be transformed into digital form and can calculate the temperature by using a Negative Temperature Coefficient Thermistor sensor. When the temperature increases there will be a decrease in resistance. The temperature range is from 0 to 50 Celsius. The humidity variation of this sensor is from 20to 80%.

Blynk is a Platform with both IOS and Android apps to control Arduino, Node MCU, etc. over the Internet. Blynk has its cloud server. It can connect to the microcontroller, receive and transmit data. Blynk supports connection over Wifi, Ethernet, Bluetooth, and Serial. It has its own libraries which enable connection with the server and process all incoming and outgoing information.

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2. Objective

- Smart agriculture system can achieve for plants with the help of IoT.
- To observed the growth of plants the various aspects are implemented such as temperature, humidity and to control the water automatically.
- For measuring the temperature and humidity the DHT11sensor is used.
- NODEMCU is an inbuilt wifi module using which the sensor value can be sent to a cloud server.
- The sensor data will receive using the Blynk app.
- The user can set the values using a timer to on and off the motor pump automatically.
- This application is real-time provided has an internet connection.

3. Methodology

A. *Block Diagram*

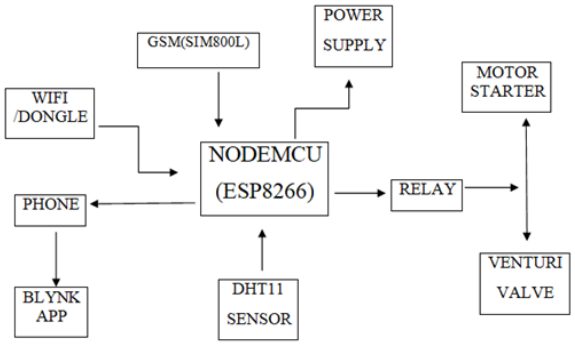

Fig. 1. Block diagram of smart farming

B. *Block Diagram Description*

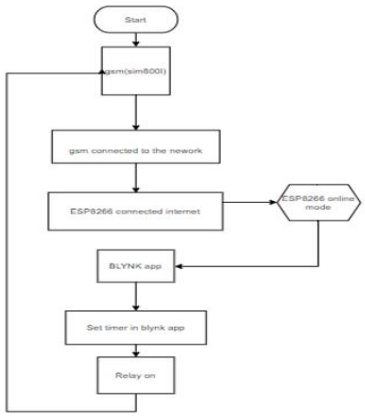

Fig. 2. Flow process of smart farming

In this project, the nodemcu (esp8266) is the most important part. It is a wifi module. But in this method nodemcu connected wifi and gsm(sim800l) also. To connect both Rx and Tx with wire. in this way, gsm to provide the internet for nodemcu. To use the dht11 sensor to monitor the farm (or) field temperature and humidity. and to use a relay to connect output devices like the motor starter and venturi valve. The Blynk application plays a major role in the project. To create an account in Blynk and create the project the auth token was sent to our register e-mail id. Use the inbuilt timer to control the motor. The timer to sync with the mobile timer. To start and stop the motor at a particular time. To set start time and stop time the motor can start and stop automatically. The most important thing is the timer is scheduled with the day. And use timer input to control the venturi valve. It is also like a timer. To set time for the valve on and off.

4. Hardware and Software Description

A. *Hardware Components*

- Nodemcu (esp8266)
- Gsm (sim800l)
- Dht11
- Switch
- Relay

B. *Software Description*

1. Arduino IDE
2. Blynk App

5. Result

1) *Serial Monitor Output*

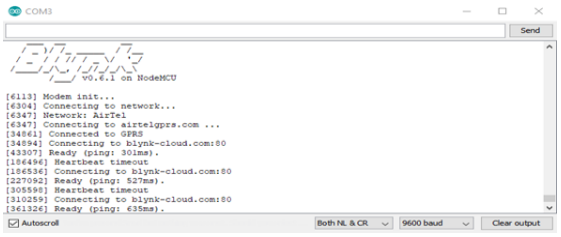

Fig. 3. Serial monitor output

2) *Blynk App for Phone*

Fig. 4. Serial Monitor Output

6. Conclusion

The proposed method is based on IoT-based smart farming into one box. The sensor values of the input are successfully sent to the cloud computing server. Also, the user can get the sensor values in real-time using Blynk mobile application. The DHT11 sensor is connected to the NodeMCU, which is connected to the internet through the Wifi module. The motor

system is executed, which is used to supply the water and venture for the fertilizer to the plants. Using the Blynk app, users can monitor the field temperature and humidity continuously. The user can set the time with the timer that is presented in the Blynk app. The setpoint is used to on and off the motor pump automatically. Time input is used on and off the venturi valve. The user can do the operation anywhere in the world and if we have the internet. The data from the sensors can be analyzed to get a clear idea about the proposed method.

7. Future Scope

- In the future, the system can be improved by adding the feature that the IoT-based smart farming is generated for many large-scale productions
- It is linked with a database to store the data of every field in the farmer's login when the farmer can see the information in the website.
- Since the information is seen through the mobile and it can display the parameters of all fields. It also consumes less time.
- To add some additional features to the farmer login we propose the future system will help the farmer to know not only about the parameters of the single large scale field.
- It is also used to detect animals and rain to monitor the large scale fields.
- STM and ESP32 is also used to control many parameters. This will even more helpful for the field owners to monitor their field.

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