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Implementation of IoT in Precise Agriculture

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Abstract: *The Internet of Things(IoT) is a technological advancement that allows communication between smart devices and devices, reducing human intervention. IoT technology-based changes have been regarded to be influencing the growth of productivity. Developing IoT based equipment to reduce farmer stress is the main purpose of this paper. This project measures environmental parameters such as temperature, humidity, soil moisture, and pH and sends the data to the cloud and then to user's device. User can monitor this dataas well as control the applications. This paper emphasizes the role of IoT in agriculture and the benefits that could be achieved by its implementation.*

Keywords: Micro-controller ESP-32, Precise, Sensors, Blynk

I. INTRODUCTION

Agriculture became a major advancement in the growth of sedentary human civilization, with farming of domestic species produced food surpluses that enabled people to live in cities. Indian farming is largely dependent on rainfall, soil, moisture and environmental challenges. Our farmers have advanced in modern technology farming. Globally IoT systems have contributed to their use in many fields and have proven to be successful. Changes in IoT technology have been thought to be influencing productivity growth. The main goal of this paper is to develop IoT-based equipment to reduce farmer stress. This project collects data on temperature, humidity, soil moisture, and pH in the field and sends it to the cloud, where it is automatically controlled in the field. The importance of IoT in agriculture is highlighted in this paper, as well as the potential benefits of its implementation. An intelligent agricultural system can be used anywhere with the help of communication technology. For example, farmers can now monitor soil temperature and moisture from a far, and even apply. Smart Agriculture can predict weather data, turn on a water pump that accepts wet conditions of humidity levels with the helpof sensors connected to microcontroller.

II. METHODOLOGY

The board receives data from all the bias. As it will send to the blynk app where the interface for controlling and monitoring already formerly builded by user. The user can see the parameters temperature, soil humidity, pH value of the soil on the blynk app and we've also used gas detector to descry any accidental fire. However, it will turn the water off grounded on the information, If the humidity position of the soil is below the set position also it'll automatically turn on the motor Consequently. The pH values and gas values are to be taken off by planter himself, and the rest can be controlled. The user can also turn on/ off manually. If the user has not given instructions also the board will work according to the information given by humidity detector and temperature detector.

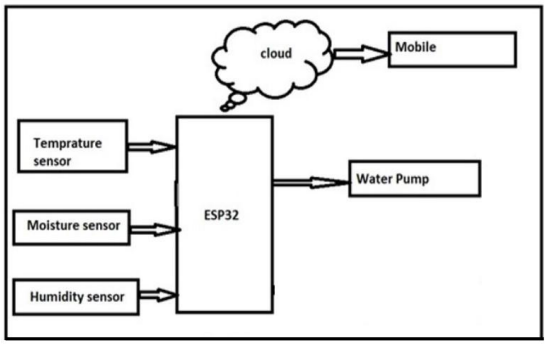

Fig.1– Block Diagram

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Humidity detector sends the data to the board and after interpreting it if the humidity position is below the set position also it'll turn the water pumps on. Consequently, it'll turn the water pumps off grounded on the information entered. Humidity detector sends the data to the board and after interpreting it if the humidity position is below the set position also it'll turn the water pumps on. Consequently, it'll turn the pumps off grounded on the information entered. position also it'll turn the water pumps on. Consequently, it'll turn the water pumps off grounded on the information entered. Humidity detector sends the data to the board and after interpreting it if the humidity position is below the set position also it'll turn the water pumps on. Consequently, it'll turn the water pumps off grounded on the information entered.

Blynk is a cloud IOT Platform that provides the tool needed to create prototype, measure and manage connected products in the most convenient way. used to control Arduino, smartphones used to control Arduino, Raspberry pi and NodeMCU online.By integrating and providing the right address for available widgets, this application is used to create a virtual interface or human interface (HMI) interface. There are different features of Blynk such as connect devices, bidirectional Efficient communication, store device data, show real time or stored data, focus on extensibility, integrable with 3rd parties.

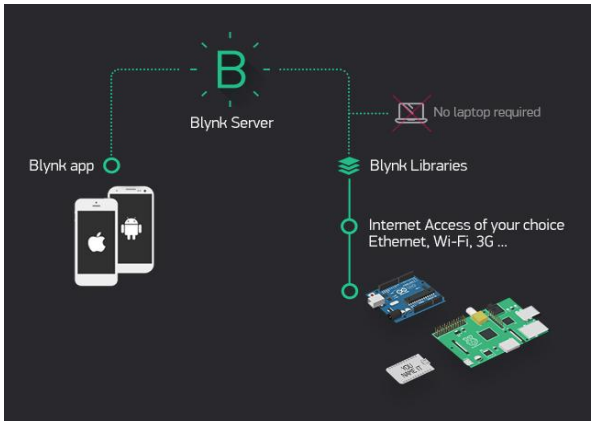

Figure 2: Software Design

III. COMPONENTS

The following are the components that will be used in this proposed project:

- ESP32
- DHT11
- Soil Moisture sensor
- Gas sensor
- PH sensor
- Submersible Water Pump
- Relay
- Connecting wires

3.1 ESP32

There are Many control devices present to develop a smart control system for a specified application.As shown in Fig. 3. We used ESP-32 in our proposed model because it allows for better remote access to IoT-based agriculture or irrigation management. When using an Arduino, a Wi-Fi module is required for wireless communication technology, but it is more expensive. If we consider the Raspberry Pi because it can be configured better than other modules, but we also consider the cost of maintenance, the ESP-32 is always a better option. As a result, the ESP-32 is a popular IoT module tool with a System of Chip (SOC).

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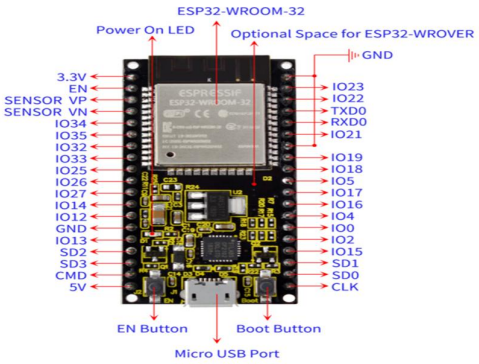

Fig.ure 3: ESP32

3.2 DHT11

This sensor module gives humidity as well as temperature. DHT11is built in such a way that it gives NTC type temperature(Negative temperature coefficient). It's range for temperature measurement is 0°C to 50°C. and can calculate humidity from 20% to 90%.

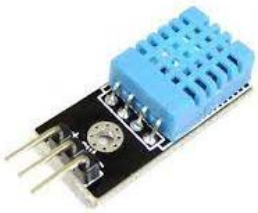

Fig.4 - DHT11

3.3 Soil Moisture Sensor

There are two probes present in this sensor that permit power to row through the ground to quantify ground obstruction relying upon how much water. Power streams significantly the water level is high, leading to reduced resistance to more humidity, Dry soil produces less water and less electrical flow, leading to higher water resistance and lower humidity levels. Water volume content 15 also be measured by this sensor and can be used in both analog and digital modes.

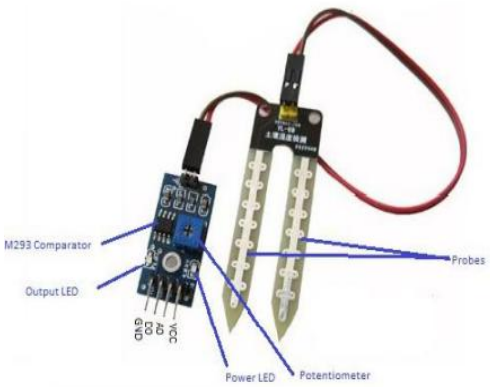

Fig.5 - Moisture Sensor

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3.4 Gas Sensor

The sensory element, especially the aluminium-oxide based ceramic, coated with Tin dioxide is present in the sensor and sealed with stainless steel. There are six connecting legs attached to the sensor element. Six of the two tracks are responsible for heating the sensor element, the other four are used for output signals. In addition to oxygen sensors, it is advertised when heated in air at high temperatures. The donating electrons present in the tin oxide are absorbed into the oxygen, thus blocking the current flow.

Fig.6 - Gas Sensor

3.5 PH sensor

The pH of the solution is used to determine the acidity or alkalinity of the sensor. PH is a reflection of the saturation of hydrogen ions in solution. Acidic solutions are solutions that contain many H + ions while the solution contains many OHs known as alkaline. The pH of the liquids varies between 1 and 14. A solution with a pH of 1 is very acidic, whereas one with a pH of 14 is very basic. The combination of hydrogen ion (H) and hydroxyl ion (OH) determines the acidity and alkalinity of the solution. Neutral solutions such as clean water, human blood etc have a pH 7.

Fig.7 - PH Sensor

3.6 Submersible Water Pump

Ground Water Pump: DC 3-6 V Mini Micro Submersible pump is low cost. Submersible Pump Motor of small size that can be used in 2.5 ~ 6V power supply. It can take up to 120 liters per hour with the lowest current consumption of 220mA. Connect the drain hose to the car surface, immerse it in water and power it. make sure the water level is usually above the motor. Dry running can damage the engine due to overheating and will emit noise.

Fig.8 - Submersible Water Pump

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3.7 Relay

Switch relays are responsible for closing and opening circuits electronically and mechanically. Transmission regulates the opening and closing of electronic circuit connections. When the contact is on open relay (NO), the relay is not opened with the open contact. However, when closed (NC), the transfer is not activated when the closed contact is considered. However, regions often change when they are empowered. In the control panels, the production and automation controls to control the power and to change the small current values in the control circuit using the transmission.

Fig.9 – Relay Modulefb

IV. IMPLEMENTATION AND WORKING

The main working and controlling unit of this project is ESP-32 microcontroller. It fetches data from DHT-11, pH sensor, Soil moisture sensor and MQ-2 gas sensor. And controls the system using Relay and Submersible water pump. For this project we're coding in Arduinoas shown in below figure.

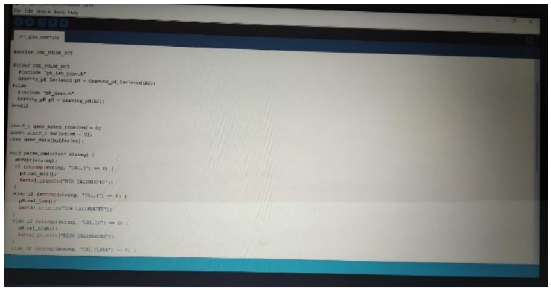

Fig.10 – ESP-32 Coding

We're using Blynk IOT App for monitoring of parameters on user's device. The parameters which we're monitoring are Temperature, Humidity, Soil moisture, pH, Smoke (CO), etc.

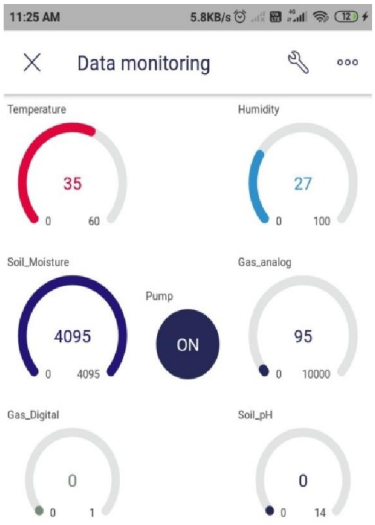

Fig.11 – User Interface of Blynk IOT APP

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Also, we've automated our system means we've set some threshold levels above which user will get a notification on their Blynk IOT App.

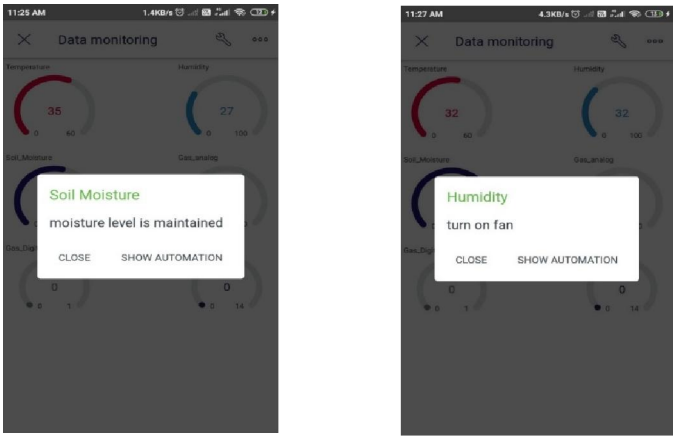

Fig.12 –Notifications on Blynk IOT App

IV. RESULT

ESP-32 is expected to monitor and implement an agricultural management plan. The main sensors used in this project are DHT11, ground moisture sensor, MQ-2 Gas sensor, pH sensor, which provides precise values and real time. This technique is very useful in greenhouse, monitoring and observation of environmental parameters can be done remotely by a simply sending of data from ESP-32 microcontroller. The data is sent on Blynk IOT App of user's device and with very accurate and précised values. We collected data such as temperature level, humidity percentage, soil moisture content, pH level, Gas, etc.And received it successfully on user's device. The automation of water pump we added is also achieved successfully, motor gets ON as soon as soil moisture level drops. This project is working and can be used in nursery's, greenhouses, etc.

V. CONCLUSION

IoT has brought a major revolution in agricultural industry. Still there is much potential of research and innovation under the agricultural sector facing challenges and issues by the farmers which needs to provide smart solutions. Researchers and farmers can use IoT agricultural applications to gather important environmental parameters that can be analysed further for a better cause. Considering the brisk growth of population, an IOT based researches and projects are in demand. The main goal is to reach the rapidly increasing demand of crop yields of good quality. In our system, we presented an integrative approach in the field of use of IoT in farming based on low power devices. The goal is to provide a low cost, easy to install & precise crop monitoring system for agriculture which will save farmer's effort, water and give updates of farm's condition like soil moisture, humidity, temperature, pH level to famer. In future, we will extend our systems functions and investigate the chance of incorporating the features of this system in other sectors.

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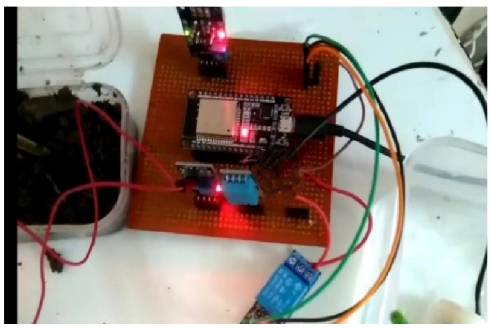

Fig.13 – Working Project

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VI. FUTURE SCOPE

- Agricultural Drones: Agricultural drones are an altogether strong instance of IoT services among the Agriculture Industry. Agricultural Industries these days, have come to be one concerning the prime industries the place drones may be put to use. Two kinds of drones, so are on-ground and aerial drones are used in agriculture among a few ways certain as, because of crop plants health assessment, irrigation, plantation, or floor & field monitoring.
- Smart Greenhouse: Smart Greenhouses is another emerging technology which helps to improve the yield of crops. In order to create the atmosphere as we needed for the crops, smart greenhouses can be a game changing player.
- Livestock Monitoring: Farmers can use IoT functions to collect information about the location and health of their livestock. This fact aids them in determining the state of their livestock. For example, checking animals if they are healthy, so Farmers can use IoT functions to collect information about the location and health of their livestock. This fact aids them in determining the state of their livestock.

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