# IOT Based Smart Agriculture System

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***Abstract*—Agriculture has a long history and is a very traditional occupation. Agriculture has undergone numerous changes since it was first developed in an effort to increase crop quality and the product. When equipment and new tools like irrigation systems, harvesters, and farm cleaning equipment were introduced in ancient agriculture, where these tasks were primarily carried out by humans and animals, some of the first indicators of improvement were observed. Climate disasters (such storms or extreme heat) and natural disasters (like pests and plant diseases) eventually have an impact on agriculture. In order to improve the precision of agriculture, the Internet of Things (IoT) was proposed as the next step in the development of the agricultural sector. Such a system can help by providing data on plant growth,,* plant ailments and advantageous qualities of the soil for plants. In order to monitor variables that directly affect plants, this paper outlines a potential solution for a dependable Internet of Things-based programme that leverages Libelium for Smart Agriculture. In order to assist farmers in growing healthy crops, the monitoring system also intends to control irrigation-related irrigation difficulties and analyse the outcomes of the measured agricultural parameters.**

***Keywords*—Arduino, IOT, sensors**

## I. INTRODUCTION

The Internet of Things (IoT) is the communication of electronic devices that send data to clouds. IoT processes this data in order to carry out the necessary activities. Farming is the main industry in emerging nations like India. About 70% of Indians are dependent on agriculture, either directly or indirectly. 15–16% of the nation's GDP is generated by agriculture.. Climate change, soil degradation from floods, growing the same harvest continuously without using scientific farming techniques, etc. are only a few of the short-term changes that affect agriculture. Flexible farming produces benefits including little water waste, higher crop yields, and less resource usage. This makes it possible to produce a good crop yield more quickly than with the prior farming technique. Today's agriculture is subject to a number of restrictions, including the kind of plant that is appropriate for the soil's current conditions, the type of irrigation, the requirement for fertiliser, etc. The agricultural system's new soil monitoring system uses parameters like temperature, humidity, and soil parameters like pH and soil temperature. Microcontrollers and sensors are both used in IoT in agriculture to use the system effectively when the senses are possessing a substantial amount of field expertise. The appropriateness and reproduction of soil can likely be determined by combining data from other senses. IoT contributes to increased crop yield and productivity. To understand the state of the soil in the field, yield monitoring is necessary in the agricultural sector with improved productivity. If necessary, IoT enables monitoring of the field from any location in the nation. Monitoring soil conditions includes keeping an eye on soil PH, moisture, temperature, and climate. According to the discussion in, farm status is transmitted to the user using Global Mobile System [GSM] technology. By replacing outdated technology with little to no human interaction, automation in agriculture encourages the adoption of new technologies and increases productivity. The authors' use of an Arduino Uno along a humidity gauge to gauge soil moisture; data is updated via GSM-GPRS on a web page The SIM900A allows farmers to view situations without spray. The automatic irrigation system's inspection and vigilance of soil moisture are its main objectives. In the event that the system examines three different parameters

for increasing plant yield. In order to detect temperature, humidity, and moisture content and display the results on an LCD display, several sensors are utilised with an Arduino Uno. However, as a result of global warming, water levels are decreasing, making it more difficult to determine moisture variability and soil fertility. Proposed application of the Arduino Uno in the irrigation system taking into account the temperature, humidity, and water flow sensors. I heard the website had some data. The pump can be managed by users. from a distance location using website. It helps to increase yield with minimal interaction of human error. As described in, water the main feature of irrigation is distributed only there it is also necessary to help prevent water wastage.

## II. PROSPOSED SYSTEM

A microcontroller was added to the Internet of Things (IoT) system through the development of an intelligent agricultural system using sensors. The launch's goal is to demonstrate to clever people how sophisticated microcontroller capabilities enable irrigation decisions to be made based on ongoing field monitoring of environmental factors. Additionally, it seeks to upload the previously established irrigation schedule that the farmers approved. Implementation of a distributed wireless network of soil moisture and heat sensors inserted into plant roots as part of an autonomous solar watering system. These sensors serve as an IoT gate by continuously monitoring the parameters and sending them to the Arduino board for additional processing. Installing a WiFi module will offer wireless power to this gateway, which will update data to clouds. With a connected module, the IoT gate once more has GSM capabilities. Using the standard packet radio service (GPRS) protocol, which is a pocket-based mobile device data service used in 2G and 4G global mobile system telecommunications (GSM), this receiver unit has a duplex-based communication link in the mobile Internet-Internet interface. The user is able to continue checking the settings for his comfort Android app wherever they are thanks to the data that has been transferred to the cloud. Based on the input the farmer can provide through a smart agricultural application, the system has the ability to adjust. The farmer has the option of selecting an irrigation plant, a season-based profile, and planning and assessing the wise use of a water resource. The amount of water present in the ground is a significant indicator that plants need water. Without this program, the farmer would have to personally monitor the plants' soil in tedious, time-consuming fields, which would be exhausting. A clever system that alerts the user anytime the water content falls below the level the farmer himself has chosen can take care of this. One of the symptoms of disruption or disturbance of yield is the entry of animals, particularly cattle, monkeys, dogs, etc. into the fields. This wastes the labour of one person and necessitates the regular, unpaid presence of one guard in the fields. This can be avoided by using the moving programme sense to find any animals in the fields and notify the farmer when they are there. The farmer himself can initially determine the distance at which he or she needs to be able to see the animals in the program.

## III. IOT DEVICES FOR SMART AGRICULTURE

Atmega328 microcontroller used in the Arduino Uno. For readingfrom the senses, open-source Arduino software is used to download user-provided instructions. It contains analogue input-output pins A0to A5 for each function as well as 0 to 13 digital output pins. It ranges from 7 to 20 volts. A computer that uses a USB connection or batteries must be linked to the microcontroller board in order for it tofunction.

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The YL 38 sens of water in the soil, is depicted in Fig. 1. There are two search. If there is a lot of moisture in the soil, the ground produces more electricity (with less resistance). If the earth is dry and less electrically conductive (has more resistance). Wet soil or dry electrical resistance determine the sensor's output.

B. DHT11 Sensor:

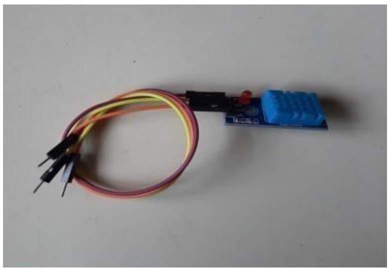

Figure 2 shows the DHT11's temperature and humidity sensors. The DHT11 sensor, which measures the local temperature and humidity, is depicted in Fig. 2. It compares the temperature to the gaseous form of water vapour that is present in the environment.

C sensor. DS18B20:

Figure 3: DS18B20 Waterproof temperature sensor

The sensor DS18B20 mperature, is shown in FIG. 3. for with stainless steel tube. 1 temperature variations in the soil prior to and after irrigation

## IV. SMART SYSTEM FOR IRRIGATION USING IOT

The sensors, microcontrollers as hardware devices, and Arduino as software make up the IoT-based agricultural system. When a combination of hardware and software tools are used to assess the soil's potential for agricultural usage. Sensitive live data is downloaded from the cloud using data collected by sensors. moment a sense is made, the microcontroller is attached Data for the input is obtained from an outside sensor.

- The Arduino microcontroller is used to control the sensors.
- All data from various sensors is collected at once and stored in the cloud for later analysis.
- A ground parameter's threshold value is taken into consideration to anticipate eligibility.
- The user receives a message instructing them to take specific actions based on forecasts.

| **Soil parameters** | **Threshold value** |
|---|---|
| Moisture | 30-80% |
| Soil temperature | 20-40°C |

The soil parameter varies from location to location and throughout time. In order to anticipate the soil status, only a few parameters are taken into account.

| | |
|---|---|
| Temperature | 18-40$^{O}$C(atmosphere) |
| Humidity | 45-70% |

## V. SYSTEM DEIGN

The Arduino Uno R3 microcontroller board, sensors like the LM 35 temperature, humidity, and motion sensors, the ESP8266 Wi- Fi module, and the GSM module make up the system structure. An android app that is part of the software allows you to set up a pre-defined irrigation profile based on the seasons or in daily and weekly modes. The installation of the farmers will send an Arduino Uno control signal to turn on or off irrigation whenever the visual limitations are below the limit value, according to additional software that was there.

All internal processes are managed by the Arduino Uno Board, which also serves as an IoT gateway. The senses receive all portable parameters and translate analogue information into digital information. The area's temperature and relative humidity are measured using temperature and humidity sensors, respectively. Capacitive soil moisture sensors are used to measure soil moisture. The pace at which crops are produced when the wind starts to blow again has an impact on crop yields. Additionally, our development system measures this. RTC module is also included to record data from sensors in real-time. The IoT gate receives this data after that. The data is subsequently sent to the cloud through the IoT port using a Wi-Fi module.

Our system's cloud will be configured to house a web server, a website, and a decision-making mind. The website will save the IoT gate data. The farmer's action is subsequently evaluated by decision logic to see if irrigation plants require it. For instance, the temperature limit is kept at 25 C in a sophisticated system. The website will activate if the action is the decision-maker of the decision whenever the temperature rises in addition to the temperature range, and it will then send a notification to it an enhanced Smart Farming Android app. The farmer's registered cell phone will also receive an SMS alert. The signal will be delivered from cloud to cloud at a gate, which will then send a signal to activate the relay and turn on the water pump, depending on the farmers' decision to OPEN or OPEN watering.

## VI. IMPLEMENTATION

Real-time data is employed in the IoT-based agriculture system to make production decisions concerning irrigation. First of all, the farmer logs into the system using the username and password he obtained from the Android app. After that, you are free to choose the crop for that year. System I is divided into three phases.

- Gathering and analyzing data gathering
- processing
- dissemination of information.

The sensory phase involves the perception of various aspects of the body, such as movement, temperature, humidity, and humidity. These sensors are all linked to Arduino. A R3 microcontroller board is what you have. The ability to perform data transfer to the cloud enables this board to function as an IoT gateway for sophisticated systems. This transfer is carried out using the ESP8266 Wi-Fi module. In the clouds, processing takes place. A decision-making mind that bases choices on auditory data maintains a website where audible data is available on the cloud's web server. The decision concept's output will be delivered to an Android application and then to an Io gate during the information dissemination phase. End-to-end The algorithm for the smart farming system is provided here.

Get started

- Continue collecting sensor data
- convert audible data to an analogue format for the Arduino board
- send data to the cloud via Io Gateway
- if the data exceeds the limit, send a notification to the Smart Farming app
- if the user selects OPEN
- send control signal to server, i.e. the cloud
- the control signal is then sent to the IoT gate.
- An IoT gate produces water and a relay.
- • The pump is on
- If the user chooses CALA
- Send control signal to server (cloud)
- which sends control signal to IoT gate
- which forms relay and water system
- There is no pump.
- Endif
- Other
- Continue to check the boundary condition End if
- Finish
- Android-based Smart Farming app.These are the features this app offers:
- Select on/off the water pump
- A choice of irrigation profile available to farmers
- the start time for irrigation on a certain day and the end time for watering. The farmer can now devote his time to something else useful. Application The farmer can choose the same programme per week or month using the profile as well.
- The farmer's proposal to use a certain pesticide on theircrop.
- A farmer's proposal to use a certain pesticide on their harvest.
- Inform the farmer about the animal invasion in the field.

## VII. CONCLUSION

An IoT-based agricultural system can be extremely beneficial to farmers because more and less irrigation is not viable for agriculture. High weather rates like humidity, temperature, and humidity can be altered according on the natural conditions of a certain place. The programme and hearing animal assaults are major reasons for crop losses. This system generates irrigation schedules based on real-time data from the location as well as data from the meteorological repository. Whether this system recommends a farmer or not, irrigation is required. A constant internet connection is essential. This can be avoided by expanding the system to make a proposal by SMS to the farmer's cell phone using the GSM module rather than the mobile app.

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