Employability of the Internet of Things (IoT) Tools and Techniques in Developing a Smart Integrated Farming

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ABSTRACT:

This paper suggests a smart irrigation system based on the Internet of Things (IoT). This paper addresses the issue of farm water waste by automating the irrigation system. IoT refers to physical objects communicating with one another and generating relevant data. The system was developed with a specific soil moisture, temperature, and humidity sensor. Additionally, using the Arduino microcontroller and the GSM makes reasonable handling possible. After the data are added to the database, a web application displays the readings. Finally, a pump and motor are controlled by the reading values of the sensor. This paper's irrigation system is automated as a result of an analysis of soil temperature and moisture and important factors like labour, power use, dependability, and expense.

INTRODUCTION

The Internet of Things (IoT) can modernize any ranch. This innovation is used to modernize anything. The automation of manuals is the primary application of this technology. Nowadays, everyone effectively computerizes their families and businesses. Enormous greenhouse farmers utilize this technology to provide additional [1].

When running a homestead, it's critical to have the right information at the right time. The crop's ideal characteristics probably will only be achieved under flighty conditions or using traditional cultivation methods. The homestead can be managed more effectively and efficiently with a web-enabled platform that grants access to growing information anytime and from any location. When presented in the property, a firm connected with different sensors can screen fundamental limits like temperature, pressure, wetness, environmental conditions, soil limits, leaf wetness, And so forth.

These days, smart farming is extremely well-known [2]. It entails conforming to recent improvements in traditional farming to deliver more rural products with less effort and in greater quantity and quality. Farmers will undoubtedly be able to meet their requirements by using this technology, which allows them to monitor and manage their homesteads. A farm, known as a "Shrewd Farm," is equipped to carry out a few activities twice [3]. As a result, effective farming is essential to managing a large property and improving system.

The most serious problem for producing harvests that result in waste is the increased volume of water being poured and the inconvenient nature of watering. Allowing water to enter the field typically destroys crops. Farmers cannot control the water system process because they are frequently far from the field and need help to obtain accurate homestead data. Any individual's weight would be helped by having ideal observation and programmed command over these boundaries. Standard tactics like pesticide overuse in manual water systems are to blame for low efficiency. These conventional methods are to blame for the decline of agriculture [4]— the incapability to comprehend legitimate strategies and deal with other crops, such as the water board.

Using a computerized nano controller, the issue with a water board can be resolved with minimal effort. Similarly, a microcontroller can undoubtedly be used to control a pump, motor, engine, or siphon.

We are developing an intelligent IoT module allowing farmers to access live farm data. Data gathered from sensors like soil moisture, temperature and humidity will be used to automatically control the motor.

MODULE PROPOSED

In this paper, an intelligent IoT module for farm irrigation is proposed. The system uses Internet of Things technology, specifically GSM and miniature Arduino controllers. The IoT innovation permits the module to send customized orders to an engine notwithstanding persistent information (like temperature, soil humidity, and moisture). At the point when the value of the temperature, soil humidity, and moistness shows up at a particular edge, the engine turns on consequently. The information is displayed through the use of web technology. Similarly, similar technology can be used to control the motor physically. The sensors are what determine the project's precision. The value that the sensors accumulate is critical to the project as a whole. MySQL [30] is a relational database that the sensors used to collect information. The data that has been collected is also kept in a database that the web application can quickly access. According to the Implementation Details and Working Methodology that follow, the main method of the project is to gather data based on specific sensors and carry out a few functionalities using the gathered data. Figure 1 illustrates the proposed module.

The overall procedure's algorithm:

Step 1: begin the procedure

Step 2: Connect to the network

Step 3: Read the values coming from temperature, humidity and soil moisture Sensor

Step 4: Examine the values of temperature sensor, soil moisture sensor, and humidity sensor.

Step 5: Start the motor if (temperature > 500°C OR moisture 200 bar).

End By the first step, the GSM module starts the network. The qualities are stored for observation in an information base following stage 1, 2, and 3. The temperature and moisture value specified in step 4 determines whether the motor can operate automatically. For instance, if the temperature is greater than 500 degrees Celsius or the soil moisture sensor value is less than 200 bar, the motor is turned on automatically. The proposed framework was put through a few tests to ensure exactness and execution.

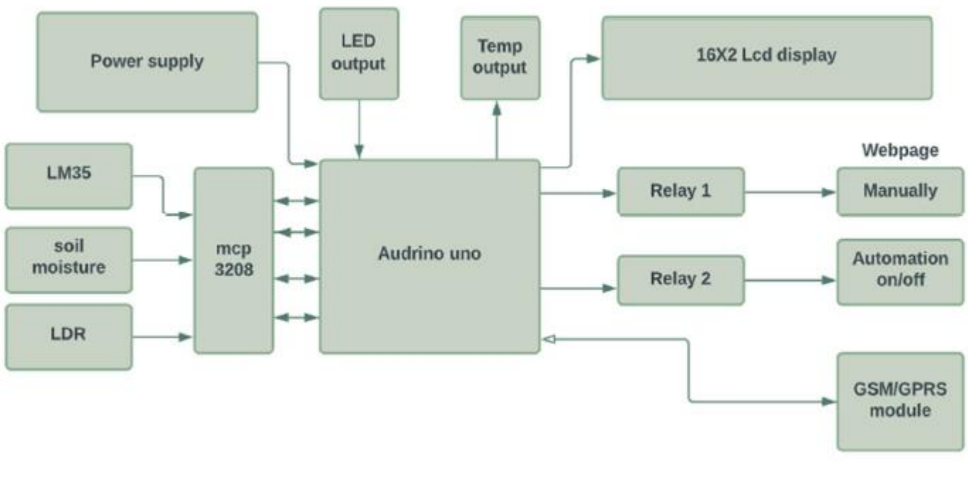


Fig 1: Proposed Method block diagram

EXPERIMENTAL RESULT AND ANALYSIS

Implementing the proposed system in various scenarios demonstrates the system's practical applicability. The proposed approach provides crucial parameters like soil moisture, temperature, and humidity. On March 4, 2022, we gathered the actual and experimental data. Figure 2 shows the actual module of the proposed system. While the proposed module measures observed data, actual data is gathered from the internet. The basic information was obtained from https://weather.timeanddate.com/india/greater-noida. Figure 2 shows the actual module of the proposed system. Actual data is data gathered from the internet, while observed data is data measured by the proposed module. On March 4, 2022, the actual and experimental data were collected.

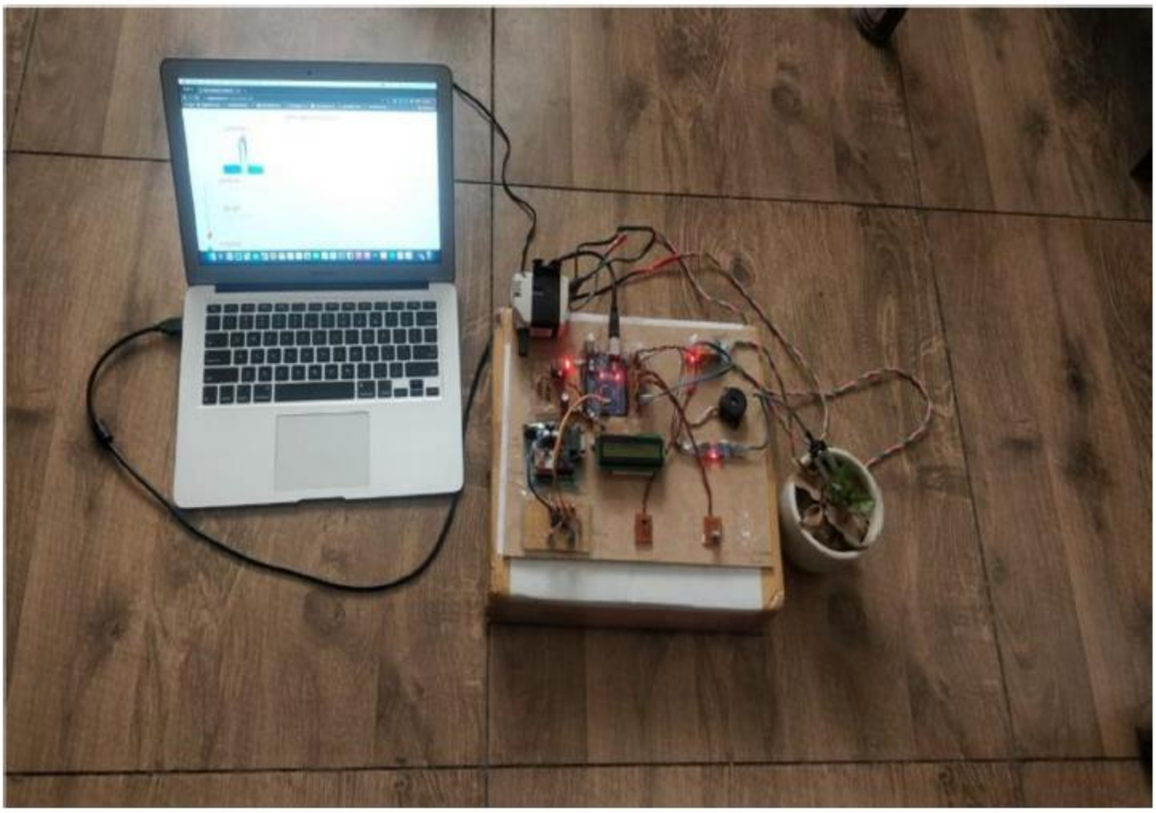


Fig 2: Proposed model representation

The percentage of errors is equal to ((actual data - observed data)/actual data)) x 100;[35] Without an analogue device, we cannot obtain soil moisture data from the internet; consequently, the data for the proposed system are presented in table 1. Table 2 contains the actual internet temperature and humidity measurements, the proposed system's observed result, and the error percentage. Figures 3 (a) and (b) graphically show the actual and observed data differences. Fig. The actual and observed temperature data are depicted graphically in 3(a). The humidity value is different from the actual value due to a lack of sensitivity or technical issues in our proposed system.

TABLE I: Soil moisture estimated by proposed module.

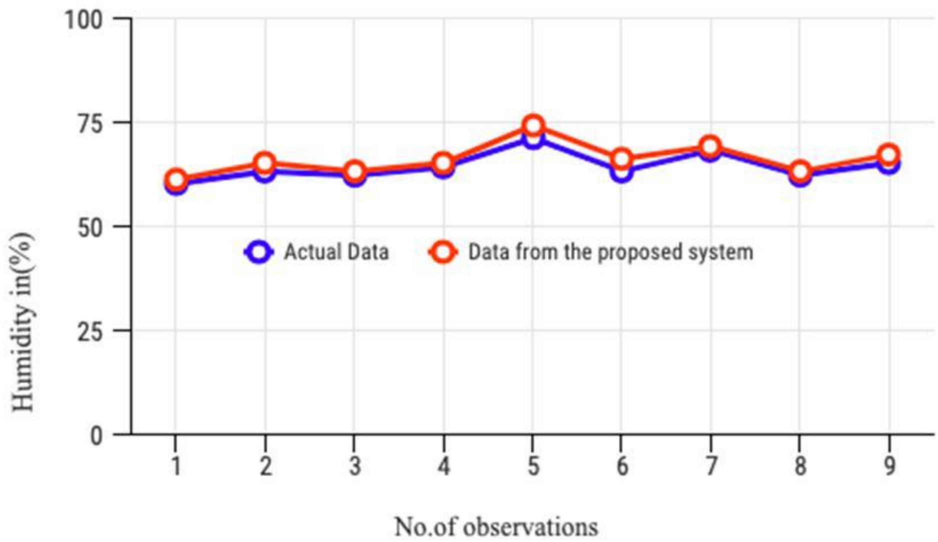
No. of observations	Data from the proposed system(bar)
1	172
2	171
3	180
4	176
5	174
6	171
7	168
8	165
9	164

TABLE II: Temperature estimated by analogue machine and proposed module.

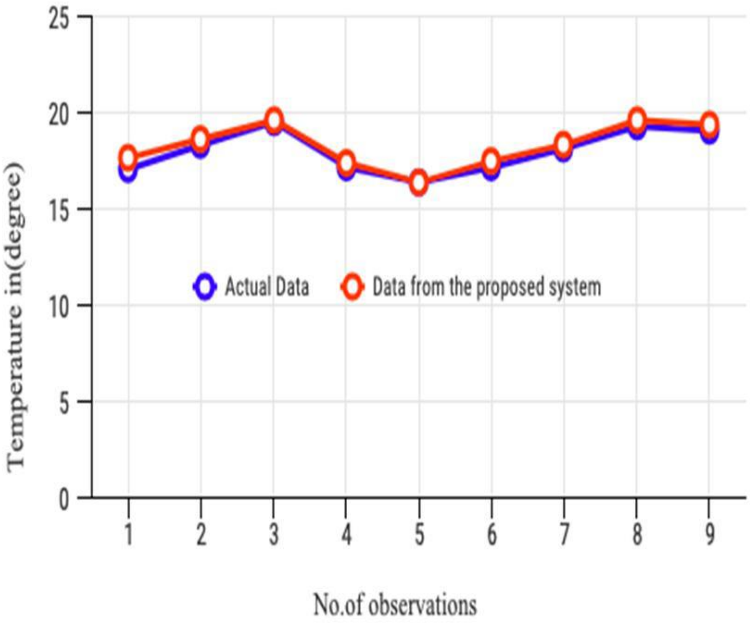
No. of observations	Actual data(bar)	Data from the proposed system(bar)	Percentage of Error (%)
1	17.02	17.60	3.29
2	18.27	18.57	1.64
3	19.45	19.55	0.50
4	17.11	17.33	0.28
5	16.32	16.32	0.0
6	17.11	17.43	1.87
7	18.08	18.28	1.10
8	19.23	19.55	1.61
9	19.01	19.32	1.63

TABLE III: Humidity estimated by analogue machine and proposed module.

No. of observations	Actual data(bar)	Data from the proposed system(bar)	Percentage of Error (%)
1	60	61	1.63
2	63	65	3.17
3	62	63	1.61
4	64	65	1.56
5	71	74	4.23
6	63	66	4.76
7	68	69	1.47
8	62	63	1.61
9	65	67	3.08



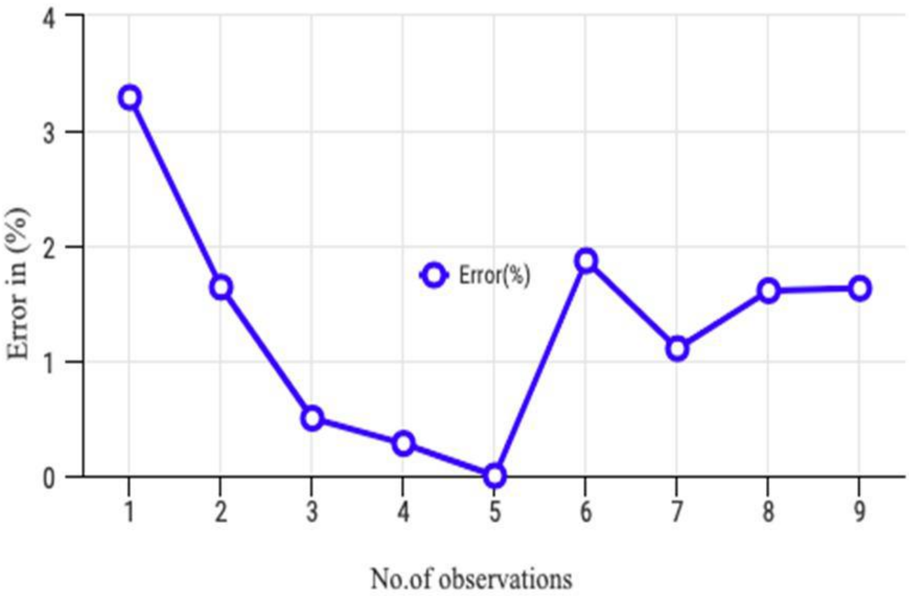
(a) Temperature



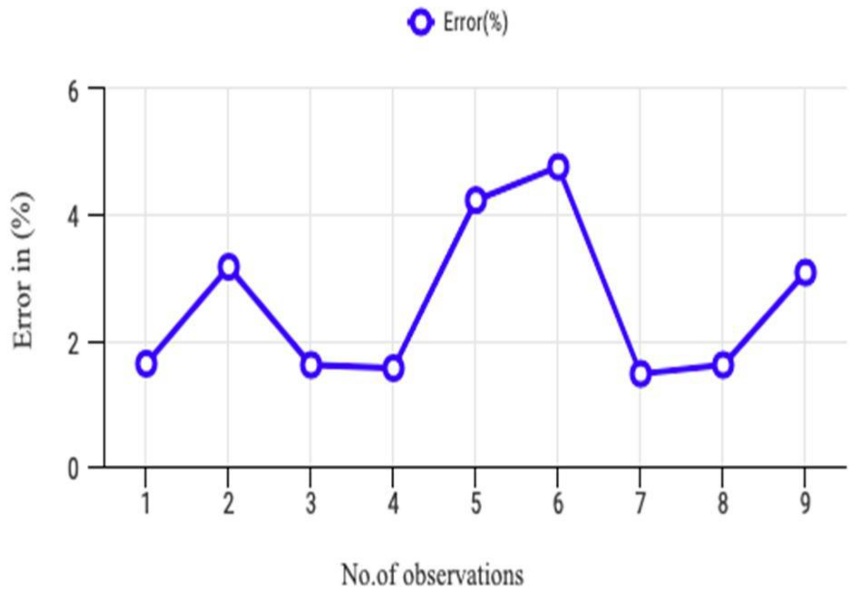
b. humidity

Fig. 3 Actual data and proposed data a) temperature b) humidity

Table 2 displays the temperature error percentage, and figure 4(a) also provides a graphical representation. The temperature has a maximum error rate of 3.29 per cent and an average error rate of 1.32 per cent. The error percentage of humidity is shown in the table, and Figure 4(b) provides a graphical representation. The upper level of error percentage is 4.76 per cent, while the error rate for humidity is 2.56% on average.



(a) Temperature



(b) Humidity

CONCLUSION

This research proposes an intelligent cultivating module that utilizes microcontrollers and Web of Things (IoT) innovation, especially GSM. Farmers can quickly access real-time temperature, soil moisture, and humidity data from any location with this module. The project's accuracy is dependent on the sensors. The sensors' values are critical to the project's operation and its entirety. The motor kicks in when the temperature, humidity, or soil moisture value reaches the threshold.

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