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Agricultural Water Irrigation using Decision Support System and IoT

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Abstract: Food production plays an important role in a country; this food production depends on two factors: weather and water, the proper use of both can achieve high yields. The more production is difficult to achieve in manual irrigation. In this proposed system, we are using automates irrigation system to reduce water wastage in irrigation system. This technology can be used low water resource. The endorse approach is to implement precision farming via the IoT, Mobile and Decision Support System (DSS),which increases the yield of plants while enhancing water use.

Keywords: DSS, IoT, Irrigation system, Raspberry pi, Sensor.

I. INTRODUCTION

As the global demand for food increases, so does the need for improvement in food production. Therefore, agriculture and allied sectors determine the economy of a country like India. Agricultural development of a country depends on the water and climate of the country. Technologies in agriculture and agricultural sectors are still poorly used. The main reason for this is the lack of rainfall and the groundwater, which causes the groundwater level to be reduced by the absorption of water from the deep well. Another reason for this is the unpredictable use of water, which often dries up without water. To mitigate this situation, the use of crop water-based IoT and DSS to transform this situation and save water and provide the right amount of water to a crop.

The Internet of Things (IoT) is a kind of network technology to monitor the Agriculture Water Irrigation System using a mobile device, which can be remotely monitored by interconnecting communication devices installed in different locations. [1]. A decision support system is a computerized program used to support making decisions and actions in any business environment. DSS is a modern technology that analyzes large amounts of data and provides detailed information that can be used to make complex decisions.

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Applying the above two technologies in agriculture can achieve a lot. The Internet of Things (IoT) technology receives information from a many number of sensors and transmits it to the central processing aesthetic. The data processed by the central unit after the data sent to the DSS compares the DSS threshold value; finally, data is transformed into a meaningful piece of information. So that the converted information is sent to the customer's mobile phone. The scheme provides proper guidance to the farmers, So that the farmers are provided with the necessary water at the right time using automated irrigation system.

The proposed design to deal with the irrigation system required for agricultural lands and plants. The system receives temperature, humidity and climate measurements with the help of different sensors. The information received with the help of the sensor is sent to a common control unit and compared with DSS. The control unit constantly collects data from the sensors. Soil sensor mounted in soil calculates soil moisture at specific intervals, when the rating exceeds the specified limit, the Raspberry Pi device to control the water pump. Soil moisture and air humidity can be monitored using an application installed on a mobile phone [1].

II. LITERATURE REVIEW

In 2017, S.Muthunpandian and team [2] designed a automated irrigation system to Crop Cultivation Monitoring and Water Level Monitoring are used to reduce the amount of electricity used to irrigate. This automation system is useful for farmers. In 2017, Joaquin Gutierrez and team to designed Automatic compression is reduce water usage and save water. Designed to provide water to the crops at the right time and precisely, avoiding wastage of time and water. Solar power and Smartphone are used to run the sensors in this system. Smartphone makes sensor control and monitor with the help of internet. In 2017, Mohanraj and team [4] designed to track agricultural data. The Automatic irrigation System uses smart phone and GSM technology to efficiently process water and its energy. Smart phone and GSM technology is used to create cost savings. This system is a smart irrigation technique using Internet of Things (IoT).the Sensors are used to assess soil moisture and water content in the well with the help of a mobile network to provide water to the assessment plant. In this setting we can get the desired functionality using the smart phone and the web server. In this system, the system makes all the decisions effectively.

The GSM connected to it monitors the water and crop growth and the sensors installed in the system provide accurate data to the crops in a timely manner. In 2015, E.W. Giusti and S. Marseille-Libelli [5] used artificial intelligence to develop a irrigation bases decision support system, old irrigation system has been developed to collect data and a database is used to compare it with the new irrigation system. Finally, more importantly, AIC. Partlett Ed [6] designed the mobile app for irrigation planning. This application is cloud based and has been named

WISE (Irrigation Planning for Efficient Use) using the Soil Water Balancing System and Data Queries of the Colorado Agricultural Weather Network (CoAgMet). The system was tested with the IRRINET database and found important results.

III. METHODOLOGY

Proposed *Architectural Design* using Raspberry pie, water pump, temperature sensors and moisturizer. Smartphone's are used to visualize the technology of the user. The Proposed system includes crops and plants, which require water for crops and plants to grow and therefore water for crops and plants at different periods depending on their growth [7].

A. Implementation of Architectural Design

Figure: 1 shows the architectural design of the proposed system. All the devices are connected to the Raspberry Pi with GSM module including Smartphone [7]. The motor is controlled by Raspberry Pi based on sensors value.

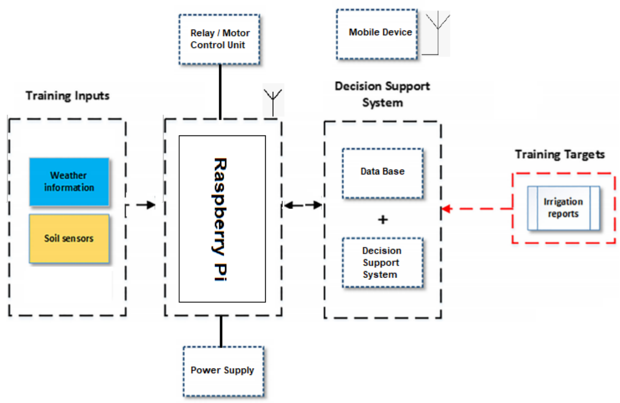

Fig.1. Architectural Design

The proposed design is shown in above Fig.1. The hardware components are incorporated as shown in Figure. During the operation of the computer to be done, and check the hardware connections to make sure all the Raspberry-Pi pins are connected. Raspberry Kit for Mobile Communication Using Ethernet to Connect Wired or Wireless Internet Connection. The above diagram divided into three layers:

Training layer: In this work we connect two sensors 1) Temperature Sensor 2) Soil Moisture Sensor. The newly designed irrigation system provides water to the crops with the most accurately designed irrigation system of old times, thus providing the water needed for the crops and plants.

Process Layer: The sensors are sent the data to the Raspberry Pi kit. The kit processes the data and sends it to the DSS system, the DSS module receives the data from the Raspberry Pi and compares that value with the value already stored in the DB and finally returns the DSS value of the Raspberry to run the water pump. Raspberry Pi sent the information to the mobile device. User / former can view those details at any time.

DSS Layer: The required input for the DSS module is available from Raspberry Pi. The available data are then compared with the Target data. Target data is stored in the Database. Finally the result set data is sent to the Raspberry Pi kit.

B. The input components used in the system are:

1. Raspberry-Pi

Sensor technology for automating irrigation improving use of water. The Raspberry Pi is a small PCB board to connect computer and other devices [7]. The Raspberry Pi kit is used as an outdoor machine Memory can be used and any input has four ports Devices can be connected. In this project raspberry pi used and configured according to our specification.

Fig. 2.Raspberry-Pi

2. Moisture Sensors

Two YL-69 Soil Moisture Sensors were placed for analysis at different location soil conditions. Sensor YL-69 is made up of two electrodes that sense the humidity around it. An electric power is passed through an electrical terminal and is computed through the other end. An electric current passed through a node is known to be high in moisture in the soil which is highly sensed through the other end and it is less in moist soil in a lesser extent [8]. The sensors used in this design have two types of outputs: analog and digital. The digital system is easy and accurate, but the analog output is not accurate.

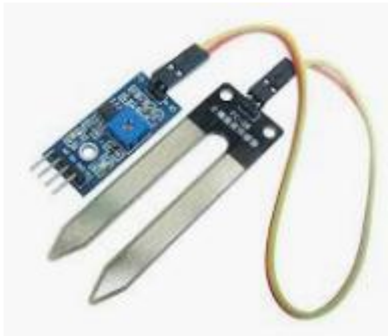

Fig. 3.Soil Moisture Sensors

3. Software used

Python programming languages is widely used for design Raspberry Pi functionality. Python programming cannot be used for web design; PHP is used for server-side programming. Python programming only used for writing customer frustration issues.

4. Relay

The relay is an electrically operated device that has both the operating coil and the normally closed contacts, commonly described as closed and generally opens contacts. There is no change in contact position when the coil has no supply. When the coil is supplied the contact is closed and the NC opens. This does not change until the coil is in a state of energy.

5. Temperature sensor (LM35)

The LM35 is a pioneering included circuit temperature sensor whose output voltage varies depending at the temperature around it. It is a small and less expensive IC that can be used to measure temperatures anywhere from -55 ° C to 150. C. The sensors as shown in fig: 4.

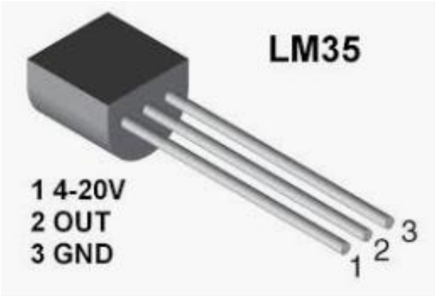

Fig. 4.Temperature sensor (LM35)

IV. RESULTS AND DISCUSSION

The attached circuit of the proposed system is shown in Fig. 4, where we install the Apache server in the Raspberry Pi to get the IP address for the board, and the Linux OS to run this embedded platform. All sensitive data from the Raspberry Pi Sensors is obtained by ADC (I2C CHIP), where the perceived analog data is digitally converted for processing.

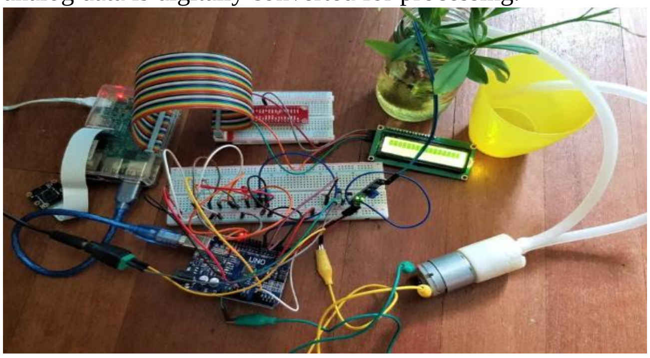

Fig.4. Working Model

We are going to write the Raspberry Pi encoding algorithm using the Ethernet port using the Putty software, which changes the threshold when the humidity level falls below the threshold switch on the motor, and when the app threshold buttons are tapped.

The LCD is used here to display sensitivity values, and for each period of time, the value from the sensors is updated in the mobile app. The Android app is built on the eclipse software, where the configuration of the application page, the number of columns, the number of tapping buttons, and the on / off buttons are the same. Access to the encoder with the help of an assigned address. All IoT components, such as the Raspberry Pi, mobile application, are connected to the Wi-Fi module and the Raspberry IP address is entered into the mobile application so that the data can now be accessed by the Raspberry Server, when we tap the threshold button the Raspberry Pi receives a request to change the threshold.

Fig.6. LCD Output

The results of the proposed system will be displayed on the LCD and the mobile app and in practice with the pump. The water pump is connected to an automatic relay. The relay is turned on and off depending on the soil moisture. Turning the motor on when the soil is humidity low, as well as turning the motor off when the humidity rises. This process is done automatically.

Table 1:
The following table shows the assumptions of input and output terms:

Atmospheric Temperature (.c)	Soil Temperature (.c)	Soil moisture Content (%)	Motor Status
20	19	65	OFF
31	30	19	ON
30	30	52	OFF
23	22	54	OFF
31	21	16	ON
29	30	12	ON
19	21	40	ON
15	17	30	ON
33	35	52	OFF
30	30	62	OFF

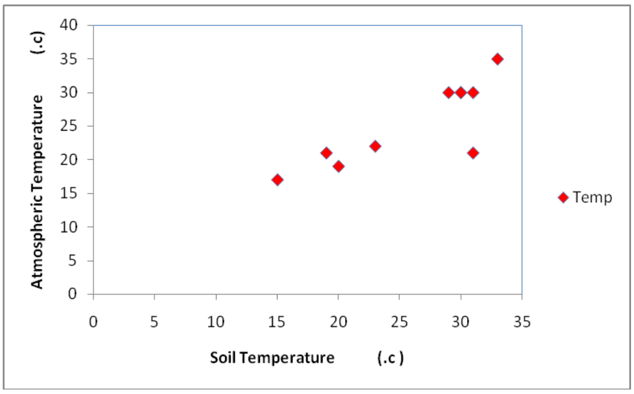

Fig.7. Relationship between atmospheric and soil temperature

If the user presses the manual button rather than another layout that is open where the on and off buttons are provided. If the user presses the ON button, the command sets GSM to Raspberry kit rather than Motorized via RS232, and if the user forgets that the motor is on, the message is received to the user the motor automatically descends after 15 minutes to turn it off. When the user presses the OFF button, the motor descends by approving PUMP IS STOP.

V. CONCLUSION

In this work, we have created a successful system and analyzing soil moisture and air humidity can provide the water needed for plants [7].

Automatic irrigation system is useful for farmers. It works better than manual system. So, those farmers can provide water to the plants and crops in a timely manner. Automated irrigation system provides the best irrigation system for farmers, but it is slightly more difficult to provide the water needed for the growth of plants and crops.DSS and IoT technology are used to improve water irrigation and monitor the plants growth. The farmer can use his Smartphone to monitor irrigation and plant growth and modify its processes. In the future, Automatic Irrigation System is designed to be used not only for agriculture but also for all its related fields.

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