International Journal of Science and Research (IJSR)
ISSN: 2319-7064
ResearchGate Impact Factor (2018): 0.28 | SJIF (2018): 7.426

IoT Data Logger in Irrigation Using Raspberry PI Model B

Bhuvaneshwari Mehtre[1], Nirmalkumar S. Benni[2]

[1, 2]School of Electronics and Communication Engineering, REVA University, Bangalore, India

Abstract: ***Agriculture plays vital role in the development of agricultural country. In India about 70% of population depends upon farming and one third of the nation's capital comes from farming. Issues concerning agriculture have been always hindering the development of the country. The only solution to this problem is smart agriculture by modernizing the current traditional methods of agriculture. Hence the project aims at making agriculture smart using automation and IoT technologies. The highlighting features of this project include controlling of water pump using relay, temperature sensor and soil moisture.***

Keywords: Raspberry pi 3 models B, Smart irrigation, temperature sensor, soil moisture sensor

1. Introduction

The Smart irrigation System has wide scope to automate the complete irrigation system. Here we are building an IoT based Irrigation System using raspberry pi 3 model B, LM35 temperature sensor and soil moisture sensor. It will not only automatically irrigate the water based on the moisture level in the soil but also send the Data to ThingSpeak Server to keep track of the land condition. The System consist a water pump which will be used to sprinkle water on the land depending upon the land environmental condition such as Moisture and Temperature. It is important to note that the different crops require different Soil Moisture, Temperature and Humidity Condition. So in this tutorial we are using such a crop which will require soil moisture of about 50-55%. So when the soil loses its moisture to less than 50% then Motor pump will turn on automatically to sprinkle the water and it will continue to sprinkle the water until the moisture goes up to 55% and after that the pump will be turned off. The sensor data will be sent to ThingSpeak Server in defined interval of time so that it can be monitored from anywhere in the world. As we know Raspberry pi is tiny credit card sized minicomputer which is powerful and inexpensive. Instead of using raspberry pi and Arduino, using of the latest raspberry pi 3 is better. Because usage of raspberry pi and Arduino you should provide external Bluetooth and Wi-Fi connectivity but whereas in the latest version of raspberry pi module it has inbuilt Bluetooth and Wi-Fi. Raspberry pi provide user friendly and convenience for the users.

2. Literature Survey

The new scenario of decreasing water, drying up of rivers and tanks, unpredictable environment, present an urgent need of proper utilization of water. To cope up with this use of temperature and moisture, sensors are placed at suitable locations for monitoring the crops. After research in the agricultural field, researchers found that the yield of agriculture is decreasing day by day. However, use of technology in the field of agriculture plays an important role in increasing the production as well as in reducing the man power. A high precision monitoring the data control agriculture automation system with IOT technologies [1]. An automated irrigation system based on cloud and Arduino is proposed to optimize the use of water for form land and assist the farmer to monitor the field [2]. All sensor nodes are connected to raspberry pi and capable the monitor the condition level of each sensor parameter throughout the GUI or android system [3]. The proposed system monitor the soil water content using soil moisture sensor then initiate adequate irrigation process [4].

As the above mentioned reviews represents the automatic irrigation system and they used both Arduino and raspberry pi as hardware component. Instead of using both Arduino and raspberry pi we can monitor and control moisture and temperature using only raspberry pi 3 model B which is cheaper and the latest version that provide comfort for the user.

3. Proposed System

The main aim of this project is to control the switch on and switch off of the pump using raspberry pi through relay. For this purpose python programming is used. The raspberry pi is connected to temperature sensor and soil moisture sensor which are considered to be input to the raspberry pi. The relay module which act as switch used to on and off water pump and ThingSpeak account which is consider to be output get data of temperature and moisture level condition. Through graph plot we get temperature and soil moisture output.

3.1 System Architecture

The system architecture consists of a Power supply, LM35 temperature sensor, soil moisture sensor, Raspberry pi module, relay, and water pump. The raspberry pi board is connected to the temperature sensor and soil moisture sensor as an input. And also connected to relay, water pump and ThingSpeak account as an output to know the soil condition.

3.2 Block Diagram

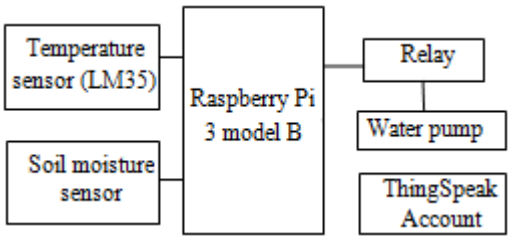

Figure 1: Block diagram of Irrigation control system

The above figure shows the main block diagram of irrigation control system .in that main model is Raspberry pi 3 model B. In this system two sensors are such temperature sensor and soil moisture sensor are connected to the Raspberry pi 3 model B and also relay is connected to the model where relay which is given to the water pump.

3.3 Raspberry Pi

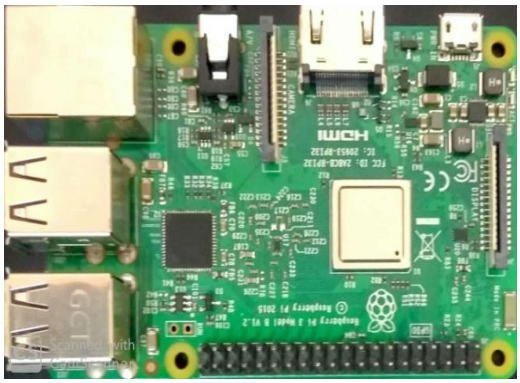

Figure 2: Raspberry pi 3 model B

The Raspberry Pi is a small, cheap, tiny computer on a single circuit board, and has been designed in such a way that it consumes less power than the regular computer. The raspberry pi consist of the micro USB power, display port, micro SD slot, HDMI, port, audio video jack, CPU, GPIO pins. Through the micro USB power the power supply for the raspberry pi is provided. With the help of the SD card it can store mass storage. The SD card of the smart phone that is used for the automation can be inserted. The GPIO pins are used to turn on the relay. When the user wants to switch on or off the particular home appliances, the command to do it is done through the Bluetooth module. The command given by the user is taken as the input by the software app i.e., Bluetooth terminal app. Once the raspberry pi receives the command, the GPIO of the raspberry pi does the switching of the relay. Depending upon command the electrical appliances will be switched on or off.

3.4 LM35

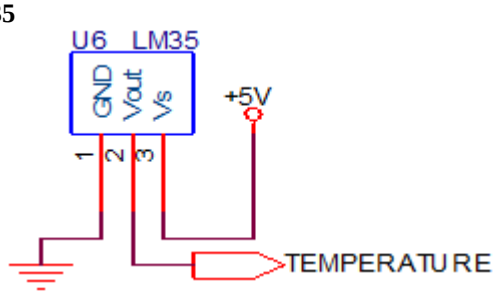

Figure 3: LM35 Temperature Sensor

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature (in degree Celsius). The LM35 temperature can be measured accurately than thermistor. It also possess low self-heating. The operating temperature range is from -55 to +150.

3.5 Soil Moisture Sensor

Figure 4: Soil moisture sensor

Soil moisture sensor measures the water content in soil. It uses the property of the electrical resistance of the soil. The relationship among the measured property and soil moisture is calibrated and it varies depending on environmental factors such as temperature, soil type, or electric conductivity. Here, it is used to sense the moisture in field and transfer it to raspberry pi in order to take controlling action of switching water pump ON/OFF.

3.6 Relay module

The relay module does the coupling between the input and output circuits. A relay allows the circuit to turn on or turn of providing complete isolation between the low and the high-voltage and controls the load. In this project relay module acts as a switch.

Software Used

a) Python

Python is an interpreted high-level programming language for general-purpose programming. Created by Guido van Rossum and first released in 1991, Python has a design philosophy that emphasizes code readability, and a syntax that allows programmers to express concepts in fewer lines of code, notably using significant whitespace. It provides constructs that enable clear programming on both small and large scales.

b) ThingSpeak

ThingSpeak is an open source Internet of Things application and API to store and retrieve data from things using the HTTP protocol over the Internet or via a Local Area Network. ThingSpeak enables the creation of sensor logging applications, location tracking applications, and a social network of things with status updates.

4. Working

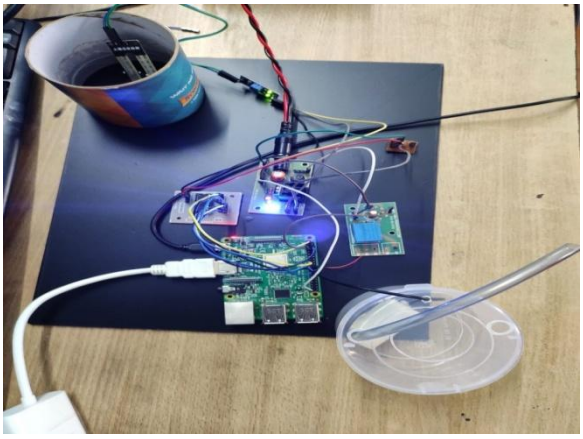

Figure 4: Prototype model of the smart irrigation control system

The prototype of smart irrigation control system consist of the raspberry pi board, relay module, water pump, temperature sensor, soil moisture sensor. A smart raspberry pi is powered by using micro USB charger. Power supply of 12v is provided to raspberry pi and it is connected to the relay channel and temperature sensor and moisture sensor. Thing Speak account a cloud server to store the data. Here Raspberry Pi will read temperature and moisture and send it to Thing Speak, and it can be monitored from anywhere in the world using internet. This will be useful if you are running the Pi for long time for some application at some remote place and need monitor its CPU temperature. Thing Speak is an open IoT platform for monitoring your data online. In Thing Speak channel you can set the data as private or public according to your choice.

The System consist a water pump which will be used to sprinkle water on the land depending upon the land environmental condition such as Moisture and Temperature. It is important to note that the different crops require different Soil Moisture, Temperature and Humidity Condition. So in this tutorial we are using such a crop which will require soil moisture of about 50-55%. So when the soil loses its moisture to less than 50% then Motor pump will turn on automatically to sprinkle the water and it will continue to sprinkle the water until the moisture goes up to 55% and after that the pump will be turned off. The sensor data will be sent to ThingSpeak Server in defined interval of time so that it can be monitored from anywhere in the world.

6. Result

Thus the smart irrigation control using raspberry pi model has become a successful done. With the help of this model we can easily control the irrigation without visiting field, with the help of raspberry pi and get field condition using ThingSpeak account. Hence it helps in saving time, money, and much reduces the human labor. The out of Thing Speak is shown below.

Graph Plots: The outputs of sensors are shown below

Chart 1: Temperature Measurement

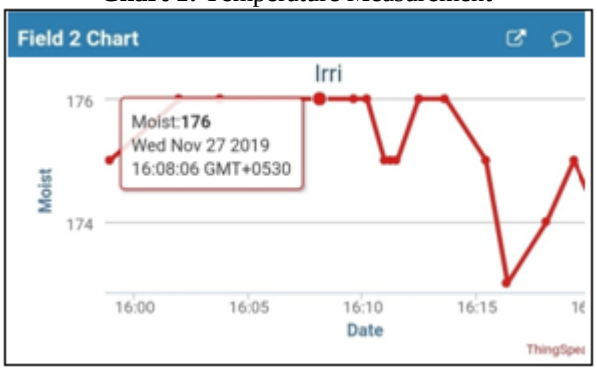

Chart 2: Moisture Measurement

7. Conclusion

The sensors are successfully interfaced with raspberry pi and wireless communication is achieved. All observations and experimental tests prove that this project is a complete solution to the field activities irrigation problems. Implementation of such a system in the field can definitely help to improve the yield of the crops and aids to manage the water resources effectively reducing the wastage.

8. Future Work

Our project can be improvised by using a sensor to note the soil pH value such that usage of unnecessary Fertilizers can be reduced and also read the temperature using Thing Speak account. The farmer can get a data without visiting the field and giving cost estimation. Further, it also reduces the investment of farmers.

References

[1] R.NageswaraRao, B.Sridhar, “Iot based smart crop-field monitoring and automation irrigation system”, International conference on inventive systems and control(ICISC) 2018, pp. 478-483.
[2] Hamza BENYEZZA. Mounir BOUHEDDA, Khaoula DJELLOUT, Amina SAIDI, “Smart irrigation system based ThingSpeak and Arduino”, International conference on applied smart systems”, (ICASS) 2018, pp. 1-4.
[3] S.N. Ishak, N.N.N.Abd Malik, N.M. Abdul Latif, N.EffiyanaGhazali, M.A. Baharudin, “smart home garden irrigation system using Raspberry pi”, Malaysia international conference on communications (MICC) 2017, pp. 101-105.

[4] Sfiso H Nkosi, S.P Daniel Chowdhury, "automated irrigation and water level management system using raspberry pi", IEEE 2018, pp. 804-809.
[5] Vaishali S, Suraj S, Vignesh G, Divya S and Udaykumar S, "mobile integrated smart irrigation [5]Vaishali S, Suraj S, Vignesh G, Divya S and Udaykumar S, "mobile integrated smart irrigation management and monitoring system using IOT", International Conference on Communication and Signal Processing, (ICCSP) 2017, pp. 2164-2167.
[6] SubhashreeGhosh, KanchanWani, SumaiyaSayyed, MrunalMhatre, Hyder Ali Hingoliwala, "Smart Irrigation: A Smart Irrigation System Using Cloud, Android and Data Mining", International Conference on Advance in Electronics, Communication and Computer Technology (ICAECCT) 2016, pp. 236-239.
[7] DhiraNegi, Bhairavi N. Savant, Ajit Kumar, "Smart Harvest Analysis using Raspberry pi based on Internet of Things", IEEE 2018