IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 9, Issue 3, March 2020

Design IoT based Smart Irrigation System using Arduino

Hardik Soni[1], Shubham Kahar[2]

Student, Electrical Engineering, Adani Institute of Infrastructure and Engineering, Ahmedabad, India[1,2]

Abstract: Agriculture plays imperative role in the development of a country. In India major population depends upon farming sector accounting of 16% of Gross Domestic Product (GDP) of India. So, in every new technology invented in a new era is created to solve the day to day life issues. We have introduced a new system based on some already made projects but with use of new technology and modern ideas. In old days in the agriculture sector there weren't many technologies invented. We have worked on the part of agriculture system which intelligently irrigates your yard with dynamic water cycles. It stops watering your yard if it is raining or has rained since your last watering. It uses the light sensor to detect the sunrise time and automatically adjust water start times accordingly. It also stops irrigation if your yard is too cold. Controlling of all these operations will be through any keen gadget or computer associated to Android based Web Applications and the operations will be performed by Soil moisture sensors, Temperature sensors, Wi-Fi modules and Arduino.

Keywords: Arduino, Soil moisture sensor, Temperature Sensors, Wi-Fi-Modules, Android.

I. INTRODUCTION

The pivotal idea to create this dexterity prototype of the irrigation process by using Internet of Things will lead to easy-going life of farmers. It can automatically work when the sensors sense the temperature of the surroundings, also works based on the weather conditions. This project is levelled up for making agriculture a smart system using IoT technologies. The most characteristics of this venture incorporates savvy Worldwide Situating Framework based on remote controlled framework to perform assignments like weeding, showering, moisture detecting, water system works, keeping carefulness, etc. Furthermore, it incorporates shrewd water system with savvy control and cleverly choice creator.

Agriculture is the Indian economy's cornerstone. In today's world, as we see rapid growth in the global population, it is becoming more important for agriculture to meet the needs of humanity. Farming requires irrigation, however, and with each year we have more water consumption than our annual rainfall, finding ways to conserve water while still producing the highest yield becomes important for farmers and developing countries. But in the present era, farmers use irrigation technology by hand, irrigating the land regularly, rather using modern technology systems. Statistics show that irrigation uses 85percent of freshwater and because of population increase and food production increasing this figure will continue to dominate the water consumption. [1]

The new system was designed to eliminate the excessive flow of water through agricultural land. The measurements of temperature, moisture and humidity are continuously monitored using the sensor of temperature, moisture and humidity and sent to the assigned IP address. Android application collects data from the allocated IP address on a continuous basis. The relay, which is attached to the Arduino microcontroller, controls the motor once the soil moisture values are reached. The whole project can be completely controlled through Android based application in which the user can decide at what time he/she wants to irrigate their yard and what water cycles command they want to give based on the weather conditions. [1]

Animals also cause severe damage to farm crops and the rate of damage seems to be burgeoning for a number of reasons. One of the reasons that is concerned is the nature of modern farming with an emphasis on monoculture and highly specialized crops and the high costs of harvesting if harm to the bird usually happens (traditional methods). [2]

The other aim of this project is to identify the wild animals interfering and damaging the crops. This can be implemented by using PIR sensor which works on the principle of infrared waves from the objects in the field of view. When any of the object is in between the view of the PIR sensor, it will detect the object based on the radiated infrared lights and will analyse the signal that the object is animal or human so that it can avoid any alarm system to buzz if PIR sensor detects the object as human. This is a great strategy to circumvent the damaging of crops. If PIR sensor detects any animals or may be humans, it should distinguish it and then send the required signal to the android application which can be further controlled by the user.

IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 9, Issue 3, March 2020

II. LITERATURE REVIEW

The current situation of diminishing water tables, drying up of streams, rivers and tanks, eccentric environment presents a pressing require of appropriate utilization of water. To manage up with this utilization of temperature and moisture sensor at appropriate areas for observing of crops is actualized in. A calculation made with edge values of temperature and soil moistness can be adjusted into a microcontroller-based system to control water sum required for irrigation. [3]
The framework can be fuelled by solar panel boards and can have a duplex communication interface based on a cellular or Wi-Fi based Web interface that permits information assessment and water system planning to be modified through a web page and can be easily controlled through the Android application. After the investigation within the rural field, analysts found that the surrender of horticulture is diminishing day by day. The system portrayed focuses of intrigued roughly the arrangement and instruments of variable rate water framework, distance sensor organizes and prominent time in field recognizing and control by utilizing reasonable computer program memory. The total system was made utilizing five in field sensor which collects the data and send it to the base station utilizing the GPS signals where crucial action is taken for controlling water framework ascension. [4]

III.PROPOSED METHODOLOGY

The proposed smart irrigation system method and its block diagram is shown in fig. -1. this system is based on global positioning system (GPS) and Wireless communication, which can be controlled remotely using computer system and further it can be expanded by using android based application.

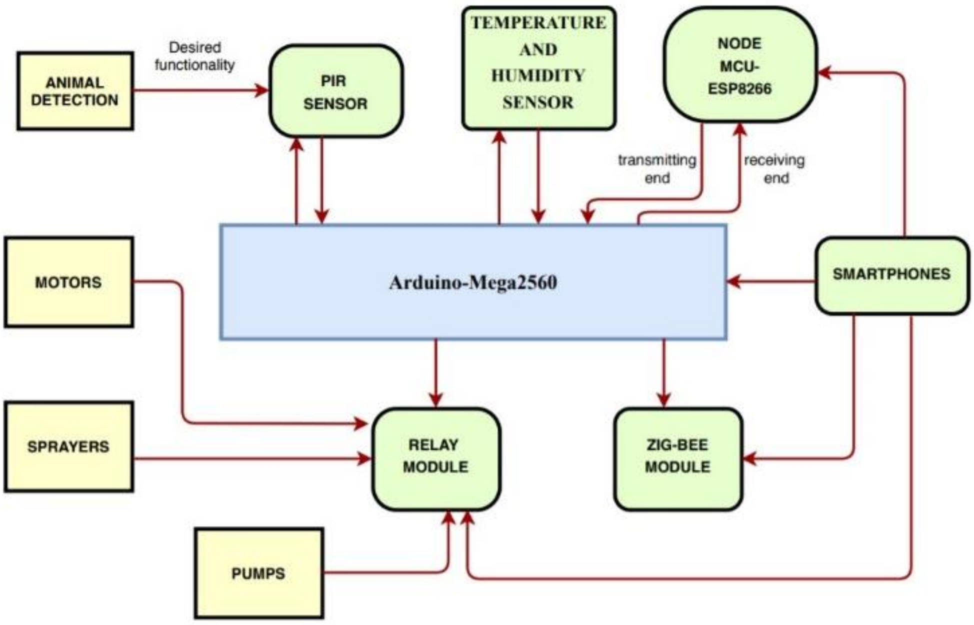

Fig. 1 – Proposed method block diagram

Farmers are starting to use a variety of monitoring and control systems to increase yields by automating agricultural parameters such as temperature, humidity and soil moisture and controlling the system that can help farmers to improve yields. This plan involves an integrated irrigation control system. This project includes a wireless sensor network for an irrigation system in real time. This system provides the agricultural farm with a consistent and sufficient water level and also allows farmers to utilize and manage the water. The module then automatically switches on the motor if the moisture level in the soil crosses below the threshold level. The motor turns OFF automatically when the level of water reaches normal level. On the Android device of the customer the sensed parameters and the actual motor state are shown and can be saved to the internal storage of the user device. This memory can be read anytime so that farmer can know what previous commands they have given to the controller. [1]

IV. HARDWARE DESIGN

In order to use any software, there is a need for hardware and its design. How it should be implemented could be directly dependent on the purpose and methodology used. Here we will talk about some hardware components used in this project and below are the listed.

IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 9, Issue 3, March 2020

4.1 Arduino Microcontroller (Mega 2560 REV30):

The MEGA 2560 is designed for projects that are more complex based on ATmega2560. There are 54 input and output digital pins and 16 analog inputs, 4 hardware serial ports, a 16 MHz quartz oscillator, USB connection, Power Jack, header for ICSP and push button. It includes all that the micro controller needs to support. This hardware can accept programming language such as C/C^{++} to work upon the hardware of the microcontroller. This type of Arduino board is also used to connect many such external components like PIR sensor, ultrasonic sensor, soil moisture sensor, temperature sensor. [4]

Fig. 2 – ArduinoMega2560 [5]

4.2 Soil Moisture Sensor:

The soil humidity sensor as shown in the Fig. 2 tests the soil water content and its temperature. This uses the value of the soil's electrical strength. It is calibrated and depends on environmental conditions such as temperature, soil type or electrical conductivity. The relationship between soil and property is calibrated. It is used for detecting moisture in the field and moving it to a microcontroller for monitoring the switching of the ON / OFF water pump. [6]

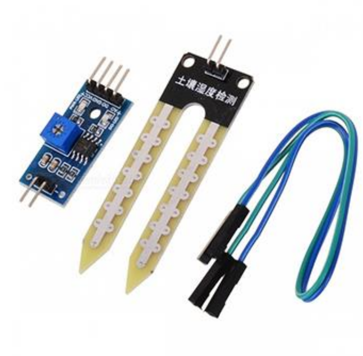

Fig. 3 – Soil Moisture Sensor

4.3 Optical Sensors:

Light is used to determine the characteristics of the soil. For near-infrared, medium-infrared and polarized light spectrums, sensors measure different reflecting wavelengths. Aerial platforms such as drones or even satellites may be equipped with sensors but that to depend upon the budget of the user. Soil reflectance and plant colour data can be aggregated and analysed by only two variables of optical sensors shown in the Fig. 3. To determine the content of clay, organic matter and humidity of soil, optical sensors are created.

Fig. 4 – Optical sensor

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 9, Issue 3, March 2020

4.4 Temperature sensor:

The temperature sensor and Humidity sensor which is highly precise because its output voltage is linear with the temperature Celsius scaling. The temperature and moisture sensor DHT11 as shown in Fig. 4 are a basic, ultra-low-cost sensor. A capacitive moisture sensor and a thermistor are used to measure the ambient air and propagate a digital signal on the data pin. It is easy to use, but it needs careful timing to collect data. Within the operating temperature range of 0 to 50°C, it is capable of measuring relative humidity between 20 and 90% of RH with ±5% of RH precision. Temperature with a precision of ±2 ° C is also measured in the range from 0 to 50 ° C. [7]

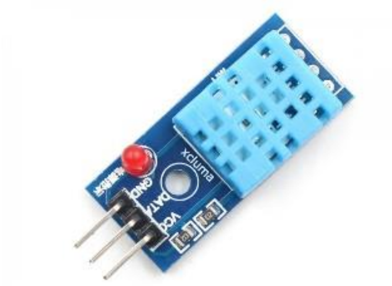

Fig. 5 – Temperature and humidity sensor (DHT11)

4.5 PIR Sensor:

All objects above the absolute zero temperature emit radiated heat energy. The human eye does not see this since it radiates infrared wavelengths. Instead they detect infrared radiation emitted or reflected from an object, PIR sensors shown in the Fig. 5 do not detect or measure heat. The movement of humans, animals, or other objects is detected. They are commonly used in burglar alarms and automated activating lights. When a person passes the field, the temperature increases from the room temperature at this point. The sensor transforms the resultant change to a voltage shift, which triggers the detection. [8]

Fig. 6 – PIR sensor

4.6 Wi-Fi Module:

This research implements the use of NodeMCU ESP8266 module for IoT based smart irrigation system. NodeMCU is a versatile Wi-Fi module because it has been equipped with GPIO, ADC, UART and PWM. In this research, NodeMCU ESP8266 as shown in the Fig. 6 function as a data logger which receives data from Arduino. Arduino will receive input from the temperature and humidity sensor in accordance with the soil moisture sensor conditions. This data is then sent to the node MCU in order to receive data to the final user. This can be further processed in the application name "Blynk" available to both the Android and iOS devices. The user can see how much temperature is logged in by the soil moisture sensor and can react upon whether watering is required or not.

Fig. 7 – Node MCU ESP8266

IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 9, Issue 3, March 2020

4.7 Zig-Bee Module:

ZigBee is a wireless technology developed to address the particular needs of low cost, low-capacity wireless networks as a free global standard. ZigBee is used for achieving wireless communication between two different systems. ZigBee module shown in the Fig. 7 has a spectrum of roughly 50 m and is supported by high-performance devices or by

Fig. 8 – Zig-Bee Module

network modules. This module operates at 2.4GHz frequency. The power consumption is very low and cheaper than other wireless modules such as Wi-Fi or Bluetooth. It is typically used for developing local wireless networks. [9]

V. SOFTWARE IMPLEMENTATION

Android software development is the process by which new Android apps are developed. Applications are usually produced with the Android Software Development Kit using Java programming language. A comprehensive range of developing tools is available in the Android development software kit (SDK). These include a simulator, collections, QEMU based handset emulation, documentation, sample codes and tutorials. In case developers want to tailor their apps for older devices, the SDK can also support older versions of the Android Platform. Old versions and tools for compatibility testing can also be updated once the latest version and framework has been downloaded. Android apps are packaged in apk format and saved on the root-user folder of the Android OS in the /data / app folder. Dex files are included in APK package (compiled byte code files called Dalvik executable), resource files, etc. [10]. Another software being used is the Arduino IDE. A cross-platform framework, written in C and C++ features, is an Integrated Development Environment (IDE) for Arduino (for Windows, macOS, Linux). It is used to write and upload compatible Arduino based programs on boards and other manufacturer device boards with the support of third-party cores. [11]

VI. RESULTS

Smartphones and IoT are mutually complementary in the era of technology of different systems. Therefore, the smart agriculture program has an enormous role to play. In addition, its computing ability allows users to develop a variety of realistic applications.

Fig. 9 – User interface through Blynk application

Another way to track and manage the field from anywhere is the Android smartphone device i.e. android app. When testing the soil using our module, farmers and gardeners will have precise information regarding the soil's condition i.e. temperature, humidity and surrounding humidity. Below table-1 shows the result analysis done with the prototype of the project model.

TABLE I User Feedback for prototype model

Sr.No.	Modules	Covering area	Productivity	User feedback
1.	With temperature and humidity testing	Area around sensor	Better than normal	helpful & accurate
2.	With soil moisture & PH testing	Soil with a radius of 10cm, semi spherically downward of the sensor	Better than normal	helpful & accurate
3.	With water pump start via call or text	Depends on the range of connectivity and used Sim card of particular service area	High	Very much helpful as it has reduced the manual effort & saves useful time

This smart system's GSM module helps farmers to reduce their workload and control water pumps by smartphones. There is no need to walk to the field just to start the pump and wait until the time when it has to be stopped. Linking the various previous techniques under IoT to render the Smart agriculture system, our proposed system is cost-effective and costs 10 times less than the present products in the market. By using our present system, it helps to analyse and predict the type of crops that are best grown in the particular agricultural field. In the future, deep learning technology will be further integrated and the proposed system will be fully automated. This system which is capable to send and receive the data from the sensors and also get the updated the precious data. The result analysis is also done with the help of Arduino IDE software which consist of serial monitor and serial plotter. The serial monitor is pop-up window which can establish connection in order to receive data and transmit data.

VII. CONCLUSION

The electrical irrigation systems used in the field of farming is discussed in this article. When the world transitions into new technology and designs, the trend in agriculture is also important. Some projects mean that data from different sensors are obtained from various nodes and sent through the wireless protocol through wireless network sensor use. The data collected provides information on the different environmental factors. Environmental monitoring is not the whole solution for burgeoning crop yield. Many other factors are more effective in reducing productivity. In order to overcome these issues, technological improvement needs to be implemented for agriculture. To solve such problems, an integrated system must be developed that will take care of all the productivity factors at each stage. Nonetheless, full automation is not achieved because of various problems in agriculture. Monitoring of crops wirelessly and irrigating the agriculture field with just tap of a button in a smartphone, allows reducing labour costs and also helps to track the changes in precise of instantaneous on the field in real time. The system proposed will track the necessary parameters for the growth of plants This proposed intelligent agricultural system of agriculture is very stable and user-friendly.

REFERENCES

[1]. Naik, P., Kumbi, A., Vishwanath Hiregoudar, C. N., Pavitra HK, S. B., & Sushmita JH, P. K. (2017). Arduino Based Automatic Irrigation System Using IoT. International Journal of Scientific Research in Computer Science, Engineering and Information Technology, 2(3)".
[2]. National Research Council. 1970. Land Use and Wildlife Resources. Washington, DC: The National Academies Press. https://doi.org/10.17226/9576.
[3]. S. R. Nandurkar, V. R. Thool, R. C. Thool, "Design and Development of Precision Agriculture System Using Wireless Sensor Network", IEEE International Conference on Automation, Control, Energy and Systems (ACES), 2014.
[4]. N. A. M. Leh, M. S. A. M. Kamaldin, Z. Muhammad and N. A. Kamarzaman, "Smart Irrigation System Using Internet of Things," 2019 IEEE 9th International Conference on System Engineering and Technology (ICSET), Shah Alam, Malaysia, 2019, pp. 96-101.
[5]. https://store.arduino.cc/usa/mega-2560-r3
[6]. Gondchawar, N., & Kawitkar, R. S. (2016). IoT based smart agriculture. International Journal of advanced research in Computer and Communication Engineering, 5(6), 838-842.
[7]. Gay, W. (2018). DHT11 sensor. In Advanced Raspberry Pi (pp. 399-418). Apress, Berkeley, CA.
[8]. Suma, N., Samson, S. R., Saranya, S., Shanmugapriya, G., & Subhashri, R. (2017). IOT based smart agriculture monitoring system. International Journal on Recent and Innovation Trends in computing and communication, 5(2), 177-181.
[9]. Lukman, A. A., Agajo, J., Gana, K. J., Ogbole, I. C., & Ataimo, E. E. (2017). Development of a low power consumption smart embedded wireless sensor network for the ubiquitous environmental monitoring using ZigBee module. ATBU Journal of Science, Technology and Education, 5(1), 94-108.
[10]. Pavithra, D. S., & Srinath, M. S. (2014). GSM based automatic irrigation control system for efficient use of resources and crop planning by using an Android mobile. IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE), 11(4), 49-55.
[11]. https://en.wikipedia.org/wiki/Arduino_IDE.