

IoT Based Smart Irrigation System

Jatin Kumar¹ Nikhil Gauta² Nitesh Kumar³

^{1,2,3}Department of Information Technology

^{1,2,3}MAIT, GGSIPU, Delhi, India

Abstract— An embedded system is a special purpose computer system designed to perform a dedicated function. Since the function is dedicated to specific tasks, design engineers can optimize it, reducing the size and cost of the product. Embedded system comprises of both software and hardware. Embedded system is fast growing technology the application of Embedded system is vast a PC or a controller is used to do the specified task the controller is programmed using assembly or Embedded language like Embedded C. Many devices are used for monitoring the humidity conditions. In early days, all the systems are analog devices and the measured value can be displayed by using recorders and CROs. This project is used to eliminate the drawbacks in the existing system. Here the humidity is monitored by sensor that can be converted in to corresponding signal to the microcontroller other sensors are also used to expand the capability of the system by sensing the environment conditions. The main feature of this project is that, according to the moisture levels, the controller activates the relay driver unit and pumps motor by using relay switches [21]. The controller receives reading from all sensors and uploads the readings to the cloud using esp8266 Wifi module. And the same readings of sensors as well as the pump status can be seen in the android App. App can even control the system remotely from anywhere in the world.

Key words: IoT, Smart Irrigation System

I. INTRODUCTION

In the fast paced world human beings require everything to be auto mated. Our life style demands everything to be more controlled. Apart from few things man has made his life automated. And why not? Advance electronics, should make the human life simpler and hence to make the life more simpler and convenient, we made "IOT BASED SMART IRRIGATION SYSTEM". A model of controlling irrigation facilities to help millions of people. This model uses sensor technology with microcontroller to make a smart switching device. The system consists of Humidity and temperature sensor, Rain sensor, Flame sensor. All this sensors can measure the corresponding weather parameter. The system is intended to use in large residential buildings and manufacturing industries.

The main concept behind the Internet of Things(IoT) is to connect various electronic devices through a network and then retrieve the data from these devices (sensors) which can be distributed in any way, upload them to any cloud service where one can analyze and process the gathered information. In the cloud service one can utilize these data to alert people by various means such as sending them an e-mail or sending them an SMS etc.

A. Internet of Things (IoT)

The Internet of Things (IoT) is an environment of connected physical objects that are accessible through the internet. The IoT grant objects to be sensed and controlled remotely

beyond existing network infrastructure, creating opportunities for more direct integration of the physical world into computer based systems, and effecting in improved efficiency, accuracy and economic benefit, when IoT is augmented with sensors and actuators, the technology becomes an sample of the more general class of cyber physical systems, which also compasses technologies such as smart grids, smart homes, intelligent transportation and smart cities.

Since IoT are actually embedded systems and smart objects connected to internet with different IP address which can be detected and communicated over internet. We have also seen that the IoT devices may have external exterior like Actuators and Sensors.[7]

II. AIM OF THE STUDY

The importance of IOT Based smart irrigation system is existed in many aspects. The moisture in the soil is very useful in the growth of the crops and plant hence it plays a major role in the yield of crop it needs to be monitored for maintaining the healthy growth in crops and to also ensure the safe working environment in agriculture based industries. Due to technological advancement, the process of reading the environmental parameters became easier and more precise compared to the past days. The basic objective behind this system that is very helpful for the farmers as well as for the manufacturing industries where soil moisture, temperature, humidity and rain drop play an important role.

III. HARDWARE REQUIREMENT

A. Soil moisture Sensor:

The Soil Moisture Sensor is a small module that can measure the water content in the soil. The soil moisture sensor is very simple to use. The two large exposed tooth function as probes for the sensor, they together acts as a variable resistor. More water amount in the soil means the better the conductivity between the two teeth will be and will result in lower resistance, and gives a higher SIG out.

B. Rain Sensor:

A rain sensor is a sensor which senses the rainfall and check the level of rainfall. There are two main operations for rain sensor. The primary operation is a water conservation device which is connected with an automatic irrigation system that gives the reason to the system for shutting down in the occurrence of rainfall. The secondary operation is a device which is used to secure the interior of an automobile from fall of rain and to hold the automatic channels of windscreen wipers. [22]

C. Flame Sensor:

A Flame Sensor is a sensor constructed to catch and reply to the existence of a flame or fire, granting flame detection. Responses to a caught flame depend on the installation, but can contain sounding an alarm, making inactive a fuel line

(such as a propane or a natural gas line), and start a fire suppression system. Their role is to give confirmation that the furnace is rightly, When used in applications such as industrial furnaces, in these cases they take no absolute action further notifying the operator or control system.

D. DHT 22 Temperatures & Humidity Sensor:

The DHT22 is a ultra-low-cost digital temperature and humidity sensor. A capacitive humidity sensor and a thermistor is used to measure the enclosing air, and gives the digital signal on the data pin (no analog input pins needed).Its reasonably simple to use, but it requires a little time to catch data. The only real downside of this sensor is you can get new data once in every 2 seconds, so when DHT library, sensor readings may be up to 2 seconds old.[24]

E. Arduino Micro-controller:

Arduino is an open-source standard platform based on easy-to-use hardware and software. Arduino boards can read inputs – e.g. light on a sensor, a finger detection on a button, or a Twitter message - and can convert it into an output - starting a motor, turning ON and OFF an LED, publishing something online. We can tell the Arduino Board what to do by uploading a set of instructions to the microcontroller board. To do so have to code in Arduino programming language i.e C, using Arduino Software(IDE). We have used Arduino UNO microcontroller in the project It is cheap and work fine with esp8266. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. [16]

F. ESP8266:

The ESP8266 is a Wi-Fi microchip, which is produced by Shanghai-based Chinese manufacturer, Espressif Systems. This small module admits microcontrollers to connect to a Wi-Fi network and make easy TCP/IP connections. However, at the time there was nearly no English-language documentation on the chip and the commands it allowed. The very low price and the fact that there were very few external components on the module which advised that it could ultimately be very nominal in volume, attracted many hackers to analyze the module, chip, and the software on it, as well as to convert the Chinese documentation.[26]

G. Electric Pump:

A pump is a device that transport fluids (liquids or gases), or sometimes slurries, by using mechanical action. Pumps can be categorized into three major groups according to the way they use to translocate the fluid: direct lift, displacement, and gravity pumps. Pumps are operated by some mechanism (e.g. reciprocating or rotary), and it consume some kind of energy to perform work by moving the fluid. Pumps can be operated via many energy sources, including manual operation, electricity, engines, or wind and it comes in many sizes, according to the requirement from microscopic for use in medical and surgical applications to large industrial pumps.

IV. SOFTWARE REQUIREMENT

A. ThingSpeak Cloud:

ThingSpeak is an Internet of Things(IoT) platform service that allows you to aggregate, visualize, and analyze data in the cloud and enable to develop IoT applications. You can transfer data to ThingSpeak cloud from your devices, create fast result of visualize data, and send alerts by using the web services like Twitter rand Twilio. With MATLAB systematics inward ThingSpeak, you can write and run MATLAB code to perform different task like preprocessing, visualizations, and analyses. ThingSpeak facilitates engineers and scientists to standard and build IoT systems without developing web software[18].

B. Android Studio:

Android Studio is the official IDE provided by Google for building Android App. Its purpose is to accelerate your development and help to build the highest-quality applications for Android devices. It offers great custom-tailored tools for Android developers, which includes rich code editing, debugging the App, testing, and profiling tools.[28]

C. Twilio:

Twilio is a online platform which communicates with the clouds as a service (PaaS).Company is based in San Francisco, California. Twilio enable developer programmatically make and receive phone calls and send and receive text messages using its web service APIs. Twilio's services are routed over the HTTP protocol and are billed depends on usage.[20]

V. METHODOLOGY

Arduino board will get data from rain sensor, flame sensor, Moisture sensor Temperature and humidity sensor and also status of relay switch this data will be uploaded to the Thingspeak cloud where readings will be shown in graphical format we can see our readings and visualize it, this data will be collected in app thorough Api calls. User can view this reading through this app. User can also control the system using App. This project also contains a feature of sms alert

As soon the reading of flame and rain sensor go beyond the threshold value a sms is received the user. For sms alert this project uses a feature of thinghttp App of thingspeak and twilio as a platform for sending sms through http request.

VI. BLOCK DIAGRAM

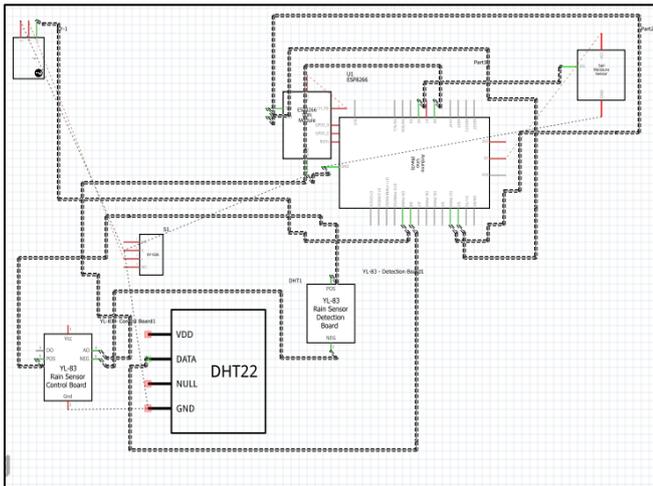


Fig. 1: Wiring connection of Arduino with esp8266 and sensors

A. Interfacing Using Arduino

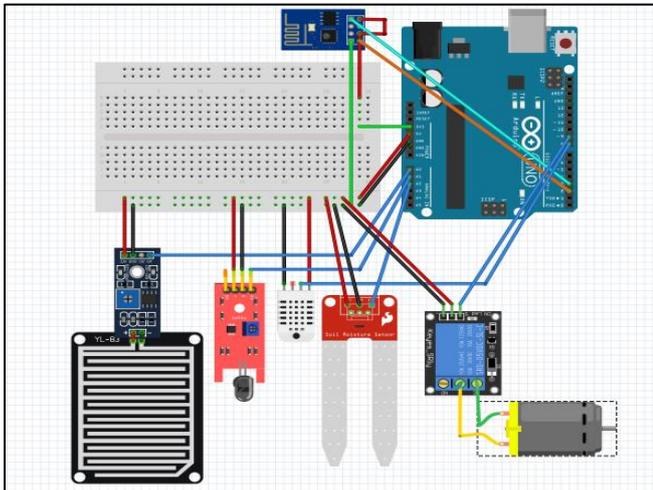


Fig. 2: Fritzing Circuit Diagram

VII. RESULT

The readings of the sensors sent by esp has been plotted successfully on the thingspeak cloud.

Reading can also be view in the custom Android App and user can control the system the Android App.

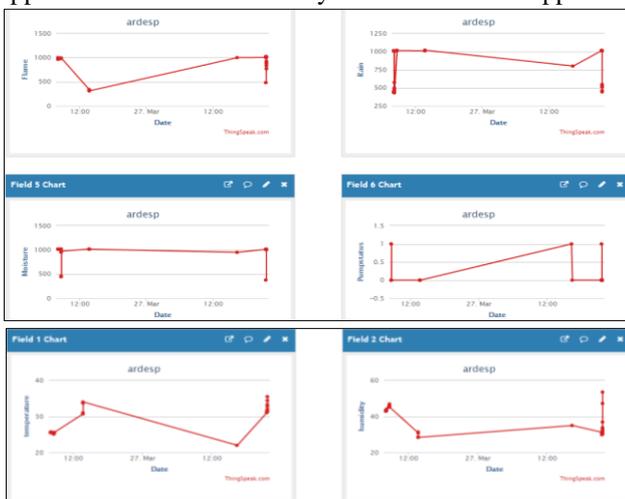


Fig. 3: Thingspeak Graph

VIII. ANDROID APP

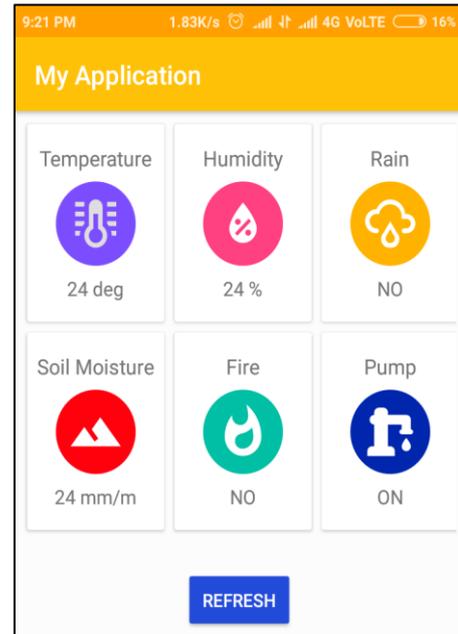


Fig. 4: Android App UI

IX. FUTURE SCOPE

This system can be developed for the event triggering i.e. is some environmental condition changes it generates an alert. System can effectively measure the surroundings parameters hence for guarded railway tracks and protection from the animals can be achieved using this type of system. System is based on real time data visualization so it is a useful prototype for the real time applications. Using App integration like Thingspeak's Talkback machine to machine communication can be achieved. Iot has a tremendous scope it can be use anywhere e.g. in government offices, Airports, Railways, against criminal, Monitoring, weather forecasting, Medical and surgical department etc. By some modification this system can be used as a wearable. Parameter like humidity, temperature, flame and rain drop levels helps in weather prediction and with the help of data analytics is plays important role in decision making.

X. CONCLUSION

The arduino Uno simple to use it makes easier to connect things through jumper. Arduino Uno has analog and digital pin that is used on this project. Arduino Bootloader is designed to automatically handle the uploading of computer programs and does not require to be proficient in Embedded programming. It is very easy to manufacture project based on arduino microcontroller. The system relies on arduino programming and being developed using arduino IDE. Arduino in combination with thingspeak and Android Studio can be used to build a vast range IOT devices

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