Irrigation and Internet of Things Platform

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Abstract- *Irrigation is an integral part of agriculture. It is what feeds a nation and keeps it going. Without irrigation, crops would wither and die. Proper irrigation ensures that crops never run out of water and give a high yield to the farmer. In irrigation, a main aspect is sensing the soil moisture level using a soil sensor connected to Arduino so as to enable automatic irrigation. Automatic irrigation reduces the intermediation of the farmer. Using an Internet of Things(IOT) platform like Thingspeak, the farmer can upload the sensed values to Internet where he can monitor the values whenever he wants. This removes the need for his presence in the field.*

Keywords:*IOT, Irrigation, Arduino,Soil Moisture Sensor,Thingspeak*

I. INTRODUCTION

Agriculturists are facing new difficulties and opportunities continuously to produce more foodcrops due to the increase in global population every year. The challenges faced are lack of education, inadequate knowledge about farming, change in climatic conditions, mismanagement of water resources and restrictions to technology. In farming, aspects like temperature, humidity, pH, soil dampness are fundamental requirementswhich have an impact on the type of crop, its development, yield, susceptibility to diseases and so on. A lot of research work is being done since last decade on irrigation and water conservation techniques. There have been a lot of innovations in agriculture tools and techniques in last decade. These can be used in all strategies for water management to save used water. Since agriculture is the largest user of fresh water, water management is essential. Wireless sensor networks can be used to save water for irrigation purposes.

As years pass, the availability of labour also decreases thereby reducing the percentage of labour. Many agrarian lands are being used for industrial or zoning or mixed-use development purposes. Various researchers are computerizing agriculture to reduce farmer dependence and burden thereby minimizing human intervention in agriculture. Thus the growth and development of food crops and other factors can be supervised and monitored from remote places using the web. There are many IOT platforms like Thingspeak, Xively, Grovestreams, IBM Bluemix, Thingworx which can store data values and help in monitoring in cases of home automation, greenhouse monitoring, smart lighting, automatic irrigation and so forth. Using an Arduino microcontroller, sensor values are read and uploaded to the IOT platform where the farmer can remotely observe and monitor the values.

II. ARDUINO

The Arduino Uno R3 SMD edition is a microcontroller board based on the ATmega328 SMD with greater flash memory of 32KB. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter. When the Uno is connected to either a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB). For the following half-second or so, the bootloader is running on the Uno. While it is programmed to ignore malformed data (i.e. anything besides an upload of new code), it will intercept the first few bytes of data sent to the board after a connection is opened. If a sketch running on the board receives a one-time configuration or other data when it first starts, we have to make sure that the software with which it communicates waits a second after opening the connection and before sending this data. The Arduino Uno has a resettable polyfuse that protects our computer's USB ports from shorts and overcurrent. Although most computers provide their own internal protection, the fuse provides an extra layer of protection. If more than 500 mA is applied to the USB port, the fuse will automatically break the connection until the short or overload is removed.
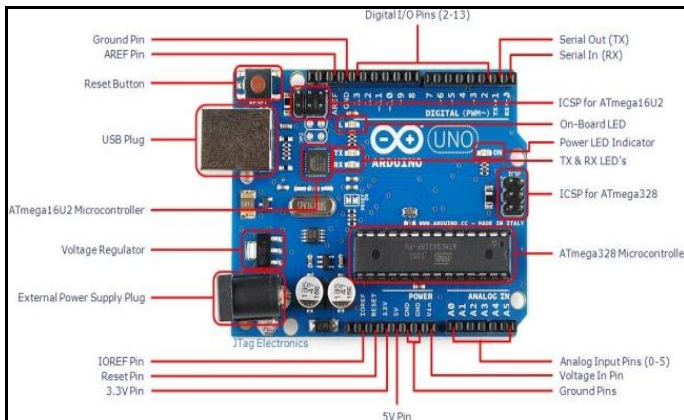
Fig -1:Arduino Uno R3 block diagram

III. SOIL MOISTURE SENSOR

 Despite the importance of soil moisture information, widespread and/or continuous measurement of soil moisture is all but non-existent. There is a need for continuous measurements of surface soil moisture. Also, remote soil moisture sensing increases the efficiencies of irrigation systems by preventing over watering and leaching of fertilizers and other chemicals offsite.

The module consists of detection probe, and sensor board. It is having triple output mode, digital, analog, and serial with exact readings. The sensor will detect the shortage of water content of the soil. If the contents are low the module output will be high otherwise the output will remain in neutral conditions. This moisture sensor has two probes used to pass the current into the soil, and then it reads that resistance between two probes to get the moisture level. More water present in the soil makes the soil conduct electricity more easily indicating less resistance, while dry soil having less water conducts electricity more poorly indicating more resistance.
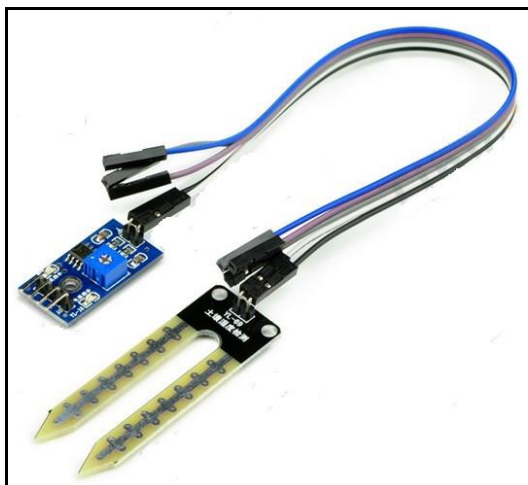

Fig -2:Soil Moisture Sensor

The features of the sensor are:

- 5V-VCC power pin
- GND-ground pin
- DO-digital output interface
- A0-Analog output interface
- Module Output is high when the soil moisture deficit, or the output is low.
- Operating voltage:3.3V~5V .

IV. THINGSPEAK IOT PLATFORM

The Internet of Things(IoT) is a system of 'connected things'. The things generally comprise of an embedded operating system and an ability to communicate with the internet or with the neighboring things. One of the key elements of a generic IoT system that bridges the various 'things' is an IoT service. The real power of IoT is harnessed when the things connect to a 'service' either directly or via other 'things'. In such systems, the service plays the role of an invisible manager by providing capabilities ranging from simple data collection and monitoring to complex data analytics.

ThingSpeak is a platform providing various services exclusively targeted for building IoT applications. It offers the capabilities of real-time data collection, visualizing the collected data in the form of charts, ability to create plugins and apps for collaborating with web services, social network and other APIs.

The core element of ThingSpeak is a 'ThingSpeak Channel'. A channel stores the data that we send to ThingSpeak and comprises of the below elements:

- 8 fields for storing data of any type - These can be used to store the data from a sensor or from an embedded device.
- 3 location fields - Can be used to store the latitude, longitude and the elevation. These are very useful for tracking a moving device.
- 1 status field - A short message to describe the data stored in the channel.

To use ThingSpeak, we need to sign up and create a channel. Once we have a channel, we can send the data to the channel using WriteAPIKey and allow ThingSpeak to process it and also retrieve the same.
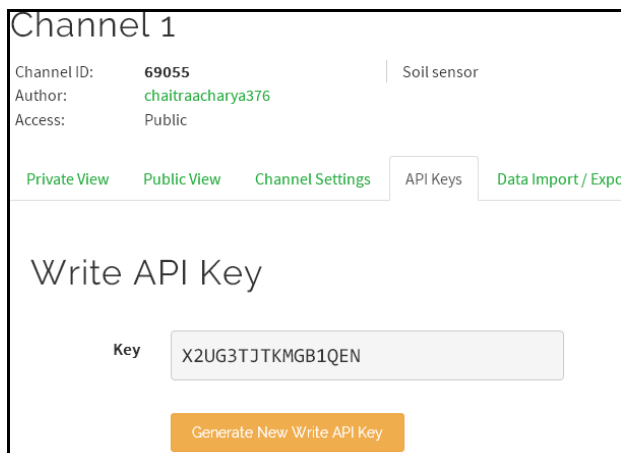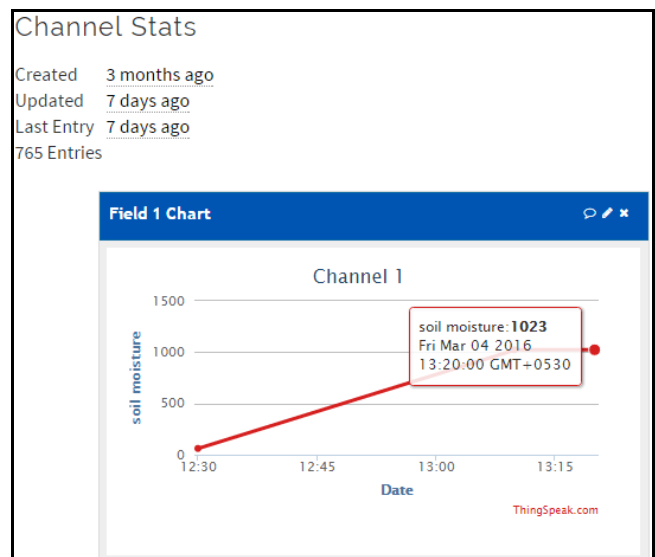
Fig -3:Thingspeak Channel and WriteAPIKey

V. UPLOADING VALUES TO THINGSPEAK

We need to first sign up for a Thingspeak account on the website Thingspeak.com. Once the Thingspeak account is created, we need to create a channel which denotes what values we are reading.The next step is to connect the soil moisture sensor to arduino and read the values. The values are then uploaded to the Thingspeak website where the values are displayed in the form as given in the figure.
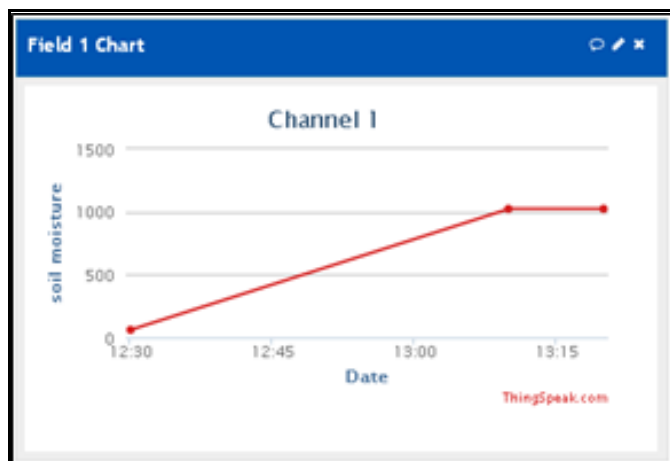

Fig -4:Data uploaded to Thingspeak

On hovering the mouse over the graph we can read the soil moisture values, the date when the values were read and the time when they were read as shown in figure 5.

Fig -5:Sensor data values read on 4 March.

VI. CONCLUSION AND FUTURE SCOPE

The above research refers to an effective system where sensor data is remotely monitored on Internet and precludes the presence of the farmer on the field. This system is simple, easy to use and reduces burden on farmer. This system is helpful to the modern farmer who faces shortage of labourers and also conserves the water. The farmer can water his field only if sensor values are low. Thus this prevents overflow of water.

In the future, using the Thingtweet app of Thingspeak, it is possible to tweet the sensor values to the user's mobile and send alerts to the user depending on the sensor values.

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