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Automatic Irrigation System Using "INTERNET OF THINGS."

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Abstract -The motivation for this project came from the countries where economy is based on agriculture and the climatic conditions lead to lack of rains & scarcity of water . Irrigation is moreover the backbone of Agricultural industry .Due to inadequate knowledge of proper utilization of water resource, lots of water is wastage in the application of irrigation system.So to overcome this problem , it is necessary to make the system automate with the help of modern technology like "Internet Of Things".

Keywords — Arduino UNO , Plotly , Soil Moisture Sensor

I. INTRODUCTION

A. Internet of things : The interconnected objects referred as Internet of Things (IoT) is continuing to evolve offering more control over our living environment and allowing more ease in doing things. Many consider this as the next big horizon in the evolution of the Internet. It has the capability of collecting, storing, analysing and distributing data among diverse interfaces, apps and devices, the freedom for real-time application of data and data-driven insights has become easier than ever before[2].

B. Smart Irrigation System/IoT Based Irrigation System :

Now a days, in a largely populated country like india a technological push of the conventional irrigation system is a urgent necessary. With the use of Automatic irrigation system [2] using IOT is capable of offering real-time water usage data to the authorities because they remain unconnected. On the other hand, the smart sensors in the farmland are additionally capable of notifying in a real time about the moisture level in lands and can prevent spoiling of water. This capability can be further aggravated if the real-time sensor data can trigger action in the meter by switching it off or on. The meter can be automatically switched on or off depending on the need of irrigation and level of the water resource [3].

II. SYSTEM IMPLEMENTATION

In our work the IoT architecture is designed in reference to Automatic Irrigation System which consist of three layers:

1. A physical layer for capturing soil moisture and water level intensities. We have implemented this using an Arduino micro controller , soil moisture and water level indicator.
2. A coordination layer used for capturing the measurements from the physical layer, and sending the measurements to our application. We have implemented this using node.js.
3. An application layer for visualizing the measurements in real-time. We have implement this using a data visualization cloud service called Plotly.

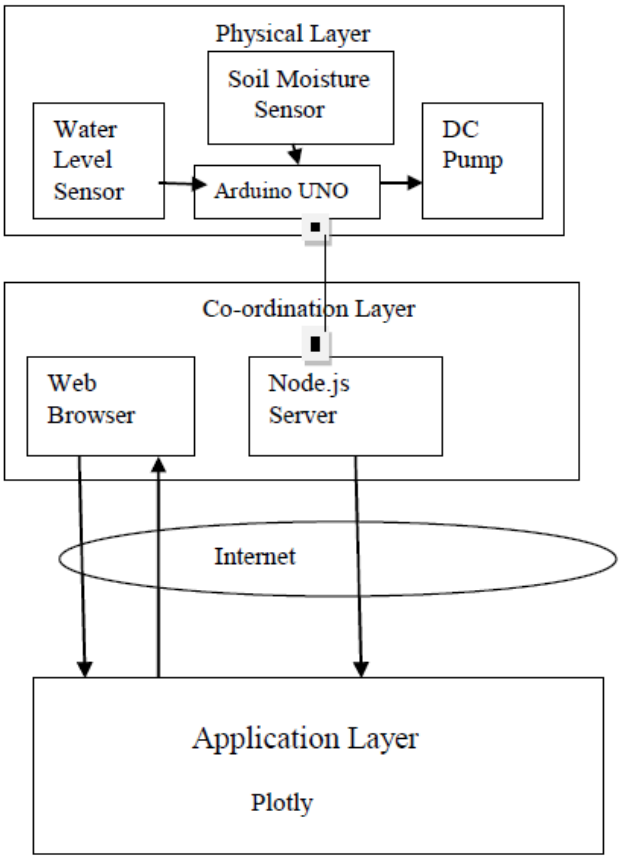

Fig: 1 Architecture Of IoT reference to Irrigation System

A soil moisture sensor device monitor moisture level of the Soil and water level circuit sense the water level of the water tank thus turning pump on and off according to different condition according to soil moisture and level of water in tank. When the humidity of soil is low that is soil is dry the water pump is on and if humidity is high that is soil is wet the water pump is off [4]. At same time the sensor used to sense the water level is also consider. When the water level is below the low level the pump is off at any soil condition which prevents the dry running of water pump. Also water level is indicated.

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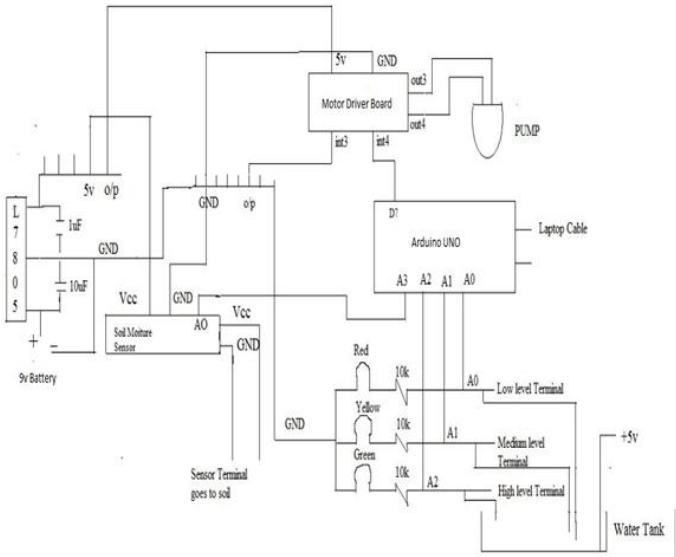

Fig 2: Complete circuit diagram

Arduino UNO is used for interfacing between Node.js server and sensing device through serial communication. **ARDUINO UNO** is one of the open sourced Microcontrollers / embedded development platform for hobbyist and embedded developers based on Atmega323 Microcontroller. Again Node.js server is connected to cloud server called as plotly, which is third party IoT platform using HTTP protocol. When we send request to plotly to access those data from Web Browser using IP address through internet ,in return plotly respond and send desired data .

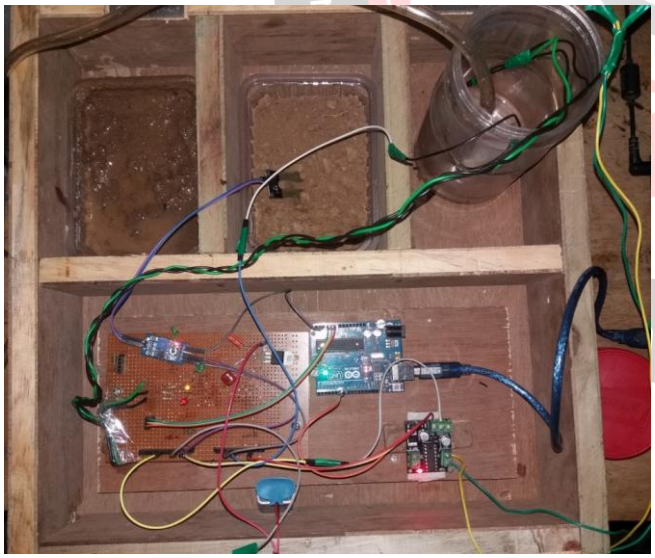

Fig 3: Complete Setup of the Project (Hardware)

Fig 2 shows the complete setup of the hardware system. Here, a wooden box is used to demonstrate the automatic irrigation system. two sensors are maily used, i.e. soil moisture sensor and water level sensor with three indicators namely High level, Medium level and Low level. Motor driver have been used for the operation of the DC pump also called as DC motor and an ICL7805 is used to convert 9V input to 5V output. Sensors are connected to analog pins of Arduino board.

III. System Software Implementation

A. *Arduino IDE tool*

The open-source Arduino environment makes it easy to write code and upload it to the I/O board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and based on Processing, Avr-gcc, and other open source software.

B. *Command-line user interface (CLI):*

A command-line user interface (CLI), also known as a console user interface, and character user interface (CUI), a means of interacting with a Computer program where the user (or client) issues commands to the program in the form of successive lines of text (command lines) is used. The interface is implemented with a command line shell, which is a program that accepts commands as text input and converts commands into appropriate operating system functions. [6]

C. *Node.js*

Node.js is an open source, cross-platform runtime environment for server-side and networking applications. Node.js allows the creation of Web servers and networking tools using JavaScript and a collection of "modules" that handle various core functionality. Modules are provided for file system I/O, networking (DNS, HTTP, TCP, TLS/SSL, or UDP), binary data (buffers), cryptography functions, data streams and other core functions. Node.js's modules use an API designed to reduce the complexity of writing server applications.

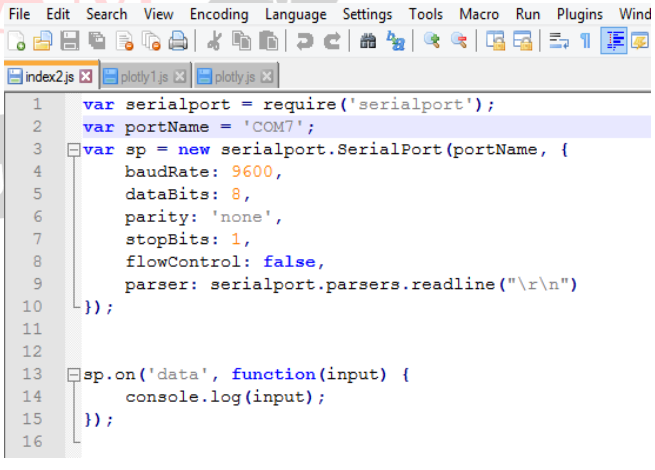

Fig: 4 : screenshot of Program to collect data by node.js from Arduino.

In this paper, we built a node.js server that gets sensors value from Arduino and displays these measurements on the terminal. To build this server, one node library called serial port is needed . From this terminal, NPM install serial port is executed to install the library. Next, it created

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a file called index2.js, containing JavaScript program and then exeuted. Here We have seen the measurements displayed on the command line terminal in the figure Below.

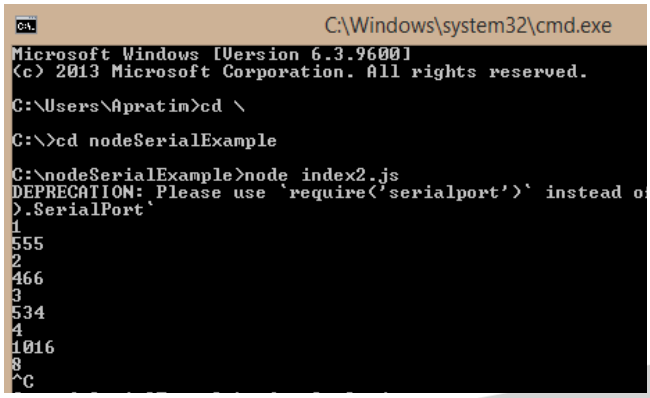

Fig 5 : Data from Arduino fetched by node.js Server.

D. Ploty:

Plotly is an online analytics and data visualization tool. Plotly has a Streaming API, which makes it perfect for our use case. It is a 3rd party data visualization for IoT. It is Mainly used to make creating graphs faster and more efficient. Plotly was built using Python and the Django framework, with a front end using JavaScript and the visualization library D3.js, HTML and CSS. Files are hosted on Amazon S3.

Here in this paper a free Plotly account is created by going to the website plotly.ly. And then went to the setting and got 3 pieces of information Username, API key, Streaming API token and saved for the later use.

Fig 6: Command prompt output of sending data to plotly and ge the url here to view the status of the system.

A node.js server is built that will get the measurements from Arduino and send the data to Plotly. To do this, we need to install Plotly library for node.js by executing npm install plotly from the terminal.

Next, a file is created as plotly.js and written the program to connect node.js server and plotly server through internet using HTTP protocol. To start the plotly.js server, we have searched the folder where plotly.js is saved, and executed node plotly.js. We get a url in the terminal after running the program plotly.js to view the status of the system.

Format and save your graphic images using a suitable graphics processing program that will allow you to create the images as PostScript (PS), Encapsulated PostScript (EPS), or Tagged Image File Format (TIFF), sizes them, and adjusts the resolution settings. If you created your source files in one of the following you will be able to submit the graphics without converting to a PS, EPS, or TIFF file: Microsoft Word, Microsoft PowerPoint, Microsoft Excel, or Portable Document Format (PDF).

IV. RESULT

When plotly.js code is run, it creates a file in Plotly called Automatic irrigation and opens a url on the terminal of the computer. It is needed to copy and paste the link on the browser to view the sensors values and status of the DC pump as shown above Fig 7.

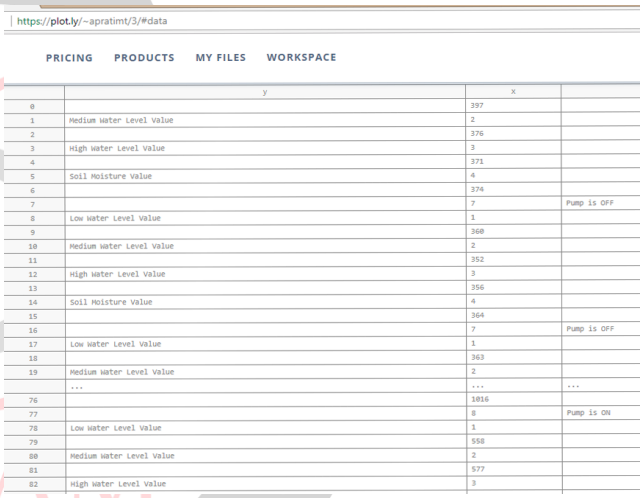

Fig 7: Streaming Data monitored through plotly

Thus The whole system output can be monitored from sitting anywhere of the world. The advantages of this small but smart irrigation system is wide reaching. This IoT irrigation system will help you have better control of your landscape and irrigation needs as well as peace of mind that the smart system can make decisions independently if you are away.

Table1 shows the different values of soil moisture sensor (X) and the water level sensor output & the status of the DC pump, where turning the pump on and off is done according to different conditions of the sensors.

V. CONCLUSION

The whole system is successful in building an end-to-end IoT application covering Getting measurements from an analogue input, Processing the data using node.js & Visualising the data using a 3rd party service. With the use

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CONDITIONS	SOIL MOISTURE & WATER SENSOR		
	Value X < 700	value X> 700	value X > 700
	WATER LEVEL<1	WATER LEVEL >1	WATER LEVEL <1
DC PUMP STATUS	PUMP IS OFF	PUMP IS ON	PUMP IS OFF

of this technique it can reduce water consumption as it can

Table1: Status of the Pump depending upon soil and water sensor

be set to lower and upper thresholds to maintain optimum soil moisture saturation and minimize plant wilting. It can contribute to deeper plat root growth, reduced soil runoff/leaching, less favorable conditions for insects and fungal disease. It is also possible to control the nutrition levels in their entirety thus, lower nutrition costs. No nutrition pollution is released into the environment because of the controlled system. Hence will have great saving of irrigation water, stronger, healthier plants and stable, high yields. Hence definitely will have improvement in biological fertility. Also water level controller and automatic irrigation controller with IoT prevents dry running of pumping motor, thus saves water, electricity, & the manpower needed to monitor the system.

VI. SCOPE OF FUTURE STUDY

We are now living in the world of big data. Big data deals with collection, storage and analysis of data to understand the information not previously known. Implementing this Big Data Analytics in Agricultural/Irrigation System might be a great technological push. By making proper use of the large amount of data available, we could develop a new perspective by consideration of data or merging it with other useful information. This process could involve understanding crop records, precipitation maps, reports of diagnosis etc., along with continuous analysis of data streams about the specific area at every instant of time[7][9].

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