IoT Based Smart Irrigation System For Barren Land

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Abstract- *The Auto irrigation system uses a soil moisture sensor to detect the moisture level and various crops control like moisture, temperature and humidity. When the moisture content of the soil is reduced then the sensor sends the detected value to the microcontroller. Then the water pump is automatically turned ON according to the moisture level and included IoT based starter. The main aim of this paper is to reduce the human work in the agricultural field. This entire system is controlled by the PIC microcontroller. Urban water supply pipe network leakage accident is an additional problem that exists among the water supply industries all over the world. The leakage in the pipe network not only causes waste of water resources but also brings water scarcity risks to the entire living community over the area. So, monitoring leakage in the water supply system is a very important aspect of water work nowadays. Especially in drought and water scarcity areas water is more precious and to be used wisely. This paper also includes an intelligent pipeline leak detection system. The proposed system collects pipe flow data with an ultrasonic flow meter. This proposed system provides a friendly user interface in an Android App, allowing the users to monitor real-time pipeline flow data. It also has an alarm so that users will know whether there has leakage in the pipeline network.*

Keywords- PIC microcontroller, IoT, moisture, temperature, leakage detection

I. INTRODUCTION

Agriculture is one of the basic needs of every human in this world. India is an agriculturally based country 70% of the Indians are either directly or indirectly involved in agricultural works. Indian economy depends on the production of agricultural products. The growing countries like India are occupied with a large population with insufficient food supply and food production. This is due to various factors like urbanization, colonization and industrialization. The people started moving towards cosmopolitan cities besides their native villages. This stops the development of Agricultural Technologies. The factors like scarcity of water, construction of buildings in agricultural lands are the major factors that act as a threat to cultivable lands. As a citizen of India, we have to give remedies for the farmers in making healthy crops with high-yielding varieties. With this instinct, the project has been designed which will give the solution to rectify the deficiency such as moisture, water level, humidity and temperature which are integrated with IoT.

II. RELATED WORKS

[1] Mohamed Rawidean Mohd Kassim (2020). Internet of Things (IoT) technologies has created tsunamis almost in every industry across the world. IoT technologies and devices will sense, collect, store and communicate data to various components in an application such as smart agriculture. The smart agriculture revolution refers to the use, integration and deployment of the latest technologies such as the Internet of Things (IoT) in agriculture, intending to improve and increase the quantity and quality of crop harvest. This paper proposes an IoT application in agriculture. IoT based agricultural applications, open-source agricultural software, issues and challenges are discussed in detail. Furthermore, this paper provides an overview of how IoT technologies are going to change the agricultural sector and help the farmers to manage their farms more effectively and at the same time increase their revenues. Finally, it is expected that IoT technologies will help the agricultural sector and farmers to meet the food demand by 2050.

[2] Kiranmai Pernapati(2018). Only 0.01 % of water is available on the earth's surface, of the overall existence of water. So, water is a rare resource and irrigation systems also facing problems with water scarcity. Therefore it's necessary to have a smart irrigation system where the water is precisely used. The main imperfection of a normal irrigation system is wasting the water during filling in a reservoir and one more reason is over watering to plant. It is the main scenario where the shortage of water will arrive. The important factor in a smart irrigation system is monitoring the soil moisture of plants. Depending on this one can assure whether the plant is having sufficient water for its growth or not. In normal irrigation systems, the formers control the irrigating land manually. These techniques take a longer duration and waste

the available water at higher rates so it leads to usage of water more than what is required. For a plant to survive healthily it needs water continuously, the automatic system helps to get absolute results for this. Implementing this kind of irrigation system in agriculture gives more comfort to farmers in terms of time-saving and accurate usage of water without wasting.

[3] Kemal Cagri Serdaroglu(2021) This study proposes a smart irrigation model-based IoT system that gradually learns the watering nature of a plant without any pre-prepared data initially given to it. As a proof of concept, it implemented a prototype application. This application adapts itself to the conditions necessary for the irrigation after a couple of manual irrigations. To evaluate its performance, it devised tests both for manual and automatic irrigations when different ML algorithms are used. The results show that the model performs with high accuracy in making irrigation decisions

[4] Rahul Dagar(2018) Farming can be made more efficient & accurate with the implementation of IoT devices. IoT can be used in different methods in agriculture. Water and electricity are the main areas where their cost can improve or break the agriculture profession. Because of the old irrigation system wastage of water more than we think and water pump operates by using Farming can be made more efficient & accurate with the implementation of IoT device. IoT can be used in different areas of agricultural land and the water pump operates by using electricity so if we can control water wastage then we are automatically controlling electricity wastage also. Water volume can be measured by using a smart device with a pump and the duration of flow can also be measured. Other domains in agriculture are insecticide, fertilizers and pesticides as in this paper we are proposing the use of IoT in a poly house and the poly house is a fully covered structure so there is almost no effect of outside factors like insects do not enter and cannot harm the crop so there will be less need of insecticides. By using sensors in the crop field that is connected to the internet, an appropriate decision can be taken

[5] Hyder Ali Hingoliwala A remote control for drip irrigation is the most beneficial approach for farmers. This system reduces the extra manpower of the farmer for his farm like supplying water to plants. This system uses different sensors like temperature, light, humidity and moisture and according to these sensor parameters the farmers can control drip due to internet connectivity between client and servers, farmer can control drip components from anywhere. This system removes drawbacks of previous systems like distance problems, range problems. The proposed system uses an externally hosted cloud computing platform to manage the database, android and isolated server by the users across the country. This approach is very beneficial for the farmer for increasing crop production. This system can be used in the area where water resources are less. This system can be used for large area farms

[6] KK Namala The implemented system is feasible and cost-effective for optimizing water resources for agricultural production. This system allows cultivation of crops in places with water scarcity by improving sustainability. The intervention of humans is much reduced using a smart irrigation system. The setup was carried out using the Raspberry pi, Arduino UNO board, XBee, Soil moisture sensor, flow meter, and relay. The Arduino with soil moisture sensor takes the reading of water content in the soil and transfers the data wirelessly to raspberry pi through XBee. Raspberry pi controls the on and off of the relay, which in turn controls the solenoid valve. The system cannot complete some of the objectives i.e., weather predicting and controlling the whole process through an android app. It uses low-cost sensors and other devices which makes the system cheap

[7] Shikha Prakash The complete survey was concluded that the wireless sensor networks play a pivotal role in the area of agriculture and help the farmers in taking the right decisions about the crops. More research work is performed in the prediction of soil moisture. In the future, this helps to enhance the productivity of the crops. Besides, the knowledge about the architecture of wireless sensor networks and the function of each layer in the OSI model is important to understand the working of the application in a sensor network.

III. SYSTEM DESIGN

At the point when the moisture content in the moisture becomes too low the soil moisture sensor detects the moisture content in the soil and sends the detected value to the microcontroller. The PIC microcontroller is used here. The PIC microcontroller is already programmed to perform a specific task. As the moisture is too low the microcontroller turns on the motor pump through a relay. The microcontroller repeats the same process when it detects low temperature in the temperature sensor and moisture sensor. Additionally, this system includes water leakage detection to reduce the wastage of water. The ultrasonic flow sensor detects the flow of the water in a pipe when there is leakage occurred the pressure inside the pipe becomes too low then the PIC microcontroller stops the pump and notifies the user by mobile it uses a wifi module to share data with the user.

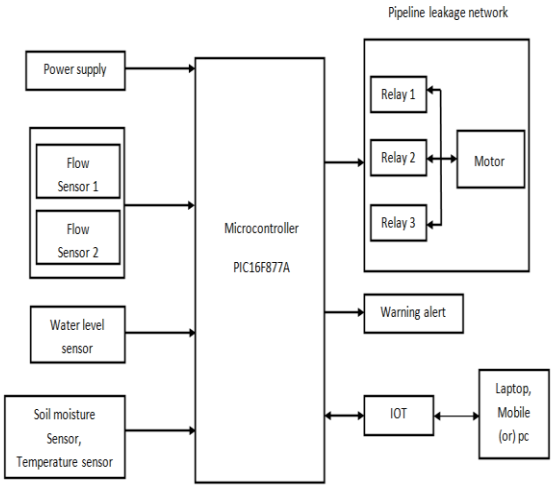

Figure 1. Block Diagram

1. PIC16F1877A Microcontroller:

Here the PIC16F877A microcontroller is used as it is very convenient to use and coding or programming is also easier. The name PIC initially referred to Peripheral Interface Controller It has 40 pins. It belongs to the modified Harvard architecture microcontrollers family. A PIC integrates all types of advanced interfacing ports and memory modules. the PIC chip also combines a microprocessor unit called CPU and is integrated with various types of memory modules (RAM, ROM, EEPROM, etc), I/O ports, timers/counters, communication ports, etc. the features of 16F877A are External gate, Volt Reference, Nano Watt, Internal Clock. A slight disadvantage of the device is that it has no internal oscillator so you will need an external crystal or another clock source. However the internal oscillator is only 1% accurate and adding a crystal (max 20MHz crystal – for 5MHz internal instruction cycle) and two 15pF capacitors is not a great chore the accuracy will be 100ppm depending on the crystal used.

Figure 2. PIC16F1877A

2. Ultrasonic sensor:

The ultrasonic sensor emits high-frequency sound pulses at regular intervals. If the wave strikes at an object, then they are reflected as return signals to the ultrasonic sensor, which itself computes the distance between the target and sensor based on the time-span between emitting the signal and receiving the echo. Here it is used to measure the water quantity of the container

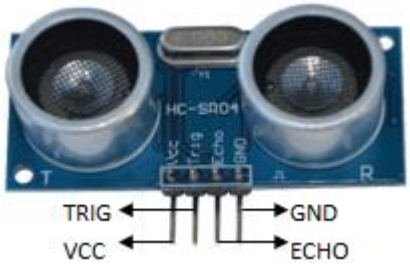

Figure 3. Ultrasonic sensor

3. Temperature sensor:

A temperature sensor is a device which monitor the temperature of its environment and converts the input signal into electronic data to record or monitor temperature changes. There are many different types of temperature sensors. Some temperature sensors require direct contact with the physical object that is being monitored (contact temperature sensors), while others indirectly measure the temperature of an object (non-contact temperature sensors).

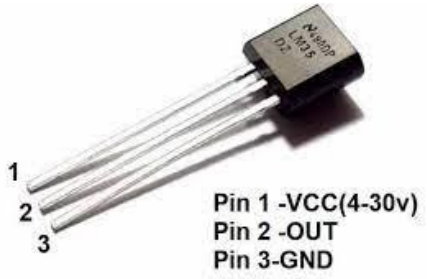

Figure 4. LM35 Temperature sensor

4. Soil Moisture Sensor

The soil moisture sensor is one kind of sensor used to gauge the volumetric content of water within the soil. The straight gravimetric dimension of soil moisture needs eliminating, drying, as well as sample weighting of soil. These sensors measure the volumetric water content not directly with the help of some other rules of soil like dielectric constant, electrical resistance, otherwise interaction with neutrons, and replacement of the moisture content. The working of the Soil Moisture Sensor is very simple. It works on the principle of voltage comparison principle. The moisture sensor module consists of four pins i.e. VCC, GND, DO, AO. The digital out

pin is connected to the output pin of LM393 comparator IC while the analog pin is connected to the Moisture sensor. Using a Moisture sensor module with a microcontroller is very easy. Connect the Analog/Digital Output pin of the module to the Analog/Digital pin of the Microcontroller. Connect the VCC pin and the GND pins to 5V and GND pins of Microcontroller, after that insert the probes inside the soil. When there is more water present in the soil, it will conduct more electricity which means resistance will be low and the moisture level will be high. Depending on the Moisture level of the soil the message is sent to the microcontroller either high or low voltage, to show if the soil is wet or dry. When the soil is wet, it will send the low output voltage, whereas when it is dry, it will send the high output voltage. Here we use this in a uniform pattern all over the land at a particular distance for sensing purposes as it is the most commonly used and efficient topology

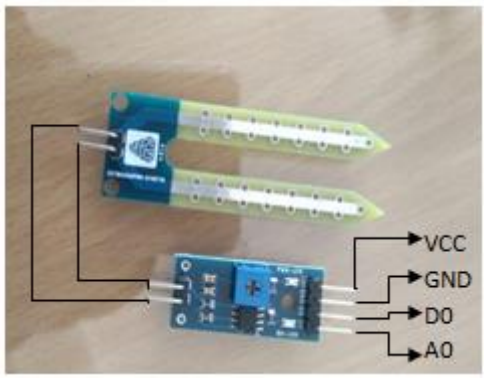

Figure 5. soil moisture sensor

5. Wi-Fi Module

An ESP8266 Wi-Fi module is a SOC microchip mainly used for the development of end-point IoT (Internet of Things) applications. It is referred as the one of the standalone wireless transceiver, available at a low price. It is used as the internet connection to various applications of embedded systems.[2]

Figure 6. WIFI module

Espressif systems designed the ESP8266 Wi-Fi module to support both the TCP/IP capability and the microcontroller access to any Wi-Fi network. It provides the solutions to meet the requirements of industries of IoT such as cost, power, performance, and design. [2] It can work as either a slave or a standalone application. If the ESP8266 Wi-Fi runs as a slave to a microcontroller host, then it can be used as a Wi-Fi adaptor to any type of microcontroller using UART or SPI. If the module is used as a standalone application, then it provides the functions of the microcontroller and Wi-Fi network. The ESP8266 Wi-Fi module is highly integrated with RF, power modules, RF transmitter and receiver, analog transmitter and receiver, amplifiers, filters, digital baseband, power modules, external circuitry, and other necessary components. The ESP8266 Wi-Fi module is a microchip shown in the figure below. A set of AT commands are needed by the microcontroller to communicate with the ESP8266 Wi-Fi module. Hence it is developed with AT commands software to allow the Arduino Wi-Fi functionalities, and also allows loading various software to design the own application on the memory and processor of the module.

6. DC motor pump

It is used to transfer liquid from one place to another. It is a normal dc motor connected to a piston or a turbine to produce a partial vacuum to draw the water out of the well or a container. The same piston or turbine is then used to increase the pressure of the water in the container.[9] This pressure, in turn, pushes the water out of the pump and down the pipe.

Figure 7. DC Motor Pump

7. Flow Sensor:

A flow sensor is an electronic device that measures the flow rate of liquids within pipes and tubes [11]. Flow sensors are generally connected to gauges to read their readings, but they can also be connected to computers and

digital interfaces. They are used in HVAC systems, medical devices, chemical factories, and septic systems. Flow sensors are able to detect leaks, blockages, pipe bursts, and changes in liquid concentration. Flow sensors can be divided into two groups namely contact and non-contact flow sensors. Contact flow sensors are used in applications where the liquid measured is not expected to become clogged in the pipe when it comes into contact with the sensor's moving parts. In contrast, non-contact flow sensors have no moving parts, and they are generally used when the liquid being monitored would be otherwise contaminated or physically altered by coming into contact with moving parts.

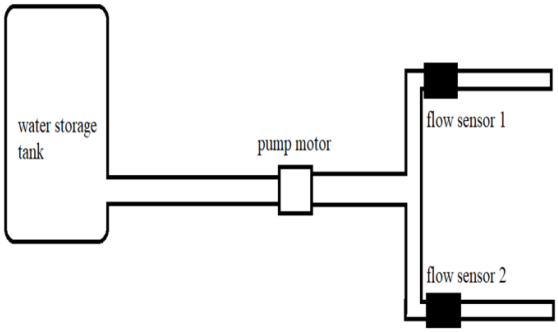

Figure 8. Flow Sensor

IV. RESULT

The result which we got while doing this project is very encouraging. It first collects the moiture and temperature from the respective sensors from the soil and sends the detected value to the PIC microcontroller which acts as a controller then the program in it is compiled and compares the data and it operates the motor according to the moisture whether to on or off the pump. When there is and damage or leakage of water the pressure sensor detects the pressure inside the pipe and stop the water to pass through the pipe and if any case of emergency the user can determine whether to flow or stop water through mobile phone using Iot.

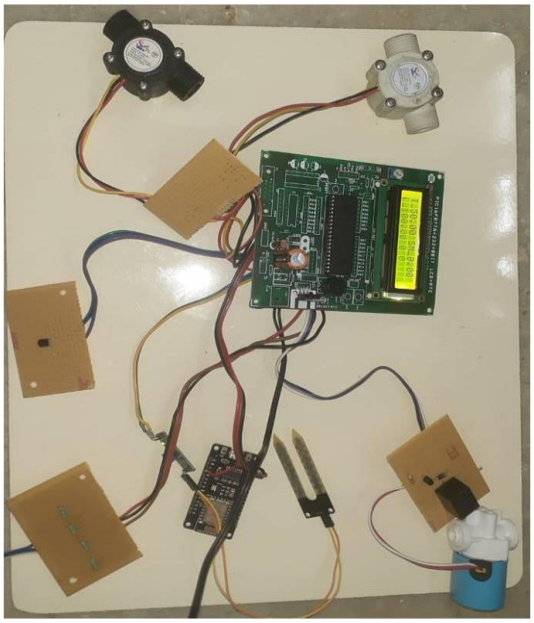

Figure 9. Hardware prototype

The simulation mode of this concept is executed in proteus software and the output of this system is obtained in a virtual terminal and the simulation snap is attached below

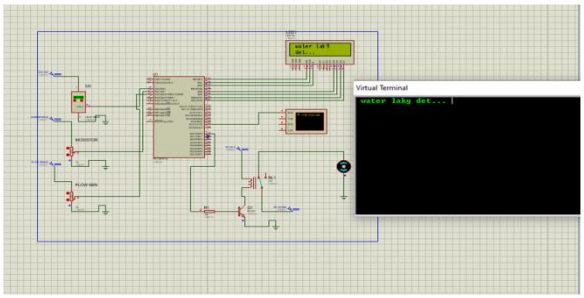

Figure 10. Simulation snap

V. CONCLUSION

A methodological approach has been followed in designing the Sensors based system for measurement and control of the plant growth parameter, i.e. soil moisture. The irrigation system will be controlled via IoT. The result gathered from the measurement of this system has proven that the system performance is more reliable and accurate. Field experience has shown that soil moisture sensors are very useful in diagnosing the changes needed and fine-tuning irrigation practices. Relatively minor regulation in irrigation practices can make a large difference in terms of increased yields or water savings. The key to proper irrigation management using soil moisture sensors is regular monitoring of the sensors to track the soil moisture level and provide irrigation when the readings are in the determined range for the particular soil type.

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