IoT Based Auto-Irrigation System for Agriculture

Avirup Mondal, Bikram Saha, Ananya Biswas, Anurima Majumdar, Antara Ghosal

Abstract*: This paper describes a cost-effectivewater saving IoT based intelligent irrigation system for agriculture. Today, the farmers are suffering from the lack of resources, rains and scarcity of water. The objective of this paper is to design a smart irrigation system that would be useful for water management. In this IoT based system a moisture sensoris used to sense the moisture content present in the soil and according to that the water irrigation will be controlled by a microcontroller. A filter is also introduced for the purification of water as per requirement. There is no need of GSM modules or any wireless transmission gateway which makes the cost of the system around Rs. 1000/- which makes it economically affordable for Indian farmers. So, there is a need of saving water for which we need a smart technology that is an intelligent irrigation system that will help us to manage the usage of water in agriculture.

***Index Terms*: IoT, Smart Agriculture**

I. INTRODUCTION

In countries like India agriculture is an important part of socio-economic balance. According to the huge population of this country there is a high demand of food, which demands continuous advancement in the field of agriculture and technology. To maintain good agricultural system, maintenance of the fertility of soil andirrigation management are the two most importantthings. Water management specially in case of irrigation is a big challenge for countries like India. Nowadays for irrigation different Techniques are available which are used to reduce the dependency of rain. To improve water efficiency there must be a proper irrigation scheduling strategy.

IoT offers a compact system with interconnected objects with built-in capability of computing, sensing and communication[1]Many authors have reported smart irrigation system using microcontroller and raspberry pi [2-5]. The cost of these proposed system is on an average Rs.15000/-. Most of them require a good network coverage and high maintenance.

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Avirup Mondal, Department of Electronics & Communication Engineering, Guru Nanak Institute of Technology, JIS Group, Kolkata, West Bengal, India

Bikram Saha, Department of Electronics & Communication Engineering, Guru Nanak Institute of Technology, JIS Group, Kolkata, West Bengal, India.

Ananya Biswas, Department of Electronics & Communication Engineering, Guru Nanak Institute of Technology, JIS Group, Kolkata, West Bengal, India.

Anurima Majumdar, Department of Electronics & Communication Engineering, Guru Nanak Institute of Technology, JIS Group, Kolkata, West Bengal, India.

Antara Ghosal, Department of Electronics & Communication Engineering, Guru Nanak Institute of Technology, JIS Group, Kolkata, West Bengal, India. E-mail: antara.ghosal1989@gmail.com /antara.ghosal@gnit.ac.in

During the field survey the authors came to know that many of the farmers are not equipped with smart phones and some have only one phone in the family. Many of the fertile fields are not under network coverage. Many farmers do not have idea about smart irrigation nor do have enough financial capability to afford one due to high cost.

So, the main aim of the project was to design a model that would fulfill all the auto-irrigation criteria and also would be easy to avail by the farmers.

In this paper the concept of IoT is used to design an auto-irrigation system. The main objectives are

- Improve water management
- Reduce human intervention
- Make it economically friendly to farmers
- Conservation of water.

The concept of IoT is used in the model of smart irrigation system. It helps in water conservation by automatically providing water to the agricultural field depending upon the dampness (moisture) level of soil and the temperature of nature's domain. But the great issue is water pumping based on the soil conditions. In this system an electronic device is responsible for sensing Moisture conditions. When this moisture value is not up to the required level in irrigation field then the motor is switched on to irrigate the field. Smart irrigation systems estimate and measure the existing plant moisture in order to restore water as needed while minimizing excess water use.A filter is used here to purify the water as per the requirement of the corps.

II. MATERIALS & METHODOLOGY

A. System Architecture

The proposed auto- irrigation system uses soil moisture sensor, power supply, DC water pump motor (9v), Arduino-Nano, water level indicator as shown in the Figure 1. The microcontroller Arduino Nano (ATmega328P) is the core part of the system. The moisture sensors are connected to the input pin of the controller. The water pump is connected with the output pin with the help of 5v relay module. If the sensors depart from the predefined range, the controller turns on the pump. The DC pump is connected with the water reservoir. The water is stored in the reservoir after filtration(if needed). There is a water level indicator with an alarm connected with the reservoir which will indicate whether the reservoirs full or not.

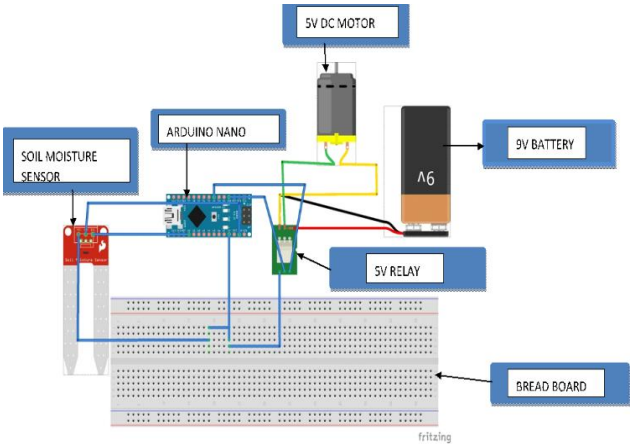

Figure 1: The connections of the proposed Auto-irrigation system

B. Working Principle:

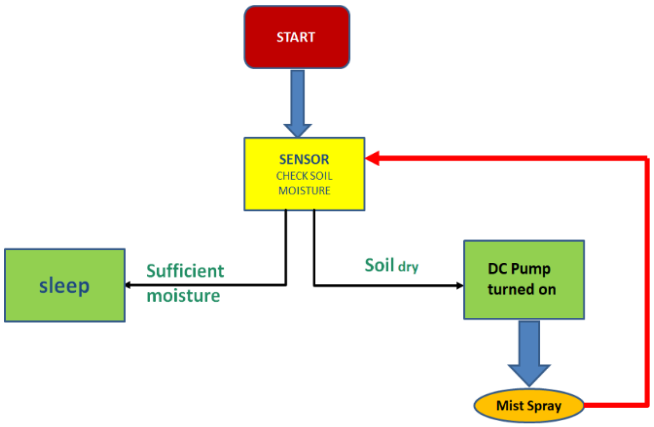

Figure 2: Work flow of the proposed model

The working principal of the proposed model is very simple as shown in figure 2. When the soil moisture sensor is interfaced with the board, the sensor sends the message and the values of resistances of the soil to the microcontroller. As soil moisture sensor is analog, an inbuilt ADC in Arduino is used to convert into its digital form (0-1023), which represents resistance. Dry soil will have the maximum resistance and wet soil will have low resistance. There is a 12V Dc Motor. If the soil is dry, moisture sensor values will be high, so the pump is turned on and switched off when the values will be low. The opposite thing is applicable for moist soil. No use of weather sensor is introduced in the model as the moisture sensor itself can sense the soil moisture which keeps the circuit simple.

The proposed circuit is shown in Figure 3

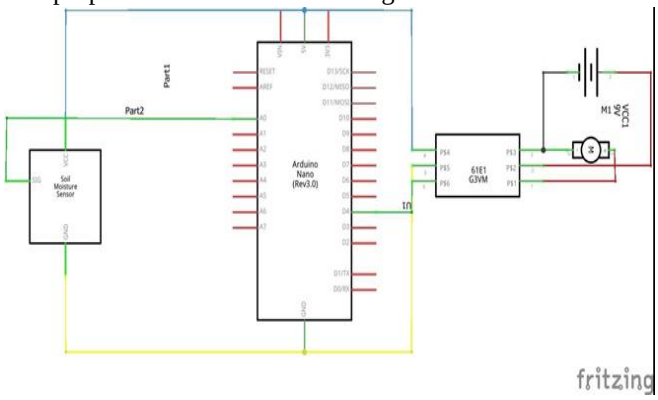

Figure 3: Schematic Diagram of the proposed System

III. RESULT

The proposed circuit is designed and tested as shown in Figure 4.The smart irrigation system was tested on a garden plant for 48 hours. The results showed a proper functioning of the system.

Figure 4: The circuit of the proposed IoT based auto-irrigation system

This project can be improvised by adding a Webs caper (which can predict the weather and water the plants and crops accordingly).

The total cost of the project is -: Rs.800/-

As seen the circuit is much cheaper than already available systems.

IV. CONCLUSION

This automated irrigation system is used for conserving water and scheduling irrigation so that retardation does not occur. This will also minimize the wastage of water and human intervention. Based on types of plants, by monitoring soil moisture this system will also allow the control on how much water will be delivered to the plant. As the model is very simple, easy to maintain and does not use any complicated or costly modules or components it becomes affordable by farmers. The total cost of this project is Rs.800/- Which is much cheaper than other recent proposed works. This project can be used for home plants as well as in large agricultural area where human effort needs to be minimized. Moreover this architecture uses microcontroller which reduces power consumption.

REFERENCES

1. L. Atzori, A. Iera and G. Morabito, “The Internet of Things: a survey,” Computer Networks: The International Journal of Computer and Telecommunications Networking, vol. 54, no. 15, pp. 2787-2805, Oct. 2010.
2. Chandan kumar sahu, Pramitee Behera, “A Low Cost Smart Irrigation Control System” 2nd International Conference On Electronics And Communication System (ICECS 2015) 978-1-4788-7225-8/15/$31.00 ©2015 IEEE
3. K K Namala*, Krishna Kanth Prabhu A V, Anushree Math, Ashwini Kumari, Supraja Kulkarni “Smart Irrigation With Embedded System”, 2016 IEEE Bombay Section Symposium (IBSS), 978-1-5090-2730-9/16/$31.00 ©2016 IEEE
4. Wenju Zhao, Shengwei Lin, Jiwen Han, Rongtao Xu, Lu Hou , “Design and Implementation of Smart Irrigation System Based on LoRa” , 978-1-5386-3920-7/17/$31.00 ©2017 IEEE

5. Amogh Jayaraj Rau, Jairam Sankar, Ashok R Mohan, Deepti Das Krishna, and Jimson Mathew “IoT Based Smart Irrigation System and Nutrient Detection with Disease Analysis”, 978-1-5090-6255-3/17/$31.00 c 2017 IEEE

AUTHORS PROFILE

Avirup Mondal is presently undergraduate student in the Dept. of ECE, GNIT, Kolkata. He is pursuing his B.Tech degree.

Bikram Saha is presently undergraduate student in the Dept. of ECE, GNIT, Kolkata. He is pursuing his B.Tech degree

Ananya **Biswas** is presently undergraduate student in the Dept. of ECE, GNIT, Kolkata. She is pursuing his B.Tech degree

Anurima Majumdar is presently assistant professor in the Dept. of ECE, GNIT, Kolkata. She obtained B.Tech degree in ECE and M.Tech degree in MCNT from West Bengal University of Technology in 2009 and 2011, respectively. Her interests are Electromagnetics and microstrip antenna. She is a member of IEEE.

Antara Ghosal is presently assistant professor in the Dept. of ECE, GNIT, Kolkata. She obtained B.Tech degree in ECE and M.Tech degree in MCNT from West Bengal University of Technology in 2009 and 2011, respectively. Her research interests are Electromagnetics, microstrip antenna, mobile communication. She is a member of IEEE.