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Automatic Irrigation System Using internet Of Things

Azim Khan
Department of Electrical and Electronics Engineering
PSIT, Kanpur India
azus.k2946@gmail.com

Shubham Singh
Department of Electrical and Electronics Engineering
PSIT, Kanpur India
shubham.singh3341@gmail.com

Shiva Shukla
Department of Electrical and Electronics Engineering
PSIT, Kanpur India
shiva.shukla270595@gmail.com

Atul Pandey
Department of Electrical and Electronics Engineering
PSIT, Kanpur India
atulpandey203@gmail.com

Abstract: An automated irrigation system was developed to optimize water usage for agricultural crops. The system has a distributed wireless network of soil moisture, humidity and temperature sensors placed in the root zone of plants. A central control unit handles sensor information, triggers actuators and transmits data on the internet so the user can monitor the field in real time from any remote location. An algorithm was developed depending on the threshold values of the soil moisture, humidity and temperature and is programmed into the central control unit to control the quantity of water fed to the field for irrigation. The whole system is powered by solar energy. Sensing unit and central control unit are connected with each other via a wireless link. Because of low energy consumption, low cost, and energy autonomy, the system has potential to be useful in water-limited geographically isolated areas.

Keywords: Arduino, GSM, Internet of Things, ZigBee.

I. INTRODUCTION

As our country is an agriculture-oriented country and the rate at which water resources are depleting is a dangerous threat hence there is a need of a smart and efficient way of irrigation. This project is designed to develop an automatic irrigation system which controls the pump on sensing the moisture content of the soil. In the field of agriculture, use of the proper method of irrigation is important. The main advantage of this project is to reduce human intervention and still ensure proper irrigation.

This project has a control unit which receives the signal of varying moisture condition of the soil through the sensing arrangement. Once the controller receives this signal, it generates an output that drives a relay for operating the water pump. The status of the soil is transmitted over the internet. The sensing arrangement is made by using soil moisture sensor.

The system has a network of soil moisture sensor and a temperature sensor placed in the root zone of the plants. A microcontroller handles sensor information; triggers pump and transmit data to the control unit. An algorithm was developed with threshold values of temperature and soil moisture that was programmed into a microcontroller to control water quantity. This unit is powered by photovoltaic panels and has a wireless communication link with the control unit. The control unit has communication link based on a cellular-Internet interface that transmits data on the internet.

II. INTERNET OF THINGS

Internet of Things generally means providing network connectivity and computing capability to various objects, sensors and everyday items which are not normally considered computers and allowing these devices to generate data, exchange data on the network and consume data with minimal human intervention. There is, however, no single, universal definition.

The IoT allows objects to be controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention. When sensors and actuators are augmented to IoT, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart homes, smart cities, smart grids and intelligent transportation. Every object is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure. Experts estimate that the IoT will consist of almost 50 billion objects by 2020.

Typically, IoT is expected to offer advanced connectivity of devices, systems, and services that go beyond machine-to-machine (M2M) communications and covers a variety of protocols, domains, and

applications.https://en.wikipedia.org/wiki/Internet_of_things_-_cite_note-M2M-IoT-12 The interconnection of these embedded devices (including smart objects), is expected to usher in automation in nearly all fields, while also enabling advanced applications like a smart grid, and expanding to the areas such as smart cities.

The concept of the Internet of Things was invented by and the term coined by Peter T. Lewis in September 1985 in a speech he delivered at a U.S. Federal Communications Commission (FCC) supported session at the Congressional Black Caucus 15th Legislative Weekend Conference.

III. AUTOMATED IRRIGATION SYSTEM

The automated irrigation system consisted of two units:

- Sensing unit
- Control unit/ Pumping unit

A. Sensing unit

The block diagram for sensing unit is shown below.

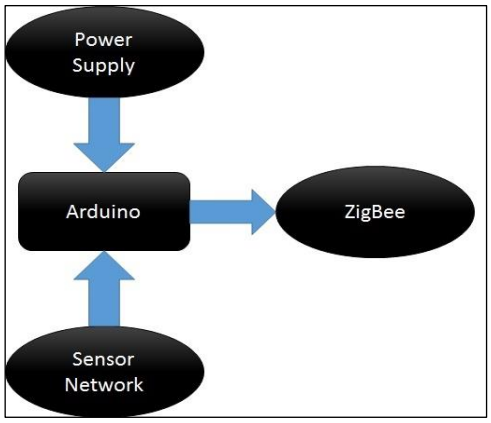

Fig. 1 Block diagram of sensing unit

Sensing unit comprises of soil moisture, humidity, and temperature sensor to sense the temperature and water content of the soil.

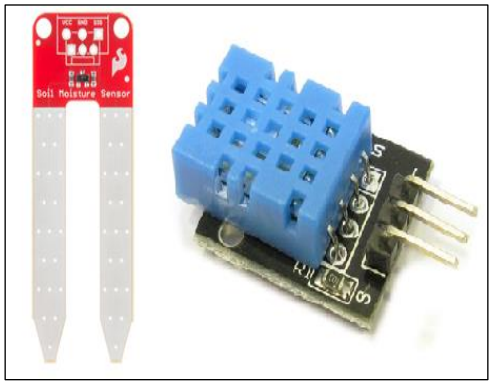

Fig. 2 SEN13322 and DHT11 sensors

DHT11 is a sensor used to sense the humidity and temperature. To sense the moisture content of the soil SEN13322 moisture sensor is used. Along with these two sensors, a water level sensor is also used to sense the amount of water pumped in the field.

The actual picture of the sensing unit is shown below:

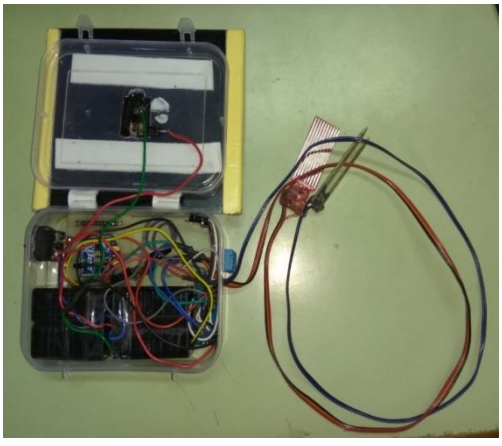

Fig. 3Actual picture of sensing unit

B. Control unit

The block diagram for control unit or pumping unit is shown below.

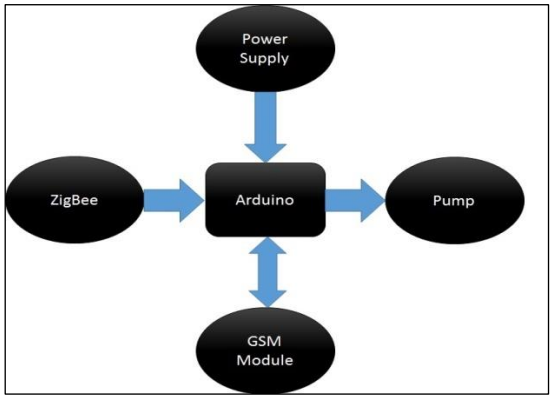

Fig. 4 Block diagram of control unit

Control unit comprises of a microcontroller which actuates the pump with the help of relays, depending on the values received by the sensors.

The actual picture of the control unit is shown below:

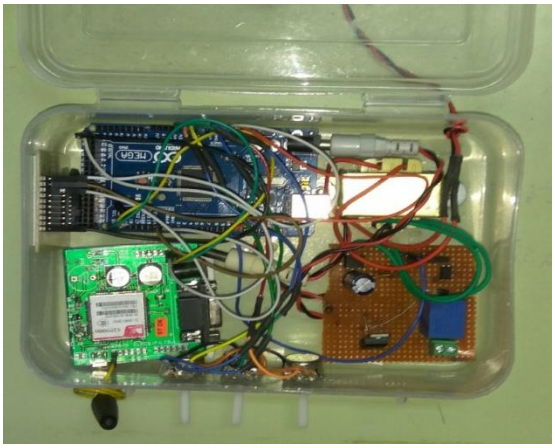

Fig. 5Actual picture of control unit

C. Arduino

Arduino is an open-source electronics prototyping platform. It is based on flexible and easy-to-use hardware and software. The microcontroller on the board can be programmed using the Arduino programming language and the Arduino development environment. It is a tool for making computers that can sense and control more of the physical world than a desktop computer. It's an open-source computing platform based on a simple microcontroller board and a development environment for writing software for the board.

Fig. 6 Arduino Board

Arduino can be used to develop interactive systems, taking inputs from a variety of switches or sensors, and controlling a variety of actuators such as lights, motors, relays etc. Arduino projects can be stand-alone, or they can be communicated with software running on a computer. The boards can be assembled by hand or purchased preassembled; the open-source IDE can be downloaded for free. The Arduino programming language is an implementation of Wiring, a similar physical computing platform, which is based on the Processing multimedia programming environment.

D. GSM module

GSM stands for global system for mobile communication. GSM is a mobile communication modem. GSM is an open and digital cellular technology used for transmitting mobile voice and data services. It operates at the 850MHz, 900MHz, 1800MHz and 1900MHz frequency bands. A GSM modem is devices which can be used to make a computer or any other microprocessor communicate over a network. A SIM card is required in GSM module to operate it over a network range subscribed by the network operator. It can be connected to a microcontroller through serial, USB or Bluetooth connection

E. Zigbee

Zigbee is a wireless communication technology. Zigbee is preferred over other wireless technologies because of its low power consumption and its ability to connect a large number of devices into a single network. Zigbee technology uses the globally available, license-free2.4GHz frequency band.

Zigbee uses a standardized set of high-level communication protocols sitting atop cost-effective, low-power digital radios based on the IEEE 802.15.4standard for wireless personal area networks. Zigbee technology is widely deployed in wireless control and monitoring applications because of its low cost. It has a longer life with small batteries due to its low power consumption. The mesh networking provides high reliability and larger range.

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IV. IRRIGATION SYSTEM OPERATION

Soil moisture sensing network is used to monitor the moisture content of soil. Three different sensors are used to monitor the soil. According to the sensor values, further action is taken by the control unit as the output of sensing network is given to the control unit.

Control unit is the heart of the whole system; it controls the overall irrigation system. It takes the input from moisture sensor, temperature sensor, and humidity sensor through Zigbee and according to the written program, it turns ON or OFF the motor pump. It also indicates the condition of the soil. Also, it uploads the data on the internet via GSM module. When soil is, the dry motor is turned on and when soil is the wet motor is turned off. Thus, the control unit controls the operation of the motor. Zigbee module is a wireless communication technology same as Bluetooth but different in a way that it is a full duplex mode of communication. It is used here to have a wireless link between sensing unit and the control unit. AC or DC motor can be used for the whole system. On the basis of soil moisture detection, motor ON/OFF working will be done. Provision of water and considering the need of water to the crop is done by controlling motor.

CONCLUSION

This paper gives a brief idea about an irrigation system which is fully automated and is based on today's emerging technology that is the internet of things. This system is very useful for the regions where water scarcity is the major problem. This system ensures the efficient use of water in the irrigation system.

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