ARDUINO BASED SMART IRRIGATION SYSTEM USING IOT

Chitrabhanu Sahoo[1] and P. Adaikkalakumar[2]
[1]Assistant Professor, Department of Civil Engineering, Gandhi Institute for Technology (GIFT), Bhubaneswar
[2]Assistant Professor, Department of Civil Engineering, Gandhi Engineering College, Bhubaneswar

Publishing Date: January 27, 2017

Abstract: An automated irrigation system for efficient water management and intruder detection system has been proposed. Soil Parameters like soil moisture, pH, Humidity are measured and the Pressure sensor and the sensed values are displayed in LCD. The intruder detection system is done with the help of PIR sensor where the birds are repelled from entering into the field. The GSM module has been used to establish a communication link between the farmer and the field. The current field status will be intimated to the farmer through SMS and also updated in the webpage. The farmer can access the server about the field condition anytime, anywhere thereby reducing the man power and time.

Key-words: Microcontroller, Sensors, intruder detecting system, IOT

INTRODUCTION

Agriculture is the backbone of all developed countries. It uses 85% of available fresh water resources worldwide and this percentage continues to be dominant in water consumption because of population growth and increased food demand. Due to this, efficient water management is the major concern in many cropping system in arid and semi-arid areas. An automated irrigation system is needed to optimize water use for agricultural crops. The need of automated irrigation system is to overcome over irrigation and under irrigation. Over irrigation occurs because of poor distribution or management of waste water, chemical which leads to water pollution. Under irrigation leads to increased soil salinity with consequent buildup of toxic salts on the soil surface in areas with high evaporation. To overcome these problems and to reduce the man power smart irrigation system has been used.

LITERATURE REVIEW

Archana and Priya (2016) proposed a paper in which the humidity and soil moisture sensors are placed in the root zone of the plant. Based on the sensed values the microcontroller is used to control the supply of water to the field. This system doesn't intimate the farmer about the field status [1].

Sonali D.Gainwar and Dinesh V. Rojatkar (2015) proposed a paper in which soil parameters such as pH, humidity, moisture and temperature are measured for getting high yield from soil. This system is fully automated which turns the motor pump ON/OFF as per the level of moisture in the soil. The current field status is not intimated to the farmer[2].

V. R. Balaji and M. Sudha (2016) proposed a paper in which the system derives power from sunlight though photo-voltaic cells .This system doesn't depend on electricity. The soil moisture sensor has been used and based on the sensed values PIC microcontroller is used to ON/OFF the motor pump. Weather forecasting is not included in this system [3].

R.Subalakshmi (2016) proposed a paper to make irrigation system simpler, the complexities involved in irrigation is tackled with automation

system using microcontroller and GSM. Based on the sensed values from soil moisture, temperature and humidity sensors, the GSM sends message to the farmer when these parameters exceed the threshold value set in the program. The nutrient content in the soil is not determined by this system [4].

Karan kansara (2015) proposed an automated irrigation system where the humidity and temperature sensors are used to sense the soil conditions and based on that microcontroller will control the water flow. Farmer will be intimated through GSM. This system doesn't monitor the nutrient content in the soil [5].

Prof C.H.Chavan and P.V.Karnade (2014) proposed a smart wireless sensor network for monitoring environmental parameters using Zigbee. These nodes send data wirelessly to a central server, which collects data, stores it and allows it to be analyzed then displayed as needed and also be sent to the client mobile. Weather forecasting and nutrient content is not determined in this system [6].

G.Parameswaran and K.Sivaprasath (2016) proposed a smart drip irrigation system using IOT in which humidity, temperature and pH sensors are used. Irrigation status is updated to the server or local host using personal computer. The farmer can't access about the field condition without internet [7].

S.Reshma and B.A.Sarath (2016) proposed an IOT based automatic irrigation system using wireless sensor networks in which various sensors are used to measure the soil parameters. This system provides a web interface to the user to monitor and control the system remotely. Weather monitoring is not done in this system [8].

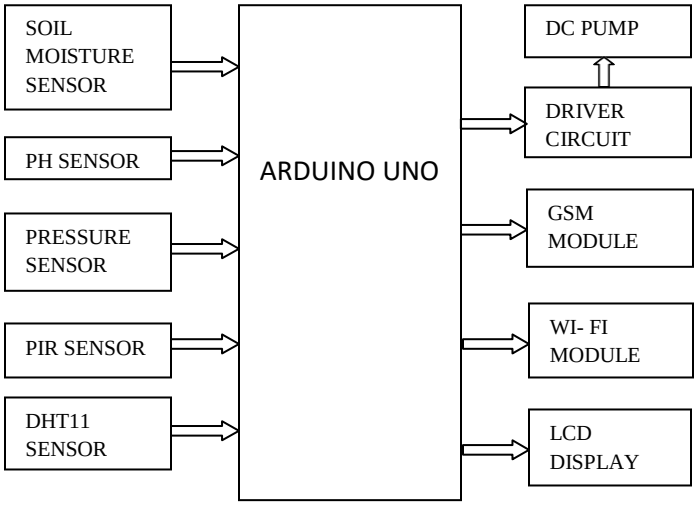
Joaquin Gutierrez (2013) proposed a gateway unit which handles sensor information, triggers actuators, and transmits data to web application. It is powered by photovoltaic panels and has duplex communication link based on cellular internet interface that allows for data inspection and irrigation scheduling to be programmed through web page [9].

Yunseop kim (2008) proposed a paper in which the field conditions were site-specifically monitored by six in-field sensor stations distributed across the field. The GPS and wireless communication has been used to intimate the farmer. Without internet the farmer cannot access the information about the current field status [10].

III. PROPOSED SYSTEM

Nowadays agricultural field is facing lot of problems due to lack of water resources. In order to help the farmers to overcome the difficulties, smart irrigation system has been used. In this system, various sensors such as pH, soil moisture, DHT11, PIR (intruder detecting system) and pressure sensors are connected to the input pins of arduino microcontroller. The sensed values from the sensors are displayed in LCD. If the sensed value goes beyond the threshold values set in the program, the pump will be automatically switched ON/OFF by the relay circuit and it is connected to the driver circuit which helps to switch the voltage. The farmer will be intimated about the current field condition through GSM module and also updated in the web page. By using this system, the farmer can access the details about the condition of the field anywhere at any time.

BLOCK DIAGRAM



1. ARDUINO UNO

The Microcontroller used here is an Arduino UNO. The UNO is a Microcontroller board based on ATMEGA 328P. The ATMEGA 328P has 32kB of flash memory for storing code. The board has 14 digital input and output pins, 6 analog inputs, 16 MHz quartz crystal, USB, an ICSP circuit and a reset button. The UNO can be programmed with the Arduino software.

2. SENSORS

a) SOIL MOISTURE SENSOR

Soil Moisture sensor is used to measure the moisture content present in the soil. When the soil moisture value read by the sensor is above the threshold value, low level (0V) will be the digital output and if it is below the threshold level, high level (5V) will be the digital output. The digital pin is used to directly read current soil moisture value to see if it is above threshold or not. The threshold voltage can be regulated with help of potentiometer.

a) PH SENSOR

PH is the measure of acidity or alkalinity of water solution which is determined by the relative number of hydrogen (H+) or hydroxyl (OH-) ions present. The pH value (below 7) is said to be acidic and (above 7) is said to be basic. The pH of a solution can change with temperature respectively.

b) DHT11 SENSOR

DHT11 sensor is used for measuring temperature and humidity. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air. This sensor is cost effective, provides low power consumption and up-to 20 meter signal transmission is possible.

c) PRESSURE SENSOR

The differential Pressure transmitter is used for measuring trace of differential pressure, PCB will transduce it to differential pressure signal thereby it can be used for weather forecasting.

d) PIR SENSOR

It is a Passive Infrared sensor which detects the motion with the variation of Infrared radiation. It can cover up to 10 meters at an angle of ±15 degrees. PIR is as same as outdoor light with the motion detector and reacts to movements made by objects that radiate heat.

2. WI-FI MODULE

The ESP8266 Wi-Fi module is a self - contained SOC (System on Chip) with integrated TCP/IP (Transmission Control Protocol/Internet Protocol) protocol stack that can give any microcontroller access to any Wi-Fi network. Each ESP8266 module comes pre-programmed meaning, it can be simply hooked up to Arduino device to get Wi-Fi ability. This module has a powerful enough on-boarding process and high storage capacity that allows it to be integrated with the sensors and other application specific devices.

3. GSM MODULE

GSM (Global System for Mobile Communication) is a standard developed by the European Telecommunication Standards Institute (ETSI) to describe protocols for second-generations (2G) digital cellular networks used by mobile phones. GSM describes a digital, circuit-switched network optimized for full duplex voice telephony and also expanded to include data communications, packet data transport via GPRS (General Packet Radio Services). The longest distance the GSM specification supports in practical is 35 kilometers (22mi).

Fig (a) GSM Module

IV.RESULT

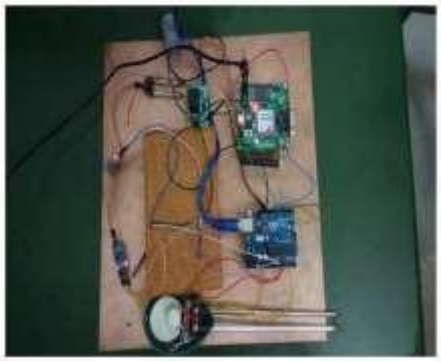


Fig (b) Hardware Setup

Fig (c) Data Display in Web

SENSORS	SENSOR VALUE RANGE
Soil Moisture	-10°c to +85°c
Pressure	±102 mmH_2O
DHT11	Temp -55°c to +150°c Humidity 40%
pH Sensor	6.5 to 7.5

CONCLUSION

The main objective of this smart irrigation system is to make it more innovative, user friendly, time saving and more efficient than the existing system. Measuring four parameters such as soil moisture, temperature, humidity and pH values and the system also includes intruder detecting system. Due to server updates farmer can know about crop field nature at anytime, anywhere.

REFERENCES

[1] Archana and Priya, ”Design and Implementation of Automatic Plant Watering System” presented at International Journal of Advanced Engineering and Global technology , vol-04, Issue-01 , Jan-2016.

[2] Sonali.D.Gainwar and Dinesh.V.Rojatkar ,“Soil Parameters Monitoring with Automatic Irrigation System” presented at International Journal of Science, Engineering and Technology Research(IJSETR),vol-04,Issue 11,Nov 2015.

[3] V.R.Balaji and M.Sudha , “Solar Powered Auto Irrigation System” presented at International Journal of Emerging Technology in Computer Science and Electronics (IJETCSE), vol-20 Issue-2, Feb-2016.

[4] R.Subalakshmi and Anu Amal, “GSM Based Automated Irrigation using Sensors” presented at Special Issue published in International Journal of Trend in Research and Development (IJTRD), March-2016
.

[5] Karan Kansara and Vishal Zaweri, ”Sensor Based Automated Irrigation System with IOT” presented at International Journal of Computer Science and Information Technologies, vol-06, 2015.

[6] C.H.Chavan and V.Karnade ," Wireless Monitoring of Soil moisture, Temperature and Humidity using Zigbee in Agriculture" presented at International Journal of Engineering Trends and Technology (IJETT) ,vol-11, May-2014.

[7] G.Parameswaran and K.Sivaprasath, "Arduino Based Smart Drip Irrigation System Using IOT" presented at International Journal of Engineering Science and Computing (IJESC),May- 2016.

[8] S.Reshma and B.A.Sarath Manohar Babu, "Internet of things Based Automatic Irrigation System using Wireless Sensor Networks" presented at International Journal and Magazine of Engineering, Technology, Management and Research, vol-03, Issue-09, Sep-2016.

[9] Joaquin Gutierrez and Juan Francisco, "Automated Irrigation System using a Wireless sensor Network and GPRS Module" presented at IEEE Transactions on Instrumentation and Measurement, 2013.

[10] Yunseop Kim and Robert G.Evans, "Remote Sensing and Control of an Irrigation System using a Distributed Wireless Sensor Network" presented at IEEE Transactions on Instrumentation and Measurement, Vol- 57, July-2008.