Innovative Journal for Opportunities and Development in Science & Technology, Volume 1, Issue 9, May 2021
Paper ID: – IJ2021V1I9 [5A-D],
ISSN 2582-6026

SMART IRRIGATION SYSTEM USING IOT

[1]Kumod Rede, [2]Suyash Duche, [3]Prasad Vitker, [4]Omkar Adsul

[1]UG Scholar, Department of Electrical Engineering. JSPM's Polytechnic, Wagholi, Pune
2UG Scholar, Department of Electrical Engineering. JSPM's Polytechnic, Wagholi, Pune
3UG Scholar, Department of Electrical Engineering. JSPM's Polytechnic, Wagholi, Pune
4UG Scholar, Department of Electrical Engineering. JSPM's Polytechnic, Wagholi, Pune
duchesuyash@gmail.com

Abstract:- In India, agriculture plays an important role for development in food production. In our country, agriculture depends on the monsoonswhich are not sufficient source of water. So the irrigation is used in agriculture field. Internet of Things (IoT) is a milestone in the evolution of technology. IOT plays an important role in many fields, one of that is Agriculture by which it can feed billions of people on Earth in future .The target of this paper is expecting to conquer this test, the entire framework is miniature control based and can be worked from far off area through remote transmission so there is no compelling reason to worry about water system timing according to trim or soil condition. Sensor is utilized to take sensor perusing of soil like soil dampness, temperature, air dampness and dynamic is constrained by client (rancher) by utilizing microcontroller. The information got from sensors are shipped off worker data set utilizing remote transmission. The irrigation will be mechanized when the dampness and temperature of the field is diminished. The rancher is advised with the data in regards to field condition through portable intermittently. This framework will be more valuable in regions where there is shortage of water and will be worth efficient with fulfilling its prerequisites.
Term Index:- LOT,MC

I. INTRODUCTION

In India, where 60-70% economy depends on agriculture, there is a great need to modernize the conventional agricultural practices for the better productivity. Due tounplanned use of water the ground water level isdecreasing day by day, lack of rains and scarcity of landwater also results in decrement in volume of water on earth. These days, water lack is getting one of the biggest issues on the planet. We need water in each and every field. In our everyday life additionally water is essential. Agriculture is one of fields where water is required intremendous amount. Wastage of water is the major problem in agribusiness [7]. Each time overabundance of water isgive to the fields. There are numerous methods to save or to control wastage of water in agribusiness.

The goal of the framework incorporates moderate energy andwater assets, handles the framework physically and automatically, distinguishes the degree of water. Due to the climatic changes and absence of exactness; farming has resulted in helpless yield when contrasted with populace growth. Irrigation is generally done utilizing trench frameworks in which water is siphoned into fields after ordinary time span any criticism of water level in field. This sort of irrigation influences crop wellbeing and produces a poor yield because a few harvests are too touchy to even consider watering content in soil.

For effective and optimum utilization of fresh water inirrigation, it becomes essential todevelop the smartirrigation systems based on dynamic prediction of soilmoisture pattern of the field and precipitation informationof upcoming days. This paper presents an intelligent system that predicts soil moisture based on the informationcollected from the sensorsdeployed at the field and theweather forecast in- formation available on the Internet. The field data has been collected through a self designed sensor node.

II. COMPARATIVESTUDY

Table 1 illustrates the overall view and comparisons of various agricultural system techniques used.

TABLE 1
Comparisons of various Smart Agricultural Systems

Existing System	Technologies used	Advantages	Cloud Implementation	Data Acquisition
Smart Irrigation System	MATLAB, wireless sensor, IOT.	Optimizes the water usage, provides a remote controlling, monitor the system.	✓	✓
Non-Linear Analysis of Soil Microwave Heating	Microwave antennas, electromagnet ethic heating.	Allows a very effective solution.	×	✓
Cucumber Disease Detection	Artificial neural network, MATLAB.	Providesthe Accuracy	×	✓
Identifying and Monitoring WinterWheat Diseases		Diseases could be determined and Differentiated.	×	✓
Detection and Identification of Disease Stages [15]	ASD spectro radiometer, MATLAB.		×	✓
Mega-Nano Detection of Foodborne Pathogens and Transgenes [16]	Quantum dots, DNA.	Established an on-the-plant design for detecting signature molecules.	×	✓
Robotic Disease Detection in Green Houses [18]	RGB camera, laser sensor, computer automation.	Overcome the threat in the crops or leafs in the agriculture.	×	✓
Identification and Classification of Fungal Disease [19]	Image processing, pattern recognition.	Monitor the crop for possible diseases and avoids upcoming loss ofcrops.	×	✓

III. LITERATURE SURVEY

5.1. Automated Irrigation System using WSN andGPRS Module

Automated Irrigation system using WSN and GPRS Module havingmain goal is that optimize use of water for agriculture crops[1].This system is composed of distributed wireless sensor networkwith soil moisture and temperature sensor in WSN. Gateway units are used to transfer data from sensor unit to base station, sendcommand to actuator for irrigation control and manage data ofsensor unit. Algorithm used in system for controlling water quantityas per requirement and condition of filed. It is programmed inmicrocontroller and it sends command through actuator to controlwater quantity through valve unit. Whole system is powered byphotovoltaic panels. Communication is duplex take place throughcellular network. Web application manage the irrigation throughcontinuous monitoring and irrigation scheduling programming. Itcan be done through web pages.

5.2. Crop Monitoring System based on WSN

The subsequent section introduces the Bluetooth technology.Wireless Sensor network crop monitoring application is useful tofarmer for precision agriculture. The application monitors thewhole farm from remote location using Internet Of Things (IOT).Application works on sensor netowrk and two types of nodes.Energy saving algorithm is used in node to save energy. Treebased protocol is used for data collection from node to base station.System having two nodes one node that collect all environmentaland soil parameter value and the other consist of camera to captureimages and monitor crops. In this System Environmental changesare not considered for sensor reading. System user is not able toprogram application. There is no controlling system for application.

5.3. Automatic Drip Irrigation System using WSN andData Mining Algorithm

Data mining algorithm are used to take decisions on drip irrigationsystem. Automated drip irrigation system having WSN placed inall over farm and different type of sensors. [9]WSN uses ad hocnetwork which gives self configuration and flexibility. Sensor datais given to base station and data is received using zigbee. Dataprocessing is done at base station for decision making. Data miningalgorithm is used to take decision on data from sensor to drip.

All observation are remotely monitor through web application.This system works on Naïve Bayes algorithm for irrigation control.Algorithm works on previous data set for decisionmaking if anyattribute is not frequent result is zero[11].

IV. COMPONENTS

4.1. Arduino Microcontroller

Arduino is an open-source electronics platform based on easy-to use hardware and software[5][4]. Arduino boards are able to readinputs – light on a sensor, a finger on a button – and turn it into anoutput – activating a motor, turning on an LED. A microcontrolleris a small computer on a single integrated circuit. In modern terminology,it is a system on a chip. It contains one or more CPUsalong with memory and programmable input / outputperipherals.Microcontrollers are designed for embedded application. There areused in automatically controlled products and devices, such asautomobile engine control systems, implantable medical devices,remote controls, office machines and other embedded systems[4].

Fig. 1:Arduino Microcontroller

Fig.1 shows Arduino microcontroller were the Arduino board can communicate at various baud rates. A baud is a measure of how many times the hardware can send 0's and 1's in a second. Thesoftware used by the arduino is Arduino IDE.

4.2. Sensors

In this system two sensors are used in order to obtain the dataabout the soil andenvironmental conditon, soil moisutre sensorand temperature and humidity sensor.

4.2.1. Soil Moisture Sensor

Soil moisture sensors measure the volumetric water content insoil[11] .Since the direct gravimetric measurement of free soilmoisture requires removing, drying and weighing of a sample, soilmoisture sensors measure the volumetric water content indirectlyby using some other property of the soil, such as electrical resistance,dielectric constant, or interaction with neutrons, as aproxy for the moisture content.This sensor has two probes through which current passes in soil,then read the resistance of soil for reading moisture level. We known that water make the soil more prone to electric conductivityresulting less resistance in soil where on other hand dry soil has, poor electrical conductivity thus more resistance in soil.

4.2.2. Temperature and Humidity Sensor

The DHT11 is a basic, ultra low-cost digital temperature and humiditysensor shown in Fig 3. It uses a capacitive humidity sensorand a thermostat to measure the surrounding air, and spits out adigital signal on the data pin.It measures relative humidity. Relative humidity is the amount ofwater vapor in air vs. the saturation point of water vapor in air. Atthe saturation point, water vapor starts to condense and accumulateon surfaces forming dew. It detects water vapor by measuringthe electrical resistance between two electrodes.

4.2.3. Bluetooth Wireless Technology

Bluetooth is a high-speed, low-power microwave wireless linktechnology, designed to connect phones, laptops and other portableequipment together with little or no work by the use. Unlikeinfra-red, Bluetooth does not require line-of-sight positioning ofconnected units. The technology uses modifications of existingwireless LAN techniques but is most notable for its small size andlow cost shown in Figure 2. The current prototype circuits arecontained on a circuit board 0.9cm square, with a much smallersingle chip version in development. The fundamental strength ofBluetooth wireless technology is the ability to simultaneouslyhandle data and voice transmissions, which provides users with avariety of innovative solutions.

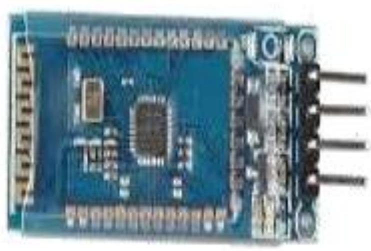


Fig 2- Bluetooth Device

This technology achieves its goal by embedding tiny, inexpensive,short-range transceivers into the electronic devices that are availabletoday. The radio operates on the globallyavailable unlicensedradio band, 2.45 GHz, and supports data speeds of up to 721 Kbps,

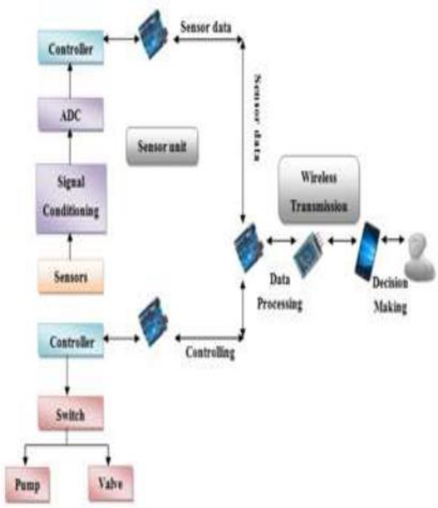
as well as three voice channels. Each device has a unique 48-bitaddress from the IEEE 802 standard. Connections can be point-topointor multipoint. The maximum range is 10 meters but can beextended to 100 meters by increasing the power. Bluetooth devicesare protected from radio interference by changing their frequenciesarbitrarily upto a maximum of 1600 times a second, atechnique known as frequency hopping.Moreover, Bluetooth devices won't drain precious battery life.The Bluetooth specification targets power consumption of thedevice from a hold mode consuming 30 micro amps to the activetransmitting range of 8-30 milliamps.

Bluetooth device uses radio waves instead of wires or cables toconnect to a phone orcomputer. A Bluetooth product, like a headseto watch, contains a tiny computer chip with a Bluetooth radioand software that makes it easy to connect. When two Bluetoothdevices want to talk to each other, they need to pair. Communicationbetween Bluetooth devices happens over short-range, ad hocnetworks known as piconets. A piconet is a network of devicesconnected using Bluetooth technology. When a network is established,one devicetakes the role of the master while all the otherdevices act as slaves. Piconets are established dynamically andautomatically as Bluetooth devices enter and leave radio proximity.The sensors are connected to the Arduino board. These hardware communicate via Bluetooth .

V. Proposed System

Irrigation can be automated by using sensors, microcontroller,Bluetooth, android application as shown in Fig.3. The low costsoil moisture sensor and temperature and humidity sensor are used.They continuously monitor the field. The sensors are associated to arduino board. The sensor information acquired are communicated through wireless transmission and are reached to the client so he can control irrigation. The versatile application can be planned in such a manner to analyze the information got and to check with the limit upsides of moisture, humidity and temperature. The choice can be made either by the application naturally without client interference or manually through application with client interference. On the off chance that dirt dampness is less than the limit esteem the engine is turned ON and if the soil dampness surpasses the edge esteem the engine is switched OFF.

The sensors are connected to the Arduino board. These hardwarecommunicate through wireless Bluetooth transmission so that usercan access the data through his mobile that has an android applicationwhich can get the sensor data from the arduino via Bluetooth. As far as cost of device is considered Bluetooth technology is usedwhich can be replaced by wi-fi. motor is switched OFF.



Paper ID: – IJ2021V1I9 [5A-D],
ISSN 2582-6026

Fig.3:- System Architecture

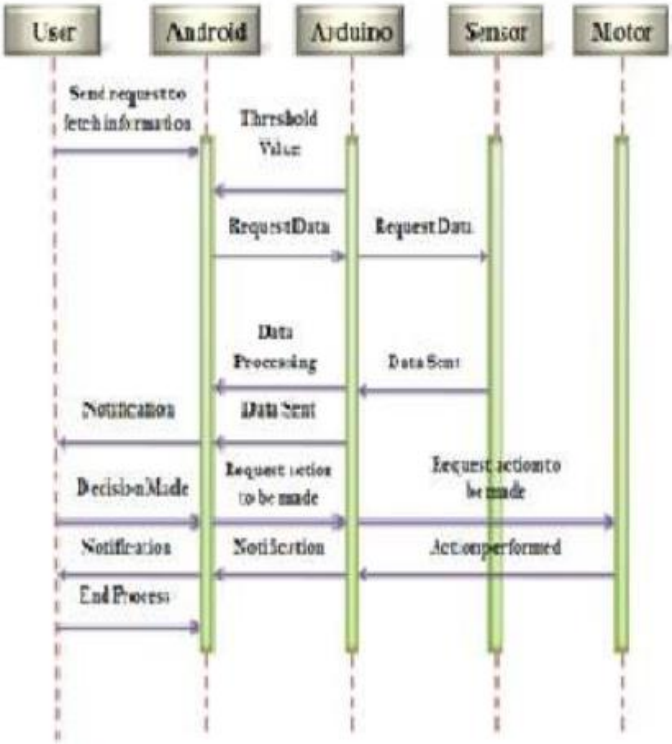


Fig.4- Sequence Diagram for the automatic irrigation

The Arduino board is programmed using Embedded C in order tocontrol the transmission of sensor data and the working of motoraccording to the decision made. The coordination of the motor and3 sensors is maintained by the program fed into the arduino. Wateris supplied to 3 different areas by using Servo Motor, motor thatcan move its head at different angles. Using this, the head of themotor is made to move at 3 different angle so that water can besupplied at different areas where the sensors are placed. The sensorscontinuously send data regarding moisture content of the soil.Whichever sensor indicates low moisture content to that placemotor is switched on and then water is pumped, if it indicates highmoisture content pumping of water is stopped by switching of themotor. All these are managed by the program that has been writteninto the Arduino Microcontroller. The coordination of all thecomponents are shown in the figure 4.The Arduino and the user communicate via Bluetooth. The rangeof Bluetooth technology is application specific. The threshold values for both soil moisture and temperature andhumidity, will beset and stored in the arduino and mobile application. The sensorvalue varies according the climatic conditions. The soil moisturewill be different in summer and winter seasons and so the temperatureand humidity values. The threshold value is fixed after considering all theses environmental and climatic conditions.The motor will be switched on automatically if the soil moisturevalue falls below the threshold and vice versa.The farmer can even switch on the motor from mobile using mobileapplication.The

irrigation system is automated once the control received fromthe mobile application. Through Bluetooth the decision is sent to the arduino and accordingly the motor switches are operated.The ultrasonic sensor is used to monitor water level in reservoir.The ultrasonic sensor work based on the piezoelectric method. Ithas trigger pin and echo pin. The trigger pin act as transmitter andthe echo pin is a reflector. The trigger pin sends ultrasonic wavesonce it started functioning. The ultrasonic waves once it startedfunctioning. The ultrasonic waves hit thewater and reflected towardsthe echo pin. The duration to receive the echo is calculatedand that indicates the water level.The duration is converted to the distance using the following equation(1) and (2).
Distance in cm = (duration/2) / 29.1 (1)
Distance in inches = (duration/2) / 74 (2)
Before the motor is switched on, the water level is checked toensure that require amount of water is available for irrigation. Ifrequired amount of water is not present, the motor will not beswitched on or only less amount water is supplied. The notification is sent to the farmer's mobile for further decision to be made.The farmer can also be able to switch on and off the motor fromthe mobile application[13].

5.1 Android Mobile Application

Android is used to develop mobile application for automatic irrigation.Android is a mobile operating system developed byGoogle, based on the Linux kernel and designed primarily for touch screen mobile devices such as smart phones and tablets.Android's user interface is mainly based on direct manipulationusing touch gestures that loosely correspond to real-world actions, such as swiping, tapping to manipulate on-screen objects, alongwith a virtual keyboard for text input[13]. The sensor data andthreshold value are stored in local memory of the mobile. The usercan read the sensor data, and can set the system into automaticmode so that the system automatically switches motor dependingon the sensor data and previouslyset threshold value. Also theuser can set the system to manual mode and he himself can decidethe switching of the motor. And he can get the notifications regardingthe water level in reservoir so that he can make alternativeswhen there is scarcity of water in reservoir.

5.2 ADVANTAGESOFSMARTAGRICULTUREUSINGIOT

Traditional irrigation strategies are not suitable for dealing with the shortage of irrigation water, this sector must benefit from modern technological advances. Hence the new smart agricultural irrigation system has following advantages.

- Increase the productivity: Productivity on farmland is going too increased.
- Reduce water consumption.
- No manpower required.
- Reduce soil erosion and nutrient leaching.
- Cost effective method.
- High quality crop production.
- System not damage by weathers and birds.
- Efficient use of water.

VI. RESULT

The smart irrigation system was tested on a artificial small plot with all the above mentionedsituation. The moisturevalue of soil moisture sensor is set to very low (i.e. 200) inIDE code of 328P microcontroller and it functioningproperly. Also the condition of climate change isdemonstrated well along with the power failure condition. Inaddition to this, the real timedata of moisture sensor isdisplayed in graphical form on BOLT cloud page.

VII. CONCLUSION

Nowadays innovations can be consolidated to let down the cost and maximize utilization of resources. Currently, farmers control irrigation method manually and irrigate their area at a systematic period. These mechanisms diminish high amount of water and the conclusion is water loss. While dry areas have less rainfall and irrigation is challenging. The smart agricultural system guarantees higher productivity with efficient use of water. Automation of the irrigation control process by using the detected environmental parameters to be needed. Smart irrigation can be automated with the help of current technologies presented above and its main advantages are increase in productivity, reduce water consumption and reduce soil erosion.

REFERENCES

[1] Joaquín Gutiérrez, Juan Francisco Villa-Medina, Alejandra Nieto-Garibay, and Miguel ÁngelPorta- Gándara” Automated IrrigationSystem Using a Wireless Sensor Network and GPRS module” ,Ieee Transactions On And Measurement, Vol. 63,No. 1, January 2014.
[2] “An Automatic Irrigation System using ZigBee in Wireless SensorNetwork” 2015 International Conference on Pervasive Computing(ICPC)- IEEE 2015 by Pravina B. Chikankar, Deepak MehetreSoumitra Das Computer Engineering Department K J College ofEngineering Management Research, Pune, India
[3] Stefanos A. Nikolidakis , DionisisKandris,Dimitrios Efficient Automated ControlOf Irrigation In Agriculture By Using Wireless Sensor Networks,
Computers And Electronics In Agriculture “0168-1699/2015 Elsevier B.V.
[4] Venkata Naga Rohit Gunturi, “Micro Controller Based AutomaticPlant Irrigation System” International
[5] Journal of Advancements in Research & Technology, Volume 2,Issue-4, April-2013.
[6] www.arduino.cc
[7] D. K. Fisher and H. A. Kebede, “A low-cost microcontroller-basedsystem to monitor crop temperature and water status,” Comput. Electron. Agricult., vol. 74, no. 1, pp.168–173, Oct. 2010.
[8] S. Li, J. Cui, Z. Li, "Wireless Sensor Network for Precise AgricultureMonitoring," Fourth International Conference on IntelligentComputation Technology and Automation, Shenzhen,China, March28-29, 2011.

[9] K. Honda, A. Shrestha, A. Witayangkurn, et. al., "Field Service Grid as Real-time Monitoring Infrastructure forUbiquitous Sensor Networks", Sensors, vol. 9, pp. 2363-2370, 2009.

[10] I. Mampentzidou, E. Karapistoli, A.A. Economide, "Basic Guidelinesfor Deploying Wireless Sensor Networks in Agriculture",Fourth International Workshop on Mobile Computing and NetworkingTechnologies, pp. 864-869, 2012.

[11] G. Yuan, Y. Luo, X. Sun, and D. Tang, "Evaluation of a crop waterstress index for detecting water stress in winter wheat in the NorthChina Plain," Agricult. Water Manag., vol. 64, no. 1, pp. 29–40,Jan. 2004.

[12] Arti Noor, Neelam Srivastava, Raghuvir Singh;"intelligent humidity sensor for wireless sensor network ";International Journal of Wireless & Mobile Networks(IJWMN) Vol. 3, No. 1, February 2011.

[13] Preliminary Design on the Development of WirelessSensor Network for Paddy Rice Cropping Monitoring Applicationin Malaysia"; European Journal of Scientific Research ISSN 1450-216X Vol.37 No.4,2009.

[14] A Survey on Control and Monitoring of Home Appliances usingInternet of Things, in International Journal of Engineering a International Conference on Convergent Innovative Technologies(ICCIT-2016) held at Cambridge Institute of Technology,Bangalore, on May 20, 2016.