International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 07
March 2018

Precision Agriculture by Implementing Smart Irrigation

[1] M.VASANTHA LAKSHMI, [2] OMKARAMURTHY ANCHA,

[1] Assistant professor, Dept of ECE, Vasireddy Venkatadri Institute of Technology, Nambur, AP, India.

[2] Sr Lecturer, Dept of computers and electronics science, Jagarlamudi Kuppuswamy Chowdary College, Guntur, AP, India.

[1] vasanthamovva@gmail.com [2] omkaramurthy.a@gmail.com

I ABSTRACT

Utilization of water efficiently is a major concern in many cropping systems in semiarid areas. The main objective of this paper is to provide an ease for people in watering their plants by using IoT technology. This technology helps in collecting information about conditions like weather, moisture, temperature, fertility of soil and also to monitor the water level of the plants. IoT leverages people to get connected from anywhere and anytime. Sensor networks are used for monitoring the plant conditions, and micro controllers are used to control and automate the irrigation process. A smart phone empowers to keep updated with the ongoing conditions of the land using IoT at any time and any part of the world. IoT technology can reduce the cost and enhance the growth of plants.

Keywords: Automation, IoT (Internet of Things).

II INTRODUCTION

Agriculture uses 85% of available freshwater resources worldwide, and this percentage will continue to be dominant in water consumption because of population growth and increased food demand. There is an urgent need to create strategies based on science and technology for sustainable use of water, including technical, agronomic, managerial, and institutional improvements [1].There are many systems to achieve water savings in various crops, from basic ones to more technologically advanced ones. For instance, in one system plant water status was monitored and irrigation scheduled based on canopy temperature distribution of the plant, which was acquired with thermal imaging 2].In addition, other systems have been developed to schedule irrigation of crops and optimize water use by means of a crop water stress index (CWSI) [3].

Digital Object Identifier using measurements of infrared canopy temperatures, ambient air temperatures, and atmospheric vapor pressure deficit values to determine when to irrigate broccoli using drip irrigation [4].Irrigation systems can also be automated through information on volumetric water content of soil, using dielectric moisture sensors to control actuators and save water, instead of a pre-determined irrigation schedule at a particular time of the day and with a specific duration. An irrigation controller is used to open a solenoid valve and apply watering to bedding plants (impatiens, petunia, salvia, and vinca) when the volumetric water content of the substrate drops below a set point [5].

The newer scenario of decreasing water tables, drying up of rivers and tanks, unpredictable environment present an urgent need of proper utilization of water. To cope up with this use of temperature and moisture sensor at suitable locations for monitoring of crops is implemented in. [1] An algorithm developed with threshold values of temperature and soil moisture can be programmed into a microcontroller-based gateway to control water quantity. The system can be powered by photovoltaic panels and can have a duplex communication link based on a cellular Internet interface that allows data inspection and irrigation scheduling to be programmed through a web page. [2] The technological development in Wireless Sensor

International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 07
March 2018

Networks made it possible to use in monitoring and control of greenhouse parameter in precision agriculture. [3] After the research in the agricultural field, researchers found that the yield of agriculture is decreasing day by day. However, use of technology in the field of agriculture plays important role in increasing the production as well as in reducing the extra man power efforts. Some of the research attempts are done for betterment of farmers which provides the systems that use technologies helpful for increasing the agricultural yield. A remote sensing and control irrigation system using distributed wireless sensor network aiming for variable rate irrigation, real time in field sensing, controlling of a site specific precision linear move irrigation system to maximize the productivity with minimal use of water was developed. The system described details about the design and instrumentation of variable rate irrigation, wireless sensor network and real time in field sensing and control by using appropriate software. The whole system was developed using five in field sensor stations which collects the data and send it to the base station using wireless network where necessary action was taken for controlling irrigation according to the database available with the system. The system provides a promising low cost wireless solution as well as remote controlling for precision irrigation. [4] In the studies related to wireless sensor network, researchers measured soil related parameters such as temperature and humidity. Sensors were placed below the soil which communicates with relay nodes by the use of effective communication protocol providing very low duty cycle and hence increasing the life time of soil monitoring system. The system was developed using microcontroller, universal asynchronous receiver transmitter (UART) interface and sensors while the transmission was done by hourly sampling and buffering the data, transmit it and then checking the status messages. The drawbacks of the system were its cost and deployment of sensor under the soil which causes attenuation of radio frequency (RF) signals. [5] The highlighting feature of this paper includes smart transmission of data using cloud (Thingspeak). . Secondly, it includes smart irrigation with smart control based on real time field data. Thirdly, smart warehouse management which includes temperature maintenance, humidity maintenance, soil moisture maintenance.

III PROPOSED METHOD

The aim of the paper is to enable the smart agriculture which means to reduce the man power & problems in cropping or any agriculture farms. The data is right away to the required place of need using the Internet of Things (IoT). Here we use an Arduino UNO along with the Wi-Fi module with the capability of connecting to the network. The figure 3.1 shows the smart agriculture farm.

Fig 1: Smart Agriculture Farm

The Node MCU is initialized and synchronized with different sensors and make a possible way to act like a mini system to control the farm from any possibly anywhere in the world with the help of any smart device or tool by using the one of the cloud network named as Thingspeak.

The system enables ease of access to information that is to be immediately reached, because we live in an area where internet is reaching the destination faster than a clock ticking for a second. So this enables sharing data easier and cheaper.

International Journal of Research
Available at https://edupediapublications.org/journals

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 07
March 2018

IV IMPLEMENTATION

i Node MCU

Node MCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi and hardware which is based on the ESP-12E module. The figure 2 shows the Node MCU-ESP8266 module. It is an Open-source, Interactive, Programmable, Low cost, simple, smart, Wi-Fi enabled board.

Fig 2 Node MCU

The ESP8266 Wi-Fi Module is a self-contained SoC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or off-loading all Wi-Fi networking functions from another application processor.

Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much Wi-Fi ability as a Wi-Fi Shield offers (and that's just out of the box). The ESP8266 module is an extremely cost-effective board with a huge, and ever growing, community.

This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area. The ESP8266 supports APSD for VoIP applications and Bluetooth co-existence interfaces. It contains a self-calibrated RF allowing it to work under all operating conditions and requires no external RF parts.

Here all the ESP8266 does is to provide internet connectivity to an already existing platform. Say you could connect an Arduino (or any other microcontroller/processor) to the internet using ESP8266 as a Wi-Fi Module. So basically, here it acts as a serial to Wi-Fi converter.

Node MCU Dev Board is based on widely explored ESP8266 System on-Chip. It has combined features of Wi-Fi access point and station microcontroller and uses simple LTA based programming language.

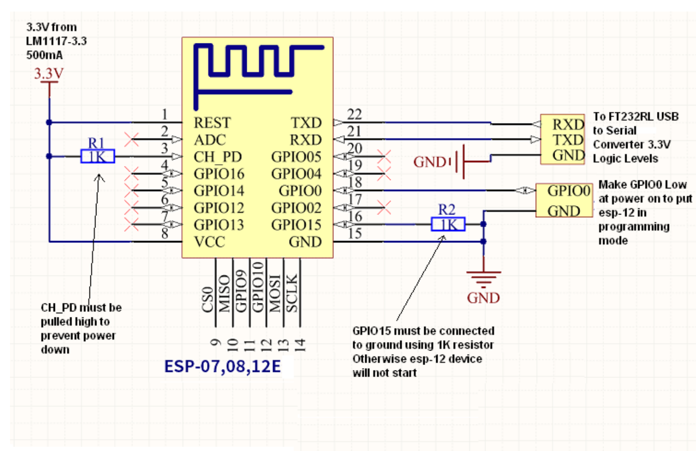

Fig 3: Node MCU Pin Out

The figure 3 shows the pin out of Node MCU. We use MCU ESP8266 integrated and easy to prototyping development kit. The development kit based on ESP8266, integrates GPIO, PWM, IIC, 1-wire and ADC all in one board. Power your development in the fastest way combination with Node MCU firmware.

ii. Arduino UNO

International Journal of Research
Available at https://edupediapublications.org/journals

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 07
March 2018

Arduino is an open source physical computing platform based on simple input/output board and a development environment that implements the processing language. Arduino can be used to develop standalone interactive objects or can be connected to software on your computer. The boards can be assembled by hand or purchased pre assembled; the open source IDE. Arduino is an architecture that combines Atmega microcontroller family with standard hardware into a board with inbuilt boot-loader for plug and play embedded programming. Arduino Software comes with an IDE that helps writing, debugging and burning program into Arduino. The IDE also comes with a Serial Communication window through which can easily get the serial data from the board.

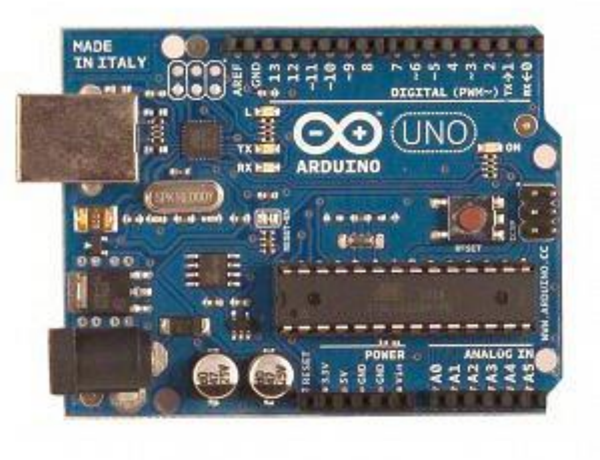

Fig 4 Arduino UNO

Arduino Genuino/Uno is a microcontroller board based on the Atmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. Arduino UNO is shown in fig 4. The pins on Arduino are the places where you connect wires to construct a circuit probably in conjunction with a breadboard and wire. They usually have black plastic headers that allow you to just plug a wire into the board. The Arduino has several different kinds of pins like 5V pin, GND Pin, 3.3V Pin, 6 analog pins, 14 digital pins, and some pins labeled on board can be used for different functions.

iii Moisture sensor

The moisture sensor can read the amount of moisture present in the soil surrounding it. It's a low tech sensor, but ideal for monitoring a pet plant's water level. This is a must have tool for a connecting two probes to pass current through the soil, and then it reads the resistance to get the moisture level. The soil moisture sensor is shown in fig 4.4. More water makes the soil conduct resistance, while dry soil conducts electricity poorly to remind us to water the indoor plants or to monitor the soil moisture in the garden.

Fig 5: Soil moisture sensor

iv DHT11 sensor

The DHT11 Temperature & Humidity Sensor features a temperature & humidity sensor complex with a calibrated digital signal output. By using the exclusive digital-signal-acquisition technique and temperature & humidity sensing technology, it ensures high reliability and excellent long-term stability. This sensor includes a resistive-type humidity measurement component and an NTC temperature measurement component, and connects to a high performance 8-bit microcontroller, offering

International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 07
March 2018

excellent quality, fast response, anti-interference ability and cost-effectiveness.

Fig 6: DHT11 sensor

v pH sensor

The pH sensor module consist of pH sensor called as pH probe and a signal conditioning board which gives an output which is proportional to the pH value and can be interfaced directly to any microcontroller.

The pH sensor components are usually combined into one device called combination pH electrode. The measuring electrode is usually glass and quite fragile. Recent developments have replaced the glass with more durable solid-state sensors. The preamplifier is a signal conditioning device. It takes the high impedance pH electrode signal and changes it into low impedance signal which the analyzer or transmitter can accept. The preamplifier also strengthens and stabilizes the signal, making it less susceptible to electrical noise.

The pH and ORP probes are both used for measuring the acidic intensity of liquid solutions. A pH probe measures acidity on a scale from 0 to 14, with 0 being the most acidic and 14 being the most basic. Similarly, an Oxidation-Reduction Potential (ORP) probe returns a voltage proportional to the tendency of the solution to gain or lose electrons from other substances (which is linked directly to the pH a substance).

Fig 7: pH sensor

v Solenoid valve

A solenoid valve is an electromechanically operated valve. The valve is controlled by an electric current through a solenoid in the case of a two-port valve, the flow is switched on or off; in the case of a three-port valve, the outflow is switched between the two outlet ports. Multiple solenoid valves can be placed together on a manifold. The solenoid valve is shown in fig 8.

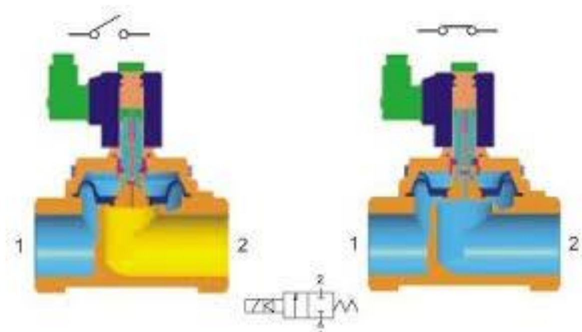

Fig 8: Solenoid valve

Solenoid valves are the most frequently used control elements is fluidics. Their tasks are to shut off, release, dose, distribute or mix fluids. They are found in many application areas. Solenoids offers fast and safe switching high reliability, long service life, good medium compatibility of the material used, low control power and compact design.

vi Submersible pump

A submersible pump is a device which has a hermetically sealed motor closely coupled to the pump body. The whole assembly is submerged in the fluid to be pumped. The submersible water pump is shown in fig 8. The main advantage of this type of pump is that it prevents pump cavitations, a problem associated with a high elevation difference between pump and the fluid surface. A small DC submersible water pump pumps fluid to the surface as opposed to jet pumps having to pull fluids. Submersibles are more efficient than jet pumps.

Fig 9: Submersible pump

V CLOUD

Thingspeak is an open source Internet of Things (IoT) application and API to store and retrieve data from things using the HTTP protocol over the Internet or via a Local Area Network. Thingspeak enables the creation of sensor logging applications, location tracking applications, and a social network of things with status updates.

ThingSpeak was originally launched by ioBridge in past as a service in support of IoT applications. Thingspeak has integrated support from the numerical computing software MATLAB from Mathworks allowing ThingSpeak users to analyze and visualize uploaded data using Matlab without requiring the purchase of a Matlab license from Mathworks.

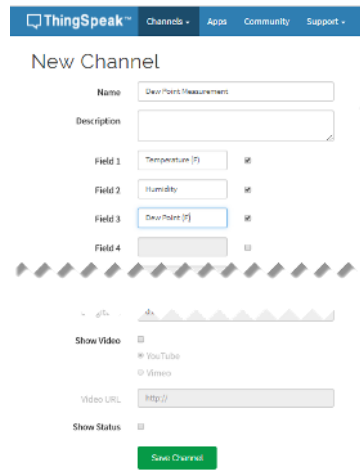

Fig 10: Channel creation

ThingSpeak channels store data sent to them from apps or devices. We have created our channel as weather monitoring system with four fields – Temperature, Humidity and LDR which represents the values that are taken from sensors in graphical format.

VI RESULTS

The below figure depicts the output of the moisture sensor when there is moisture in the soil/field, Temperature, Humidity and pH values.

International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 07
March 2018

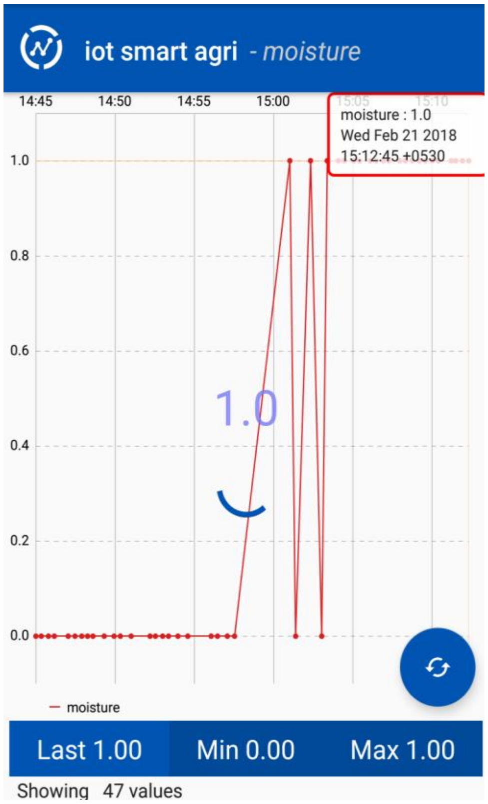

Fig 11: Moisture sensor result

Fig 12: Humidity sensor result

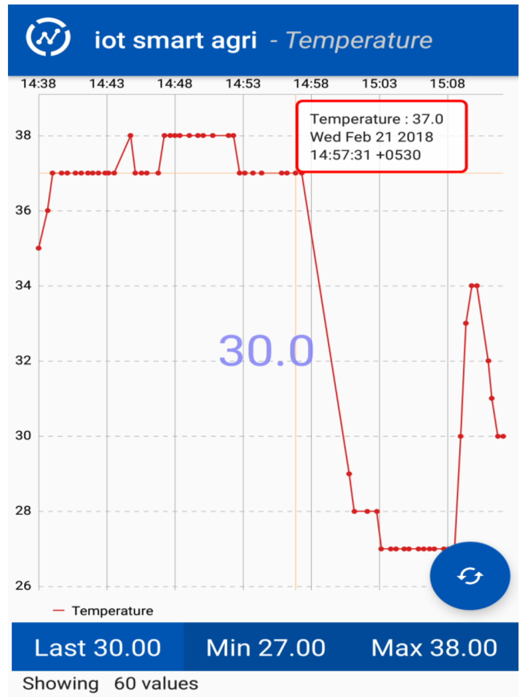

Fig 13: Temperature sensor result

Fig 14: pH sensor result

VII CONCLUSION

A system to monitor moisture levels in the soil was designed and the paper provided an opportunity to study the existing systems, along with their features and drawbacks. The proposed system can be used to switch on/off the water sprinkler according to soil moisture levels thereby automating the process of irrigation which is one of the most time consuming activities in farming. Agriculture is one of the most water-consuming activities. The system uses information from soil moisture sensors to irrigate soil which helps to prevent over irrigation or under irrigation of thereby avoiding crop damage. The farm owner can monitor the process online through a website. Through this it can be concluded that there can be considerable development in farming with the use of IOT and automation. Thus, the system is a potential solution to the problems faced in the existing manual and cumbersome process of irrigation by enabling efficient utilizations of water resources.

REFERENCES

[1] S. R. Nandurkar, V. R. Thool, R. C. Thool,"Design and Development of Precision Agriculture System Using Wireless Sensor Network", IEEE International Conference on Automation, Control, Energy and Systems (ACES), 2014

[2] Y. Kim, R. Evans and W. Iversen, "Remote Sensing and Control of an Irrigation System Using a Distributed Wireless Sensor Network",IEEETransactionson Instrumentation and Measurement, pp. 1379– 1387, 2008

[3] Ankita Patil, Mayur Beldar ,Akshay Naik ,Sachin deshpande , "Smart farming using Arduino and Data mining", IEEE International Conference on agricultural contribution, smart farming, Internet ,2016.

[4] Ankita Patil, Mayur Beldar ,Akshay Naik ,Sachin deshpande , "Smart farming using Arduino and Data mining", IEEE International Conference on agricultural contribution, smart farming, Internet ,2016.

[5] Sangamesh Malge and Kalyani Bhole "Novel, Low cost Remotely operated smart Irrigation" 2015 International Conference on Industrial Instrumentation and Control (ICIC) College of Engineering Pune, India.

[6] Simon Blackmore, Bill Stout, Maohua Wang, Boris Runov, Robotic Agriculture –The future of agricultural mechanisation? AgroTechnology The Royal Veterinary and Agricultural University Agrovej 10 DK-2630 Taastrup, Denmark.

[7] C. Cariou, R. Lenain, B. Thuilot, and M. Berducat,"Automatic guidance of a four-wheel-steering mobile robot of accurate field operations,"J. Field Robot., vol. 26, no. 6/7, pp. 504–518, 2009.

[8] D. Bochtis, C. Sorensen, and S. Vougioukas, "Path planning for in-field navigation-aiding of service units," Comput. Electron. Agric., vol. 74, no.1, pp. 80–90, 2010.

[9] Abhinav Valada, David Kohanbash, George Kantor, Design and Development of a Wireless Sensor Network System for Precision Agriculture, Robotics Institute Carnegie Mellon University Pittsburgh, Pennsylvania 15213.

[10] R. Eaton, J. Katupitiya, K. W. Siew, and B. Howarth, "Autonomous farming: Modeling and control of agricultural machinery in a unified framework," in Proc. 15th Int. Conf. Mechatronics and Machine Vision Practice, Auckland, New Zealand, Dec. 2008, vol. 1, pp. 499–504.