INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X
Impact Factor: 4.295
(Volume7, Issue2 - V7I2-1159)
Available online at: https://www.ijariit.com

IoT based smart agricultural system

Shubham Paras Chordiya
shubhamc9180@gmail.com
Amrutvahini College of Engineering, Sangamner, Ghulewadi, Maharashtra

Dr. Ms. R. P. Labde
rplabde@gmail.com
Amrutvahini College of Engineering, Sangamner, Ghulewadi, Maharashtra

ABSTRACT

The agriculture field plays a vital role in the development of agriculture. In a country like India, this issue is very important because almost 60% of peoples are depending on agriculture, and these peoples are from rural areas. For that instance, there is a solution to this problem is by doing smart agriculture by considering the current traditional methods of agriculture. Hence, this proposed paper aims at making IoT Based Smart Agricultural System. Using sensors, analyze, monitoring, and selection of crops, etc. The controller takes the input data from the sensors, and then it processes the entire system after integrating all the peripherals along with the software. This project is working in three phases, [1] Taking the data from the sensors, Sending that data to the Atmega 328 pi controller, and Controlling the device as per the data obtained. The software used for this is Arduino UNO. In this Paper, Sensors are used for sensing the different parameters such as Humidity and Temperature, Smoke, Level, and Light, etc. Atmega 328 pi is controlled by all parameters. The outputs are shown manually on to the LCD, and through the Webpage using IoT. The buzzer used for the alert notifications.

Keywords: *DHT11, CO2, IoT (Internet of Things), Liquefied Petroleum Gas (LPG), Sensors.*

1. INTRODUCTION

India's major source of income depends on the agriculture sector. And almost 60% of general people depend on agriculture. In the Indian irrigation system, the farmers choose different methods for developing the land according to the various crops. These methods such as Drip system, Terraced irrigation, and Ditch irrigation system. To improve and increase the productivity of crops, and increase the quality of the product from the farm, the farmers can use the automation method for giving a quality product[1]. Also, the availability of water throughout India is a major issue, and water is also a valuable resource. We aim to protect and save water for future needs.

The weather conditions are required to be monitored to maintain healthy growth in crops and to ensure a safe working environment in industries, etc. This will be done with the help of sensors. Due to technological growth, the process of reading the environmental keys becomes simpler as compared to the past days. The sensors are used to measure the environmental parameters and sending to the controller. The system proposed in this paper [1], describes

how to monitor and control the weather condition by using sensors. An automated weather station that is based on sensors that measure and records the meteorological parameters without the intervention of humans. The measured parameters can be stored in a data logger or can be transmitted to other remote locations. The recorded data can be downloaded from a computer at a later time for further processing. Hence, the communication system is an essential element in an automated weather station [4]. The automated weather stations have been developed in the universities for interfacing meteorological parameters. For monitoring the data from the computer there is pre-recorded data stored on the computer. This paper presents the IoT Based Smart Agricultural System.

2. METHODOLOGY

The proposed block diagram is shown in Figure. 1. The Arduino 328 pi[1], a microcontroller was developed at the Ivrea Interaction Design Institute. It is an easy tool for fast prototyping, and programming. It takes the attraction from the students who don't know the background in electronics programming. The Arduino Uno is a software that is used for the applications of IoT, 3D printing, and embedded programs. It consists of simple open-source hardware, and it has around an 8-bit Atmel AVR microcontroller with a 32-bit Atmel ARM.

The block diagram shows an LCD for showing the output data values and is connected with a microcontroller. There are 4 sensors are used. Temperature or Humidity, LPG or smoke, LDR, and Level sensor are the different sensors used in this paper. The temperature and Humidity sensor DHT11[5], that features a calibrated digital signal output in surroundings and then transfer it to the micro-controller. The Liquefied Petroleum Gas is suitable for sensing the smoke or fog in the circuit as well as in the surroundings.

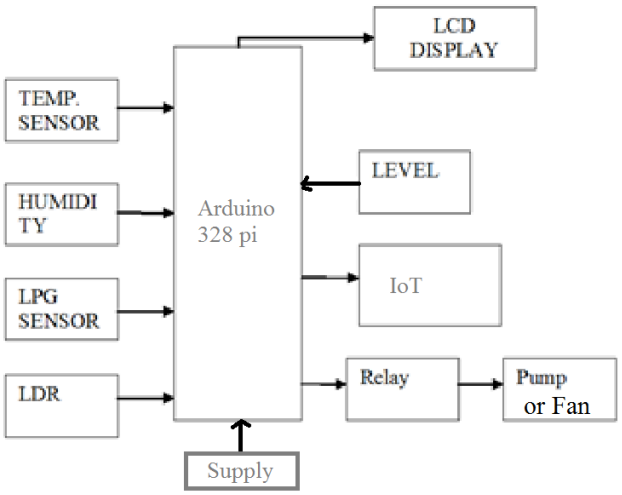


Fig. 1: Proposed block diagram.

The temperature, humidity, LPG, and LDR sensors collect the data from the field according to the crop. This analyzed data is compared with the saved data. The saved data are stored in the microcontroller previously. The Level sensor is used to senses the level of water from the field. And then this data is transfer to the microcontroller. Then according to the saved data, it gets compared and then it controlled. The Arduino 328 pi sends the data information to the user by using the Webpage, SMS, and Call.

3. HARDWARE AND SOFTWARE DESCRIPTION

IoT Based Smart Agricultural system, shows 4 different sensors, LCD, IoT, Relay and Pump or Fan. The software used is the Arduino UNO.

DHT 11

The DHT11[5] is a Temperature & Humidity Sensor. It shows a digital signal output, and also it has high reliability, durability, and excellent long-term stability. In that DHT 11, there is a resistive type of humidity measurement component and NTC temperature measurement component. It can connect with a high-performance 8-bit microcontroller, and also it can offer good quality and fast response, anti-interference ability, and cost-effectiveness. It is small in size, it takes low energy, and has a range up-to-the 20-meter signal strength. And that's why the transmission making it the best choice for various applications. The DHT 11 is a 4 pin component that is in a single row pin package, it is convenient to connect with the controller.

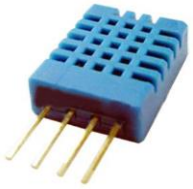


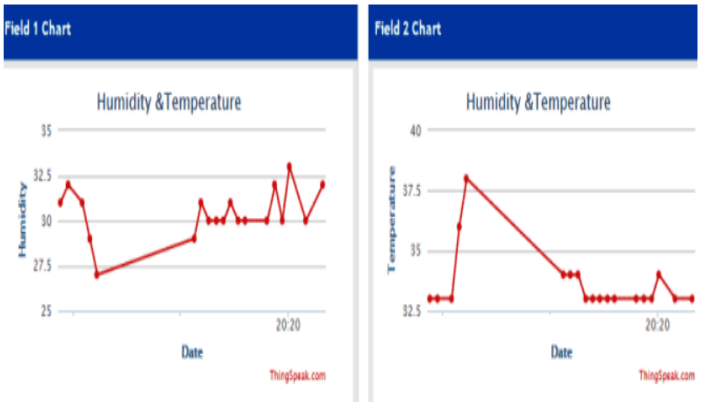
Fig. 2: DHT 11

Technical specifications

Item	Measurement Range	Humidity Accuracy	Temperature Accuracy	Resolution	Package
DHT11	20-90%RH 0-50 □	±5%RH	±2□	1	4 Pin Single Row

The DHT11 requires a 3-5.5V DC power supply. There is One capacitor of 100nF is added in between VDD and GND pins for the power filtering. The input data consists of decimal forms.

The transmission of data is in the range between 35-40bit, and the data output sends a higher data bit first.



Attribute name	Type	Properties
ID	int(5)	The ID of an individual record
NodeID	int(5)	The ID of the Node
Time	Timestamp	The timestamp in milliseconds
Temperature	Double	The temperature in degree celsius
Humidity	Double	The humidity in percentage
Moisture	Double	The moisture level
PH	Double	PH level

Fig. 3: Graphs of DHT 11

Relay

A relay is an electromagnetic switch that can be operated electrically. It requires a small electric current and that can be turned ON or OFF a much larger electric current. This electronic switch is used where it is necessary to control by a low power signal.

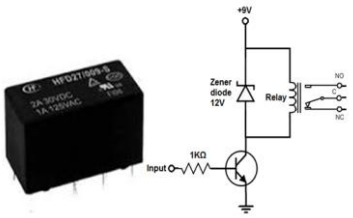


Fig. 4: Relay module

Operating voltage is 5V DC, and nominal current requires 70 Ma. It has a maximum 250/125 V AC load current, and a 30/28V DC maximum DC load current. It is a compact 5-pin configuration with plastic molding.

Liquid Crystal Display

LCD (Liquid Crystal Display) screen is an electronic display module, has 2 resistors namely as a command, and data.

Fig. 5: 16*2 LCD

There are 16 pins for LCD as:

Pin no.	Name	Function
1	VSS	Ground
2	VCC	Supply
3	VEE	Contrast adjust
4	RS	Register select
5	R/W	Read or write
6	E	Enable
7, 8, 9, 10, 11, 12, 13, 14	DB0 – DB7	Data
15	LED +	Back light LED +
16	LED -	Back light LED -

Power Supply

The 230V AC input supply is step down by using the step-down transformer. The step-down transformer converted 230V to 12V and is fed to a rectifier. The output voltage is obtained from the rectifier is a pulsating DC voltage.

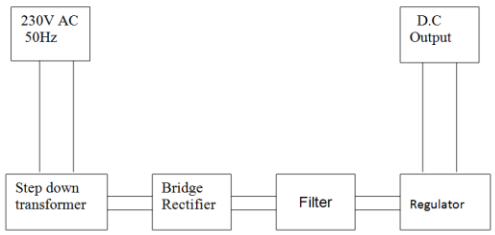


Fig. 6: Power supply

Rectifier

A rectifier used to convert AC voltage into pulsating DC voltage. In this paper, a bridge rectifier is used because of its good stability and full-wave rectification. At a time two diagonally diodes are worked.

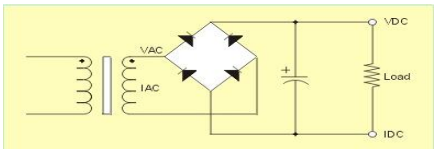


Fig. 7: Rectifier

Arduino 328 pi

The microcontroller ATmega328 pi has an operating voltage of 5 V. The input signal recommended as 7-12 V. And the actual input voltage requires 6-20 V. The digital I/O pins requires about 14 pins of which 6 are PWM output. Out of there are 6 pins of analog input pins. The DC per I/O Pin required 40Ma. The flash memory required for the microcontroller is 32 KB, EEPROM = 1 KB, and SRAM = 2 KB. The clock speed is about 16 MHZ.

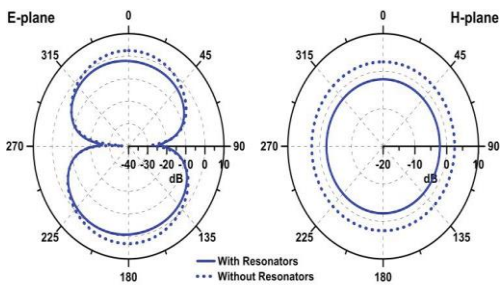


Fig. 8: Arduino 328 pi

ESP8266 Wi-Fi Module

It is mostly used for the development of IoT embedded applications. It has a 2.4 GHz Wi-Fi range, requires 3.6V, has 16 General purpose input/output pins, Inter-Integrated Circuit (I2C), with the serial communication protocol.

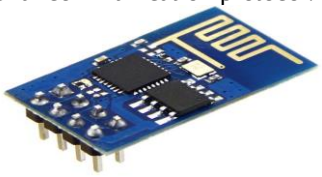
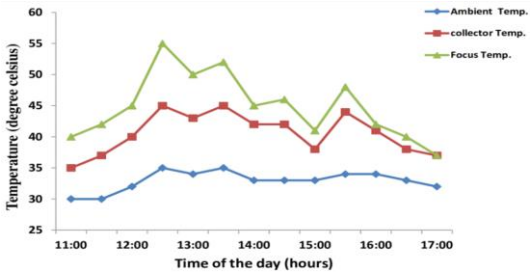
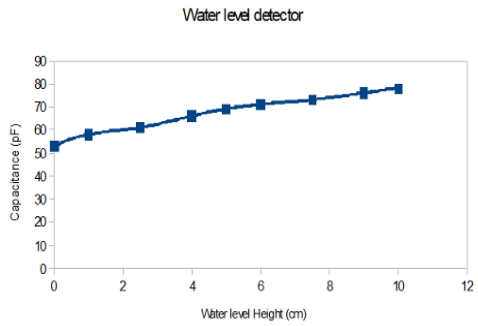


Fig. 9: ESP8266 WI-FI Module

4. RESULTS

The below circuit and graphs show the proposed system.





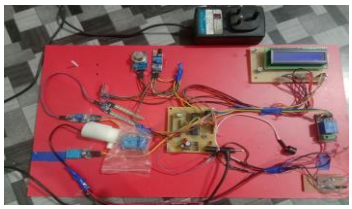


Fig. 11: Proposed result

Based on this module there are some advantages such as –

- Power can be saved using Atmega 328 pi
- Decreases the manpower, Low maintenance
- Very economical and low power consumption.
- Reliable, and Useful to all climatic conditions and all types of irrigation

5. CONCLUSION

The proposed system concludes that the Arduino 328 pi is a microcontroller that controls all sensor data which we are taking from the surroundings of the crop field. And then Arduino 328 pi is compared these values with the previous data which we are saved with the help of Arduino UNO. Arduino UNO is the programming software. The user gets the output data in 3 ways, manually from the LCD screen, and Thing speak through IoT in the form of Graphs or waveforms. The DHT 11 sensor shows the different values of temperature that depend on various hours. Sometimes it goes from 20 - 55 °C.

All the observations and experimental tests show that the proposed result is a complete solution for field activities of irrigation problems and implementation. It can also help to improve the field of crops and overall production.

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