Scientific Journal of Impact Factor (SJIF): 5.71

e-ISSN (O): 2348-4470
p-ISSN (P): 2348-6406

International Journal of Advance Engineering and Research Development

Volume 5, Issue 04, April -2018

SMART AGRICULTURE SYSTEM USING IOT

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Abstract —*An advanced agriculture field environment monitoring system using IOT technology. The parameter values can be monitored using appropriate sensors and the information can be sent to the farmer mobile through Wi-Fi technology. The agricultural field environment monitoring is an important aspect for better yielding of the crops. The main features involve in the maintenance of agriculture environment are the soil moisture, temperature, humidity, rain sensing, intruder sensing, gas sensing, etc. Considering the advantages of Wi-Fi technology, an advanced system was developed to monitor the environmental conditions of the field and control actions are performed accordingly.*

Keywords-*Arduino UNO, DHT11, Soil senor, PIR sensor, MQ2 gas sensor, Rain sensor, LDR sensor,IOT module.*

I. INTRODUCTION

In our country agriculture is the one of most important occupation of the people. More than 60% of our total population depends for their subsistence on agriculture. After independence due to various development projects introduced in the field of agriculture, production of food grains has been continuously increasing. The entire Indian economy depends on agriculture. Any changes in agriculture income will directly affect the India's national income. In this regard, a thought is given to develop a electronic system, which can monitor the agriculture environment and indicate through IOT (Wi-Fi). Recent developments in wireless communications and electronic devices have considerably contributed to the evolvement of low cost densely deployed sensor networks. Sensor network applications are diverse, ranging from civil to military applications and agriculture is not exception for this. Many applications of wireless sensor network (WSN) are useful only when connected to an external network. In this paper the development of low cost wireless sensor network is proposes, which will transfer monitored parameters such as temperature ,humidity,soil content,gas levels in atmosphere to the outside world using IOT device such as Wi-Fi.

II. SMART AGRICULTURE SYSTEM

The Smart agriculture system is proposed and developed a proto type to measures the temperature, soil moisture, water level in soil, gas and humidity levels in the atmosphere. All these parameter values are displayed in the LCD and also transmitted to the android device via Wi-Fi. The entire control circuit is designed using the arduino microcontroller ATMEGA 328. As the controller cannot read the analog values, the same is implemented for converting analog information in to digital, there by this controller is playing major role in this project work. But as the arduino controller is having in-built ADC.The controller performs major functions like monitoring the parameter value continuously, displaying the same value through LCD and transmit the same through Wi-Fi. These above said hardware are integrated to develop smart agriculture system for continuous monitoring of agriculture. As the system utilizes very sensitive sensors, it can be used to measure the space or atmosphere humidity, soil moisture, temperature, intruder entry and gas levels accurately. The sensors used here is very sensitive, such that they can absorb the changes instantly.

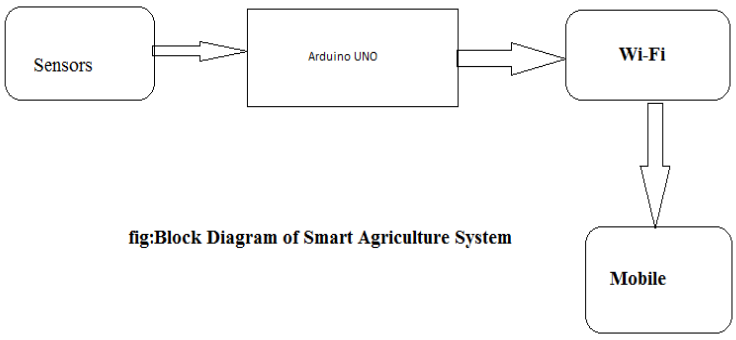

fig:Block Diagram of Smart Agriculture System

III. FUNCTIONAL DESCRIPTION

The proposed prototype is divided into various modules; fig. of the hardware module depicts the functional module of the prototype. The explanation of these modules is given below

3.1 DHT11 SENSOR:

This module consists of three sections - one senses the humidity and temperature by using humidity and temperature sensor DHT11. The second section reads the DHT sensor module's output (i.e., Arduino board) and extracts temperature and humidity values into a suitable number in percentage and Celsius scale. And the third part of the system displays humidity and temperature on LCD. [1]

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3.2 SOIL MOISTURE:

Soil moisture sensors measure the volumetric water content in soil. Since the direct gravimetric measurement of free soil moisture requires removing, drying, and weighting of a sample, soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content. In this module two copper electrodes are used for identifying the soil moisture content (dry or wet). One electrode is provided with electric supply and the other is connected to the controller. If the moisture content in the soil is high, the second electrode will get the potential fed to the first through the soil, by which the controller identifies the soil as wet. Else if the potential is not received, it identifies as dry.[2],[7]

3.3 RAIN SENSOR:

A rain sensor automatically detects the water droplets on the sensor. The rain sensor system comprises first and second electrical conductors spaced uniformly from one another and an electrical insulator interposed there between. A dual network voltage divider circuit couples the first conductor to an applied reference DC voltage level, and the second conductor is coupled to ground potential via a similar network. The magnitude of the applied voltage changes in relation to the intensity of rainfall or amount of raindrops adhering to the conductors to send the information through Wi-Fi to the android device. In addition a common electrode is connected with power supply and whenever rainfalls on the sensor, the corresponding transistor conducts and amplify the sensor output. The main reason behind using the transistor amplifiers after the sensors is to provide sufficient energy to the sensor output to trigger the microcontroller. Depending on this the controller transmits the information and also displays in the LCD.[3]

3.4 GAS SENSOR:

This sensor senses the release of any toxic gases and gives indication to the controller that transmits the information to the authorized person mobile through Wi-Fi modem by activating the exhaust fan through the relay. The output from the gas sensor is connected to a trigger circuit designed using an Op-Amp. When the input voltage form the gas sensor is greater than the reference voltage set at the op-amp, the output becomes high which is fed to the arduino controller. Depending on this signal, the controller identifies that harmful gases are detected and transmitting a message through Wi-Fi.[4]

3.5 PIR Sensor:

PIR sensor is used to detect any motion of an object which helps us find object present near to the field. The reason for using PIR sensor in this prototype is that crops field like maize ,rice and wheat are effect by rampage of buffalo ,cows, birds etc.so we can range this sensors to fields so that they can detect the object before entering into fied.basically operation of PIR sensor involves in two ways, one is how object enter it's field and second is how it's leaving the range .PIR sense the object based on the IR rays emitted by any object it may a human or a cow .Internally PIR sensor contains one BIS0001 chip which has FET transistor and one Fresnel lens for diffracting the ray coming from atmosphere .In this prototype we interfaced PIR sensor with Arduino controller to read the values and display it on LCD along with transmit this information to android device through Wi-Fi module.[5]

3.6Arduino UNO:

Arduino is open hardware and software platform can be use even for beginners also.Arduino UNO is one the beginning level micro chip hardware board .basically Arduino board can read the analog input such temperature ,humidity ,soil contents and convert them into output display them on lcd.The reason for using Arduino board in this prototype is

Arduino microchip inexpensive and can be easily accessed by any one.arduino family micro chip many advantages when you compare them with other micro controllers like parallex basic stamp,Netmedia BX'5 etc.

ATmega328

The micro chip used in Arduino uno is AT mega 328 .this micro chip was created by Atmel in the mega AVR family.The Atmel 8-bit Avr RISc based microchip combines 32KB ISP memory with read writ capabilities,1KB EEPROM,2KB SRAM and many other features present in this micro chip.[6]

3.7Wi-Fi Communication:

Wi-Fi nets use radio wave technology with Institute of Electrical and Electronics Engineers (IEEE) standards, such as IEEE 802.11a, 802.11b, and 802.11g. These standards provide reliable and safe wireless connectivity. Wi-Fi nets can be used for connection between computational devices and also to connect these devices to Internet. Wi-Fi net operates in the not licensed radio waves 2.4 GHz, in the IEEE 802.11b and IEEE 802.11g technologies and in the 5 GHz frequency of the 802.11a technology. The Wi-Fi modem is based in the RN-171 module to promote connection to the wireless networks. The connection of this modem needs only four pins designated to power and Wi-Fi communication. This device has an independent antenna to increase its reach and offers stronger signal and support for the most common communication protocols like Transmission Control Protocol (TCP), User Datagram Protocol (UDP), and File Transfer Protocol (FTP).[8]

V. SOFTWARE ANALYSIS

Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (*shields*) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler toolchains, the Arduino project provides an integrated development environment (IDE) based on the Processing language project.

Software development

A program for Arduino may be written in any programming language for a compiler that produces binary machine code for the target processor. Atmel provides a development environment for their microcontrollers, AVR Studio and the newer Atmel Studio.

In this prototype we implemented various codes for various modules like DHT11,soil moisture and many sensors.we developed this code in Arduino IDE which is available free of cost on Arduino website [7]

VI. RESULTS AND DISCUSSION:

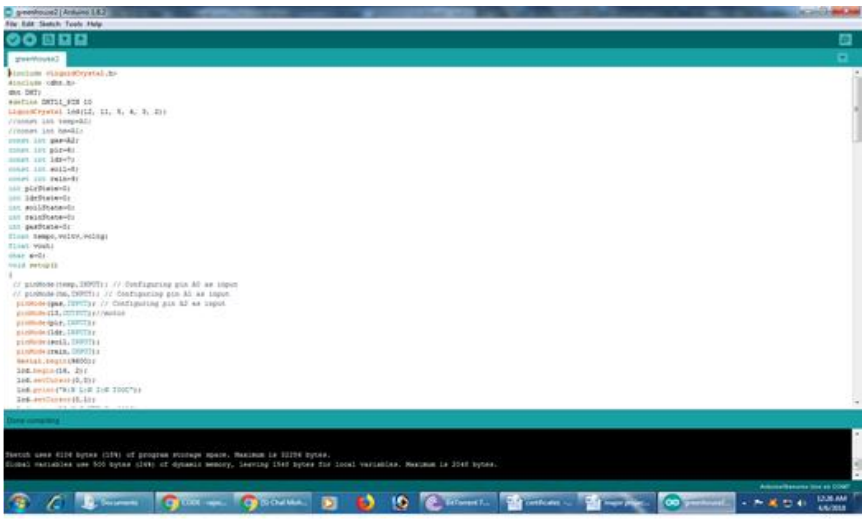


Figure 1:software complied result

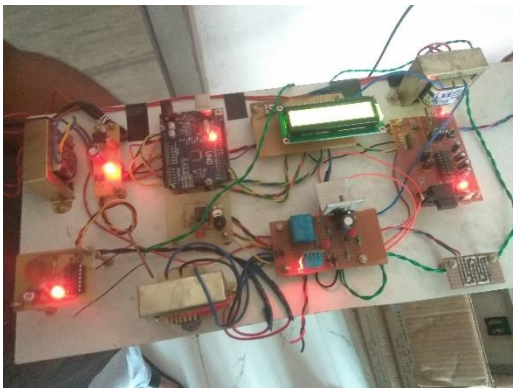
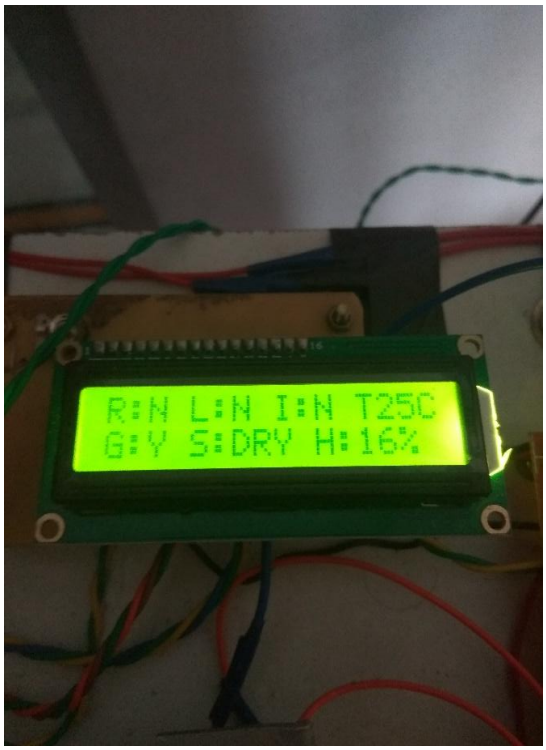


Figure 2: Hardware result



V. CONCLUSION

"Smart agriculture system" is successfully designed & developed, and a demo unit is fabricated and the results are found to be satisfactory. The concept is presented here can be used for real applications for measuring the other parameters like wind speed, direction, pressure, etc. The temperature sensor used here is very sensitive and hence it can be used to acquire atmosphere temperature accurately. It can be used as electrical instrument for measuring the atmospheric temperature and in the same way humidity for measuring the humidity in the atmosphere. By incorporating additional sensors for the parameters mentioned, this system can be implemented for real time operations.

Since it is a prototype module, a simple module is constructed, which can be used for many applications. While designing and developing this proto type module, we have consulted few experts those who are having knowledge in embedded systems and these professionals working at different organizations belongs to Hyderabad helped us while fabricating this prototype work. Since it is a prototype module, much amount is not invested. The whole machine is constructed with locally available components. Some of the modifications must be carried out in design to make it as real working system.

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