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IOT Based Agriculture System

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Abstract:
The project has been made keeping the farmer as well as environment in mind. 17% of India's GDP is based on agriculture and around 50% of the population is engaged in farming. Yet there are very few things in the market to make the work of the farmer easy. The farmer keeps checking for the water supply in the field. In winters also, he sleeps in the field in chilly nights to look out for animal intrusion. Sometimes, the soil temperature and humidity are not sufficient for a particular crop but the farmer does not know that which ultimately leads to bad crop or crop failure. The paper aims to look at all these problems and to find a solution. Since, IOT is an emerging field and its applications are wide, the paper has included the application of IOT in agriculture as well. The paper aims at helping the farmer by providing data such as air temperature and humidity, soil temperature and moisture ,through sensors, which is sent on the website, through ARDUINO microcontroller which uses ATMEGA328 chip, on which the farmer can easily see. The sensors will extract the analog data from soil and air. This data will then be converted in digital form through an ADC which will then be sent to the website. An automatic water pump connected through a relay has been added to water the crops automatically thus reducing the work of the farmer. A PIR sensor senses an animal intrusion and lets the farmer know through an SMS via GSM, thus saving his crops.

Keywords: IOT, ARDUINO, ATMEGA328 and GSM

1. INTRODUCTION

Since time immemorial, human being has been growing crops according to his needs. There are different types of farming depending on various factors like climate, soil, temperature, moisture and most importantly the need of the population. Traditional farming systems include shifting cultivation(slash and burn), nomadic herding. Semi commercial systems include rice based, root crop based, grain legume based, agrisilvicultural, silvopastoral and agrisilvopastoral systems. Commercial systems include plantations, agro forestry and ranching. Till now only human beings are connected to each other through the internet but with the advent of IOT even the things around us would be connected, making everything automatic. There is a high degree of accuracy in automation and that is why we have used IOT in our project. With changing times, man has overcome many problems but still some of the problems persist like ruining of crops by animals, water logging and unawareness of soil and air parameters. Our project aims to solve these problems. There are many other systems which do the entire farming automatically but the touch of human being is required because computer cannot beat generations of experience which man has gained in farming. Our project improves the efficiency of the farmer thereby improving the quality of his crops.

2. PREVIOUS WORKS:

There have been many IOT based agriculture projects before. The authors have used different technology like they have used raspberry pi instead of ARDUINO UNO. In one such article, the author has used PIC microcontroller. The project has certain features like moisture and temperature sensing, remote controlled monitoring using GPS, scaring the intruder, security, leaf wetness etc.[1]. In another article, the author uses both Raspberry Pi as well as Arduino microcontroller to automate water supply based on moisture level and daylight intensity. As soon as a water shortage is detected, an SMS is sent[2]. In one article, the author talks about a robot which is used for weeding, moisture sensing, spraying etc.[3]. A wireless sensor network has also been developed for sensing water level and moisture content of the soil[4]. In China, an IOT based micro-irrigation system has been developed which overcomes the difficulties of layout of soil moisture and expensive hardware components [5]. The advantages of Internet Of Things along with cloud computing have been shown in an article. The advantages of IOT include safety of agriculture product, agriculture information transmission with intelligent detection, precision irrigation, intelligent cultivation control etc.[6].

A precision agriculture system based on Internet Of Things has been developed. The author has mainly focused on network architecture, hardware architecture and software process control[7].

3.COMPONENTS:

3.1 List of components:

- ATMega328 controller
- 16x2 character LCD display
- NIOWAY M590 GSM module
- PIR sensor
- SOIL MOISTURE sensor FC-28
- SOIL TEMPERATURE SENSOR
- AIR TEMPERATURE AND HUMIDITY SENSOR-DHT11

- SOLID STATE RELAY

3.2 PIR SENSOR:

Figure.1. PIR Sensor

PIR sensor is another name for passive infrared, pyroelectric or IR motion sensor, since it senses an intrusion based on the IR levels. Everybody emits some amount of IR radiations, some emit low some high depending on how hot they are. A PIR sensor has two slots in it which are made of IR sensitive material. When there is no movement in front of the slots, both the slots detect same levels of IR. When something warm like an animal passes in front of the slots then the first slot detects some change in IR level and creates a positive differential change between the two slots. As the animal passes from the second slot, it creates a reverse effect i.e., negative differential between the two slots. These changing levels of IR are detected by the PIR.

3.3 SOIL MOISTURE SENSOR:

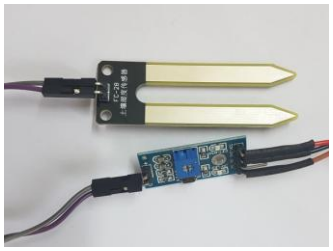

Figure.2.Soil Moisture Sensor

The soil moisture sensor works by measuring the dielectric constant of the soil. The dielectric constant of water is more than that of soil and therefore increases as the water level increases. The average of the water content of the entire two plates is taken. The ends are very little sensitive. The sensor does not have an inbuilt Analog to digital converter. Therefore, we have used an external ADC so that we can get the values in digital form.

3.4 AIR TEMPERATURE AND HUMIDITY SENSOR:

Figure.3. Air temp.&humidity

The Air Temperature and Humidity sensor consists of a Negative Temperature coefficient sensor, humidity sensing element and an IC.The humidity sensing element has two electrodes for measuring moisture content. As soon as the moisture content changes, the resistance between the two electrodes changes and the moisture is sensed. The temperature sensing element consists of a negative temperature coefficient element or a thermistor. Both of them are made from semi conductors like ceramics or polymers which show a large change in resistance for a small change in temperature. The change in resistances for both humidity and temperature is processed by IC and is read by the microcontroller.

3.4 SOLID STATE RELAY:

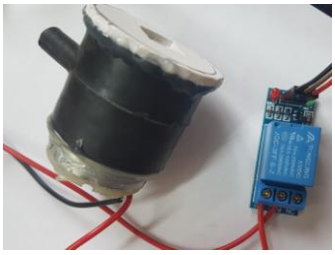

Figure.4.Solid State Relay

A static circuit compares or measures the electrical quantities and gives an output based on which the circuit breaker trips. they are called static since they do not have any movable part. to create the relay characteristics we do not use mechanical components or magnetic coil but analog electronic devices. The analogy circuits monitor the incoming current or voltage and not digital.

4. METHODOLOGY:

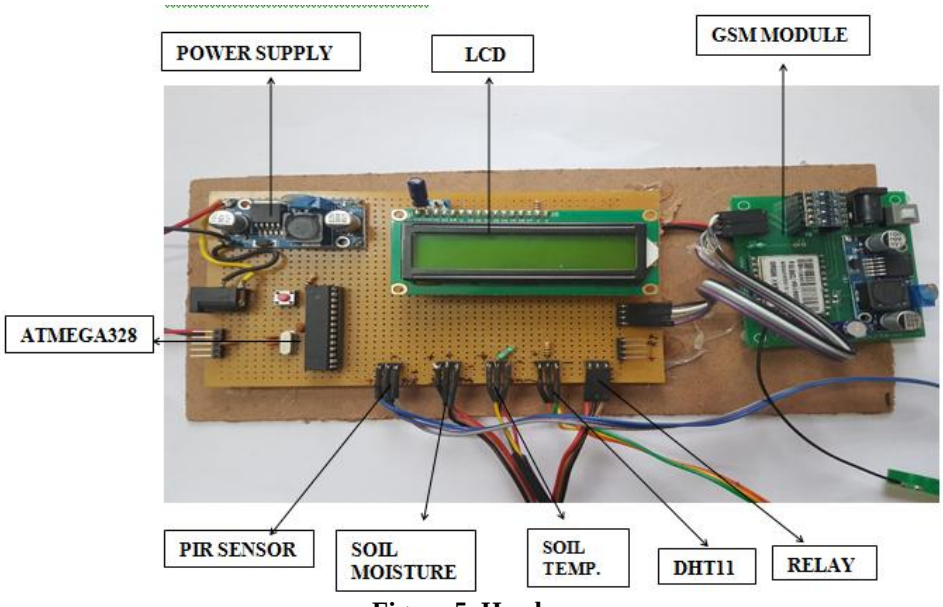

Figure.5. Hardware

4.1 POWER SUPPLY:

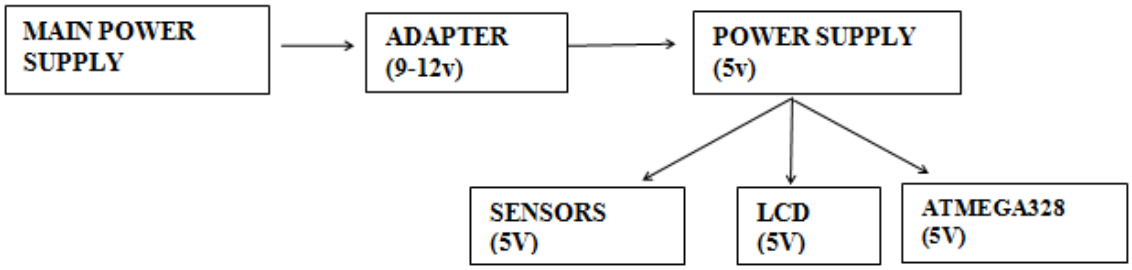

Figure.6.Flow Chart for Power Distribution

The socket receives 240 volts which is clearly not ideal for the hardware. Therefore, we have used an adapter which changes the voltage to 9V. this voltage however is also not suitable for the hardware. The power supply thus changes 9V to 5V which is suitable for working of the hardware. After the voltage is changed to 5V it goes to the ATMEGA328 chip, different sensors and the LCD.

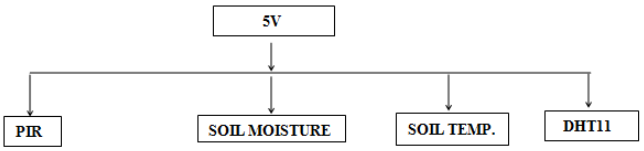

Figure.7.Power Distribution to Sensors

As soon as the power reaches to the sensors they start working.

4.2 PIR:

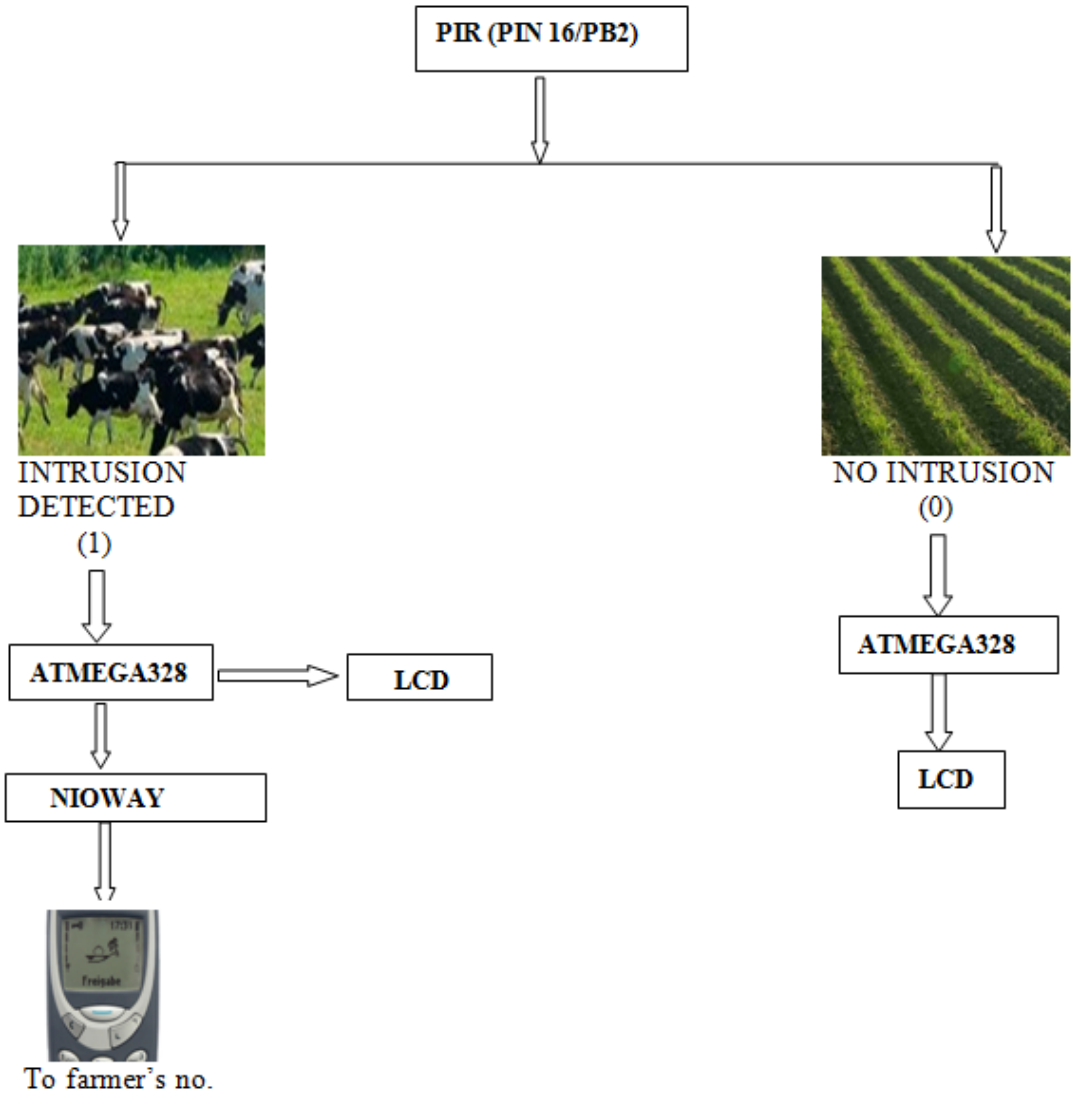

Figure.8.Flow Chart for Pir

As the power reaches to PIR sensor, it starts looking for intrusion and keeps sending a 0 to the ATMEGA chip which is shown on the LCD.As soon as it detects an intrusion it sends a 1 to the ATMEGA chip which sends a signal to the NIOWAY (GSM) to send an SMS to the farmer alerting him about the intrusion and simultaneously displays it on the LCD.

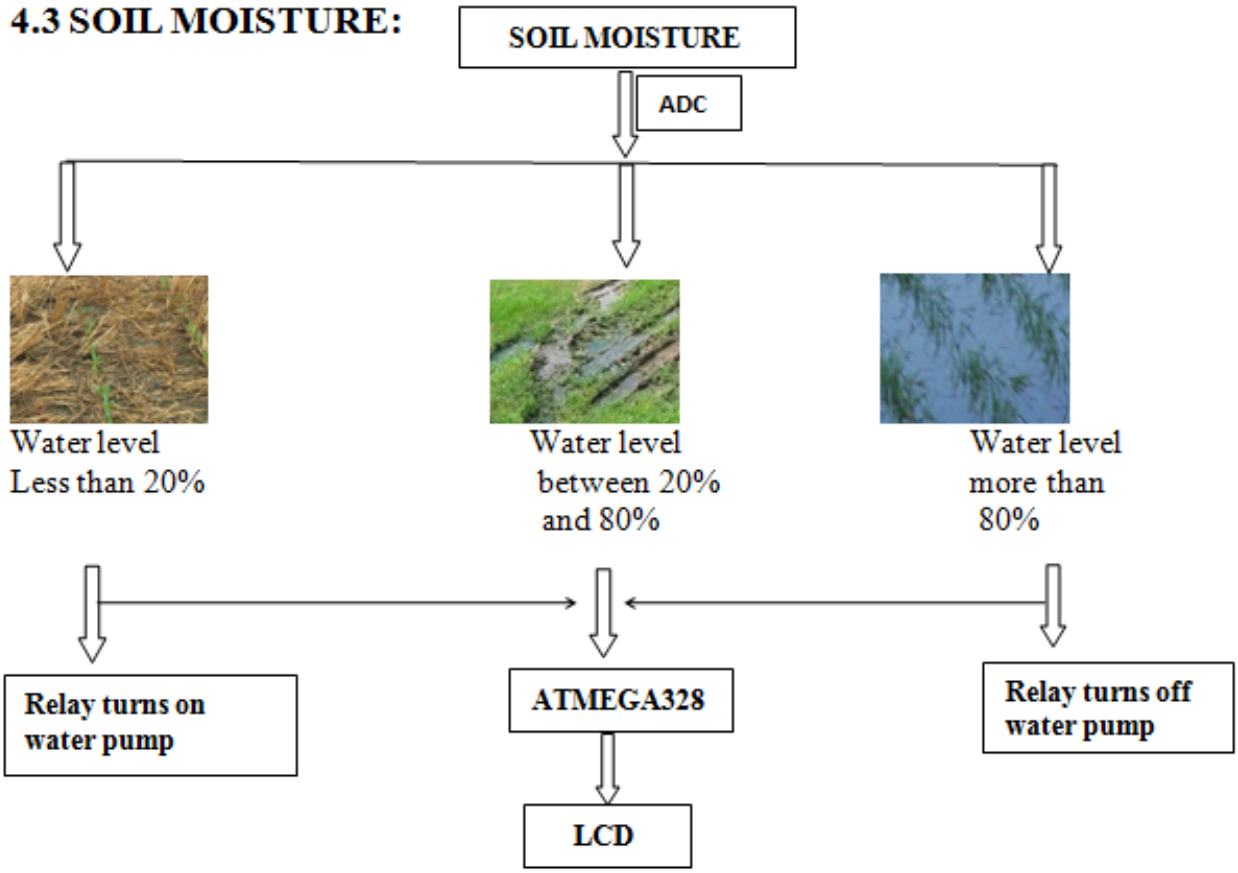

Figure.9.Flow Chart for Soil Moisture

As soon as the soil moisture sensor receives power it starts sensing the moisture of the soil. The moisture level which it senses has an analog value which needs to be converted in digital. Since, the soil moisture sensor does not have an inbuilt ADC(Analog to digital convertor), this function is done by an external ADC.The digital value is sent to the ATMEGA chip. Based on the digital value following steps are taken:

- If the soil moisture level is more than 80%, the solid state relay turns the water pump on.
- If the soil moisture level is between 20% and 80%, the value is sent to the LCD from the ATMEGA chip.
- If the soil moisture level is more than 80%, the solid state relay turns off the water pump.

4.4 SOIL TEMPERATURE AND HUMIDITY:

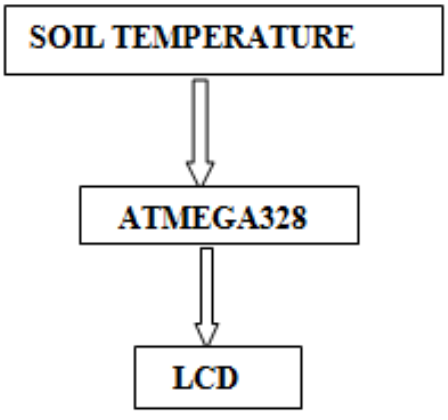

Figure.10. Flow chart for air temp.&humidity

As soon as the Soil Temperature sensor receives power it starts sensing the air temperature and humidity. Since, it has an inbuilt ADC, there is no requirement of an external ADC and the digital value reaches to the ATMEGA chip and then to the LCD.

4.5 AIR TEMPERATURE AND HUMIDITY:

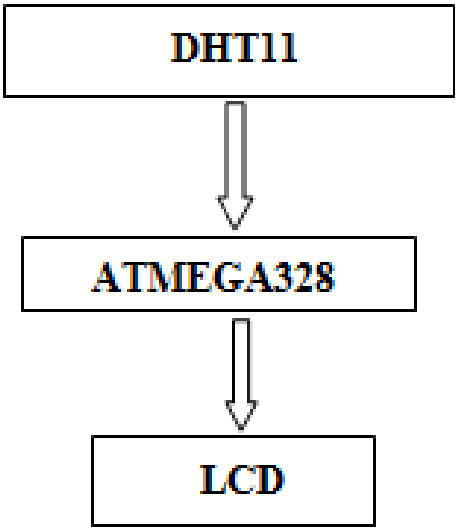

Figure.11.Flow Chart for Dht11

As soon as the air temperature and humidity sensor i.e., DHT11 receives power it starts sensing the soil temperature. It also has an inbuilt ADC which gives a digital value. This value is sent to the ATMEGA chip and then to the LCD.All the values from the ATMEGA328 chip are sent to a website through a server using the application of IOT.

5. IMPLEMENTATION:

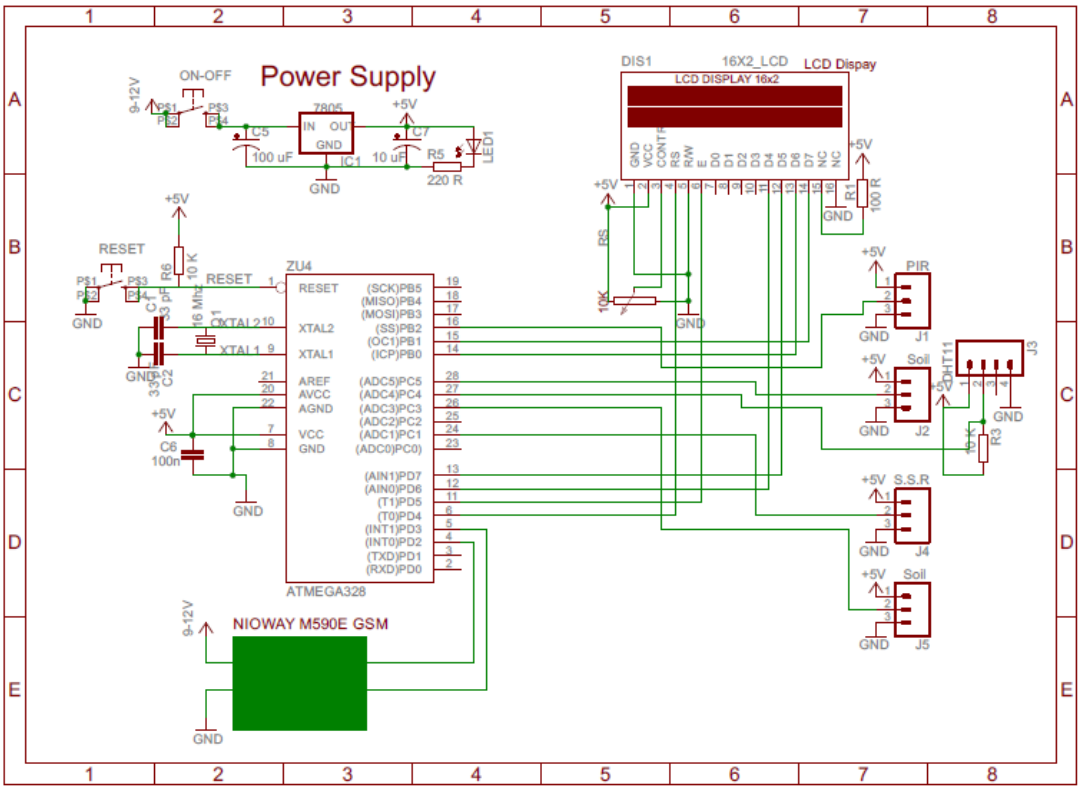

Figure.12.Circuit Diagram

6. CONCLUSION:

Our aim was to develop a farmer friendly agricultural system. Earlier, the farmer had to keep a lot of vigil on his fields but with this project the time wasted in monitoring the fields has been reduced with the help of sensors and alert systems which have been implemented. With automatic water pump, water is judiciously used. Hence, the project has been made keeping both the farmer's as well as environment in mind.

7. REFERENCES

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