PROTECTION OF CROP AND PROPER USAGE OF RAIN WATER USING WIRELESS SENSOR NETWORK

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ABSTRACT

Agriculture is regarded as backbone of a country's economy. During heavy rain falls, the Farmers face lots of problem as their cultivated crops get washed off or destroyed and in times of less or no rainfall the crops may not get adequate amount of water. The farmers grow crops which are totally dependent on the weather and natural conditions. Due to the changeable atmospheric conditions which may vary from place to place in large farmstead, which makes extremely difficult to maintain the constancy at all the places in the farmstead manually. So to address these problems this project is proposed which helps in protecting the crops from heavy rainfall and saving rainwater for later usage. The saved water can be used for feeding animals, washing, cooking etc. and can also be reused to sprinkle it back to the field when needed. In this system an automatic roof is inculcated which works by taking the signals from the rainfall detectors and soil moisture sensors and then covers the whole field to protect it from heavy rains. And in times of less rainfall the saved rainwater can be sprinkled on crops by measuring the dryness of land through moisture sensors.

Keywords: - *Gross domestic product (GDP), Internet of things (IOT), wireless sensor network (WSN), Liquid crystal display (LCD), Light dependent resistor (LDR), Micro controller unit (MCU)*

1. INTRODUCTION

The economic contribution of agriculture to GDP in most of the countries across the globe is steadily declining with the country's broad-based economic growth while large number of people continues to work in the agriculture sector [1]. Hence, there is an immediate need to improve the System which can increase the yield and produce healthy organic food. In order to improve the crop productivity there is an urgent need to change the manual method to automation [2]. Also considering the water availability which is one of the valuable resources to be protected and saved for future needs. Embedded based automatic irrigation system is suitable for farmers and is available at low cost and also easy to install. This system will help the farmers in feeding water to the crops at stringent time and quantity.

This system observes the moisture and temperature variations around the crop area to gives precis time of operating the motors into ON and OFF state. So automatically avoids the human errors. The wireless sensor Network (WSN) which collects the data from different type of sensors and then send it to the main server using wireless protocol. The collected data provides the information about different environmental factors which in turn helps to monitor the system.

Nowadays Farmers grow various crops in their farm like Grapes or Pomegranate as like older techniques, so by adopting this concept farmers can save time, water, and money. The proposed system implemented uses WIFI and an Android mobile phone to report the details about irrigation.

2. LITERATURE SURVEY

2.1 Related Works

According to Dr.N.Suma [3] et.al, IOT based smart agriculture monitoring system 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 appropriate locations for observation of crops is implemented in. An algorithm elevated with threshold values of temperature and soil moisture can be programmed into a microcontroller-based gateway to manage water quantity. The system can be powered by solar panels and can have a semidetached communication link based on a cellular Internet interface that allows data inspection and irrigation scheduling to be programmed through a web page.

According to Ravi Kishore Kodali [4] et.al, Iot Based Smart Greenhouse India receives ample amount of precipitation and have many large river systems but still only one third of the total agricultural land is connected via canal irrigation system. Remaining majority of the portion is dependent on monsoon or tube wells. Places with excess water faces problem of land stability due to over irrigation and water logging. Water collected on the surface also blocks pores in the soil and kills beneficial microorganisms.

Alternatively, places with finite supply of water cannot do irrigation throughout the growing season because the necessary of water often exceeds the supply due to conventional type of irrigation like sprinkler or in case allowing the water to just irrigate the field directly from water drainage channels. Effects of excessive and irregular irrigation

- Increase salinity
- Water logging
- Hindrance in air communication to plant roots
- Reduction in temperature to soil
- Land becomes marshy
- More nitrate formation in soil
- Acidity of soil

Hence, problem lies in the mismanaged use of water. For optimal use of water, we use drip irrigation. It is an irrigation technique to save water by allowing water to target the roots of plant.

Water obtained from all the sources like canal, rainwater harvesting, tube well etc. are not allowed to irrigate the fields directly; instead it is first stored into an underground tank. Tank is equipped with an ultrasonic sensor which measures the level of water continuously and alerts the user with a SMS whenever water level falls below the threshold mark.

2.2 Wireless Sensor Networks (WSNs)

Wireless sensor networks or WSNs are sensor nodes that communicate wirelessly to obtain data about the surrounding environment. Sensor nodes include sensing, data processing, and communicating components. The sensor nodes positions are not predetermined. We are using Wireless Sensor Networks as it is perfect for our project because the farmer need not be physically present in the field to check the moisture content of the soil to turn ON the Pump. As all the information such as temperature, humidity, rain and animal entry in the field will be sent to the farmer. And the farmer can not only monitor his field from any place but he can also give instructions like turning ON the Pump when the field is dry and covering the crops during rain.

3. PROPOSED METHODOLOGY

This Model involves sensors, LCD display, and Node MCU and ARM processor. All the sensors will give analog output but processor will accept only the digital data. So to connect all the sensors to the ADC channel pins which are in-built to the processor. LCD will be used for field display purpose. Wi-Fi module contains a Subscriber Identity Module (SIM) with which user can communicate with this SIM-Number. When the actual command is activated or given by the user, immediately the corresponding sensor will activate and reads this reading and immediately sends results to the registered mobile number and also displays the reading on the LCD panel. The user will take the necessary action immediately. Temperatures, Humidity, Soil moisture and Rain sensors are used. All these devices are connected to the ARM7 LPC2148 processor. Node MCU is used for communication purpose, with the help of AT (attention)-Commands can communicate with the components. Relay is connected to the water pump to pump water to the field. A battery is used to store the energy or power coming from the solar panel. Water storage tank collects rain water which can be used for later purposes.

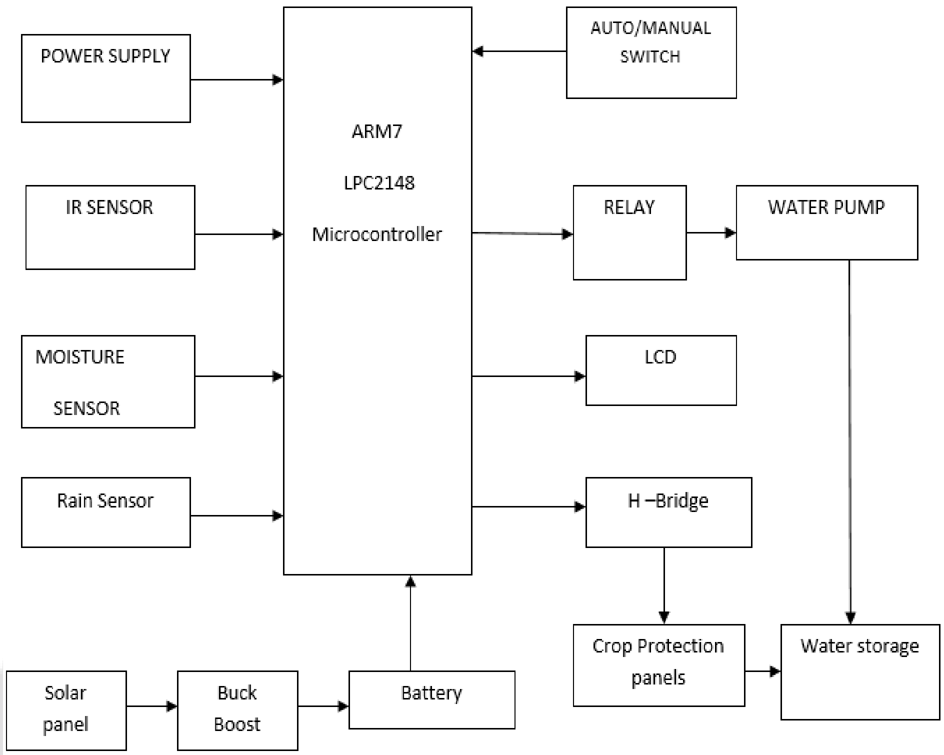

Fig -3: Proposed Block Diagram

4. System requirements

4.1 Microcontroller

In this project we are using LPC2148 IC from ARM-7 micro-controller family in embedded system which is based on a 16-bit/32-bit ARM-7 TDMI-S CPU with real-time emulation and embedded trace support, that combine the micro-controller with embedded high-speed flash memory ranging from 32 KB to 512 KB. It supports both 32-bit and 16-bit instructions using Thumb and ARM instruction sets. The ARM7 processor is capable of executing up to 130MIPS on 0.13µm digital CMOS process. Pipelined techniques are employed so that all parts of the processing and memory systems can operate simultaneously. Typically, while one instruction is being executed and completed, its successor is being decoded, and a third applications with memory restrictions, or applications where code density is an issue.

Fig -4.1: ARM LPC2148 Micro-controller Board

4.2 Soil Moisture Sensor

We make use of YL-69 soil moisture sensor to measure the amount of water in soil. This sensor uses the property of electrical resistance of the soil. Here, it is used to sense the moisture in field and transfer it to micro controller in order to take controlling action of switching water Pump ON/OFF.

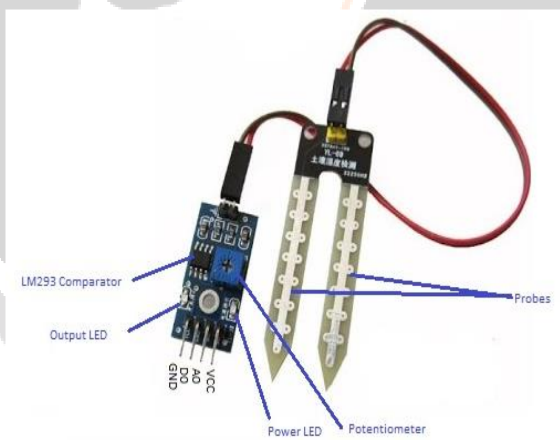

Fig -4.2: Soil Moisture Sensor

4.3 Humidity and Temperature Sensor

A DHT 11 is a basic, and a very low cost sensor. It is used to measure the humidity and temperature of the surroundings. The unit has a capacitive humidity sensor for measuring humidity and a thermistor for measuring the temperature. Humidity sensor indicates the exact amount of water vapour present in the air and these values are displayed on LCD. It converts directly relative humidity to voltage; the digital signal is then used to transfer the measured values onto the controller using a digital signal. The sensor has a delay of 2 seconds. This means that the sensor reading can be up to 2 seconds old.

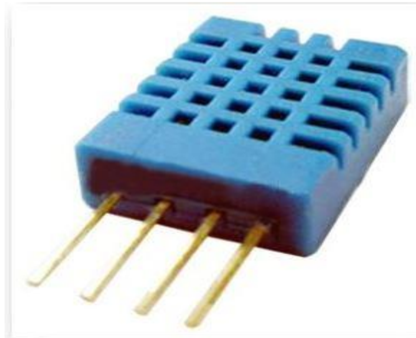

Fig -4.3: Humidity Sensor

4.4. Rain Sensor

Rain sensor or a rain switch is activated by rainfall. We are mainly using FC-37 rain sensor so that when it senses rain it is able to transfer the information to the microcontroller which in turn sends the message to the farmer so that he commands to cover the crop.

Fig -4.4: Rain Sensor

4.5. Kiel µVision

In this model µVision4 IDE is used as it is Windows-based software development platforms that combines a robust editor, project manager and make facilities. µVision4 integrates tools such as the C compiler, macro assembler, linker/locator, and HEX file generator. And the µVision3 IDE offers various other features and advantages that help us to quickly and successfully develop embedded applications. They are easy to use and are guaranteed to help you achieve your design goals.

4.6. Botfather

Botfather is a universal automation framework. We are using Telegram to communicate with the farmer. Telegram bots are AI-inspired apps which serve various functions such as sending relevant information about the humidity and temperature or other useful information, schedule reminders, play tunes, create to-do lists, and so much more. It uses Transport Layer Security or TLS protocol applied in HTTPS web encryption.

5. WORKING MODULE

When the power supply is switched on, the Node MCU modem gets initialized. The Node MCU modem communicates with the ARM LPC2148 board using AT commands. After the initialization, the system asks the user to select either automatic mode or the manual mode. The LCD display is connected to the ADC pins of the ARM processor, in order to display the message. Firstly the processor checks for the availability of the solar energy with the help of solar panels, the solar panel is interfaced with the DC motor, which in turn is connected with the driver.
The solar panel rotates both in clockwise and anti-clockwise direction and stops where the maximum sun intensity is available and stores that energy in the battery. If the farmer opts for auto mode all the functions will be carried out

automatically. The IR sensor detects for any animals around the field and sends a message to the farmer appropriately. The temperature Sensor senses the surrounding temperature of the farm. The soil moisture sensor checks for the moisture content in the soil whose maximum threshold is kept at 1000 and minimum of 300. Relay is connected to the pump which starts pumping water when the soil moisture content is less than 300 the water pump will turn ON and water the filed until the sensor measures 1000.

Similarly, when there is an unconditional rain the rain sensor closes the panel automatically to protect the crop. All the above information will be informed to the user using Node MCU technology. When it starts raining, the Pump Motor will stop Pumping the water to the field and updates the user using Node MCU modem/Wi-Fi modem technique

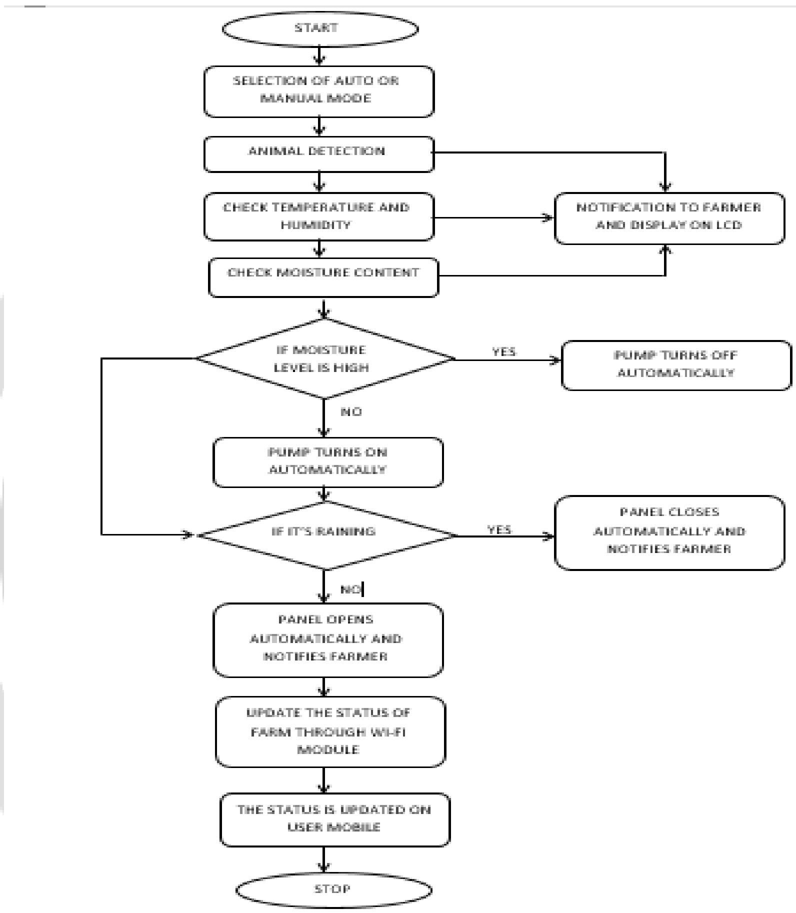

Fig -5: Working Module

When the manual mode is selected, the information about the field will be sent to the user only on the authenticated number given. But the farmer himself will have to manually operate all the operation such as turning ON/OFF the pump or instruct to open/close the panel during rainfall.

6. IMPLEMENTATION

In our project we have designed a model to help the farmers in rural zones. By implementing this project we can avoid crop damage against rains and floods and as well a good yield can be achieved in farming lands. The problem of crop Protection by wild animals has become a major social problem in the current time. It requires urgent attention and an effective solution. Thus this project carries an excellent social relevance because it aims to deal with this problem. Hence we've designed a sensible embedded farmland protection and surveillance based System which is low cost, and also consumes less energy. The main aim is to prevent the loss of crops and to protect the area from intruders and wild animals which pose a major threat to the agricultural areas. Such a System are going to be helpful to the farmers in protecting their orchards and fields and save them from significant financial losses and also saves them from unproductive efforts that they endure for the protection of their fields. This System will also help them in achieving better crop yields thus leading to their economic well-being. By using solar roof tops instead of normal panels we can generate energy from it and same can be used for Agriculture activities.

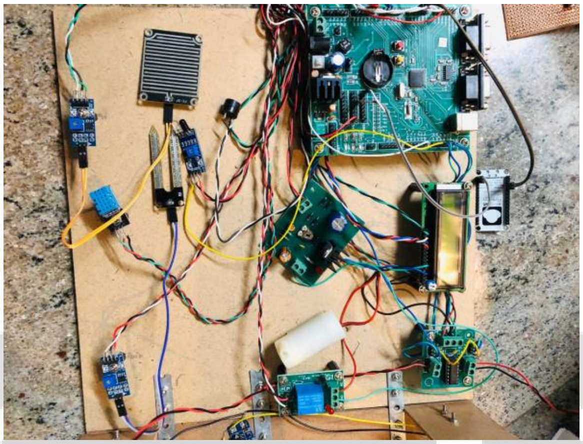

Fig -6: Interfacing of all the Devices

7. RESULTS AND DISCUSSIONS

The System was tested in both the extreme cases of heavy rainfall and less or no rainfall. The obtained results are as shown. As soon as the GSM is initialized the system asks for the user to select either auto mode or manual mode.

Figure 7.1 shows the mode selection. The user will be provided by two switches he can select the option depending on his requirement.

Fig -7.1: Mode selection

Figure 7.2 shows the measuring of temperature and humidity in the land. Temperature and humidity Sensor measures the temperature of the field and the information will be sent to the user in the form of SMS and will also be displayed on the LCD.

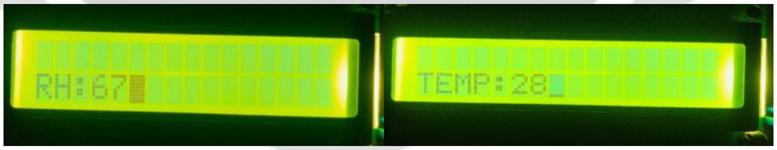

Fig -7.2: Measuring of temperature

Figure 7.3 shows the measuring of moisture level in the soil. Moisture Sensor measures the amount of moisture content in the soil. If the moisture level is normal then it indicates there is sufficient amount of water present in the soil. If the moisture level is above the normal value it indicates that the land is getting over water due to heavy rain, in that case the roof panels will be closed by sending signals to the Motors attached to the panel.

If in case the moisture level is below the normal value it indicates that the land is dry, in that case the pump attached to the water storage is turned ON to water the field.

Fig -7.3: Measuring of moisture level

Figure 7.4 shows the opening and closing of panels to protect the crop from the rain. If the rain Sensor detects rain then the panels will get close to protect the crops from rain otherwise the panels will remain open.

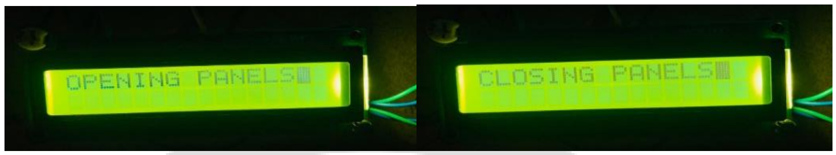

Fig -7.4: Opening and Closing of panels

Taking readings purely depend on the moisture, temperature, humidity at that instant of time. Our System keeps on monitoring the conditions for regular intervals of time which is displayed on the LCD.

We have set the threshold value to the Sensors of above-mentioned physical parameter depending on the type of crop. Now we are setting threshold of moisture Sensor as = 300;

1. If moisture is > threshold value it displays the respective moisture content reading (Eg: If moisture content =540). It indicates that the land is moist and does not need water.
2. If moisture content < threshold value it displays the respective reading (Eg: If moisture content =120). It indicates that the land is dry and requires water.
In the same way we track the conditions of other Sensors and the respective action will be taken.

8. CONCLUSION

It can be concluded that the use of electronic and mechanical System will be very advantageous for better agricultural output. In this project we have designed a model to help the farmers by sending alert messages and controlling agricultural activities in the land in the presence or absence of the farmer using wireless Sensor network technology by simply sending a message. The user can operate this equipment from anywhere by sending a message, for security purpose the software will make sure that it works only with pre-assigned phone numbers. This System is integrated to track the changes accurately, happening in the field like the soil moisture content and also protect the crops from rain. The proposed System is capable of controlling the essential parameters necessary for growth of the plants which includes, watering the crops depending on temperature, humidity, soil moisture and light intensity as per variety of the crop. The microcontroller and sensors are interfaced successfully and wireless communication is achieved. Also this proposed System of farming is user-friendly, cost effective and highly robust.

9. ACKNOWLEDGEMENT

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