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Smart Irrigation System with Safety and Security using Alarm Systems

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ABSTRACT : The Smart Irrigation System is an IOT based device which is capable of automating the irrigation process by analyzing the moisture of soil and the climate condition. It provides water supply at the right time, in right quantity and at the right place in field which place a vital role in plants growth. Water management remotely is also a challenging task, especially the management becomes more difficult during the storage of water, which may otherwise damage the crop. The system has a distributed wireless network of soil moisture and temperature sensors place in the root zone of the plants. Soil parameters like soil moisture, pH, humidity are measured and the pressure sensor and sensed values are displayed in LCD. By using sensors like moisture, rain, etc. Water supply for irrigation can be managed easily by analyzing the condition of soil and climate. Soil moistures sensors smartly measure the moisture and based on that data, field is get irrigated automatically with less human interventions. The IR sensor senses the animals nearing the fields and produces the huge alarm sounds. The intruder detection system is done with the help of PIR sensor where the birds are repelled from entering into the fields. The GSM module has been used to establish a communication link between the farmer and the field. The current field status will be intimated to the farmer via SMS. The farmer can access the server about the field condition anytime, anywhere thereby reducing the man power and time.

KEYWORDS: Microcontroller, Sensors, Intruder Detection System, IOT, Monitoring and Controlling System

I.INTRODUCTION

India is basically an agricultural country, and all its resources depend on the agricultural output. Even in the modern span of industrialization, agriculture is the key area that decides the economy growth of the country. Agriculture also accounts for 8.56% of the country's total exports.

Irrigation is the science of planning and designing an efficient, low cost, economic irrigation system designed in such a way to fit natural conditions. By the construction of proper distribution system and providing of adequate water supply will increase the yield of crops. Rising population, there is a need for increase at the cultural production. In order to support greater production in farms, the requirement of the amount of fresh water used in irrigation also raises. Currently, agriculture accounts 83% of the total water consumption in India. Unplanned use of water inadvertently results in wastage of water.

In the internet era, where information place a key role in people's lives, agriculture is rapidly becoming a very data intensive industry where farmers need to collect and evaluate a huge amount of information from a diverse number of devices in order to become more efficient in production and communicating appropriate information. With the advent of open source Arduino boards along with cheap moisture sensors, it is viable to create devices that can monitor the soil moisture content and accordingly irrigating the feels or the landscape as and when needed. The propose system makes use of microcontroller LPC2148 on Arduino platform and IOT which enable farmers to remotely monitor the status of sprinklers installed on the farm by knowing the sensor values there by, making the farmers work much easier as they can concentrate on other farm activities.

II.LITERATURE REVIEW

In order to effectively reduce the impact of inadequate water resources on China's economy, from modern agricultural cultivation and management perspective, according to the basic principles of Internet, with wireless sensor technology, this article proposes precision agriculture irrigation systems based on the Internet of things (IOT) technology, and

focuses on the hardware architecture, network architecture and software process control of the precision irrigation system**. [1]**

The paper discusses about wireless technology using various sensors for precision agriculture has become a popular research with the greenhouse effect. Ethernet network, RF module and ZigBee wireless network are used to transmit data in Remote Monitoring System. This paper gives a review of remote control and monitoring systems based on existing technologies and a ZigBee. **[2]**

The project aims at making agriculture smart using automation and IOT technologies. The features of this project includes smart GPS based remote controlled robot to perform tasks like weeding, spraying, moisture sensing, bird and animal scaring, etc.. Secondly, it includes smart irrigation with smart control and intelligent decision making based on the accurate real time field data. Thirdly, it includes smart warehouse management and theft detection in the warehouse. Controlling of all these operations will be through any remote smart device or computer connected to internet and the operations will be performed by interfacing sensors, wi-fi or ZigBee modules, camera and actuators with microcontrollers. **[3]**

They explained that agriculture is the broadest economy sector and plays an important role in the overall economic development of a nation. In this paper, they have proposed a novel methodology for smart farming by linking a smart sensing system and smart irrigator system through wireless communication technology. Our system focuses on the measurement of physical parameters such as soil moisture content, nutrition content, and pH of the soil that plays a vital role in farming activities. Based on the essential physical and chemical parameters of the soil is measured, the required quantity of green manure, compost, and water is splashed on the crops using a smart irrigator, which is mounted on a movable overhead crane system. The detailed modelling and the control strategies of a smart irrigator and smart farming system are demonstrated. **[4]**

Indian farmers face a multitude of problems. Some of the issues faced, such as irregular monsoons and insufficient rainfall, are not in the realm of problems that can be addressed of technology, as of now. But, there are numerous problems that can indeed be solved with proper advice to farmers, at the right time. They can be made to acquire essential farming skills such as how to maximize yield by growing compatible crops, along with main ones, various crop rotation strategies depending on the location, soil. **[5]**

III.SYSTEM ARCHITECTURE

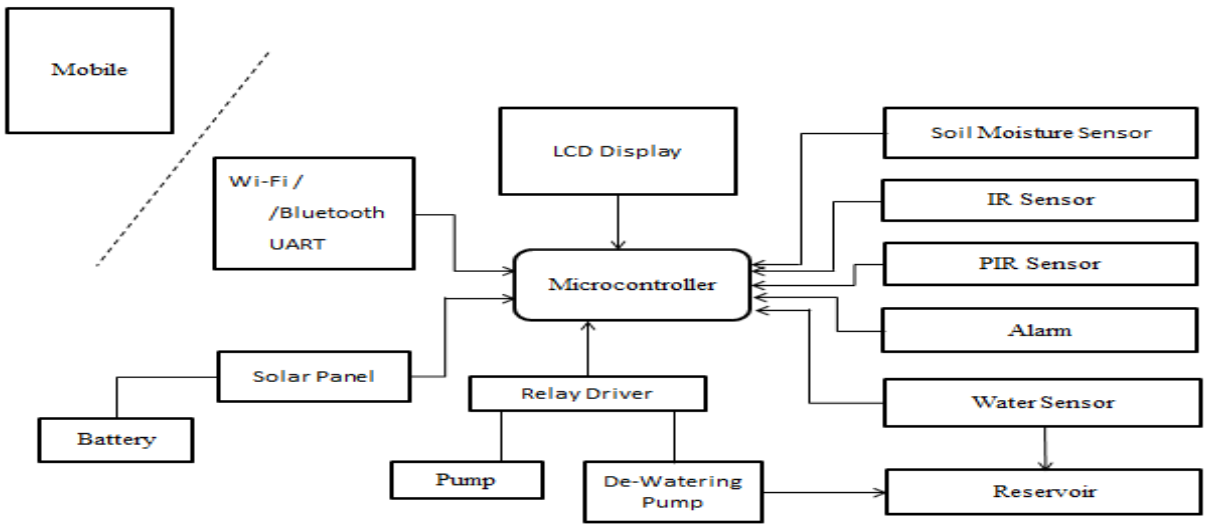

Figure 3.1: System Architecture

MICROCONTROLLER:
A LPC2148 Microcontroller is a small computer on a single metal-oxide-semiconductor integrated circuit chip.

SOLAR PANEL:
It works in dual mode. Firstly, it absorbs the light rays emitted from the sun and coverts it to the electrical energy. Secondly, it works by absorbing the light rays from the rays emitting equipment and stores it in the battery.

SOIL MOISTURE SENSOR:
It measures the volumetric water content in soil.

IR SENSOR:
It is an electronic device, that emits in order to sense some aspects of the surroundings.

WATER SENSOR:
It is a device used in the detection of the water level for various applications.

RELAY DRIVER:
It is an electro-magnetic switch that helps switching between pump and de-pump.

LCD Display:
LCD uses a liquid crystal to produce a visible image.

Data flow diagrams:

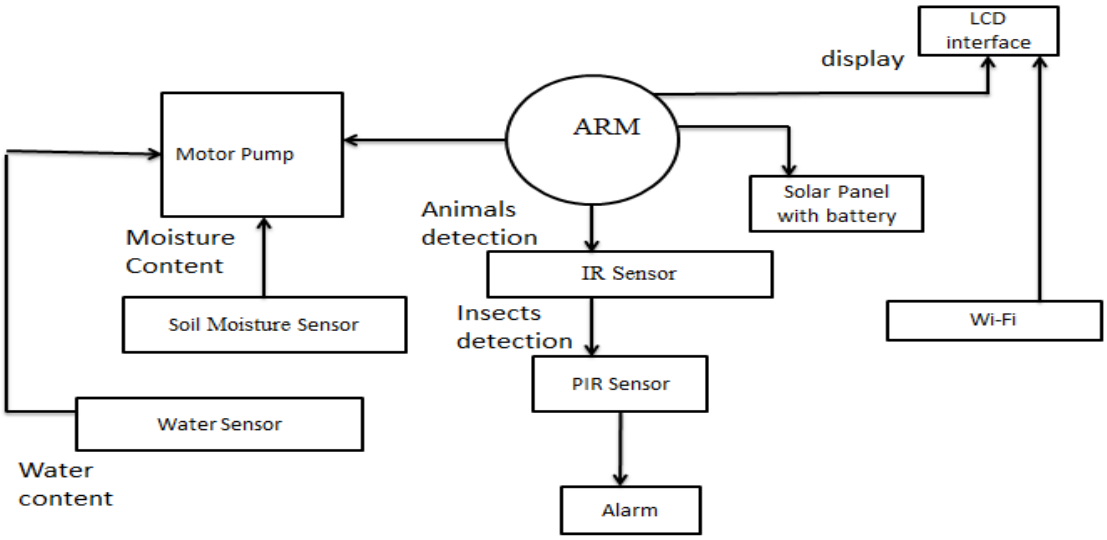

Figure 3.2: Data Flow Diagram

Data Flow:
The DFD is clear graphical formalism that can be used to address a structure the extent that the data to the system, diverse get ready did on this data and the yield data made by the structure. From the soil moisture sensor, the moisture content data is been observed and motor gets ON or OFF accordingly. Likely, water content data is been observed with the help of water sensor. If incase excess water is found it is stored in the reservoir for future purposes. The motion of animals and/or insects that are nearing the field will be detected by the IR sensor and PIR sensor respectively. The notifications will be intimated to the user via wi-fi.

IV.MODULE SETS

Soil Moisture Module

Soil moisture sensors measure the volumetric water content in soil. Since the direct gravimetric measurement of free soil moisture requires removing, drying and weighing 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. The relation between the measured property and soil moisture must be calibrated and may vary depending on environmental factors such as soil type, temperature, or electric conductivity. The threshold water content is defined for different crops. So based on water content and threshold value the plants are irrigated. The plants are watered using automatic motor, which works based on the output of soil moisture sensors.

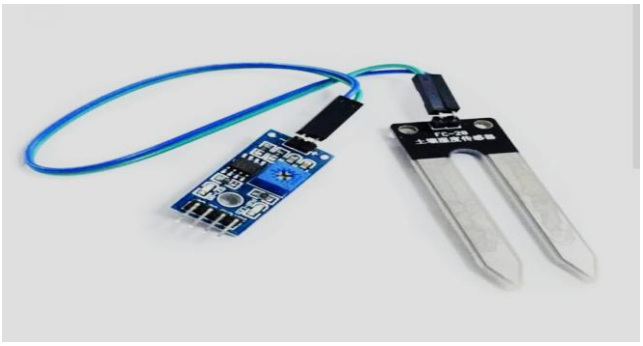

Figure 4.1: Soil Moisture Sensor

IR Sensor Module

An infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings. It can measure the heat of an object as well as detects the motion. These types of sensors measure only infrared radiation, rather than emitting it. The emitter is simply an IR LED and the detector is simply an IR photodiode that is sensitive to IR light of the same wavelength as that emitted by the IR LED. The intruder deduction system is done with the help of PIR sensor where the birds, insects are repelled from entering into the field. An IR sensors senses movements in the land and detects physical intruders such as animals etc. An intrusion in farmland is notified to the user. An alarm system is activated and produce huge sound as the physical intrusion is detected.

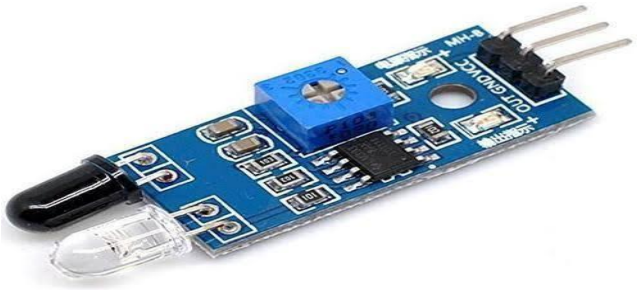

Figure 4.2: IR Sensor

Water Sensor Module

A water sensor is a device used in the detection of the water level for various applications. Water level senses are used to detect the level of substances that can flow. Level measurements can be done inside containers or it can be the level of a river or lake. Such measurements can be used to determine the amount of materials within a closed container or the flow of water in open channels. Water sensor brick is designed for water detection, which can be widely used in sensing the rainfall. During heavy rains, the excess water from the field is de pumped into the reservoir. This information is notified to the user.

Figure 4.3: Water Sensor

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V.IMPLEMENTION

SOIL MOISTURE MODULE

Function Name: #define WATER (IOPIN0 & (1<<23))
Input: Moisture content of land.
Output: Should ON the motor if less water content.

```
if(!(WATER))          //Motor Off
{
IOCLR1=m1p;           // p1 24,25          are motor pins
IOCLR1=m1n;
water();
LcdCmd(0x01); // Shift cursor position to left
LcdCmd(0x80);   //   Sets   cursor   to   line   1   of   display
LcdWriteText("MOTOROFF");
gsmsend();str_serial_0("MOTOROFF\n");
delayseconds(1);
gsmsend(); //notifies user
str_serial_0("SOIL MOISTURE DETECTED,MOTOR OFF\r\n");
delayseconds(2);
}
```

The above code explains when there is no water needed for the farm land and calls the function water() hence it displays in the LCD as “MOTOR OFF”, and also it calls predefined function gsmsend () and sends notification as “SOIL MOISTURE DETECTED, MOTOR OFF”

.

```
void water() //Water detected in soil moisture
{
LcdCmd(0x01);  //  Shift  cursor  position  to  left  LcdCmd(0x80);  //Sets
cursor to line 1 of display LcdWriteText("WATER DETECTED");
delayseconds(1);
LcdCmd(0x01);
}
```

The above snippet function tells water is present and sends notification as “WATER IS DETECTED”.

```
if(WATER) // Motor On
IOCLR1=m1p; // p1 24,25 are motor pins
IOCLR1=m1n;
delayseconds(2);
LcdCmd(0x01); // Shift cursor position to left LcdCmd(0x80); // Sets cursor
to line 1 of display LcdWriteText("MOTOR ON");
gsmsend(); //notifies user
str_serial_0("SOIL MOISTURE NOT DETECTED,MOTOR ON\n");
delayseconds(2);
}
```

The above snippet tells there is no moisture content in the farm land and hence water is needed for crops and sends notification as “SOIL MOISTURE NOT DETECTED, ON THE MOTOR”.

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WATER LEVEL MODULE

Function Name: #define RAIN (IOPIN0 & (1<<20))
Input: Level of water
Output: Pump to the reservoir

```
if(RAIN) //Water is de-pumped
{     IOCLR0=(1<<12);
IOCLR0=(1<<13);
LcdCmd(0x01); // Shift cursor position to left LcdCmd(0x80); // Sets cursor
to line 1 of display LcdWriteText("RAIN MOTOR OFF");
gsmsend();
str_serial_0("WATER IS DEPUMPED\n");
delayseconds(2);
}
```

This function explains that there is no excess water in the land and sends notification as “RAIN MOTOR OFF” and also notifies user as Water is de-pumped.

```
if(!(RAIN)) //Rain water depumping to reservoir
{      IOSET0=(1<<12);
IOCLR0=(1<<13);
LcdCmd(0x01); // Shift cursor position to left LcdCmd(0x80); // Sets cursor
to line 1 of display LcdWriteText("RAIN MOTOR On");
gsmsend();
str_serial_0("RAIN DETECTED DEPUMPING TO RESIVOUR\n");
delayseconds(2);
}
```

This above snippet explains there is excess of water in land and that water is transferred into reservoir so it gives message as Rain Motor ON. And sends notification to user as “RAIN DETECTED DEPUMPING TO RESERVIOR”.

IR MODULE

Function Name: #define IR (IOPIN0 & (1<<18))
Input: Physical intruders
Output: Buzzer ON

```
if(IR) // Object Detection
{
LcdCmd(0x01); //Shift cursor position to left
 LcdCmd(0x80);
LcdWriteText("OBJECT DETECTED");
delayseconds(1);
IOSET0=(1<<16);                  //LEDOutput
IOSET0=(1<<15);
delayseconds(2); IOCLR0=(1<<16);
IOCLR0=(1<<15);
//Buzzergsmsend();
str_serial_0("OBJECT DETECTED\n");
delayseconds(2);
}
```

This function explains whether any intrusion present in the farm land. If any obstacles in the farm land then IR sensor detects and sends the message as “OBJECT DETECTED”.

V.EXPERIMENTAL RESULTS

User Application

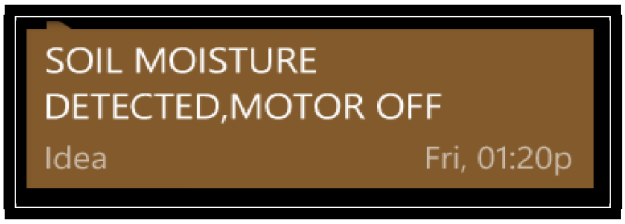

Figure 6.1: Output of Soil Moisture

Figure 6.2:Output of Soil Moisture

Figure 6.3: Output of Water Level Module

Figure 6.4: Output of IR Module

Figure 6.5: Solar Panel

LCD

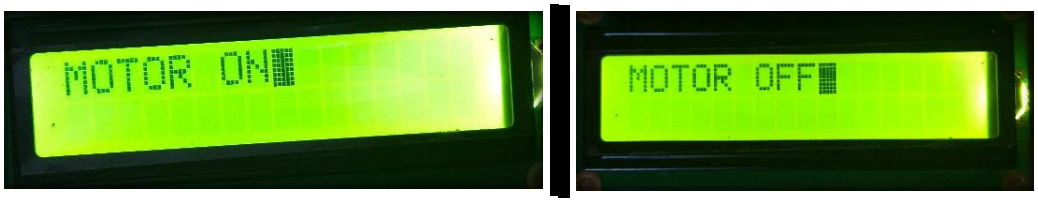

Figure 6.6: Output on LCD

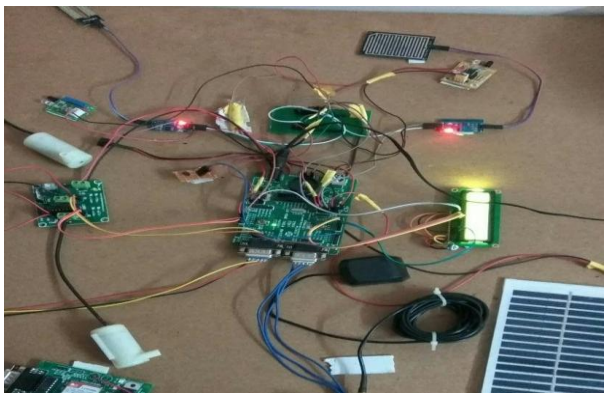

Figure 6.7: Hardware Kit

VI.CONCLUSION

In this system, it provides all kind of help that a farmer needs to know about the crops, start to end process is included in the proposed application where farmers can easily get the information about soil condition, temperature condition and also about solar panel as well as motor. The application proposes new techniques of securing and maintaining the farmland in a better way. It also has cattle tracking where we can track the cattle beyond certain distance. The farmers will get notification about the farm land. There is also a reservoir that is used when there is a heavy rain, excess of water gets stored in that reservoir and used in the future. Farmers can ON and OFF the motor through his android application handheld device. It cures all issues of existing system as it reaches everyone and can be accessible by every farmer.

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