Protection of Crops and Proper Usage of Rain Water with Embedded System Using GSM Technology

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Abstract:

Agriculture is a backbone of our country. About 70% of our country's revenue comes from agriculture. But during heavy rain falls, the farmers face lot of problems because there cultivated crops get washed off or destroyed. So in order to avoid this problem this project is designed which helps if protecting the crops from heavy rainfall and saving that rain water to use it for other purposes. 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 rain and soil moisture sensors and covers the whole field to protect it from heavy rains. Whenever there is rainfall the rain sensor gets activated. The water level in the soil is sensed by the soil moisture sensor. Whenever there is rain, the rain sensor is 'ON' and when the water level in the soil is beyond the normal level then soil moisture sensor is 'ON'. If both the sensors are 'ON' then this information is given to the controller and the GSM. Then the controller indicates the DC motor to run which opens the roof automatically to close the field using a polythene sheet. If there is any problem in opening of the roof, then this is intimated to the farmers thought SMS to their mobile phone using GSM. Then the roof can be opened manually using mechanical roller. In this project, the roof is open automatically when both the sensor is 'ON'. The emerging applications of GSM is used in this system. The power source to this project is supplied through solar power which is a renewable energy.

Index Terms: Rain sensor, soil moisture sensor, PIC microcontroller, GSM, DC motor, polythene sheet, solar panel and battery.

I. INTRODUCTION

In this project we are proposing the system which prevents the spoilage of crops due to heavy rains. This is achieved with embedded system design using GSM technology. The actual concept of this project is protecting the crops from heavy rainfall by covering the field automatically and also to save the collected rain water. In order to achieve this, in this system we use GSM, Rain sensor and soil moisture sensor. We also use renewable energy sources, solar power that is generated from solar panel as the power source to this project.

Then generated power is stored in DC battery. During cloudy season, the power supply is recovered from DC battery. This system mainly works on the sensors, the automatic roof works when both the sensors are ON. Here the auto roof is mainly depending on the rain sensor and soil moisture sensor. As the rain starts the rain sensor is ON also when the moisture of the soil is above normal level then soil moisture sensor is also ON. Then this information is sent to the controller.

The controller sends this information to the GSM and DC motor to run so that the automatic roof gets opened and the field gets covered by the polythene sheet. Then the rain water in the roof is collected to the Water tank. When water scarcity in agricultural field, the collected water is pumped out using sprinkler. In this way the wastage rain water is saved. The collected rain water can also be used for other purposes. Through GSM the farmer gets the intimation that the system has been operated. Therefore, this system helps not only in protecting the crops but also in making use of rain water. The automatic roof can be operated manually through mechanical roller. So whenever there is any fault in the working of the system then the roof can be operated manually.
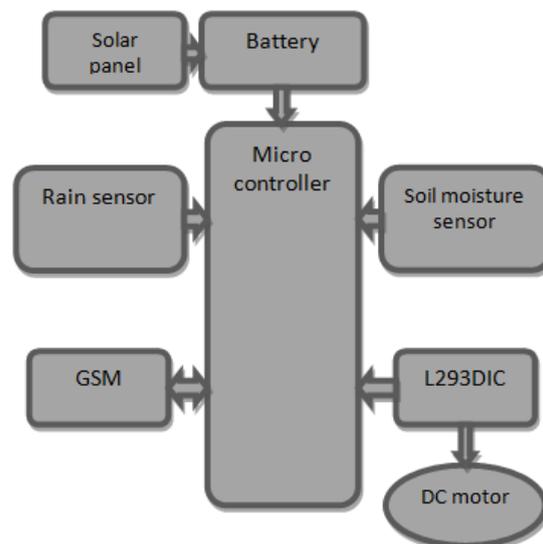
II. SYSTEM ARCHITECTURE

Figure.1. System block diagram

III. HARDWARE DESCRIPTION

1. Microcontroller Unit:

The working of the system is written using program and stored in the microcontroller in its ROM. According to the written program the system operates and do not change its working over the life time until and unless it's program is changed. The architecture and instruction set of the micro controller are optimized to handled data in bit and byte size. The areas if applications of micro controllers include control process, manufacturing process, medicine, instrumentation etc.

2. PIC:

PIC is abbreviated as peripheral interface controller as coined by microchip technology Inc., USA. PIC is a very popular microcontroller worldwide Microchip is the first manufacturer of 8 pin RISC MCU.

Microcontroller Core Features:

- High performance RISC CPU
- Only 35 single word instructions to learn
- All single cycle instructions except for program Branches which are two cycle
- Operating speed: DC - 20 MHz clock input DC - 200 ns instruction cycle
- Up to 8K x 14 words of FLASH Program Memory
  Up to 368 x 8 bytes of Data Memory (RAM)
  Up to 256 x 8 bytes of EEPROM Data Memory
- Pin out compatible to the PIC16C73B/74B/76/77
- Interrupt capability (up to 14 sources)
- Eight level deep hardware stack
- Direct, indirect and relative addressing modes
- Power-on Reset (POR)
- Power-up Timer (PWRT) and
- Oscillator Start-up Timer (OST)
- Watchdog Timer (WDT) with its own on-chip RC
- Oscillator for reliable operation
- Programmable code protection
- Power saving SLEEP mode
- Selectable oscillator options
- Low power, high speed CMOS FLASH/EEPROM Technology
- Fully static design
- In-Circuit Serial Programming□ (ICSP) via two Pins
- Single 5V In-Circuit Serial Programming capability
- In-Circuit Debugging via two pins
- Processor read/write access to program memory
- Wide operating voltage range: 2.0V to 5.5V
- High Sink/Source Current: 25 mA
- Commercial, Industrial and Extended temperature Ranges

3. Solar panel:

The solar panels are made of photovoltaic cells. A photovoltaic cell or a solar cell, is an electrical device that converts the solar energy directly into electrical energy by using the photovoltaic effect, which is a physical and chemical phenomenon. A solar panel is a packed of photovoltaic modules. The operation of a photovoltaic (PV) cell requires three basic attributes:

- The absorption of light, generating either electron-hole pairs
- The separation of charge carriers of opposite types.
- The separate extraction of those carriers to an external circuit.

4. 12 V Battery:

A 12 V Battery is used to store the power generated from the solar panel. This power supply is used to control the whole system unit such as microcontroller, DC motor etc.

5. Rain Sensor:

A switching device which is activated when rain occurs is called rain sensor or a rain switch. Rain sensors for irrigation systems are available in both wireless and hard-wired versions, most employing hygroscopic disks that swell in the presence of rain and shrink back down again as they dry out — an electrical switch is in turn depressed or released by the hygroscopic disk stack, and the rate of drying is typically adjusted by controlling the ventilation reaching the stack. However, some electrical type sensors are also marketed that use tipping bucket or conductance type probes to measure rainfall. Wireless and wired versions both use similar mechanisms to temporarily suspend watering by the irrigation controller — specifically they are connected to the irrigation controller's sensor terminals, or are installed in series with the solenoid valve common circuit such that they prevent the opening of any valves when rain has been sensed

6. Soil Moisture Sensor:

Measuring soil moisture is important for agricultural applications to help farmers manage their irrigation systems more efficiently. Knowing the exact soil moisture conditions on their fields, not only are farmers able to generally use less water to grow a crop, they are also able to increase yields and the quality of the crop by improved management of soil moisture during critical plant growth stages Soil moisture sensors measure the volumetric water content in soil. 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.

7. GSM:

GSM is a device which is used to control or operate appliances from longer range of distances. GSM (Global System for Mobile Communications, originally Groupe Spécial Mobile) is a standard developed by the European Telecommunications Standards Institute (ETSI) to describe the protocols for second-generation (2G) digital cellular networks used by mobile phones. In this system we use 'SIM 300 GSM MODEM' as GSM. Designed for global market, SIM300 is a Tri-band GSM/GPRS engine that works on frequencies EGSM 900 MHz, DCS 1800 MHz and PCS1900MHz SIM300 provides GPRS multi-slot class 10 capability and support the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4. With a tiny configuration of 40mm x 33mm x 2.85mm, SIM300 can fit almost all the space requirement in your application, such as Smart phone, PDA phone and other mobile device. The physical interface to the mobile application is made through a 60 pins board-to-board connector, which provides all hardware interfaces between the module and customers' boards except the RF antenna interface.

- The keypad and SPI LCD interface will give you the flexibility to develop customized applications.
- Two serial ports can help you easily develop your applications.
- Two audio channels include two microphones inputs and two speaker outputs. This can be easily configured by AT command.

8. DC Motor:

Here the DC motor is used to make the roof automatic in opening and closing whenever it rains and when the rain stops respectively. A D.C. motor is a machine that converts D.C. electrical energy into mechanical energy D.C. motor works on the principle that, when a current carrying conductor is placed

in a magnetic field, a mechanical force is experienced on the conductor, the Direction of which is given by Fleming's left hand rule and hence the conductor moves in the direction of force. Fleming's left hand rule states that "If the fore finger, middle finger and thumb of left hand are extended at right angles to each other, then if the fore-finger points towards the direction of magnetic field, the middle finger points towards the direction of current in the conductor, then the thumb will point towards the direction of motion of the conductor. The magnitude of force experienced on a current carrying conductor placed in a magnetic field is given by
F=B.I.L. Newton's

IV. HARDWARE AND SOFTWARE USED

i. Hardware used:
1. Solar panel
2. 12 V Battery
3. GSM
4. Rain sensor
5. Soil moisture sensor
6. DC motor

ii. Software used:
1. Microcontroller.
2. PIC 16F877A

V. ADVANTAGES

- Low power consumption and easy to install.
- Remote monitoring is possible from field to farmer's home
- By automatic control of DC motor, we can reduce power consumption.
- Wastage of water can be reduced.
- High Humidity and temperature can be detected. And controlled.

VI. APPLICATIONS

This can be used in the agricultural fields.
* Controlling moisture of soil.
* Optimising the water usage.
* Temperature control of soil in fields.
* Motor to be ON/OFF.

VII. FUTURE SCOPE

- Detection of soil moisture level can be added to the system
- Control of water usage by using temperature level and humidity level
- This project can be extended for cattle monitoring

VIII. CONCLUSION

- This GSM based agriculture monitoring system serves as a reliable and efficient system for monitoring agricultural parameters.
- The corrective action can be taken and reduce the human power, but it also allows user to see accurate changes in it.
- It is cheaper in cost and consumes less power. The GDP per capita in agro sector can be increased.

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