

Automatic Irrigation using GSM Module and Solar Panel

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Abstract: Most of the Indian people depends on the agriculture and due to that economy of our country mainly depend on the agriculture, so proper irrigation is must for efficient agriculture and accordingly we can improve the economy of our country. we can achieve this with the help of various electronic devices and by using this we can achieve proper irrigation on the field in automatic manner. For automation, we require various hardware and software tools such as various kinds of sensors for checking the status of field and GSM module for wireless communication and the microcontroller along with DTMF IC for decision purpose.

Keywords: Automated Irrigation system using GSM, Sensors, Microcontroller, Dual Tone Multi Frequency (DTMF).

I. INTRODUCTION

The process of artificially supplying water to the land where the crops are cultivated is known as irrigation. Traditionally in dry regions where the rainfall is negligible then another way of providing water to the crops is through canals, pumps etc. But it increases the work-load on the farmer and thus reduces the effective yield of field. Thus, there was a need of testing the soil condition before supplying water to the crops which helps in increasing the effective yield of agricultural field. With the help of advancement in the field of technology, it is possible to design systems which eliminate the direct involvement of farmer with respect to the irrigation of their fields. Technologies are developed to that extent that entire irrigation systems can be automated by the use of systems which can control the motors that irrigate the fields.

Thus, a GSM based irrigation system is used to provide automation of agricultural field. A GSM based Irrigation system has two major parts, primary being the GSM and secondary is the microcontroller. GSM (Global System for Mobile Communication) is a standard set which is used to describe the protocols for digital cellular networks. GSM is used for controlling the irrigation on field and also sending the results to the farmer via SMS to a mobile device which indirectly controls the entire farm irrigation system. The microcontroller works as a central unit of the system and its function is to automate the process after it has been initiated by the GSM module and then finally presents the output to the device.

II. PROPOSED MODEL

Firstly, we are providing supply voltage with solar plates which is regulated with the help of voltage regulator IC 7805 as it is shown in fig.(a). Indicator which is usually a LED will indicate whether the circuit is in ON/OFF condition. Moisture sensor will detect the moisture content from the soil and provide the output in both analog and digital form as well. DTMF IC is basically a dual tone

multi-frequency IC which is used for recognizing the sequence of DTMF tones from the standard keypad of mobile phone.

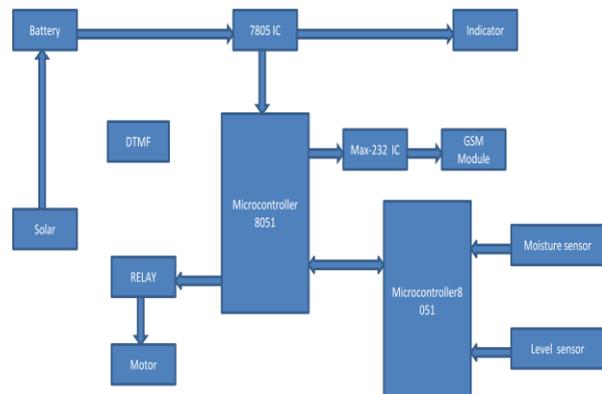


Fig: Block Diagram of Model

GSM is connected to the microcontroller with the help of MAX 232 IC or UART. It provides the serial communication between microcontroller and PC for the programming purpose. Level sensor is used as water level detector in the water tank. Relay is used as a switch for connecting the motor or a pump. Microcontroller will control the switching ON and OFF of motor depending upon the conditions detected by the respective sensors.

III. COMPONENTS USED

A. Solar Panel: Solar panels are basically solar cells which convert light energy from sun into electrical energy. This converted electrical energy is stored in battery and then it is available for user applications. The most commonly used material in solar panel is silicon crystal. As we know, when light energy or photons from sun strikes these silicon crystals the electrical energy (DC) is generated. The Ratings of solar panel used is 18 volts and 23 watts.



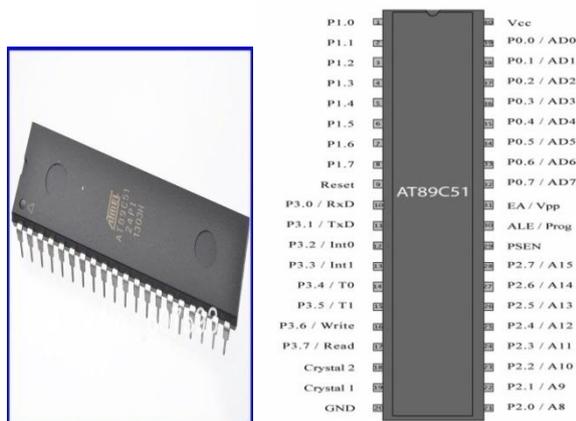
Fig; solar panel

B. Battery: Battery used in this project is Lead Acid Battery and the Rating of this battery is 12volts and 7.2AH. The main purpose of battery is to store the DC supply from the solar panels.



Fig; Battery

C. Microcontroller AT89C51: Microcontroller is the major part of this project and hence it is also called as the heart of the project. AT89C51 is an 8 bit microcontroller which belongs to Atmel's family of 8051 microcontrollers. It has 4kb of flash memory which is programmable and erasable read only memory (PEROM) and also comprises 128 bytes of RAM. This microcontroller can be erased and programmed to a maximum of 1000 times, hence it is suitable for not programmers. AT89C51 microcontroller has 40 pin IC which consist of four ports denoted as P1,P2,P3 and P0. These ports of AT89C51 are bidirectional ports i.e. input-output ports. AT89C51 has inbuilt UART for serial communication and has two timers and hardware interrupts, it has total of six interrupts.



Fig; AT89C51 IC Fig; Pin Description

D. GSM: GSM stands for global system for mobile communication. GSM network operates in the frequency range between 900 to 1800 MHz. These frequency bands

vary from different countries. GSM has various features such as SIM (subscriber identity module) support which is used to send and receive SMSs and calls. We can use GSM of frequency 900 MHz for this project to send and receive the status of the field.



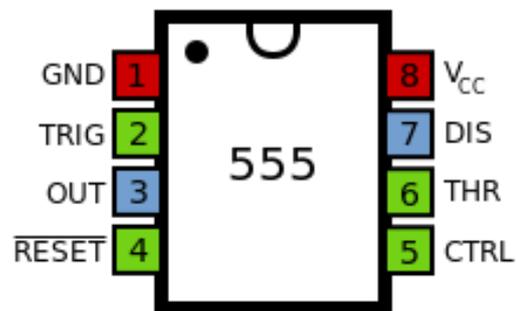
Fig; GSM module

E. Crystal Oscillator: Crystal oscillator is an electronic oscillator circuit which is used to provide a stable clock signal for digital integrated circuits. It also stabilizes frequencies for radio transmitters and receivers. The working principle of crystal oscillator is based on piezoelectricity and resonance. Crystal oscillator used in this project provides a clock of frequency 11.0592 Mhz.



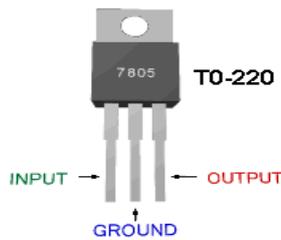
Fig; crystal oscillator

F. IC555: The IC 555 is a timer integrated circuit which is used in a variety of timer, pulse generation, and oscillator applications. The IC555 timer can also be used for providing time delays, as an oscillator and as a flip-flop element. Thus, IC555 is also known as timer IC. It is a 8 pin IC as described in the figure below.



Fig; IC555 Pin diagram

G. IC7805: IC7805 is a voltage regulator integrated circuit. IC7805 is a member of 78XX family of integrated circuits. This IC is used to provide a regulated voltage supply of 5volts to the other circuit elements of the PCB. IC7805 is a 3 pin IC which consist of input, output and ground pin respectively.



Fig; Pin diagram of IC7805

H. Relay: A relay is defined as a electrically operated switch. Typically most of the relays use electromagnet to operate a switch mechanically. Relays are usually used at a place where several circuits are controlled by one signal. The first relay used is used as an amplifier which repeated the signal coming from it and re-transmitted it on another circuit. Relay was widely used in telephone exchanges and early computers to perform logical operations. In this project we are using relay in order to control the operation of motor.



Fig; Relay

I. Motor: A DC motor is a rotary device which converts the electrical power into mechanical power. The most common types of motor depend on forces produced by the magnetic field. All types of DC motor has some internal mechanism which is either electromechanical or electronic in order to change the direction of current flow in the part of motor. DC motors are available in two types: Brushless DC motor and DC motor with Brush. Brushless DC motors are more efficient than as compared to brushed DC motors as they require less maintenance as compared to brushed DC motors. In this project we are using 12 volt DC water cooler motor to draw water from the water tank and supply it to the irrigation fields.



Fig; DC 12 volt water cooler motor

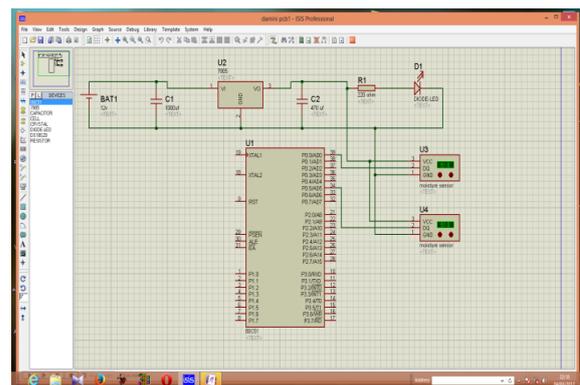
J. Soil Moisture Sensor: Soil moisture sensor is used to detect the water content of the field. Soil moisture sensor has four input ports namely Vcc, Gnd, A0 and D0. Here,

‘A0’ denotes the analog output of moisture sensor, ‘D0’ denotes the digital output of moisture sensor, ‘Vcc’ port is the supply pin which is used to provide 5 volts power supply to the moisture sensor.

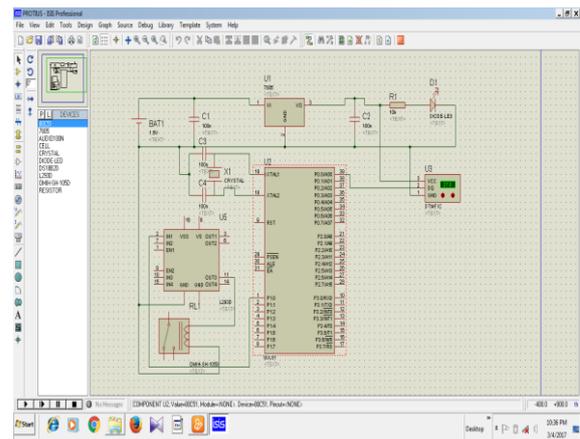


Fig; Soil moisture sensor

IV. CIRCUIT DIAGRAM



Fig; Circuit Diagram 1



Fig; Circuit Diagram 2

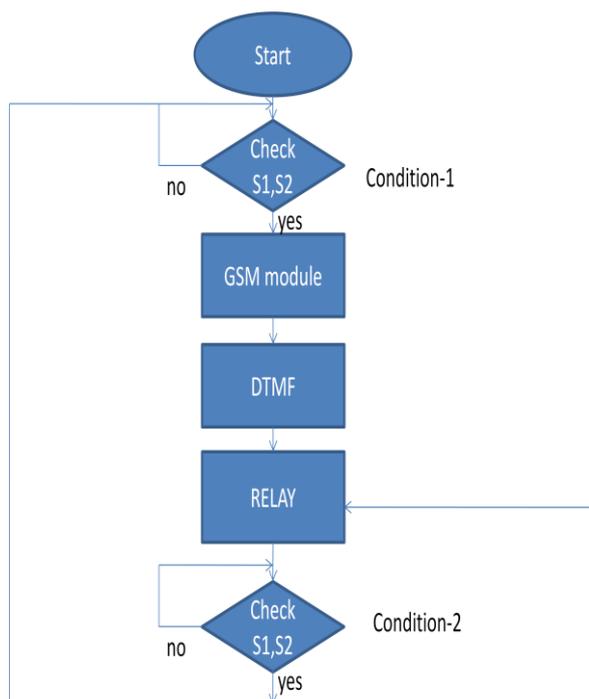
V. WORKING

Firstly, the power is supplied to initialize the circuit and sensors. Sensors provide their output to the microcontroller. Microcontroller checks for the following conditions whether the soil is in dry condition and water tank is full, if this condition is met then it sends the information to the user about the field condition through GSM module otherwise not. Then user provides the control signal to ON the motor by calling at the mobile number provided at the GSM module, which is auto received by the help of DTMF (dual tone multi-frequency) IC. As soon as the call is received, microcontroller turns on the motor through relay switch to supply the water to



the field. It continues the irrigation until the condition that soil is in wet condition is met. The microcontroller is programmed to continuously evaluate the output data from the respective sensors. The motor will not be turned on in the condition when the water tank is empty and even though the soil is in dry condition. So, for this system farmer has to take care that water tank is completely filled with water to perform automatic irrigation because running motor without load will definitely damage it. Thus, automatic and effective irrigation can be performed with the help of this project.

VI. FLOW CHART



Advantages:

- There is no power issues in this project since we are using solar energy which is a renewable energy resource.
- Water is saved through this project and productivity is also increased.
- Time and labor cost of farmer has also been reduced to great extent.
- Modifications can be made in the circuit depending upon the requirements of the farmer.

Disadvantages:

- It is not applicable for fields which are larger in size.
- Initial cost is high.

Applications:

- It is used for effective irrigation of the fields by providing water to the fields automatically according to the information from installed sensors.
- This project is very efficient for Paddy, Rice fields.

VII. CONCLUSION

An irrigation controlling circuit is designed using GSM module and Microcontroller powered by solar panels to help the farmer and thus increasing the agricultural economy of the country. The system is used to control the supply of water to the crops depending upon the moisture content of the soil and the water level in the tank sensed by the moisture sensor and level sensor respectively.

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BIOGRAPHIES



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