

# Automatic Irrigation System on Sensing Soil Moisture Content Using PV and GSM

**Rohith Chilumula**

Dept. of Electrical & Electronics Engg.  
CVR College of Engineering  
Hyderabad, India  
rohith.chilumula@gmail.com

**Rahul Peddibhotla**

Dept. of Electrical & Electronics Engg.  
CVR College of Engineering  
Hyderabad, India  
rahulpeddibhotla@gmail.com

**Abstract-** Agriculture and Gardening works are not trivial. There is a wide range of crops and plants and many varieties of each plant or crop. Various plants and crops have different requirements for water, fertilizers and sun. Soil ripeness for any strain or planting society is for the most part made a decision by the level of supplements and dampness in it. Various occasions and nursery workers are not ready to sustain the dirt with enough compost or water, while ordinarily just you do it. This undertaking is to encourage ranchers and nursery workers keep up control of the dirt dampness level.

**Keywords-** Arduino, GSM module, Moisture Sensor, Solar Panel, Irrigation System, Relay etc.

## I. INTRODUCTION

Sunlight based vitality is the most plenteous wellspring of vitality around the globe. Sun powered vitality isn't only a response to the present vitality emergency, yet additionally a type of vitality that regards the earth. Photovoltaic generation is an efficient use of solar energy approach.

Sun oriented boards (a progression of photovoltaic cells) are generally utilized today to chip away at road lights, to bolster water warmers and cover residential burdens. The expense of sun oriented boards is consistently declining, empowering their utilization in different segments. An utilization of this innovation is utilized in water system frameworks for farming. The sun oriented vitality water system framework can be a feasible option for agriculturists in the ebb and flow condition of the vitality emergency in India.

This is a way of producing green energy that provides energy for free when the initial investment is made. The irrigation system is a misleading water supply experimental method to the area or soil that is the main base of our crop system. Water must be supplied mainly to fields or through ditches. This system should reduce the workload of the farmer and contribute to maintaining adequate soil quality for better growth. From that point on the advancement of development was possible that they executed the units delineated the prompt addition of worker ranchers water system in their fields.

These machined frames of the entire engine irrigation system that flooded the fields. A framework of irrigation based on GSM has two significant advances behind, the "GSM" optional and being essential is the controller or processor. GSM (Global System for Mobile

Communications) is a standard used to speak to automated cell meeting frameworks.

The irrigation system in the field and sending the results to the agricultural producer with coded indications for a cell phone, which implicitly controls the entire irrigation system irrigation system. The processor or controller acts as the focal point for the robotic work process after it was released by the GSM based finally highlights the progress of the gadget.

## II. IRRIGATION SYSTEM

Irrigation is the artificial application of water to the ground or soil. It is utilized to help develop farming yields, finishing and drying of brutal soils in dry situations and amid times of insufficient precipitation. Notwithstanding, the general water system situation is described by poor execution, expanded interest for expanded agrarian efficiency, lessened water accessibility for agriculture, increased soil salinity and the possible effects of global warming and climate change. Later, because the dried crops. Water deficiencies can be unsafe to plants before noticeable consumption happens. The moderate development rate, the heaviness of natural products is the lack of lighter light water.

This issue can be explained in the event that we utilize a completely flush Arduino programmed water system framework where water system happens just when there is a solid requirement for water. The venture utilizes a DHT sensor to keep a dampness follow and a moistness sensor to record mugginess. The system automatically checks a water pump that can be activated via SMS in response to real-time alert. Once the water pump is connected via SMS, it automatically turns off after

reaching the appropriate humidity level. The rancher or guardian can likewise disengage the water pump between sending a SMS or an undertaking manual task interface. This framework determines the intensity of sunlight based vitality through photovoltaic cells. In this way, there is no requirement for uneven exchanging power reliance.

### III. DESCRIPTION OF COMPONENTS

Following are the major components used from which Automatic irrigation system has been fabricated.

- Arduino UNO
- GSM SIM module
- DHT11 humidity sensor
- 12v Relay
- BC 547 transistor
- Voltage Regulator- 7805 and 7812
- Solar panel
- Battery

#### 1. Arduino UNO

Arduino UNO Arduino Uno is a microcontroller dependent on the (detail) Atmel ATmega328. It has 14-stick advanced information sources/yields (6 of which can be utilized as PWM yields), 6 simple data sources, 16 MHz reverberation earthenware production, a USB connector, a power connector, an ICSP and a reset catch. It has each and everything mandatory to support the microcontroller; Just you have to connect it to your computer using a USB cable or connect an AC adapter or DC source. This driver does not utilize the FTDI USB sequential chip, rather it's ATmega16U2 (Atmega8U2 to R2), modified as a USB port converter.

Variant 2 plate obstruction by pulling the line 8U2 HWB edge, encouraging their situation in DFU mode. Check the tab 3 has the accompanying new highlights: Pin 1.0: The ASD and SCL pins are situated beside the Are stick and two new screws situated close to the reset IOREF enable you to change the objective's predetermined voltage. In future drives will be compatible with the card using AVR, which works with Arduino 5V and the reason that works with 3.3V. The second has nothing to do with the contact, or, in other words future purposes.

"Uno" implies one Italian and is called to check the expected arrival of Arduino 1.0. Uno and adaptation 1.0 will be the reference forms of Arduino, pushing ahead. For examination with past forms, see the record on Arduino. Each ATmega328 has 32 KB (with 0.5 KB utilized for bootloader). It likewise has 2 KB of SRAM and 1 KB of EEPROM (which can peruse and keep in touch with the EEPROM library). Arduino Uno can be controlled by means of a USB association or an outside power source. The power source is automatically selected (non-USB) External power can come from a

DC AC adapter (wall wart) or battery. The adapter can be connected by inserting a 2.1 mm positive centre connector into the paper feed connector. The second has nothing to do with the contact, or, in other words future purposes. "Uno" implies one Italian and is called to check the expected arrival of Arduino 1.0. Uno and adaptation 1.0 will be the reference forms of Arduino, pushing ahead. For examination with past forms, see the record on Arduino. Each ATmega328 has 32 KB (with 0.5 KB utilized for boot loader). It likewise has 2 KB of SRAM and 1 KB of EEPROM (which can peruse and keep in touch with the EEPROM library).

Arduino Uno can be controlled by means of a USB association or an outside power source. On the off chance that more than 12V, the voltage controller may overheat and harm the board. The prescribed range is 7 to 12 volts. The power pins are as per the following:

**1.1 VIN**-Input electrical vitality to the Arduino board when by means of a fringe control supply (not at all like 5 volt USB or other controlled power supply).

**1.2 5V**-This stick yields a 5V controller set on the plate. The plate can be controlled by the DC control connector (7-12 V), the USB connector (5V) or the VIN (7-12V) stick plate. Power supply between pins 3.3V or prevents 5V regulator, and can damage our board. I do not recommend.

**1.3 3.3V**-A power supply 3.3V generated by the controller board. The maximum current is 50 mA.

**1.4 GND**-Pin of earth.

**1.5 IOREF**-This Arduino pin card provides the reference voltage to the operating microcontroller. A legitimately arranged shield can peruse IOREF stick voltage and select the fitting force source or empower live yield transducers to work with 5V or 3.3V. An ATmega16U2 on the board channels of this sequential correspondence by means of USB and resembles a virtual programming port on the PC.

The firmware 16U2 utilizations standard USB COM drivers, and no outer drivers are required. In any case, in Windows, an inf document is required. The Arduino programming incorporates a sequential screen that permits basic information sent to and from the Arduino card. The RX and TX LED squints when the information is transmitted through the sequential USB chip and USB association with the PC (however not for sequential correspondence on pins 0 and 1).

Software Serial library permits sequential correspondence on one of the advanced pins of one. The ATmega328 likewise bolsters I2C (TWI) and SPI. The software includes an Arduino wire library to simplify the use of the I2C bus. For SPI communication, use the SPI library.

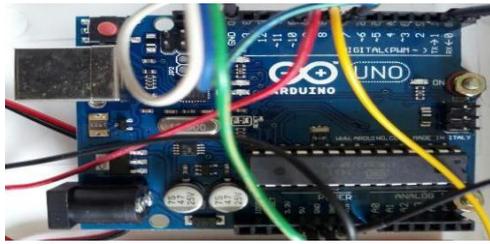


Fig.1 Arduino UNO Board.

## 2. GSM Module

GSM acronym Global System For Mobile Communications. This is an arrangement of measures created by the European Telecommunications Standards Institute (ETSI) to portray conventions for second era advanced cell systems (2G) utilized by cell phones. A modem is a gadget that tweaks and demodulates the signs as expected to meet the correspondence prerequisites. Regulates a simple transporter flag to encode computerized data and demodulates the information transmitted to interpret said bearer flag. A GSM modem is a gadget that tweaks and demodulates signs and GSM in this specific case the 2G signals.

The modem we are utilizing is SIMCOM SIM300. It is a three-band GSM/GPRS modem, as it very well may be distinguished and worked at three frequencies (EGSM 900 MHz, DCS 1800 MHz and PCS1900 MHz). Working frequencies are EGSM and DCS 900MHz 1800MHz. GSM innovation has developed such a great amount of that there is actually no place on the planet where there is no GSM flag.. In this scenario, GSM provides a wide range of things to remotely control from anywhere with your fingertips. GSM also provides the ease of communicating more robust.

SIM300 GSM module can be utilized to send and get SMS by interfacing it to a PC when a SIM card is embedded. The GSM modem can send directions to send or get SMS from PC by means of a COM (sequential or USB) port. These directions are called as AT directions. Through the AT directions you can play out a few activities like sending and getting SMS, MMS, and so forth.

The Sim300 has a RS232 interface and this can be utilized to speak with the PC. The Sim300 typically keeps running at 9600 baud, 1 bit stop, no equality, no equipment control, and 8 Data Bit. Sim300 is widely used in many designs and therefore many developmental variants of these plates have been developed. These development boards come with several features to facilitate communication with the SIM300 module. Some motherboards give just the TTL interface, while a few cards incorporate a RS232 interface and some others incorporate a USB interface. On the off chance that your PC has a sequential port (DB9) you can purchase a GSM

modem with the TTL and RS232 interface financial matters. The sim300 GSM module utilized here comprises of a TTL and a RS232 interface. TTL interface enables you to interface specifically with a microcontroller while the RS232 interface incorporates a MAX232 IC to permit correspondence with the PC.



Fig.2 GSM Module.

## 3. DHT11 Humidity Sensor

The DHT11 sensor is supplied in a four-wire package of one line and works with a power supply of 3.5 and 5.5 V. The temperature of 0-50 ° C can be measured with a precision of  $\pm 2$  ° C and Relative humidity between 20-95% comprised between with a precision of  $\pm 5\%$ . The sensor provides fully calibrated measurements for the two digital outputs. It has its own owner protocol thread 1, and therefore communication between the sensor and the microcontroller is not possible through a direct interface with any of its peripherals. The protocol must be implemented in the firmware of the MCU with the exact time required by the sensor.

The accompanying planning charts depicting the information exchange convention among MCUs and the DHT11 sensor. The MCU begins information transmission by issuing a "Begin" flag. The MCU stick must be set as yield for this reason. The principal low-MCU drag line for somewhere around 18 ms and after that removed for 20-40 ms before discharging. At that point, the sensor reacts to the MCU begin motion for 80 ms, trailed by a high rationale flag additionally endures 80 ms. Keep in mind that the MCU stick must be designed to enter in the wake of finishing the "Home" sign.

When the flag sensor is identified, the MCU must be prepared to get information from the sensor. The sensor sends 40 bit (5 bytes) persistently information on the information line. Note that amid the byte transmission, the sensor sends the most huge piece. Information (40 bits) = full bytes of RH + decimals RH byte + full bytes of Temp + Decimal Temp Byte + Checksum Byte For DHT11 sensor, decimal decimals of temperature and mugginess estimations are constantly zero. Therefore, the first and third bytes of received data actually provide the numerical values of relative measured

humidity (%) and temperature (° C). The last byte is the byte checksum that is used to ensure that data transfer is verified without any error. If all five bytes are correctly transferred then the byte checksum must be the same for the last 8 bits of the sum of the first four bytes, that is,

$$\text{Checksum} = \text{last 8 bits (byte integer RH + decimal RH + byte Total Temp Bytes + Decimal Temp Bytes)}$$

Now let's talk about the most important thing, which is the signalling for the transmission of "0" and "1". To send a data bit, the first low-sensing strip for 50 ms. Then it raised the line for 26 to 28 ms if you have to send "0", or 70 ms if the bit to be transmitted is "1". So is the width of the positive pulse that carries information about 1 and 0.

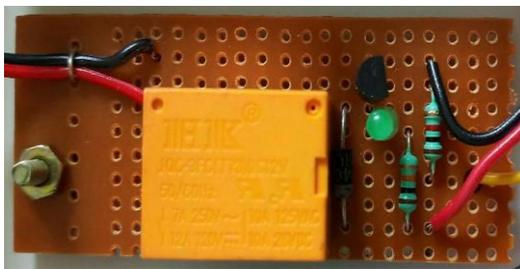


Fig.3DHT11 Humidity Sensor.

#### 4. Relay

The relay is used to electrically isolate two circuits and connect them magnetically. Allow a circuit to change another while they are completely separate. They are often used to connect an electronic circuit (low voltage) to an electrical circuit that operates at a very high voltage. For example, a relay can create a 5 V battery circuit for a 230 VAC circuit switching network so a small sensor circuit can, for example, a fan or an electric bulb. A relay switch can be divided into two parts: input and output. The input section has a generator coil magnetic field when a small voltage is applied by an electronic circuit.

This voltage is called operating voltage. Common relays are available in different operating voltage configurations such as 6V, 9V, 12V, 24V and so on. The output section is relays connected mechanically or unplugged. Three relay contacts normally open (NO), normally closed (NC) and common (COM) are present in the relay base. When no voltage is applied through the relay, NC is connected to COM. When the operating voltage is applied, the relay coil energizes and changes the NO COM contact. Various configurations are available as SPST, SPDT, DPDT, etc. relays, which have a different number of switching contacts. Using the correct combination of contactors, the electrical circuit can be switched on and off.

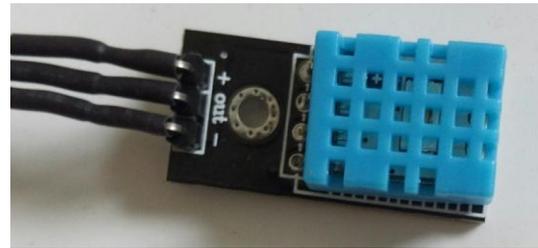


Fig.4 12V Relay Circuit.

#### 5. Solar Panel

Photovoltaic modules are photovoltaic array of a photovoltaic plant that generates and supplies solar electricity in commercial and residential applications. Each module is classified by standard test output current (STC) conditions, typically between 100 and 365 watts (W). The efficiency of a module determines the area of a module with the same nominal power - efficient 230W module 8% will have twice the area of a 230W module with a yield of 16%. There are some commercially available solar module efficiencies over 22% and are supposed to exceed even 24%.



Fig.5 Solar Panel.

#### 6. Battery

Lead batteries, also known as SLA batteries, are used for a wide variety of applications. These batteries are all rechargeable, fully sealed and maintenance-free; There is no need to maintain water levels. These SLA batteries are commonly used in backup power sources. Many of our customers buy them for use in Uninterruptible Power Supply Units (UPS).



Fig.6 4V Lead Acid Rechargeable Battery Connected in Series.

#### IV. BLOCK DIAGRAM

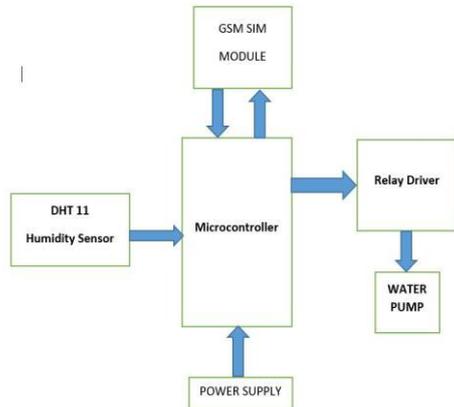


Fig.7 Block Diagram (Power supply consists of three 4V lead acid batteries connected in Series to give 12V supply).

The basic blocks of this system is as shown in the block diagram in figure 1. The above block diagram consists of the controller, sensor, pump and the power supply. The controller is the one which monitors the entire system. The sensor senses the environment and sends the appropriate values to the controller. The controller checks for the received values. If the values have reached a certain threshold then the controller will take certain actions based upon the algorithm provided. Here GSM module block is used for send and receive message to the user.

Power supply block consists of the element which provides the energy to run the controller, sensor and pump. DHT 11, Humidity Sensor, Microcontroller, Relay Driver Water Pump, GSM Sim Module, Power Supply Here in this prototype we use Arduino as the controller as it is very reliable and user friendly. The software required is the Arduino IDE application.

It is used as the interface between the Arduino and the user. It also requires the knowledge of simple c programming which is used as the language to program the Arduino. We also use DHT11 (temperature and humidity sensors). The heart of this system is the Arduino microcontroller. Temperature, humidity sensors are interfaced to Arduino. It consists of the relay module. Whenever an AC load is to be turned ON/OFF just we simply send the SMS to the GSM and control signals from Arduino are given to the relay module to controls the AC load actions. The water pump is used to pump water.

#### V. RESULTS

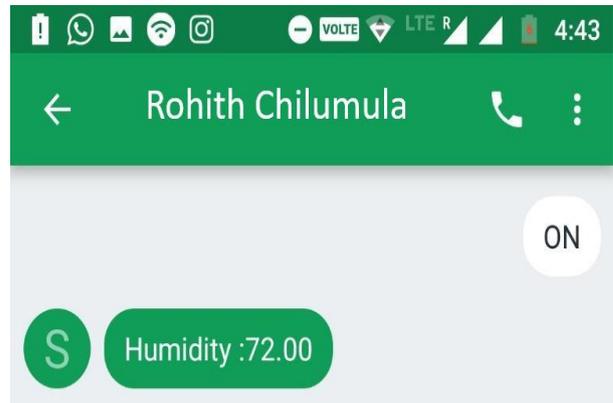


Fig.8. (On sending “ON” SMS message to the system, it gets ON and sends the data of humidity content. It starts the water pump if the humidity is less than the threshold value which is set as 80RH. The system automatically switches off the pump if the humidity rises beyond threshold value).



Fig.9 (We can switch OFF the system any time by sending a SMS message “Device OFF”).



Fig.10 (The device gets switched OFF and sends the confirmation message).



Fig.11 The Whole Setup.

## VI. FLOW CHART

The system automatically checks a water pump that can be activated via SMS in response to real-time alert. Once the water pump is connected via SMS, it automatically turns off after reaching the appropriate humidity level. The farmer or caregiver can also disconnect the water pump between sending an SMS or a project manual operation interface. This system derives the power of solar energy through photovoltaic cells. Therefore, there is no need for uneven trading power dependency.

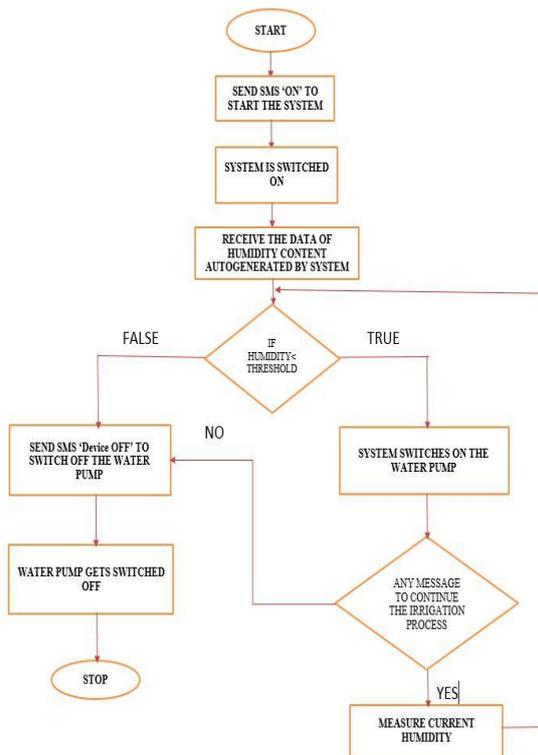


Fig.12 Flow Chart.

## VII. CONCLUSION

There is an urgent need for a system to facilitate the agricultural process and the burden on farmers. With the recent advancement in technology, India has been increasing its production of annual crop production, a completely-centric economy. The ability to conserve natural resources and give impetus to superb agricultural production is one of the main goals of setting up this technology in the country's agricultural sector. To save the farmer's fatigue, water and time were the most important consideration. Therefore, systems must be designed to provide this efficient functionality by using sensor networks, sprinklers, GSM, SMS technology.

For a long time, the field of hardware is prospering and has caused awesome effect the people. The venture will be executed as a programmed water system strategy and has awesome potential for future advancement. The task can be stretched out to nurseries where manual checking is uncommon and uncommon. The standard can be reached out to make completely robotized patio nurseries and farmland. Joined with the rule of water gathering, it could prompt extraordinary water reserve funds whenever connected in the correct way.

On farmland with extreme lack of rain, this model can be effectively connected to accomplish extraordinary outcomes with most sorts of soil. By developing an intelligent wireless sensor and using techniques coming from a farmer can increase your profit by solving various problems faced by agriculturist. The task of the undertaking above essentially relies upon the yield of the moistness sensors.

At whatever point you require overabundance water in the coveted field (paddles), at that point you won't have the capacity to utilize sensors innovation. To do this we need to take DTMF innovation. Utilizing this we can water the coveted field and the coveted amount. Advance we can likewise join a smoke sensor to avert fire in the fields. The smoke sensor will detect the smoke or discharge and will begin shining water through Rain gun or funnels We can use the concept of solar tracking to make our solar panel, a solar tracker which will track sunlight and increase efficiency of system by giving more output.

Table 1 Specification of Arduino UNO.

Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14(of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328)
EEPROM	1 KB (ATmega328)
Clock speed	16 MHz
Length	6.86 mm
Width	5.34 mm
Weight	25 gram
Data Retain	20 year

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Lots of efforts have been taken in this project. Be that as it may, it would not have been conceivable without the kind help and help of numerous people and associations. I might want to stretch out my genuine on account of every one of them. I am profoundly obligated to Dr.R. Vijay for his direction and consistent supervision. I might want to offer my thanks towards my folks and staff of CVRCE for their kind co-activity and consolation that helped me a considerable measure in consummation of my venture. My thankfulness additionally goes to my partner in building up the venture and individuals who have readily bailed me out with their capacities.

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