Automatic Smart Irrigation System UsingGSM

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***Abstract* — The traditional irrigation system involves most manual labor, intensive tasks, farmers usually work on large portions of land to grow different type of crops. Agriculture depends a lot on the source and supply of water and thus becomes a major issue in places which rely solely on the monsoons as their primary source of water, since the monsoons are not evenly distributed all over the country every year. In such cases, the scheduled watering of the crops can get hampered and that might in turn hamper the quality and quantity of crops produced. To overcome thus problem, an automatic irrigation system using Arduino and monitoring the farm field by using message alert. Depending upon the level of soil moisture content, the system supplies the water to a farm field by sensing the soil moisture when the water level goes down the motor automatically stops, sends the notification of a farm field to the farmers. This helps in irrigating the field even during night time, so does not require the farmer to switch on motor manually. However, in this paper our aim is to propose a low cost, sustainable solution to the problem of water supply in indoor cultivation, farm and agricultural field.**

Keywords: *Soil Moisture Sensor, Arduino, Current Sensor, Rain Sensor, GSM.*

I. INTRODUCTION

Proper irrigation is an important feature for giving healthy crops. India is a country where plantation is considered as the center of economic revenue. Moreover, the variation of climate changes, ancient and inefficient farming technique end up with improper harvesting. To keep pace with the population growth and subsequent. The in-demand agriculture techniques have to be smart and advanced. As we are stepping into a world of automation, the work load of the farmers can be reduced by replacing the traditional system with automated system of watering the plants according to its need.

This system will be used for every crop with their respective required moisture levels pre-programmed in the microcontroller. Here an Arduino board has been programmed to sense the moisture level of the soil. When the moisture level of the soil drops below a definite level pre-defined in the Arduino the system will be activated automatically and the plants will be watered. The system is also helpful in saving water as the system supplies water to the crop or the plant concerned, when needed.

The setup includes GSM(Global System for Mobile Communication) technology to establish a communication link with the farmer about the soil and crop conditions automatically. Rain Sensor is a tool used for sensing rain. A rain board that detects the rain and a control module which compares the analog value and convert it to a digital value. The rain-board module consists of copper tracks, which acts as a variable resistor. Its resistance varies with respect to the wetness on the rain board.

The ACS712 module that is current sensor uses the famous ASC712 IC to measure current using the Hall Effect principle. This modules outputs analog voltage(0-5V) based on the current flowing through the wire.

II. LITERATURE SURVEY

The humidity and the soil moisture sensors are placed in the root zone of the plant. The microcontroller controls the supply of water to the field. This system does not inform the farmer about the field status i.e., whether the pump is ON or the pump is OFF. This system was proposed by Archana and Priya (2016) [1] . The second system derives power from sunlight through photo-voltaic cells. This system does not depend on the electricity. The soil moisture sensor has been used and based on the sensed values PIC microcontroller is used to turn ON/OFF the pump. This system was proposed by V. R. Balaji and M. Sudha(2016) [2]. Soil parameters such as pH, humidity,

moisture and temperature are measured for getting high yield from soil. System is fully automated which turns the motor pump ON/OFF as per the level of moisture in soil. The current field status is not informed to the former. This system was proposed by Sonali D. Gainwar and Dinesh V. Rojatkar (2015) [3] .

III. Hardware Review

Arduino:-

Arduino is an open hardware development board which depends on a microcontroller that makes installed programming a lot simpler than conventional strategies. The reason for choosing Arduino is:-

1) Arduino is easily available in market and hence it is useful and cheap.
2) Multi-platform software and simple.
3) Open source and extensible hardware.

The microcontroller (ATMEGA328P) specifications are as mentioned below:-

1) Operating Voltage:- 0-5V
2) Input Voltage Performed:- 7-20V
3) I/O Digital Pins:- 16 (6 Provides PWM O/p)
4) Analog I/P Pins:- 6
5) Clock Speed:- 16MHz
6) Flash Memory:- 32Kb
7) Powered by:- USB Cable or external 9V Battery.

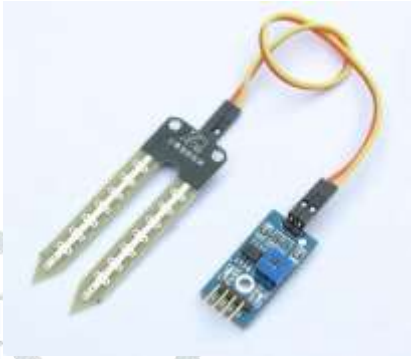
Fig:- Arduino Uno Board

Sensors Overview:-

1) Soil Moisture Sensor:-

The soil moisture sensor is used to measure the volumetric content of water. The two probes allow the current to pass through the soil and then it gets the resistance value to measure the moisture value. The soil moisture sensor consist of two conducting plates which functions as probes. When there is more water, the soil will conduct more electricity which means that there will be less resistance. Therefore, the moisture level will be higher.

Similarly, dry soil conducts less electricity. When there will be less water, then the soil will conduct less electricity which means that there will be more resistance. Therefore, the moisture level will be lower.



2) LCD (Liquid Crystal Display):-

The liquid crystal display is a fled- panel display which is based on the light modulating properties of the liquid crystal. Liquid crystals do not emit light directly,[1] instead using a backlight or reflector to produce images in color or monochrome. LCDs are available to display arbitrary images(as in a general-purpose computer display) or fixed images withlow information content, which can be displayed or hidden, such as preset words, digits, and seven-segment displays, as ina digital clock. They use the same basic technology, except thatarbitrary images are made from a matrix of small pixels, while other displays have larger elements. LCDs can either be normally on (positive) or off (negative), depending on the polarizer arrangement. In our system, 16X2 LCD will be used.

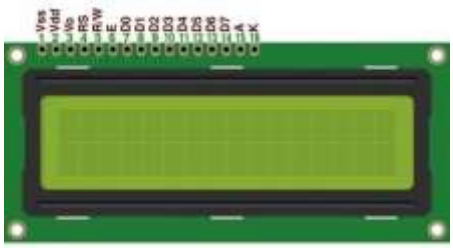


Fig:- 16x2 LCD Display

3) Current Sensor (ACS712):-

In our system, we are going to use ASC712 current sensor.

ACS712 Module measures both Ac and Dc current. It provides isolation from the load. Easy to integrate with the MCU, since it outputs analog voltage.

This sensor operates at **5V** and produces an analog voltage output proportional to the measured current. This tool consists of a series of precision Hall sensors with copper lines.

ACS712 Current Sensor is the sensor that can be used to measure and calculate the amount of current applied to the conductor without affecting the performance of the system. .

Fig:- ACS712 Current Sensor

4) Rain Sensor:-

Rain sensor is used to detect the rain and accordingly it detects the rain. System will work working voltage for rain sensor is 5v. Potentiometer adjusts the sensitivity. Antioxidation and anti -conductivity with long use time are its few advantages.

The rain sensor works on the principle of total internal reflection. An infrared light beam at a 45-degree angle on a clear area of the windshield from the sensor-inside the car. When it rains, the wet glass causes the light to scatter and lesser amount of light gets reflected back to the sensor.

Fig:- Rain Sensor

5) GSM Module:-

In our project, we are going to use SIM 800C GSM Module. SIM 800C is a quad band GSM module that works on frequencies 850/900/1800/1900 MHZ. SIM 800C features GPRS multi-slot class 10 / class 12 (optional) and supports in GPRS coding schemes CS-1 to CS-4.

It is a cellular communication module. It stands for Global System for Mobile Communication. GSM Module consists of mobile station, Base station and N/W subsystem. Here the GSM module is used to send SMS alerts and also helps the user to manually override the system.

Fig:- GSM Module SIM 800C

6) Relay Module:-

This is a 5V, 10A 2 channel relay interface board. It can be used to control various applications and other equipment's with large current . It can be controlled directly with 3.3V or 5V logical signal from a microcontroller.

Here the relay module is used to turn the combination of DC motors ON and OFF. A relay is an electrically operated switch that can be turned on or off, letting the current go through or not, and can be controlled with low voltages, like the 5V provided by the Arduino pins. Controllinga relay module with the Arduino is as simple as controlling anyother output.

Fig:- Relay Module

7) DC Motor:-

A Dc motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy.

The most common types rely on the forces produced by the magnetic fields.

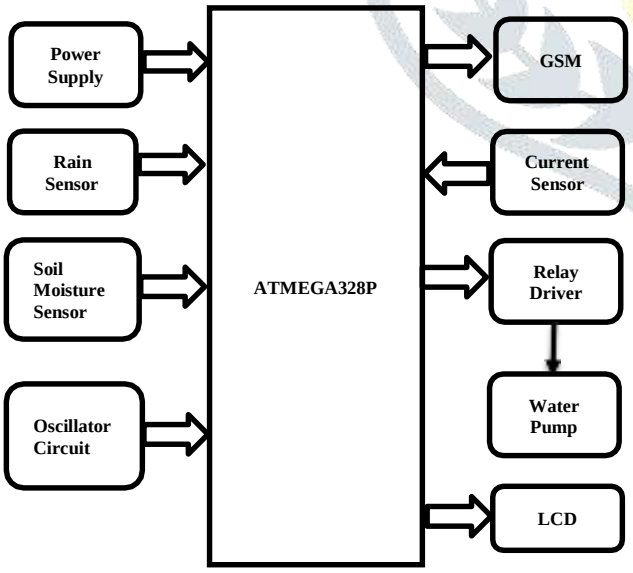
Specifications of the motor are:-

1) Operating Voltage:- 3-6V
2) Operating Current:- 130-220 mA
3) Flow Rate:- 80-120 L/H
4) Continuous Working Life:- 500 Hours
5) Driving Mode:- Dc, Magnetic Driving
6) Material:- Engineering Plastic
7) Outlet Outside Diameter:- 7.5mm
8) Outlet Inside Diameter:- 5 mm

Fig:- DC Motor

IV. System Description

a) Block Diagram:-



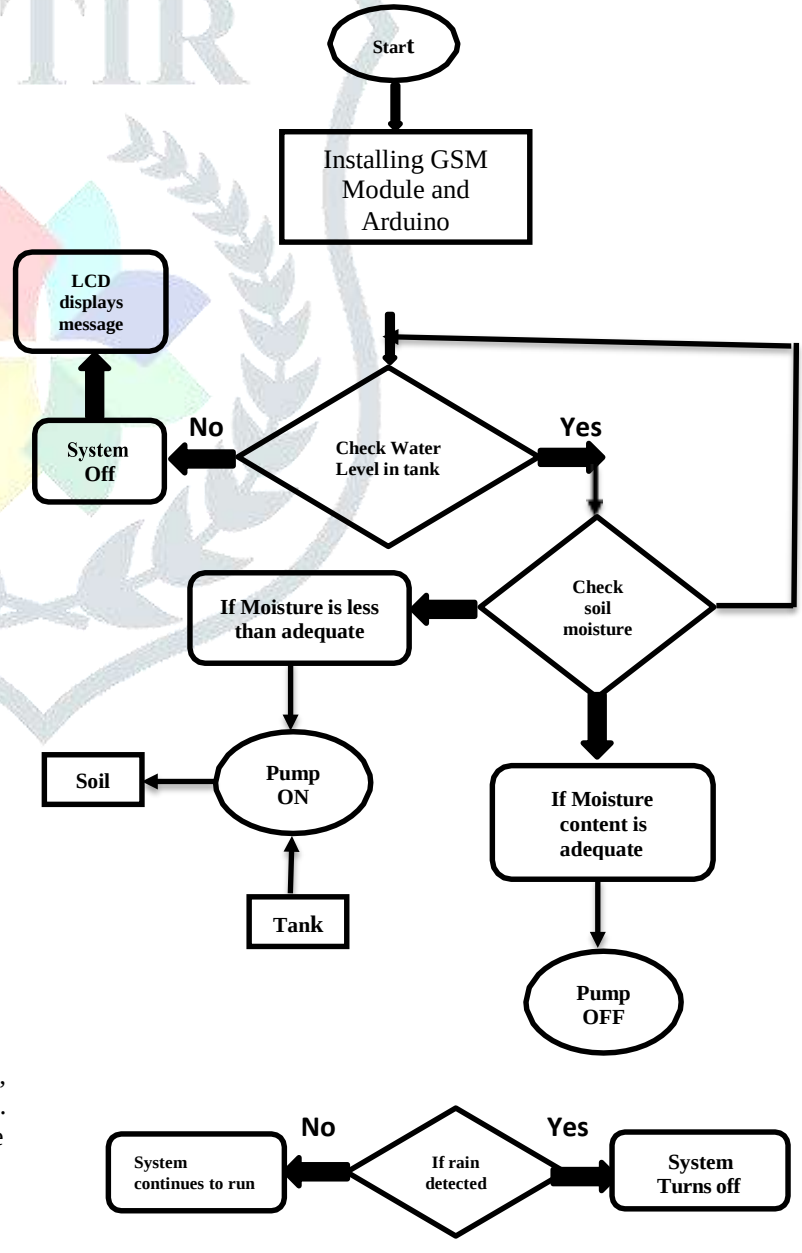
The system has been constructed keeping accuracy, time saving and cost in mind. The whole system is automated. The moisture sensor reads the moisture of the soil and sends the data to the microcontroller, which is Arduino here. The level of moisture in the soil is pre-defined. When the level goes down Arduino receives the data from the moisture sensor.

According to the data, Arduino sends the alert to the owner of the crop with the help of GSM module. After the alert, the Arduino with the help of the relay module switches ON the pump first, which is constructed here by a DC motor and supplies the crop water. The reading from the moisture sensor reaches to the normal level.

If the water in the tank is below the low level, which is being measured by the current sensor, the signal is sent to Arduino which further sends an SMS alert to the owner of the crop when the water reaches the highest level in the tank which is measured by the water level circuit and the system again starts.

If rainfall is detected by the Rain Sensor, then the system will automatically stop and the message will be displayed on the LCD. Once the rainfall is detected, system will restart and again take moisture data and according to that the system will work.

b) Flow Chart:-



Note:- During the pump ON and pump OFF of the motor, messages will be sent to the user using GSM module.

V. Results

The proposed system is constructed using a single pump which supplies water to the farm when soil moisture level goes below the required level. An LCD display has been used to display the output status.

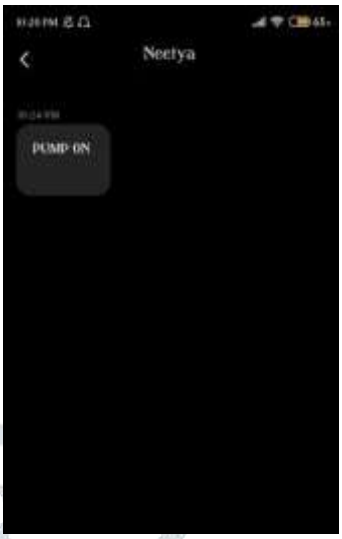
A GSM module is used to send messages regarding the status of the farm to the owner.

When water level in tank comes to lowest level, the pump is automatically turned OFF. And the pump will also be turned OFF when rain is sensed by the rain sensor.

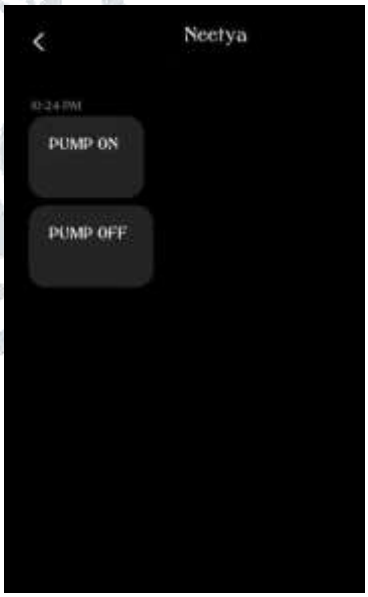
Results:-

The soil moisture sensor will sense the moisture content in the soil, if the moisture level in the soil is high then pump will turn ON and message will be displayed on LCD as shown in the figure below:-

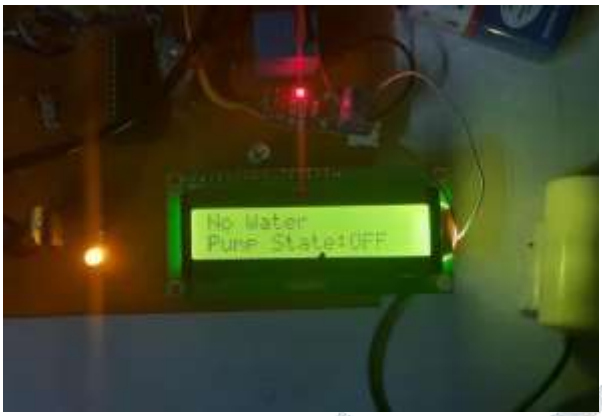
With the help of the GSM module message will be sent to the user as shown below:-



In the same way when the moisture level in the soil is low (adequate moisture present in the soil), then the pump will be OFF and corresponding message will be sent to the user through GSM module as shown in the figure below:-



When there is no water in the tank, then there will be a message displayed on LCD, NO water Pump Off as shown below:-



If rain is detected by the rain sensor, then the pump will automatically turn OFF.

VI. Future Works

The various factors like climate change conditions, soil pH, optimum temperature and solar receptivity can be taken . This data sets can be uploaded to rain machine learning algorithms and optimum inputs and outputs will be generated. This can be more efficient when connected with a cloud computing network.

Further, we can train a deep learning model on image processing algorithms to include some more features such as predict the species of the crop or the quality of the crop. Based on its picture we can further automate the system by training the model with previous data for various soil types, their properties and crop yield trends.

VII. Conclusion

In the present era, the farmers use irrigation technique which involves a lot of manual labor so this project has been made in order to reduce the work load of the farmers and use the efficiency of irrigation process. This project has also been aimed towards the automated agriculture sector. The problem of water wastage during irrigation has also been solved.

Dry areas where water supply is limited, those areas can also be perfectly irrigated by the use of this system. Moreover, components of the system are also reliable, low cost and easily affordable. Installing automated irrigation monitoring system saves time and ensures judicious usage of water.

VIII) References

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