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Automatic Drip Irrigation System using Wireless Sensor Technique Powered by Solar System

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***Abstract*— India is developing country and economic growth of India is depending upon agriculture field .So improvement of agriculture field is very important ,Now in our country the 70% land is agriculture land and more than 60% people is depending upon agriculture field. The farmers working in the farm& this are dependent on the rains, river, pond and bore wells. Even if the farm land has a pump, most of the time it is being kept stand-still due to non-availability of grid power in the remote areas .If the solar power is harnessed, an agricultural pump can run during day hours without depending on grid power. The important objective of this paper is to establish an automatic solar powered drip irrigation system by using wireless sensor technology (WSNT) by integrating solar system, Arduino microcontroller, soil moisture sensor, water pump etc.**

Keywords*— Drip irrigation, Solar panel, Soil moisture sensor, Microcontroller, Wireless network, Timer, GSM.

I. INTRODUCTION

Water is a basic component of all life. Water is also a very precious natural resource that must not be wasted. If too much water is applied the problems rise up depending upon the soil texture. Irrigation is artificial way of watering the soil for the proper growth of the plant. It is mainly used in the places where rainfall is less. Irrigation also helps to suppress the weeds growing in the agricultural fields. The old methods used for irrigation it was manual irrigation using buckets and watering cans, by using sprinkler irrigation, localized irrigation, drip irrigation etc . But by using these techniques we can't predict the amount of water that is to be watered or the sufficient quantity of water that a crop needs (1).Wireless technologies have been growing fast in recent years. These technologies depending on the range of communication between sensor nodes. This wireless sensor based system monitors the water requirement for a crop continuously and sends the data to the main system which controls the flow of the water. The sensors used for measurement of soil moisture can also measure temperature of the soil to solve the problems related to soil for a particular crop. Soil moisture sensor senses the environmental and soil conditions which can be send back to the system for achieve the excellent &efficient performance. System measures information of soil moisture content stored in it and sends it to the main system with the help of microcontroller and other electronic devices(2).In recent few years rapid growth in irrigation system. The user communicate through SMS. Irrigation depending on soil moisture reading from sensor and type crop and automatically irrigated the field the information exchange between designing system via SMS on GSM network(3).

II. METHODOLOGY

The various components used for the developing GSM based Automatic Drip Irrigation System Using Wireless Sensor Technique Powered By Solar System is shown in the following Figure.

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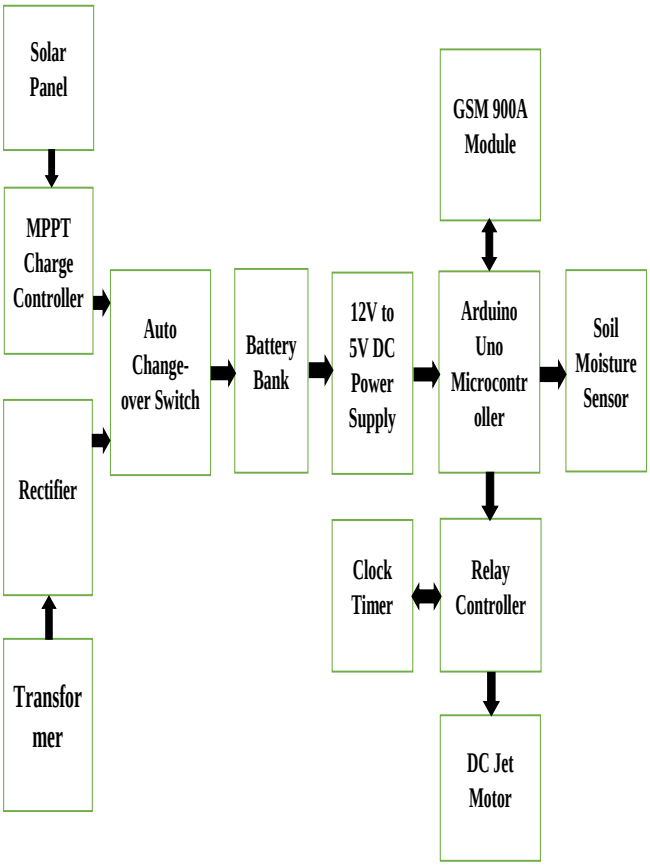

Figure 1: Block Diagram of Automatic Drip Irrigation System Using Wireless Sensor Technique Powered By Solar System.

From these we uses the solar panel ,these panels are nothing but the PV Cell. In these it connect the solar panel to MPPT solar charge controller and then it connect to battery. Solar charge controller are used for preventing the overcharging the battery. In these system relay will used as switch , it will connect to microcontroller and Submersible pump. Microcontroller receive the voltage signal from the soil moisture sensor and it give the command to pump. Also GSM and Bluetooth technology will be used for communication purpose and also collecting the information from the field.

- ***Drip Irrigation System:-***

Drip irrigation means distributing water directly to the soil at a very low rate. A system has small diameter plastic tubeing fitted with outlets called emitters or drippers. Drip irrigation is more efficient because the water soaks into the soil before it can evaporate. The water is also applied close to the plant root providing a high moisture level in the soil. The main components of a drip system consist of a mainline, valve, backflow preventer pressure regulator, filter, tubing adapters and fittings, drip tubing, emitters and an end cap these are shown in the fig.2(4).

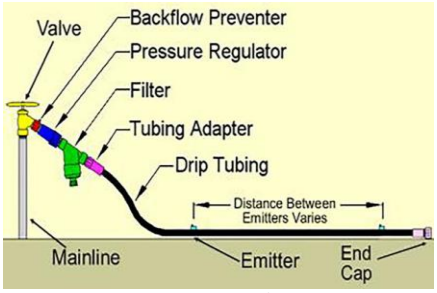

Figure 2.Block Diagram of Drip Irrigation

- ***Design of Pump :-***

It was decided to keep a water tank nearer to this land and watering to be done to this selected land by using a small submersible DC pump which is expected to run for about 3hours/day with the help of solar panel and battery. A 20W (DC) submersible pump shown In Figure3.

Figure 3 :Jet Motor

Specifications :-

DC Voltage range :12V
Current range: 5A
Operating freq. : 50Hz
Power consumption : 60W

- **Design of Battery :-**

In the Lead acid battery with 7.5Ah, 12V capacity which will deliver maximum voltage 12-14 V and maximum current 1.4A has been selected.

Fig 4.Batteries (7.5Ah, 12V Battery)

- ***Design of Solar Panel :-***

In the solar panel it will contain nothing but photovoltaic cell(PV Cell).This Photovoltaic cell use sun light to generate electricity, the generated power is the product of voltage times the current (i.e., P = V x I). The amount of electrical

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power generated by photovoltaic cell it depends upon the amount of solar radiation that hits it PN junction as well as the percentage of solar radiation it actually converts into electricity. Solar panels are used to liberate irrigation from the shackles of load shedding. The requirement of water is judged and information is transmitted to the solar circuit which modifies its configuration such that it provides enough DC power to drive the pumps and full fill the assigned task(5)

Figure5: Solar Panel

Specifications :-

Rated Voltage : 12V
Rated Current : 1.6A
Total capacity : 20 W

- **Auto Change Over Switch:-**

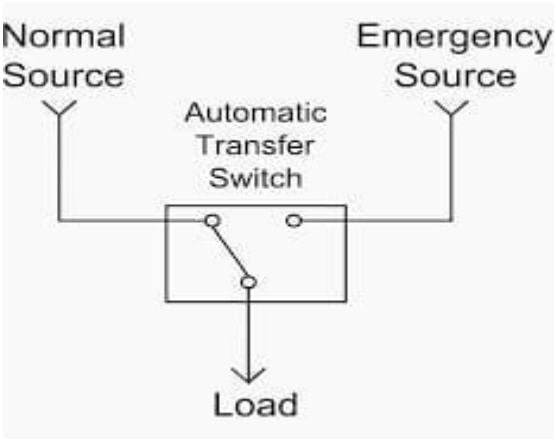

Figure 6. Auto Change Over Switch

Specification :-

Rated Current: 20A
Rated Voltage: 12-18V

- **Design of Solar Charge Controller:-**

Figure7. Solar Charge Controller

Specifications :-

Rated voltage: 12V
Rated current: 20A

- **Design Of Step Down Transformer:-**

A Step Down Transformer is a device which converts high primary voltage to a low secondary voltage. In a Step Down Transformer, the primary winding of a coil has more turns than the secondary winding.

Figure 8.Step Down Transformer

Step Down Transformer Equation:-
The formula used to design a Step Down Transformer is

$$\frac{N_S}{N_P} = \frac{V_S}{V_P}$$

Where,
Ns = number of turns in secondary
Np = number of turns in primary
Vs = Voltage in secondary
Vp = Voltage in primary
So from that we use 12V and 5A will be used.

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➢ Design of Soil Moisture Sensor:-

Soil is nonconductive by nature but presence of water in soil increases its conductivity due to the presence of conduction ions in water. Soil resistivity is a measure of a soil's ability to retard the conduction of an electric current(2,6).

Specifications :-

Operating voltage : 3V-5V

Dual output, 4 wire interface.
Panel PCB dimension : 3cm x 1.5cm
Soil Probe dimension : 6cm x 3cm

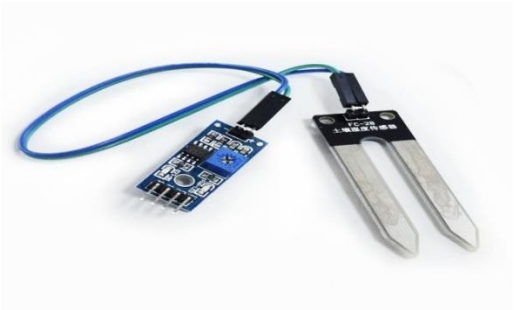

Figure 9. Soil Moisture Sensor

➢ Arduino Uno Microcontroller:-

In this present study, Arduino micro controller has been used. The different pins (digital, analog and power supply) of Arduino .Arduino is genesis of the proposed system. The center of all operations taking place in the system. Components are connected to Arduino through different ports and are dependent on its instruction. Arduino has been used because of its versatility.(5)

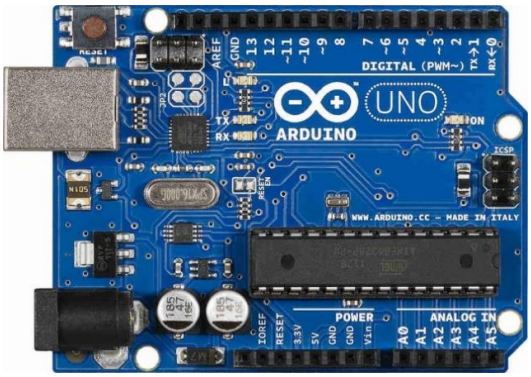

Figure 10. Arduino Uno

Specifications :-
Operating voltage : 5V
Input voltage : 7-9V
Input voltage(limits) : 6-20V
Digital I/O pins :14 (6 provide PWM Output)
Analog input pins :6
DC Current Per I/O Pin : 40mA
DC Current For 3.3V Pin : 50mA
Flash Memory :32kB of which 0.5KB used by boot loader
SRAM :2 KB
EEPROM :1 KB
Clock Speed : 16MHz

➢ *Digital Clock Timer:-*

Figure 11. Digital Clock Timer

Specification :-
Input voltage : 230V
Output load current : 10A

➢ *GSM900A DIGITAL GSM UNIT:-*

The Global System for Mobile Communications is a standard set developed by the European Telecommunications Standards Institute (ETSI) to describe technologies (2G and 3G). General packet radio service (GPRS) is a packet oriented mobile data service on the 2Gand 3Gcellular communication system's global system for mobile communications (GSM). GSM based motor control board is shown in Figure. GSM contains a Subscriber Identity Module (SIM), farmers can communicate with this SIM-Number.(7)

Figure12.GSM900A Digital GSM Unit

Now a days the GSM module is used for Remote Control performance such as Gate Control and Temperature Control. GSM/GPRS component consists of a GSM/GPRS modem assembled equally with power supply circuit and communication interfaces for computer. These are pretend for specific cellular network (GSM/UMTS/CDMA) or specific cellular data standard technology (GPS/SIM).(3)

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III. EXPERIMENTS

Based on the our project hardware model, many experiments are conducted to understand the functional behavior of soil moisture sensors ,batteries charging voltage, batteries discharging voltage while keeping the solar panel disconnected from the circuit and batteries discharging voltage while running the pump drawing power from batteries and simultaneously it is also kept in charged condition from SPV.

The following table shows the voltage developed by the moisture sensor with respect to addition of water.

It was observed that when the soil was completely dry it was developing 5V and when 60ml water added, the soil turned into completely wet as shown in Figure

For this complete wet, the voltage developed from the soil sensor was 0.98V.

Arduino uno microcontroller receives the incoming voltage signal from the moisture sensor and gives the moisture content in the soil.

Soil Cup No	Weight of soil,(g)	Added water quantity, (ml)	Moisture sensor output voltage,(V)	Soil mois-ture, (%)
1	250(dry)	0	5	0
2	250	15	3.6	35.56
3	250	30	3	51.24
4	250	45	2	75.42
5	250(wet)	60	0.98	100

Table : Moisture sensor voltage w.r.t water content in the soil

A LCD display was also connected with the arduino to display the moisture content and pump ON/OFF status.

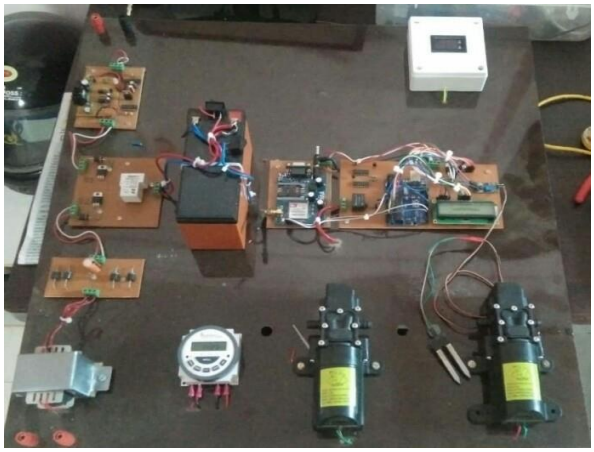
This system can run either with electricity or solar power.

The pump can run without solar panel.(i.e receiving ac power from the grid & then converting the dc power with help of the rectifier.)

It is suggested to use Automatic drip irrigation system using wireless sensor technique powered by solar system with batteries to get longer life to the pumps.

IV. RESULTS ,APPLICATIONS & FUTURE SCOPE

- RESULTS:

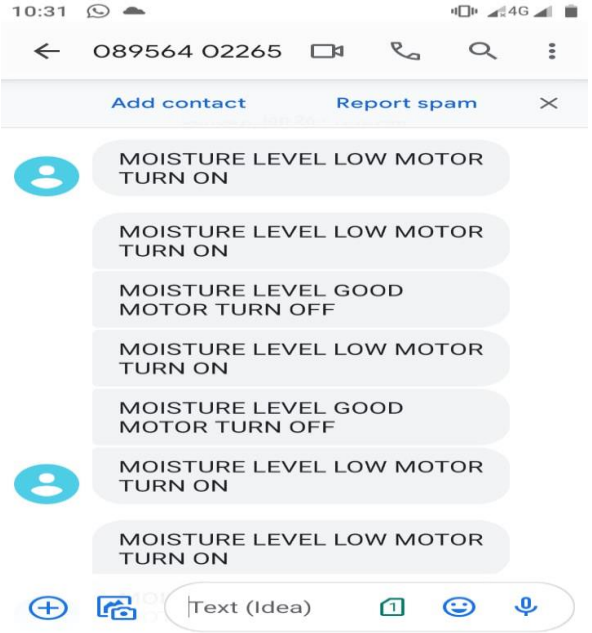


Our project is shown in above images.

As the result of our project, messages are send with help of GSM to the farmer that messages contains the information about condition of farm.

If the soil is dry then motor gets automatically turn ON and if soil is wet then motor gets automatically turn OFF. so accordingly the messages will be send to farmer with help of GSM.

Below image shows how actually the messages will send to the mobile number of farmer.



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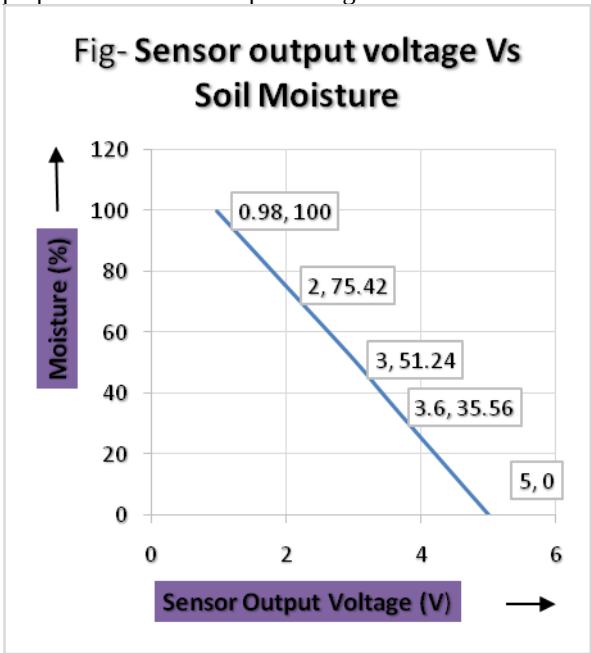
From the Table the moisture sensor which will give voltage output w.r.t the water content in soil
If the soil is completely dry, the voltage output from the sensor would be 5V and if the soil is completely wet then the voltage output would be 0.98V.

Hence, this 5V relates 0% moisture and 0.98V relates to 100% moisture. The following Figure shows the calibration curve
prepared for sensor output voltage versus % of moisture.



Based on the experiments, it has been decided to switch ON the pump whenever the soil moisture goes down to 65% (i.e., at sensor output voltage at 2.75V) and switch OFF the pump when the moisture level reaches to 75% (i.e. sensor output voltage at 1.5V).

- APPLICATIONS:

1. This system can be used in gardens and provide proper irrigation to garden plants.
2. This system can installed in Green House where different parameters needs to be monitored and
controlled with small changes.
3. This system can also be used in Poly houses.
4. The system can be used for study of crops under different water and pH condition.
5. The application of nutrients is quantitative and in accurate, therefore is adapted for perennial crops like
citrus, fruit trees and crops grown on heavy soil.

- FUTURE SCOPE:

1. We can enhance the performance of automatic irrigation system by connection it with IoT (internet of thing), we can versatility by connecting it with many device.
2.In future we try design this system much smarter where we can make such system which include data of all crops means which fertilizer is now required for crops and what will be the amount we can provide fertilizer to crop, which season is most preferable for crops , atmospheric condition throughout the year etc.
3.And also we try to give some advanced feature such as detection of broken pipes and identification of sensor damaged position.

V. CONCLUSION

A remote control for drip irrigation is most beneficial approach for the farmers. This system reduces the extra manpower of the farmer for his farm like supplying water to plant. Solar power provides sufficient amount of power to drive the system. The subcomponents of solar powered automatic drip irrigation system consists Arduino microcontroller , Bluetooth module, GSM module , solar panel, battery, charge controller and other accessories such as submersible pump, drip irrigation kit. With the help of this system, the pump can run minimum 5hours per day with the help of solar panel and battery and 45 min per day without battery from the solar panel. The pump status and moisture value was obtained on mobile phone with help of GSM module. Also this system monitor the water soluble fertilizers such as Urea, Potassium, Nitrate, Ammonium sulfate, Ammonium Nitrate etc. The system provide a real time feedback control module which monitor and control all the activities of drip irrigation system efficiently. To overcome the necessity of electricity and ease the irrigation system for our farmers, the propose model can be suitable alternative. Also with this system one can save manpower & water to improve production which ultimately increase the profit.

VI .REFERENCES

1] Devika CM, Karthika Bose ,VIjayalekshmys, “Automatic Plant Irrigation System Using Arduino”, International Conference on Circuits and Systems (ICCS2017) 2017 IEEE.

2] Gagandeep,Dinesh Arora and Hardeep Singh Saini, “ Design and Implimentation Of An Automatic Irrigation Feedback Control System Based On Monitoring Of Soil Moisture”, International Conference on Inventive Computing and Informatics (ICICI 2017)IEEE Xplore Compliant - Part Number: CFP17L34-ART, ISBN: 978-1-5386-4031-9

3]B.Anitha , A.sandhiya ,D.Vidhay,V.Vanaja and K.Vinodhini, “GsmBased Automatic Irrigation Control System For Efficient Use Of Resources And Crop Planning Using Mobile”, International Journal of Advanced Research Trends in Engineering and Technology (IJARTET) March-2016 Vol. 3, Special Issue 2, ISSN 2394

4] Chandan kumarsahu, Pramitee Behera, “A Low Cost Smart Irrigation Control System”,IEEE Sponsored 2nd international Conference On Ectronics And Communication System (ICECS 2015)

5]Ateeq Ur Rehman, Rao Muhammad Asif, Rizwan Tariq and Ahmed Javed, “GsmBased Solar Automatic Irrigation System Using Moisture, Temperature And Humidity Sensors”,International Conference on Engineering Technology And Technopreneurship (ICE2T) 2017 IEEE.
6] Veena Divyak ,AyushAkhouri, A Real time implementation of a “GSM based Automated Irrigation Control System using drip Irrigation Methodology” (Volume 4, Issue 5,May 2013)

7] R.suresh, S.Gopinath, K.Govindaraju, T.Devika, N.Suthanthira Vanitha, “GSM based Automated Irrigation Control using Rain gun Irrigation System”,International Journal of Advanced Research in Computer and Communication Engineering Vol. 3, Issue 2, February 2014.

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