ISSN No:-2456-2165

High Efficient Solar Based Micro Drip Irrigation System

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Abstract:- The agriculture plays the important role in the economy and the development of the country. Irrigation is one of the major requirements of agriculture which requires abundant electric power. Solar powered drip irrigation system can be suitable alternative for farmers in the present state of energy crisis. The proposed drip irrigation system uses solar power for irrigation. Solar powered water pump operates automatically based on different soil parameters like Moisture and Temperature. The most significant advantage of a high efficient solar based micro drip irrigation system is that water is supplied only when the moisture in soil is identified as low and the flow of water is controlled by valve with the help of moisture sensor to enhance crop productivity.This project focuses on the convenience of the farmers by making the system is to switch between electricity board and solar panel.

Keywords:*-Irrigation, Solar Power, Moisture content, GSM control, Solenoid valve.*

I. INTRODUCTION

In many countries where agriculture plays an important part in the economy, but still we are not able to make much benefit out of agricultural resources. One of the main reasons is the lack of rains and scarcity of land reservoir water. The farmers working in the farm lands are solely dependent on the rains and bore wells for irrigation of the land. Even if the farm land has a water pump, manual intervention by farmers is required to turn the pump on/off whenever needed. Also, the unplanned use of water inadvertently results in wastage of water. This process sometimes consumes more water and sometimes the water supply to the land is delayed due to which the crops dry out. Water deficiency deteriorates plants growth before visible wilting occurs. This problem can be perfectly rectified if we use high efficient automated irrigation system in which the irrigation will take place only when there will be intense requirement of water, as suggested by the moisture in the soil. The most significant advantage of a high efficient automated irrigation system is that water is supplied only when the moisture in soil is identified low.

In this paper we propose an automatic irrigation system using solar power which drives water pumps to pump water from bore well to a tank and the outlet valve of tank is automatically regulated using controller and moisture sensor to control the flow rate of water from the tank to the irrigation field which optimizes the use of power.

II. EXISTINGMETHOD

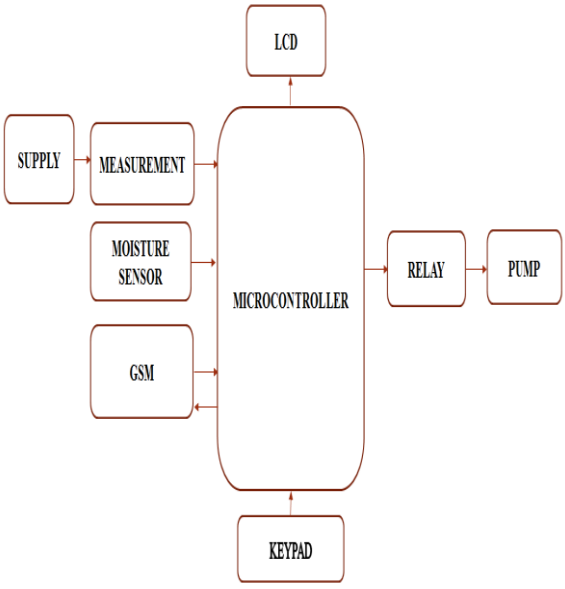


Fig 1:- Block Diagram of the Existing System

In this existing drip irrigation method (Fig1) supply will be given and the moisture content of the soil is measured using moisture sensor which indicates dry condition or wet condition. The output will be given to the microcontroller(5V) which gives signals to the relay(12V) to ON/OFF the submersible pump.It will be displayed in the LCD screen by using GSM.

III. PROPOSED SYSTEM

The Solar power(3W) will be boosted and stored it in the battery.The AC power will be rectified as DC by using rectifier and stored it in the battery.The block diagram of power switching is given in (Fig2) that shows the technique of switching between twopower sources using a relay. The automatic drip irrigation system shown in (Fig2) uses PIC16F877A which is a powerful microcontroller that provides a highly-flexible and cost-effective solutions to many embedded control applications.

ISSN No:-2456-2165

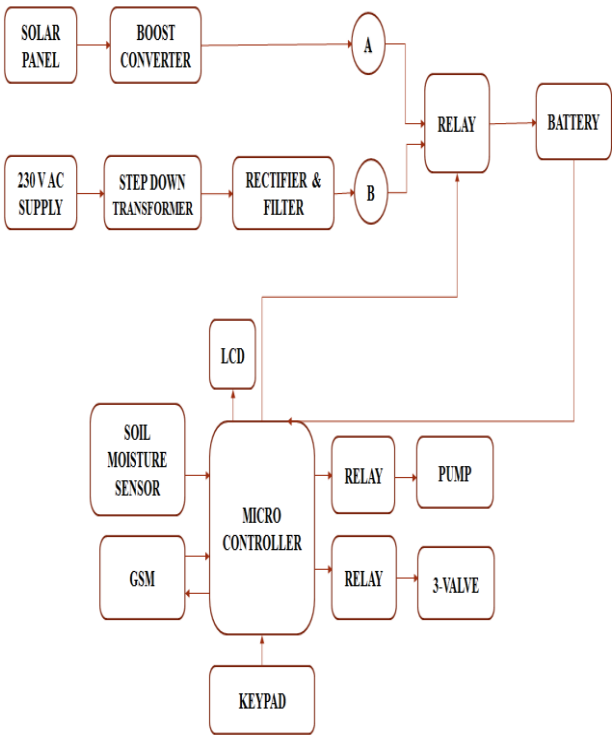


Fig 2:- Block Diagram of the Proposed System

The major inputs to the system are moisture of the soil .Based on the input conditions the controller will drive asubmersible pump through a relay and driver circuit. Based on cost comparison of AC and DC loads it indicate that,for renewable energy powered small scale irrigationsystems, AC pumps leads to uneconomic results andexcess generation. On other hand, DC pumps prove to be economic and reliable.

A GSM module is used to send the information tothe former via SMS. GSM RS232 Modem is built with SIMCOM Make SIM800 Quad-band GSM engine, works on frequencies 850 MHz, 900 MHz, 1800MHz and 1900 MHz it is very compact in size and easy touse as plug in GSM Modem. The Modem is designed withRS232 Level converter circuitry, which allows you todirectly interface PC Serial port. Initially Modem is in Auto baud mode. This GSM/GPRSRS232 Modem is having internal TCP/IP stack to enableyou to connect with internet via GPRS. It is suitable forSMS as well as DATA transfer application in M2Minterface.

A 16X2 character general purpose alphanumeric LCD display is used to display the information.The 8-bit data pins, D0-D7, are used to send information tothe LCD or read the contents of the LCD's internalregisters. To display letters and numbers, we must sendASCII codes for the letters A-Z, and number 0 -9 to thesepins while making RS=1 [9].The Power Supply is a primary requirement for the project. The required DCpower supply for the base unit as well as for the rechargingunit is derived from the mains line. For this purpose centre tapped secondary of 12V transformer is used. Fromthis transformer 5V DC is extracted. Output is furtherregulated using IC7805 positive voltage regulator. This is a 3Pin voltage regulator that can deliver current up to 800milli amperes.

IV. WORKING AND OPERATION

This setup (Fig4) works initially in solar power(12V,3W).The output of solar power is boosted and it is stored in battery. When the solar power goes beyond the specified value(that can be set with the help of keypad) it will automatically switch to electricity board(230V, AC supply) with the help of the relay and it is rectified as DC and stored in battery as 12V.

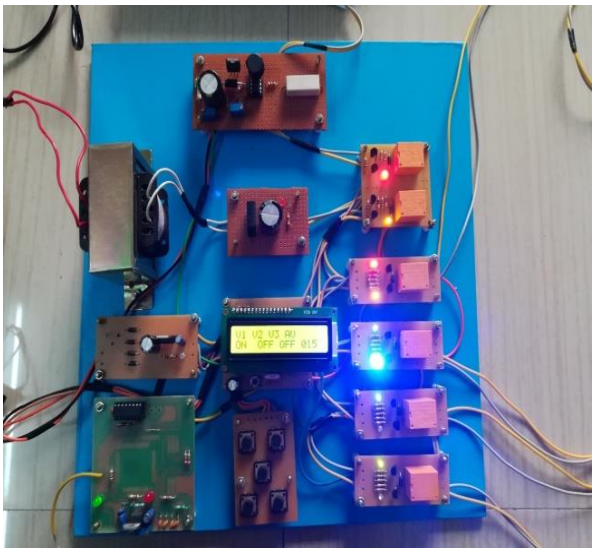


Fig 3:- Hardware Circuit Diagram

The moisture content of the soil is measured using moisture sensor which indicates wet condition(>50cu.m) or dry condition(<50cu.m). The output will be given to the microcontroller which gives signals to the relay(12V) to ON/OFF the solenoid valve.The GSM control application is used to control the solenoid
Valve(flow of water) by operating in auto mode or manual mode.

V. BUILDING BLOCKS

A. Moisture Sensor

Soil moisture module is most sensitive to the ambient humidity is generally used to detect the moisture content of the soil. Module to reach the threshold value is set in the soil moisture, DO port output high, when the soil humidity exceeds a set threshold value, the module D0 output low. The digital output D0 can be connected directly with the microcontroller to detect high and low by the microcontroller to detect soil moisture. The digital outputs DO also can connect to relay module directly to drive buzzer module, which can form a soilmoisture alarm equipment. Analog output AO can be connected through the AD converter or microcontroller analog port to get more precise values of soil moisture.

ISSN No:-2456-2165

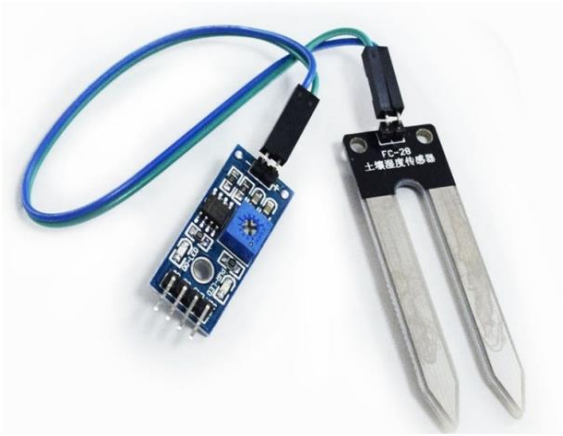


Fig 4:- Soil Moisture Sensor

B. PIC Microcontroller

Various microcontrollers offer different kinds of memories. EEPROM, EPROM, FLASH etc. are some of the memories of which FLASH is the most recently developed. Technology that is used in PIC16F877A is flash technology, so that data is retained even when the power is switched off. Easy Programming and Erasing are other features of PIC16F877A.

C. Relay

Fig 5:- Relay Diagram

Relays are usually SPDT or DPDT but they can have many more sets of switch contacts, for example relays with 4 sets of changeover contacts are readily available. Most relays are designed for PCB mounting but you can solder wires directly to the pins providing you take care to avoid melting the plastic case of the relay. The picture shows a working relay with its coil and switch contacts. You can see a lever on the left being attracted by magnetism when the coil is switched on. This lever moves the switch contacts. There is one set of contacts (SPDT) in the foreground and another behind them, making the relay DPDT.

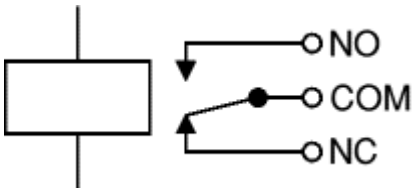


Fig 6:- Switching Connections of Relay

The relay's switch connections are usually labelled COM, NC and NO:

- COM = Common, always connect to this; it is the moving part of the switch.
- NC = Normally Closed, COM is connected to this when the relay coil is off.
- NO = Normally Open, COM is connected to this when the relay coil is on.

D. Liquid Crystal Display

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over and other multi segment the reasons being: LCDs are economical; easily programmable; have no limitation of displaying special&even (unlike in seven segments) and so on.

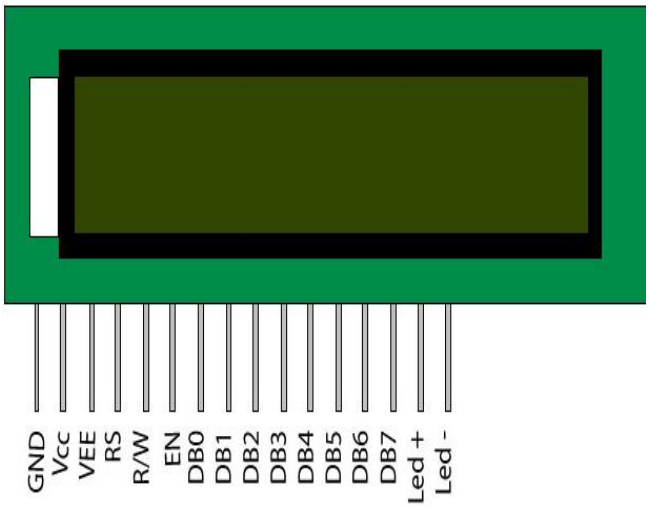


Fig 7:- Pin Diagram of LCD

E. Battery

A battery is a device in which chemical energy is directly converted to electrical energy. It consists of one or more voltaic cells, each of which is composed of two half cells connected in series by the conductive electrolyte consists of one or more voltaic cells in series.

Each cell has a positive terminal, shown by a long horizontal line, and a negative terminal, shown by the shorter horizontal line. These do not touch each other but are immersed in a solid or liquid electrolyte.The electrolyte is a conductor which connects the half-cells together. It also contains ions which can react with chemicals of the electrodes. Chemical energy is converted into electrical energy by chemical reactions that transfer charge between the electrode and the electrolyte at their interface. Such reactions are called faradaic, and are responsible for current flow through the cell. Ordinary, non-charge-transferring (non-faradaic) reactions also occur at the electrode-electrolyte interfaces. Non-faradaic reactions are one reason that voltaic

ISSN No:-2456-2165

cells (particularly the lead-acid cell of ordinary car batteries) "run down" when sitting unused.

VI. SETUP OF SOLAR BASED MICRO DRIP IRRIGATION SYSTEM

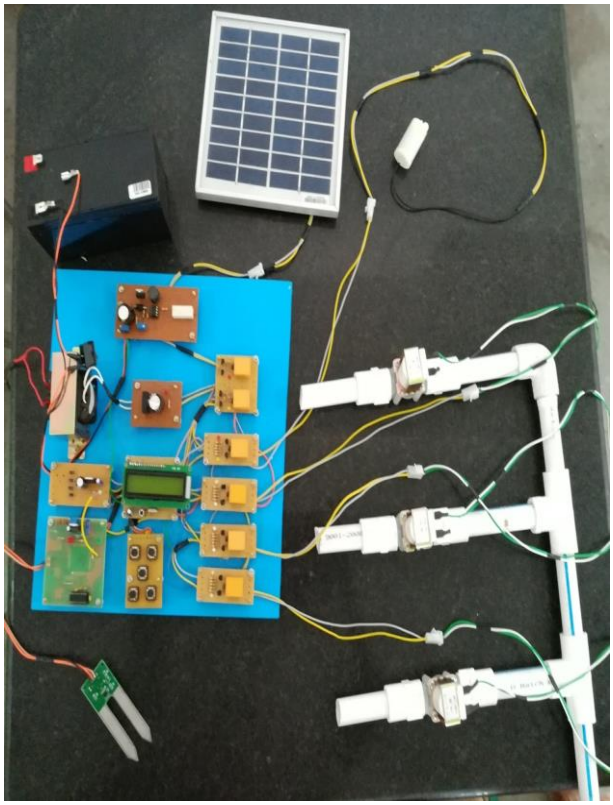


Fig 8:- Setup of Solar Based Micro Drip Irrigation System

VII. RESULT

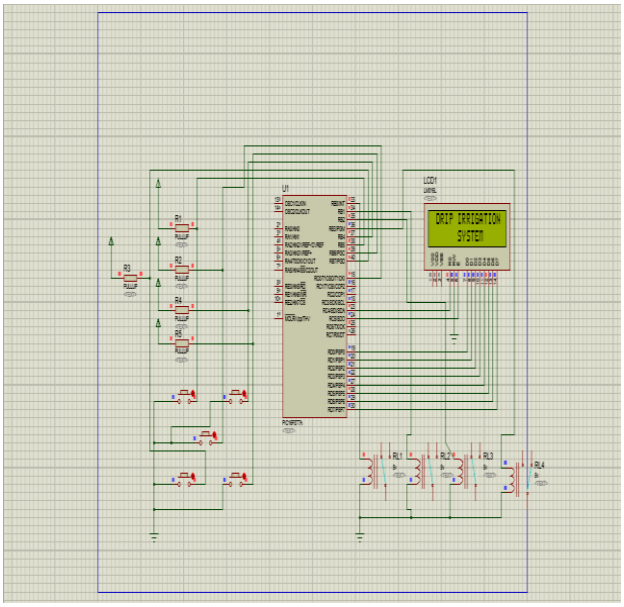
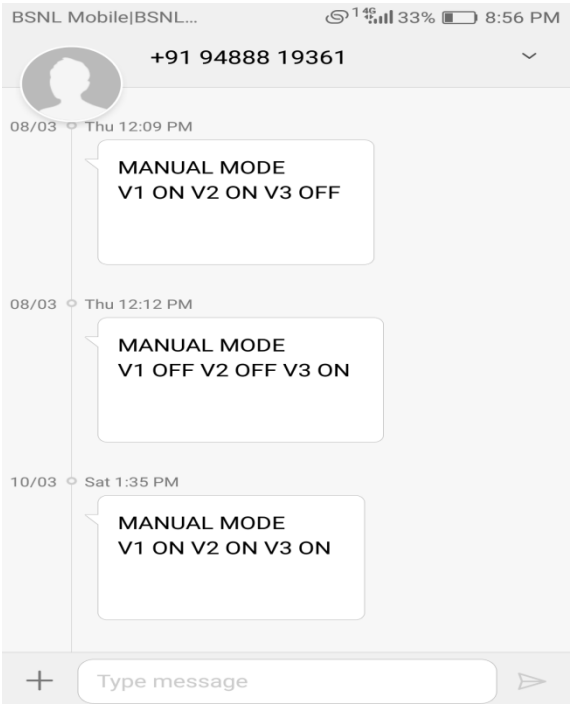


Fig 9:- Simulation Output



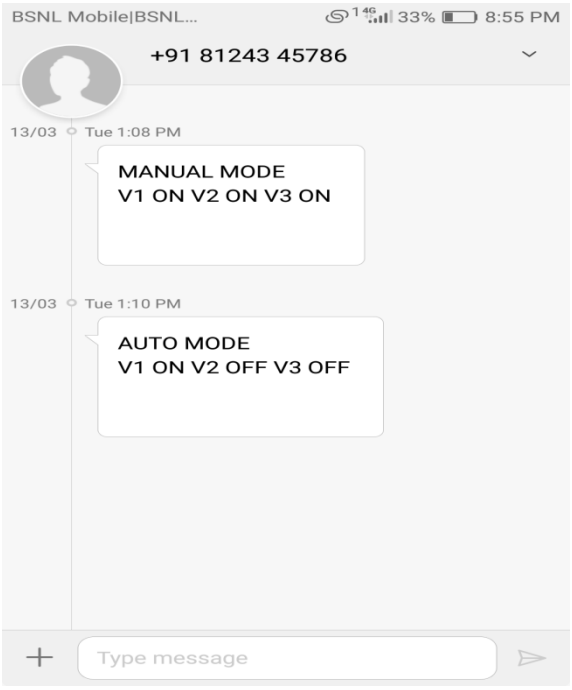


Fig 10:- Hardware Output

By using GSM control application,we can choose the manual mode and automatic mode. In manual mode, we can set it by own selection process(ON/OFF).In automatic mode,the moisture sensor is used to detect the moisture content of the soil, then the keypad is set and the operation (ON/OFF) of the valve(V1,V2&V3) will be processed.

VIII. CONCLUSION

By implementing the proposed system there are various benefits to both the government and the farmers. This

can be a solution for the government in the present state of energy crisis. By using the automatic irrigation system one can optimizes the usage of water by reducing human intervention. Proposed system is easy to implement and environment friendly solution for irrigating fields. The system was found to be successful when implemented for bore holes as they pump over the whole day. Solar pumps also offer clean solutions with no danger of borehole contamination. The system requires minimal maintenance and attention as they are self-starting. GSM Modem is also implemented to get status of motor to the former by an SMS.

IX. ACKNOWLEDGMENT

We have great pleasure in thanking Dr. A. EBENEZER JEYAKUMAR, Director (Academics), SNR Sons Charitable Trust. We would like to thank our beloved Principal, Dr. N.R .ALAMELU for her continuous motivation towards the development of the students.

We are very grateful to Dr. S.U.PRABHA, Professor and Head, Department of Electrical and Electronics Engineering, Sri Ramakrishna Engineering College, Coimbatore, who has encouraged us in all aspects We express our sincere and deepest gratitude to our external guide Mr. T.SENTHILKUMAR, Director of Texro Electronics, Coimbatore, Tamil Nadu for his valuable technical support.

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