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SOLAR POWERED AUTO IRRIGATION SYSTEM

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***Abstract*— The Auto irrigation system of this system uses soil moisture sensor to detect the moisture level and 4X4 keypad for various crops control. When the moisture content of the soil is reduced then the sensor sends detected value to the microcontroller. Then the water pump is automatically ON according to the moisture level. The main aim of this paper is to reduce the human intervention for farmers and use solar energy for irrigation purpose. The entire system controlled by the PIC microcontroller.**

***Index Terms*— Auto irrigation, moisture sensor, water pump, PIC microcontroller.**

I. INTRODUCTION

The proper method is to be implemented for the irrigation system because of lack of rain and scarcity of water in soil. Agricultural field always needs and depends on the water level of the soil. But continuous extraction of water from soil reduces the moisture level of soil to avoid this problem planned irrigation system should be followed. And improper use of water leads to wastage of significant amount of water. For this purpose, automatic plant irrigation system is designed using moisture sensor and solar energy.

The proposed system derives power from sunlight through photo-voltaic cells. Hence, the system cannot depend on the electricity. In this proposed model by using sunlight energy, power the irrigation pump. The circuit comprises of soil moisture sensor are inserted in the soil to sense whether the soil is wet or dry.

A PIC microcontroller is used to control the whole system. When the moisture level of the soil is low then the sensor detects the soil condition and gives condition to the relay unit connected to the switch of the motor. It will ON in dry condition and switch off the motor when the soil is in wet condition. The moisture level of the soil is sensed by the sensor inserted into the soil which gives signal to the microcontroller whether the land needs water or not. The signal from the sensor received through the output of the comparator and it is preceded with instruction from the program stored in the microcontroller. When the soil is dry motor ON and in wet condition motor is OFF. This condition of motor ON and OFF is displayed on a 16X2 LCD.

A.PV cell

Photovoltaic cell is a system converts light energy into electricity. Photovoltaic cell is otherwise known as “solar cells”. This is used in simple and complicated application. The simplest system of photo voltaic cells is small calculators and wrist watches in everyday usage. Most complicated system that provide electricity for pumping water, powering communications equipment, lights to the homes and running our appliances. The PV cells which takes sunlight and convert it into electricity this is kept as a small grid. Solar electric panels more commonly referred to as photovoltaic, or PV, panels, it converts sunlight into electricity. The electricity is used to run appliances and electrical devices or stored in batteries to be used later. Solar Thermal Panels are used in commercial purpose to heat the water.

Solar collectors are the heart of most active solar thermal energy systems. The collector absorbs the sun's light energy and converts it into heat energy. This thermal energy used to heat water for commercial and residential purposes and conserve the electricity power. Solar buildings technologies are useful to the buildings which uses more power to run man applications. Solar thermal collectors are the main component of active solar systems, and are designed to meet the specific temperature requirements and climate conditions for the different endues. Flat-plate collectors, Evacuated-tube collectors, concentrating collectors, transpired air collectors these are some types of collectors in solar system. The proposed system uses the solar energy to ON the water pump. Here the irrigation maintained through the soil moisture sensor and solar energy. There are many plants which required minimum level of moisture. If the required level of water is not provided then the plant will die and results in low production [2]. By irrigate the crop according to the moisture level they need, is provided by the soil moisture sensor. Due to the presence of sensor crops will irrigate properly.

II.SYSTEM DESIGN

This System consists of a Solar panel, which is the main source of energy and is given to the charge controller for extracting regulated power from Solar panel at different irradiation and also to maintain correct charging voltage and current in order to charge the battery and increase its life. Water conservation in farm land is controlled using microcontroller with soil moisture sensor.

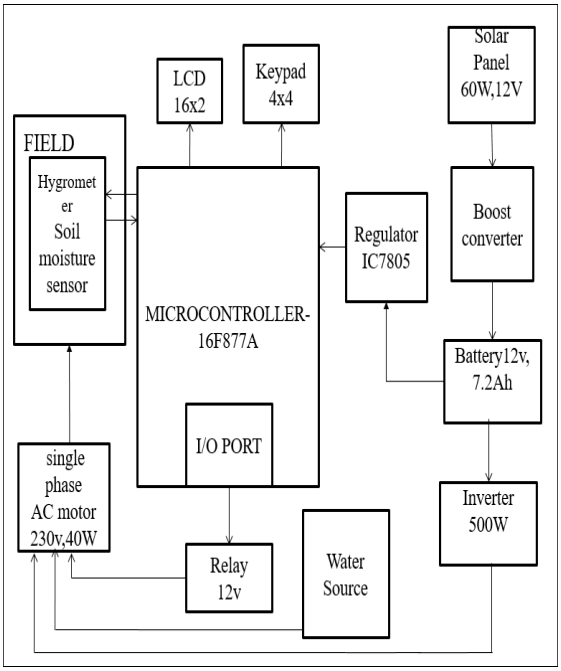

Fig 2.1 Irrigation system diagram

The boost converter is used to convert DC to DC power to improve the output power of the solar panel because if solar panel receives less amount of light then boost converter gives higher voltage compared with input voltage. Boost converter is a switch mode power supply contains a diode and a transistor with one energy storage element, capacitor. Filters are used to reduce output voltage ripple..

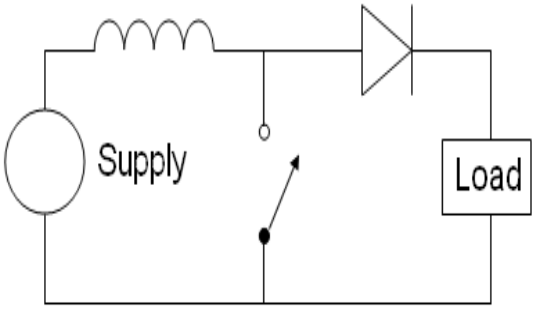

Fig: 2.2 Basic circuit of boost converter

When the switch is closed then the current flows in clockwise direction through the inductor and it stores some energy by generating a magnetic field. When the switch is opened, current will be reduced as the impedance is higher. The magnetic field previously produced will be destroyed to maintain the current flow towards the load. For this the polarity will be reversed (means left side of inductor will be negative now). As a result two sources will be in series causing a higher voltage to charge the capacitor through the diode D. The automatic irrigation system consist of solar panel, boost converter, Inverter, motor supply, soil moisture sensor, LCD display, 4X4 key pad, microcontroller, regulator. Soil moisture sensor is inserted into the soil for level of moisture detection and also it indicates different moisture level for different crops. In this system crops like paddy, wheat, and sugarcane can be irrigated. For the selection of crops 4X4 key pad is used in this system. The next important part of the system is solar panel here the power is driven from the solar panel. The solar panel that converts sunlight into electricity this converted electricity is send to boost converter and to the battery.

Regulator is used to regulate the power from the convertor. Here the microcontroller needs 5v power supply so the IC7805 is used in the system. The power supply is also connected to the single AC motor .To ON/OFF the motor relay 12v is connected to the motor.

III. PROPOSED SYSTEM

The proposed system uses Solar power panel to energies the system and soil moisture sensor to sense the water level for crops. Solar power is used only the source of power to control the overall system, supply from the solar panel 12V is given to boost converter circuit. The boost converter circuit has resistance R1, R2 (1kΩ, 330Ω) these are used to control the voltage from solar panel.IN4007 Diode(d1) is act as voltage controlled device, inductance(100µH) are connected series in it. Through MOSFET device PWM pulse is generated to increase the stored voltage in capacitance (1000µF) with respect to T/2 cycle.

Constant voltage from boost converter is stored to 12V Battery, 500W inverter are used to convert 12V DC to 230V AC for ac pump. Regulator IC 7805 positive regulator are used to regulate the 12V DC to 5V DC with the help 1000µF and 100µF with current limiting resistor 330Ω. 5V from regulator are used to operate the PIC microcontroller, microcontroller act as a control circuit to control the overall process. It has 40pin IC each pin is connected for respective operation, soil moisture sensor are dipped in the soil to sense the humidity value. Soil humidity value for different crops are selected by 4x4 matrix keypad, programming for crop selection and respective humidity value are programmed in the PIC16F877A microcontroller. Signal from microcontroller to 12V relay are operate to on/off the motor pump. Water flow from the pump are depends upon the signal from PIC microcontroller.

The system is controlled by the PIC microcontroller. When the soil moisture sensor sense the low level of the soil moisture then a signal is send to the microcontroller then the controller check for the condition given in program. In program stored in the microcontroller is different for different crops. The humidity level needed to grow the crop is varies from one crop to another. According to the growth of crop water is supplied. The irrigation is automated with Soil moisture sensor and the relay unit. When soil moisture level is low then a signal send to the relay to switch ON the motor and when the soil is wet then motor is in OFF condition. Relay gives the ON/OFF condition to the motor.

The entire system is powered by solar panel energy. When the system uses solar energy then the electricity energy can be conserved. The PIC microcontroller needs 5v supply and motor needs 230v supply. Regulator is connected to the PIC microcontroller to regulate the power supply from the solar panel.

IV. HARDWARE AND SIMULATION RESULTS

This System consists of a Solar panel, which is the

main source of energy and is given to the charge controller for extracting regulated power from Solar panel at different irradiation and also to maintain correct charging voltage and current in order to charge the battery and increase its life. Water conservation in farm land is controlled using microcontroller with soil moisture sensor. The simulation of this system consist of PIC microcontroller connected with LCD display, relay, 4X4 key pad, Transistor and power supply from solar panel.

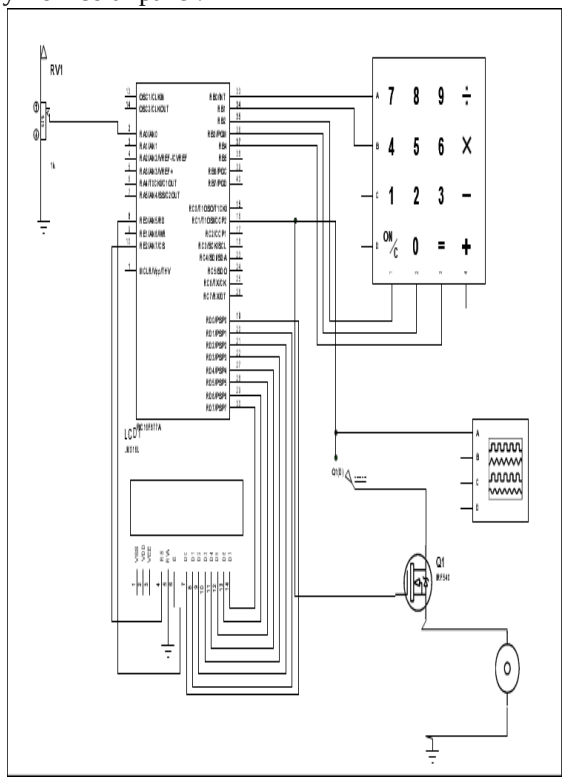

Fig 4.1 Simulation diagram

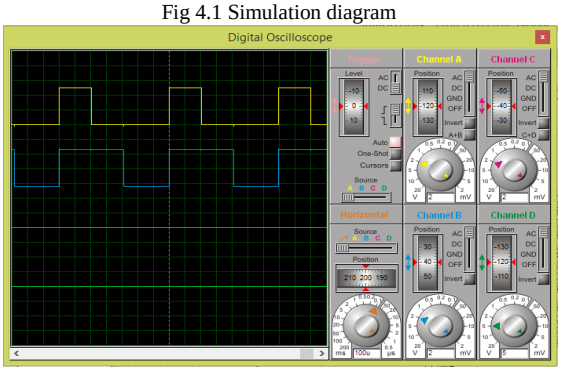

Fig 4.2 Output waveform with moisture level

A. Boost converter

This charge controller is suitable for charging flooded lead acid, Gel cell or sealed lead acid (SLA) and Absorbed Glass Mat type batteries. The Boost converter charge controller keeps the solar panel current and voltage at the regulated power point while charging the battery. Boost converter helps to maintain the constant output from solar panel to battery.

B. Regulator

In this regulator IC 7805 are used to convert the 12v supply from battery to 5v supply through the microcontroller 16F877A and to hygrometer soil moisture sensor.

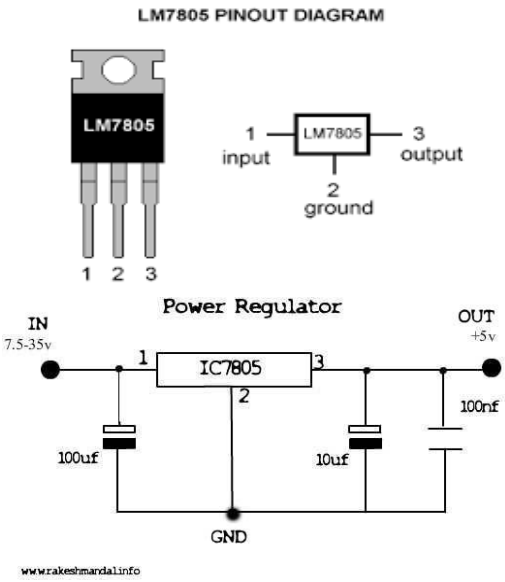

Fig 4.3 Basic circuit of IC7805

C. 4X4 Keypad

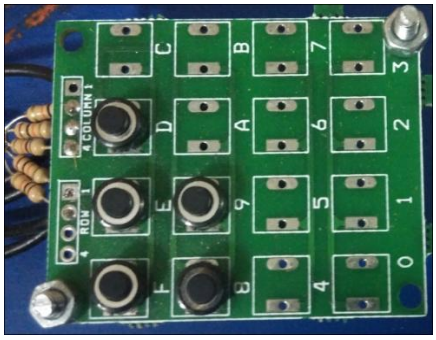

Fig .4.4 4X4 Keypad

The MCP23X08 devices have several features that make them ideal for controlling a 4x4 matrix keypad. These features have been broken down into two main groups:

- The ports input and output characteristics.
- The interrupt-on-change feature, which is an important aspect of the key scan method used.

D. Hardware setup

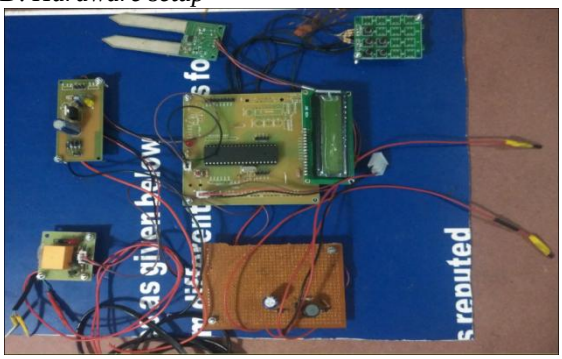

Fig 4.5 Hardware with moisture sensor

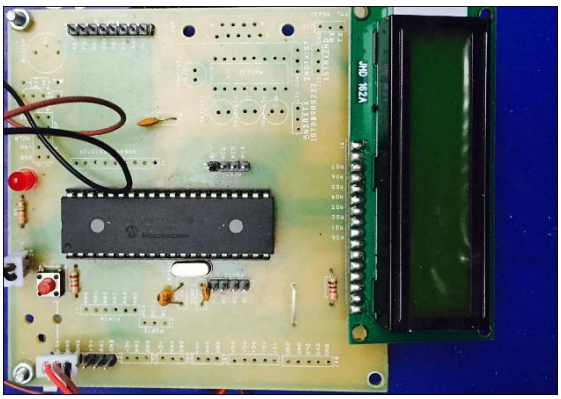

Fig 4.6 Microcontroller and LCD

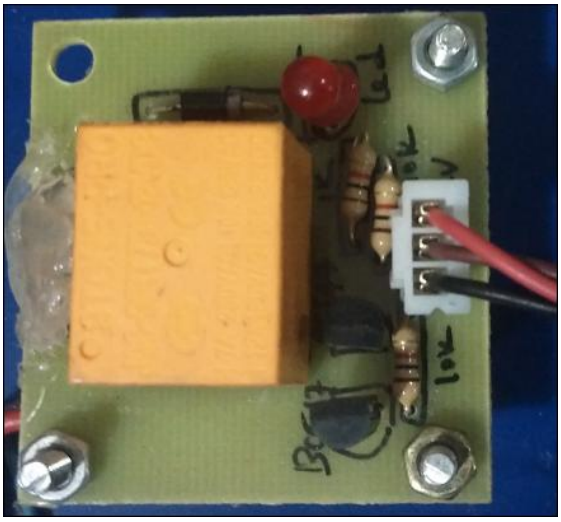

Fig 4.7 Relay unit

V. CONCLUSION

The proposed system is beneficial to the farmers when this system is implemented. And also useful to the government with solar panel energy, solution for energy crisis is problem. When the soil needs water is indicated by the sensor by this automatic irrigation system is implemented. Then the various crops also irrigated with this system by turn on the button. According to the button pressed the irrigation system detects the moisture level of the crop. For example, Wheat, Paddy, Sugarcane crops moisture content of soil is detected and irrigated automatically. Automatic irrigation system is used to optimize the usage of water by reducing wastage and reduces the human work. The energy needed to the water pump and controlling system is given by solar panel. Solar panels which are small grid that can be produce excess energy. By using solar energy reduces the energy crisis problem.

The system requires minimal maintenance and attention because they are self-starting. To further enhance the daily pumping rates tracking arrays can be implemented. This system demonstrates the feasibility and application of using solar PV to provide energy for the pumping requirements for sprinkler irrigation. Even though this system requires more investment but it solves more irrigation problem after long run of this system.

VI. FUTURE WORK

In future, the Automated Irrigation System Using Linear Programming provides to be a real time feedback control system. This control system monitor and controls all the activities of drip irrigation system efficiently and also efficient water management gives more profit in less cost. Using this system, manpower and water can be saved, as well as with this system the productivity improved and ultimately the profit. In future with some modification in this system can also supply agricultural chemicals like sodium, ammonium, zinc, calcium to the field along with fertilizers by adding new sensors and valves.

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