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SOLAR POWERED AUTO IRRIGATION SYSTEM

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ABSTRACT:

Cost effective solar power can be the answer for all our energy needs. Solar powered auto irrigation systems are the answer to the Indian farmer. This system consists of solar powered auto tracker along with an automatic water flow control using a moisture sensor. It is the proposed solution for the present energy crisis for the Indian farmers. This system conserves electricity by reducing the usage of grid power and conserves water by reducing water losses.

Keywords:

Photovoltaic cells, solar energy, dc drives, renewable energy, irrigation system, microcontroller, moisture sensors.

INTRODUCTION:

This paper consists of two sections. The first one includes the use of solar tracker to grab energy from the sun whereas the second one is having moisture sensors which is helpful in the irrigation process. Our paper includes the design and implementation of a solar tracking system. Solar tracking allows more energy to be produced because the solar panel is tracking the maximum power point of the sun's position. Also in a country like India, the agriculture plays an important role in the economy and development of the country

SOLAR TRACKING SYSTEM:

The main objective is to find the maximum sun radiations in order to get maximum charge for the batteries. Electricity can be generated from the sun in several ways. Photovoltaic's (PV) has been mainly developed for small and medium-sized applications, from the calculator powered by a single solar cell to the PV power plant. For large -scale generation, concentrating solar thermal power plants have been more common, however new multi-megawatt PV plants have been built recently. A photovoltaic cell (PV cell) is a specialized semiconductor that converts visible light into direct current (DC). Some PV cells can produce DC electricity from infrared (IR) or ultraviolet (UV) radiation. Photovoltaic cells are an integral part of solar-electric energy systems, which are becoming increasingly important as alternative sources of power utility. Solar cells generate DC electricity from light, which in turn can be used in many applications such as: charging batteries, powering equipment, etc. This solar tracker works on the photovoltaic technology.

AUTOMATIC IRRIGATION USING MOISTURE SENSORS:

In this part of the project, the system checks the moisture content in the soil, based on that pumping motor will automatically pump the water into the field. Here we are using tin probes moisture sensor. By using this sensor, we can find whether the soil is wet or dry. If it is dry, pumping motor will pump the water. In this project, the main controlling device is AT89S52 microcontroller. Here soil sensor will give the status of the soil to the microcontroller, based on that microcontroller will display the status of the soil on the LCD and switch on or off the pumping motor through relay. The pumping motor will pump the water into the field until the field is wet which is continuously monitored by the microcontroller.

MATERIALS AND METHODS:

Hardware used

Solar Panel, Relays, Micro controller, ADC, Humidity sensor, Voltage amplifier, comparator current to voltage convertor, temperature sensor, diode resistors and capacitors.

Humidity sensor

The humidity sensor just senses the humidity or the moisture of the soil. The change in humidity is proportional to the amount of current flowing through the soil. The humidity sensors available in market are too costly to be used for such small household applications. So for domestic purpose, we have designed a simple humidity sensor which works on the principle of conductivity of the soil. Whenever the soil is dry the conductivity of soil is less and vice-versa. Our humidity sensor consists of two metal rods and 9V battery. The two conducting metal rod used are of Aluminium. These two rods are separated by wooden block for supporting the two rods and keeping the spacing between them constant. The two rods are inserted in soil. The 9V battery is connected in series with these rods. So, the current flows from the rods through the soil. Here, if soil is dry, current flowing is negligible. And if soil is wet, current is sensed .This current is then converted in to voltage using I to v converter.

I to V converter and voltage converter

The current to voltage converter converts current coming from the humidity sensor into voltage and this voltage is given to the voltage amplifier for amplification

Comparator

It compares the reference voltage and the amplified voltage coming from I to V convertor .

Temperature sensor and LM 339

IC LM35 senses the surrounding temperature. The output of this IC is analog voltage. This voltage is given to the LM339 for comparing the present condition with the ideal one.

Micro controller AT89S52

The entire automation is done using micro controller.

Design of power supply

Power supply consists of a transformer, bridge rectifier, and voltage regulating ICs 7805, 7812, 7912. +5 V,-5V, +6V DC power supply is designed to provide VCC as well as reference voltage to the various ICs.

Bridge rectifier

Rectifier converts ac voltage into dc voltage. 4 diodes are connected in bridge. Its input is from transformer and output is given to the voltage regulator IC's.

Voltage regulator IC

Voltage regulator IC gives constant DC voltage at output in spite of fluctuations in input.

Temperature sensor IC LM135

LM135 IC senses instantaneous temperature, and converts it into voltage. This voltage is then amplified and given to ADC.

I to V converter IC 741

This IC converts current into voltage. IC 741 is used for this purpose. Output voltage is then amplified and given to comparator.

Comparator IC LM 339

Comparator IC LM 339 compares 2 voltages. Vref is given by formula:-

Vref= (R2/ (R1+R2)) X 5

We have used two comparator ICs. As discussed above the first comparator IC compares amplified voltage from I to V convertor. Now the second comparator IC is used to compare different temperature conditions. LM 339 IC has four internal comparators. Out of those four comparators we are using only two comparators. The one comparator compares whether temperature is above or below 20 degree Celsius. Another one compares whether temperature is above or below 30 degree Celsius. The output of this Ic is given to the Micro controller.

Micro controller IC AT 89C52

Program is given to microcontroller to check values of temperature and output of comparator which compares the Vref and amplified voltage of I to V convertor, and make the LED 'ON' for particular time interval. Time interval is different for different ranges of temperature. Program is written in assembly language

Flip Flop IC 7474

Microcontroller AT89C51 has clock frequency 12MHz.For ADC 0808, 680KHz frequency is required. . So, this frequency is derived from microcontroller clock using flip flops. Ic 7474 is used as flip flop IC.

LED

It indicates the need of sprinkler. When LED is on, that means sprinkler should be on. If it is off there is no need of water.

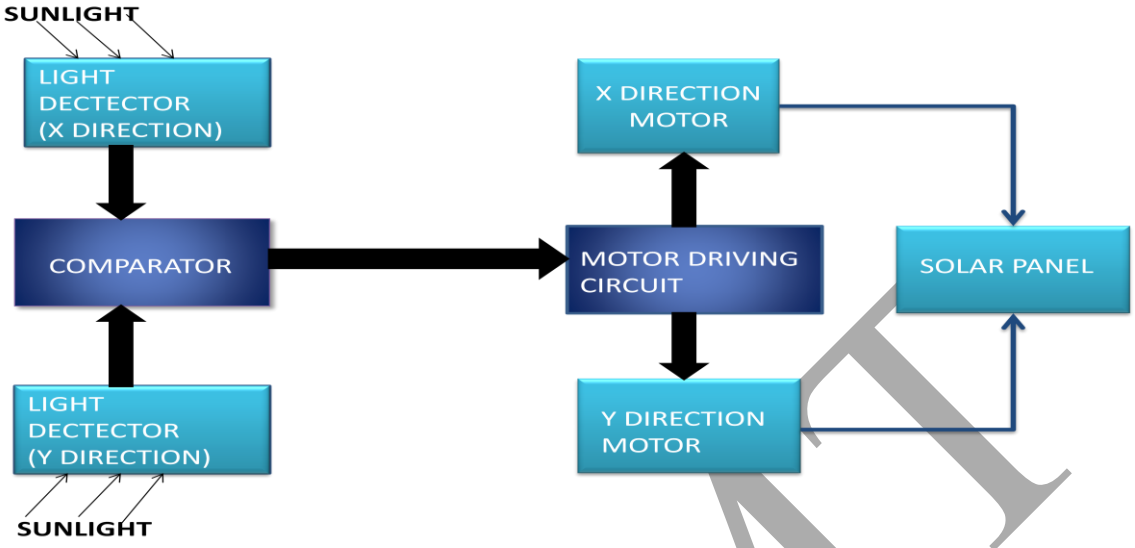
METHODOLOGY:

This project consists of two sections. First one is Solar Tracking whereas the second one is Automatic irrigation using microcontroller.

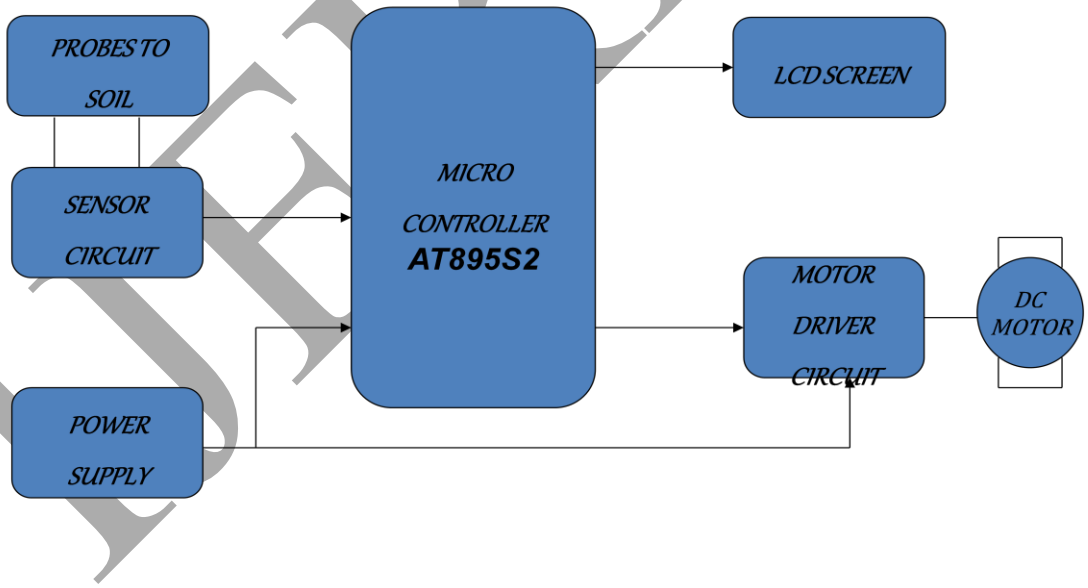
Solar Tracking System

The tracking device is composed of two same CdS (Cadmium Sulphide) light sensitive resistors, which detect light intensity from eastern and western directions, respectively. Inside every direction, there is a CdS light sensitive resistor with an elevation angle 45o to face a light source. The two sensors are separated into two groups. One uses CdS light sensitive resistor to be an eastward-westward direction sensor for comparing the light intensity of eastward and westward directions. When the eastward-westward direction sensor receives different light intensity, the system will obtain the signal according to the output voltages of the eastward-westward direction sensors. The applied circuit can read different output voltages of the sensor and decide which direction has larger light intensity than the other direction. Then, the system will drive the dc motors to make the solar panel turn to the decided direction. When the output voltages of the eastward-westward direction sensor are equal, i.e., the difference between the outputs of the eastward westward direction sensors is zero, then the motor voltage is also zero. This means that the tracking process is completed in the eastward-westward direction.

BLOCK DIAGRAM



Automatic irrigation using moisture Sensors



In this project we use solar energy which is used to operate the irrigation pump. The circuit comprises of sensor parts built using op-amps. Op-amp's are configured here as a comparator. Two stiff copper wires are inserted in the soil to sense whether the soil is wet or dry. A microcontroller is used to control the whole system by monitoring the sensors and when sensors sense dry condition of soil, then the microcontroller will send command to relay driver IC the contacts of which are used to switch on the motor and it will switch off the motor when the soil is in wet condition. The microcontroller does the above job as it receives

the signal from the sensors through the output of the comparator, and these signals operate under the control of software which is stored in ROM of the microcontroller. The condition of the pump i.e., soil condition is displayed on a 16X2 LCD which is interfaced to the microcontroller .Also we have used a temperature sensor for sensing the temperature at that point of time.

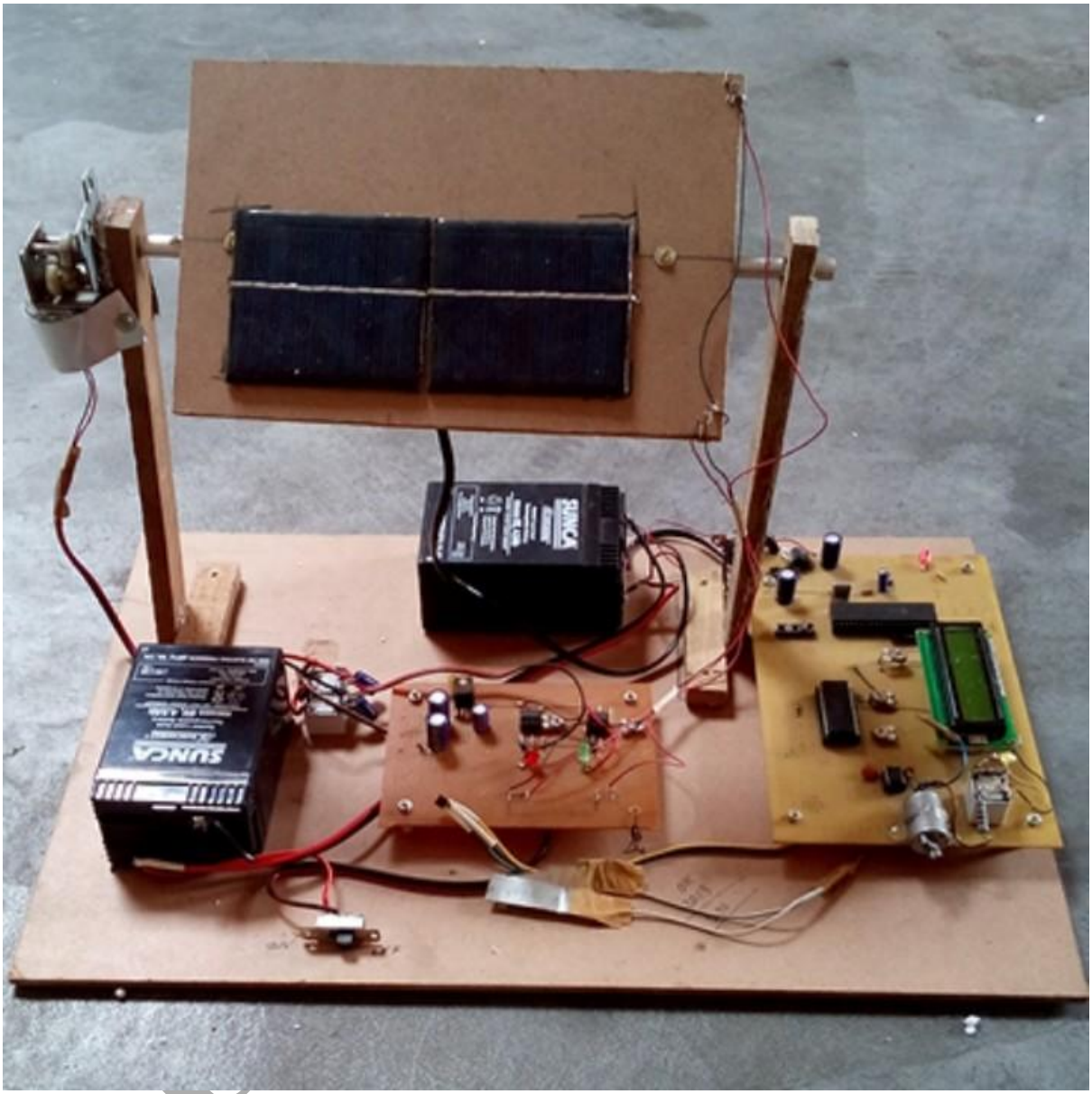


Fig. Proposed implementation of the project

CONCLUSION:

The paper has presented a means of tracking the sun's position with the help of solar tracking system. The solar tracker also provides lucrative solution for third world countries to integrate it into their solar system with a comparatively low cost through software based solutions. Though the prototype has limitations in hardware areas as an initial set up, still it provides an opportunity for improvement of the design methodology in future. The system provides with several benefits and can operate with less manpower. The system supplies water only when the humidity in the soil goes below the reference. Due to the direct transfer of water to the roots water conservation takes place and also helps to maintain the moisture to soil ratio at the root zone constant to some extent. Thus the system is efficient and compatible to changing environment.

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