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GSM Based Smart Agriculture System with Auto Solar Tracking

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Abstract: **Cost effective solar power can be the answer for all our energy needs. Solar powered smart irrigation systems are the answer to the Indian farmer. This system consists of solar powered water pump along with an automatic water flow control using a moisture sensor and GSM technology. 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. For the security purpose for the agriculture field cost effective laser fencing system is used. This type of security system is environment friendly and uses less power than electrical fencing. This circuit mainly consists of LDR, when there is an interrupt to the beam of laser the system produces a huge noise so that the wild animals run far away from the place. This project will be a design and implementation of a polar single axis solar panel tracker. It will have a fixed vertical axis and an adjustable horizontal motor controlled axis. This setup is similar to an office swivel chair. The tracker will actively track the sun and change its position accordingly to maximize the energy output. To prevent wasting power by running the motor continuously, the tracker will correct its position after 2 to 3 degrees of misalignment. The sensors will compare the light intensities of each side and move the panels until the tracker detects equal light on both sides. Additionally, it will prevent rapid changes in direction that might be caused by reflections, such as cars passing by. A rear sensor circuit is also incorporated to aid in repositioning the solar panels for the next sunrise. The gear motor will have overturn triggers to prevent the panel from rotating 360° and entangling wires. The motor control and sensing circuitry will run on batteries charged by the solar panel. This project will use 10W solar panels of approximately 15 inches by 10 inches to model larger panels used in industry.**

Keywords: **Smart irrigation; GSM; solar tracking; moisture sensor; energy crisis, tracking equipments; laser fencing**

1. INTRODUCTION

1.1 About auto irrigation:

Irrigation is the most important cultural practice and most labor intensive task in daily agriculture sector. Knowing when and how much to water is two important aspects of irrigation. To do this automatically, sensors and methods are available to determine when plants may need water. Automation involves mechanism of all the industrial activities so as to improve the speed of production, reduction of cost, effective use of resources. Automation is the use of control systems such as computers, cell phones microcontrollers. The main objective of this paper is to develop a microcontroller based system to irrigate the plant automatically. This system also supports water management decision, which determines the controlling time for the process. Another objective of the project is to send a short message service (SMS) to farmer regarding irrigation of different plots and motor ON and OFF condition.

1.2 About auto solar tracking:

A solar tracker is a device for orienting a solar photovoltaic panel, day lighting reflector or concentrating solar reflector or lens toward the sun. Solar power generation works best when pointed directly at the sun, so a solar tracker can increase the effectiveness of such equipment over any fixed position. The solar panels must be perpendicular to the sun's rays for

maximum energy generation. Deviating from this optimum angle will decrease the efficiency of energy generation from the panels. A few degrees of misalignment will only cause 1% to 5% of energy loss, while larger angles of 10° to 20° will significantly decrease the energy generation of up to 35%. Although, this loss is also dependent on the material and pattern of the protective glass that covers the solar panel.

An active tracker uses motors to direct the panel toward the sun by relying on a sensing circuit to detect light intensity. There are two main ways to mount a solar panel for tracking; single axis and dual axis. Single axis trackers usually use a polar mount for maximum solar efficiency. Polar trackers have one axis aligned to be roughly parallel to the axis of rotation of the earth around the north and south poles. When compared to a fixed amount, a single axis tracker increases the output by approximately 30% .The second way is a two axis mount where one axis is a vertical pivot and the second axis is the horizontal. By using a combination o f the two axes, the panel can always be pointed directly at the sun. This method increases the output by approximately 36% compared to stationary panels. As the gain from a dual axis tracking system is not a significant improvement over a single axis tracker, this project will focus on a single axis horizontal angle tracking with a manually adjusted vertical angle.

1.3 About laser fencing:

A laser fence is a mechanism to detect objects passing the line of sight between the laser source and the detector stronger lasers can potentially be used to injure someone or something passing the laser beam

2. METHADOLOGY

The system discussed over here is based on natural and clean solar power. This is a whole automated system with self decision making capability. The decision making part will be carried out by the Microcontroller and GSM. The solar tracking system will help in capturing maximum sunlight from the sun. This energy will be stored in a DC Battery. The stored power will be used to drive the irrigation pump. Here the system will be a sensor based one where the pump will start only when there is the need of water to the land. The control of the irrigation pump will be made through a mobile phone from any remote location or auto decision using sensors. In this section some related works are connected to the monitoring system using GSM services. In this system is used to control home appliances tenuously and offer security when the owner is away from the place.

This energy is also used for fencing for agriculture field, lighting, and auto cleaning of the solar panel and GSM technology is used to fetch the information about the motor running and which part of the field is irrigating and moisture level etc

1 .*Microcontroller:* Microcontrollers are used in automatically controlled products and devices, such as automobile engine control systems, implantable medical devices, remote controls, office machines, appliances, power tools, and toys. By reducing the size and cost compared to a design that uses a separate microprocessor, memory, and input/output devices, microcontrollers make it economical to digitally control even more devices and processes.

2. *Solar Cell Panel:* The solar cells that we see are also called photovoltaic (PV) cells, which convert sunlight directly into electricity. A module is a group of cells connected electrically and packaged into a frame (more commonly known as a solar panel), which can then be grouped into larger solar arrays.

3. *Moisture sensor:* The terms humidity and moisture are not interchangeable. Humidity refers to the water content in gases such as in the atmosphere. Moisture is the water content in any solid or liquid. Other important, related quantities are dew point temperature absolute humidity and relative Humidity.

4. *GSM modem:* A GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the mobile operator perspective, a GSM modem looks just like a mobile phone. When a GSM modem is connected to a computer, this allows the computer to use the GSM modem to communicate over the mobile network.

5. *DC motor:* A DC motor is designed to run on DC electric power. The Most Common DC Motors are the brushed and brushless types which use internal and externally. Brushless DC motors are commonly used where *precise speed control is necessary.*

***6. 12 V DC Battery*:** A 12 V DC battery is used to store the charge or power that is generated by the Solar Cell Panel.

3. OBJECTIVE

3.1 Problems in Indian agriculture

1. Inadequate irrigation facilities
2. Lack of mechanization
3. Inadequate power supply
4. Lack of technology usage
5. lack of interest towards agriculture in present generation

3.2 Aim of the project

1. Use of solar energy and designing of solar tracking for maximum power generation
2. Usage of this power for smart irrigation purpose
3. GSM technology for controlling mode of irrigation and information purpose
4. Laser fencing security for agricultural plot
5. We aim at finding problems of our farmers who are considered as the builders of our nation
6. To bring back unemployed youths into agriculture industry by introducing right technical support
7. Upgrading of agriculture system and developing it as like other industries
8. Usage of technology and renewable energy for better tomorrow
9. Available technology integration

4. WORKING PRINCIPLE

The basic idea of developing this paper is to obtain maximum sunlight from the sun throughout the day, by tracking the movement of the sun. Here the Solar Cell Panel is moved according to the position of the sun. By tracking the movement of the sun, maximum sunlight is obtained; further this energy will be stored in a 12 V DC Battery. The solar cell panel will be mounting on a rotating structure. This structure will have DC motors that will help the structure to rotate. The LDR will be detecting the sunlight and send the data to the microcontroller. One at each direction East and West. As long as the sunlight is in the perimeter of the 1st LDR the solar panel will remain in the same direction. Once the sunlight is out of the perimeter of the 1st LDR, it will stop sending data to the microcontroller. But at the same time the sunlight will be in the perimeter of the 2nd LDR, as we have installed the LDRs in such a pattern. Now the 2nd LDR will start sending the data to the microcontroller. Upon getting the data from the 2nd LDR the microcontroller will send a command to the DC motor. After receiving the command from the microcontroller now the DC motor will get started and the panel will move to the corresponding direction. This is how we are going to track the sunlight and adjust the solar panel in a position where it will receive maximum sunlight.

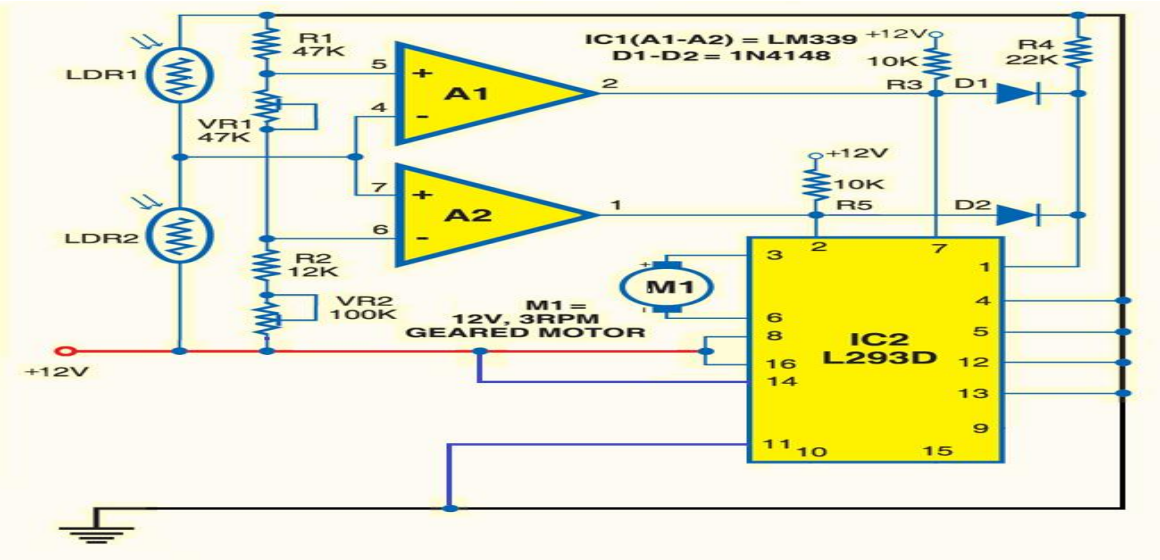


Fig1: Circuit diagram of auto solar tracking system

Now moving to the second part of the project, the energy generated through the solar panel will be sent to a DC battery. The battery will store the energy for further applications. Now we are connecting a water pump to the battery so that the motor should run on the power generated by the solar panel. We are making the irrigation system an intelligent one. In this system the water supply will be an automated one that means the pump will supply the water only when the land needs it. And the water pump will be controlled by a cellular phone from any remote location. In order to achieve this task we are making use of a moisture sensor and a GSM Module or device. The moisture sensor will be placed in the field, and it will be connected to the microcontroller. The moisture sensor will be continuously sending the amount of moisture to the microcontroller, where it will be compared with a predefined value. Now whenever the moisture level becomes less than the predefined level, the microcontroller will activate the GSM Module, which will send a message to the user, stating that the moisture level of the land has dropped. Now upon receiving the message the user can activate or switch on the water pump by just sending a sms. After receiving the sms the GSM module will send the data to the microcontroller and the microcontroller will send a command to activate the water pump. After the motor gets started and starts supplying water to the field, simultaneously the moisture sensor will be sending the moisture level to the microcontroller. Since the field is getting water supply now the moisture level of the field will start increasing, this increase in the moisture will again be compared with a predefined moisture level by the microcontroller. Once if it reaches the maximum level again the microcontroller will activate the GSM module which will again send a message to the user about the increase in the moisture level. Now if the user wants he/she can switch off the water pump by sending a sms and they can manage to irrigate desired plot by sending an sms. This is how the system will become an automated system also .we are drawing maximum power through the sunlight. The user is free to take a decision whether to supply the water or not from any remote location as long as there is cellular phone network

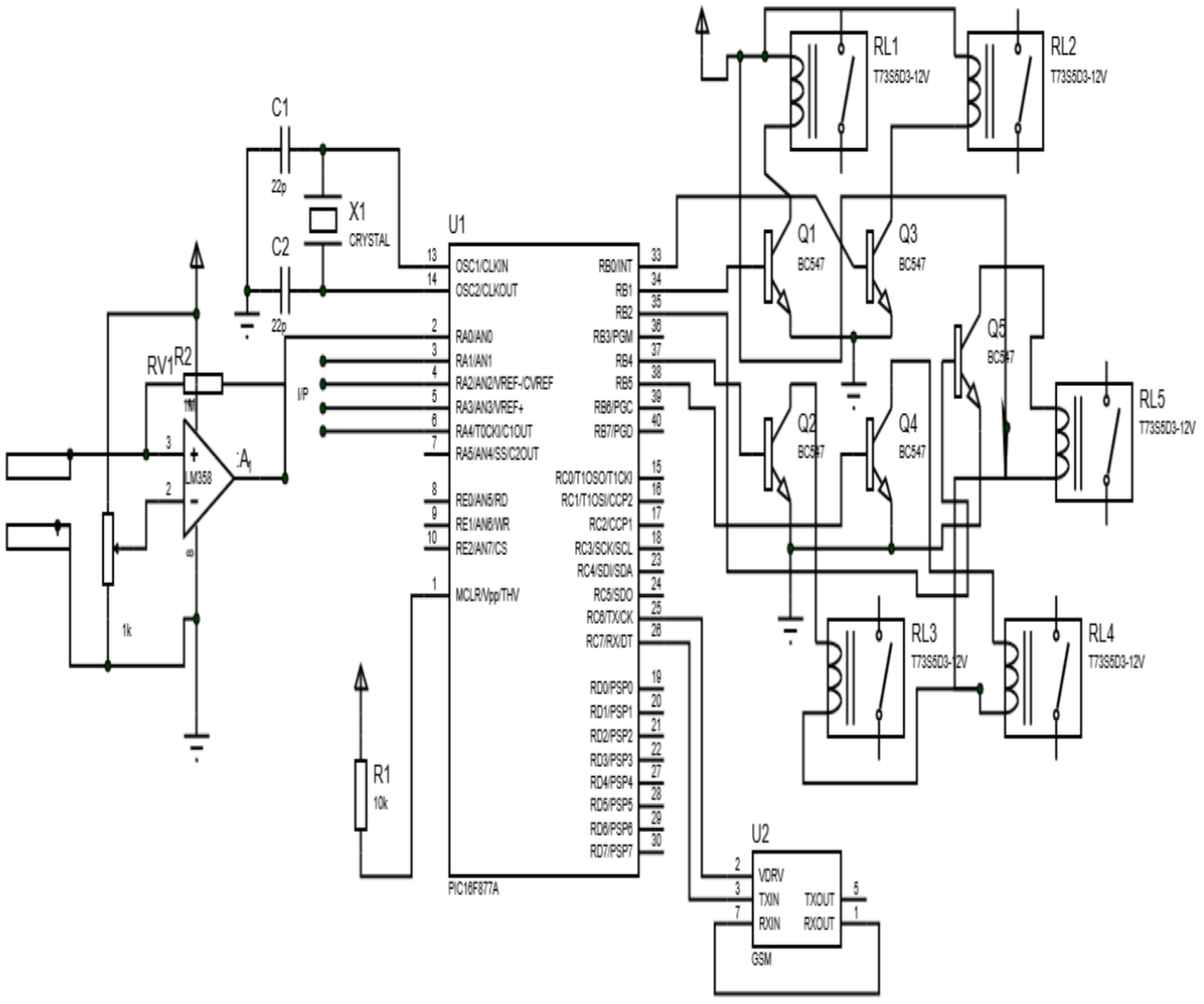
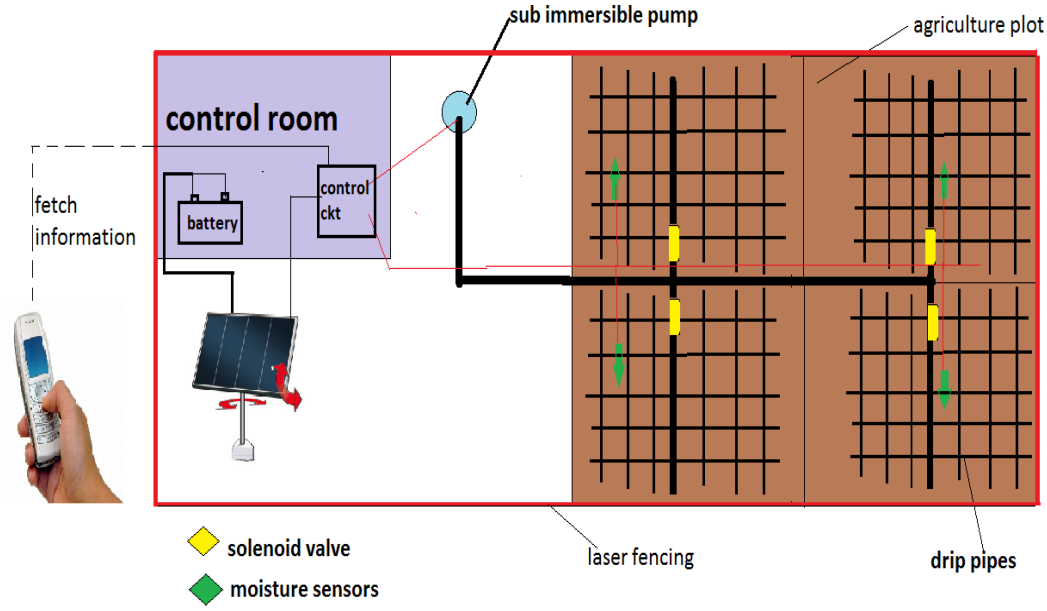


Fig2: Circuit diagram of auto irrigation system

5. SNAPSHOTS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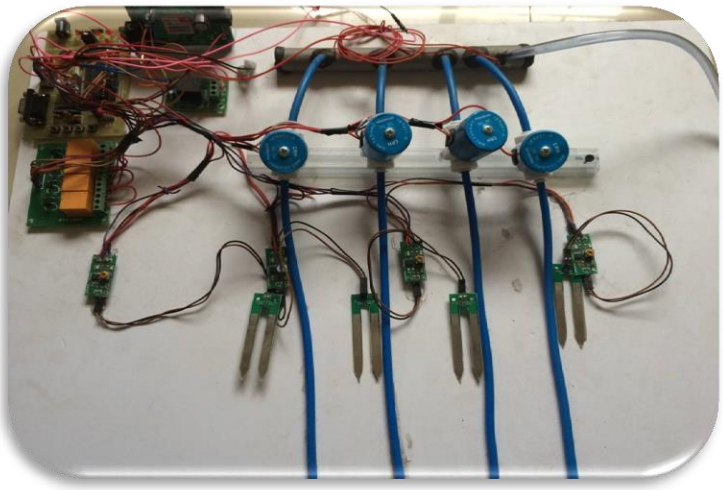
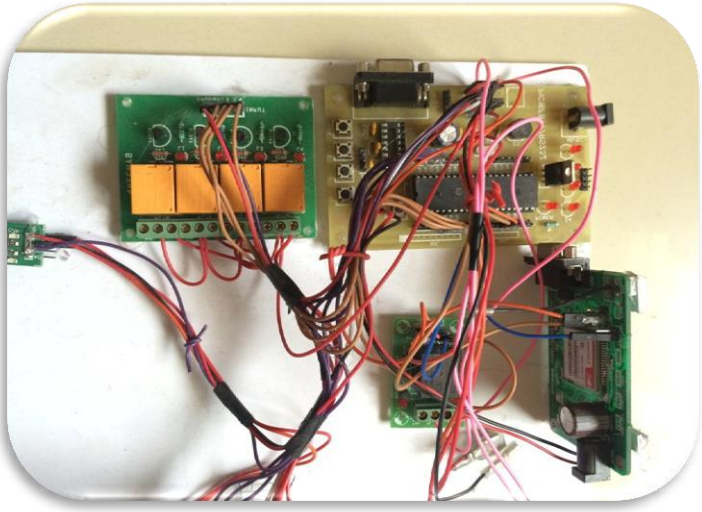
moisture sensors
laser fencing
drip pipes





6. CONCLUSION

Renewable energy solutions are becoming increasingly popular. Photovoltaic or solar systems are one good example of this. In order to maximize power output from the solar panels, one needs to keep the panels aligned with the sun. This is a far more cost effective solution than purchasing additional solar panels when dealing with large panel arrays [3]. A fairly large solar panel tracker would cost several hundred dollars and will increase the energy produced by 30% to 50% depending on the season and location. The solar panels in the large arrays would cost in the thousands of dollars, so the addition of a solar tracker is very cost effective. Another benefit is the space saved rather than adding extra panels

This project develops an automatic tracking system which will keep the solar panels aligned with the sun in order to maximize efficiency. The use of the PCB drastically reduced the size of circuitry in the project and made it more reliable as there were no more connection problems. This project can be converted to a dual axis tracker fairly easily. The components and circuitry are already present in the finished tracker. The rear sensor can be converted to a tracker for the second axis with some wiring changes. All that is needed is a second gear motor or linear actuator.

To conclude, this project turned out well and met the original requirements and functionality. Although there were many problems and more work on the mechanical side than originally expected, overall it was an enjoyable experience completing this project.

This technology in future will enable the farmer to control & view farming direction from home through various methods like internet, mobile. The farm can be protected from animals, fire and any anonymous person entering the field. Insects can be detected and avoided. Growth of crops can be informed to the farmers.

REFERENCES

[1] Sabe,A.y.,Venaagmoothy,G.K.”Efficient Utilization of renewable energy sources by Gridable Vehicles in Cyber-Physical energy System Journal,IEEE-sept 2010.

[2] Bull,S.R., renewable energy sources and Rural Development in Developing Countries”, Proceedings of the IEEE 2001

[3] Nehrir,M.H.;Wang,C.;Srunz,k.;Aki,H;Ramakumar,R.;Bing,J.;Miao,Z.;Salameh,Z.;”A Review of Hybrid Renewable /Alternative energy System for electric Power Generation ;Configuration,Control,and Application”, Sustainable energy,IEEE transaction on Oct. 2011

[4] 100 Electronics projects-Bright publications.

[5] BASIC for AVR microcontrollers by- Nebojsa Matic

[6] Code Vision tutorials -Saurabh Sankule(I.I.T. Kanpur)

[7] Bull,S.R., renewable energy sources and Rural Development in Developing Countries”, Proceedings of the IEEE 2001

[8] http://www.sunrom.com

[9] http://www.datasheets.com