Solar Energy Tracking System using At89s52 Microcontroller and L293d Motor Driver Circuit

Battu Deepa, M. Hemalatha

Abstract- With the increasing demand of energy and the diminution of the fossil fuels, with increase in pollution level and depletion of the ozone layer the demand for the natural and renewable sources of energy is the need of the hour and this has been the point of discussion all over the world with many organizations working for the utilization of these resources and its promotion and United Nations allocating huge amount of funds for its promotion we have also made an effort to contribute a bit in the same direction. It is a known fact that the most unutilized source of energy is solar energy. This paper deals with a microcontroller based solar panel tracking system. Solar tracking enables more energy to be generated because the solar panel is always able to maintain a perpendicular profile to the sun's rays. Development of solar panel tracking systems has been ongoing for several years now. As the sun moves across the sky during the day, it is advantageous to have the solar panels track the location of the sun, such that the panels are always perpendicular to the solar energy radiated by the sun A solar energy tracker is a device used for orienting a solar photovoltaic panel or lens towards the sun. Hence the sun tracking system can collect more energy.

Index Terms— Solar system, solar panel, microcontroller AT89S52, LCD HITACHI 44780, L293D MOTOR DRIVER CIRCUIT.

I. INTRODUCTION

The most common method of electrical power generation uses fossil fuels such as coal which causes pollution gas which has been directly associated with global warming due to the greenhouse effect. solar energy can be used as an alternative source of energy for the world's ever increasing requirements. In this solar energy tracker AT89S52 microcontroller was used to control the movement of the solar panel. The system is designed to be autonomous; such that energy generated by the solar panel would be used to charge two lead acid batteries. Solar Energy is one of the most popular renewable sources nowadays [1]-[3]. It is being widely used also, and within some more years it will be very popular that it will be used for many purposes, in industries and household as well. So it is most important fact to utilize the maximum energy of the sun so that maximum power can be generated. The thought behind this paper is also derived from this fact. In many places experiment is being done on this fact how it is possible to make full use of the day light. In many places application of this project can be seen also. This paper has got a bright future scope further. Accuracy of this solar panel can be increased further and number of steps can be increased as well to get more accurate desired output.

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Timer circuit can also be integrated with this so that this system responses more accurately. Even in a cloudy day when intensity of sunlight may vary at different time of a day, the timer circuit can be more that handy to drive the solar panel correctly in that low light. As per energy concerned solar energy is one of the most promising energy which is going to be a main source of energy in near future [4]-[8].

a) NEED OF SOLAR ENERGY TRACKER

Increases solar panel output
Maximum efficiency of the panel
Maximum power per unit area
Able to grab the enegy throughout the day

b) TYPES OF SOLAR TRACKERS

The sun position in the sky varies both with the seasons and time of day as the sun moves across the sky [9], hence there are two types of solar tracker:
1.single axis solar tracker
2.dual axis solar tracker

(A)

(B)

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Overview of Present Tracker Drive Types

Solar tracker Drives, can be divided into three main types depending on the type of drive and sensing or positioning system that they incorporate.

- *1. Passive trackers :* use the sun's radiation to heat gases that move the tracker across the sky.
- *2. Active trackers :* use electric or hydraulic drives and some type of gearing or actuator to move the tracker.
- *3. Open loop trackers :* use no sensing but instead determine the position of the sun through pre recorded data for a particular site.

(C)

Fig 1: (a). single axis solar tracker (b). dual axis solar tracker (c).types of solar energy trackers

II. DETAILED DESCRIPTION OF THE SOLAR ENERGY SYSTEM
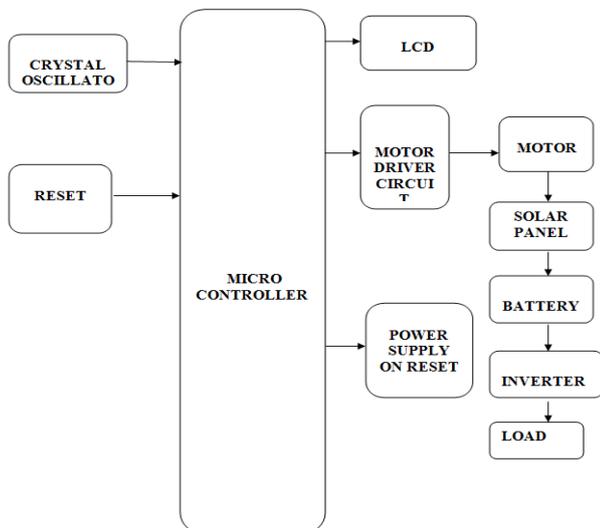
a) The Microcontroller part: [10]-[12] In the figure the interfacing circuitry of the Unipolar Stepper Motor with microcontroller AT89C51 is shown. The AT89S52 provides a set of standard features:

- ➢ *8K Bytes of Re-programmable Flash Memory.*
- ➢ *RAM is 256 bytes.*
- ➢ *4.0V to 5.5V Operating Range.*
- ➢ *Fully Static Operation: 0 Hz to 33 MHz's*
- ➢ *Three-level Program Memory Lock.*
- ➢ *256 x 8-bit Internal RAM.*
- ➢ *32 Programmable I/O Lines.*
- ➢ *Three 16-bit Timer/Counters.*
- ➢ *Eight Interrupt Sources.*
- ➢ *Full Duplex UART Serial Channel.*
- ➢ *Low-power Idle and Power-down Modes.*
- ➢ *Interrupt recovery from power down mode.*
- ➢ *Watchdog timer.*
- ➢ *Dual data pointer.*
- ➢ *Power-off flag.*
- ➢ *Fast programming time.*
- ➢ *Flexible ISP programming (byte and page mode).*
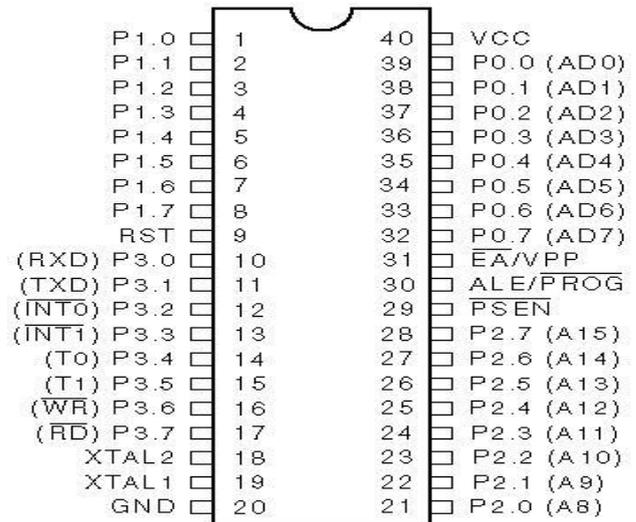
Fig2: pin description of AT89S52

b) POWER SUPPLY

A power supply can by broken down into a series of blocks, each of which performs a particular function. For example a 5V regulated supply:
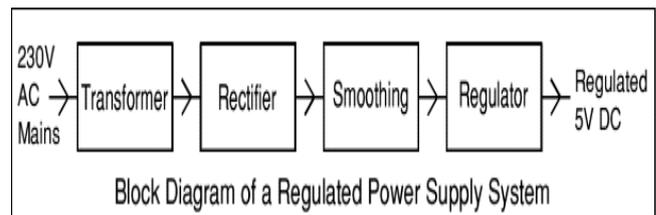
c) GEAR MOTORS

A gear motor is a type of electrical motor. Like all electrical motors, it uses the magnetism induced by an electrical current to rotate a rotor that is connected to a shaft. The energy transferred from the rotor to the shaft is then used to power a connected device

Fig 3: Gear motor

d) L293D MOTOR DRIVER CIRCUIT

L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors.
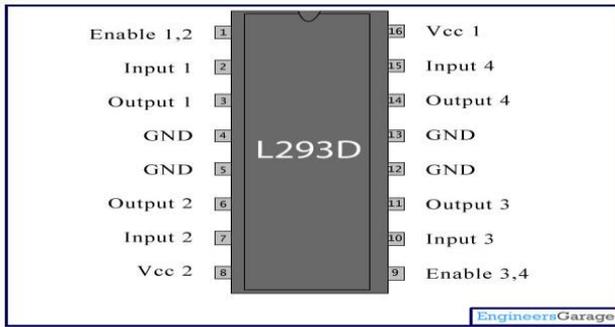
Fig 4: pin diagram of L293D

Pin No	Function	Name
1	Enable pin for Motor 1; active high	Enable 1,2
2	Input 1 for Motor 1	Input 1
3	Output 1 for Motor 1	Output 1
4	Ground (0V)	Ground
5	Ground (0V)	Ground
6	Output 2 for Motor 1	Output 2
7	Input 2 for Motor 1	Input 2
8	Supply voltage for Motors; 9-12V (up to 36V)	Vcc 2
9	Enable pin for Motor 2; active high	Enable 3,4
10	Input 1 for Motor 1	Input 3
11	Output 1 for Motor 1	Output 3
12	Ground (0V)	Ground
13	Ground (0V)	Ground
14	Output 2 for Motor 1	Output 4
15	Input2 for Motor 1	Input 4
16	Supply voltage; 5V (up to 36V)	Vcc 1

e) LCD DISPLAY

Liquid Crystal Display also called as LCD is very helpful in providing user interface as well as for debugging purpose. The most common type of LCD controller is HITACHI 44780 which provides a simple interface between the controller & an LCD. These LCD's are very simple to interface with the controller as well as are cost effective. The most commonly used *ALPHANUMERIC* displays are *1x16* (Single Line & 16 characters), *2x16* (Double Line & 16 character per line) &*4x20* (four lines & Twenty characters per line). The LCD requires 3 control lines (RS, R/W & EN) & 8 (or 4) data lines. The number on data lines depends on the mode of operation.
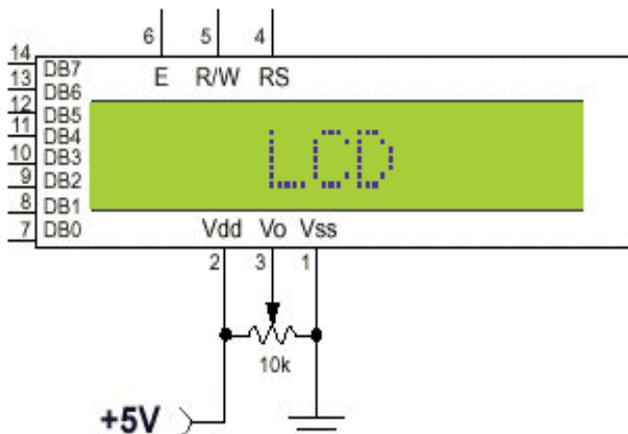
Fig 5 : LCD Display

f) Display Data RAM (DDRAM)

Display data RAM (DDRAM) is where you send the characters (ASCII code) you want to see on the LCD screen. It stores display data represented in 8-bit character codes. Its capacity is 80 characters (bytes).

g) Character Generator RAM (CGRAM)-User defined character RAM

In the character generator RAM, we can define our own character patterns by program. CG RAM is 64 bytes, allowing for eight 5*8 pixel, character patterns to be defined. However how to define this and use it is out of scope of this tutorial. So I will not talk any more about CGRAM

RS	R/W	Operation
0	0	IR write as an internal operation (display clear, etc.)
0	1	Read busy flag (DB7) and address counter (DB0 to DB6)
1	0	DR write as an internal operation (DR to DDRAM or CGRAM)
1	1	DR read as an internal operation (DDRAM or CGRAM to DR)

Table 1 : Register selection

h) Busy Flag (BF)

When the busy flag is 1, the LCD is in the internal operation mode, and the next instruction will not be accepted. When RS = 0 and R/W = 1 (see the table above), the busy flag is output to DB7 (MSB of LCD data bus). The next instruction must be written after ensuring that the busy flag is 0.

i) LCD COMMANDS

The LCD's internal controller accepts several commands and modifies the display accordingly. These commands would be things like:
– Clear screen
– Return home
– Shift display right/left

Instruction	Decimal	HEX
Function set (8-bit interface, 2 lines, 5*7 Pixels)	56	38
Function set (8-bit interface, 1 line, 5*7 Pixels)	48	30
Function set (4-bit interface, 2 lines, 5*7 Pixels)	40	28
Function set (4-bit interface, 1 line, 5*7 Pixels)	32	20
Entry mode set	See Below	See Below
Scroll display one character right (all lines)	28	1E
Scroll display one character left (all lines)	24	18
Home (move cursor to top/left character position)	2	2
Move cursor one character left	16	10
Move cursor one character right	20	14
Turn on visible underline cursor	14	0E
Turn on visible blinking-block cursor	15	0F
Make cursor invisible	12	0C
Blank the display (without clearing)	8	08
Restore the display (with cursor hidden)	12	0C
Clear Screen	1	01
Set cursor position (DDRAM address)	128 + addr	80+ addr
Set pointer in character-generator RAM (CG RAM address)	64 + addr	40+ addr

Table 2: LCD commands

III. SOLAR PANEL

A solar module, (photovoltaic module or photovoltaic panel) is a packaged, connected assembly of photovoltaic cells. The solar panel can be used as a component of a larger photovoltaic system to generate and supply electricity in commercial and residential applications. The efficiency of a panel determines the area of a panel given the same rated output - an 8% efficient 230 watt panel will have twice the area of a 16% efficient 230 watt panel. Because a single solar panel can produce only a limited amount of power, most installations contain multiple panels [13]-[15].
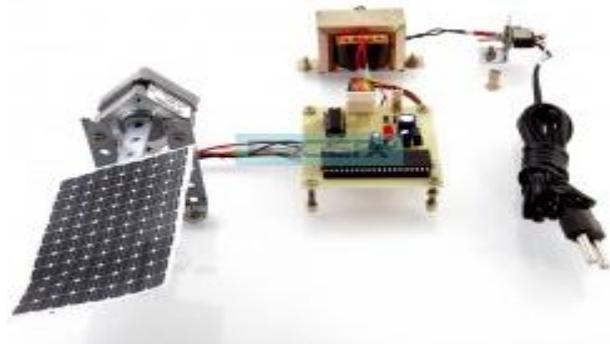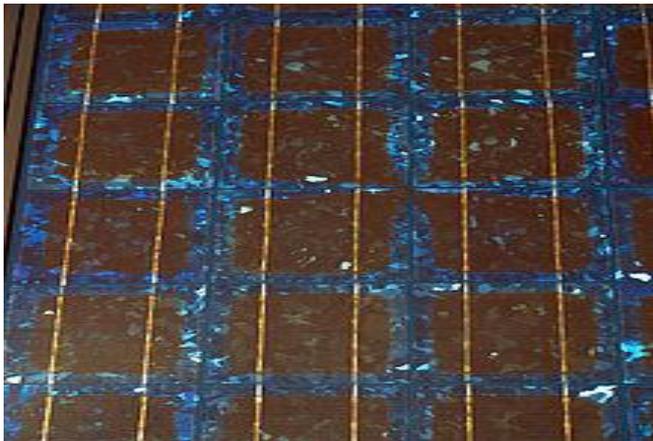
Fig 6. Model of solar energy tracking system

a. HOW SUN TRACKING SOLAR PANELWORKS?

❖ Initially power the circuit.
❖ Place the set up in dark
❖ When the two LDRs are in dark, there is no movement in the panel.
❖ Now place a torch in front of the left LDR. Panels slowly move towards its left.
❖ Now move light from left to right. You can observe the panel moving slowly with the torch towards right.
❖ In the middle, when intensity on both LDRs is equal, panel will not move until there is difference between the light intensity falling on the LDRs [16]-[18].

IV. SOFTWARE USAGE

The microcontroller chip AT89S52 is directed as the program in its flash memory instructs it. So it is obvious to load the program into the chip. Program is written in ASM notepad and compiled. If any compilation error occurs, then it is debugged. Then the HEX-code is generated. Then the program is simulated in 8052 simulator. This gives an opportunity to see what will be the result of the code. If the code gives desired result then the USB based superpro is used to load the program; or to _burn' the chip. USB based superpro is basically a universal programmer. After downloading the HEX code in the chip is again connected to the main circuit.

About Keil

- Click on the Keil u Vision Icon on Desktop
- Click on the Project menu from the title bar
- Then Click on New Project
- Save the Project by typing suitable project name with no extension in u r own folder sited in either C:\ or D:\
- Then Click on Save button above.
- Select the component for u r project. i.e. Atmel……
- Click on the + Symbol beside of Atmel
- Select AT89C51
- Then Click on "OK"
- Then Click either YES or NO………mostly "NO"
- Now your project is ready to USE
- Now double click on the Target1, you would get another option "Source group 1"
- Click on the file option from menu bar and select "new"
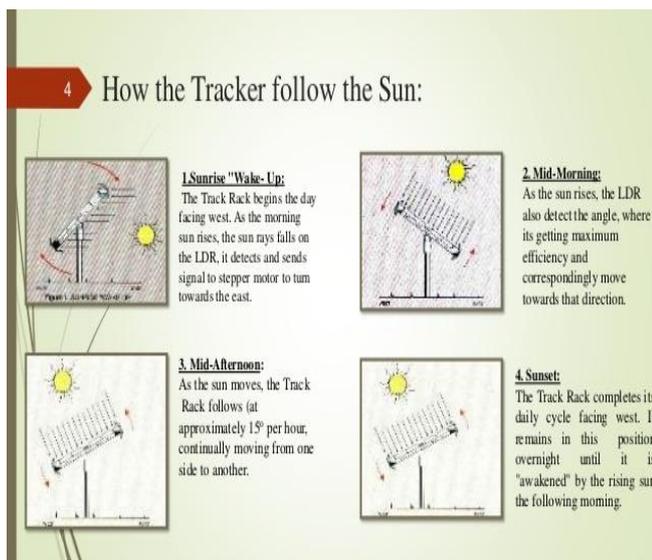
- The next screen will be as shown in next page, and just maximize it by double clicking on its blue boarder.
- Now start writing program in either in "C" or "ASM"
- For a program written in Assembly, then save it with extension ". asm" and for "C" based program save it with extension " .C"
- Now right click on Source group 1 and click on "Add files to Group Source"
- Now you will get another window, on which by default "C" files will appear.
- Now select as per your file extension given while saving the file
- Click only one time on option "ADD"
- Now Press function key F7 to compile. Any error will appear if so happen.If the file contains no error, then press Control+F5 simultaneously.
- The new window is as follows
- Then Click "OK"
- Now Click on the Peripherals from menu bar, and check your required port
- Drag the port a side and click in the program file.
- Now keep Pressing function key "F11" slowly and observe.
- You are running your program successfully

FLASH MAGIC:
Flash Magic is Windows software from that microcontroller iseasyly programmed using In-System Programming technology to all the ISP feature empowered devices.
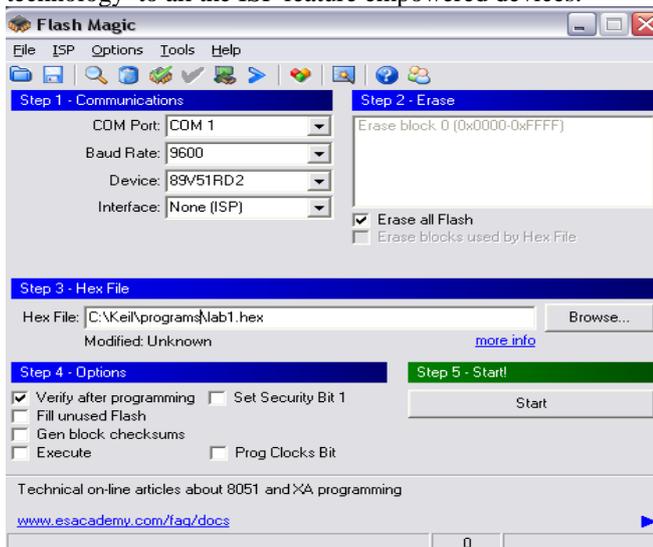
After installing the software when we click on the icon of the software the window will open on the screen as shown in figure. We need to change the device and have to select the device 89V51RD2, and then we set to 'erase all flash' option on the flash magic window If we need to verify the proper dumping of the program in the microcontroller then we need to set the 'verify after program' option. Loading of hex file: After selecting device we load the hex file in the given block by using the 'browse' option on the 'FLASH MAGIC' window. Programming of device: after loading the file next step is dumping of code in microcontroller. For that we first connect the computer's serial port to your controller board through serial cable. Then after give the power supply to the controller board. Now it's time to dump the code in controller.

Press the start option on your flash magic window. Then your microcontroller will be programmed in few seconds.

V. RESULTS AND ANALYSIS

STEP1: Circuit
STEP 2: Solar Panel Connecting To the Citcuit
STEP3:LCD Indicating Tracking
STEP 4: Tracking position of the Solar Panel using LDR
Step 5: Battery connected in the circuit
Step 6: Bulb Is Lighted Using the Battery power which is stored energy from the solar panel
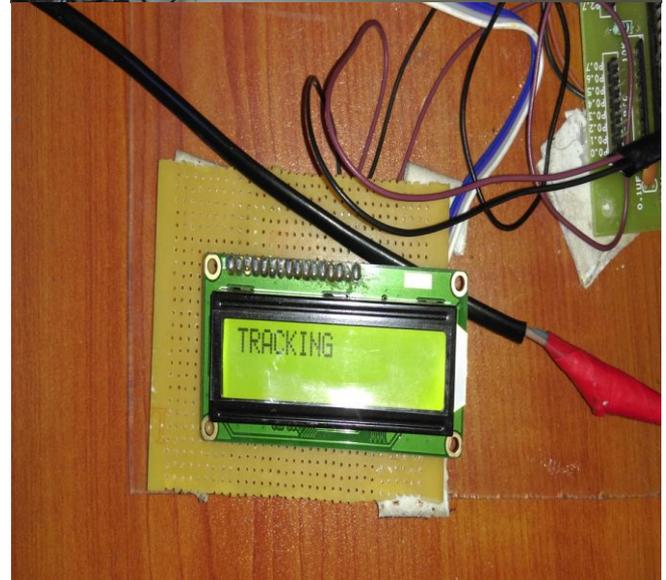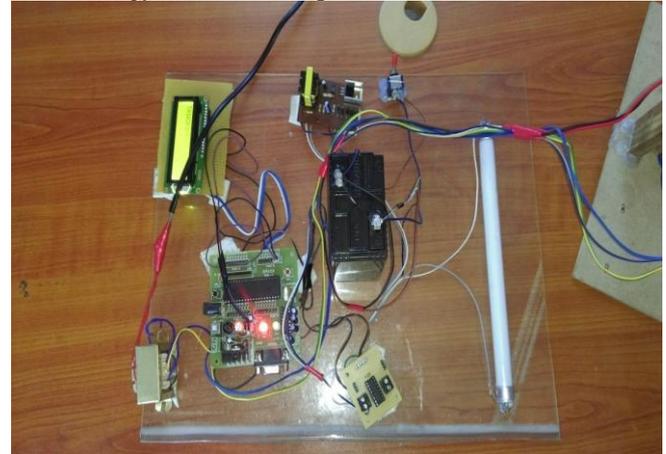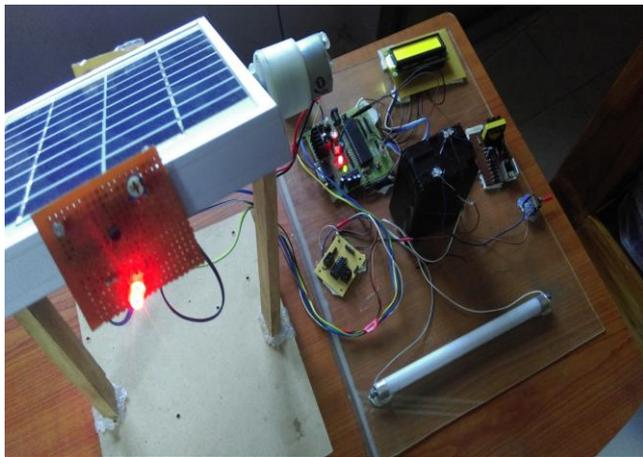
VI. CONCLUSION AND FUTURE SCOPE

In recent years, the generation of electricity using solar technology has seen a tremendous growth, in particular because of the economic considerations and smooth operation of the solar panels. Even though the initial costs are high, but operation costs and maintenance costs are low. Solar tracking system today offer an innovative method to track the solar insolation and provide economic compatibility of the generation of electric power where grid connections are difficult to setup and costly. Accuracy of this solar panel can be increased further and number of steps can be increased as well to get more accurate desired output. Timer circuit can also be integrated with this so that this system responses more accurately. Even in a cloudy day when intensity of sunlight may vary at different time of a day, the timer circuit can be more that handy to drive the solar panel correctly in that low light. As per energy concerned solar energy is one of the most promising energy which is going to be a main source of energy in near future.

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