Visvesvaraya Technological University Belgaum,

Karnataka-590 018

A Project Report on

"Power Generation from Footstep and Solar to Charge Mobile Phones"

Project Report submitted in partial fulfillment of the requirement for the award of the degree of

Bachelor of Engineering

In

Electrical & Electronics Engineering

Submitted by

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Department of Electrical & Electronics Engineering

2020-2021

CMR INSTITUTE OF TECHNOLOGY
DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
AECS Layout, Bengaluru-560 037

Certificate

Certified that the project work entitled **"Power Generation From Footstep and Solar to Charge Mobile Phones"** carried out by Mr. Sagar V Gowda, USN 1CR17EE061; Mr. Rajath A R, USN 1CR18EE411; Mr. Sachinreddy, USN 1CR18EE412; Mr. Veeramani, USN 1CR17EE081 are bonafied students of CMR Institute of Technology, Bengaluru, in partial fulfillment for the award of Bachelor of Engineering in Electrical & Electronics Engineering of the Visvesvaraya Technological University, Belgaum, during the year 2020-2021. It is certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in the Report deposited in the departmental library.

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Signature of the Guide	*Signature of the HOD*	*Signature of the Principal*
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DECLARATION

We, [Mr. **Sagar V Gowda (1CR17EE061),** Mr. **Rajath A R (1CR18EE411),** Mr. **Sachinreddy (1CR18EE412),** Mr. **Veeramani (1CR17EE081)],** hereby declare that the report entitled **"Power Generation From Footstep and Solar to Charge Mobile Phones"** has been carried out by us under the guidance of **Ms. Sanitha Michail.C,** Assistant Professor, Department of Electrical & Electronics Engineering, CMR Institute of Technology, Bengaluru, in partial fulfillment of the requirement for the degree of **BACHELOR OF ENGINEERING in ELECTRICAL & ELECTRONICS ENGINEERING**, of Visveswaraya Technological University, Belagaum during the academic year 2020-21. The work done in this report is original and it has not been submitted for any other degree in any university.

Place: Bengaluru

Date:

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Abstract

Sun has been providing heat and light to the habitants of earth from centuries and its intensity is all the same. Photovoltaic cells can be used to collect the rays of sun and then to transform them into electricity. The method is although expensive but it is a onetime investment that can support life for decades. Solar electricity is a renewable source of energy that has been with use since the onset of life. Solar energy is captured through the solar panels and then it is converted to solar electricity using Photovoltaic (PV) technology. PV solar panels are longer lasting and efficiently convert energy from the sun to electricity. Piezoelectric Energy Harvesting is done by the piezoelectric effect. The essence of the piezoelectric effect works as follows: by applying a mechanical stress to a crystal, one can generate a voltage or potential energy difference, and thus a current

Acknowledgement

The satisfaction and euphoria that accompany the successful completion of any task would be incomplete without the mention of people, who are responsible for the completion of the project and who made it possible, because success is outcome of hard work and perseverance, but steadfast of all is encouraging guidance. So, with gratitude we acknowledge all those whose guidance and encouragement served us to motivate towards the success of the project work.

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We are thankful to all the faculties and laboratory staffs of ***Electrical and Electronics Engineering Department, CMR Institute of Technology, Bengaluru*** *for helping us in all possible manners during the entire period.*

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CONTENTS

CHAPTER 1
INTRODUCTION

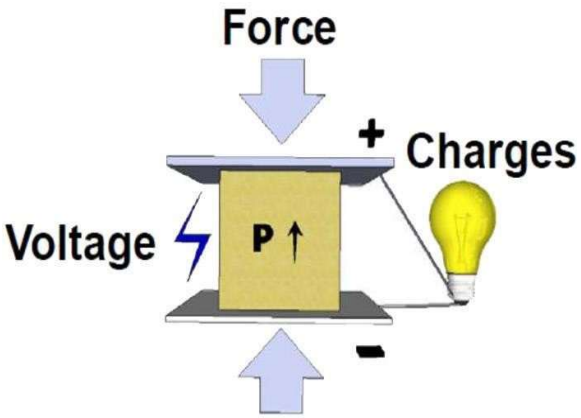
With increasing concern of global warming and the depletion of fossil fuel reserves, many are looking at sustainable energy solution to preserve the earth for the future generations. Other than hydro power, vibration and photovoltaic energy holds the most potential to meet our energy demands. The vibration energy is capable of providing large amounts of power but its presence is highly uncertain as it can be here one moment and gone in another. Similarly, solar energy is present throughout the day but the solar irradiation levels vary due to sun intensity and unpredictable shadows cast by clouds, birds, trees, etc. The common inherent drawbacks of vibration and photovoltaic systems are their intermittent natures that make them unreliable.

However, by combining these two intermittent sources and incorporating maximum power point tracking (MPPT) algorithm, the system's power transfer efficiency and reliability can be improved significantly. When a source is insufficient, the load demands some other energy sources to compensate for the difference. Several hybrid vibration power systems with MPPT control have been proposed and discussed in works.

Due to advancement in the field of technology in recent years, wireless data transmission techniques are commonly used in electronic devices. For powering them we rely upon power supply through wires charging, else power may be supplied from batteries. But while travelling for longer distances continuously we may not be able to obtain power supply for these devices to operate or to recharge their batteries. So in order to operate them continuously we need a power source that provides continuous energy to operate these devices.

The mechanical vibrations which are produced by the automobiles can be utilized as a source of energy for generating electrical energy that can be utilized by this electronic equipment to operate. These vibrations are produced by different vehicles around us which are going as a waste. Piezoelectric materials is used by this technique, where deformations done by the vibrations are directly converted into the electrical charge via piezoelectric effect and principle of electromagnetic induction between coil and magnetic field that produces Electromotive force (EMF) in the coil and so it provides displacement to the performance magnet by the vibrations. All the piezoelectric materials and magnets are used as the energy

conversion devices for converting mechanical vibrations into electrical energy. In this context, we introduced two methods and considered its output performance provided input vibrations, by using piezoelectric materials such as piezoelectric for electromechanically conversion using Mass- spring system as medium of conversion of force from vibrations applied on piezoelectric materials and by using spring-magnet system where relative displacement of magnet with respect to coil, provided input vibrations generates Electromotive force in coil.



CHAPTER 2

Literature Survey

Ref 1.

Earlier developments in the piezo electric circuitry involved concentration on small vibrations and hence small strains. Also, few of them required external voltage supply and there were number of losses in the system which amounts to low voltage output.

In December 1929, scientists in U.S Navy performed various researches on piezoelectric crystals. Their focus was primary on the dimensions of crystals. This research proved that by changing the dimension and orientation of crystal the output is considerably changed. They designed the crystal named 'Curie cut' or 'Zero Cut' based on the changes made in the angles of the crystal. Thus, this proves that the crystals designed with such dimensions are effective in controlling oscillations of a 50watt vacuum tube. So, they act as a voltage controlling device too.

In 1985, the concept of using handwriting dynamics for electronic identification was performed in Sandia Laboratories. A piezoelectric sensor pen for obtaining the pen point dynamics during writing was studied. Design equations were derived and details of an operating device were studied. Typical output waveforms obtained from the operation of the pen and showed the dissimilarities between dynamics of a genuine signature and an attempted forgery. So, this also shows high sensitivity of Piezo material towards marginal pressure change.

In 2000, various applications of piezoelectric in wireless sensing was studied and experimented. Numerous industrial and military applications require remote sensing of various machine and equipment operating parameters in locations where traditional power sources may not be available and long periods of unattended operation are required. Quite often, however, some source of Vibrating energy may be present in operation of the machine in question. Hence a piezoelectric source is efficiently utilized to generate power for the operation of a microcontroller and radio transmitter to acquire sampled machine data. Various techniques for the efficient conversion, use and storage of piezoelectric power are discovered and used in a general energy harvesting data transmitter design.

In 2005, United States Defense Advance Research Project Agency (DARPA) initiated an innovative project on Energy harvesting which attempts to power battlefield equipment by piezoelectric generators embedded in soldiers' boots. However, these energy harvesting sources put an impact on the body. DARPA's effort to harness 1-2 watts from continuous shoe impact while walking was abandoned due to the discomfort from the additional energy expended by a person wearing the shoes.

In this project the concentration is mainly on use of the piezoelectric crystals and films in high vibration system with efficient arrangement to get higher efficiency. Moreover, the amplification level designed will be such that the output rating of system will be considerably higher than previous systems.

Ref 2.

sensor is a device that uses the piezoelectric effect to measure changes in pressure, acceleration, temperature, strain, or force by converting them to an electrical charge.

The piezoelectric effect is common in piezo ceramics like $PbTiO_3$, $PbZrO_3$, and PZT.

In this present footstep power generator, the piezoelectric material plays a great role so its choice is of great importance. The prefix Piezo is a Greek word which means to ‘press’ or ‘squeeze’.

Piezoelectric ceramics fit to the group of ferroelectric materials.

PZT and PVDF are the two most commonly available piezoelectric materials.

Ref 3.

To generate electrical energy from the footsteps there are several methods i.e., gear wheel and fly wheel to produce power. These are used in places where there is a lot of people’s movements to generate power because the mechanical portion of this will work on the principle. Footstep from crowed on floor and piezo plate scheme that is used below the floor is done for the generation of power, piezo plate will be covered by the sheet and piezo sensor experience a vibrating force by the spring. Electric power will be generated in form of electric current by the striking of piezo plate on the floor. Power generated by the footsteps is used for the additional features like light or street light used at the place of pedestrians. Credit is given to the pedestrian for the energy which they produced.

The burning of coal, wood, diesel (generators) and so forth are used for traditional power generation method, which is continuously depleting our natural resources such as fossil fuels (Sekhar, Kishore, & Raju, 2014). The demand for power rises with the increase in population. Besides, the traditional methods cause pollution and encourage deforestation (cutting of trees). Therefore, this results to consequences such as global warming, power shortage just like what we are facing in Bangladesh. Global warming indicates an average rise of the temperature in the atmosphere near the Earth’s surface. The global surface temperature increased 0.74 ± 0.18 °C (1.33 ± 0.32 °F) during the 100 years ending in 2005 (Global Warming-Climate 365). Since the mid-twentieth century, the temperature rises with the intensity of anthropogenic greenhouse gas. Solar variation, volcanoes, and cooling effect contributes to the entropy rise from pre-industrial age to nowadays, IPCC indicate that average global surface temperature will likely rise further from 1.1 to 6.4 °C (2.0 to 11.5 °F) (Portal: weather/selected Article/6,19) during the 21st century. Most studies up to 2100 show that entropy and sea level continuously rise. The rate of reaching equilibrium is slow due to the high heat capacity of the sea. Scientists have stated with 66–90% confidence that the effects of human-caused aerosols and volcanic activity have a significant effect on global warmings, and that greenhouse gases accelerate the warming. The steady decline of the depletion of ozone in the Earth's stratosphere is regarded as global warming. Problem Definition Some developing countries, in almost all cities and villagers, faces several hours of daily load shedding due to uneven demand for electricity with the electric power generation rate. Many developed countries use gasoline electric generator and IPS (Instant power supply) at their homes during the power-cut. Industry and IT hubs also use standby generator due to power crisis. This system ultimately intensifies the crisis of power.

Problem Statement

Electricity is one of the daily requirements of life. It is required to increase as much as sources of renewable energy. This system can be used for utilization of waste energy of foot step to provide electricity during the cut-off of electricity in some places like gym or any crowded places. For example, there is cut-off of electricity because of that, gym members are not able to measure their weight on weighting scale and in the night, visibility is disappearing

due to cut-off of electricity. This system can be used with different techniques like use with weighting scale etc.

Methodology

In this Electrical Power Generation Using Foot Steps Project, we are generating electrical power as non-conventional method by simply walking or running on the footstep. For this purpose, piezoelectric sensor is used in order to measure force, pressure and acceleration by its change into electric signals. A piezoelectric sensor is an electric device which is used to measure acceleration, pressure, or force to convert them to an electric signal. These sensors are mainly used for process control, quality assurance, research and development in various industries. The applications of this sensor involve, aerospace, medical, instrumentation, and as a pressure sensor it is used in the touch pad of mobile phones. In the automotive industry, these sensors are used to monitor ignition when developing internal burning engines.

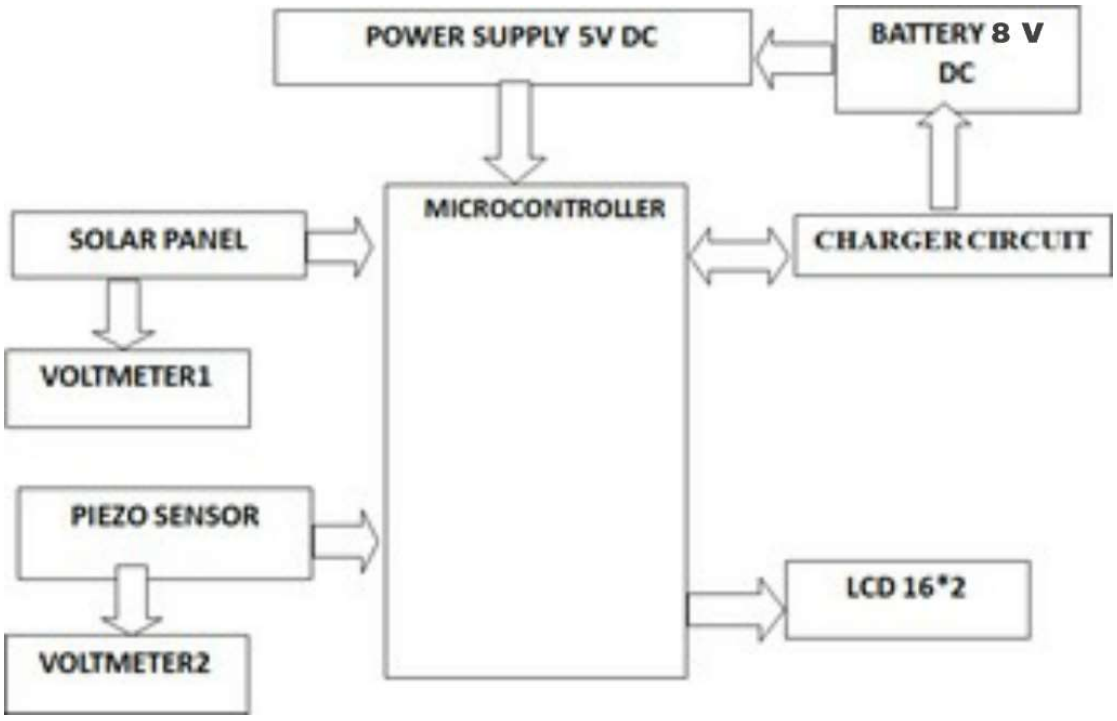
The complete diagram of the foot step power generation is given below. Only one step is inclined in certain small angle which is used to generate the power. The pushing power is converted into electrical energy by proper driving arrangement. The rack & pinion, spring arrangement is fixed at the inclined step. The spring issued to return the inclined step in same position by releasing the load. The pinion shaft is connected to the supporter by end bearings as shown in fig. The larger sprocket also coupled with the pinion shaft, so that it is running the same speed of pinion. The larger sprocket is coupled to the small cycle sprocket with the help of chain (cycle).

This larger sprocket is used to transfer the rotation force ro the smaller sporket .The smaller sprocket is running same direction for the forward and reversedirection of rotational movement of the larger sprocket. This action locks like a cycle pedaling action. The fly wheel and gear wheel is also coupled to the smaller sprocket shaft. The flywheel is used to increase the rpm of the smaller sprocket shaft. The gear wheel is coupled to the generator shaft with the help of another gear wheel. The generator is used here, is permanent magnet D.C generator. The generated voltage is 12Volt D.C. This D.C voltage is stored to the Lead-acid 12 Volt battery. The battery is connected to the inverter. This inverter is used to convert the 12Volt D.C to the 230 Volt A.C. This working principle is already explained the above chapter. This 230 Volt A.C voltage is used to activate the light, fan and etc.

By increasing the capacity of battery and inverter circuit, the power rating is increased. This arrangement is fitted in shopping complex, college and wherever the large people walking on the footsteps simultaneously.

CHAPTER 3

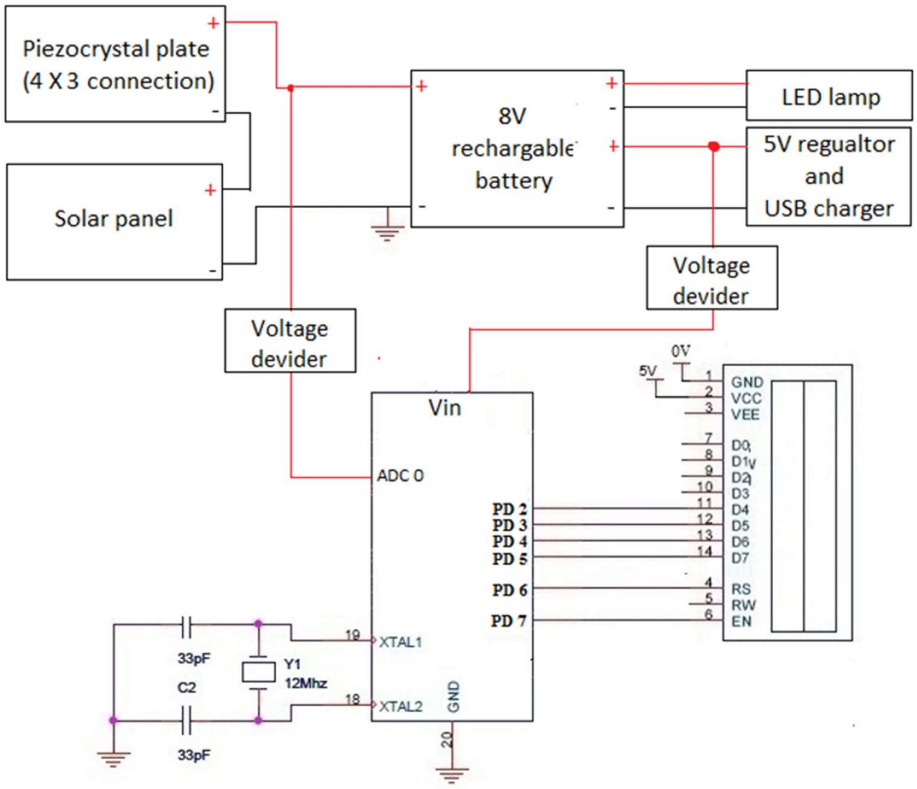
BLOCK DIAGRAM



1. In above diagram we can see that the battery is used to give 8V DC power supply which is required to drive all other components.
2. The 8V DC power supply needs to be converted into the 5V DC supply, because our microcontroller, LCD, voltmeter etc. drive on 5V DC supply.
3. Solar panel is used to take light energy from sun and converts that energy into the voltage form.
4. Piezo sensor converts force energy into the voltage.
5. So we getting output of solar panel and piezo sensor as voltage, by using voltmeter we find out exactly how much energy is actually being generated.
6. LCD 16*2 is used to display message from where is energy generating and LCD also display a message as we want.
7. The charger circuit is used to the charge the battery.

CHAPTER 4

CIRCUIT DIAGRAM



HARDWARE DESCRIPTION

3.1 Hardware Used

- Atmega328 microcontroller
- LCD 16*2
- 8V battery
- Bridge rectifier
- SOLAR PANEL
- PIEZO SENSOR

4.1.1 Atmega328

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

Microcontroller	ATmega328P
Operating Voltage	5V
Digital I/O Pins	14
PWM Digital I/O Pins	6
Analog Input Pins	6
DC Current per I/O Pin	20 mA
Flash Memory	32 KB (ATmega328P)
SRAM	2 KB (ATmega328P)
EEPROM	1 KB (ATmega328P)
Clock Speed	16 MHz
UART	2
SPI	1
I2C	1

4.1.2 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 LCDs 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).

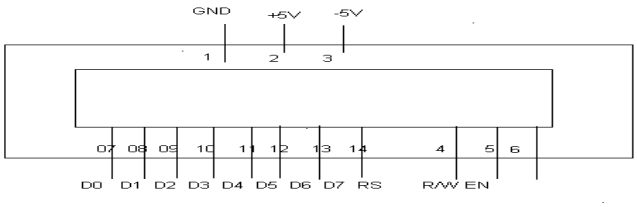


Fig. Pin Diagram of LCD

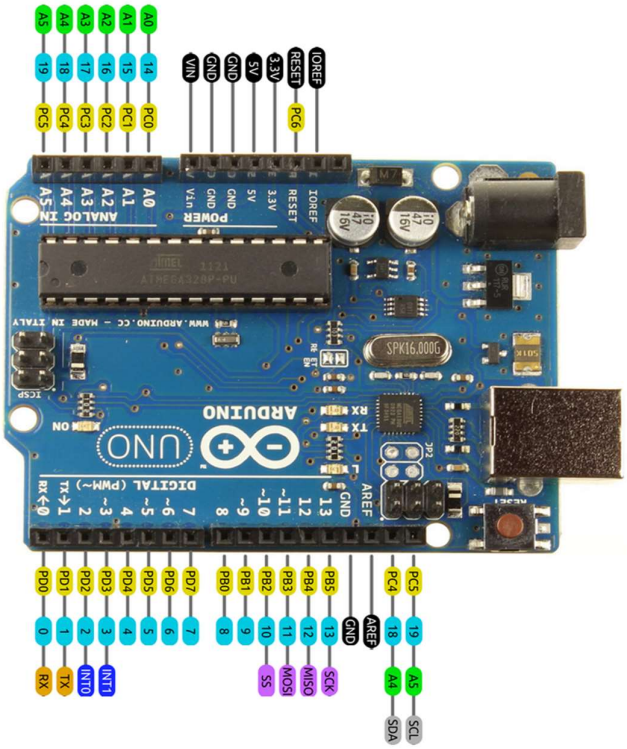


Fig. Pin Description

PIN DESCRIPTIONS: -

Vcc, Vss and Vee: -

While Vcc and Vss provide +5V and ground respectively, Vee is used for controlling LCD contrast.

RS Register Select: -There are two very important registers inside the LCD. The RS pin is used for their selection as follows.

If RS=0, the instruction command code register is selected, allowing the user to send a command such as clear display, cursor at home, etc.

If RS=1, the data register is selected, allowing the user to send data to be displayed on the LCD.

R/W, read/write: -

R/W input allows the user to write information to the LCD or read information from it.

R/W = 1 for reading.

R/W= 0 for writing.

EN, enable: -

The LCD to latch information presented to its data pins uses the enable pin. When data is supplied to data pins, a high–to-low pulse must be applied to this pin in order for the LCD to latch in the data present at the data pins. This pulse must be a minimum of 450 ns wide.

D0 – D7: -

The 8–bit data pins, DO – D7, are used to send information to the LCD or read the contents of the LCD's internal registers.

To display letters and numbers, we send ASCII codes for the letters A–Z, a-z numbers 0-9 to these pins while making RS=1.

There are also instruction command codes that can be sent to the LCD to clear the display or force the cursor to home position or blink the instruction command codes.

We also use RS = 0 to check the busy flag bit to see if the LCD is ready to receive information. The busy flag is D7 and can be read when R/W=1 and RS=0, as follows: if R/W = 1, RS = 0. When D7= 1 (busy flag = 1), the LCD is busy taking care of internal operations and will not accept any information.

4.1.3 8V Battery

The storage battery or secondary battery is such battery where electrical energy can be stored as chemical energy and this chemical energy is then converted to electrical energy as when required. The conversion of electrical energy into chemical energy by applying

external electrical source is known as charging of battery . Whereas conversion of chemical energy into electrical energy for supplying the external load is known as discharging of secondary battery.

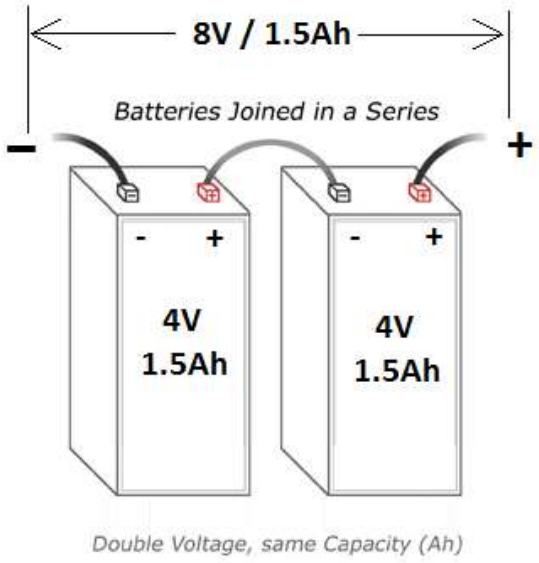
Lead Peroxide (PbO2)

The positive plate is made of lead peroxide. This is dark brown, hard and brittle substance.

Features

Nominal Voltage	4.0 v
Nominal Capacity	1.5 Ah, 1500 mAh
Max. Charging current	0.36 A
Max. Discharging current	18 A max
Dimension (LxWxH)	100mm X 25mm X 40mm
Weight	100g

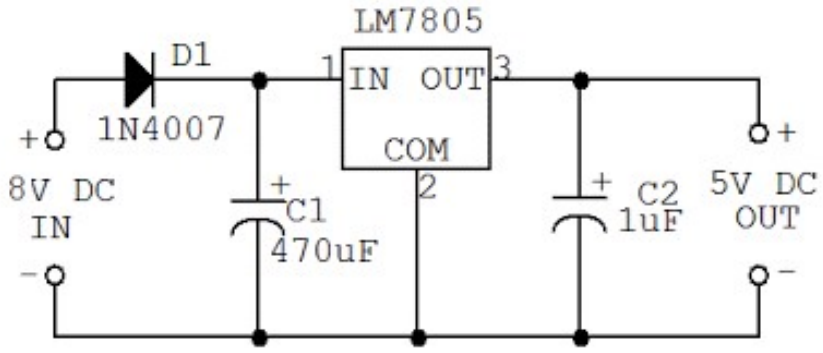
Two 4V batteries are connected in series to get 8V/1.5Ah rating.



Power supply is needed for all of electronic circuits. Say you have a 8V power supply and you want to use it as a 5V power supply. Then use this 8v to 5v dc-dc converter circuit diagram to convert 8 volt to 5 volt.

This DC converter circuit provide 5V, 1Amp at output. Here is the small schematic circuit diagram of 8volt to 5volt converter.

A voltage regulator is designed to automatically maintain a constant voltage level.



This DC-DC converter is based on IC LM7805. The LM 7805 is a 3-terminal fixed output positive voltage regulator IC. The output current of this circuit is up to 1 Amp. Use a heat sink with LM7805 to protect the IC from overheating

4.1.4 BRIDGE RECTIFIER

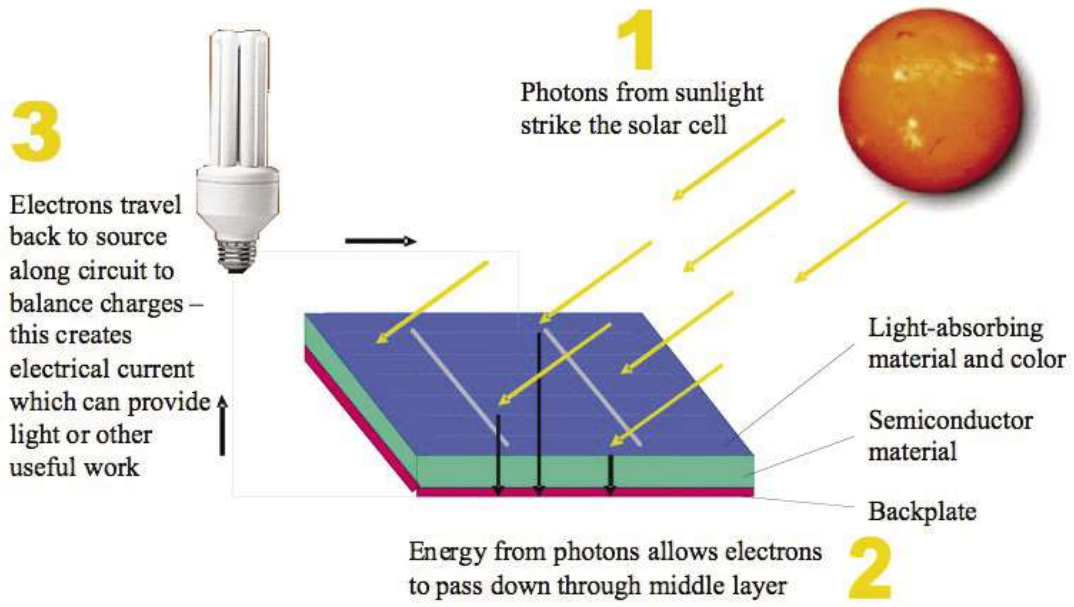
Bridge rectifier convert 8V DC power is into 8V DC, but the required power is 5V DC; for this purpose, 8V DC power must be primarily converted into 8V DC power then it can be stepped down to the 5V DC. Bridge rectifier used for polarity protection.

4.1.5 SOLAR PANEL

Central power can be generated directly using photovoltaic (PV) cells. This may be accomplished using flat PV panels that are either stationary or tracked to follow the sun, or by using concentrating optics to focus the radiation on a much smaller area, thus reducing the amount and cost of expensive cells. The tracking and concentrating methods parallel those described in the previous section on solar thermal technologies, and are not addressed here.

PV cells convert sunlight directly into electricity by taking advantage of the photoelectric effect. Cells are constructed from semiconductor materials coated with light-absorbing materials. When photons in sunlight strike the top layer of a PV cell, they provide sufficient energy to knock electrons through the semiconductor to the bottom layer, causing a separation of electric charges on the top and bottom of the solar cell. Connecting the bottom layer to the top with a conductor completes an electrical circuit and allows the electrons to flow back to the top, creating an electric current and enabling the cycle to repeat with more sunlight.

Working principle:



Solar (or photovoltaic) cells convert the sun's energy into electricity. Whether they're adorning your calculator or orbiting our planet on satellites, they rely on the the photoelectric effect: the ability of matter to emit electrons when a light is shone on it.

Silicon is what is known as a semi-conductor, meaning that it shares some of the properties of metals and some of those of an electrical insulator, making it a key ingredient in solar cells. Let's take a closer look at what happens when the sun shines onto a solar cell.

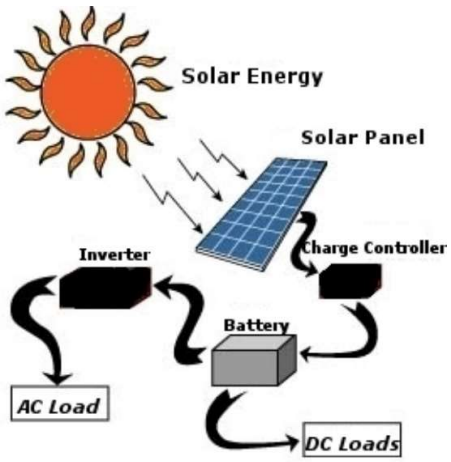
Sunlight is composed of miniscule particles called photons, which radiate from the sun. As these hit the silicon atoms of the solar cell, they transfer their energy to loose electrons, knocking them clean off the atoms. The photons could be compared to the white ball in a game of pool, which passes on its energy to the colored balls it strikes.

Freeing up electrons is however only half the work of a solar cell: it then needs to herd these stray electrons into an electric current. This involves creating an electrical imbalance within the cell, which acts a bit like a slope down which the electrons will flow in the same direction.

Creating this imbalance is made possible by the internal organisation of silicon. Silicon atoms are arranged together in a tightly bound structure. By squeezing small quantities of other elements into this structure, two different types of silicon are created: n-type, which has spare electrons, and p-type, which is missing electrons, leaving 'holes' in their place.

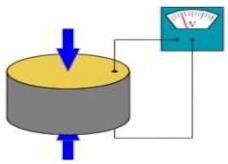
When these two materials are placed side by side inside a solar cell, the n-type silicon's spare electrons jump over to fill the gaps in the p-type silicon. This means that the n-type silicon becomes positively charged, and the p-type silicon is negatively charged, creating an electric field across the cell. Because silicon is a semi-conductor, it can act like an insulator, maintaining this imbalance.

As the photons smash the electrons off the silicon atoms, this field drives them along in an orderly manner, providing the electric current to load. In our project load is DC water pump and Rechargeable Battery.



4.1.6 PIEZO SENSORS

Harvesting of Piezoelectric Energy is based upon the piezoelectric effect. The essence of the piezoelectric effect works as follows: by applying a mechanical stress to a crystal, one can generate a voltage or potential energy difference, and thus a current. Piezoelectric generator principle states that the conversion chain starts from vibration for which a mechanical energy source is required. The vibrations are converted into electricity via piezoelectric element. The electricity produced is then afterward formatted by a static converter before supplying the load (electrical device). Piezoelectric generators work due to the piezoelectric effect. This is the ability of certain materials to create electrical potential when responding to mechanical changes. To make it simpler, we can say that when compressed or expanded or while changing shape a piezoelectric material will give output as some voltage.



CHAPTER 5
SOFTWARE USED AND CODE

5.1 ARDUINO IDE

Code:

```
#include <Wire.h>
#include <LiquidCrystal_I2C.h>

LiquidCrystal_I2C lcd(0x27, 16, 2); //16 X 2

#define input_voltage_pin     A0
#define batt_voltage_pin      A1

float input_voltage, batt_voltage, adc;
int batC;

#define input_ratio     11.1
#define batt_ratio      11.1

void setup()
{
   Serial.begin(9600);
   lcd.begin();
   lcd.backlight();
   lcd.setCursor(0,0);
   lcd.print("   Welcome to   ");
   lcd.setCursor(0,1);
   lcd.print("CMRIT, BENGALURU");
   delay(2000);
   lcd.setCursor(0,0);
   lcd.print("     HYBRID     ");
   lcd.setCursor(0,1);
   lcd.print(" PWR GENERATION ");
   delay(2000);
}
```

```
void loop()
{
   adc = analogRead(input_voltage_pin);
   input_voltage = (adc*5)/1023;
   input_voltage = input_voltage * input_ratio;

   adc = analogRead(batt_voltage_pin);
   batt_voltage = (adc*5)/1023;
   batt_voltage = batt_voltage * batt_ratio;

   if(batt_voltage > 0 && batt_voltage < 0.4){
    batC = 00;
   }
   if(batt_voltage > 0.4 && batt_voltage < 0.8){
    batC = 05;
   }
   if(batt_voltage > 0.8 && batt_voltage < 1.6){
    batC = 10;
   }

   if(batt_voltage > 1.6 && batt_voltage < 2.4){
    batC = 20;
   }

   if(batt_voltage > 2.4 && batt_voltage < 3.2){
    batC = 30;
   }

   if(batt_voltage > 3.2 && batt_voltage < 4.0){
    batC = 40;
   }

   if(batt_voltage > 4.0 && batt_voltage < 4.8){
    batC = 50;
   }
```

```
if(batt_voltage > 4.8 && batt_voltage < 5.6){
  batC = 60;
}

if(batt_voltage > 5.6 && batt_voltage < 6.4){
  batC = 70;
}

if(batt_voltage > 6.4 && batt_voltage < 7.2){
  batC = 80;
}

if(batt_voltage > 7.2 && batt_voltage < 7.6){
  batC = 90;
}

if(batt_voltage > 7.6 && batt_voltage < 8.0){
  batC = 95;
}

if(batt_voltage >= 8.0){
  batC = 100;
}



lcd.clear();
lcd.setCursor(0,0);
lcd.print("Inp:");
lcd.setCursor(4,0);
lcd.print(input_voltage);


lcd.setCursor(9,0);
lcd.print("Bat:");
lcd.print(batt_voltage);
```

```
        lcd.setCursor(0,1);
        lcd.print("Per:");
        lcd.print(batC);
        lcd.setCursor(7,1);
        lcd.print("%");


        Serial.print("Input : ");
        Serial.print(input_voltage);
        Serial.print("\t\t");

        Serial.print("Batt voltage : ");
        Serial.print(batt_voltage);
        Serial.print("\t\t");

        Serial.print("Batt charge : ");
        Serial.print(batC);

        Serial.println();
        delay(500);
}
```

CHAPTER 6

CONCLUSTION AND RESULT

In this study, we have investigated the feasibility of applying piezoelectricity to convert the mechanical vibrations of roadway to useful electricity. We have also investigated the practicability of employing solar concentrators to enhance the output power of the solar panel to a considerable level. We hope that our proposal towards an efficient way to electrify the streets of all the city corporations under the prevailing "Power Generation from Footstep and Solar, to Charge Mobile Phones and Lightings" project will help to more effectively implement the project within the budget and thereby reducing pressure on conventional power use and current generation.

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