Solar Peizo Hybrid System

Hybrid power generation using solar panel and peizosensors

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Abstract :

This paper implements an efficient way to power generation system, using solar power. Solar energy system is used to collect maximum power from sun. this proposal is to use the solar panels implemented in this project more efficiently and to carry out a realistic experimental approach to enhance the solar output power to a significant level and piezoelectric energy harvesting circuit. In this paper, piezoelectric-based energy harvesting technology is applied to generate electricity from mechanical stress (vibrations). Using piezoelectric material to harvest vibration energy from humans walking, machinery vibrating, or cars moving on a roadway is an area of great interest, because this vibration energy is otherwise untapped. Since movement is everywhere, the ability to capture this energy cheaply would be a significant advancement toward greater efficiency and cleaner energy production. The goal of this experiment is to investigate whether piezoelectricity would be able to provide sufficient source of voltage to charge the parent battery in case of rainy or cloudy days. . This configuration allows the two sources to supply the load separately or simultaneously depending on the availability of the energy sources. This paper implements an efficient way to electrify or generate electricity using solar power and piezoelectric energy harvesting circuit.

Keywords*:* Photovoltaic (PV), Piezoelectric Energy, Full Wave Bridge Rectifier.lM317 voltage regulator

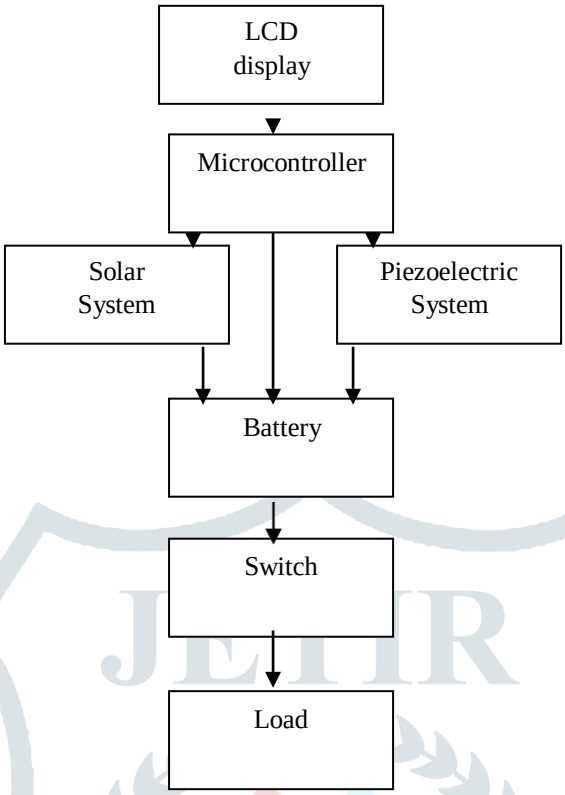
1. INTRODUCTION-

In recent years ,energy has became the most important issue all over the world. There is problem of energy crisis in many of the countries. As we know now a days most of the electricity generation takes place by using non renewable energy sources. If we continue to use such non renewable sources in such a great extent then in coming 50-60 years all this sources will be vanished. Renewable energy is the great opportunity to resolve such energy related problem. The availability of this sources are free in nature. The power generation from such sources green and not harmful for the environment.

In this paper we are using two types of renewable energy sources i.e. solar energy and peizo sensors. Solar panels are devices that convert light into electricity. They are called "solar" panels because most of the time, the most powerful source of light available is the Sun, called Sol by astronomers. Some scientists call them photovoltaic which mean, basically, "light-electricity." A solar panel is a collection of solar cells. Lots of small solar cells spread over a large area can work together to provide enough power to be useful. The more light that hits a cell, the more electricity it produces. So spacecraft are usually designed with solar panels that can always be pointed at the Sun even as the rest of the body of the spacecraft moves around, much as a tank turret can be aimed independently of where the tank is going.

Piezoelectricity, also called the piezoelectric effect, is the ability of certain materials when subjected to mechanical stress or vibration generates an AC voltage. The most common piezoelectric material is quartz. Certain ceramics, Rochelle salts, and various other solids also exhibit this effect. A piezoelectric transducer comprises a "crystal" sandwiched between two metal plates. When a sound wave strikes one or both of the plates, the plates vibrate. The crystal picks up this vibration, which it translates into a weak AC voltage. Therefore, an AC voltage arises between the two metal plates, with a waveform similar to that of the sound waves. Conversely, if an AC signal is applied to the plates, it causes the crystal to vibrate in sync with the signal voltage. As a result, the metal plates vibrate also, producing an acoustic disturbance.

2. SYSTEM DIAGRAM-



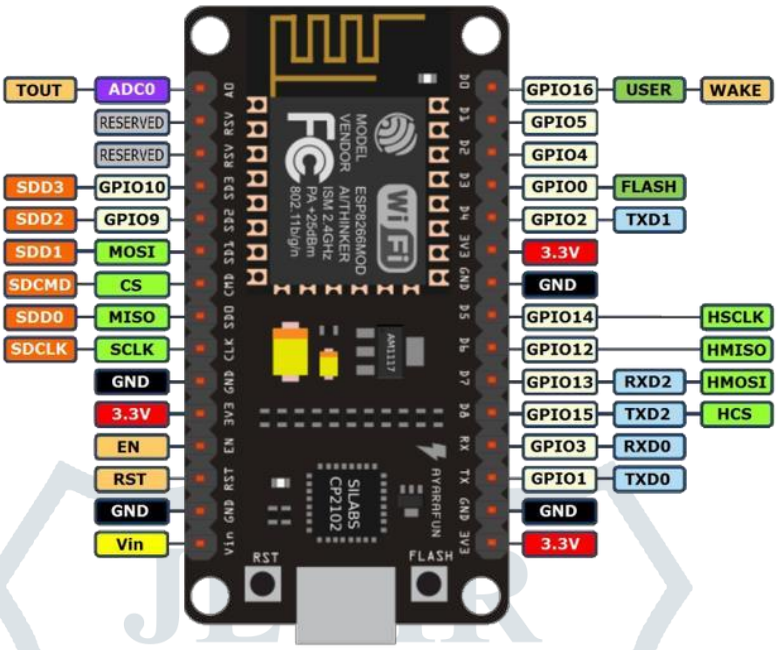
- **Solar system and piezoelectric system are directly connected to the battery. Output voltages from both the sources will charge the battery through the capacitor and proper circuitory. The battery is directly connected to the load through switch. Microcontroller is connected to the battery, solar system, piezosensors and LCD. It measures the voltage generated by solar and piezo and display the separate output of both the systems on LCD display . It will also display the total output voltage,thus one can know the details about the generation of power from both the sources. One can also the microcontroller for wireless data transmission and automatic operation of switch.**

2.1. Node MCU-

It is used to receive and transmit the data and the information about generated output.This microcontroller is also known as wifi development board. Node mcu is an open source for IoT platforms. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the firmware rather than the DevKit. The firmware uses the Lua scripting language. It is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as luacjson and spiffs.

- **Features:** Finally, programable WiFi module.
- Arduino-like (software defined) hardware IO.
- Can be programmed with the simple and powerful Lua programming language or Arduino IDE.
- USB-TTL included, plug & play.
- 10 GPIOs D0-D10, PWM functionality, IIC and SPI communication, 1-Wire and ADC A0 etc. all in one board.
- Wifi networking (can be used as access point and/or station, host a web server), connect to internet to fetch or upload data.
- Event-driven API for network applications.
- PCB antenna.

- **Pinout Diagram:**



3. THEROTICAL FRAMEWORK-

This project should be erected in the highly populated or crowded areas.One of the best application of this project is to run the streetlights by solar piezo hybrid system. Therotical framework for the practical application of the system is as follows:

- **let the height of the street light - 25ft /7.6 m (approximately)**
- **Distance between the street lights - 29 m (max 50m) (approx.)**
- **Integrated solar LED street light madels- 8w,12w,,15w,20w,24w,32w,40w,65w,80w**
- **Back up- 2 to 3 days**
- **High quality lithium ion battery(life p04)**
- **5 years guarantee**
- **working hr.-6 to 12 hrs**
- **charge time-7 to 9 hrs**
- **Average wattage of street lights- 80w**
- **If used LED street lights wattage will be- 73w**
- **Calculations for battery-**

-lithium ion battery

8 lamps of wattage 80w -80*8=640w
consumption per hour=640w/ hr

- **Battery brands-**
  1.exide-gel tech, water proof
  2.luminous
  3.0 kaya
  4.50-kqm

Measurement parameters - Ampere Hours

- **Formula for the calculation of the capacity of battery=** Battery AH* 12v *n/power consume in watts (n=efficiency)
- eg.-100AH*12v*0.8/150w (n=80% generation)

=6.4 hrs

- **price-** solar battery : 8- 104rs lite
  5 years warranty
  20% max backup

- for , 640 w suppose we are using lights from 7 pm to 7 am i.e 12 hrs
  i.e. 12 hrs= (x AH*12*0.8)/640w
  =800 AH
- Battery size require for 12 hrs of backup for consumption of 640w/hr= 800 AH
  800*12=9600W (Battery size)

- considering only solar panel: charging module panel:
  pv panel size recommended=2*battery capacity
  because , battery charging current=battery AH/sunlight hours

- eg. consider battery AH is 150 AH /10 h(from 8am to 6pm)=15 amps

if 15 amps current is required then 2 panels of 8 amps required
when battery gives backup less than 1 hr then consider it as a dead.
for our size , 800AH/10hrs=80 amps
considering panels of 10 amp , required ah 8 panels for charging 80 amps in day.

- **Piezo power calculations:**
- suppose in one square ft. we use 12 piezo sensor.
- As piezo sensors power generating varies with pressure,
- for avg 50 kg weight we will be having minimum vtg =1v
  maximum vtg=10.5v

As we are putting theses sensors on streets avg weight on piezo will be 100 kg per 10 sec(vehicles).so it will just take 20 to 30 sec to charge the battery .We can increase the output by series parallel combination of sensors.

- We can also give the excess energy to the grid i.e. it could be distributed generation system.Thus it reduces the municipal load as well as grid load.

4.FUTURE SCOPE-

This paper comes up with an idea of using vibration and solar energy together for generating electricity for our future needs. Hybrid vibration and solar power generation system is one of its kind which is low maintenance and also economy to use. And this system is also very efficient. To get maximum efficiency this kind of systems should be installed in busy crowd places such as railway stations, malls, bus stops and busy footpaths, speed breaker, highway. In future we can also improve this system by making it dual sun tracking solar panels or if the area or geographical conditions allow we will also be able to add other power generation systems to increase efficiency in order to increase the output.

5. CONCLUSION-

The purpose of this research paper is to observe the feasibility of a collection of free hybrid energy through roadside that can be used to run the lighting load of street. This reduces the burden on municipal load and also load on the grid. We wish that our approach towards using free energy for efiicient electrification of the streets of all the municipal corporations under the initiation of " solar piezo hybrid system" project will help to more effectively use the economy and thereby reducing the burden on the current generation.

6. REFERENCES-

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