SIMULATION AND REAL TIME PROTO-TYPEIMPLEMENTATION OF PIEZO AND SOLAR BASED POWER GENERATION SYSTEM

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ABSTRACT
Due to their ease of accessibility and low cost, the utilization of renewable resources like solar energy and several other clean forms of energy has seen a growth in demand in recent years. With this project, you can see how to combine solar energy with the kinetic energy created when people walk over a piezo-based footboard. To capture solar energy, a solar panel is employed. It transforms solar energy into voltage, which , when greater than the battery's voltage, can be used to recharge the battery. By using a solar piezo –based mobile charging system, one may charge the battery using both solar and human motion energy while also monitoring how much is being produced. This vibration energy is otherwise unused, thus using piezoelectric material to capture it from moving vehicles, vibrating machinery, or people walk in is of tremendous interest. Being able to cheaply capture this energy would be a big step towards improved efficiency and greener energy generation because movement is ubiquitous. And also verified this piezo- solar integrated system usingmatlab simulation model.
Keywords:piezo sensors, solarpanel,voltageboostermodule.

INTRODUCTION

Now-a-days, many people are looking at sustainable energy alternatives to protect the world forfuture generations due to growing concerns about global warming and the depletion of fossil fuelsupplies. Vibration and photovoltaic energy have the greatest potential to meet our energy needs,except hydropower. Vibration energy can generation a lot of power when used alone, but it ishighly unpredictable because it might appear one second and disappear the next. Similar to this,solar energy is present throughout the day,but the amounts of the suns uneven intensity and theerratic shadows created by clouds, birds, trees ,etc. Both vibration and photovoltaic systems havethe similar intrinsic flaw of being intermittent which renders them unreliable. By combiningthese two intermittent sources, the other energy source can make up the difference when onesource is unavailable orinsufficienttofulfillthedemandoftheload.

The main goal of this work is to create a solar piezo – based mobile charging system that utilizesmicro energy harvesting technology that is based on mechanical vibration, mechanical stress andstrain, thermal energy from friction , furnace, heater, and light sources , human body, chemical,or biological sources, and that can produce MW or W level power. The requirement for micro power supplies is growing rapidly as our technology advances to the micro-and Nano scale manufacturing levels. Our description of this is centered on the use of piezo electric material to produce micro energy from vibration and pressure.

SYSTEM MODEL

Fig.1. shows that the modeling of piezo sensors and integrated with solar PV- system generates power to charge the applications like mobile charging.here the solar PV- system convers input solar irradiation into electrical energy, where piezo sensors converts input kinetic energy into electrical energy and both outputs are connected to charge the battery through voltage booster module. This module is a non-isolated step-up (boost) voltage converter featuring adjustable output voltage and high efficiency This module can take an input voltage of between 5 and 32V DC and converts it to an output voltage between 5 and 35V DC. The output of booster module is used to charge the battery with fixed output voltage. And the buttery charging energy is used for various application like mobile charging and laptop charging, for mini sized LEDs operation etc..

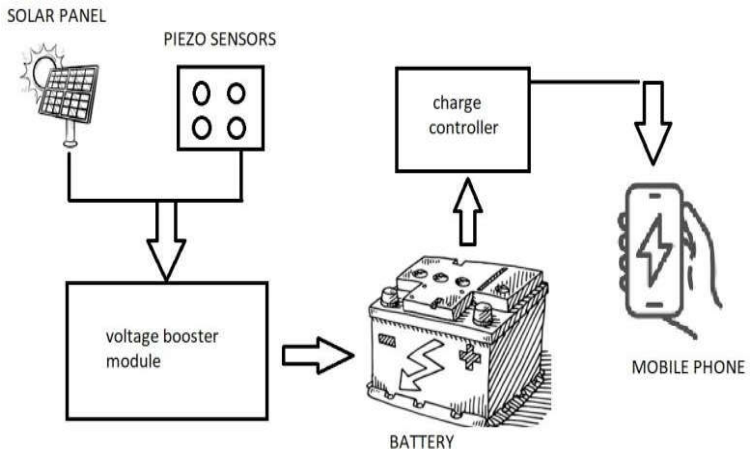

Fig.1. system model for piezo and solar integrated system

HARDWARE REQUIREMENT

a) Piezoelectric sensor:

A piezoelectric sensor is one that makes use of the piezoelectric effect to translate changes in acceleration, strain, pressure,and force into electric charge. Is a GPiezoreek term that means to squeeze or press . Due to pressure being applied to specific solid materials, such as piezoelectric crystals, ceramics, bone, DNA, and some proteins, which create electric charge, the piezoelectric effect results in the occurrence of electric dipole moments in solids.

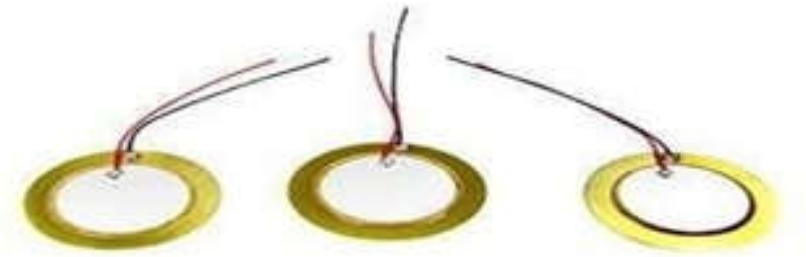

Fig.2. piezo electric sensors

The pressure exerted on the solid piezoelectric crystal materials determines how much piezoelectricity is produced. In this post, we'll talk about piezo sensor switches, one of the most common uses for piezoelectric sensors.

b) Solar panel:

The photovoltaic solar panels use the energy they capture from the sun to produce electricity. A bundled, connected assembly of typically 6x10 photovoltaicsolarcellsisknown as a photovoltaic (PV) module. A photovoltaic system that produces and suppliessolar electricity for use in commercial and residential applications is made up of photo voltaic modules.

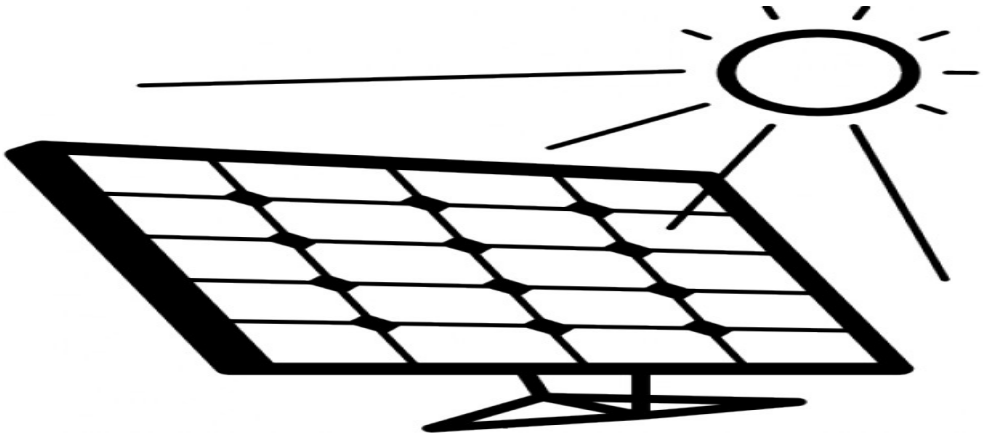

Fig.3. solar panel

Solar water heating systems are the most prevalent use of solar energy collecting outside ofagriculture. At the atomic level, photovoltaic is the direct conversion of light into electricity.The photoelectric effect is a characteristic of some material that causes them to absorb lightphotons and release electrons. An electric current that can be utilized as electricity resultsfrom the collection of these free electrons. The basic operation of a photo voltaic cell, often known as a solar cell is shown in the diagram above.

Voltage booster module:

The converter booster is employed to "step-up' an input voltage toa greaterlevel when a load so demands. By holding energy in an inductor and releasingit to the loadatagreatervoltage,this specialcapacityismade possible.

As the name implies, it increase or boosts an input voltage. As the voltage rises, the current falls off as well. They can step up and step down voltages with this small number of components. In addition, they offer a lower operating cycle and greater efficiency over abroad range of input and output voltages. It provides low working duty cycles and a high output voltage

c) Battery :

A rechargeable battery is a type of energy storage that may be recharged bypassing dc current through its terminals after ithas been discharged.Several uses of a cellare possible with rechargeable batteries, which reduces waste and on general, offers a batterlong-terminvestmentintermsofmoneyspentforusable device time.This holds true even after accounting for the rechargeable batteries greater initialcost and charger required. In general, a rechargeable battery is a more practical and long-lasting substitute for single-use batteries, which produce electricity thought a chemical reaction in which a reactive anode is consumed. With a rechargeable battery, the anode is also consumed, but at a slower rate that enables numerous charges and discharges.

MATLAB SIMULATION AND RESULTS

Fig.3. shows the simulation model for piezo and solar interconnected system in which it contains vibration excitation system is used to generate required mechanical vibrations and gives kinetic energy as output, is connected to piezo stack excitation system which converts input kinetic energy into electrical energy. Generated electrical energy is connected to battery through the full wave rectifier and DC-DC converter which can works as voltage booster module system. And the solar PV-system is connected in parallel with piezo system to supply reliability of power supply to charge the battery.

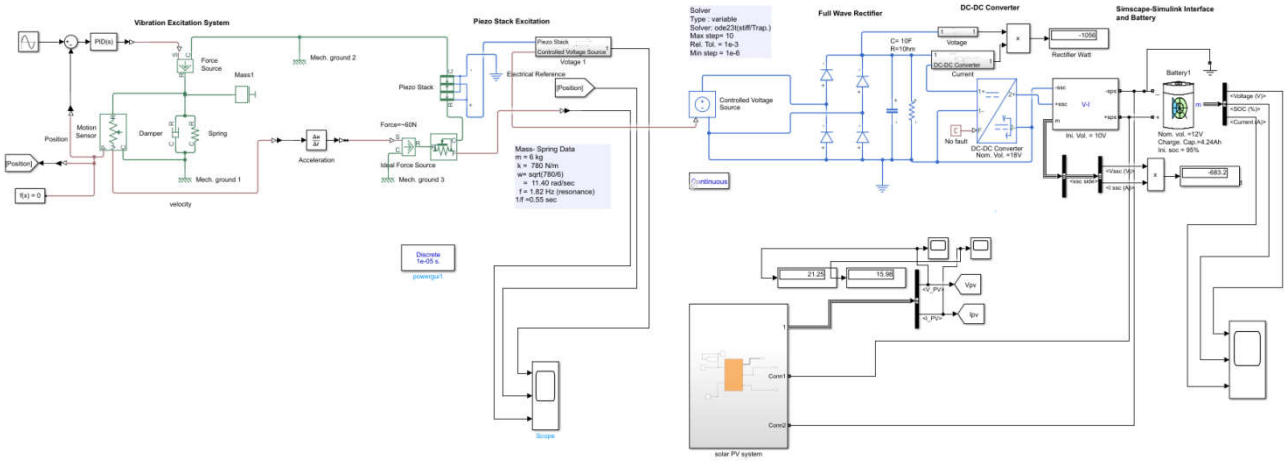

Fig.3. Simulation model for piezo and solar interconnected system

SIMULATION RESULTS

Fig.4 shows that simulation results of pizeo sensor voltage, mass spring position, applied force. From the graph as the applied force changes the output from the piezo sensor also changes in accordance with the mass spring position because of the thepizeo sensor can generate the output electrical energy in the reverse operation of applied force.

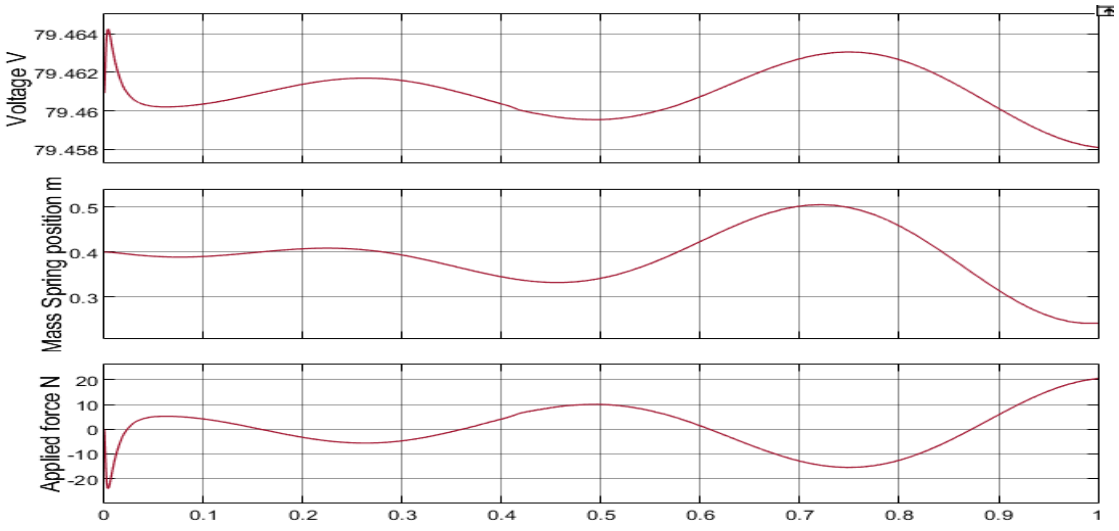

Fig.4 simulation results of pizeo sensor

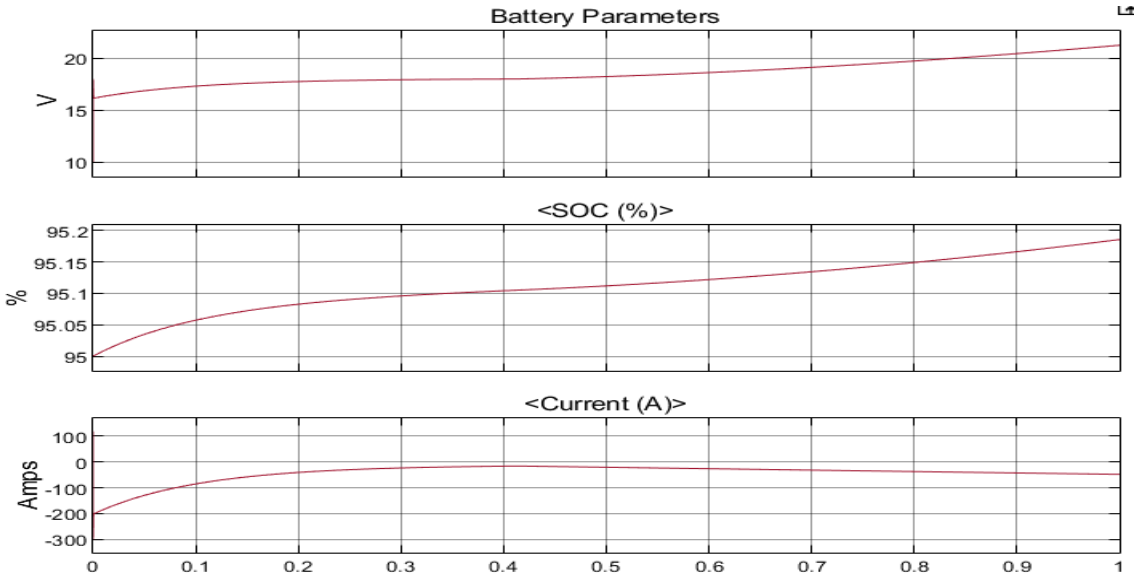

Fig .5. simulation output from pizeo+ solar

HARDWARE DESIGN STRUCTURE

All of the hardware parts have been connected in the manner shown in the block diagram.Positive and negative solar panel terminals are separated and connected with an additional load point,which receives dc power straight from the solar panel for immediate use.

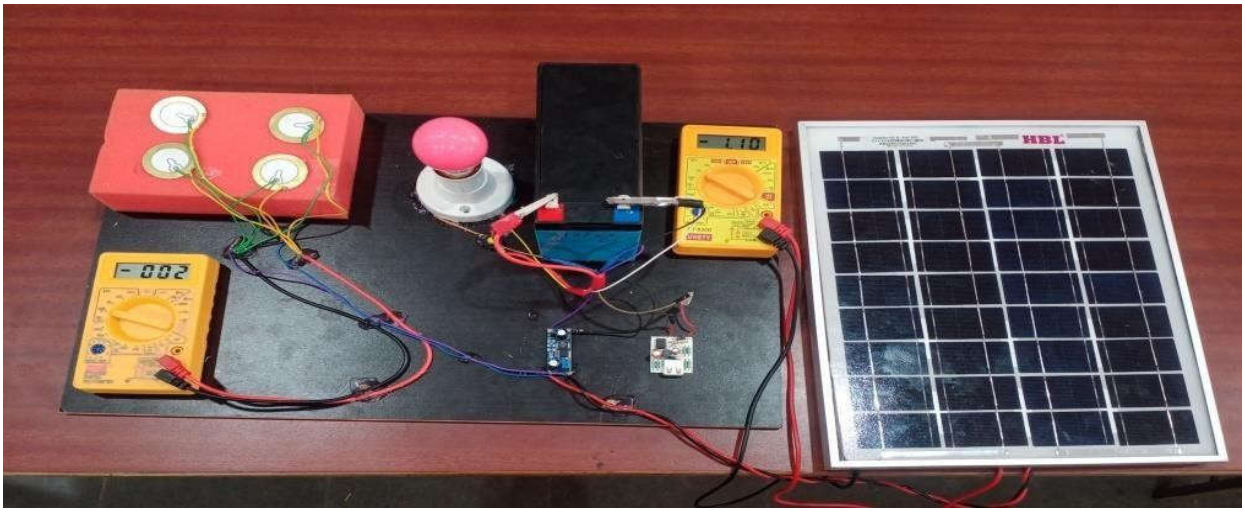

Fig.6. Hardware implementation diagram

The charge controller regulates the combined inputs from the solar panel and piezo sensors to match the battery's 12volts input rating. The aim was achieved after the plan was finished and the system's components were gathered. Also ,all specifications were met in order to complete and complete this mobile charging system that is powered by solar PV and piezo sensors. The system was put to the test, and the outcome was exactly what was needed. Now,the system will function.

HARDWARE RESULTS:
SOLAR PANEL

PIEZO SENSOR	THEORITICAL	PRATICAL
At openCircuitvoltage	17v	16v
At maximum loadDemandvoltage	4*3=12v	8-10v

PIEZOSENSORS:
SOLAR&PIEZOSENSORS:

SOLAR+PIEZO	THEORITICAL	PRACTICAL
At open circuitvoltage	34-36 v	32-35v

SOLAR	THEORITICAL	PRACTICAL
At open circuit	21.5v	19-20v
At maximum load	18.05v	16-17v
At maximum loadDemandvoltage	28v	24-26v

FUTURE SCOPE

Piezoelectric sensors will be able to sense more than simply vibration and pressure as technology advances. They will be able to recognize environmental elements including light, temperature, and humidity. And as technology advances, solar energy will become even more affordable in the future years. Throughout a significant portion of the world, solarenergy will now be the most significant source of energy for the production of electricity. When you generate electricity with solar panels and piezosensors, no greenhouse gas emissions enter the atmosphere.

CONCLUSION

The goal of this experiment was to determine whether a roadside hybrid energy collection/recovery system, which could be utilized to power neighboring street services likelights and signals, was feasible. The two hybrid energy sources are solar energy, which iscaptured by a solar cell that is readily available in the marketplace and is placed next to theroad, and piezoelectric energy, which is captured by a grid of piezoelectric elements, each of these system had a controller at the component level. In the design of the supervisor controller, a practical ratio of economically viable energy recovery from these two sources had been searched after. Using a wireless display placed a safe distance away from the energy harvesting equipment, it is should be feasible to keep an eye on the system's functioning.

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