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"CAM-POWERED ENERGY GENERATION: HARNESSING ELECTRICITY THROUGH PEDESTRIAN MOVEMENT FOR FOOTPATHS IN URBAN AREAS"

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ABSTRACT:

In general, we are aware that fossil fuels like coal, oil, and natural gas are used to produce energy. Carbon dioxide (CO2) is emitted into the atmosphere during the combustion of fossil fuels to generate energy. This adds to global warming and the greenhouse effect. In addition, various pollutants like Sulphur dioxide (SO2), nitrogen oxides (NOx), and particulate matter are released during the combustion of fossil fuels. These pollutants can cause air pollution and have detrimental effects on both the environment and human health. additionally, India has a significant energy need. India, one of the most populated nations on earth, has a huge population and an economy that is expanding quickly, which raises the need for energy. Several industries, including the residential, commercial, industrial, and transportation. To meet this demand and also reduce the dependence on renewable resource, presenting a study proposes a new approach for electricity generation through footsteps. This concept is based on energy conversion from kinetic energy to electrical energy. The method is to produce electricity by utilizing the kinetic energy generated while walking on a tile which is assembled with generator called CAM. The electricity is stored either in lithium-ion battery or lead acid battery. then it can be further used for street lights.

Keywords: kinetic energy, footpath tiles, cam generator, sensor, Storable battery, gear box, alternator, street light.

Introduction:

For humans, electricity is an essential source of energy. In actuality, electricity is a scientific marvel. The invention of electricity bears some responsibility for all aspects of human existence. Considering this, it is appropriate to refer to this period of time as the "age of electricity." Electricity is essential in today's world. We fuel the machinery in our workplaces, heat our houses, and run our public transit. Electric power has undoubtedly changed transportation forever. Additionally, electric trains are available throughout our nation. Thus, as the population has grown, so has the need for electricity. However, we all know that there is a finite amount of energy-generating resources, and that this is what has triggered the current energy crisis. In this situation, we need to create power from commonplace items. In this experiment, we attempted to use pedestrian footsteps as a source of renewable energy. Since the number of pedestrians on the footpath is only expected to grow, installing the tiles along major crowded footpaths is a great way to harness that growth and turn it into usable energy. The generated power can be put to several uses, including powering traffic signals and streetlights. Components like a gear box and cam equipment are simple mechanical necessities for this arrangement. The battery, alternator, and other electrical parts are also included**.**

Materials used

Generator

A cam generator, also known as a cam-driven generator, is a device that converts mechanical energy, typically generated by human or machine motion, into electrical energy using a cam mechanism. As the cam rotates, it imparts reciprocating or oscillating motion to a follower, which in turn drives a generator to produce electricity.

Sensors

Sensors are devices or instruments that detect changes in their environment and convert these changes into usable signals.

Storable battery

A storagable battery, also known as a rechargeable battery or secondary battery, is a type of energy storage device that can be charged and discharged multiple times. It is designed to store electrical energy in a reversible chemical reaction, allowing it to be used repeatedly.

Alternator

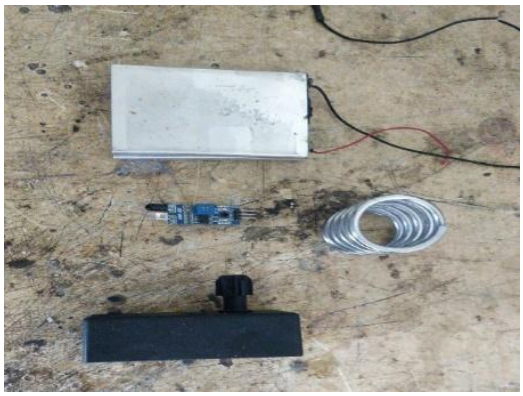
Alternating current (AC) electrical energy is produced by an alternator, an electrical generator that transforms mechanical energy. The rotor in an alternator revolves inside the stator, creating an alternating magnetic field that causes the stator windings to conduct an alternating current. Direct current (DC) is created by rectifying the alternator's output before it is used in the car's electrical system.

Springs

It is described as an elastic body that may change shape when under load and return to its original configuration when the load is released. It absorbs, cushions, or regulates energy resulting from vibrations or shocks. This kind of elastic material can be utilized to store mechanical energy.

Gear box

A gearbox is a mechanical device that transmits power from a rotating power source to another device using gears to alter the speed, torque, and direction of rotation.

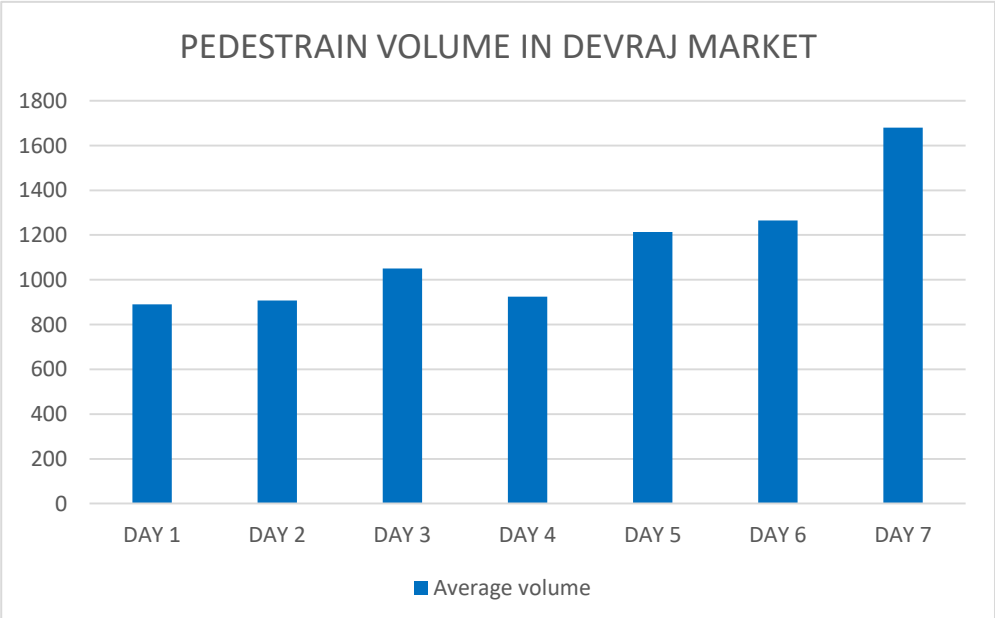


Methodology:

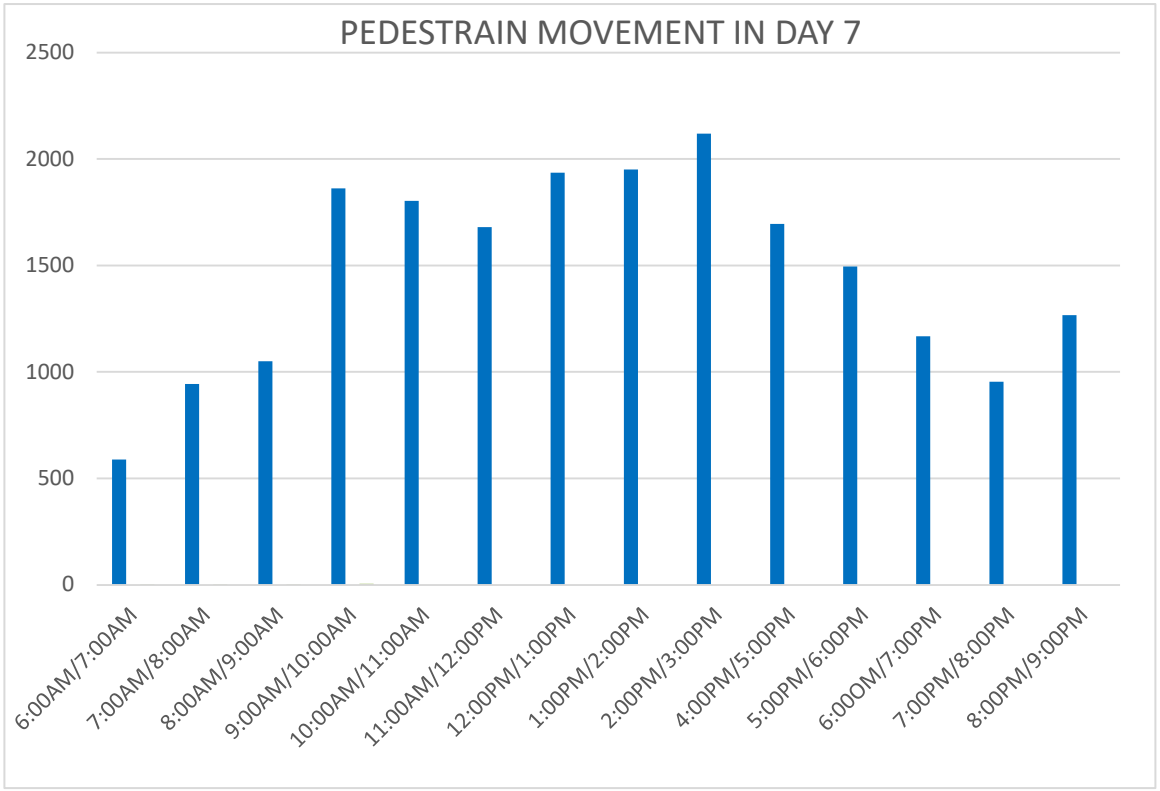
3.1 Pedestrian survey

For this project we've chosen the street known as sayyaji rao which is located in Mysore Karnataka. where the pedestrian movement is more during both weekdays and weekends so we've done survey on this street to get the maximum pedestrian movement**.**

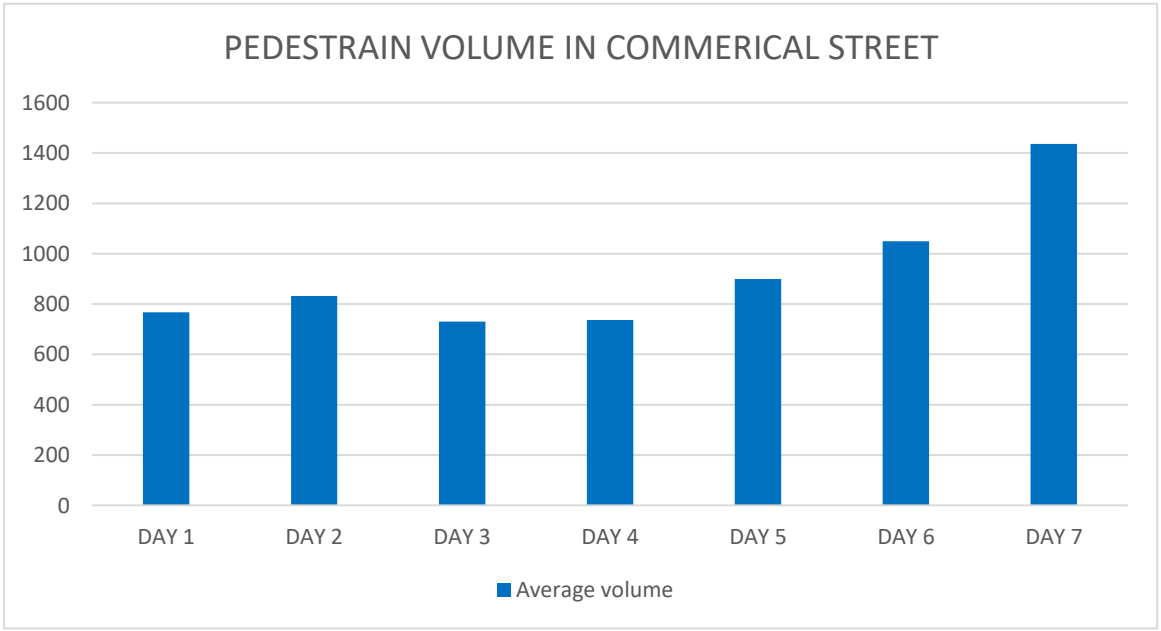
Bar chart of Pedestrian Volume in Devaraj Urs Market



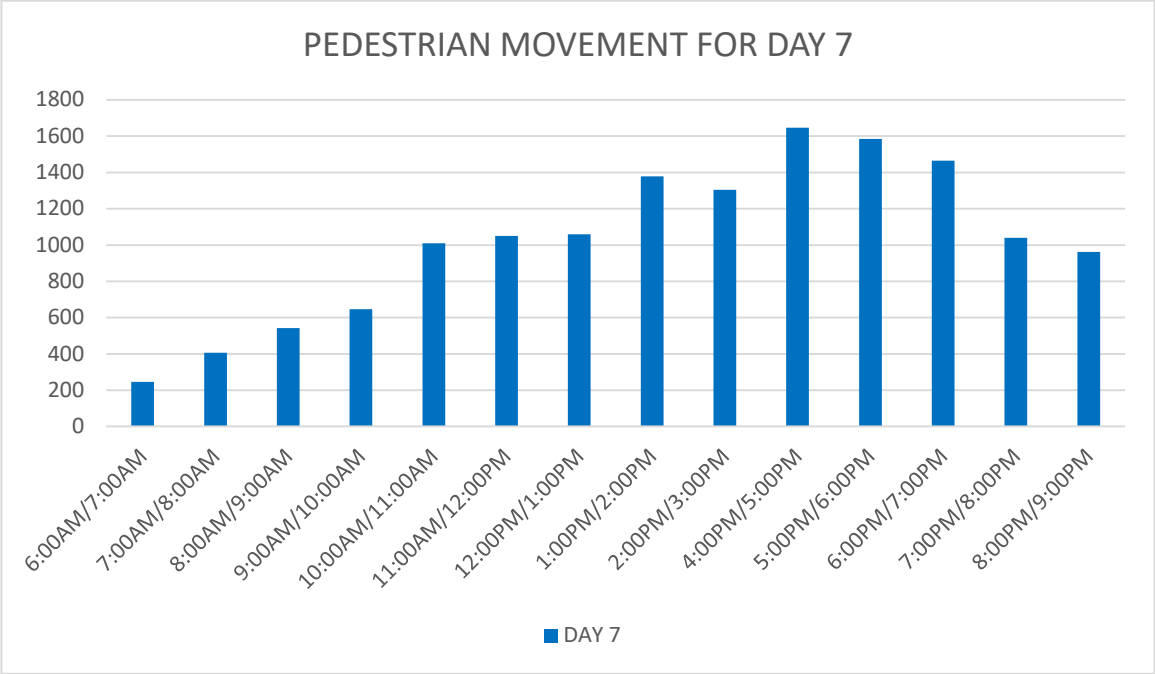
Bar chart of Pedestrian Volume In day 7



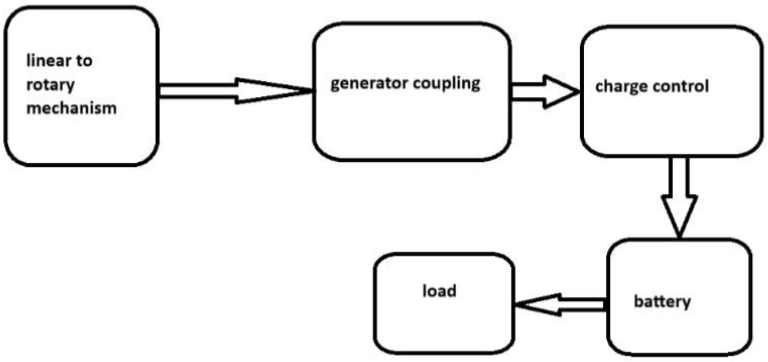
Bar chart of Pedestrian Volume in Commercial Street



Bar chart of Pedestrian Volume of day 7



3.2 Block diagram and working principle:



For our project, we opted for a straightforward and efficient design for a generator based on the cam mechanism. The goal of the project is to create a system similar to pedestrian footsteps that can be used to generate electricity. In this case, we design a tile using some of the mechanical and electrical component. The top is provided with a cabinet where the pedestrian will walk on that. The cabinet mechanism is designed for minimum 20 kg upto 120 kg. when the pedestrian of 45kg walks on the tiles it gets compressed about 2.5cm using small springs provided with cam which makes the generator to rotate. The generator rotates only at 45 degrees. To get the complete rotation the tile is mounted with a gear box and alternator. When the generator rotates at 45 degrees for 1 rotation it makes the alternator to rotate 3 rotations at 360 degree which runs in the ratio of 1:100. Which is then connected to sensor provided with 3 light system.

1. Photo diode sensor which senses the light.
2. The light automatically turns on in the dark.
3. It is a indicator the indicates the power generation

Then the sensor is connected to a battery which have a capacity of 2000mah and 6V Which can store the power generation of 2 watts for each footstep. And the small electrical wires of 6SWG are provided to connect the sensor and the battery. After the pedestrian walk the cabinet came back to its original position using the spring which placed between the top and bottom of the cabinet. The springs can bear the load upto 200 to 250kg. In this plan, we figure out how to harness the energy that is currently being lost every time a pedestrian walk over a footpath. By passing a pedestrian over it, a great deal of energy is released. If we convert the pedestrian footsteps into a generator, we can harness the kinetic energy it produces and turn it into electricity. A cam system can transform the kinetic energy of a moving pedestrian into mechanical energy of the shaft. The mechanical energy will then be converted by a generator into electricity, which will be kept in a battery. During the day, we can preserve energy that can then be used to power street lights at night. In this way, we may reduce our energy consumption and free up resources to meet emerging needs. This project utilizes a gear arrangement and electronic devices to harvest energy from a pedestrian. And the government stands to gain a lot if this is put into action.

Power and tile calculation

Obtained data from the pedestrian survey

Length of the street = 800m =2624ft

Tiles calculation

Length of the tile = 2ft

Length of the street/ Length of the tile = 2624/2 = 1312 tiles

1312/4 = 328 tiles (Therefore 4 ft is the spacing between tiles)

Power calculation

From 1 tile:

1 press = 2w

1000 press = 2000 w

1000 press/hr = 2 units

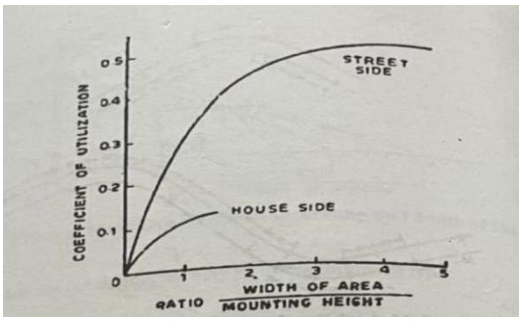
For 328 tiles

2u*328tiles = 656 units / day

656 u * 30 days = 19680 units / month

Street light calculation

Standard values of co efficient of utilization



Spacings = lamp lumen * coefficient of utilization * maintenance factor / average lux*width of the road

Street width = 15m

Mounting height = 7.5m

Lamp size = 6000 lumen

Calculate the spacing between lighting units to produce average lux = 6

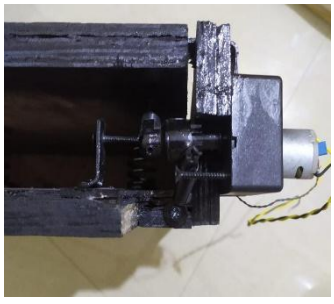
Ratio = pavement width / mounting height = 15 / 7.5 = 2

Coefficient of utilization = 0.44

Assume a maintenance factor = 0.8

Spacing = 6000*0.44*0.8/6*15 = 23.2m

3.3 Prototype



3. Results

From the user's perspective, the bearing enables the generator to rotate, facilitating the conversion of vertical motion into rotational motion. A return spring is incorporated between the top and bottom of the cabinet to maintain its position after being displaced by the downward force of pedestrians. The spring's load capacity is determined based on the weight of the pedestrians walking over it. Additionally, a battery is provided to store the generated power, capable of storing 2 watts of power for each footstep.

Based on our pedestrian survey findings, we estimate that each footstep can generate approximately 2 watts of power. Therefore, over the course of a month, we anticipate generating nearly 19,680 units of electricity from the 328 tiles installed along the 800-meter footpath.

4. Conclusion

Electricity plays a vital role in modern living, yet the current methods of power generation are insufficient due to the rapid growth of the global population. Discovering a reliable mechanism to generate electricity from footsteps offers a promising solution to conserve our planet's natural resources. Therefore, we conclude that this technology has the potential to be an effective system for generating power from human footsteps. In densely populated countries like India or China, this system could serve as a solution to various energy challenges. Additionally, individuals can meet their own energy needs by simply walking or running on tiles installed with cams, efficiently converting motion into electrical energy.
The electric poles along Sayyaji Rao Road currently consume 1000 units per month. According to the analysis, we estimate that we can generate 19,680 units of electricity per month. This means that we can easily meet the current criteria for electricity consumption along the road.

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