PaveGen

PROJECT REPORT

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ABSTRACT

Humans have devised various methods to harness energy since ancient times. Earlier, the sustainability aspects of these various sources were not considered, giving weight to only the benefits. The understanding that conventional energy sources can be depleted if excessively utilized, led to the search for renewable sources of energy. This paved the way for harnessing solar, wind energy and also the search for alternative sources. One such untapped source is the human body. The energy used for the motion of a person from one place to another can be harnessed to generate electrical energy. This idea of energy generation was popularized by the company PaveGen, who introduced floor tiles which are capable of producing approximately 7 watts of electricity per step. The device uses a motion converter which uses a pressure sensitive mechanism that converts linear progression caused by traffic related impulse forces into rotational motion which drives the rotor of an electricity generator, thus generating electricity which can be stored for later consumption. This can prove useful in areas with high amount of pedestrian traffic, as large step counts can be expected to provide enough electricity to light up a building. The cost and challenges of setting up such a system in the malls and airports of Cochin is the main objective of this project.

MEDIA BRIEF

Friday 01/09/2018

FOOT POWER TO LIGHT UP RAILWAY STATION

Technology used in Federation Square in Melbourne can be used to reduce on grid electricity consumption

Cochin: The Ernakulam Junction railway station boasts a daily footfall of around 10000 people. This high footfall can be utilized to generate electricity which can be stored and used to power the lighting systems of the railway stations thus providing considerable amount of energy savings. Inspired by the PaveGen tiles set up in Federation Square in Melbourne, group of students from Rajagiri School of Engineering & Technology, kakkanad have come up with a solution to harness this untapped energy. This technology utilizes a motion converter that converts the linear motion from footfall into rotational motion which drives a generator that produces electricity that is stored in a battery.

The data collection about the project was collected by Reshma Abraham, Nithya M B, Nitha Elizhabeth John, Amritha Behanan, Jaison Iype, Cyril lucas and Jeffin Johnson.

ACKNOWLEDGMENTS

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We take this opportunity to express my profound gratitude and deep regards to our guide Dr.Karan Kapoor for his exemplary guidance, monitoring and constant encouragement throughout the course of our project. The help and guidance given by him time to time shall carry us a long way in the journey of life on which we are about to embark.

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INTRODUCTION

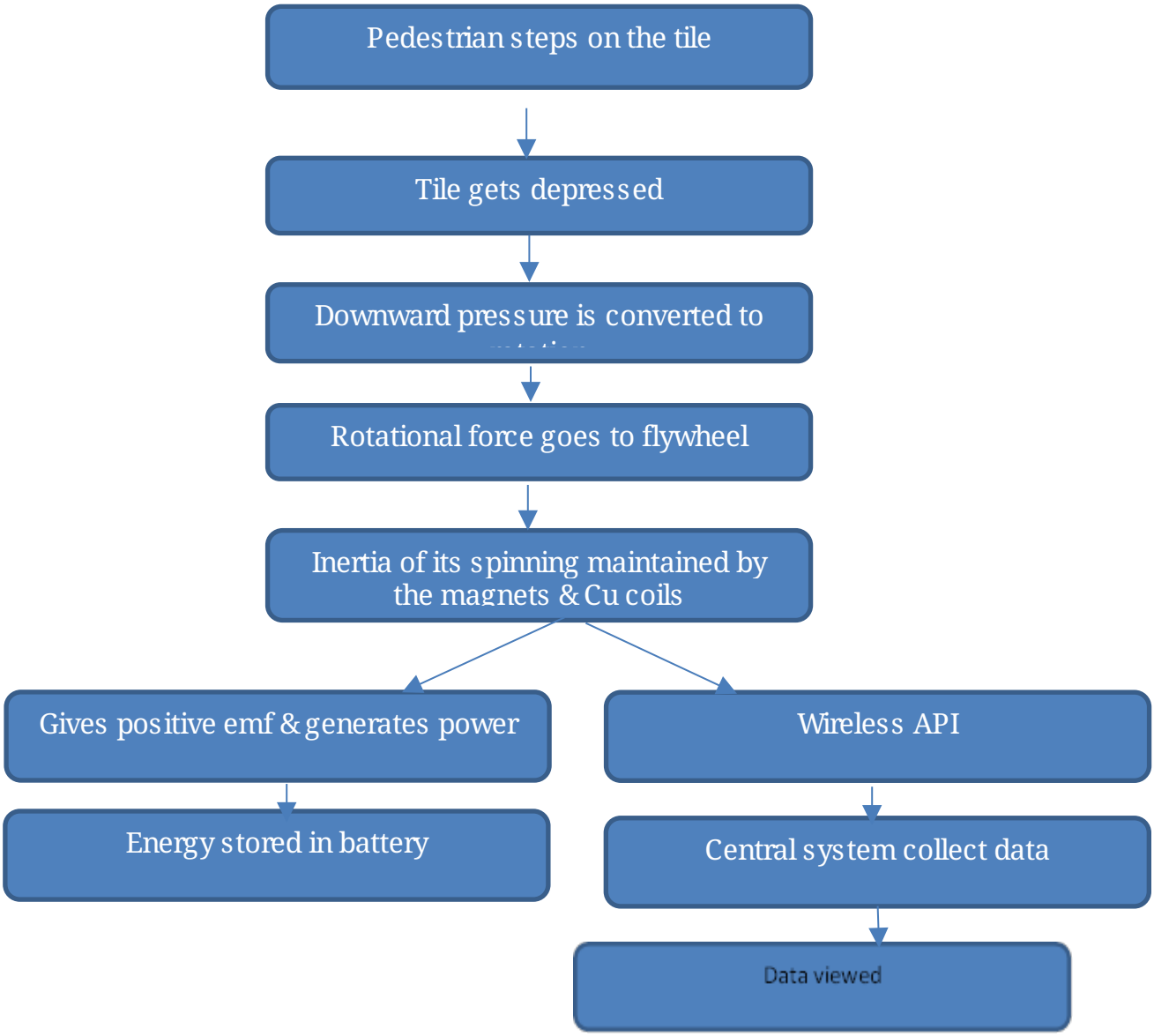
Clean, renewable and environmentally friendly energy generation has always been an issue that needs to be solved. Technologists have created various methods such as solar panels, wind turbine, hydroelectricity and so forth. Another energy source that is left underused is the kinetic energy in footfall within cities. An average person during their lifetime has around 150 million footsteps.

PaveGen is a company that produces tiles that generate energy from your footsteps. So, as people step on these tiles, their weight gets converted to electrical power so the more people walk on the floor the more energy is stored in the batteries and it can be used to power the lights in our cities, Wi-Fi networks, pollution monitoring, anything you need can be powered through the simple act of a human footstep. One footstep will give you about 20 Sec of light on an LED filament. But what it does as well is producing data. Each tile is equipped with a wireless API that resembles real time movement data analytics , while directly producing power when and where it is. It only takes about an hour to install it on a raised floor system where our flooring tiles are dropped straight.

OBJECTIVE

- Using flywheel technology which converts downward pressure to rotational force.
- Provides solution to the issue of sustainability by harnessing energy in footfalls
- Reducing electricity bill of Railway station and making it fully self-powered in the near future.

FLOWCHART



WORKING

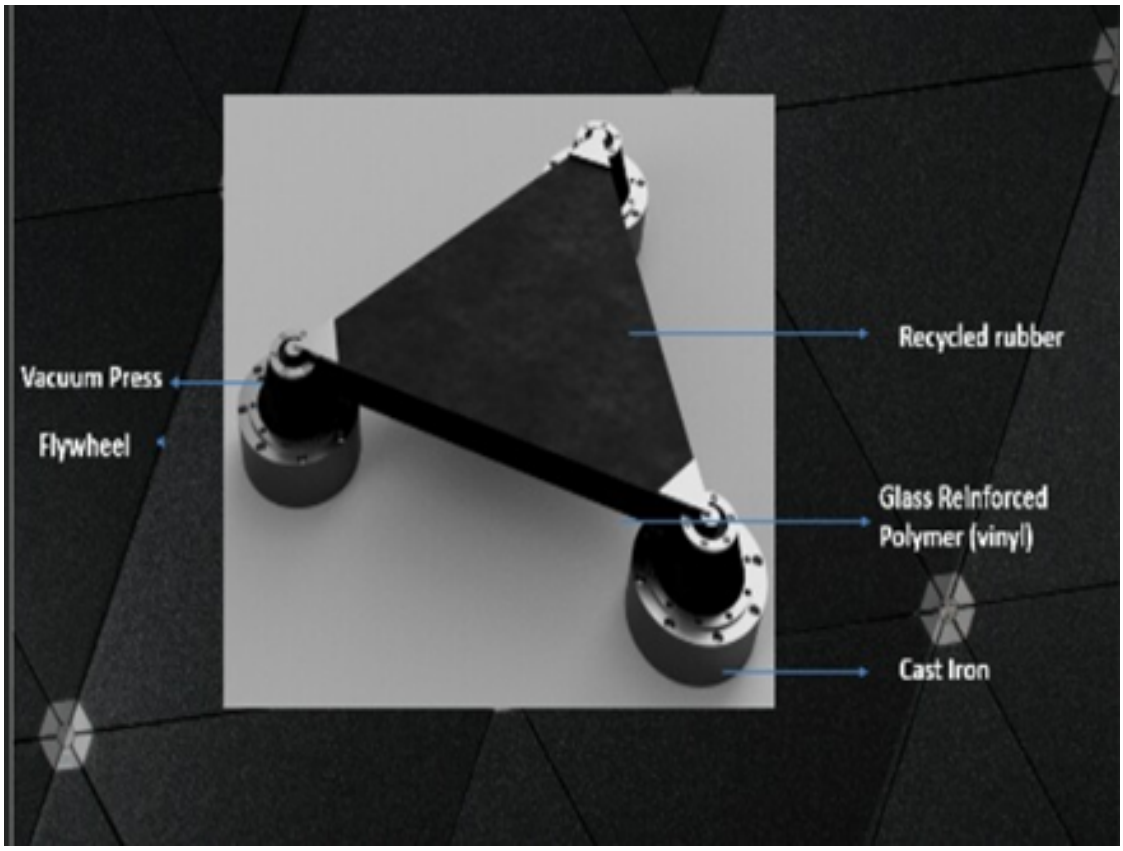
When a person steps on the tile, pressure is applied on the tile and this downward motion is converted to rotation. This converted rotational force goes to the flywheel. The flywheel holds almost all the power in the kinetic of its spinning. The inertia around it is maintained while the magnets and copper coils around it will gives us positive emf resulting in power that can be stored in lithium battery. The small energy generators are kinetically sealed i.e all the kinetic energy converted stays within the system ,hence its more durable .Unlike in a car where a piston has to move up and down for the flywheel to rotate ,here only a fraction of downward motion is utilized to rotate the flywheel because of the use of magnets and copper coil around it. So only a fraction of its lifespan is used. Each tile is equipped with wireless API that resembles a real time movement data analytics, while directly producing power when and where its is required.

DESIGN AND CONSTRUCTION

The tiles used for the product are triangularly shaped. This is because maximum pressure distribution occurs in this shape. Generators along with the flywheel are placed at the three corners of the triangle. The entire mechanism is kinetically sealed, i.e., the energy that is formed inside is not allowed to escape in any manner. The flywheels are placed inside the cylindrical generators. Copper coils and magnets are present to ensure that flywheels maintain its inertia.

Vacuum press is used to connect the tile with the generators. This replaces the conventional spring thereby minimising friction in moving parts. This ensures greater durability of the product. The mechanism also utilises API sensors to capture data about foot fall and other related information.

MATERIAL & COMPONENTS



COST ESTIMATION AND PAYBACK PERIOD

Dimensions of the desired patch = 200X85 cm

Area of a patch = 1.68 m^2

Estimated number of patches = 20

Dimension of each tile (equilateral triangle) = 50 cm

Estimated number of tiles for one patch = 16 tiles

Total number of tiles = 320 tiles

Cost of a tile (approx.) = Rs 25,000

Total cost of implementation (approx.) = Rs 80,00,000

Materials	Price(AUD)	Price (INR)
Recycled Rubber (per m^2)	8.55	440.11
Vacuum Press	11.43	590.248
Flywheel	1.59	82.061
Generator	13.01	671.55

Payback period:

Daily footfall at Ernakulam railway station = 29,283

Hourly footfall at Ernakulam railway station = 9,761

Footfall of a person crossing 8 patches (estimate) = 78,088

Energy/footfall = 0.294 Wh

= 0.000294 kwh

KSEB electricity rate(approx.) = Rs 5/kwh

78,088 footfall = 22.957 kwh

Total electricity cost = Rs 114.789 per hr

= Rs 2754.944 per day

Total electricity cost for a year = Rs 1,005,554.793

Total estimated implementation cost = Rs 8,000,000

Estimate payback period = **8 year**

SWOT ANALYSIS

Strengths

This project aims to generate electricity sustainably from harnessing kinetic energy of pedestrians. Thus it is a environment friendly method that does not generate any waste and is pollution free.

It is a new source of energy which utilizes high pedestrian traffic in Urban areas thus providing an alternative energy source to growing smart cities.

Indirectly, it encourages people to walk and use public transport thus promoting a healthy and sustainable lifestyle.

Weaknesses

Electricity generated from the project has a small scale of application due to the comparatively low amounts of energy produced.

Payback period of this project is long as the amount of electricity generated is over a small area is insufficient to recover the initial funding.

Opportunities

This project provides a direct social involvement in public energy generation thus giving the public an opportunity to participate in the development of a smart city.

Attractive incentives can be offered to promote public transportation by using PaveGen as a platform

Threats

A competitive energy sector and higher efficiency of alternative energy options may discourage initial interest.

The initial cost of setting up this project is quite high as materials sourced locally may not be up to technological standards.

SOCIAL AWARENESS:

To enable people to directly engage in generation of clean energy and to increase their understanding of sustainability various steps can be implemented

1. The daily pedestrian foot count and power generated can be displayed on smart monitors to make users aware of their contribution.
2. Awareness stalls can be set up in future locations like schools and universities to introduce this technology and impart sustainable values.
3. Advertising campaigns on PaveGen tiles can be utilized to generate additional revenue.
4. To further incentivise the use of walking and public transport, commercial tie-ups with business ventures can be utilized to provide attractive incentives through software applications.

CONCLUSION AND RECOMMENDATION

Our proposal to implement PaveGen technology at the Ernakulam junction railway station was proved to be feasible and could be extended to institutional buildings ,sports stadiums etc.. Its payback period was calculated to be 8 years with the product lifespan of 20 years.

Another option is to etch logos of sponsors onto the tile's glass. This way, we can help promote our sponsors and at the same time reduce the cost that we have to spend on the tiles through sponsorship.

REFERENCE

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