Optimized Automated Lift Control with Realtime Occupancy Detection

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***Abstract*—The project is concerned with the generation of electricity using footsteps of people. When we walk, we exert ourselves on the floor, though of which force we lose the greater part. It aims at capturing that wasted power and convert it into electric power. The power generating floor operates by converting the motion and stress of walking into useful electricity. The world is experiencing a large scale today energy shortage. This concept is a minor attempt to assist in curbing that issue.**
For example, if 100 watts of power could be made using 12 steps by floor then 120 steps would have yielded 1000 watts. When the same kind of system is placed on 100 floors, they would have the capability to create approximately 1 megawatt of electricity. Although such is a simple concept, the degree of power that it can generate. gives it importance and significance.

I. INTRODUCTION

The move towards electric mobility in the world has accelerated, which has increased the pursuit of alternative, renewable and non-central energy sources. Traditional charging systems of electric EVs mainly rely on the grid-based electricity which in most cases is produced using fossil fuels and subject to intermittency in supply, seasons of great demand and geographical restrictions. As mobility the more the electrification is carried out the greater is the pressure upon centralized systems of power, and the greater the demand creative ways of how to create, capture and distribute clean energy at its most critical point of need. One emerging perception movement of humans-an excessive, perpetual and unused motion resource as a practicable source of local power generation. By this concept Footstep energy harvesting expands by transforming mechanical movements that are generated during change of movement of persons walking and running or crowd into electricity. Earlier prototypes were able to prove they can be used in lighting applications and small electronics, their possible size and smart. EV charging integration is not well-investigated. Transport hubs such as transport hubs are urban spaces millions of feet walk along commercial complexes, university paths and walkways. On a daily basis, it is offering a distributed and renewable energy reserve. With systematic exploitation, the areas can become microgeneration ecosystems in favor of green transportation. New innovations in power electronics, intelligent sensors, materials, and Internet of Things (IoT) technologies have created avenues of conversion of fixed energy harvesters to adaptive, energy systems that are based on a network. IoT will allow monitoring, storing, and controlling power generated in an intelligent way so that predictive maintenance may be used, real-time information may be provided, and EV infrastructure may be integrated smoothly. Through incorporating control by data in footstep harvesting. Energy collection is able to be optimized, operational fault minimized, and charging is possible platforms demand-oriented activities. The study suggests the design and realization of a high-tech footstep-powered. IoT-enabled EV charging generation system, taking earlier ideas further lighting applications into viable mobility enablement.[1] The work participatory energy repositions the movement of a man in the renewable ecosystem- where pedestrians do not simply consume energy and take part in its production. By mechanical to electrical conversion, efficiency in storage, and intelligent monitoring, the system is aimed at establishing micro-level green charging facilities that can supplement the traditional grids. The research explores this model and provides a different approach to the electrification of cities it will show how the daily motion can be converted into intelligent energy that will be applied to e-mobility. The application covers the sustainability, community engagement and intelligent energy management, leading to a better future in which renewable microgeneration increases accessibility of EV charging and lessens reliance on non-renewable resources.

II. LITERATURE REVIEW

The increasing popularity of environmentally friendly cities and intelligent mobility has motivated scientists to develop alternative renewable energy that can help supplement the conventional energy networks. This is one area that has continued to develop over time and that is the generation of power using feet to produce the energy. Early Harvesting of kinetic energy Studies were done on piezoelectric flooring systems, with a significant portion of the research proving that the repetitive pressure that occurs when walking could be changed into electrical energy.

These studies were able to demonstrate conceptual feasibility but many of them frequently reported that the amount of power generated was large was narrow and could only be used to light pathways or run small electronics. Scientists then spread their attention by experimenting with other conversion technologies such as electromagnetic induction, mechanical gear based modules and rack and pinion. Such mechanisms increased the harvested output by increasing the displacement and the torque transfer. However, durability, maintenance overhead and friction and mechanical wear losses were problems that were likely to be experienced in the literature. While many prototypes they worked successfully in laboratory settings, but their application in actual pedestrian situations experienced the problem of sustainability. Similar developments in smart sensing systems and low-power embedded systems slowly changed the nature of research. Later studies introduced the IoT integration as a facilitating layer to monitor energy generation, control the charging cycles, and record.

Remote performance of system. Researchers realized that kinetic harvesting may not be sufficient without combining it with smart monitoring, storage optimization and user visible analytics. These changes brought about a shift between generation to management and utilization, indicating that IoT might enhance trustworthiness, and help towards feasible implementation. At the same time, the existing information regarding electric vehicle infrastructure emphasized the reliance on grid-based charging and the cost that higher EV adoption will cause. Consequently, scientists researched microgeneration and hybrid charging systems as the auxiliary solutions. Attempts were made to couple solar harvesting, piezo-tiles and battery reserve in communal areas like parks, buses and business establishments to evaluate the viability of a supplementary EV charging. Although early results were encouraging, with majority of the literature finding a lack of energy density or low conversion control as the limiting factor to increased capacity charging. Later studies started to deal with more recent studies these constraints are reduced by optimization techniques like better energy conditioning circuits, smart switching modules, multi-tile integration networks. IoT based dashboards emerged has the ability to monitor harvested wattage, forecast charging capability and enhance energy scheduling. Despite this, there are some observable gaps in the literature: not many of them go with kinetic energy harvesting EV charging in a systematic, scalable design; the most people view footstep energy as the one which is a majority view innovation as opposed to an effective infrastructure element. Similarly, on-going data-driven assessment and automatic charging control, which is essential in EV safety, is still missing underdeveloped. Out of these, it is clear that the future course is not only in the direction in producing energy out of footsteps but in developing coordinated systems that are smart at capturing, store, control, and put to real use such energy as EV charging. The existing the idea has academic underpinning, but also suggests that progress requires an improvement conversion mechanisms, IoT-based monitoring, enhanced energy conditioning, and provable scalability.[2] The current study fits into this gap that is yet to be filled by suggesting an advanced kinetic-to-electrical conversion system with IoT based control and performance analysis that was specifically focused on EV charging. It is evident through this literature review synthesis that a model of this type would be of value in the research on sustainable power infrastructure and the changing smart city ecosystem.

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III. METHODLOGY

This is a project whose working principle is the piezoelectric effect in which the effects of pressure are converted into electricity. A number of piezoelectric sensors are linked together and in case a person steps on them, they generate electric power. This energy is stored in a battery which is rechargeable. Microcontroller plays the role of the brain of the system. It receives the irregular voltage emerging out of the converts it into a constant output using sensors. A diode is inserted to avoid the flow of electricity in the wrong direction. The metal detector is scanned to determine whether the user can access the system and when validated, he or she gets 10 seconds of charge time. The LCD display indicates the level of voltage that is stored in the battery. All the sensors are linked in series and wedged up under a floor tile. Footsteps are the largest source of energy in humans' movement considered are most powerful (estimated at 67W) though stepping is less common and pressure on shoes change and still it is not easy to harness this energy effectively. When the individuals are walking on these tiles in crowded places, they press on the sensors. This pressure produces AC voltage, and the volume of this is dependent on the vigor of the steps taken by the person. Studies demonstrate that the vertical pressure may get up to 130 percent of body weight. The generated voltage is then powered to a rectifier circuit, which changes the AC output to DC allowing it to be stored and used.

IV. WORKING

4.1. Architecture

- The footstep board consist of piezoelectric sensors which are connected in parallel
- When the pressure is applied on board mechanical energy is converted into electrical energy
- The energy is stored in the rechargeable battery which is connected to inverter
- The inverter converts DC to AC
- When the energy is stored in battery it can be use to charge the equipments like mobile phone for small scale and E-Vehicles for large scale.
- Human can swip the rfid card to get the access and the bill will generate on his mobile for charging purpose[6]

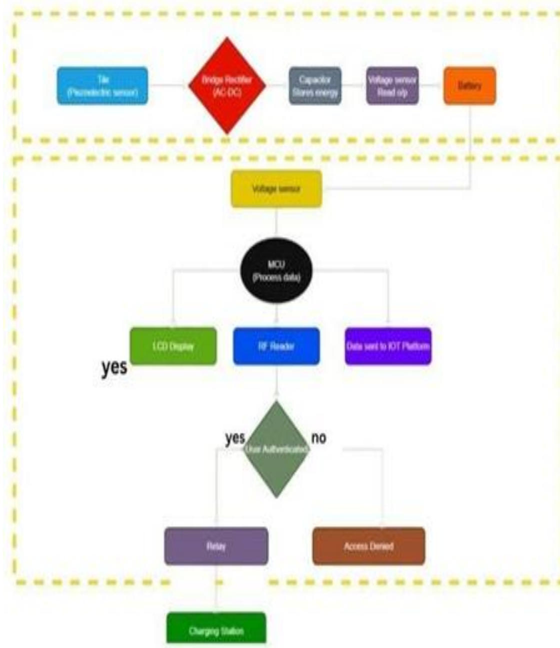

Fig 1. Block Diagram of Footstep Power Generation System

4.2. Objective

- To design and develop a system that translates mechanical energy, produced by footsteps of human beings, into electrical energy by use of piezoelectric sensors in high foot-traffic regions.
- To be able to store the generated power in the form of electrical energy in batteries or supercapacitors so as to be able to provide power throughout and be reliable.
- To have the controlled mechanism of charging E-vehicle with the harvested footstep energy with proper voltage regulation and protection.
- To incorporate the IoT technology in real-time monitoring and control of the energy production, storage volume, and E-vehicle charging.
- The delivery of a sustainable and environmentally friendly energy source that will lower reliance on traditional power sources to charge E-vehicles.
- To maximize energy consumption by smarter power management with the help of a microcontroller-based control system.
- To facilitate the analysis of data and remote access implementation via a cloud server and mobile/web application to perform an evaluation

of performance.

- To encourage renewable energy generation in intelligent city facilities, like railway stations, shopping malls, and campuses.
- To prove the possibility of relying on non-conventional sources of energy to serve the increasing electric vehicle demand.
- To develop a prototype that is cheap, scalable and efficient enough to be implemented in the real world.

4.3. Hardware

To design and prepare a system that transforms mechanical energy generated by the feet of people to electrical power with the help of piezoelectric sensors in the high foot-traffic zones. To effectively store the produced electrical energy in batteries or supercapacitors in order to have consistent accessible power that is reliable. The highly developed footstep power generation is based on the premise of the transformation of mechanical energy of human activity into electrical energy that is used to charge the electric vehicles through the assistance of the IoT-based monitoring and control. This system will be installed in locations where there is a lot of pedestrian traffic including rail stations, shopping centers, learning institutions and footwalks. Mechanical force is exerted on the plates when an individual steps on the pre-specifically designed pressure plates. This force is relayed to a system of piezoelectric sensors which are attached to the plates. These sensors produce an electrical response in the shape of small-scale alternating voltage with regard to the pressure applied as a result of the piezoelectric effect. The voltage generated by one footstep is not large and is intermittent hence several piezoelectric sensors are used consecutively and in series with other sensors so as to increase the total voltage and current produced. The AC voltage generated is then passed to a conditioning unit of power, comprising a rectifier circuit and voltage regulation phase. The AC output is then converted to DC by the rectifier, and then the voltage is brought to a stabilized value appropriate to store energy by the regulator or DC-DC converter. This step is essential in securing the storage components and enhancing the efficiency of the system in general. The conditioned DC power is then stored in a rechargeable battery bank or a supercapacitor which is filled with energy produced by constant footsteps in the course of time.[3] The presence of this stored energy guarantees that there is adequate power to be used in the E-vehicle charges even when there is a lack of foot traffic. The energy storage system is like a buffer, which supplies a steady and continuous power supply to the load. The control component of the system is a microcontroller unit. It constantly checks the main parameters which are produced voltage, current, battery charge status, and power consumption. Using these inputs the microcontroller regulates the charging and discharging operation, safe working operation as well as control of the power flow to the E-vehicle charging unit. The controller is also used to protect against over-voltage, over-current and deep discharge prevention. The system has an IoT module (Wi-Fi or GSM) to facilitate real-time transmission of data to a cloud server. The microcontroller transmits data like operational information about the amount of energy produced, battery state, the number of footsteps and the charging of E-vehicle to the cloud. This information is kept, processed and analyzed in the server to give useful information. This information can be delivered to the users and system operators via a mobile application or web-based dashboard, where the users can observe system performance, the available charging energy, and E-vehicle charging status. The notices and alarms may also be raised when there were faults, low battery levels, or when there was an abnormal operating condition.

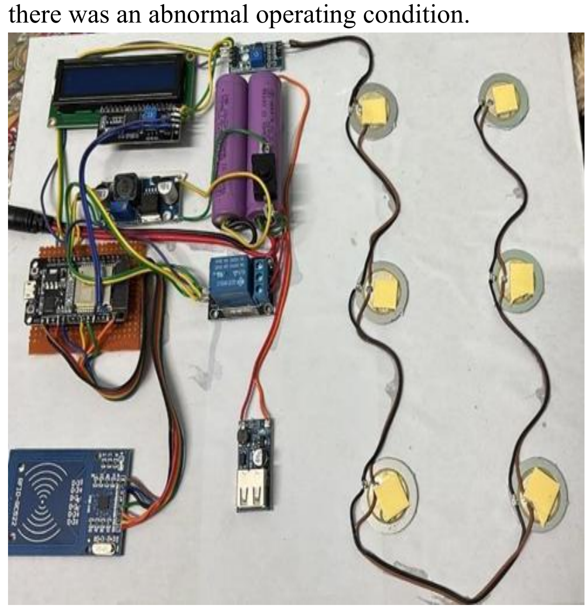

Fig 2. Hardware Setup

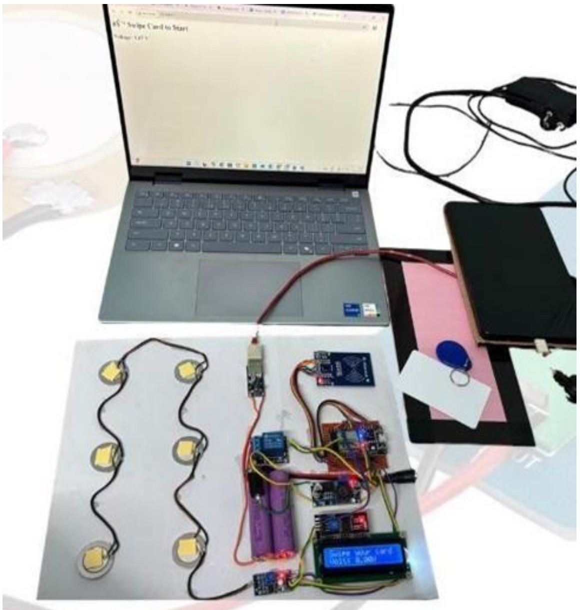

Fig 3. Hardware Working

V. RESULT

The Advanced Footstep Power Generation System, which was designed and implemented was effective in showing how human footsteps could be converted into useful electrical energy through piezoelectric sensors with the help of mechanical power. The system could produce electrical power in relation to the magnitude and amount of footsteps taken on the pressure plates. The energy produced was then rectified, regulated and stored in a rechargeable battery to have stable and continuous provision of power.

The microcontroller control unit was effective in measuring voltage, current, battery, and energy flow and thus allowed the safe and regulated charging of the electric vehicles. The integrated E-vehicle charging module was able to charge low-power electric vehicles like e-bikes and e-scooters with controlled conditions effectively. Overcharging, over voltages and deep discharge was prevented by protective measures that enhanced the reliability of the systems.[4]

Through the IoT integration, real-time monitoring of the key parameters of the system such as the energy production, the status of the storage and the charges were viewed on a cloud-based dashboard. The transmission of data was stable and enabled the offsite monitoring and evaluation of system performance. The findings proved that the system can act as a renewable, environmentally-friendly, and intelligent solution to energy harvesting to be used in the public installations.

Table 1: Weight vs Voltage Generated [1]

S.No	Approximate weight on sensor	Approximate Voltage
1.	50kg	7V
2.	60kg	9V
3.	70kg	11V
4.	75kg	13V

VI. CONCLUSION

The Design and Implementation of the Advanced Footstep Power Generation System to Charge E-Vehicles through IoT has been effectively done and shown. The system is fairly successful in converting mechanical energy produced by human footsteps to electrical energy with the help of piezoelectric sensors and conditioning and storing it before feeding it to charge electric vehicles. This method offers a new way of tapping renewable energy out of the normal human activity that otherwise would not have been utilized.

The incorporation of a microcontroller-powered control unit allowed to guarantee efficient energy management, the safe nature of charging operation and the predictable performance of the system. The monitoring system was IoT-enabled, which made it possible to monitor energy generation, battery condition and E-vehicle charging conditions in real-time through a cloud platform to make the system more intelligent and easier to use. The findings proved that the system can provide power to low-capacity E-vehicles like e-bikes and e-scooters.

Altogether, the suggested system will be sustainable, environmentally friendly, and affordable to use when in places with heavy pedestrian traffic. As the storage capacity of energy and power conversion efficiency continue to improve, this system has great prospects of large-scale application in smart city infrastructure with the help of energy conservation and development of green transportation.

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