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Raindrop Powered Electricity Generator

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The rapid development of industrial sector had given rise to the energy crisis, which are urgently needed to be solved. Electric energy is one of them, In India the electricity is generated from coal, wind, solar, thermal, nuclear etc. from which 40% energy is renewable energy. In order to contribute in renewable energy generation a attempt has been made to generate electricity from rainfall. This paper presents a raindrop power electricity generator which uses the kinetic energy of raindrop and convert this energy in electricity. This can be achieved by using piezoelectric generator to harness the kinetic energy from falling water. When a raindrop falls on the piezoelectric sensor due to piezoelectric effect the kinetic energy is converted into electrical energy, the voltage generated is further displayed using microcontroller. The project focuses on building a prototype and analyzing its power generation capabilities.

KEYWORDS;- Raindrop, Electricity, Prototype, Voltage

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I. INTRODUCTION

In past years, the rapid development of the industries had increased the demand of energy, especially the electric energy. It has become one of the necessary need in this developing era. In order to suffice this growing power demand the extraction of energy is done from non-renewable, renewable and rare sources of energy. Almost 60% of power generation in India is based on non renewable sources but the day by day reduction of non-renewable energy has lead to the increase in necessity of generating power by using renewable sources.

Solar, wind, tidal, ocean wave, etc are some forms of renewable energy which are used for generating power. Apart from this, the average rainfall in India is around 125cm (890 mm). Moreover some states in India receives heavy rainfall all around year. So raindrop can be used as one of the source for generating the energy. But the form in which it occurs is a major obstacle to use it in the power generation. So it is tough to convert energy associated with raindrops into electric energy.

This paper explores the development of the system that utilizes the kinetic energy from the falling rain and convert it into electricity. This conversion is facilitated through diverse mechanism such as piezoelectricity. Piezoelectric transducers are used to harvest the energy since the piezoelectric material are able to convert mechanical energy into electric energy due to its piezoelectric effect. Moreover the mechanism is simple and straight forward. After the effective conversion the output is rectified and the voltage generated is displayed by using voltage sensor and microcontroller.

This system can contribute to electricity generation in remote areas, emergency power supply during natural disasters and green energy initiatives in urban environments. But the ultimate goal is to contribute to the development of a sustainable and innovative method for generating renewable energy from environmental phenomena like rainfall.

II. LITERATURE SURVEY

Benasciutti and Moro L has proved that voltage can be generated by hitting a single drop of water on the piezoelectric plates, but there is no proposed evaluation. The raindrops hits the piezoelectric material in a cantilever configuration, which can help to improve the energy produced. [1]

Vatansever et al. compared different piezoelectric material to investigate the possibility of energy generation from rain drop to power small electronic devices. [2]

Researchers at the university of California, Berkeley developed a generator which can generate enough electricity through raindrops to power small wireless sensor nodes. It uses PENG which is made of flexible substrate on which thin film of piezoelectric material is deposited. [3]

Researchers at IIT Delhi develop a device that can generate electricity from raindrops and ocean waves by using triboelectric effect. They concluded that when compared to convectional method the proposed system can generate more electricity.[4]

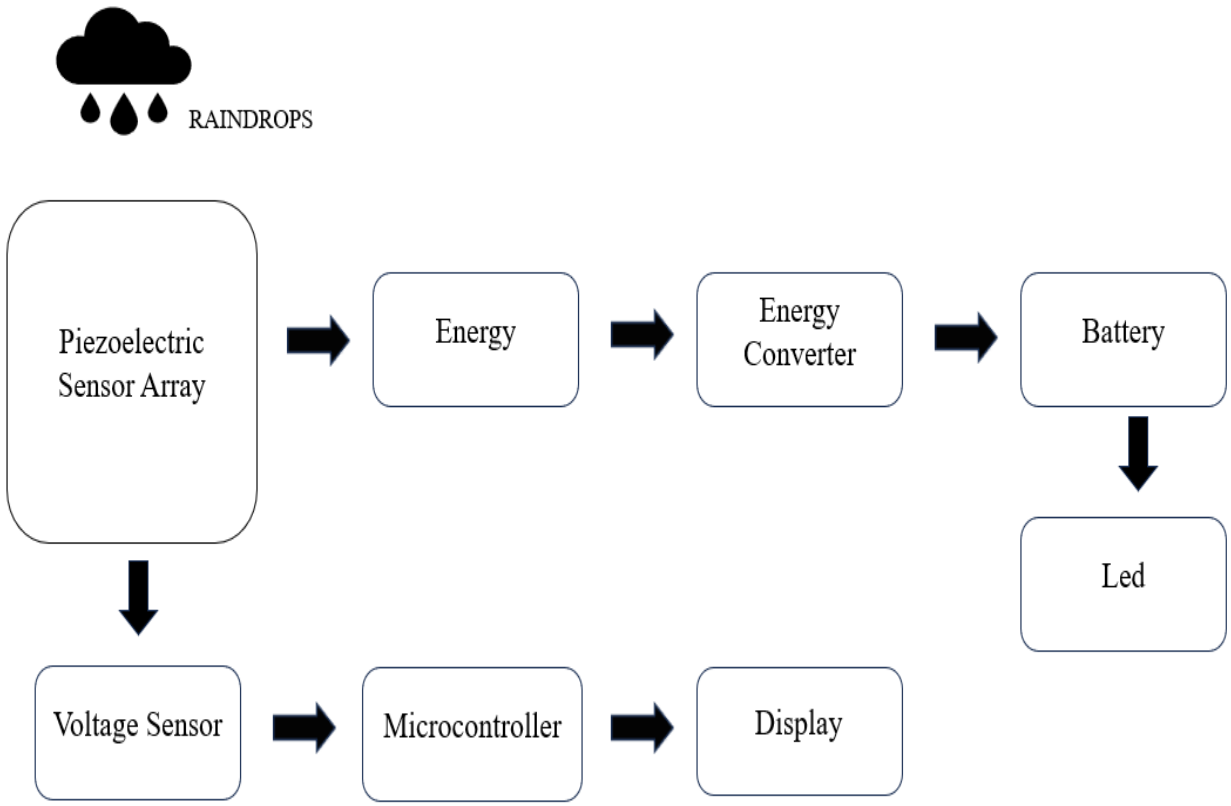
A team of researchers at the University of Toronto developed a generator that can power small led light by generating electricity from raindrops. The generator is made up of silicone matrix on which a piezoelectric fiber is embedded.[5]

Scientists from university of Hong Kong Prof. Wang Zhong Lin, Prof Wang Zuankai and Prof. Zeng Xiao Cheng has developed droplet based electricity generator which can generate upto 140V when the 100 microlitres of water is released from a height of 15 cm. [6]

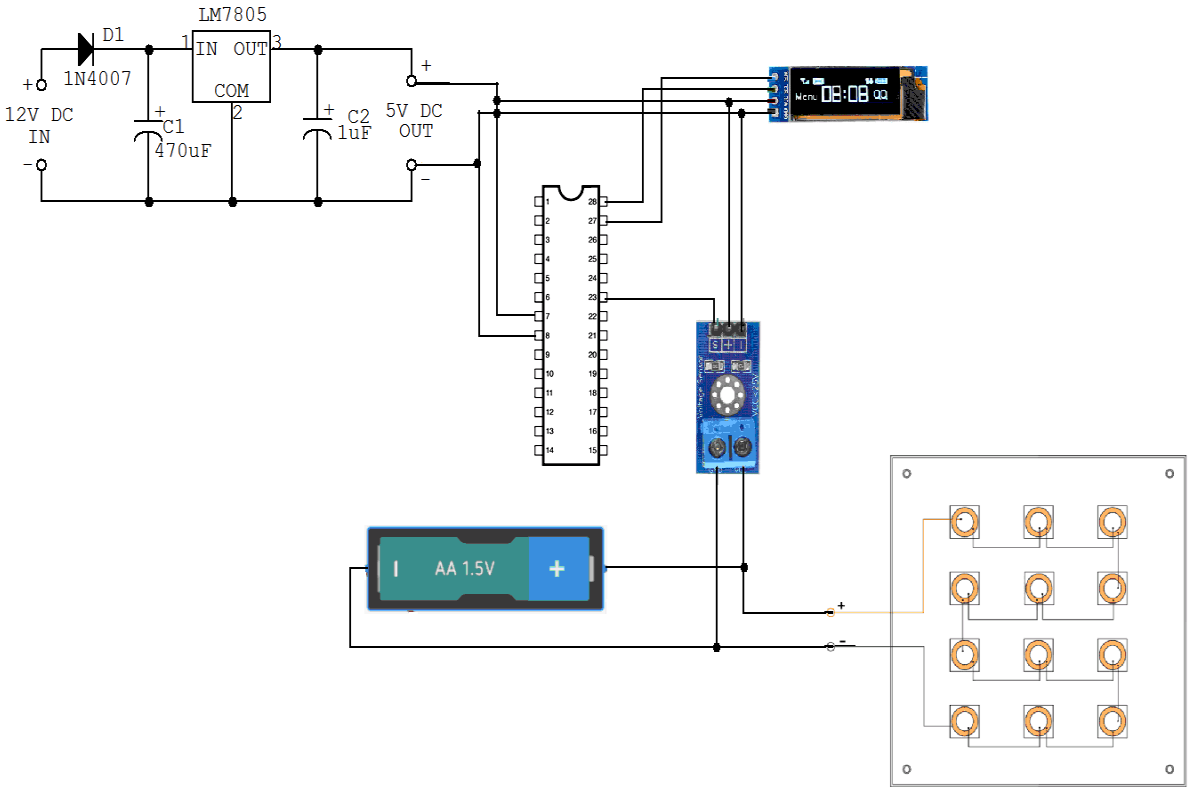
III. METHODOLOGY

- Selection of piezoelectric material based on different factors and as per the requirement of the project
- Assemble the piezoelectric sensor in series and parallel combination and ensure the electrical connections to get efficient output voltage
- Design a housing or the case for the protection of the assembly from environment and rain water and encase the above assembly in the following housing
- Rectify the generated output
- Calculate the generated output by voltage sensor and display it using microcontroller and store it in a battery
- Optimize power generation experiment with different impact angles of raindrop
- Analyze the collected data to establish the relationship between the raindrop and output power

IV. BLOCK DIAGRAM: DEPICTING THE SYSTEM FLOW



V. CIRCUIT DIAGRAM



This project aims to make a small contribution in generating clean energy by using raindrops for the generation of electricity. It uses a panel of piezoelectric sensors connected in series and parallel combination ensuring proper electrical connections for the conversion of energy. Here piezoelectric sensor are used because it has a unique effect known as piezoelectric effect which convert the mechanical energy into electric energy when subjected to the compressive or tensile tress. When the raindrops falls on the panel on the rooftop continuously it creates vibrations on the sensor which act as a mechanical stressor. It creates a compressive force which squeezes the material triggering the piezoelectric effect. Which convert this kinetic energy of the raindrop in electrical energy. The voltage generated is a alternating current in order make is more usable further it is rectified using rectifier and is store in the battery which can be further used as a alternating source for a power. In order to display the generated voltage, voltage sensor is which calculates the generated voltage and display it using the microcontroller.

VI. CONCLUSUION

Raindrops can be used as one of the renewable sources to generate electricity. Output voltage can be obtained when the mechanical energy generated by the impact of hitting raindrop on the designed piezoelectric panel is converted to the electricity by the piezoelectric effect. The generated energy can be stored in the batteries and can be further used to power small electronics devices. The recoverable energy depends on factors like raindrop size, falling velocity, and properties of piezoelectric material used (i.e. thickness, piezoelectric strain coefficient, etc.)

The current output of this project is very less and factors like inconsistency in the rainfall , environmental factors and low power output effect the efficiency of the project. but by making advancement and upgrading the system or by using different technologies such as nanotechnology we can improve the overall output of the project and can be able to increase the conversion efficiency.

Raindrop power generation with piezoelectric sensors is a promising concept for sustainable, low-level energy harvesting. Continued research and development efforts focused on material advancements, design optimization, and energy storage solutions can unlock the true potential of this technology, paving the way for a greener future.

VII. FUTURE SCOPE

The development and upgradation of the system can help to generate more power in the future. Also the use of nanotechnology can create highly efficient energy generators with a improved conversion efficiency.

Combining raindrop power energy generator with other renewable sources can create a great power generation system.

Integrating the system with IoT devices and smart grids can emphasise the effective use of generated energy. Development of special generators such as TENGs, DEGs, SMEGs, etc. can productively convert the energy by maximizing the conversion efficiency.

Powering of larger devices can be possible by using raindrop power generators to charge batteries. It could also power small electronic devices such as sensors and wireless transmitters.

It could provide power to remote areas in the times of natural calamities and also to communities which do not have access to grid.

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