IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Renewable Energy By IR Sensors: A Trustable Method To Save The Environment

Kulkarni Ambarish N.1, Dr. Magan P. Ghatule2, Dr. Astha Singh3,

1. Research Scholar, Department of Physics, Shri JJT University, Jhunjhunu, Rajasthan, India
2. Research Co-Guide, Sinhgad College of Science, Pune, Maharashtra, India
3. Research Guide, Department of Physics, Shri JJT University, Jhunjhunu, Rajasthan, India

Abstract: In the contemporary world, energy is a vital requirement for undertaking any type of task. It can be produced using a range of methods, encompassing both renewable and non-renewable options, and is based on the physical principle of "work accomplished." However, the methods of producing energy frequently harm the environment. Accordingly, technologies aimed at green energy are being developed to reduce this ecological footprint. Within renewable energy systems, the role of sensors is crucial for electricity generation, and their effectiveness significantly affects energy production. Energy sources that rely on sensors bring numerous benefits, especially regarding sustainability and environmental conservation. This paper investigates the advantages of energy generation that uses sensors, placing particular emphasis on how infrared (IR) sensors compare to other sensor types.

Index terms: Electricity, sensor-based electricity, wind electricity, free energy, IR sensor.

Introduction:

"Energy cannot be created nor be destroyed; it can only be converted from one form to another." This law has motivated people to use energy for the work they need. However, the conversion of energy into a suitable form is not an easy task. Different methods are proposed to do this, and all these methods have different advantages and limitations. However, nowadays, impact on the environment is measured, and hence a method to generate energy should be eco-friendly. Presently, solar electricity is generated using silicon panels. Wind energy is generated by an alternator; tidal energy uses a set of alternators and hydroelectric uses water pressure to rotate alternator coil. Some other methods, like energy generation from moving vehicles, energy generation from speed breakers on the road, and regeneration of energy from braking systems of moving vehicles, also use

sensors. The sensor-based systems are eco-friendly. However, IR sensor has many differences over these sensors and hence these sensors are superior than others.

Literature Review:

Aiswarya Baburaj et. al. (2025) describes the use of triboelectric nanogenerators for self-powered sensors. It is recommended to support this system using artificial intelligence. TENGs are well-proven electricity generators for smart sensors where the performance is reliable. However, the design of the TENG device is still crucial. The use of AI will simplify this work.

Suraj C. Bulakhe (2025) takes the review of the electricity generation method from raindrops using piezoelectric sensors. The system has limitations of material durability, power output, seasonal dependency, and scalability. The conclusion leads to more research on limitations and analysis in real-life implementation.

Pallavi Shelar and Panchsheela Kamble (2024) connected piezoelectric sensors in parallel. When a person walks on it, due to foot pressure, the electricity gets developed. This electricity is measured by using voltmeters and is stored in batteries. The paper is written on electronic circuits but has not been implemented for practical usage. However, the readings are quite impressive and encourage researchers to work on the concept.

Aras Ghafoor et.al. (2024) takes a review of wind turbine-based renewable energy generation systems. There are several problems that occur during the generation of electricity, viz., heat, stability of the system, interconnection to the grid, and many more. Different developers handle these problems to minimize the losses. The main issue of "increasing system reliability" is also important, and it is also managed. Short-term instability is another manageable problem.

Namrata. J. Helonde et.al. (2021) also implement electricity generation using piezoelectric sensors. The system uses microcontroller interfacing to the sensor network. This ensures the accurate measurement of the generated power. Further, it also ensures stable performance as the system is digital. However, the main limitation of the system is the delicate crystal.

Ritik Banger et.al. (2020) Used solar cells to generate electricity in night. For this purpose, his team discovered PVTR material, which effectively converts night heat radiations in to electricity. Since, the sky is supposed to absorb radiations, and earth has to radiate, the system worked satisfactorily. The system basically uses heat radiations or IR waves to generate electricity.

Research Methodology:

This paper compares different methods of electricity generation on their different performance indicators and derives conclusions. The paper refers to the research papers published on electricity generation methods using different sensors, IR sensors and compares it with conventional methods. The possible limitations of each

method are based on literature available. The advantages of IR sensor-based methods are compared with the other methods.

Results and Discussion:

1. Conventional methods versus sensor-based methods of electricity generation: Along with the above-mentioned research papers, many other papers also design electronic systems to generate electricity. The piezoelectric sensors, pressure sensors, solar cells, alternators, TENG, thermopiles, and heat sensors are preferred sensors to generate renewable electricity. Conventional methods are also preferred to cater the increasing need of electricity. All the methods use microcontroller/ computer-based system for their reliable performance and parameter measurements.

The table 1 below gives comparison of sensor-based electricity generators and conventional methods of electricity generation.

Table 1 Comparison of Conventional methods and sensor-based methods of electricity generation

Sr. No.	Conventional Electricity Generation Methods	Sensor based Electricity Generation Methods
1	Uses Gas, fossil fuels, coal, atomic reactions, etc.	Uses different sensors
2	No need of external power supply for operation	Needs battery for operation
3	Output is independent of environmental changes	Output varies with variation in sensor parameter
4	Assembly is time consuming	Assembly is easy
5	Failure of system may be hazardous	Failure of system is not hazardous
6	Need to follow all quality checks after major repairs	No need to perform quality checks for assured performance.
7	Polluting systems	Non-polluting systems
8	Radiations, gas leakages, heat and other pollutants	No gas leakages, no harmful radiation
9	Large output power in MW	Small output power in W or KW
10	Skilled handling is needed	Basic skills for handling are needed

2. Piezoelectric sensor-based electricity generation: The method uses piezoelectric sensors as pressure sensor. When pressure is applied on the tile made of sensor, the voltage is developed. This voltage charges the battery. However, pressure applied must have some proper frequency, so that the voltage will get generated on regular intervals. Again, the amount of pressure must not go beyond certain limits. Otherwise, the sensor gets

damaged. To get higher voltages, sensor should be designed and proper design of the complete system is needed.

3. **Vibration sensor-based electricity generation:** The vibration sensor either uses piezoelectric sensor or TENG. In both cases, the frequency of vibration and pressure are important. So, the system cannot be used all the time.

4. **Alternator and magneto based (windmill) electricity generation:** The windmills are basically dependent on wind speed and direction. At huge height, they get ventilation that can rotate the alternators and electricity can be generated. Recent developments in windmill allows vertical structure of wings makes it compact. However, in both cases wind speed is important. Excess speed of wind may damage the structure and at very low speed, wind mill cannot generate electricity. Further, the electricity cannot be generated at every place and every time.

5. **Solar cell-based electricity generation:** Solar cells have major drawback of generation in sunlight only. Solar cells are designed to work in the wavelengths of visible light. Therefore, for UV and IR radiations, solar cells are useless. The solar cells cannot work in night time and even in low day light. Further, the maximum efficiency of solar cells is 18-19 % only which is not increased practically. Some chemical-solar materials known as Perovskites have shown good performance, but the things are at laboratory level.

6. **IR sensor-based methods for electricity generation:** IR sensor-based methods use IR radiations to generate electricity. There are two types of IR detectors, active and passive. Passive IR sensors have low outputs and the sensors are costly. Whereas active IR sensors have more output and cost is low. In atmosphere, IR radiations are always present. sunlight has IR, Visible and UV radiations with approximate percentage of 52-55, 42-45 and 6-8 respectively. The earth also radiates heat during night and it is found at about 75 W – 150W per sq. meter depending on the nature of the land. Thus, IR radiations are available during day and night also and can be used to generate electricity. The IR photodiode can be used to generate electricity. Typical IR photodiode is shown in Figure 1. The IR based electricity generation methods offer different features as listed below.

- IR sensors are designed using semiconductors.
- IR sensors have no movable parts.
- IR sensors can work in day as well as in night.
- IR radiations have wide bandwidth and hence more energy.

- IR sensors are tiny sized sensors having 3mm, 5mm diameter and can give good electric current up to 5-10 mA at 3V-5V reverse voltage.
- IR sensors can be connected in matrix form to get more electricity.

Fig. (1): IR Sensor Photodiode

Conclusion:

This research emphasizes the significant promise of electricity generation utilizing IR sensors as a viable and environmentally friendly option compared to traditional approaches. Although conventional systems yield considerable energy output, they frequently lead to pollution and require extensive resources. Systems based on sensors, particularly those employing IR technology, provide cleaner, safer, and more versatile alternatives. IR sensors excel over other sensing technologies due to their capability to operate around the clock, their small dimensions, affordability (especially with active IR sensors), and flexibility for expansion. They harness the constant infrared radiation available in the surroundings, establishing them as a dependable source of energy at all times.

While still in development, energy systems using IR sensors are highly promising for decentralized and sustainable energy initiatives. Their implementation could greatly lessen environmental damage and facilitate the global transition toward renewable energy options.

References:

[1] Aiswarya Baburaj et. Al. (2025)**,** *AI-Driven TENGs for Self-Powered Smart Sensors and Intelligent Devices,* Advanced Science published by Wiley-VCH GmbH, DOI: 10.1002/advs.202417414, pg. no. 1-38

[2] Suraj C. Bulakhe (2025)**,** *Electricity Generation with Piezoelectric Sensors Using Raindrop Energy in the Rainy Season: A Review,* International Journal of Scientific Research in Science and Technology**,** doi: https://doi.org/10.32628/IJSRST

[3] Pallavi Shelar and Panchsheela Kamble, (2024), *Harvesting Footstep Energy: Piezoelectric Sensor Based Power Generation For Sustainable Urban Environments,* 2024 IJCRT, Volume 12, Issue 10 October 2024, ISSN: 2320-2882, pg no. a955-a963

[4] Aras Ghafoor et.Al. (2024), *Intelligent Integration of Renewable Energy Resources Review: Generation and Grid Level Opportunities and Challenges,* Energies **2024**, 17, 4399. https://doi.org/10.3390/en17174399 , pg no. 1-29

[5] Namrata.J.Helonde et.Al. (2021), *Footstep Power Generation Using Piezoelectric Sensor,* International Journal for Research in Applied Science & Engineering Technology (IJRASET)**,** Volume 9 Issue XII Dec 2021, ISSN: 2321-9653; pg no 1347-1353

[6] Ritik Banger et.Al. (2020), *Electricity Generation From PV TR Cells at Day and Night Time from Space Energy,* Juni Khyat, Vol-10 Issue-5**,** ISSN: 2278-4632, pg. no. 25-29