Energy Production from Mechanical Stress, Thermal and Wind Power

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Abstract - The two main factors for living, water and non-renewable energy are being over used these days which will ultimately lead to contamination and depletion of natural resources. Ground water is getting contaminated due to pollution while fossil fuels are being used in excess for generation of electricity. To overcome these issues author proposes a system which not only uses available natural resources to generate electricity but also helps in conserving rain water. A compact design is proposed which utilizes solar and wind energy along with rain water harvesting. System is designed in such a way that the energy produced does not depend on the ratio of availability of resources thus conserving the two main factors for living water and energy.

Key Words: Water harvesting, energy, renewable resources, electricity.

1) INTRODUCTION
The major part of industries depends upon non-renewable energy resources. To generate electricity, non-renewable energy is widely used. Burning non-renewable energy resources not only pollute environment but also harmful for us [1]. To overcome this problem renewable energy are used. Photovoltaic (PV) cell which are used to harness energy from sunlight are widely used as a renewable source of energy. Wind turbines with unique design to harness maximum wind energy are also designed [2]. One more source for harnessing energy is through rain ,and to harness rain energy piezoelectric materials are used but the problem is they are not feasible to use for generation of electricity[3].The problem with all these renewable sources is they are climate dependent as if there is no sunlight then PV cells will not work and with windmills is if air is not flowing then no wind energy can be harnessed. In present technique hybrid system are developed which can harness two energy at the same time[4].An integration of different processes can be designed so if one system stops working other will harness energy .This is done so it can work in such a way that it never stops harnessing the energy from the environment [2]. Economies are widely affected by the way energy is harnessed and distributed. Renewable energy sources are freely available and do not get exhausted with time. Many techniques have been developed to harness energy from rain, sunlight and wind [3,4]. Methods have been thought like hybrid system which integrate much energy together but those techniques get expensive and also switching between the energy is also not reliable to use. In this design a compact model is developed which efficiently integrates energy and stores it in a power source like battery. A major concern about the consumption of water and the quantity that is let also arises, which can be solved with the oppositely facing umbrella design. It is difficult with present technique to harvest rain water and at the same time filter it for drinking purpose. In areas of congestion where solar panels or windmills cannot be placed, a system is needed to harvest energy from these areas. The main problem with solar panels is that they not only use a large piece of land but also left the land for no other use hence leading to land pollution. So, to decrease this kind of pollution government has planned to give subsidy to user for selling electricity to them generated from solar panels that are fixed on their roofs. The product designed is also used by such users and also massive electricity can also be generated when we are harnessing energy from more than one resource at the same time creating a smarter way of harnessing energy. Traditional ways like making a tank for conserving rainwater are widely used which are not suitable and does only one job of conserving water and rainwater is now not suitable for drinking as it has
some acidic chemicals altogether, so an efficient filter which can purify all those chemicals which are harmful for drinking is necessary. People of south region faced scarcity of water which tells a need for designs to harness energy as well as conserving water which will lead to a healthy and suitable form of living.

2) PROBLEM STATEMENT
Urban and rural both areas are facing a major concern regarding water and energy consumption. As due to increase in pollution which occur due to burning of non-renewable resources, so industries cannot rely more on non-renewable resources. These resources not only pollute water, land and air but also affects living. There is a transition seen from using non-renewable sources to renewable resources which do not degrade the environment and also create a healthy living. Many techniques like drip irrigation system in agriculture, roof water harvesting system have been developed but the feasibility of these systems is not enough with fast growth of technology the classical ways to harness energy from conventional resources cannot be used for long so a new system is created to solve such issues.

a) A solar cell harvesting system
Solar cells are fixed in ground due to which they utilize much of the land and also no other system can be fixed to harness energy, in this design solar cells are placed at a height in a circular manner so they take the shape of umbrella when the sun rays hit the cells electrons starts moving. There are many types of photovoltaic cells like monocrystalline, polycrystalline and concentrated photovoltaic cell which has the highest efficiency. Each of the method solar cell has their own advantage. They are categorized on the basis of purity of material used, efficiency of cell, cost and size. The three parameters necessary for design is the cost, size of cell and efficiency. Polycrystalline have efficiency around 15%, they are less expensive and take moderate space for energy production. When a photon hits a cell the current generated is not regular and if the batteries are directly charged then it may damage or overcharge it. Efficiency of the solar panels also depends on the way batteries are charged. To overcome this problem, we use charge controller which reduces the risk of overcharging and only provides a regular voltage as an output.

b) Harvesting energy from rainfall
Due to motion of water energy can be harvested, piezoelectric material is used for this task, and piezoelectric material is fixed on the circumference of the design. The task is to recover maximum energy from impact of rain drop. The impact experienced by piezoelectric material is inelastic in nature. The velocity of the raindrop gets constant at some point. Piezoelectric material work on a simple principle that when the material is pressed an electric field is generated when generates a potential difference which ultimately leads to flow of current. piezoelectric comes in many forms like plastic, ceramic and crystal. Polyvinylidene fluoride polymer (PVDF) is used in this design. Piezoelectric material generates an AC voltage so to store this energy in a battery it should be converted into DC and also the generated voltage is weak, so a voltage multiplier circuit is used to convert AC to DC and amplify the desired voltage.

c) Wind Energy harvesting system
A compact design is made which will be fixed just beneath the umbrella; the design has an outward curve fixed on the whole area of the wind system design. The important part is, it is very light and harness maximum wind energy.
A dynamo is used to harness wind energy. The shape of this system is similar to an umbrella and also sections are made which will experience a force due to which the wind system will move. The output of the dynamo is AC in nature which cannot be used to charge a battery. So to do that
voltage multiplier is used which not only converts AC to DC but also amplifies the voltage, the circuit is a combination of diodes and capacitor which do this job. The way of structure, the size of dynamo will depend on the size of product. A system of gears can be used to increase the number of rotations of the shaft so that the more the number of rotations, higher the voltage obtained. As this system is also used in homes so a small system will be needed and to generate a considerable amount of voltage this should be done.

d) Integrating the three energies
In figure 1.0 it is shown that after harnessing the energy they all added by the integrating circuit, this mechanism has diodes in it which not only allows combining the three currents but also protects one source current to move to other sources. This can further be explained as when a current is coming from piezoelectric material, dynamo and solar cell they should be added in such a way that current coming from solar panel does travel to dynamo side else it may damage the dynamo and piezoelectric.

e) Regulation of current
After the integration of the three energy the net current cannot be directly used to charge the battery it may cause severe damage to the battery or may overcharge it. To reduce this risk charge controller is used. This controller acts like a valve which only allows charge to pass when desired charge is collected and also controls the current. The advantage is that it charges the battery faster if the battery is empty, if the battery is about to fill then it slows down the charging process hence increasing the lifespan of battery .It automatically shut downs when battery is fully charged hence reducing the risk of overcharging .It also has ports which will be connected to load as shown in figure1.0 to use the energy of the battery.

f) Water harvesting system
The benefit of opposite facing umbrella design is that it not only has solar panels and piezoelectric on it which generates electricity but also has a system which collects water. Due to global warming it is becoming difficult to predict rainfall many a time and also rainwater can’t be drunk directly as it has many acids and chemicals. So, a filter specially designed to filter rainwater is designed and the electricity supply is given by the batteries for filter to work. The rainwater first hit the surface of the umbrella where solar panels and piezoelectric are fixed .In the middle of the umbrella a hole is given through which rainwater can pass .The surface of the umbrella is inclined upward which covers maximum area for collection of water, the water passes through a filter for purification and then it is stored in a tank for drinking and other purposes. When this system is used in street, the water collected can also be used to water plants in case of no rainfall for a longer period of time. The complete structure is so compact that it can be used in homes and in areas where the weather is in there extreme meaning heavy rainfall in shorter period and longer summer. This system can also provide shade in the time of heavy sunlight thus making it multipurpose.
3) BLOCK DIAGRAM

![Block Diagram of proposed system](image_url)

**Fig (1.0) Block Diagram of proposed system**

**Block Diagram Description**
As in Fig (1.0) it is shown that umbrella design has all the three resources in it, where all the three are attached to each other. Going outside this design, joining the three-energy block is shown, after this joining charge controller is used to regulate and transfer that energy to battery and if excessive energy is available then energy meter calculates that energy and then transfer it to the main grid.

4) WORKING PRINCIPLE
This design consists of different energy sources and energy regulation, conversion system. The first energy resource is sunlight, which is harnessed by solar panel when photons hit the p-n junction of solar panel, they easily enter the junction hence produces electricity. There are many forms of solar panels available of which monocrystalline has highest efficiency because it is made of the highest grade of silicon. Whereas to harvest energy through rainfall piezoelectric material is used (PVDF). It works on the principle that when a mechanical stress is applied to this material the output is a flow of charge hence leading to flow of electricity but the energy obtained is less in magnitude. The challenge is to consume maximum energy from the impact of rain drop. Through the impact of rain in PVDF material the kinetic energy which get constant at some point for rain is to be converted in generating an electric field leading to a potential drop across the terminal. For generating electricity from mechanical motion in case generating electricity from wind, dynamo is used. When a moving coil is placed in the influence of magnetic field and potential drop is obtained at the terminals. The umbrella shaped design has fan like outer section which rotate in the influence of wind. This system
is further connected to gear system whose shaft is connected to a dynamo which generates electricity. When we have all three energies, the only need is to integrate them or add them so they can become one. A combination of diode is used to do that. When energy is collected the only part, left is to use this energy to charge the battery and if energy is in excessive form then transfer it to grid system. charge controller is used which only allows charge to flow when needed and also charges all battery with equal speed which leads to more lifespan of batteries, charge controller also has the ports which transfer excessive energy to grid system [6].

5) CHALLENGES AND FUTURE SCOPE:

As the conventional sources are unlimited in form so, new techniques can be developed to harness them. Transparent solar cell is one such example, these can be used in smart homes. and also, can be used in mobile phone screen which generate energy through the light coming out of the screen and also from outer environment. Further, present piezoelectric material generates very less output voltage, so increasing the efficiency will correspond more applications. Large system for solar panel and wind mill are widely used as a renewable source of energy but no such system is made to harness energy from rain at a very large scale. This project initiative can help to make it possible at a large scale. Charge controller are widely used in solar panels to regulate current and to charge batteries. Charge controller widely helps in controlling the charge for efficient charging but a new circuit is needed to boost the charging time and also to increase the life of battery.

6) CONCLUSION

Thus by implementing this idea the increase demand of energy and water resource can be fulfilled more efficiently for healthy living leading to a brighter and safe future.

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