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Hybrid Power Generation System (Wind, Solar and Sound Energy)

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ABSTRACT:
One of the primary needs for socio-economic development in any nation in the world is the provision of reliable power supply systems. This work is a development of an indigenous technology hybrid wind-Solar-Sound power System. The system harness the renewable energies in sun, wind and sound to generate electricity. Solar panels are used for converting solar energy, windmill is used for conversion of wind energy and speakers are used for conversion of sound energy into electricity. This data deals with the production of electric power by using three sources combine and give output as electric energy with low and affordable cost without damaging the nature balance.

KEYWORDS: Socio-Economic development, Hybrid system, Wind-Solar-Sound energy, Sustainable development.

INTRODUCTION:

Electricity is the basic requirement for our day to day life. The two ways of generating electricity are either by conventional energy resources or by non-conventional energy resources. The demand of electricity increases day by day so to fulfill the demand we need to produce electrical energy. In earlier days electricity was generated using coal, diesel. Now a day we prefer nuclear generation of electricity. Both the ways are conventional energy resource. The main disadvantages of these ways are waste generation like ash in coal, nuclear waste in nuclear plant. These waste damages the environment very severely and also conventional sources are getting depleted very quickly. In next 50 years conventional sources are going to vanish from our earth therefor we need a substitute for it Non-conventional energy resources are pollution free and reliable too because of which they are good alternative energy sources for conventional energy system. The non-conventional energy sources are wind, tidal, solar, sound etc. The drawbacks with tidal and geothermal energy resource are that tidal energy can be generated only on sea shores whereas geothermal energy need very large area to extract heat from underground earth. Non-conventional energies like Solar, Wind, and Sound are easily available. In cloudy or rainy season solar energy is not easily available. We are using wind and sound energy as a remedy for that case. If one energy fails as a source then other two will keep the system working.

HYBRID ENERGY SYSTEM:

In Hybrid system we are using energy combination of two or more type for giving supply to the load. In other word it can be defined as "Energy system which is fabricated or designed to extract power by using two or more energy resources is called as the hybrid energy system." This system has good reliability, high efficiency and lower cost.

In this system we are using solar, wind and sound power for generation of electricity. Solar and wind have advantage over sound energy and other non-conventional resources. Both (solar, wind) the energy sources have greater availability in all areas. The hybrid power system is a onetime investment as installation of

these energy devices is costly. After the installation the cost of generation of electric power is very less. This device can be installed anywhere in the world.

Solar Energy

Solar energy is the kind of kind of energy which we get from the sun i.e. through radiation. It is present all over the earth and in abundant form. It is a free form of energy and also pollution free i.e. doesn't produce any harmful gases or ashes. Solar energy production is affordable in cost. Only installation cost is expensive otherwise maintenance cost is very low. Solar energy has longer life span and has lower emission.

Wind Energy

Wind energy is taken from wind itself. For extraction of wind energy we use wind mill. Wind energy is renewable energy sources. The installation and maintenance of wind energy resource is very less. It is present almost 24*7 on earth. Emission rate of wind energy is very low. Generation of electric power from wind is depended upon the speed of wind flowing.

SOUND ENERGY

Sound energy is nothing but mechanical form of energy, mechanical wave. Sound energy can't travel through vacuum and need medium. In liquid and gas state sound is transmitted as longitudinal wave whereas in solid state it could be transmitted as both longitudinal wave and transverse wave. Longitudinal waves are of alternating pressure, causing local region of compression and rarefaction, while transverse wave (solid) are waves of alternating shear and stress at right angle to the direction of propagation.

PROTOTYPE OF HYBRID POWER GENERATION SYSTEM:

For prototype of the hybrid power system we need data as follows

A. For Solar System:

1. Annual average of regular duration of Sunshine calculated in hrs.
2. Daily Solar Radiation level horizontally (KWH/m2/day)

B. For Wind System:

1. Average Annual hr Wind Speed (m/sec).
2. Wind Power that can be generated from the wind mill.

C. For Sound System:

1. Speaker, mic or woofer for sound production.
2. We can use this disturbance of sound wave to convert it into electricity.

BLOCK DIAGRAM & CIRCUIT DIAGRAM OF THE DESIGN:

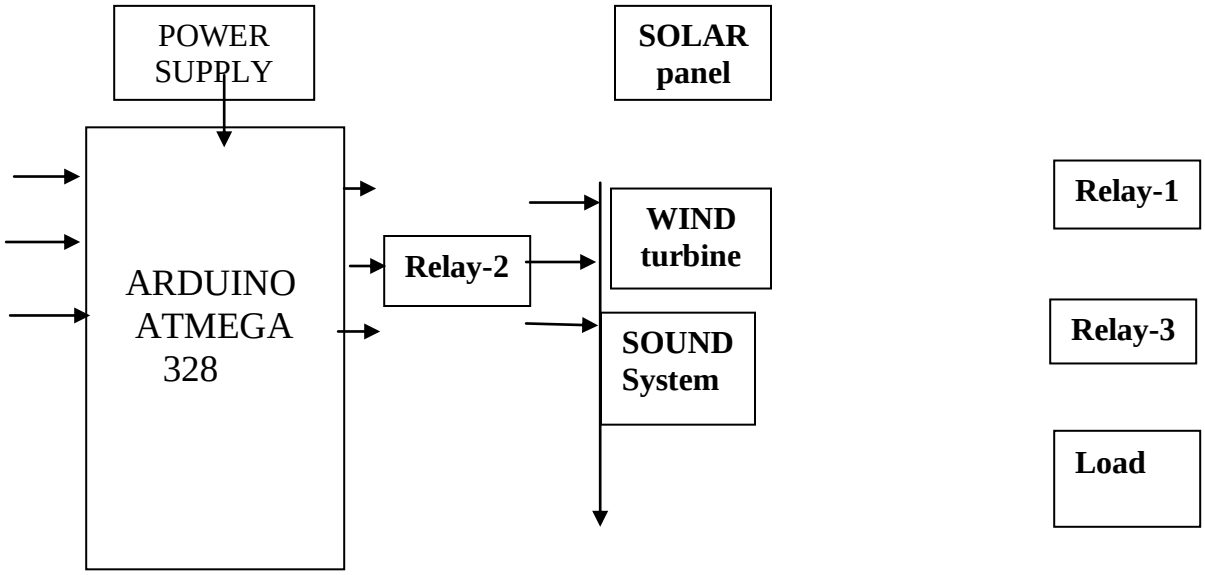

Figure. BLOCK DIAGRAM OF HYBRID POWER GENERATION

Above figure shows the block diagram of the hybrid power generation system using Solar, Wind and sound power. This block diagram includes following blocks.

i. Solar panel
ii. Wind turbine
iii. Speaker (Sound energy)
iv. Arduino
v. Relay
vi. Load

I. SOLAR PANEL:

Solar panel is use to convert solar energy to the electrical energy. The Photo Votic cell is very similar to that of the diode with a PN junction formed by semiconductor material. When the junction absorb light, the energy of photon absorbed is moved to the e- system of the material, creating charge carrier that are placed at the junctions. The charge carriers at the junction region create a knee voltage, get accelerated under the electric field, and create a current through an external circuit. Solar panel is a group of a several module connected electrically in series & parallel combination to produce the required current and voltage. Solar panels are the source of conversion solar power into the electrical power.

II. WIND TURBINE (MOTOR):

It is that system which extracts energy from wind by rotation of the mill (blades) of the wind turbine in horizontal or vertical direction i.e. wind turbine has two types:

i. Vertical type
ii. Horizontal type.

As the flow of wind increases power generation also increases. The power generated from wind is not regular, it keeps on fluctuating. For obtaining the non-fluctuating energy we have to store in a battery and then provide it at the output.

III. SPEAKER/MIC:

With speaker we create a very thin curtain (diaphragm) which gets fluctuated by the oscillation and pressure created by the sound wave and a conductor is interfaced to it which will be placed between magnetic bars. These fluctuation in the curtain create a movement in conductor which affect the magnetic field of the magnet this will generate motional electromotive force and will generate voltage across it. According to faradays law generated voltage is given by

Generated voltage =

Electromotive force =velocity of conductor * magnetic field * length of conductor

Thus oscillation created by the sound wave could be converted into electric power and as the frequency is high the movement will be fast due to it we will get appreciable amount of electric energy.

IV. ARDUINO:

It is an open-source electronic platform based on daily use hardware and software. It is intended for anyone making interfacing projects. It is a tool for making computers that can sense and adapt more of the physical world than your personal computers. Arduino is an open-source physical computing platform based on a simple controller, and an environment for writing software on the board. It can be used to develop interactive objects, taking inputs from a variety of switch or sensor, and controlling a variety of lights, motors, and other physical outputs. Arduino projects can be communicate with software running on your computer. The microcontroller boards can be assembled by hand or purchased preassembled; the open-source Integrated development environment can be downloaded for free. Its programming language is an implementation of Wiring, a similar physical computing platform, which is based on the Processing multimedia programming environment.

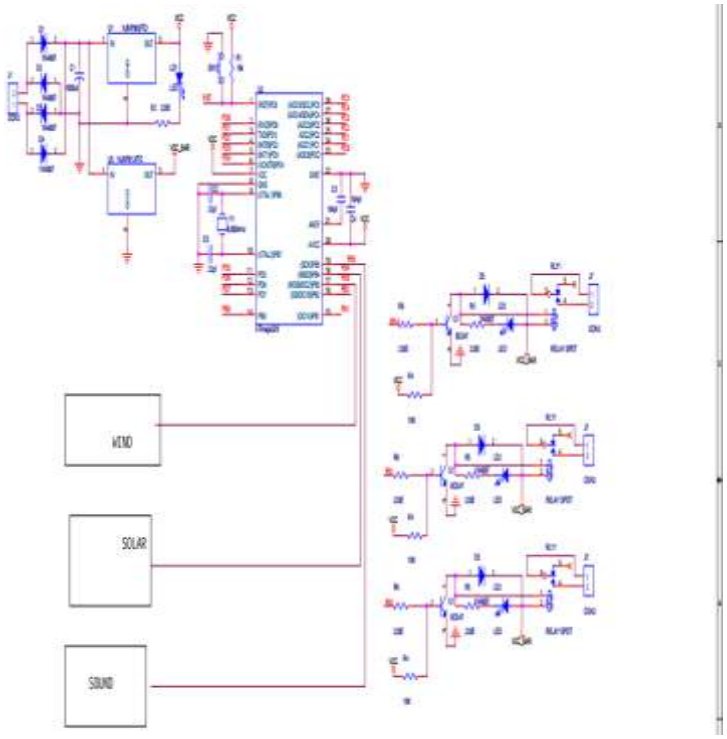

FIGURE CIRCUIT DIAGRAM OF DESIGN CIRCUIT:

Fig. above is a generalized circuit diagram for the implementation of above mentioned concept it comprises of the entire section starting from the transformer section that shows three different sources supplying power. The first important part is the the DC power supply to the Controller and in order to get a DC supply, we created a full bridge rectifier with a capacitor to work as a filter and finally applying voltage regulator to it. Diode D1 & D2 provides full wave rectifier. Capacitor 470□ f gives ripple filtration across the battery. This is an electronic switch circuit which will close the contact of a relay after a certain period of time. This can be adjusted from few second to several minutes. When the circuit is activated, Capacitor Charges to about two thirds of its full potential and bleeds off through RI preset. When RI is low, the discharge occur at a fast rate. Which allows the wire to rotate while keeping a complete electric circuit.

The second part consist of controller. Here we have used Arduino atmega328 microcontroller. Interfacing of renewable supply (solar, wind, sound) is done on B port of the controller. Here the analog value of power signal is converted to digital value i.e. analog to digital conversion takes place. The output of the signal is taken at port D of the controller. Each output is taken to a rely switch which turns on as the signal pass through it. An LED is applied to each rely to check the flow of signal. The output of rely is finally given to load and the circuit gets complete.

PROPOSED CALCULATION:

The total energy generated by this system may be given as the sum of the energy generated by the solar PV panel and power generated by the wind turbine (motor).

Mathematically it can be represented as

$$E_t = N_W * P_W + N_S * P_S$$

Where,

E_t is the total power generated

P_W is the power generated by wind turbines

P_S is the power generated by solar panels

N_W is the no of wind turbine

N_S is the no of solar panel used

1. CALCULATION FOR WIND POWER:

The power generated by wind energy is given by, Power = (density of air * area * velocity cube)/2

$$P_W = ½. \rho (A_W) (V)^3$$

Where,

P is power in watts (W)

ρ is the air density in kg per cubic meter (kg/m³)

A_W is the swept area by air in meter square (m²)

V is the wind speed in meter per second (m/s).

2. CALCULATION FOR SOLAR ENERGY:

To determine the dimension of Photo Votic modules, the required energy consumption must be estimated. Therefore, the power is calculated as

$$P_S = Ins (t) * A_S * Eff(pv)$$

Where,

Ins (t) = isolation at time t (kw/ m^2).

A_S = area of single PV panel (m^2).

Eff(pv) = overall efficiency of the PV panels and dc/dc converters.

Overall efficiency is given by,

Eff(pv)= He * PR

Where,

He= Annual average solar radiation on tilted panels.
PR = Performance ratio, coefficient for losses.

CONCLUSION:

Hybrid power generation system is good and effective solution for power generation than conventional energy resources. It has greater efficiency. It can provide to remote places where government is unable to reach. So that the power can be utilize where it generated so that it will reduce the transmission losses and cost. Cost reduction can be done by increasing the production of the equipment. People should motivate to use the non-conventional energy resources. It is highly safe for the environment as it doesn't produce any emission and harmful waste product like conventional energy resources. It is cost effective solution for generation. It only need initial investment. It has also long life span. Overall it good, reliable and affordable solution for electricity generation

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