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SMART STREET LIGHT USING HYBRID ENERGY

Mr. Pavan D. Mare[1], Mr. Sohel R. Mulani[2]

Ms. Ankita A. Lohote[3], Mrs. Shweta Suryawanshi[4]

[1,2,3]Students ,[4] Asst. Prof ., E&TC Dept., DYPIEMR, Akurdi, Pune(India)

ABSTRACT

Man has needed energy at an increasing rate for his substance and well. Generally power is produced from various ways. Access to energy is a fundamental pre-requisite for modern life and a key tool in eradicating extreme poverty across the globe. Now, we have many ways to fulfill our basic energy need. Humankind has passed through many stages in development of energy sources.

In this system, we discuss the universal issues about energy management for renewable resource, Wind / Photovoltaic (PV) hybrid power system in order to improve energy efficiency with LED's as the light source. The LED's are energy saving, high luminous efficiency. Due to this hybrid system, an uninterrupted power generation by solar and wind takes place. This would put down the electricity bill and reduce the pollution rate to a certain limit. System consist of an emergency switch which when pressed a detail address of current location is sent through GSM to nearby hospitals. These days traffic management and pollution control is a major issue, for this Gas sensor is used.

Keywords: *photovoltaic/wind hybrid power system, LED, Gas sensor, GSM.*

I. INTRODUCTION

Universal issues about energy management for renewable resource, traffic management, pollution control are discussed in this system. The fossil fuel of nonrenewable resources like oil, natural gas, coal etc. is gradually coming to an end. In India, 80% of power produced from thermal power plants. But the problem of thermal power plant is to create the pollution in environment and the cost of the coal material is high. In India, very less % of power produced from nuclear power plants. It does not create the environmental pollution but the cost of the coal materials is so high compare than thermal power plants. But the main disadvantage of nuclear power plant is, it creates very big problem when any components failure.

In order to avoid that, we enter the renewable energy systems. It does not create the environmental pollution. There are many types of renewable energy sources are available such as solar, wind, tidal etc. The density of solar level is high in day timings. Solar energy is very large inexhaustible source of energy. The power from the sun intercepted by the earth is approximately 1.8×1011 mw which is many thousands of times larger than the present consumption rate on the earth of all commercial energy sources. Thus in principle solar energy could supply all the present & future energy needs of the world on a continuing basis. This makes it one of the most

promising of the unconventional energy sources. Wind generators are two blade systems. It has synchronous generator type model. A mechanical braking system was used to stop the rotation of wind systems. The wind density is average for all the timings. So our hybrid system has the combination of solar with wind. We get the average power for 24hrs. So we choose the hybrid systems. In order to improve energy efficiency with LED's as the light source. System consist of an emergency switch which when pressed a detail address of current location is sent through GSM to nearby hospitals. These days traffic management and pollution control is a major issue, for this Gas sensor is used.

The purpose of this paper is to know the importance of renewable energy systems and to create awareness of natural resources.

II. LITERATURE SURVEY

At present, major challenge faced by the world is that approximately 1.2 billion people live without any access to modern energy services. Humankind has passed through many stages in development of energy sources. From the beginning fire was essential and it was generated by rubbing two stones on each other. Other sources included wood, charcoal, dried dung and animal oil. Homes oriented with respect to the sun and wind for heating cooling and light. With further demand for energy man began to use the wind for sailing ships & for driving windmills, & the force of falling water to turn water wheels. Till this time it would not be wrong to say that the sun is supplying all the energy needs of man either directly or indirectly & that man was using only renewable sources of energy. Kerosene was distilled from oil in 1853 and was used in lamps. Other developments in the use of energy were taking place in 19^{th} century. In time, electric trolleys and electrical lights and heaters began to replace horses' kerosene, coal and wood. Largest oil fields were discovered between 1927 & 1958. As more diesel and petrol fuel was made available, the railroad industry switched to these fuels. Since 1973, the word "energy" has been continuously in the news. There have been shortages of oil in many parts of the world & the price has increased. Now,we know that the nonrenewable resources like fossile fuel is gradually coming to an end, oil & natural gas will be depleted first, followed eventually by coal. Generally power produced from various ways.

SOLAR ENERGY: Solar energy is the most abundant energy resource and it is available for use in its direct and indirect forms. About 60% of the total energy emitted by the sun reaches the Earth's surface. Even if only 0.1% of this energy could be converted at an efficiency of 10%, it would be four times larger than the total world's electricity generating capacity of about 5 000GW. The use of solar energy is growing strongly around the world, due to the rapidly declining solar panel manufacturing costs. Between 2008–2011 PV capacity has increased in the USA from 1168MW to 5171MW, and in Germany from 5877MW to 25039MW.

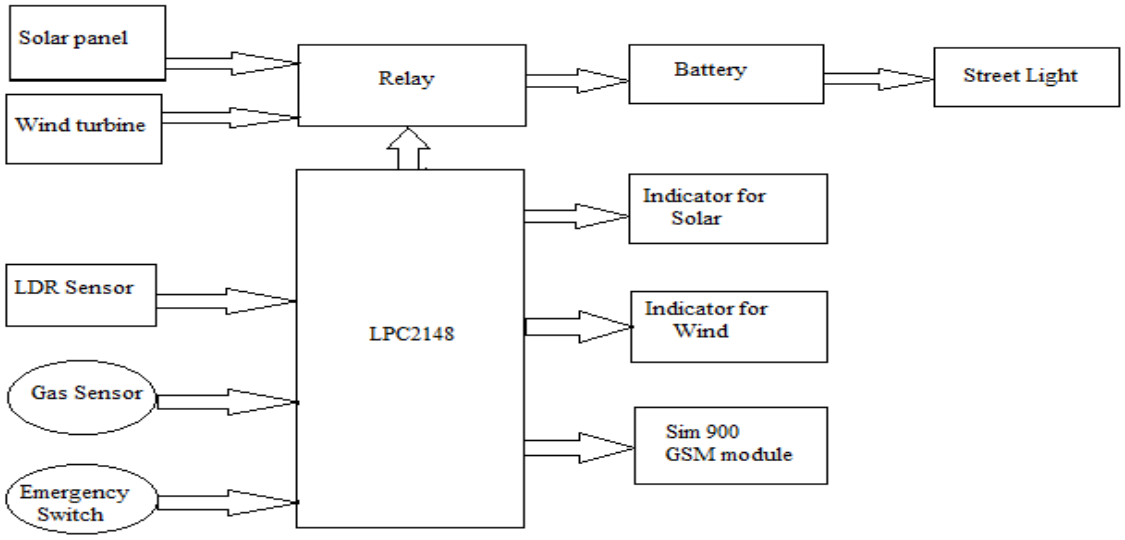
WIND ENERGY: Aydogan developed a model which determines the number of batteries needed for continuous energy supply, for each wind turbine taking into account of the economical aspects. It was found that the wind battery hybrid system was not economical in the areas of low wind potential. Rogers et al (2002) studied experimentally the design requirements for a medium sized wind turbine for remote and hybrid power systems.

TABLE1: COMPARISON OF VARIOUS LIGHT SOURCES

Parameter	Sodium vapour	LED lamp	Mercury vapour lamp
Life	2500h	100,000h	20,000h
Cost	Low cost	High cost	Medium cost
CRI	0	75	45
Quality	Bad visual Quality (light yellow -orange)	Good Quality (light white)	Good Quality (Light white)
Efficiency	Luminance 85-150	Luminance 30-90	Luminance 35-60
Ignition time	0-15 min	Instant	0-15 min

III. DESIGN METHODOLOGY

3.1 Block Diagram

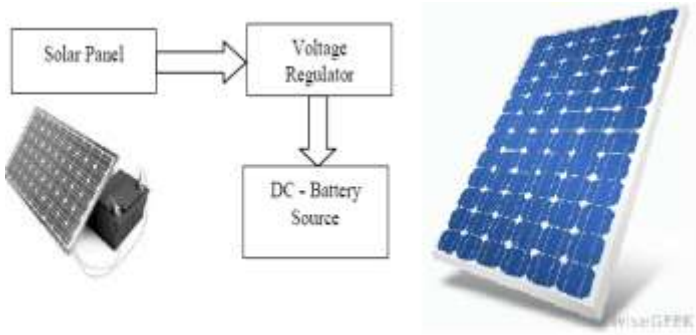


3.1.1 Solar Panel

Absorb the sun rays as a source of energy for generating electricity. PV module is a connected assembly of solar cells. There are silicon cells within each PV panel. These react with photons, or unit of light from the sun to produce Direct Current (DC) or Electricity.

Solar PV panels constitute the solar array of a photovoltaic system that generates and supplies electricity to commercial and residential applications. Each module is rated by its DC output power under standard test conditions, and typically ranges from 100 to 320 watts. The efficiency of a module determines the area of a module given the same rated output – an *8% efficient 230 watt module will have twice the area of a 16% efficient 230 watt module. There are few solar panels available that are exceeding 19% efficiency. A single solar module can produce only a limited amount of power; most installations contain multiple modules. The price of

solar power, together with batteries for storage, has continued to fall so that in many countries it is cheaper than ordinary fossil fuel electricity from the grid.



Solar power is available (*9am to 6pm*) during the day hours. Recently the researchers has made a record by utilizing 44.4% of the energy from solar at highways .The output of the solar energy is taken to a voltage regulator to maintain a constant voltage. The regulated voltage is stored in a DC-Battery source.

3.1.2 Wind Energy

Wind farms are erected based on the availability of atmospheric pressure of wind in a specific region. At Highways there is availability of wind by the motion of moving vehicles. When a free moving air particle is disturbed by forceful object succeeding in its path, a pressure is developed at the body of the object and it is delivered to the surrounding near objects. By this phenomenon wind turbine is placed on the top of street light. The wind turbines are not placed in vertical path, but horizontally. This design will keep the blades in rotational motion since the vehicle are directed towards left and right direction and hence a forceful wind can be obtained when two vehicles crosses the blade evenly. The blades are connected to synchronous generator to maintain the rotational RPM (Rotation per minute) as constant.

Design of wind energy generator:

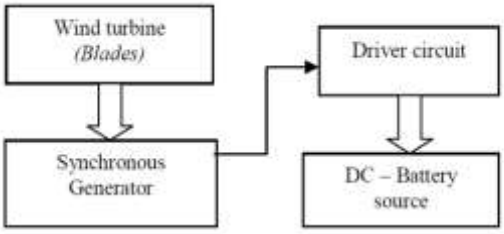
Power (watts) in the Wind blowing through the rotor = 1/2 x air-density x swept-area x (wind speed) ^3

(When the air density is 1.2 kg/m3)

The diameter is one of the main criteria. When the diameter of the blade increases, the power may be doubled .The speed of the blade is decided by the amount of load put on to it by air, Rotor blades are designed with speed in mind, relative to the wind. This is said to be the tip speed ratio (tsr). Tip speed ratio is the speed with which the blade tips travel divided by the wind speed at that time. It can be determined by,

Rpm = wind speed x tsr x 60/circumference

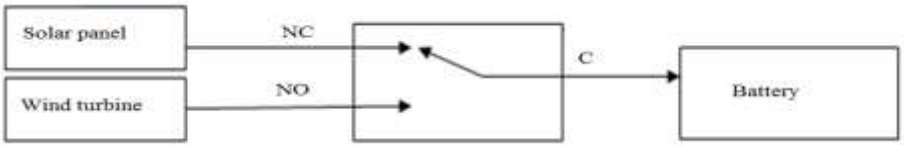
The number of blades also plays a vital role in the speed developed by the rotor, multi-blade has low tip speed ratio. It creates a high torque but power does not increase. The speed should be more than the torque to generate electricity.



Block Diagram of working of wind energy generation

As show in fig. the turbine rotates when the pressure is developed the median of the turbine is coupled with synchronous generator. An AC output obtained is given to the driver circuit where the AC input is converted to DC and the power is stored.

During day (normal condition)



During night or cloudy environment

The relay is used as the connector between solar panel, wind and battery. Solar panel is connected to NC pin of relay, while dynamo is connected to NO pin of relay and battery is a connected to COMMON pin of relay.

3.1.3 LDR Sensor & Emergency Switch

LDR is a light-controlled variable resistor. Input energy source is selected using LDR sensor. The resistance of a photo resistor decreases with increasing incident light intensity. Applications: Light-sensitive detector circuits, and light- and dark-activated switching circuits. A photo resistor is made of a high resistance semiconductor.

Project consist of an emergency switch which when pressed an detail address of current location is sent through GSM to nearby hospitals.

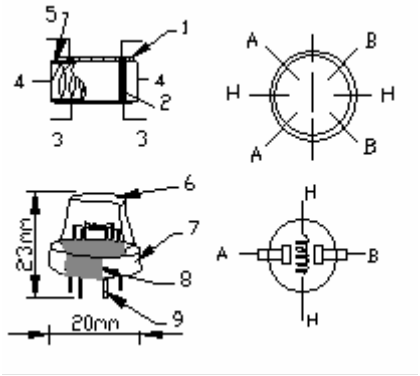
3.1.5 GSM

Global System for Mobile communication is a digital mobile telephony system. With the help of GSM module interfaced, we can send short text messages to the required authorities as per the application. GSM module is provided by Sim-card insertion same as that of mobile phone. With the help of this we can send text message to the owner. It operates at either the 900 MHz or 1800 MHz frequency band GSM systems consists of an antenna and a transceiver, which read the radio frequency and transfer the information to a processing device, and a

transponder, or tag, which is an integrated circuit containing the RF circuitry and information to be transmitted.GSM systems can be used just about anywhere, from clothing tags to missiles to pet tags to food -- anywhere that a unique identification system is needed. Its applications that promise to increase efficiency and productivity.

3.1.6 Gas Sensor

- High sensitivity to carbon monoxide
- Stable and long life



	Parts	Materials
1	Gas sensing layer	SnO_2
2	Electrode	Au
3	Electrode line	Pt
4	Heater coil	Ni-Cr alloy
5	Tubular ceramic	Al_2O_3
6	Anti-explosion network	Stainless steel gauze (SUS316 100-mesh)
7	Clamp ring	Copper plating Ni
8	Resin base	Bakelite
9	Tube Pin	Copper plating Ni

Structure and configuration of MQ-7 gas sensor as shown in fig is sensor composed by micro AL2O3 ceramic tube, Tin Dioxide (SnO2) sensitive layer, measuring electrode and heater are fixed into a crust made by plastic and stainless steel net. The heater provides necessary work conditions for work of sensitive components. The enveloped MQ-7 have 6 pin ,4 of them are used to fetch signals, and other 2 are used for providing heating current.

IV. ADVANTAGES

1. Energy generation & saving
2. Ease of maintenance
3. Quick actions can be take after accident
4. Traffic control by pollution measurement

V. DISADVANTAGES

1. High cost

VI. APPLICATIONS

1. Street lights
2. Railways
3. Bus

4. Private apartments

VII. FUTURE SCOPE

1. In future we can make use of RFID cards, so that only person having card can press emergency switch.
2. We can implement smart speed breaker such that when vehicle will pass over it, automatic electricity generation will take place.

VIII. CONCLUSION

In this smart street light system, concept of hybrid energy is used and LEDs are used as a light source. Thus we get continuous supply of energy and energy savings takes place. It is capable of taking corrective actions in case of unprecedented events of climatic change. In case of sudden road accidents due to emergency switch connected, quick actions can be taken by nearby hospitals on receiving message via GSM. This smart street light system also helps in traffic management & pollution control with the help of gas sensor.

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