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ENHANCEMENT OF HYBRID POWER SYSTEMS USING IOT

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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 electricity supply systems. The whole world including our country is faced with an issue of lack of back- up power, exhaustion of fossil energy and global warming. This paper describes a novel and developing electrical power generation mechanism by integrating photovoltaic solar energy. Solar energy with Nano-antenna and wind energy-a non-conventional energy sources. Thus have an interrupted power supply with affordable cost without damaging the natural balance. Currently, maintenance of power plant management is provided at the Centre through remote monitoring by using measuring sensor installed at power plant and as regular check-up or repair being performed at site is progressed by site management personnel. But there is a difference in time and accuracy depending on the ability of site management personnel. To overcome this drawback by managing hybrid power system using (INTERNET OF THINGS, IOT).It may be expanded to a technology of recognizing other power generation facility in the future. The result will obtain for both economic and various environmental condition.

Keywords: **Solar power, wind power, hybrid generation energy, grid , Internet of Things(IOT)**

INTRODUCTION:

As we know energy is the basic need for any development. Since 17th century requirement of energy ismore due to the rapid increase in world population,technology and other political and economic condition. Dueto the rapid increase in cost and environmental concern it is necessary to discuss the various method and process ofgeneration of power by Hybrid renewable energy sources. All the conventional energy resources are depleting day by day. So we have to switch on to non-conventional from conventional energy resources.This paper describes a novel and developing Electrical Power Generation mechanism by integrating photovoltaic Solar Energy, solar Energy with Nano-antenna, Wind Energy,the non –conventional energy sources.There are two ways of electricity generation either by conventional energy resources or by non-conventional energy resources.[5]

Now a day's electrical energy is generated by the conventional energy resources like coal, diesel, and nuclear etc. The main drawback of these sources is that it produces waste like ash in coal power plant, nuclear waste in nuclear power plant and taking care

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of this wastage is very costly. And it also damages the nature. The nuclear waste is very harmful to all living beings. All the conventional energy resources mentioned are depleting day by day. Soon it will be completely vanishes from the earth so we have to find another way to generate electricity. The new source should be reliable, pollution free and economical. The better alternative way is to generate electricity by using non-conventional energy resources energy resources. There are many non-conventional energy resources like geothermal, tidal, wind, solar,hydro power etc. the tidal energy has drawbacks like it can only implemented on sea shores. While geothermal energy is a large process to extract heat from earth.As hydro-electricity power generating system is season based, it cannot afford much power. Solar and wind are easily available in all condition. The non-conventional energy resources like solar, wind can be good alternative source. Solar energy has drawback that it could not produce electrical energy in rainy and cloudy season so we need to overcome this drawback we can use two energy resources so that any one of source fails other source will keep generating the electricity. And in good weather condition we can use both sources combine. Amitabh Bachchan's villa in Pune has a solar wind hybrid system for powering the garage doors!\

FLOW CHART FOR SOLAR-WIND HYBRID POWER SYSTEMS:

Energyresources are mainly divided into two ways.

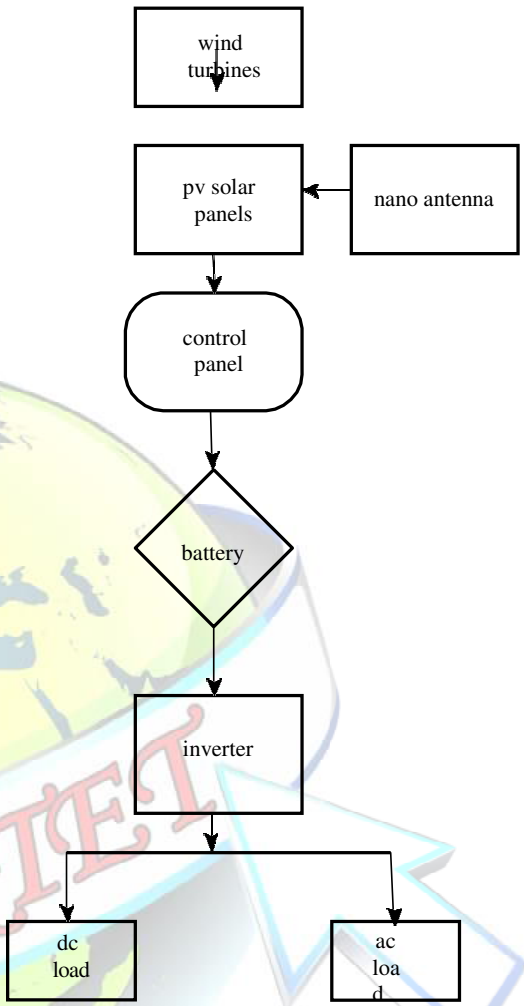
Un-renewable Energy assets: The resources which are lower in amount and can be vanished after fewyears.

Example: Natural gas, Wood, Coal etc.

Renewable Energy assets: The resources which are always available and renew itself in the nature.

Example: Solar power, Wind Power, Biomass etc

FLOW CHART FOR SOLAR-WIND HYBRID SYSTEMS:



1) Wind Power

The wind energy is a renewable source of energy. Windpower is converted to electric power using wind turbines.Electric generator inside the turbine converts themechanical power into the electric power. Wind turbinesystems are available ranging from 50W to 3-4 MW. The energy production by wind turbines depends on the velocity of the wind acting on the turbine. Wind power is able to feedboth energy production and demand in the rural areas.It is used to run a windmill

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which in turn drives a windgenerator or wind turbine to produce electricity. Practically it is observed that the flexible three blades propeller about 40m in diameter, in a 62 Km/hr wind pressure with a rotation speedof 48 rpm produce maximum power 14 MW. The main drawback of this system is that as the windspeed or velocity is not constant with respect to time i.e.fluctuating, hence the electric power thus obtained is alsodoesnot have a fixed value i.e. varying nature. Thus, it is better tofeed the wind electricity to the battery or any power storage device. Christo Ananth et al.[2] discussed about E-plane and H-plane patterns which forms the basis of Microwave Engineering principles.

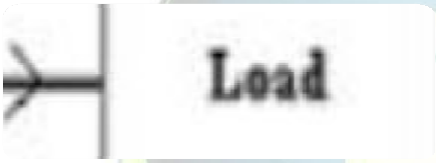

Fig.1 Block Diagram of basic Windmill Power System

In wind power system, the power generation is proportional to the cube of the wind speed. Thus it is highlyaffected in rainy and stormy season when the wind speed istoo less to produce electricity. This power generation system is pollution free and ecologically balanced.

2. Photovoltaic Solar Power:

Solar panels serves as a medium to convert solar energy into theelectrical energy.Solar panels can convert the energy directlyor heat the water with the induced energy. PV (Photo-voltaic) cells are made up from semiconductor structures. Sun rays are absorbed with this material and electrons are emitted from the atoms. Thus the emitted electron activates a current.Photovoltaic is known as theprocess between radiation absorbed and the electricityinduced. Solar power is converted into the electric power by acommon principle called photo electric effect.The solar cell array or panel is connected in series or parallel based on the requirement of current and voltage.It consists of an appropriate number of solar cell modules.

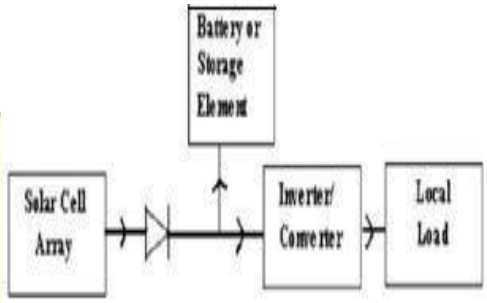

Fig.2 Block Diagram ofBasic Solar (Photovoltaic) System

Storage batteries provide the backup powerduring cloudy weather to store the excess power or someportion of power from the solar arrays. This solar powergenerating system is used for domestic power consumption, meteorological stations and entertainment places like theatre,hotel, restaurant etc.Traditional p-n junction solar cells are the mostwidely used for the solar energyharvesting technologies. Thebasic physics of energy absorption and carrier generation are afunction of the materials characteristics and corresponding electrical properties (i.e. band gap). A photon need greater energy than 2eV that of the band gap in order to excitean electron from the valence band into the conduction band.However, the blackbody spectrumis approximately at the range of ~6000 K, and as much of the solar radiation reaching the Earth is composed of photons withenergies greater than the band gap of silicon. These higherenergy photons will be absorbed by

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the PV cell, but thedifference in energy between these photons and the siliconband gap is converted into heat rather than into usable electrical energy. For a single-junction cell this sets an maximum efficiency of ~20%. The current research path of implementing complex, multi-junction PV designs to overcome efficiency limitations does not appear to be a cost effective solution. Even the optimized and developed PVmaterials are only operational during daylight hours an drequire direct (perpendicular to the surface) sunlight for good efficiency.

HYBRID SOLAR-WIND ELECTRIC SYSTEM:

The Word hybrid refers to the combination of more than one element. In energy system the electricity can be generated by more than one source at a time like Wind, solar, biomass etc. [3]There are various module to generate hybrid energy like wind-solar, Solar-diesel ,Wind- hydro and Wind –diesel. Among the above hybrid energy generation module the wind- Solar hybrid module are more important because it is abundant in nature and it is very much environment friendly.Hybrid energy generation is more important because the wind not flow continuously and sun radiation is only present an approx of 8 to 10 hours in a day. So for an uninterrupted power supply there is a need to hybridize the solar and wind power with the storage batteries.

Time	Grid Supply	Charging/Discharging
During the Day (9 AM to 7 PM)	Intermittent Supply	From the Solar and Wind, from grid , depending on conditions, Solar supports load and battery charging simultaneously. Battery may be fully discharged at the end of some days.
Till late night/early morning (1 AM)	Grid not available	Battery charged to 15-20% by wind
From early morning (1 AM) to sunrise (6 AM)	Grid available	Battery charged to 90% by grid
From sunrise to office commencement (9 AM)	Grid available	Battery charged by solar/grid to 100%

TABLE 1: CHARGING AND DISCHARGING CYCLE

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Solar	600W	1 kW	3.5 kW
Wind	500W	1 KW	3.5 kW
Number of electricity units produced per day (kwhr)	4	8	28
Capital Cost	Rs. 2,50,000	`Rs. 4,00,000	Rs. 12,00,000

TABLE 2: CONFIGURATION & COST OF MEETING3 UNITS OF POWER REQUIRED PER DAY

ALTERNATIVE SOLUTION TO PV BASED SOLAR CELL: INGRESSION OF NANO-ANTENNA:

There is an alternative energy harvesting technique along with solar-wind hybrid system based on Nano-antennas that absorb the incident solar radiation.TheNano-antennas target mid-infrared rays, which the Earthcontinuously radiates as heat after absorbing energy from the sun during the day. In contrast, traditional solar cells can onlyuse visible light, rendering them idle after dark. Infra red radiation is a rich energy source as it is also generated by industrial processes such as thermal power plants.[8]

We have designed a Nano-antenna made up elements that capture electromagnetic energy from solar radiation and geo thermal radiation. The size of the antenna is relative to the wavelengthof light we intend to harvest. The basic theory of operation is as follows: The incident electromagnetic radiation produces astanding-wave electrical current in the finite antenna arraystructure. Absorption of the incoming Electro Magnetic radiation energy occurs at the designed resonant frequency of the antenna .

Since objects give off heat as infrared rays, the nanoantennas could collect those rays and re-emit the energy at harmless wavelengths. Such a system could cool down buildings and computers without the external power source required by air-conditioners and fans. so it can be implemented in many industries and IT parks as two in one process. It also provides designers an another mechanism to increase the efficiency of antenna arrays through the expansion of the radial field.

Antennas by themselves do not provide a system of converting the collected energydirectly to electricity. This will need to be accompanied by associated circuitry such as rectifiers, inverters, and storage batteries.The Nano-antennas are tiny gold squares that are set in a specially treated form of polyethylene, which is a material used in plastic bag.A Nano-antenna array capable of collecting power from infrared rays that could be harvested in any weathercondition. The cell production process is even supposed to be ridiculously cheap compared to making standard silicon photovoltaic cells,but, as always, there's a rub. The grid collects its oscillating IRenergy at ten thousand billion times per second, which is proving to be a challenge to the nerds behind the tech, who are working on a way to convert that to the 50-60Hz power that the world uses.

Nano-antennas, on the other hand, can be tweaked to pick up specific wavelengths depending on their shape and size.

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This flexibility would make it possible to create double-sided nanoantenna sheets that harvest energy from different parts of the sun's spectrum.To eliminate the drawbacks of individual renewable power generation system like Solar and Wind, we design a new electricity or power generating system by integrating the wind energy sources, Photovoltaic solar energy and Solar energy with Nano-antenna simultaneously, so that power supply remains continuous without any sort of interruptions or load shedding.The aim of this work is to design and implement a Hybrid power generation system using wind energy ,photovoltaic solar energy- solar energy with Nano-antenna for continuous (24*7) power generation[8].

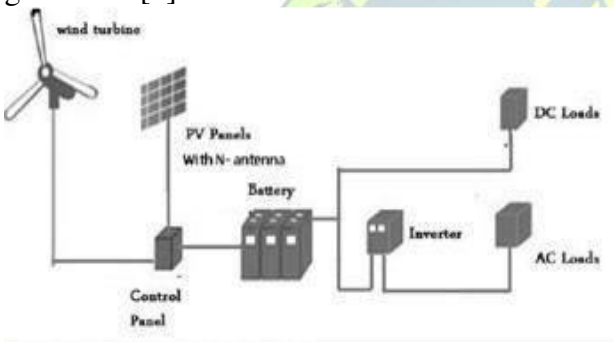

Fig: 3Integrated Electricity Generating System

The Solar-Wind with Nano-antenna Power Generation System is designed as shown in Fig. It has some special equipment which is used to charge the battery or the power storage (accumulator) circuit.Control circuit ad-joint with electric power generating systemprovides necessary control functions such as adding or summing up electric power derived from more than one sources at a time[3] i.e. solar and wind power simultaneously, solar with Nanoantenna and wind power. simultaneously,over voltage protection, amount of electric power directed to the load and the battery etc. Thus by implement ingintegrated Solar -Nano-antenna Wind-Lightning Power Generation System in a compact package, we have an uninterrupted power supply at the minimum cost to all places at all times. Moreover, we can avoid the accidental risk and causes by lightning to human and nature both. This method ensures a highly practical oriented pollution free and accident free inventory for electric power generation system. The electric power afforded by this system is completely pure and secured form without any sort of environmental pollution. Also it does not produce any greenhouse effect or acid rain or emit any kind of poisonous gases or radiation etc. In addition to this we can also increase one country's economy.

ENHANCEMENT OF HYBRID POWER SYSTEM USING IOT:

The solar energy power generation facility or wind power generation facility, has diversified products, standards and forms. There are a lot of difficulties for exact check-up. In case of small-scaled power generation facility, in view of its features, as maintenance cost is high and a lot of cost is required once a failure is taken place. The prevention of failure in advance is required through regular check-up and operational check-up. Recently, due to popularization of smart phone, a study on industrial application by using smart phone is under way and as smart phone is mounted with wireless internet communication module (3G, 4G, Wifi, etc.), GPS sensor, electromagnetic sensor, image sensor, diversified information provision by using facility recognition technology is enabled [4]. In this paper, a system of managing smart grid power generation facilities by using power generation facility INTERNET OF THINGS based technology is suggested. This system recognizes smart grid power generation facility image in real time by using image sensor and GPS sensor and it provides site manager with detailed

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information, hardware drawing, sensor data, facility history of power generation facility. In addition, it provides location information of facilities so that site manager could identify the facilities of other environmental surroundings conveniently. When utilizing suggested system, site manager could perform regular check-up and maintenance of repair conveniently and by using facility recognition based technology instead of existing QR code, its direct application is allowed without additional equipment to smart power generation technique being operated at present and by development of power generation facility recognition technology using markerless based facility recognition technology, it may be expanded to a technology of recognizing other smart grid power generation facility in the future.

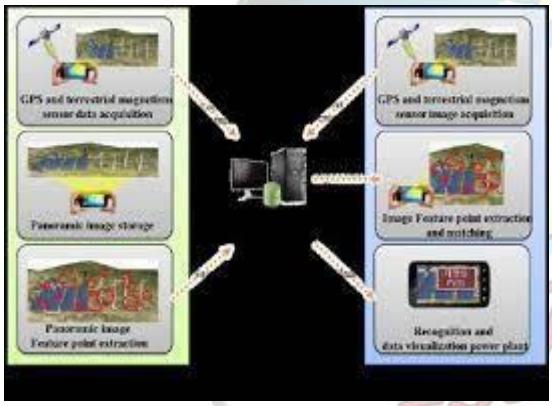

Fig:3 Recognition and registration process of power generation facility

RESULT:

Both modeling and experimental measurements demonstrate that the individual nanoantennas can absorb closeto 90 percent of the available in-band energy. Optimization techniques, such as, increasing the radial field size could potentially increase this efficiency to even higher percentages.The current and voltage values from the wind turbine, solar panels, battery group, and load are measured in the implemented system. Production and consumption of power for each module can be calculated. In order to allow separate chassis, a laptop computer which is disconnected from the power line is used to record the measurement data of the operating system. Thus the electricity production is near to 100% by implementing the solar-wind hybrid power systems along with the help of NANO- ANTENNAS. This system could be distributed world wide with the help of INTERNET OF THINGS, as everywhere and everything is internet today.

CONCLUSION :

This combination of solar-wind energy source will be highly effective in commercial areas. It is eco-friendly at the same time prevents accidents due tolightening. It is usedto cut short power charge. By this system electricity charge could be saved as very less maintenance charge is required for equipment. Moreover there is no power cut or load shedding at any times. In addition to this, the system is controlled by INTERNET OF THINGS as site manager is able to receive detailed information of facility at site, efficient maintenance for regular checkup and failure could be performed conveniently. It is the most reliable and cost efficient. This research is at an underdeveloped stage and may take years to bring it into market. We encourage the scientific community to consider this technology along with others when contemplating efforts and resources for renewable energy.

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