

Integrated Smart Highway for Efficient Utilization of Renewable Energy

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Abstract – The solar roadways i.e smart highway uses renewable energy sources which are solar and wind energy sources. Solar Roadways uses solar panels for its infrastructure which replaces the current asphalt road. Also vertical wind turbine is installed on divider of the road which can take advantage of air produced by moving vehicles. The solar panels and wind turbine generates energy, this generated energy is stored in battery which is kept in charging station installed on both sides of Highway. Further this generated energy used for charging of electric Vehicle and street light automation.

The use of renewable energy replaces the need of fossil fuels. Also by use of renewable energy the greenhouse gases reduces nearly to half. The capacity of solar roadways is 8-10 times greater than current. Road. Also solar roadway i.e smart highway reduces the pollution, co2 emissions and promote to use clean energy.

The initial cost required for this project is more but maintenance cost is very less. the capacity is comparatively more than asphalt roads.

Key Words: solar roadways, solar panels, vertical axis wind turbine, electric vehicles, fossil fuels etc.

1. INTRODUCTION

Now a days the pollution, greenhouse gas emissions are major problems facing by society. So to overcome these problems the integrated smart highway is best option due to use of solar roadways the global warming pollution, greenhouse gas emissions also dependency on fossil fuels reduces. The solar roadways is designed by using solar panels. The main purpose of solar roadways is to replace current petroleum based asphalt roads.

The smart highway concept uses combination of solar and wind energy. The vertical axis wind turbine are installed on divider of both sides of highway which can take advantage of air produced by moving vehicles. The generated electricity by solar panels and wind turbine is stored in battery which is used for charging of vehicle and street light automation control.

The cost of smart highway is little extra but maintenance is very much less. The solar roadways is durable and having 100% efficiency. The main purpose of this project is to use wind and solar energy in effective manner to get maximum electric outputs. The electricity plays vital role for development of nation, So production of electricity is one of the aim of the country.

So, by use of solar and wind energy in smart highway concept reduces pollution, co2 emissions, global warming effect. Also due to street light automation, the energy consumption is also possible. So this integrated smart is very useful in current situation for society which facing problems of pollution and global warming.

1.1 Background

The integrated smart highway technology is combination of solar and vertical axis wind power generation technology. The series of structurally engineered solar panels is used for construction instead of asphalt or petroleum road and on the divider of the road the vertical axis wind turbine is installed. The solar panels works on principle of photovoltaic effect. In that the cell converting solar radiation into direct current electricity using semiconductor that exhibit the photovoltaic effect.

2. Solar Roadways:

The solar roadways consist of structurally built solar panels that are driven on. Every solar road panel interlink with neighbouring panel to make the solar roadways system. The solar road replace our crumbling petroleum based asphalt road infrastructure with an intelligent highway that plays for itself through the generation of electricity. The solar road generates power from the sun and becomes our nation suburbanized, intelligent, self healing power system, replacement our current deteriorating power distribution infrastructure.

Block Diagram

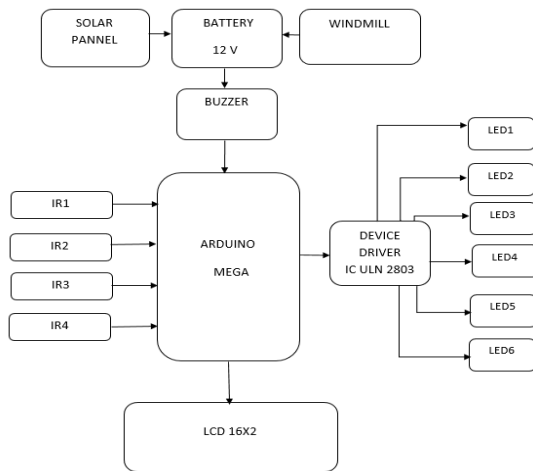


Fig.1 Block Diagram

The solar road distributes its power to any or all business and houses connected to the system via their parking and drive ways additionally travel through the solar roadways, that acts as a passage for these signals. This feature eliminates the unpleasant power lines, utility poles and relay links. We have tendency to see everywhere the rural area. It additionally eliminates power interruption caused by fallen or broken Electrical poles.



Fig.2 Smart Highway

Each solar road panel uses a number of its own power to illuminate embedded LED's that point the road lines from at a lower place that powered surface. This feature is additionally permit message to be spelled out on the paved surface, like " SLOW DOWN" or "ACCIDENT AHEAD" road lines are often instantly to direct traffic to one lane or to detour. This eliminate the requirements for cones or flares higher visibility in the dark with the road lines. It will be like driving on a well lit runway. The solar road panel heat themselves for snow and ice removal in the northern climates. No additional won't for snow removal or school,

business cancellation. These safer driving conditions can forestall several insurance rates each health and automotive.

An intelligent road infrastructure and a self healing suburbanized power system which will eliminate our want for fossil fuels and additionally it will result in less invest in archaic technology viz asphalt and overhead power lines. As the day by day the value of fossil oil product have gotten vast hike and resources are terribly less there will be now not possible material like asphalt for our road surfaces. Once solar road panel are refurbished the solar cells are upgraded to newest technology which can permit maintaining with growth and magnified energy desires. Additionally if such technology is furnished with in any of the country; the country would forces roughly 5 billion solar road panel for converting road parking lots, drive ways that etc.



Fig.3 Solar Roadway

The solar roadways will save the wondrous countries within the world. The day to day the kith and kin are searching for the answer to our deteriorating road infrastructure our crumbling power system, and therefore the climate crisis for all such queries the solution is solar roadways.

The solar panel divided into 3 basic types

1. Road surface layer
2. Electronic layer
3. Base plate layer

1. Road surface layer

Paved surface layer as this is often the highest most layer of the assembly and conjointly from this layer the solar rays can reach upto the electrical phenomenon cells they ought to be clear and high strength conjointly this is often created in such fashion that it is rough enough to provide nice traction to avoid the skidding of vehicles because the material is formed rough however material used is clear it still passes daylight cell embedded inside it, together with light emitting diodes and constituent and it's robust enough for handling todays heaviest hundreds below the worst condition and it is

created water proof so it will forestall physical science layer beneath it.

2. Electronic layer

Electronic layer comprises silicon chip board which support electronic equipment for sensing load on the surface and dominant a constituent by implementing this technology no a lot snow, ice removal and no a lot of college business closing thanks to inclement weather within the snow falling region. The management lighting, communication, observance etc. That are fitted at far, which may prove solar roadways as an intelligent transportation system.

3. Base plate layer

White electronic layer collection the energy from the sun, it's the bottom plate layer that distribute power and information signal down line to any or all homes and business connected solar roadways. The bottom layer created water proof in order that it will give the electronic layer on top of it.



Fig. 4 Structure of Solar Roadways

3. Vertical Axis Wind Turbine

Vertical Axis Wind turbine uses the air on highway divider for power generation. When vehicle passed on the highway it produces a considerable amount of air due to its speed. This unused considerable amount of pressurized air used to drive the vertical axis wind turbine from which the kinetic energy of turbine is converted into electrical energy. The generation with the gear mechanism is connected to shaft of the vertical axis wind to generate electricity. The vertical axis wind turbine is designed and fabricated in such a way that it can able to capture wind from all the direction. The generated energy replaces need for current fossil fuels for generation of electricity which reduces the greenhouse gases and helps in supportable development. For efficient use of electricity we use street light automation system with the help of electronics devices.

Vertical Axis wind turbine is capable of significant amount of electricity from wind an attractive alternative option because wind is freely available in nature. Wind as an input energy for wind turbine system can be given by two parameter i.e speed and direction. The main advantage of this arrangement is that the wind turbine does not need to be pointed into the wind direction is highly variable or has turbulent wind.

It is difficult to mount vertical axis wind turbine on towers means they are often installed nearer to the base such as the ground building roof top, road divider. The wind speed is slower at a lower altitude. The wind speed energy is available for given size turbine.

4. CONCLUSION

The combination of solar panel and vertical axis wind turbine energy sources are good and effective solution for power generation. In this project the combination of two sources works seasonally any of it fails other keeps generating electricity. Solar panels used to convert solar energy and wind turbine used to convert wind energy into electricity. The energy produced by solar and wind is stored in battery and used for charging of electric vehicle and street light automation control. More benefits are can achieved in term of fuel saving by operating this advanced vehicle control schemes. Significant research work need to exploit the potentialities. Condition of renewable energy sources such as wind, solar system is satisfactory in India but required additional attention for better development of renewable energy sources. India reaches in "Grid Party" in solar energy in 2017 for future development it is necessary to focus on renewable energy sources which requires better policy requirement.

5. FUTURE SCOPE

As integrated smart highway is the system based on solar and vertical axis wind turbine. These two are actual and provisional scenario for renewable energy in India. This integrated smart highway is very essential and useful ecofriendly electrical power generation. This generated power is fully based on renewable energy sources which will replace the current need of fossil fuels which leads to reduce greenhouse gases, co2, pollution. This generated power used for electrical charging station (ECS) further which will used to change the hybrid electric vehicles.

The renewable energy sources are abundant in nature and very much environment friendly. The hybridization in India has large prospect because 75% of Indian facing problems of pollution, greenhouse gases and co2 emissions. Also use renewable energy sources plays an important role in development of nation.

6. Advantages

- Purely independent of fossil fuels
- Life span is more than current asphalt roads
- Traffic control and street light control automation system is operated
- Intelligent and secure highway infrastructure is obtained
- Seasonal efficiency is more efficient in summer season

7. Disadvantages

- High construction and capital cost
- Implemented only in Urban area

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