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E-Highway: A Future Transportation

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Abstract: Highways are one of the significant parts of the modernized world. They play an important role for the development of country's economy. An E-highway, also known as an electric highway, it is revolutionary transportation infrastructure system designed to provide a consistent and efficient power supply to electric vehicles, particularly heavy-duty trucks and buses. The primary goal of an e-highway is to enable electric vehicles to charge while in motion, minimizing the need for large battery packs and addressing range limitation. E-highway can significantly reduce greenhouse gas emissions and operating costs for fleet operators. The technology involves overhead lines, rail, or inductive system to transmit power to electric vehicles. Overhead lines are the most commonly used technology, accounting for the largest share of the market. The transport sector depends upon non-renewable sources. Such that fossil fuels, coal, petroleum and natural gases. The transportation sector not only contributes for the nation's development but also for the greenhouse gases emission that accounts for nearly $1/5^{th}$ of the global total energy consumption. The electric highways is a technique where large trucks or vehicles, hybrids with dynamic pantographs on their top, coupled to the overhead power cables so as to get electricity from the power grid. As a result, E-highways with the combinations of EVs can eliminate the need of vehicle recharging. This technology is the efficient one in term of both fuel-consumption and smart power supply.

Index Terms – Solar charge controller, Battery switch setup, Dynamic pantograph, electrical road system, E-highways, electrical vehicles, power grid, smart power supply.

I INTRODUCTION

Every nation aims at a future which doesn't need non-re4newable sources of energy. As there is a presumed growth of demand for transport, the quantity of emission of carbon dioxide is more than that of country's economy. In order to minimize the effect of the fossil fuel gases, a new, harmless and an efficient technique or system should be practiced. The E-highway system is introduced with such a motto. ERS are principally, the electrified roads enable to the vehicles on the road to perform using power transfer. Generally, power source integrated into the road surface by externally driving energy to an electric engine.

One of the important challenge of any country is to make their environment pollution free. Electric road trucks are fitted with overhead line. The e-highway is twice efficient to the conventional combustion engines and provide reliable services with less impact on environment. This innovation supplies trucks with power from an overhead contact line. This reduces emission of green house gases and contributes to the healthy environment. One the main advantage of this system is that it saves the time of charging that is it will charge the battery of the vehicle while moving. It is one of the significant step to increase the transport facility while reducing the uses of non renewable resources. For this sector in the field of pollution must be controlled. E-highway is one of the significant step towards the overcoming of these challenges.

Fig-1 Illustrates a truck driving on an electrified road using overhead lines.

II. OBJECTIVES:

The main objectives of present work is to carry out a research if there is a probability to substitute the major part of the transportation area's enslavement of fossil fuels by presenting a new system electrical system ERS.

III. METHODOLOGY:

3.1 Planning and design

1 Route selection: Identify suitable routes for e-highway implementation, considering factors like traffic volume, road condition and environmental condition.

2 infrastructure design: Design the e-highway infrastructure, including overhead lines, and pantographs.

3.2 Technical components

1 Overhead lines: install overhead lines along the selected route, using materials like copper or aluminium.

2 pantographs: equip electric vehicles with pantographs, which connect to the overhead lines to receive

3.3 Power transmission and control

1 power transmission: Transmit power from the power supply system to the overhead lines.

2 power control: Implement a control system to regulate power transmission, ensuring power transmission, ensuring efficient and safe energy transfer.

IV. BLOCK DIAGRAM:

4.1 Road side unit:-

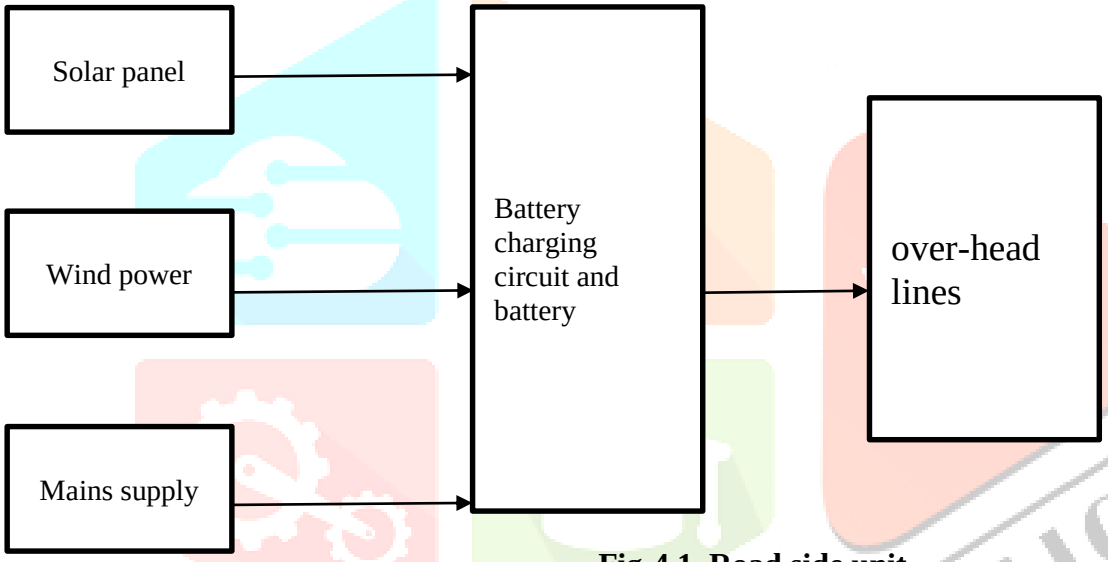


Fig-4.1 Road side unit

4.2 Vehicle unit:-

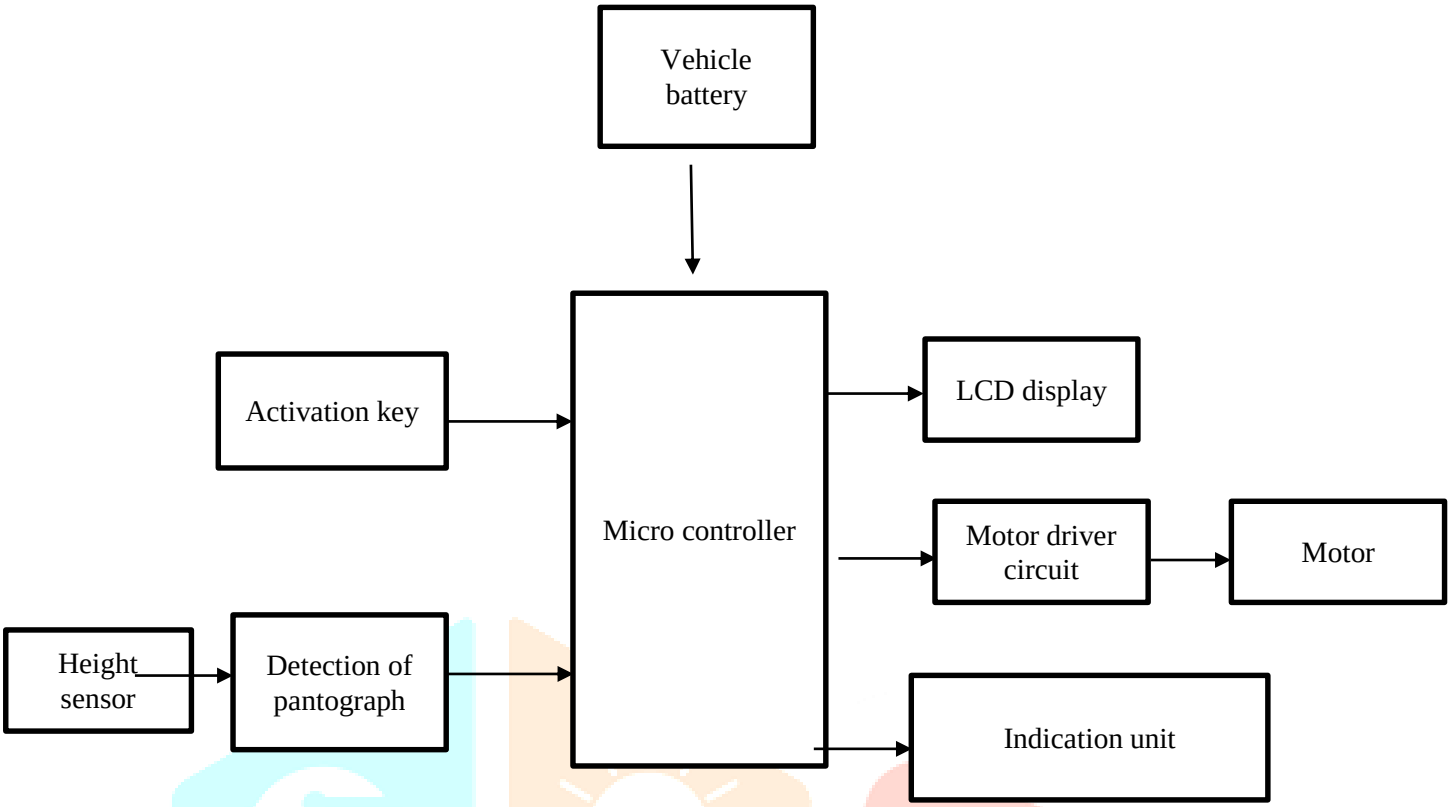


Fig-4.2 Vehicle unit

4.3 Block diagram description :

1) Height sensor:

It is used to measure the height of vehicle and for transfer the power through pantograph. The pantograph is special devices which is used for collecting power for overhead line.

2) LCD display: (liquid-crystal display)

The full form of LCD is liquid crystal display. Which is used to display information.

3) **Motor driver circuit**:

A direct current motor is a type of electric machine that convert electrical energy into mechanical energy, and it is used to drive DC motor.

4) Motor:

There are 3 stepper motors are used 2 for vehicle for demo purpose and 1 for controlling or driving pantograph.

5) Solar panel:

A solar panel is a device that converts solar energy into electricity by using photovoltaic cell. PV cells are made of material that produce excited electrons when exposed of light.

6) **Overhead lines**:

It is also referred as ropeways which is used as a transmission line and pantograph is connected to it.

7) Battery charging circuit and battery:

Batteries store energy being produced by given generating source and when this source is unavailable this energy can be used by loads. The inclusion of storage in any energy generating system will increase the availability of the energy.

8) **Microcontroller**:

The microcontroller is the heart of the system. A microcontroller is a small integrated circuit. The PICI6F877a microcontroller is used for the system. It is 40 pin IC with 5 ports. The pantograph and height sensors are connected as its input and LCD display, motor driver circuit, motor, LED as an output.

V. LITERATUE SURVEY:

1. construction and maintenance of overhead lines: The construction and maintenance of overhead lines requires expertise in electrical engineering and civil engineering consideration include the type of conductors, support structures, insulation, safety precaution and ongoing maintenance procedures to ensure reliable and safe operation.

2. Economic viability: Analyzing the costs and benefits of implementing e-highways, including infrastructure investment, operational costs, and potential revenue streams.

3. Technical feasibility: Assessing the technical viability of e-highways, including power transmission, energy storage, and vehicle compatibility.

4. Power supply and grid integration: Planning for sufficient power supply and grid integration is essential. This includes assessing the power requirements of the charging infrastructure and coordinating with the energy suppliers to ensure sufficient power supply capacity and grid stability.

5. Infrastructure design: Infrastructure design should consider the arrangement and placement of overhead power lines, charging points and other necessary components. This may include coordinating with utilities, road authorities and other stakeholders to ensure proper installation and integration with existing infrastructure.

VI. REQUIREMENT SPECIFICATION:

6.1- 10 Watts Solar Panel:

A solar cell is a key device that converts light energy into electrical energy in photovoltaic energy conversion. Solar cells are generally classified into four generations depending on time and categories of materials that are used for their fabrication. Sharvielectronics Tags, 12V 10 watt solar panel. Like any other solar panel, 10 watt solar panels also collect the energy from the sunlight and then convert it to electrical electricity. However, the only difference is that they can generate around 12v power while the other solar panels can create more power, and they are more efficient.

FEATURES

- Voltage Rating: 12V
- Max Power Rating: 10 watt
- Open Circuit Voltage: 21V
- Short Circuit Current: 0.61A
- Voltage At Maximum Power: 18V

- Dimension In: mm
- Length: 355mm
- Width: 265mm
- Height: 25mm
- Approx. Weight: 1.5kg

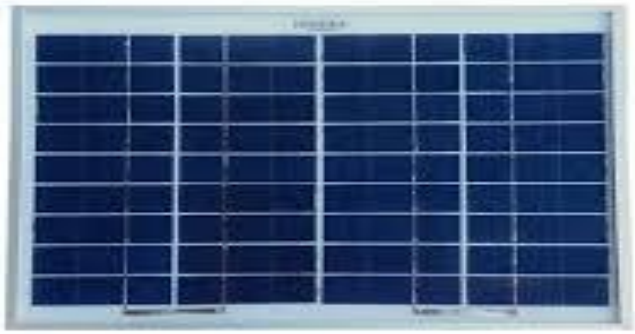


Fig- Solar Panel (10)

- These solar panels can easily operate in rural as well as urban areas.
- Also, due to their rigid composition, the 10 watt solar panel provide high efficiency.
- Plus, they are small, so you can carry them anywhere without inconvenience.
- Moreover, due to their small size, they are quite light weight.
- You can install these solar panels on motorhomes, solar gardens, and boat, too.

A 10W solar panel can easily generate approx. 0.8 amp. However, it is insufficient to charge a 12V battery efficiently. Users can use a 10w solar panel as a backup source for power outages or emergencies. Also, it can be used for charging a battery or low-power appliances such as fans and lights.

6.2- Solar Charge Controller:

A solar charge controller is an electronic device used in off-grid and hybrid off-grid applications to regulate current and voltage input from PV arrays to batteries and electrical loads (lights, fans, monitors, surveillance cameras, telecom and process control equipment, etc.). the controller safely charges and maintain batteries at high state of charge without overcharging. A good solar charge controller can extend battery life, whereas a poor quality charge controller can cause battery failure and which causes the entire off-grid system to shut down. Solar charge controllers are also commonly called solar charge regulator.

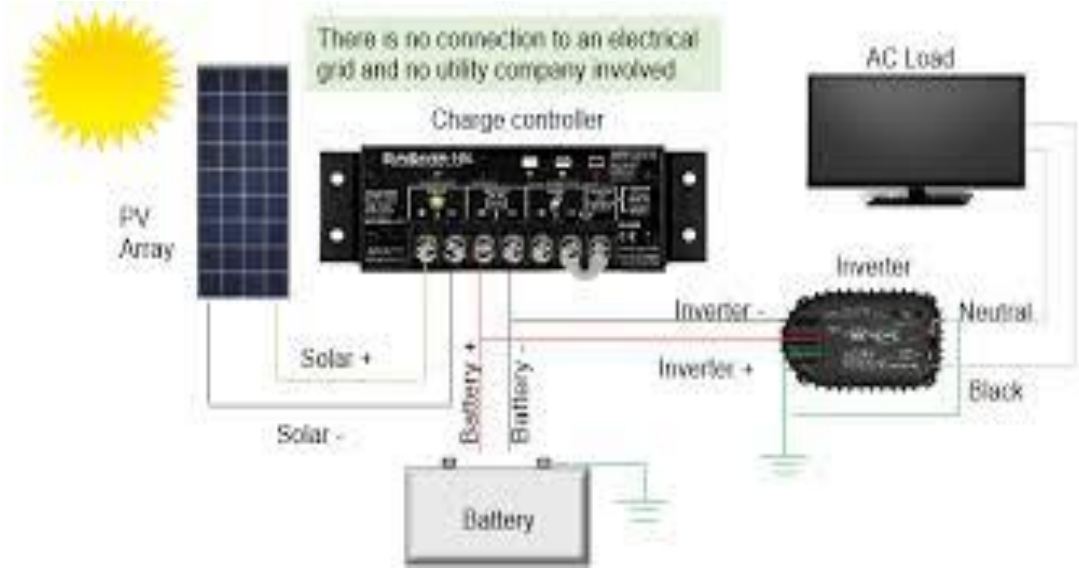


Figure1: Off-grid Diagram with DC Load

Solar charge controllers typically deploy either pulse width modulation (PWM) or maximum power point tracking (MPPT) technology to regulate and deliver the right amount of current and voltage from PV arrays to run electrical loads and safely charge batteries during the day. Then during the evening when there is no sunshine, the controller allows the battery bank to run the electrical loads. Solar controllers have electronic protections to protect against nighttime reverse current, short circuiting, high voltage, high temperatures, and battery reverse polarity. Additionally some controllers have low voltage disconnect capabilities and are equipped with LED warning lights to alert about installation errors and faults within the system.

When disconnecting, you reverse that order. The battery provides power to the controller so always make sure that solar and loads are disconnected before connecting or disconnecting the battery from the controller. Connections between the battery, load, PV array, and the controller should have disconnect switches to enhance safety and facilitate ease of installation and breakdown.

In the wire diagram schematic above with DC load, sunlight contacts the solar modules, which convert solar into DC electrical power that it delivers to a charge controller. The charge controller regulates the amperage and voltage that is delivered to the loads and any excess power is delivered to the battery system so the batteries maintain their state of charge without getting overcharged. During the evening when there is no sunlight, battery power is used to run the load. It's important to note that the inverter is connected and powered from the battery, not the controller's load terminals like we did in the DC load example. That's because the inverter can have a high energy surge upon startup, and this high current surge might be higher than the rated capacity of the charge controller, whereas the batteries will be able to meet the high energy surge requirement.

Features of Solar Charge Controller:

- Protects the battery (12V) from overcharging
- Reduces system maintenance and increases battery lifetime
- Auto charged indication
- Reliability is high
- 10amp to 40amp of charging current
- Monitors the reverse current flow

6.3- 1.3ah lead acid battery:-

12V 1.3Ah Rechargeable Lead Acid Battery is normally use for robots in competition. Wired or Wireless Robots runs for a long time with high speed with this type of battery. Seal Lead Acid (SLA) Rechargeable battery is the most common general purpose battery. Low cost, robust and less maintenance required are the advantages of SLA. But it is considered heavy weight for certain robotic application. To charge SLA batteries, you can use any general DC power supply as long as it provides the correct voltage to your battery.

Features:

- Rechargeable
- Recyclable
- No Memory Effect
- Able to use for most of the 12V controllers, motors or any other appliances

Specification:

- Voltage: 12V
- Capacity: 1.3Ah
- Size: 98mm x 43mm x 52 mm
- Weight: 0.450kg

Fig- 1.3ah lead acid battery

6.4- Vehicles with 4 wheels:

Four-wheel drive in cars or trucks refers to a system in which the engine provides power to the four wheels of that vehicle. Regarding trucks or cars, there are only four options: rear-wheel drive, four-wheel drive, all-wheel drive and 2 wheel drive.
All of these four options have their advantages and disadvantages. The main difference between these is traction. A four-wheel drive system is more efficient when it comes to traction.

Traction can have different uses depending on the driver's purpose. Some drivers may be looking for higher traction in wet weather conditions or when it comes to speed or handling.

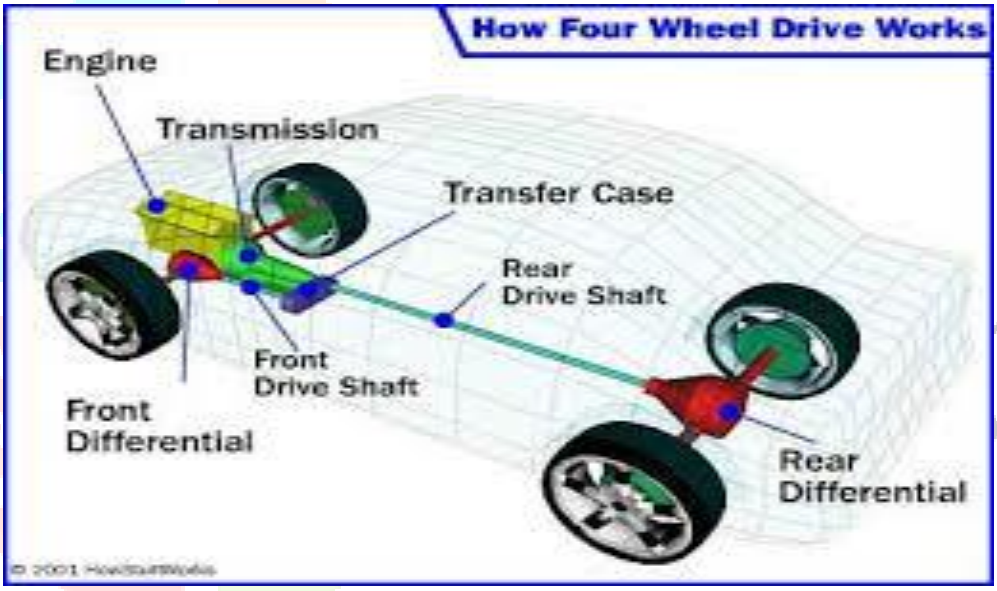
A 4X4 car is a vehicle with a two-axle vehicle drivetrain. Such a driving system can simultaneously offer torque to all four wheels of the vehicle. This can be a full-time or in-demand situation that requires all four vehicle wheels to work simultaneously. This is usually linked through a transfer case with an

additional driveshaft, which often has additional gear ranges

A 4-wheel drive works as per a gear arrangement known as differentials. The engine is connected to these differentials by drive shafts. These shafts transfer power to the wheels using drive axles. Locking differentials are typically driver-engaged, but there are 4WD models that have automatic locking differential systems. The task of locking differentials is to ensure that both wheels receive the same amount of power, even if their traction is different. This is how the wheel with higher traction performs better in a low traction situation.

Benefits of Four-Wheel Drive:

- Larger Space and Capacity
- Higher Fuel Economy
- Ideal for Off-Road Adventures
- Suitable For All Terrain
- Enhanced Traction and Towing Capacity



VII. CONCLUSION:

It is hereby conclude that this modern electrifying highway is twice as efficient as internal combustion engines. Besides this, this is a noiseless system which turns out as an eco-friendly technique in transportation sector. The power consumption is less i.e. running cost is less when compared to that of conventional petroleum based transportation.

The E-highway system not only enhances the benefit of reducing the harmful CO2 emission into the atmosphere but also improves the nation's economy by its reliable system. The electrification of roads/highways will enable evident decrement in CO2 emission and ensure a sustainable supply of energy. The significant advantage in this system is that electricity can be produced in several ways i.e. through conventional power plants and also from renewable sources.

While the technology is still in the early stages of development, several pilot projects are already underway around the world, including in Sweden, Germany and the United States. The potential benefits of electric highways are significant, including reducing greenhouse gas emissions and improving air quality and reducing dependence on fossil fuels. Electric highways also have the potential to reduce transportation costs and increase the convenience of electric vehicles. However, there also several challenges associated with this technology that need to be addressed. One of the biggest challenges is the cost of infrastructure.

VIII. REFERENCES:

- Electrical Road Transportation System", by Waghmode D. S., Miss. Patole S. S, Gaikwad S.S, Kulkarni K.S., Sakat S .A, Raykar A.B., International Research Journal of Engineering and Technology

- "E-HIGHWAY [ISNS Green Zonal Area for Smart Greed Power Generation With Chargeble Electronic Roofway]" by Swapnil Narwade, Divyani Thorat, Snehal Kadam, prof.Shital Mahajan, 2017,

- Design of a Siemens eHighway System Implemented across Funen" by Alexander M.E. Plougmann, Kristan L. Kvist, Magnus V_Rbak, University of Southern Denmark, May 22nd 2017.

- Bin, F. Pin and X. Guoqing, "Simulation of Hybrid Electric Truck and Plug-in Hybrid Electric Truck Based on ADVISOR," 2007 IEEE International Conference on Integration Technology, Shenzhen, 2007.

- M. Miao et al., "Research on Comprehensive Optimization of Power Intensive UHV/EHV Sending Power Grid," 2018 International Conference on Power System Technology (POWERCON), Guangzhou, 2018,