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Enhanced Electric Vehicle using Pantograph

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Abstract: *Current Electric vehicle technologies face several limitations, particularly in long distance travel and public transport applications, due to the reliance on batteries, which require long charging times and have limited range and very time consuming system. An electric vehicle (EVs) as one seeks to overcome these difficulties. With numerous advantages, electric vehicle technology has experienced various difficulties like battery charging, expanding electric charges, and accessibility of charging stations and battery life assessment and battery weight also. The smart Electric vehicle is proposed in this paper. Vehicle detection by using ultrasonic sensor and then pantograph is connected and running is started.*

Using ultrasonic sensor, the system identifies when a vehicle is present at the transmission line. Details of the running mechanism, which operates after detecting the battery voltage of the vehicle, are provided in a subsequent section. The suggested setup offers an energy efficient, cost-effective, and eco-friendly method for charging electric vehicles.

Keywords: Pantograph, Electric vehicle, DC voltage sensor, Transmission line.

I. INTRODUCTION

Electric Vehicles (EVs) have acquired the user's consideration because of their smart, economical, and eco-friendly services. Owing to the impressive pace of urban expansion, it is now vital that city regions implement environmentally sustainable strategies. The transportation business alone is one of the significant supporters of this ecological instability, representing about a quarter of greenhouse gases emission around the world. After decades of reliance on conventional internal combustion engines, there are now evident signs pointing towards a full-scale shift to electric vehicles and there is motivation to accept that for the time being, there will be a time of development and an ascent of the EV industry. Lowering the emission of harmful gases (like CO2 and nitrogen oxides) is a primary driver, through elements such as financial advantages, greater energy self-sufficiency, and transitioning to vehicles with lower oil reliance significantly influence the expansion of the electric vehicle sector. Customer interest, industry innovation advancements, as well as government initiatives and guidelines are the three primary forces that drive the reception of EV technology. With increasing impact of these factors, the presence of EVs in the overall industry is expected to rise. By 2030, EVs are expected to represent up to 60% of new vehicle deals. If shoppers buy EVs at the normal rates throughout the following five to ten years, an absence of charging stations could turn into a hurdle to EV adoption. Establishing a growing network of EV running is important to address future flexibility issues. The car and battery manufacturing industries have experienced notable innovation, presenting diverse methods to the mass-market challenges, including enhanced running systems. The establishment and business exploitation at the necessary scale of a public charging framework, or a public charging station (CS) organization, is a critical component to work with mass Adoption of electric vehicles increases due to improved availability, lower range-related worries, and greater support for long trips. The financial demand is too great for public authorities to manage on their own, and this solution helps mitigate it. Therefore, making a public EVs station plan of action is a difficult issue that requires further exploration. With consideration of all aspects, there is a need to develop smart Electric vehicle using pantograph worldwide to enhance the applicability of EVs.

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II. LITERATURE SURVEY

According to the article A Simultaneous Approach for Optimal Allocation of Renewable Energy Sources and Electric Vehicle Charging Stations in Smart Grids based on Improved GA-PSO Algorithm the optimal sitting and sizing of the RES and EVs charging station improve the power systems voltage profile via reducing voltage deviation in highly-loaded buses. Furthermore, applying variable tariff strategy to manage the charging and discharging of the EVs prevents the occurrence of overload caused by charging at the peak time and voltage drop in sensitive buses. The results also show that the appropriate selection of the coefficients in the multi-objective optimization problem and the instantaneous energy pricing method improves the load factor and helps to modify the demand curve. Consequently, the EV charging demand can shift to lower demand and higher RES production time intervals. This study indicates that using EVs as active power sources RES in the network can reduce losses, voltage deviations, and the cost of the both system operator and subscribers. In this paper, the uncertainty of input parameters is considered in the load flow which can help the distribution network planners to make the optimal decision.

In Smart Charging for Electric Vehicle using Pantograph gives the advancement of EV technology, charging infrastructure, and grid integration facilities, EV popularity is expected to increase significantly in the next decade. In this context, the proposed system increases the charging efficiency using Pantograph technology. The system with improved facility also works better from environmental perspective because the system avoids the emission of harmful gases. The automation in the system also facilitates more accurate technology and with less manpower requirement. Thus the proposed system is the economical and environment-friendly solution for charging EV.

III. PROPOSED SYSTEM

The LCD display is used to display voltage level of electric vehicle. On the way of transmission line road, a power supply block is used to power the PIC micro-controller. A relay driver circuit is used to move the Pantograph. The presence of the vehicle on the transmission line road is detected using the ultrasonic sensor. A pantograph is a device that collects electric current from overhead for electric trains or trucks or buses.

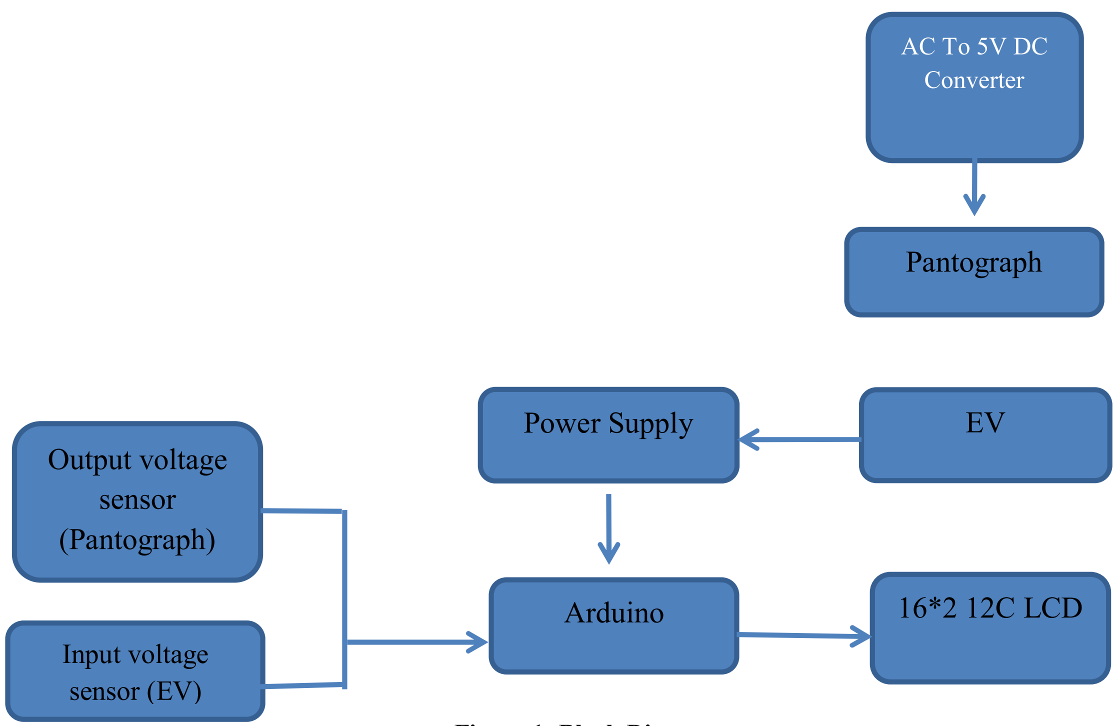

Figure 1: Block Diagram

1. Power Supply & Transmission:
A 5V AC to DC power supply is designed to provide power to the pantograph transmission line.
The pantograph is mounted on the EV to collect power from the overhead line.
2. Voltage Monitoring:
DC voltage sensors measure the voltage supplied by the pantograph and the voltage received by the EV.
The measured voltage readings are processed using Arduino Uno and displayed on a 16x2 I2C LCD display.
3. EV Movement Control:
60 RPM DC motors are used to drive the EV.
A DPDT switch allows the EV to move forward and backward as required.
4. Real-time Display & Monitoring:
Voltage readings from the pantograph and EV are continuously displayed on the LCD screen.
The system ensures stable power transmission while monitoring fluctuations.
5. Testing & Optimization:
The system is tested to ensure smooth power reception and vehicle movement.
Adjustments are made to improve power efficiency and pantograph alignment for better connectivity.

Pantograph

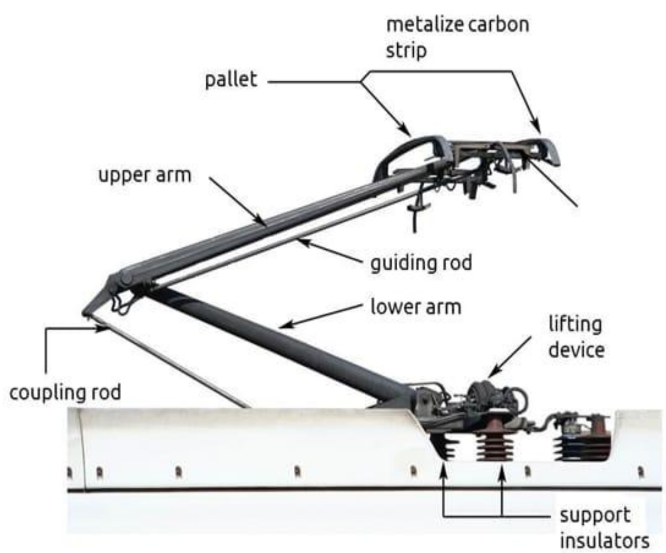

Figure 2: Pantograph

Pantograph Collects power from the overhead transmission line and transfers it to the EV.Pantograph is a word derived from Greek language which means every write. It is a structure with mechanical linkage therefore it works by forming parallelogram. The modern pantograph principle is derived from a linked.

5V AC to DC Power suppy

5V AC to DC Power Supply – Converts AC power from the transmission line to stable 5V DC for the EV.
Arduino Uno – Acts as the main controller, processing sensor data and displaying voltage readings.

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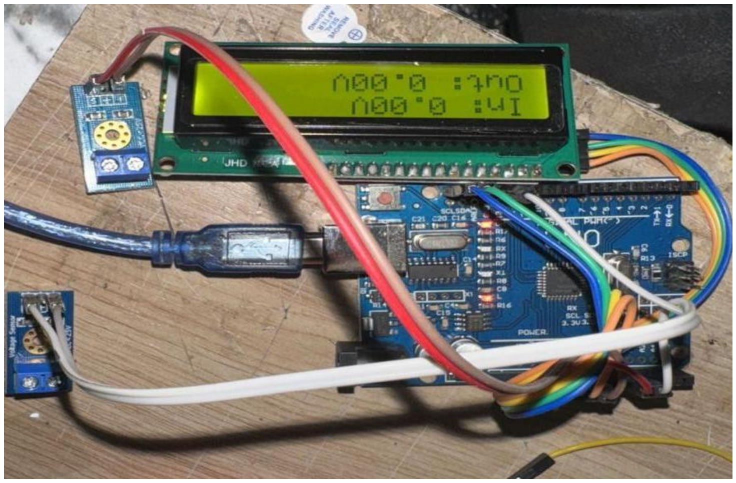

Figure 3: AC to DC voltage sensor

DC Voltage Sensors

Measures the voltage supplied by the pantograph and the voltage received by the EV.Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit.

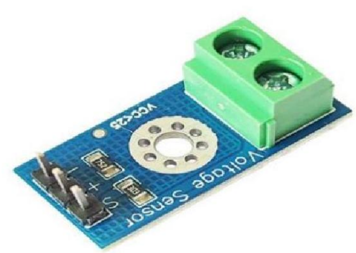

Figure 4: DC voltage sensor

Figure 5: DPDT system

DPDT Switch

Controls the direction of the EV (forward/reverse).

Chassis & Wheels – Provides structural support and movement for the EV.

Connecting Wires & Connectors – Used for circuit connections and power transmission.

IV. CONCLUSION

The Pantograph-Powered EV System provides a continuous power supply to electric vehicles, eliminating the need for battery charging. By integrating a pantograph, Arduino Uno, voltage sensors, LCD display, and DC motors, the system ensures real-time voltage monitoring and efficient movement control. This prototype demonstrates a cost-effective, eco-friendly, and sustainable alternative to traditional battery-powered EVs, making it ideal for public transport, industrial automation, and smart city applications. However, infrastructure development and maintenance are key challenges that need to be addressed for large-scale implementation.The system with improved facility also works better from environmental perspective because the system avoids the emission of harmful gases. The automation in the system also

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facilitates more accurate technology and with less manpower requirement. Thus the proposed system is the economical and environment-friendly solution for EV.

V. ACKNOWLEDGMENT

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