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BATTERY SWAPPING SYSTEM FOR ELECTRIC VEHICLES

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Abstract - This project focuses on a design model and methodology for increasing EV adoption through automated swapping of battery packs at battery sharing stations (BShS) as a component of battery sharing network (BShN), which might become integral to the smart grid. Current battery swapping methodologies are reviewed and a replacement practical approach is proposed considering both the technical and socio-economic impacts. The proposed BShS/BShN provides novel solutions to a number of the foremost preeminent challenges that EV adoption faces today like grid reliability, range anxiety and price.

Key Words: **EV adoption, swapping, challenges**

1. INTRODUCTION

The transportation industry contributes a major amount of carbon emissions and pollutants to the environment globally. The adoption of electrical vehicles (EVs) incorporates a significant potential to not only reduce carbon emissions, but also to supply needed energy storage to contribute to the adoption of renewable generation.

Electrical vehicles are attracting customers due to its environment-friendly nature as it does not have an exhaust system which creates emissions so they are planet healthier, also they possess less maintenance cost and they are potential to a tax credit as the customer is cutting down the impact on the environment by choosing a zero-emission system. Many countries like the United States, China, Japan, Germany had updated its policies and standards to support the development of EVs. These vehicles majorly face a problem of range anxiety and long charging period time which can be overcome by implementing Battery Swapping Station Concept.

In this concept, when the vehicle arrives at a station, then the discharged battery pack is replaced by the charged one. Rapid charging can also decrease the charging time but it affects directly the battery life because this process puts stresses on battery. Battery Swapping again plays a key role in increasing battery life by charging the battery packs under favorable conditions. The battery can be swapped mainly in two ways. Robotics Automation- This means the battery pack is replaced by the automation process without the interference of manpower. ii. Manually- In this process discharged battery is replaced by a person.

2. Body of Paper

After arriving the EV at BSS, doors underneath the vehicle gets opened to allow access to the batteries. Then using RFID, one particular slot of the battery swapping system gets open. The discharged battery is then placed at that slot to check its battery percentage. After the successful verification fresh and completely charged battery now can be replaced with the discharged one. The amount gets displayed according to the difference between charged battery and discharged battery percentage. After successful payment, that charged battery can be placed at the particular slot in vehicle.

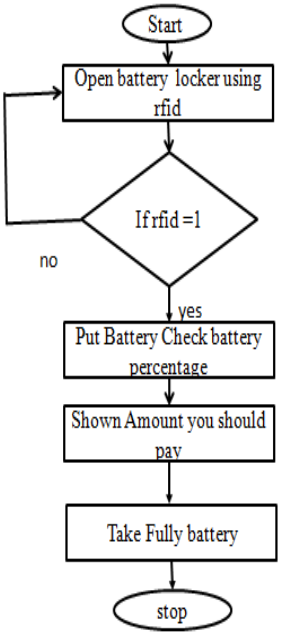

Figure 1: System Flow Chart

To establish and successfully implement the swapping technique for buses, vans, and other cars, extensive planning must be done covering all the required requirements starting from the availability of the batteries, chargers to data storage and management through cloud and communication between the components to confirm interoperability. The BSS for the vehicles will operate successfully provided there's continuous communication between the various components of the system viz. the smart vehicle, swapping station, and knowledge system. The information system are accustomed communicate with the vehicle yet like the station. The vehicle will communicate with the data system through the WAVE communication while the station will utilize the local internet for communication. When the vehicle's battery is depleted, the knowledge system will receive the notification from the vehicle, requesting A battery swapping service.

The knowledge system will inform the station about the placement of the vehicle, its expected point in time and identifications so it prepares the battery by the time

the vehicle reaches the station. Once the vehicle reaches the station ,th driver swipes his identity card and also the system locates all the relevant data correlated with this card. This data includes information concerning the vehicle, battery, vehicle's swapping history, transactions completed and other pertinent information. Operating personnel will verify this data and direct the customer towards the swapping area where the desired battery switching will occur by means of a robotic arm. All the information is being backed up on cloud storage from where it'll be accessible to the authorities further as customers to confirm complete transparency within the procedures.

Once the swapping is finished, the vehicle's battery are monitored immediately for its state of charge, state of health (SOH), remaining charge, battery age, battery life, number of charging and discharging cycles undergone and accordingly the owner are going to be informed about the fees incurred and the estimated time by which he can receive his fully charged battery.

This system effectively fulfills the expected results. The system provides better reliability as well as reduces time as compared to other battery charging systems for EV's.

3. RESULT

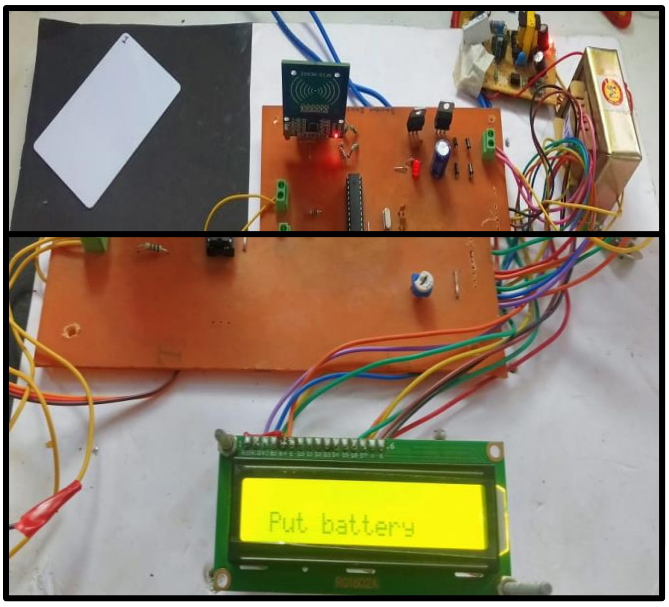

Figure 2: Hardware after Power On

In this project as shown in fig.30 we successfully displayed the expected result using all required components and calculations. Our motto is to minimize the man power for this system and make it more easily accessible to everyone.

We have shown the battery charging status and according to the status of energy used by that battery the system displays the amount to pay. It helps the person to easily pay the amount to replace the charged battery with discharged one

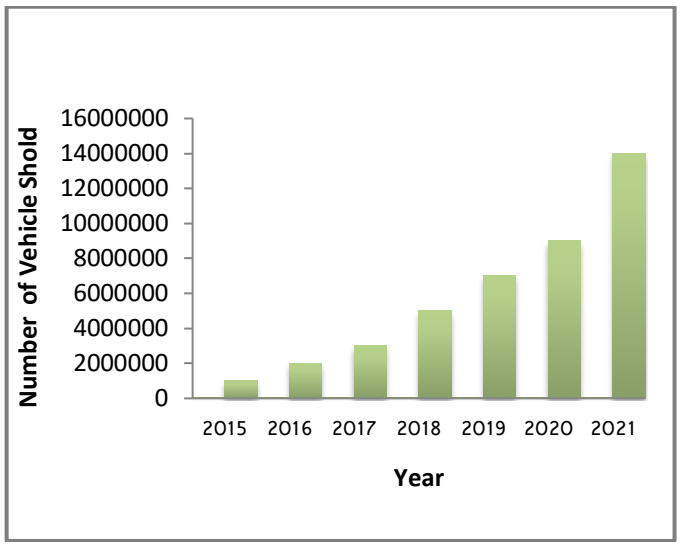

Figure 3: Global Electric Car Fleet

3. CONCLUSIONS

Adoption of Electric Vehicles by the customer will play a great role in making an environment free from unhealthy gases to some extent. To attract customers towards it swapping technology is in peak demand nowadays in different regions of the world.

The methods described above are a novel approach where a vehicle can get a fully charged battery in a few minutes. As of now, these methods are based on a few assumptions. In the future, we will seek to study them without assumptions and make this system handier.

BSS strategies are arising as a promising alternative to the traditional battery charging station approach since they supply a wider set of business opportunities to the dedicated stakeholders. This work has presented the multidimensional aspects of a perfect BSS deployment. the entire infrastructure, techniques, and benefits of BSS with relevance the buyer, facility operator, and aggregator has been presented. Furthermore, the key challenges related to the BSS like interchange ability feasibility, infrastructure, battery degradation, and battery ownership is discussed intimately. Furthermore, the subsequent area can be considered as a thrust area of research:

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