Site Sutability analysis of Electric Vehicle charging station using GIS

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Abstract - *India has the world major automobile sector which is further being moving towards the EV. Finding out the location for EV Charging station is major task as to ensure the adoption of EVs and to address problems like lack of charging infrastructure, risky maintenance, running costs. Charging station availability directly reflects the adoption rate for the EV. Data about the user understanding and adoption behavior of the users were considered along with the data obtained from the NMC. The data obtained will be transformed into the maps using GIS.*

*Key Words***:** GIS, Electric Vehicles, Site Suitability, Charging Stations,

1. INTRODUCTION

India is a vast country and imports about 82.8% of the crude oil and 45.3% of the gas as per the reports provided by Petroleum Planning and Analysis Cell (PPAC) for such import India spends 111.9 Billion USD. Thus the burning of the oil/gas ultimately result in the environmental hazards like pollution and greenhouse gas emissions. In order to reduce the over dependency on the oil, it is necessary to make the transportation system dependent on renewable sources. One of the major known source is electricity and nowadays major attention is being given to the electric vehicles.

Electric Vehicles are more effective, environment friendly with comparatively economical fuel source[2]. In 2017, Government of India has taken major initiative of pushing 6 to 7 million EV's on road by 2020 and converting all conventional vehicle's to EV by 2030. But putting this efforts is not returning the result back, considering the lack of the charging stations compared to conventional fuel stations. The gap between this two fuel sources is huge and ultimately affecting the decision making power of the buyer. Government of India pushed major subsidiaries for the customer to buy the EV's but lack of charging station making it hard to achieve.

1.1 TYPE OF EV'S

Electric Vehicle (EV) is a vehicle which mainly work on the electric power which generates torque through motors for the movement. Electric Vehicles exist from the long time but the battery/range issues kept them apart from the major population[1]. With the improvement of the technology the new generation electric vehicles can run up-to 500km in a single charge. Electric Vehicles also have been made compatible with the existing fuel source. They are mainly classified into following categories.

A. Battery Electric Vehicle

This type of electric vehicles are fully electric motor with rechargeable batteries and do not have any dependency on other fuel sources. The main working is battery powers the motor which generates the torque[6]. BEV do not emit any dangerous emissions. They are charged by the external power supply.
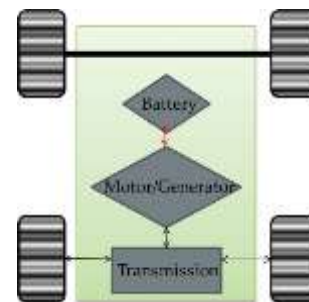

Figure 1Battery Electric Vehicle (BEV)

B. Plug-in hybrid electric Vehicle

PHEV's recharge the battery through regenerating the power and by plugging in into the external power source. Whereas "standard" hybrids will go 1-2 miles before the fuel engine starts[2], PHEV models will go everywhere from 10-40miles earlier then gasoline provides assistance.
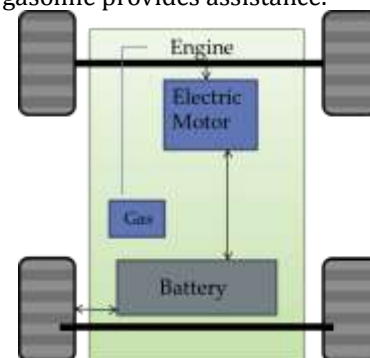

Figure 2Plug-in hybrid electric Vehicle

C. Hybrid electric Vehicle

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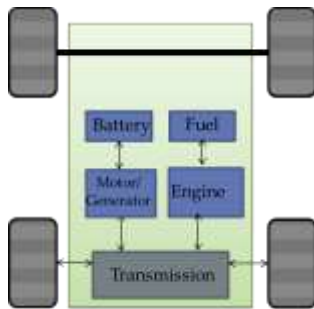

Figure 3Hybrid Electric Vehicle

1.2 CHARGING STATION

Charging station are provided at the various places in the City/Town/Highway as a fuel source for the EV. They are classified into various categories depending upon the time taken for charging the vehicle[5]. The classification of charging station is as follows.

A.   Level 1 Charging Station
This EV Charging station is used at homes or at workplaces where the end user stays for the long time. This charging station uses 120v[3] of supply and generally 8 hour of charge provides about 110km to 120km range[4].

B.   Level 2 Charging Station
This EV Charging station is faster compared to the Level 1 charging station. It provides the supply of around 240v[3] and are provides generally in the places like public charging station and places of work. The 4 hour charge provides the travel range of about 110km to 120km[4].

C.   Level 3 Charging Station
This EV Charging station are also known as DC Quick Charge[3]. This is the quickest charging station amongst all. About the 30min charge can provide the range of 130km to 155km.

2. METHODOLOGY

The main objective of this research is to find the optimum location of the charging stations depending upon the current infrastructure. At present, there are no standard charging station available in Nashik. The general workflow for the research will be as follows
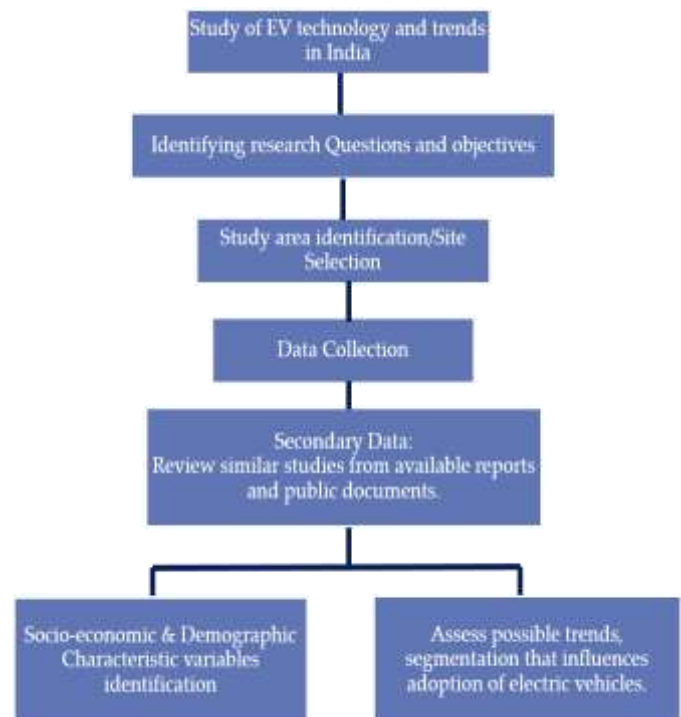

Figure 4 Methodology

Before commencing the work on research it is necessary to have idea about the current improvements and the new technological innovations available. Studying them to understand the new trends and new possibilities to be implemented into the current workflow. Further on identify the current situation of the market availability of the current services in the charging sector and the research objective is the main task.

Once the objective are set, it is necessary to define the area to be worked on and zoning the area into various sectors. In this research work the area being divided based upon the election wards defined by the government.

With the classified area, it is easy to acquire the data from various sources like Google Places API which directly provides the popular infrastructures in the city along with gathering data from the local municipal corporation.
The data obtained has need to be validated in order to get the correct suitability analysis at the end.

3. STUDY AREA & POINT OF INTEREST

A.   Study Area

The research being carried out on the part of Nasik city. The area in consideration for the research is 1870ha representing population of 2,34,696. The considered area is being divided into various wards as defined by the election committee.
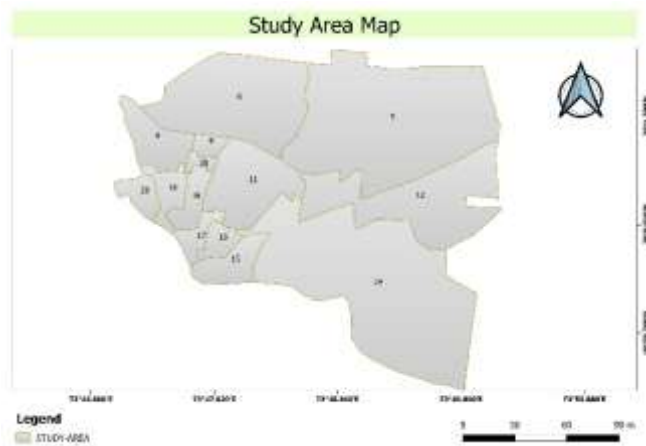
Figure 5 Study Area

B. Point of Interest

For the considered area different type of POI are gathered. With the help of Google Places API along with the data obtained from the local municipal corporation. The data is sorted into various categories like hotels, colleges, library, mall, parks, public parking, hospitals etc[7]. The sorted data then being again classified on the basis of availability of the parking infrastructure into the category.
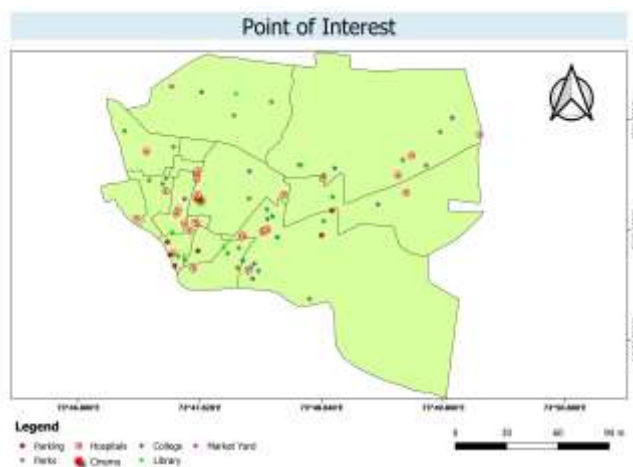

Figure 6 Point of Interest

The above classified data being imported into the QGIS so as to obtain the map with the actual parking infrastructure.

4. FUTURE SCOPE

The future research can be used to find the location for the exact location of the charging station along with the classification of them into various categories. The goal for it is to find the optimum site which can handle the crowd and at the same time improve the trust on the EV.

5. CONCLUSION

This study focuses on finding the optimum site of charging station based upon the current availability of the parking infrastructure in the city. So with the low cost modification existing parking infrastructure will be able to handle the EV's and ultimately result in improving the acceptance of the public.

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