International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 03 | Mar 2020 www.irjet.net p-ISSN: 2395-0072

A Review on Multi-Functional Multi-Ability Electric Vehicle

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Abstract - *The car of today is a concept of an internal combustion engine vehicle (ICEV) that is based upon merely the packaging of the engine that is expanded to the body structure of the vehicle. Applying fine electric vehicle (EV) technology a renewed car transportation is created to solve the problems of today's traffic jams, car accidents and transportation smog. The handling of vehicle is depends number of parameters, centre of gravity of that vehicle is one of them. For sport car it always keeps low but for the passenger car it compromises with its ground clearance. To provide the appropriate ground clearance is need of designer to reduce the destructive damage of bottom component of vehicle. CG is important parameter to vehicle for handling and dynamic stability at high speed. In advanced vehicle there are active and semi-active suspensions to give stability to the vehicle. Here, this paper introducing various techniques used to provide ability to the vehicle for more stability and road holding capacity. The concept has been developed to reduce the driver's effort during parking or maneuvering sharp curves. Steering ratio decides how far the driver has to turn the steering wheel to get the wheels to turn a given distance.*

Key Words: Electric Vehicle, Parallel Parking, Motors, Energy Source.

1. INTRODUCTION

The idea to employ electric motors to drive a vehicle surfaced after the innovation of the motor itself. From 1897 to 1900, EVs became 28% of the total vehicles and were preferred over the internal combustion engine (ICE) ones But the ICE types gained momentum afterwards, and with very low oil prices, they soon conquered the market, became much more mature and advanced, and EVs got lost into oblivion. A chance of resurrection appeared in the form of the EV1 concept from General Motors, which was launched in 1996, and quickly became very popular. Other leading carmakers, including Ford, Toyota, and Honda brought out their own EVs as well. Toyota's highly successful Prius, the first commercial hybrid electric vehicle (HEV), was launched in Japan in 1997, with 18,000 units sold in the first year of production. Today, almost none of those twentieth century EVs exist; an exception can be Toyota Prius, still going strong in a better and evolved form. Now the market is dominated by Nissan Leaf, Chevrolet Volt, and Tesla Model S; whereas the Chinese market is in the grip of BYD Auto Co., Ltd (Xi'an National Hi-tech Industrial Development Zone, Xi'an, and China). Road conditions are not similar at all place, it changes with application, environment and climate. In city at different sectors like school-hospital there are speed breakers of different dimensions. At certain condition road goes straight without any pits else we found irregularity. Most of the people buy only one 4 wheeler which they use that at all this condition. Hence it's necessary to give some standard ground clearance to the vehicle. But still there are some restrictions to drive the car on highway and in city.

It is not possible for the vehicle to run at high speed on its standard ground clearance provided considering the city obstacles. To provide the ability to the vehicle to give the good performance at high speed and low speed it is necessary to build one system which can vary the ground clearance. This can achieve by changing the suspension height with respect to speed of the vehicle. Suspension systems plays vital role while designing the car for good stability and road holding ability. It is very difficult to achieve this ability at all road condition with passive suspension system.This problem can solve by active suspension system but this is not widely used because it required more external energy and additional controlling system which affected on cost of the vehicle. With a view to reducing complexity and cost while improving ride, handling and performance the semi active suspension system is used. In this paper various parameters are discussed which are related to the ground clearance and suspension system and its control.

EVs can be considered as a combination of different subsystems. Each of these systems interact with each other to make the EV work, and there are multiple technologies that can be employed to operate the subsystems. key parts of these subsystems and their contribution to the total system is demonstrated. Some of these parts have to work extensively with some of the others, whereas some have to interact very less. Whatever the case may be, it is the combined work of all these systems that make an EV operate.

2. RELATED WORK

2.1 Adjustment of Height

Ground Clearance (also known as ride height) is one of the most basic but very important general dimensions of a vehicle. It is defined as the minimum distance between the lower end of the vehicle body (or chasis) and the road. In other words, it indicates the height of the lowermost part of the vehicle with respect to ground. Generally, most of the manufacturers specify this dimension in unladed vehicle condition i.e. without any load of cargo or passengers. That is

why, when you load the vehicle with passengers and cargo; the available ride height is always lower than specified in the actual running condition. On rough and bumpy roads, higher ground clearance is always better. This is because it avoids the scratching of the underbelly of the vehicle. As a general rule, it could be observed that a specific body type of a vehicle has some standard for ground clearance. Sedans and high-performance sports cars have very low ground clearance while hatchbacks are on the next step of the ladder. SUVs secure the top position of the ladder by offering highest ride height.

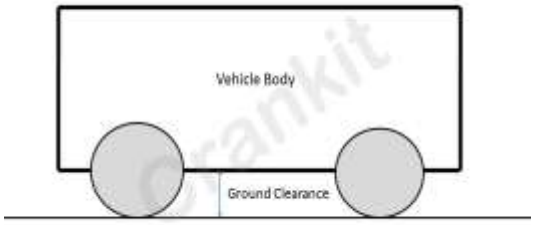

Fig 2.1 : Ground Clearance

It is the trickiest dimension because vehicle handling directly depends on it. The higher the clearance, the higher is the position of Centre of Gravity (CG) of the vehicle. And the higher position of CG means that the vehicle is prone to roll over. That means vehicles with higher clearance have more possibility of turning over than the vehicles with lower clearance. Thus it affects the handling. On the other hand, vehicles with lower ride height offer superb handling performance due to lower height of vehicle CG. The most common way to increase the ride height of the vehicle is by modifying the suspension of the vehicle. Many aftermarket agencies follow this practice.

2.2 Parallel Parking System

Parallel Parking System currently, there are cars which already equipped with parking assist system (PAS) whether in semi or fully autonomous such as in Ford Focus, Toyota Prius and Mercedes A45-AMG. Most of the available autonomous parallel parking system in a car integrates a set of sensors, visual image captured by the camera and microcontroller and also digital signal processor to detect the environment and act accordingly to complete the parking maneuver. Radio control servo controller is the one steering the front tires. Its input and output is PWM (pulse width modulation) signal. A built in speed controller is used for controlling direction and speed. Sensors are used to detect the available parking area and then the system will decide whether or not the parking space is enough. Only after that the parking maneuver is carried out. Techniques that have been suggested for parallel parking can be divided into two categories. The first one uses conventional controllers to tackle the parallel parking problem. On the other hand, the second one uses intelligent control by taking the advantage of the merits of some tools of computational intelligence (Gowan, K. et al.).

Fig 2.2 : Conventional Method Of Parallel Parking

A sensor based maneuver (SBM) provides smooth and safe motion for the vehicle while undergoing the parking maneuver. It is initiated by using some predefined sensor modalities and controls. The vehicle will perform a specific type of maneuver in a reactive way. Besides that, it also involves three main phases which are detecting a parking space, retrieving an appropriate starting position for the vehicle, and executing the parallel parking maneuver (Moghri, M, P., Karami, R, M., Ghaderi, R., 2012). Fuzzy logic theory and a sensor based navigation method are applied together to design a real-time execution program. Knowledge base on a FLC can be obtained from human experts or from a referential data set. It has been proven that these concepts can be applied successfully in autonomous mobile robot control applications.

2.3 Zero Turning Radius

Our zero turn four wheel steering vehicle will move on power supply from an A.C. source. So we are connecting the plug of the battery eliminator to an A.C. supply now alternating current is supplied to the battery eliminator which is converted into D.C. supply and transferred to the switch board. The switch board is a combination of two ways switches and ON/OFF switch. Now to give the constrained motion i.e. forward and reverse motion, we are using a set of two on and off switch and two 2 way switches. To provide the forward motion we are moving the two way switch to the up position. Now pressing the corresponding on and off switch we are moving all the four wheels in the forward direction thus resulting in a forward motion of the vehicle. In our model turning the wheel in 90 degree is optional and

which can be achieved by pressing the joystick. When the wheels are to be rotated to 90 degree or less, then power is given to the two motors which are individually connected to the power supply. When power supply is given then the motors shaft rotates, in turn it rotates the spur gear which is mounted on its shaft.

The Porche Weissach axle was an important precursor to 4WS. Most production cars experience some rear toe changes during cornering due to rubber suspension bushings compressing or deflecting; this is called compliance steer and can cause oversteer with abrupt changes in throttle position. To combat this tendency, Porsche arranged the 928's rear suspension bushings so the rear wheels toed in (rather than out) if the throttle was closed. This passive rear steering later became common—Citroë, Isuzu, Mazda and others employed it. The Prelude was the first active 4WS car sold in the U.S., but Nissan's Japanese-market R31 Skyline came earlier, launched in late 1985. The rear-wheel-drive Skyline offered Nissan's first-generation High Capacity Actively Controlled Suspension system. Like Porsche's Weissach axle, HICAS' original intent was mitigating compliance steer on powerful RWD cars. Nissan recognized passive rear steering's limitation—its dependency on cornering loads. They don't necessarily build quickly enough to provide useful toe adjustment.

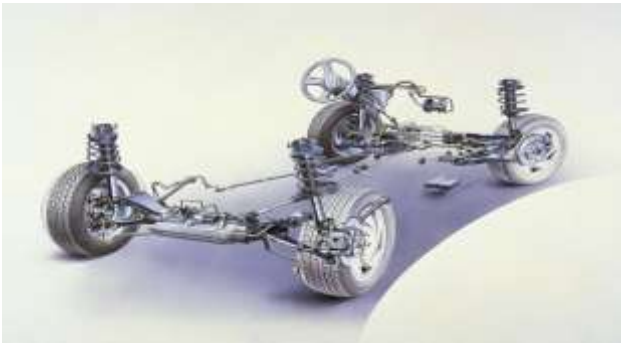

Fig 2.3: Concept of Four Wheel Steering System

3. METHODOLOGY

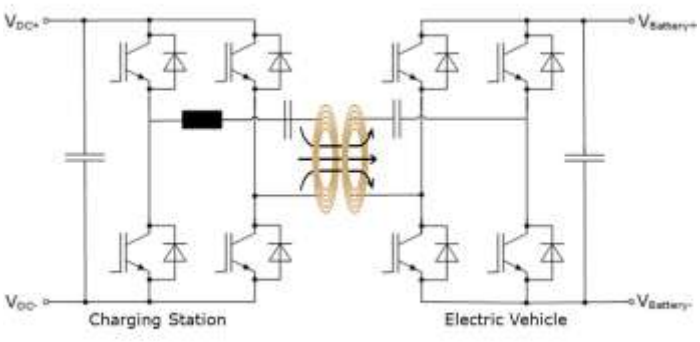

Fig 3.1 : Circuit Diagram Of Electric Vehicle

Generally, there are 6 transfer architectures in BEV; the first is the conventional drive train with clutch (Fig4.a). The vehicle is equipped and Energy Storage System (ESS) that delivers electrical energy to the main EM through a power converter. The mechanical energy provided reaches the front wheels through a quite long way; a clutch, a gearbox and a differential. In second type (Fig4.b), the clutch is deleted and the gearbox is replaced with a fixed gear transmission unit while the entire architecture remains the same. This little enhancement simplifies the driveline configuration and reduces the size and weight of transmission system [20,21]. By following the same logic, a third configuration (Fig4.c) offers a further simplification. It groups the electric motor, the single-gear box and the differential in same level with wheels. The BEV is lighter and mechanical transmission losses become minimal. The need to enhance the cornering performance in BEVs, each wheel gets its own fixed gearing and own electric motor. Thus, it is possible to operating different speeds. In some other configuration, the wheels were exploited. In-wheel application reduces even more weight and complexity.

An electric drive vehicle, or simply electric vehicle (EV), is a vehicle based on one or multiple motors (electric or traction) to ensure propulsion. The degree of electrification varies from one vehicle to another. In fig1, EVs are classified through a scale from zero (0=Conventional vehicle) to one (1=Full Electric Vehicle)

The All Electric Vehicle (AEV) or Battery Electric Vehicle (BEV)uses high capacity batteries and electric motor for propulsion (Fig2.a). It derives all the power from its batteries pack and has no internal combustion engine, neither fuel cell, nor fuel tank. The only way to recharge its batteries is by plugging in the vehicle to a charging point [31, 4-8]. This is the case of Chevy Spark and the

Mercedes-Benz B-Class Electric. The second type is the Hybrid Electric Vehicle (HEV) that uses mechanically a combination of Electric Motor (EM) in low speeds dedicated for in-city traffic and a conventional Internal Combustion Engine (ICE) to be used outside urban areas (Fig2.b). When ICE mode is activated, the EM stops and batteries start charging using an alternator driven by the same equipped ICE. The HEV get an upgrade to the Plug-in Hybrid Electric Vehicle (PHEV), it includes actually a new battery charging system that can be fed externally.

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