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DEVELOPMENT OF ACCIDENT-FREE SOLAR POWERED JEEP

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Abstract - *A Problems like air pollution and the consumption of petroleum have gotten worse as there are more and more moving automobiles on the road. The awareness that people have of the energy and environmental issues is promoting research into alternate car technologies including multiple fueling, hybridization, and electrification. The systems are also changed in tandem with the present issues. Road accidents are another problem. India's Electric vehicle mission is a major initiative by the government of India to bring down pollution. However, the major hurdles faced in the implementation of Electric vehicles on a proper scale are the battery life and the charging range. The unavailability of charging stations is a major hurdle in setting up India's EV mission as the charging stations need to be set up throughout the country. Since the proposed concept is to develop a full-fledged solar-powered vehicle the cost of operation of the vehicle is zero as it completely runs on solar energy. The vehicle creates zero pollution and is completely eco-friendly and eliminates the need for charging or charging stations to charge the vehicle. Further, the car is made intelligent, which continuously monitors the car's health and sends it to the cloud so that breakdowns can be avoided. The Car is made 4 WD so that it can be easily driven across non-planar driving conditions. Smart accidental safety systems such as collision avoidance and GPS tracking are also implemented in the project to make the vehicle smart.*

Key Words*: *Electric Car, 4WD, Solar, Smart, Accidental, Tracking, etc.

1.INTRODUCTION

Today, the global automotive industry is ready to submit EVs to create a greener world. The environmental effect of internal combustion engines is rising by the day. To mitigate the consequences of pollution and promote a cleaner environment, the automobile industry is exploring new avenues for introducing electric vehicles. Because in the past, hybrid electric vehicles have proven to be less polluting. But this was not enough to stop the contamination's full steam ahead. When compared to internal combustion engines, electric vehicles have greater technology and enormous efficiency. This research article focuses on the overall structure and components of an electric vehicle. This also includes power generation and battery performance in relation to market circumstances. The key concern, as addressed in this research, is battery performance. The relevance of charging stations and the surrounding area should inspire the design of future stations. Fuel stations are the primary source of information for pricing services every 5 kilometers. This primarily aids in time savings and the creation of a stress-free environment near the charging station.Because of the increased number of automobiles on the road, issues such as air pollution and oil consumption are becoming more frequent. Human sensitivity to energy and environmental issues drives research into alternative automotive solutions such as fuel multi-fuel, hybrid, and electrification. At the same time, the system has been modified to consider current issues. This paper discusses the concept of the design and fabrication of Solar powered 4WD electric vehicle with an Accidental safety system and GPS Tracking system.

1.1 LITERATURE SURVEY

The literature search used vibrant approaches and current research being done in the field of vehicle construction to focus mostly on its linked Electric cars and accident safety systems.

Ashwin Chander et. al (1) create an idea for an electric automobile with a multi-speed gearbox (EV). Due to the added size, complexity, and cost that a multi-speed transmission system would imply, electric car manufacturers have chosen against putting them in their vehicles in the current environment. While multi-speed transmission systems promise to reduce energy consumption and increase effectiveness for EVs, thus increasing the EV's "range," colourful variations (making the system clutch-less and limiting gear selection to three speeds) can be made to make conventional transmission systems suitable for electric vehicles. There are further benefits to lowering the size of the battery and engine.

Hailemariam. Hailu et. al (2) did research on the green vehicle launched and promoted to minimize the problem of

air pollution caused by conventional vehicle emigration seen mobility are cars with low energy/energy consumption and low/zero exhaust gas emigration; these vehicles are like a mongrel, battery-powered, and energy cell electric vehicle that can be upgraded to be more effective than conventional vehicles via a new design and development of power transmission system.As various experimenters have shown, the type of gearbox used is critical for great vehicle efficiency. A vehicle equipped with a binary clutch transmission and an automated manual transmission (AMT) is more efficient in terms of energy loss and smooth gearshifts.

CHENG et. al (3) Provide a summary of the area's most recent efforts to develop electric vehicles. The study discusses the evolution and evaluation of many component elements. Examined are the key aspects of battery technology, bowl design, motor, steering, and retardation. As a finale to the papers, the article ultimately displays various electric car prototypes.

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Chokri Mahmoudi et. al (5) executed a research project Since the first EVs were built and the outdated power structure was implemented, power operation in EVs has undergone a revolution. At the present, it may be fueled by a single source or a mix of sources, and it can be guided by a single algorithm or a collection of algorithms. The outcomes are much better as a result of this improvement. This study examines the state-of-the-art following conception, explains each subcategory, and provides information on power operating tactics and charging methods, as well as urgent issues and outcomes.

1.2 METHODOLOGY

The entire design is carried out differently so that the crimes can be minimized through the approach of the design. The detailed methodology to carry out the design is given below

- The literature check and problem description:

The literature review is carried out to study the current as well as being system. Different exploration papers from different exploration scholars were studied to arrive at the problem description.

- The designing a of smart adaptive speed control system: To bring about of conception of adaptive speed control with a smart collision discovery and avoidance system, an object detector has connived with the microcontroller. The sensor continuously checks for the presence of the object in the range of the vehicle and keeps on transferring signals to the microcontroller which is present in the vehicle.

- The vehicle framework fabrication:

to demonstrate this conception, an electric 4-wheel drive vehicle is fabricated. originally the lattice of the vehicle is fabricated. The chassis is fabricated originally as it forms the structural element of the vehicle and houses all the other corridors of the vehicle.

- The Drive train:

When the chassis is constructed, the system's four-wheel electric drive train is constructed and fitted. The drive train transfers the motor's power to the bus. The suggested drive train in this concept consists of a gear drive and a sprocket chain drive. In this stage, the electric drive system is reinforced and put together to create a fully working electric vehicle.

- The Solar Power System:

The drive train is powered using batteries which are driven using solar energy. In this phase, the solar power system is developed which is responsible for making the auto solar powered

- The smart accident and notification system:

Discovery and announcement system In this phase the GPS-grounded accident discovery and announcement system is enforced which will decrease the accident of the vehicle using the MEMS detectors present on the vehicle and automatically spark an announcement to the hospitals and family members along with the live tracking of the jeep.

- Assembling and operating:

The completion of the design process entails putting all the components together. The integrated components—both designed and manufactured—are put through performance testing. This stage involves doing any optimizations that are required.

- Conclusion

1.3 WORKING PRINCILE

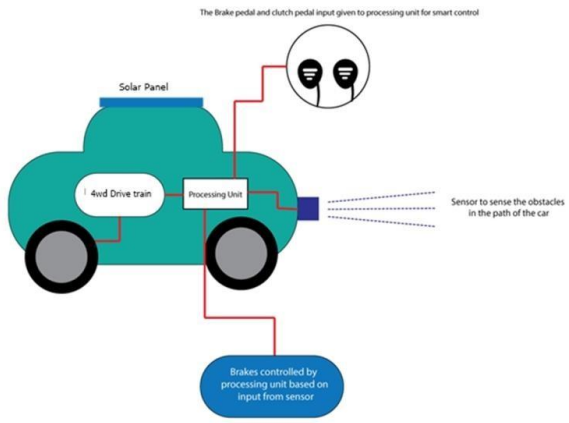

Fig 1 Working Principal Model

Fig 1. Working Principle As shown in the illustrative diagram the system consists of the development of solar powered 4wd electric car with an accidental safety system.

The sensors mounted on the vehicle are interfaced with a microcontroller. The microcontroller processes the data fed by the sensors. If there is an obstacle in the range of the vehicle at a certain distance from the vehicle, the vehicle first drops its speed adjusting to the proximity of the obstacle. When the distance between the object and the car gets more, the speed gets slower. This is done with the help of ultrasonic range finders which continuously feed the distance between obstacles to the microcontroller which automatically adjusts the speed.

The 4-wheel drive electric vehicle is fabricated which is driven completely using solar energy and can be easily used for daily commutes.

2. STANDARD COMPONENTS USED

1. ERW Steel Pipes
2. PMDC geared Motors for drive train
3. Sheet metal
4. 12V Battery
5. PMDC Motor Control
6. Proximity Sensor
7. GPS Sensor
8. Accident Sensor
9. Sprocket Chain Drive
10. LCD Touch Display

3. DESIGN CALCULATIONS

- GVW (gross vehicle weight) = 250 kg = 250*9.81 = 2452.5 N

2452.5/4 =613.125N weight on each driving wheel (WW)
The radius of the wheel/tire (RW) is equal to 0.22 m.
Vmax (desired highest speed) =25 Kmph=6.94 m/s
The desired acceleration time (ta) is 40 seconds.
2 degrees is the maximum inclination angle. Concrete provides a good working surface

- Vehicle total tractive effort (TTE) requirement:

RR + GR + FA = TTE TTE = Total Tractive Effort [N].
TTE stands for Total Tractive Effort [N].
GR = Force Required to Climb a Grade [N]
FA = Acceleration force necessary to reach ultimate velocity [N]
The following procedures will reveal the variables of this equation.

- Rolling Resistance Calculation:

The type of surface the vehicle will drive on should be considered. Rolling resistance is the amount of force required to move a vehicle over a certain surface (RR).
RR = GVW x Crr = 24.52 N = 2452.8 x 0.37 (mud) = 907.24 N = 2452 x 0.60 (sand) = 1471.2 N
Where:
Rolling Resistance [N] = GVW is an abbreviation for Gross Vehicle Weight [N].
Surface Friction = Crr (value from Table below)

Contact Surface	Crr
Concrete (good / fair / poor)	.010 / .015 /.020
Asphalt (good / fair / poor)	.012 / .017 / .022
Wood (dry/dusty/wet)	.010 / .005 / .001
Surface Snow (2 inch / 4 inch)	.025 / .037
Dirt (smooth / sandy)	.025 / .037
Mud (firm / medium / soft)	.037 / .090 / .150
Grass (firm / soft)	.055 / .075
Sand (firm / soft / dune)	.060 / .150 / .300

Fig 2: Contact Surface vs crr factor

- Grade Resistance Calculation:

Grade resistance is the force required to push a vehicle up a grade or slope. In this calculation, the maximum angle or gradient that the vehicle is expected to climb during normal operation must be employed.
Converting an inclination angle to grade resistance.
GR = GVW x sin 20 = 838.6 N
Where GR denotes Grade Resistance [N]. GVW is an abbreviation for Gross Vehicle Weight [N].
α = Maximum Incline Angle (in degrees)

- Calculating Acceleration Force:

Acceleration Force (FA) is the force required to accelerate from a standstill to maximum speed in a given amount of time.
FA = GVW x Vmax / (9.81 x ta) / (9.81 x 40) = 43.366 N
Where:
FA = Force of Acceleration [N]
GVW is an abbreviation for Gross Vehicle Weight[N].
ta = time necessary to obtain maximum speed [s]
Vmax = maximum speed [m/s]

- Total tractive effort calculation:

The forces assessed in phases 1, 2, and 3 are put together to generate the Total Tractive Effort (TTE). (With faster automobiles, friction in the drive components may necessitate an increase in total tractive effort of 10 to 15% to provide adequate vehicle performance.)
TTE = 24.52 N + 838.6 N + 43.36 N = 906.48 N

- Determination of Wheel Motor Torque:

Calculating the necessary wheel torque (TW) based on the tractive effort is critical to ensure the vehicle will operate as intended in terms of tractive effort and acceleration.
TW = TTE x RW x RF = 906.48 x 0.22 x 1.1 = 219 N-m Where:
TW = wheel torque [N-m]
TTE = Total Tractive Effort [N]
RW = radius of the wheel/tire[m]
RF = Resistance Factor [-]
The resistance factor takes into consideration the drag on the motor bearings as well as the frictional losses between the caster wheels and their axles. Values typically fall between 1.1 and 1.15.

4. RESULTS

Detection results for type of obstacle at different times of the day: The detection of the kind of barrier was performed at several times of the day to ensure accuracy. This was done to better understand how lighting conditions impact image processing operations.

Time	Lighting Conditon	Detection Result
Early Morning	Low Light	25%
Morning	Proper Light	100%
Afternoon	Proper Light	100%
Evening	Low light	38%
Evening	Artificial Light	98%

Fig.3 Accuracy Detection Table

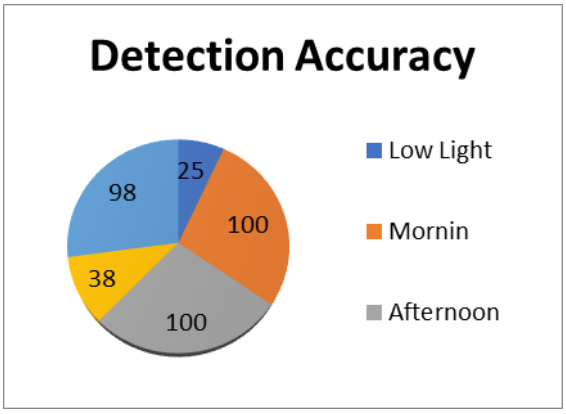

Fig.4 Accuracy Pie Chart

Testing of obstacle detection distance: Various tests were conducted to identify the obstacle detection for the smart system created in the hybrid vehicle with the distance specified in the program, as well as to assess the accuracy. The detection distance is chosen, and the table below illustrates the real vs. detected distance when the ultrasonic sonar sensor is used to do the test.

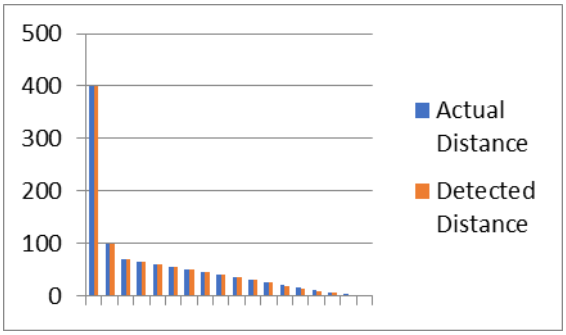

Fig.5 Obstacle Detection

GPS readings: The GPS data was recorded at known coordinates over a period

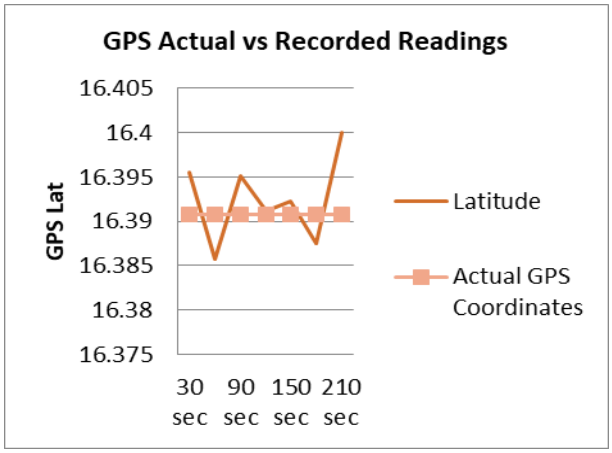

Fig.6 Gps Readings

5. CONCLUSION

The paper discussed the concept of the project is expected to provide a Solar powered smart electric car that runs on solar energy making it clean green and ecofriendly. By making the automobile solar-powered, the planned idea is anticipated to address the issues with charging facilities that now affect electrical vehicles. The project implemented is expected to reduce the dependency on fuel-powered cars thereby saving fuel as well as reducing pollution. The project is also expected to provide a cost-efficient solution for daily commutes since the cost per km is almost negligible with this solarpowered car. The project is also expected to provide accidental safety and alert system by implanting a smart system that can prevent a collision, and over-speeding and notify immediately if an accident happens.

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