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Design and Analysis of Solar-Powered Smart Electric Car with Accidental safety system

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Abstract - *India's Electric vehicle mission is a major initiative by India's government to reduce pollution. In this paper, we tend to introduce a new concept in the developing sector of electric vehicles. We develop a completely solar-powered Electric Car, which is light in weight and provides better or extended battery range due to onboard solar panels to charge the vehicle. Since the proposed concept is to develop a fully-fledged solar-powered vehicle, the cost of operation is zero as it completely runs on solar energy. The vehicle creates zero pollution and is completely eco-friendly and to some extent, it eliminates the need for charging or charging stations to charge the vehicle. Further, the car is made with multiple features, which continuously monitor 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.*

The smart accidental safety system has been added such as collision avoidance and GPS tracking are also implemented in the project to make the vehicle more reliable and add the main difference between other Electric vehicles.

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

1. INTRODUCTION

Today Automobile industries over the globe are all set to file the EVs to make a pollution-free globe Nowadays, due to the use of internal combustion engines, the effects on the environment are increasing day by day. To avoid this effect of pollution and to build a cleaner environment, the society of automobile industry is trying to find a new way by introducing electric vehicles because in the past as we have experienced hybrid electric vehicles, were causing less pollution but that was not enough to stop the complete rate pollution.

An Electric Vehicle has better technology and a more immeasurable efficiency as compared to the Internal Combustion engine. This research article focuses on the complete structure of the Electric Vehicle and the elements used in the Electric Vehicles. This also refers to the power generated and the performance of the battery according to the market situations.

The chief issue is the battery performance which we have highlighted here in the paper.

The significance of the charging stations and the region to embellish the new station. The fuel stations are the foremost source where we can put on the charging services every five kilometers. This would prime to secure the time and also a rush-free environment around the charging station.

Increasing the number of traveling vehicles has increased the problems such as air pollution and to the use of petroleum. The human sensibility for the energetic and environmental problem is encouraging research in alternative solutions for the automotive field, such as multiple-fueling, hybridization, and electrification. At the same time, the systems are modified considering the current problems. This project deals with designing and fabricating a Solar powered 4WD electric vehicle with an Accidental safety system and GPS Tracking system.

2. LITERATURE REVIEW

Ashwin Chander et. al[1] propose a design for a multi-speed transmission for electric vehicles (EVs).

Hailemariam N. Hailu et. al[2] conducted a study on the green vehicle was introduced and promoted to minimize the problem of air pollution caused by emissions of a conventional vehicle.

K.W.E CHENG et. al[3] provides an overview of the recent work of electric vehicle in the region. The paper describes the development and the comparison of different part of components. The major components in battery technology, charger design, motor, steering and braking are examined. The paper finally shows some electric vehicle prototype as a conclusion of the papers.

5y Dr. Chokri Mahmoudi et. al[5] conducted a research work according to which Power management in electric Vehicles has been revolutionized since the old power structure was introduced with the first EVs.

M. Prabha , M. Seema, P. Saraswathi et. al [1] developed a distance-based accident avoidance system using Arduino. The proposed system comprises an idea of having safety while reversing a vehicle, detects any object within the following distance, and displays the distance between one vehicle and another vehicle to the driver using LCD.

Divya Thakur, A. P. Thakare developed an FPGA for an automatic Reverse braking system. which the devices and sensors are interfaced. This system is suitable for commercial vehicles such as cars, emergency services vehicles, trucks, and buses.

Vishal Kumar[3] developed an automatic emergency braking system. An Automatic Emergency Braking System (AEBS) combines Advanced Driver Assist systems and Electronic Stability Control to slow down the vehicle and potentially mitigate the severity of an impact when a collision is inevitable.

Shivam S. Shinde, Aditi V. Lawate[4] Developed automatic intelligent accident avoidance system.

3. COMPONENTS

Fig 1: .: 350-Watt PMDC motor

The motor: The motor driver used is 24 V 20 Amp DC motor H- bridge. The H- bridge IC is used to provide the directional control to the DC motors as well as to control the speed of the DC motors. However in our project we will be keeping the speed of the scissor lift same and concentrating only on the direction control of the DC motor.

Fig 2: A ESP32 SOC microcontroller

The microcontroller: A ESP32 SOC microcontroller is used in this project. A compact microcomputer designed to govern the operation of embedded systems in motor vehicles which includes a processor, memory, and peripherals. They are used as Input and output devices including solenoids, LCD displays, relays, switches, and sensors for data like humidity, temperature, or light level, amongst others. a single integrated circuit containing a processor core, memory, and programmable input/output peripherals. The ESP32 SOC microcontroller has several specifications including WIFI module: ESP-WROOM-32; Processor: ESP32-D0WDQ6; Built-in Flash: 32Mbit; Antenna: Onboard PCB antenna; Peripheral interface: UART/GPIO/ADC/DAC/SDIO/PWM/I2C/I2S; WiFi protocol: IEEE 802.11 b/g/n; Bluetooth: Bluetooth 4.2; Frequency range: 2.4G ~ 2.5G (2400M ~ 2483.5M); WIFI mode: Station / SoftAP / SoftAP+Station; Power supply: 5V; Logic level: 3.3V; Dimensions: 48.26mm x 25.4mm.

Fig 3: : V 30AH sealed lead acid battery

Battery: The battery used in this project is 12 V 30AH sealed lead acid battery and Two batteries are used in this project to make the voltage 24V. Batteries are a crucial component of electric cars, as they provide the energy necessary to power the vehicle. One of the key advantages of using batteries in electric cars is that they are much more efficient than internal combustion engines. Batteries can convert up to 90% of the energy stored in them into usable power, compared to only around 20% for gasoline engines.

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The components like GPS modem, solar panels, LCD display, Chassis materials is also included to build the final assembly.

4. RESEARCH METHODOLOGY

The implementation of this project involves designing and fabrication of smart system and also 4 wheel drive electric vehicle on which the concept can be demonstrated. The methodology implemented in the project is as follows.

1) The designing of smart adaptive speed control system: To bring about of concept of adaptive speed control with smart collision detection and avoidance system, an obstacle sensor is interfaced with the microcontroller.

2) The vehicle chassis fabrication :

To demonstrate this concept, electric 4 wheel driven vehicle is fabricated. Initially the chassis of the vehicle is fabricated. The chassis is fabricated initially as it forms the structural component of the vehicle and houses all the other parts of the vehicle. The chassis should be strong enough to transfer all the load to ground as well have adequate amount of space for mounting all the other components.

3) The Drive train:

After the chassis is fabricated, 4 wheel electric drive train is fabricated and installed on the system. The power of the motor is given to the wheels using the drive train. In this project the proposed drive train is Sprocket Chain Drive and Gear drive. The electric drive train is implemented and assembled in this phase to make completely functional electric car. The drive train should be suitably chosen so that it should be a proper balance between the speed and power

4) 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 car solar powered

5) The smart accident detection and notification system: In this phase the GPS based accident detection and notification system is implemented which will detect the vehicle using the MEMS sensors present on the vehicle and automatically trigger an notification to the hospitals and family members along with the live tracking of the car.

6) Assembly and optimization: This is the final phase of the project and involves assembling of all the components. The fabricated as well as designed components are assembled and tested for performance. The optimizations required if any are done in this phase.

5. WORKING PRINCIPLE

The sensors mounted on the vehicle are interfaced with microcontroller. The microcontroller processes the data fed by the sensors. If there is an obstacle in the range of the vehicle at certain distance from the vehicle, the vehicle first drops its speed adjusting to the proximity of the obstacle. As the distance between the obstacle and the vehicle goes on increasing the speed goes on dropping. This is done with the help of ultrasonic range finders which continuously feed the distance between obstacle to the microcontroller which automatically adjusts the speed.

When a particular point approaches where the car is too close to the obstacle and is about to collide the braking system is automatically activated which brakes the vehicle thus preventing head on collision.

Three cases can be considered to understand the concept of the project.

1) There road is empty: When the road is empty the vehicle will be moving with full speed as you can see in the figure above. The adaptive cruise control system won't be working this time.

2) When the car approaches another car or an obstacle: When the car approaches another car or obstacle and the obstacle is still at a sufficient distance from the car, the speed of the car goes on dropping as it approaches another car. This is nothing but adapting the speed of the car with respect to another car, the core concept of adaptive cruise control.

3) When the car is about to collide:

When the car is about to collide, the car automatically applies the brake even if the throttle is pressed by the drives. This prevents the head-on collision between the cars.

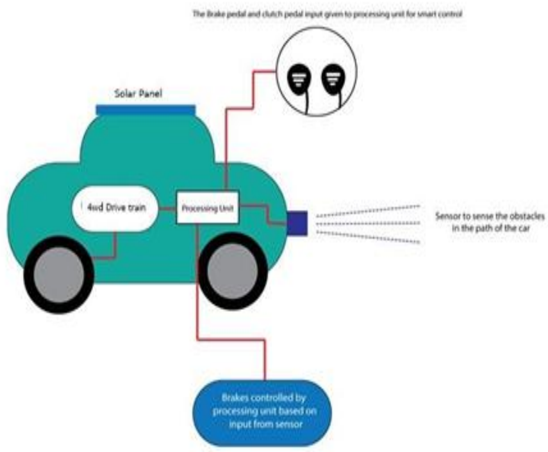

Fig 4: Working Principle

6. 3D MODELLING AND DESIGN CALCULATION

3D Models of the components:

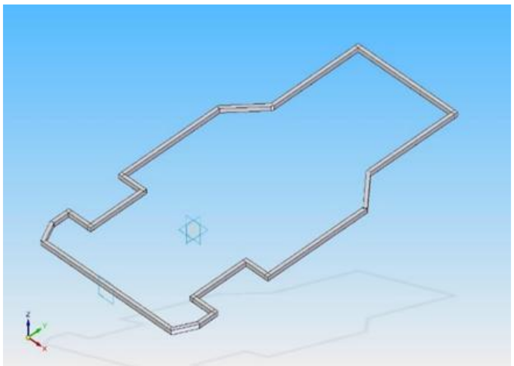

Fig 5: 3D Chassis model

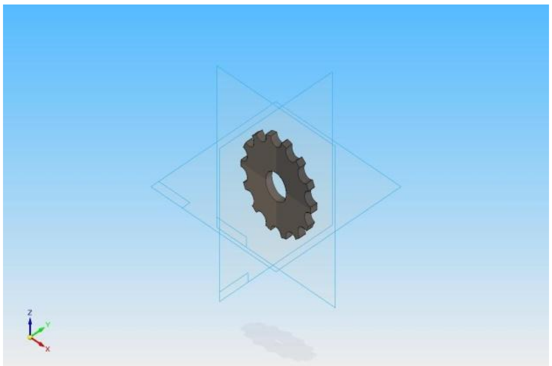

Fig 6: Driven Sprocket

Design calculation:

Weight on each drive wheel (WW) 2452.5/4 =613.125N

Radius of wheel/tire (RW)= 0.22 m

Desired top speed (Vmax)=25 Kmph=6.94 m/s

Desired acceleration time (ta)= 40 sec

Maximum incline angle = 2 degrees Working surface= concrete (good) Total tractive effort (TTE) requirement for the vehicle: TTE = RR + GR + FA Where:

TTE = Total Tractive Effort [N]

TTE = Total Tractive Effort [N]

GR = Force required to Climb a Grade [N]

FA = Force required to accelerate to final velocity [N]

Calculation of Rolling Resistance:

Surface type to be encountered by the vehicle should be factored into the equation. Rolling Resistance (RR) is the force necessary to propel a vehicle over a particular surface.

RR = GVW x Crr

=2452 x 0:01 (good concrete) = 24.52 N

= 2452.8 x 0.37 (mud) = 907.24 N

= 2452 x 0.60 (sand) = 1471.2 N

Where:

RR = Rolling Resistance [N] GVW = Gross Vehicle Weight [N] Crr = Surface Friction

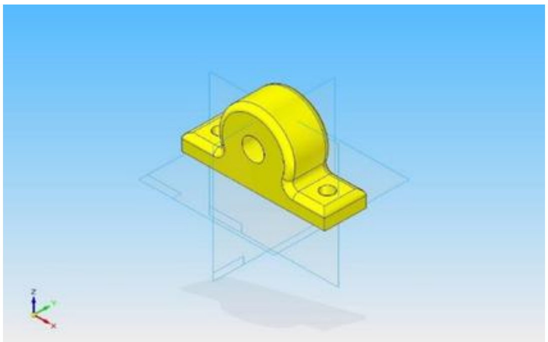

Fig 7: Bearing

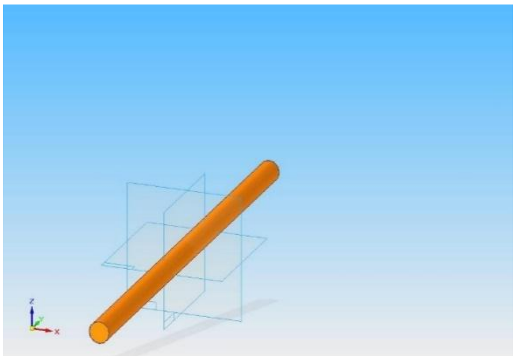

Fig 8: Rear axle Shaft

6. CONCLUSION

The proposed project is expected to provide an Solar powered smart electric car which runs on solar energy making it clean green and ecofriendly. The proposed project is expected to solve the problems of charging stations which exist in the current electrical vehicles by making the car solar powered. The project implemented is expected to reduce the dependency on the fuel powered cars there by saving the fuels as well as reducing the pollution. The project is also expected provide a cost efficient solution for daily commute since the cost of per km is almost negligible with this solar powered car. The project is also expected to provide accidental safety and alert system by implanting smart system which can prevent collision, over-speeding and also notify immediately if accident happens.

REFERENCES

[1] Ashwin Chander, Madan Kumar, Shobith Nambiar, Harsh Zaveri; "Design and Study of Transmission System for Electric Vehicles" International Journal of Engineering Science and Computing, March 2018, Volume 8 Issue No.3. 16512 http://ijesc.org/ [pp16512]

[2] Hailemariam N. Hailu* and Daniel T. Redda; "Design and Development of Power Transmission System for Green and Light Weight Vehicles: A Review", The Open Mechanical Engineering Journal, 2018, Volume12DOI:10.2174/1874155X01812010081

[3] K.W.E CHENG; "Recent Development on Electric Vehicles"2009 3rd International Conference on Power ElectronicsSystems and Applications. https://www.researchgate.net/publication/224585929

[4] ZHANG*, C. ZUO, W. HAO, Y. ZUO, X. L. ZHAO and M. ZHANG; "Three-Speed Transmission System For Purely Electric Vehicles" International Journal of Automotive Technology, Vol. 14, No. 5, (2013),[pp. 773].0

[5] Dr. Chokri MAHMOUDI; "An Overview of Electric Vehicle Concept And Power Management Strategies" 978-1-4799-7300-2/14/$31.00 ©2014 IEEE https://www.researchgate.net/publication/265709143

[6] Jae-Oh Han, Jae-Won Shin, Jae-Chang Kim and SeHoon Oh; "Design 2-Speed Transmission for Compact Electric Vehicle Using Dual Brake System" Appl. Sci. 2019, 9, 1793; doi:10.3390/app9091793 www.mdpi.com/journal/applsci. [pp1]

[7] M. Prabha, M. Seema, P. Saraswathi, "Distance-based Accident-Avoidance System using Arduino", International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056

[8] Divya Thakur, A. P. Thakare, "A Review on Implementation of FPGA for Automatic Reverse Braking System", International Journal of Science and Research (IJSR)ISSN (Online): 2319-7064

[9] Sushil Kumar, Vishal Kumar, "AUTOMATIC EMERGENCY BRAKING SYSTEM", International Journal of Research In Science & Engineering e-ISSN: 2394-8299 Volume: 1 Issue: 3

[10] Shivam S. Shinde, Aditi V. Lawate, "Intelligent Automobile Accident Avoidance System", International Journal of Scientific & Engineering Research, Volume 4, Issue 10, October-2013 ISSN 2229-5518