NOVEL BASED SMART ELECTRIC VEHICLE

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Abstract - *As the usage of hydrocarbons for running IC engines increased, it gradually started depleting and caused an imbalance in the environmental aspects. This made the vehicle manufacturers look for alternative, where Electric Vehicle (EV) paid their attention. No doubt, EV is more promising one in the environmental issues. There were several limitations over its merits so major researches have been done to improve EV efficiency and overcome its drawbacks. This paper deals with providing smart features and increasing battery efficiency by placing thin-film solar cell on EV top and coupling generator to a car tire, so the generated energy is also used to run a vehicle. To provide safe, secure and highly reliable vehicle several features are added. All the controlling actions will be taken by Raspberry-Pi. Speed controlling, biometric authentication and switching of beam light from high to low intensity or vice-versa depending on the situation are the major concept discussed in this paper.*

Keywords: *EV - Electric Vehicle, Finger-print sensor, Raspberry-Pi, Beam light, Biometric authentication.*

1. INTRODUCTION

It is estimated at the present day there are approximately 2 billion internal combustion engines are being used all over the world. As the use of IC engines increases as shown in Figure 1, the adverse effects on the environment proportionally get increasing as a result the glaciers are melting out and global temperature is increased by 2 every year [1]-[9]. The other major cause is the depletion of fossil fuels, which made vehicle manufacturers pay their attention to alternatives. This made the foremost raise of Electric vehicles in the market and just bloomed like anything.

The EV was a solution for the above-stated problems but there were many drawbacks too, overcoming those was a great challenge as Electricity is not a freely available source. Battery efficiency is very less and the replacement of the battery was very expensive [2]. The short driving ranges, speed, recharge points, and dearth of electricity in many rural areas. As people like to hear a noise if any vehicle is coming behind them, the however motion of EV is silent and this may lead to accidents sometime [4]-[6]. Earlier few governments do not encourage EV in loans or tax aspects.

In this paper, we have come across a smart EV where most of the drawbacks are overwhelmed. The generator coupled to a car tire and thin-film solar cell placed vehicle rooftop generates electrical energy which is used for the motion of EV just like a back-up for the main battery [9]. The other concerned objective is object detection and reducing speed also switching of beam light based on the distance between obstacle and EV. Fingerprint authentication for the starting of the EV is certain applications that are solving some drawbacks of EV [5]. Our Indian Government in 2019 budget, Financial Minister Smt. Nirmala Sitaraman has announced an additional income tax deduction of Rs. 1.5 lakh on interest paid on EV loans and customs duty exempted on certain parts of electric vehicles which boosted EV.

According to the 2013 global survey of traffic collision by the UN World Health Organisation, India faced a road casualty rate of 16.6 per 100000 people. The National Crime Records Bureau (NCRB) 2016, the report states there were 464674 road collisions reported shown in Figure 2. This severe issue can be regulated from the automatic speed controller and switching of beam light.

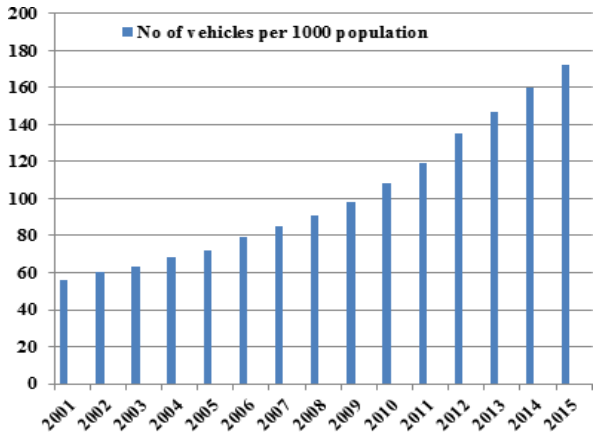


Chart - 1: Number of registered motor vehicles across India from 2001 to 2015 (per 1,000 populations)

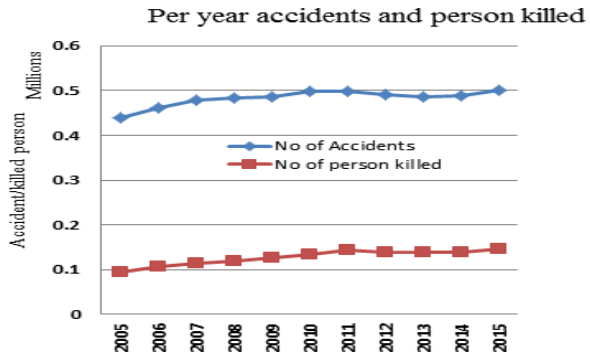
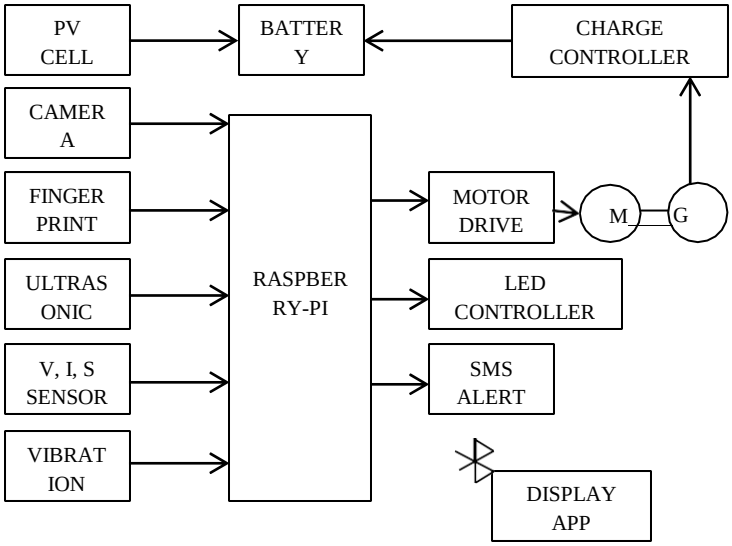


Chart - 2: Number of accidents occurred and killed Persons in India from 2005 to 2015

2. PROPOSED SYSTEM

2.1 Block Diagram



2.1.1 **Generation of Energy**: The energy generated from solar PV cells and DC generators is fed to the charge controller. Since both are in DC there is no necessity of conversion. Use of the charge controller plays a prominent role and safeguards during sudden acceleration and regenerative braking, vehicle speed drops less than the optimum range then energy is used from the main battery. Once the EV crosses its optimum speed and PV cells also generating energy then vehicle motion will be from generated energy and these generating readings are shown in the app.

2.1.2 **Fingerprint Sensor**: To unlock the EV, the driver needs to scan his fingerprint, the encrypted fingerprint details will be sent to the fingerprint controller once it matches the preset the vehicles will be unlocked also for further details it maintains the timeline records. From this, the driving of unlicensed and stealing of the vehicle is regulated. The other interesting fact is that due to the recorded timeline if any accidents occurred and culprit tries to escape from the case, he can easily be caught by assuring he was the person driving a vehicle.

2.1.3 **Speed controller**: A 5MP camera and ultrasonic sensor are used in EV to continuously monitor the presence of an obstacle, if it found then the distance between EV and obstacle is measured. If the distance measured is less than 50cm then speed drops to 50% else the same speed is maintained. Raspberry pi will be controlling all the commands and takes-up instant decisions.

2.1.4 **LED Controller**: Automatic switching of beam light is done when an obstacle or any vehicle comes closer i.e., less than 50cm then beam light intensity drops else the same intensity is maintained. These controlling actions will be taken by the Raspberry Pi controller.

3. METHODOLOGY

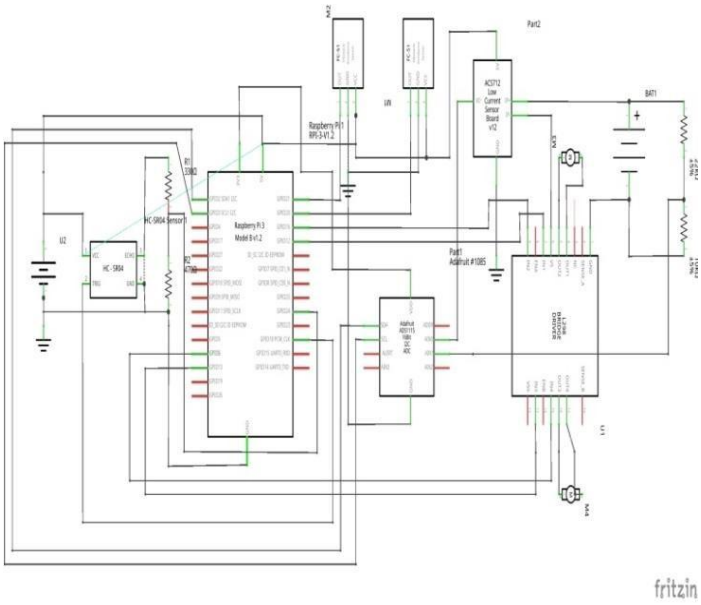
In this, four DC motors of 150rpm are used. The front two motors will be acting as generators since, it is freewheeling. The back two motors draw source from the main battery and responsible for EV motion. But, once it reaches its nominal speed it uses the energy generated from generator and solar panel. Thin-film solar PV cell which generates maximum power when the sun is overhead as the radiations directly fall with high intensity. The charge controller regulates the addition of charges from both generator and PV cells, also it limits overdrawing from a battery. The main reason for using the charge controller is to prevent the device from overcharging and protect against overvoltage. Generators are connected in series so they add up their voltages and generators are connected parallel to solar PV cells.

Bluetooth (BT) is the media or technology used to transmit or receive the data. There are two types of BT namely, Classic and BLE (Bluetooth Low Energy). We are using BLE for short-range applications. The global variables like BTtx and BTrx are used to transmit and receive data respectively. Two IR (Infrared) sensors are used to follow the provided line path. Once GPIO (General Purpose Input Output) initialize is done, it checks for the conditions. When both are zero which means no obstacle it moves forward. If one sensor i.e, left IR=1 then choose the opposite path and vice versa.

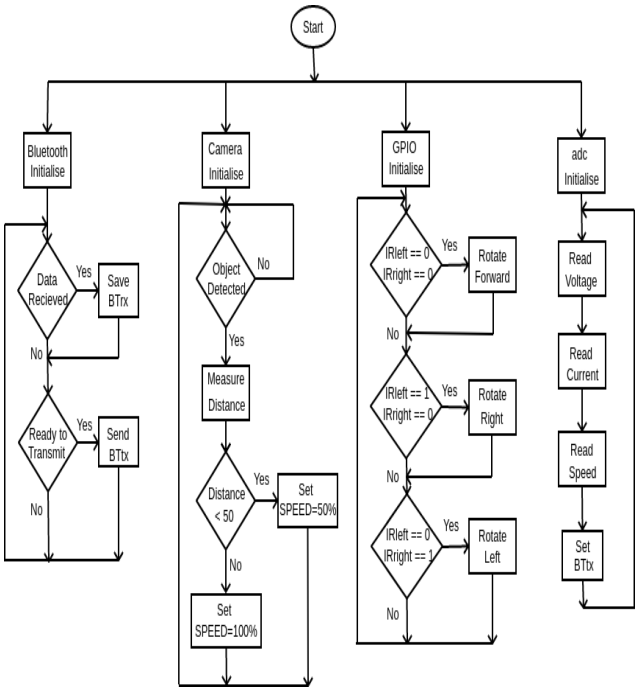
ADC (Analog to Digital Converter) which collects the data of speed, current, and voltage in analog form and convert into digital form, then transmitted via Bluetooth Raspberry Pi, which is display in-app. Raspberry-Pi is a 'Single Board Computer' that performs operations similar to the desktop or laptops. It supports Linux operating system (OS). Along with the OS it also requires monitor, keyboard, and mouse to operate the OS initially, which can increase the cost of the system. The solution for this is 'Headless' computer, one that operates

without a monitor, keyboard, and mouse. Once the 'headless installation' is done, raspberry can be operated remotely by the host computer.

3.1 Circuit Diagram



3.2 Flow Chart



4. MERITS AND DEMERITS

4.1 Merits:

1) It uses energy efficiently and uses a renewable source for its motion.

2) It minimizes the need for charging stations.

3) Plays a prominent role in regulating the count of a road collision.

4) Battery efficiency increases and often replacement of the battery is reduced.

5) Less maintenance and cost-effective.

6) It also provides a timeline record of the driver.

4.2 Demerits:

1) Due to the addition of parts for wheel alignment results in a reduction of speed.

2) It is hard to overcome friction.

5. FUTURE SCOPE

In many aspects still, the EV has to be enhanced. Firstly, electricity isn't a freely available source. Burning of Natural gas and coal, the emission CO_2 takes place. Comparatively it's better than CO emission but not the best way. So,

- If charging of vehicles is based on renewable sources then purely it is eco-friendly.
- Hopefully, the charging of batteries should be made faster and instant.
- The development of clean batteries is also highly required for a clean environment.

6. RESULT AND CONCLUSION

TABLE 1: Output Data

Device	Parameters		
	Voltage (v)	Current (mA)	Speed (rpm)
Generator	5-8	50-60	120
PV Cell	12	500	120

GENERATOR: It generates 5V and 50mA.

Po = V*I = 5*0.05 = 0.25W.

SOLAR PANEL: It generates 12V and 500mA

Po = V*I =12*0.5 = 6W.

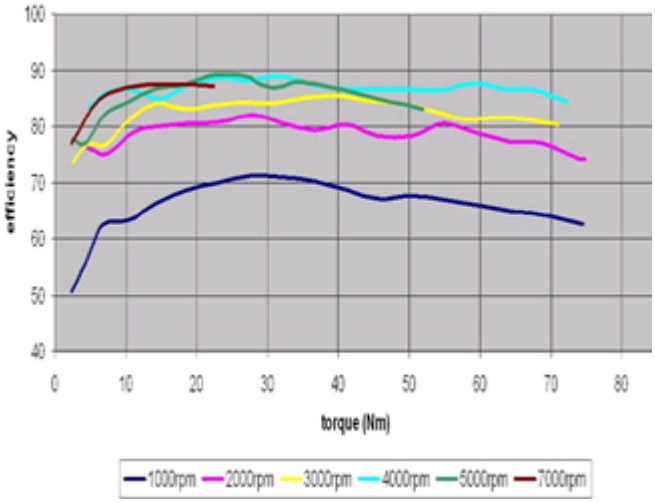


Chart - 3: The relation between efficiency and Torque under difference speed

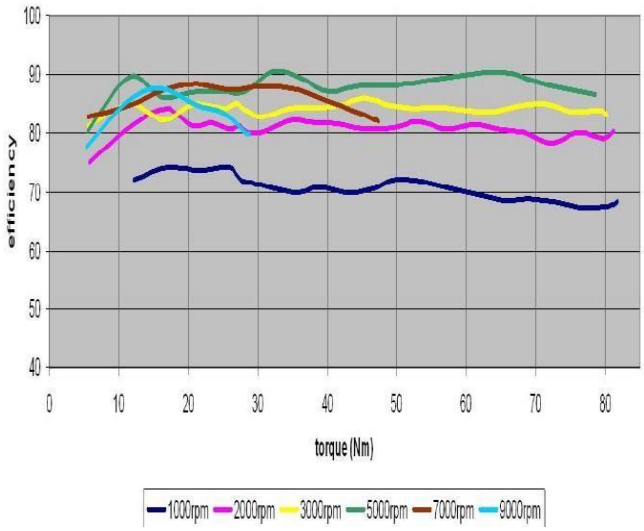


Chart - 4: The relation between efficiency and Torque under difference speed with solar cell

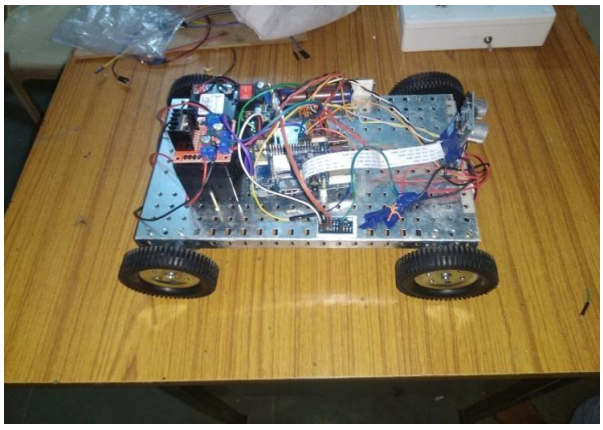


Fig - 1: Prototype Model

Fig – 2: Readings obtained in Graph

In this paper, the drawback of EV is overwhelmed in a cost-effective method. The battery efficiency is improved and the smooth operation takes place during sudden acceleration and regenerative braking system hence only in the needed condition the energy is used from the main battery and the rest of the time it runs from the energy generated from the generator and solar cell. In this project 40-45W of power is generated and utilized for as battery backup. The fingerprint authentication is used for starting the vehicle and stopping the vehicle by maintaining the timeline records of the driver. The worst circumstance road collisions can be reduced by automatic speed control of a vehicle by the use of advanced controller boards like Raspberry Pi. The energy can be utilized in an efficient and optimistic method with automatic switching of beam light.

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REFERENCES

[1] M. Al Rizwan Khan, B. Gowtham, A S Akash Saravanan, R. Arun Bharathi, A. Elakya, “Smart Electric Vehicle”, 2019 5th International Conference on Advanced Computing and Communication Systems (ICACCS 2019).

[2] Syed Muhammad Arif, Tek-Tjng Lie, Boon-Chong Seet, “ANovel Simulation Model for Analyzing the state of charge of Electric Vehicle”, IEEE-2018.

[3] Cristian Lazaroin, Mario Pagano, Naples, “Smart Agent to Optimize Recharge of Electric Vehicles(EVs) into Smart Cities", International Symposium on Power Electronics, Electrical Drives, Automation, and Motion-2018.

[4] R. D. Thombare, P.M. Sawant, P.P. Sawant, P.A. Sawant, V.P Naik, "Automatic Speed Control of Vehicle Video Processing", Preecidins of the 2nd International Conference on Inventive Communication and Computational Technologies (ICICCT-2018).

[5] Vidhyotma, Jaiteg Singh, Davinder Virk, "Bluetooth Enabled anti-Theft System Using Android Based Handheld Device", 978-1-5386-7050-7/18 IEEE-2018.

[6] Yuchen Ma, Junhong Wang, Weibin Hon, "Smart Antenna with Capability of Beam switching for 5G Applications", 978-1-7281-07281-0716-5/19 IEEE-2019.

[7] Joao C. Ferreira, Vitor Monteiro, Joao L. Afonso, Alberto Silva, "Smart Electric Vehicles Charging System", IEEE Intelligent Vehicles Symposium Germany, pp. 758-763, 5-9 June 2011.

[1] K.Jaber, B. Ben Saleh, A.Fakhfakh, r.Meiji, "Modelling and Simulation of Electric Vehicle in VHDL-AMS" 16th IEEE International Conference on Electronics, Circuits, and systems, ICECS 2009, pp.908-911, ISBN 978-1-4244-5090-9, Dec 2009.

[2] D. B. Richardson, "Electric vehicles and the electric grid: A review of modeling approaches, Impacts, and renewable energy integration," Renew. Sustain. Energy Rev., vol. 19, pp. 247–254, Mar. 2013.

[3] U.S. Department of Energy, 2012. SunShot vision study. DOI: SunShot, Energy Efficiency, and Renewable Energy U.S. Department of Energy NREL Report No. BK520027; DOE/GO-102012- 3037.