COMPLETE VEHICLE SAFETY & TRACKING SYSTEM WITH AUTOMATIC RECHARGING

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Abstract – *Car Safety has become a vital question as the number of cars on the roads are growing day by day and as the cars are getting better and better in terms of their engines and power output so consequently there is also a gigantic problem of road accidents.*

Rapid surge is also observed nowadays in carjacking because of absence of safety apparatus existing in the cars as the domestic low budget car companies lay off these expenses as these device's borderline there manufacturing budget.

So, if there is a system that is industrialized in low budget that can track the car, can provide safety information, can record the car information and can also recharge itself that will be a boon.

Keywords- *Tracking, Speed detection, Speed sensor, Recharging, GPS & GSM module, ESP 32.*

1. Introduction

The vehicle accident and theft are a major problem nowadays, in the year 2018 the number of road accidents reported in India were 467,044 and the number of vehicle thefts were 40,972.

The automotive industry has a mindful about these crimes and accidents but the low budget car manufacturers don't provide a resolution to these problems as they are very parsimonious on their budget for mass productional profit so a device which is an amalgamation of many safety systems required for a vehicle is very beneficial for the companies as well as for people who have formerly bought a vehicle and are now theft and safety concerned.

The system performs vehicle tracking by using GPS technology which can be used for locating a vehicle which is displaced, lost or if somebody wants to access its location, the location stat contains the position as well as the speed at present of the vehicle which is measured using a speed sensor embedded with the system.

Apart from these parameters the system stores the collision speed in case of an accident or collision to be used for further prognosis by the maintenance team, research and development unit of the car manufacturer or the insurance company and to draw the final card the system is running on a flow battery that can be recharged by the car battery itself so there is no need for adding an extra power unit and making over the top adjustments for placing this system in the car.

2. Literature Survey

Many kinds of researches have been done in the field of car safety and tracking and some of these devices are evidently used in cars or can be assembled independently.

There are even researches on vehicle black box systems that can be used for recording the traces or information of the vehicle if it undergoes a serious calamity.

Some projects are employing IOT, ML (Machine learning) and mobile phone applications to provide location and safety information in an accessible and user-friendly way but that increases the cost and deviates the project towards a software-based domain.

One paper that I came across while researching discussed the idea of linking the safety system with the inbuilt vehicle infotainment system by adding a GSM and GPS module to the already assembled system it was quite an economic method but it was not properly justifying the entire problem regime.

Another paper inculcated the idea of a system that was a vehicle black box but it calculated the assessment of an accident by using a lot of sensors and no idea of storing the information or speed detection was given, many papers presented the idea of accident detection as well.

So, by an extensive research I found out that no system deals with the collective problem statement solution of vehicle tracking, speed tracking, activity control and vehicle safety with a regenerative charging response of the system and that is why I went ahead with this idea.

3. Methodology

This system is designed in such way that it is powered all the time so that the position of the vehicle can be tracked even when the vehicle is not ignited. But as the battery used in the system is a flow battery it is recharged by the car batter itself and that is the purpose of using flow battery and additionally these batteries don't discharge very quickly because of passive inter-oxidation.

The operation of this system is such that there is a GPS module that tracks the system via satellite communication and will give us the exact position in a 3-axis coordinate system which will be given as coordinates.

The speed sensor has a bipartite operation in this arrangement, the sensor is attached to the system but the actual actuator part is placed in the speed rotor of the car from where the speedometer also gets the moving speed.

So, the speed sensor is programmed in such a way that it stores the speed of the car in real time and sends it whenever a demand arrives in GSM module to send the location and speed, GSM module sends a text message to a programmed mobile number as the module is embedded with a SIM card also, consequently the text message received by the owner will contain the geographical coordinates which can be traced to the actual location easily with the speed of the car.

Secondly, the speed sensor also stores the maximum speed in a particular duration in a 256 Kb EEPROM so that the speed in case of an accident can be known and recovered. The ROM is automated in such a way that every time the driver drives faster than the previous threshold highest speed, the faster speed takes the first priority in storage and this continues until a trip is completed which is measured as the time when the battery stops powering the car i.e., the car is switched off.
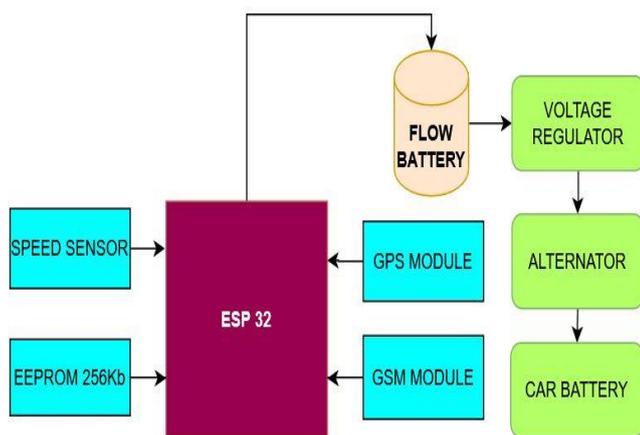
Fig 1. Block Diagram depicting the functioning and components of the proposed system.

4. Hardware Specification

The detail about the constituents involved in the working of this set up are discussed below.

a) ESP 32

ESP 32 is a SOC (system on chip) based microcontroller with embedded system for Wi-Fi and bluetooth connectivity, it uses a constant DC of 3.3 V to operate and has a SRAM of 32 Kb, it is the best suited microcontroller for connecting sensors and lesser no. of peripherals it is best used for controlling and automation.

Fig 2. Image of an ESP 32 Controller

b) Speed sensor

Fig 3. Speed Sensor

Speed sensor is a type of sensor that can detect the speed of a vehicle by its internal circuitry that measures the frequency of movement of the connected apparatus and transmits the speed value as signal which is further processed by our microprocessor, the speed is originally in RPM and is converted into Kmph or Mph for our use.

This speed sensor used here is RICO TM1C whose internal actuator is connected with the rotary shaft of the car as mentioned before. It has a frequency of 15KHz and requires an input power of 8V to operate.

c) Flow battery

Flow battery is an electrochemical cell that works on the principle of reduction-oxidation so it recharges and charges quickly it is made by using 2 electrolytes separated by a membrane that are pumped for flow of electrolytes.

These are not manufactured broadly so one has to develop this battery in a laboratory based on the required power, use and size.

d) EEPROM

EEPROM stands for '*electrically erasable programmable read only memory*' it is used for storing the speed values in our project, the model we are using is AA02UID has a storage of 32Kb with clock frequency of 10 Khz and needs a voltage of 5V to operate it can be programmed easily to erase and has an erase/ write cycle of about 1 million times.
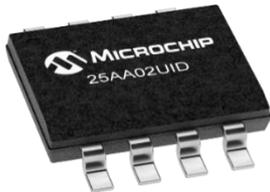
Fig 4. EEPROM AA02UID

e) GPS and GSM module

As everybody is quite familiar with GPS and GSM modules, I will not elaborate their statistics but will discuss their application here, GPS is used in our project to get the location as geographical coordinates and GSM module is used for sending an SMS to the owner with the location and speed on user's mobile number.
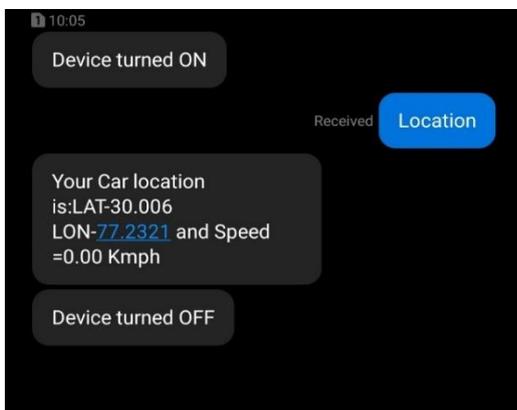
Fig 5. Resulting message that is sent by GSM module with coordinates from GPS

The software tool used for programming ESP 32 with the sensors and other devices is Arduino IDE with the library '*esp-idf*'.

5. Application

- This system can be used in all type of vehicles for tracking and speed monitoring, preventing theft and over speeding.
- Can be used after an accident to determine the driving speed of the vehicle as it saves the entire array of speed values in the whole journey.
- Can be used by the taxi service providers in their cabs to track the position and speed of any driver.
- Can be easily assembled in any car, its cheap and no constant power supply is required.

6. Results and Conclusion

Through this project I am trying to make a system that if fixed in a vehicle can track its position and speed just by the user demanding it through a text message thorough the GSM module and location gathering by GPS module. It is also proficient in recording the speed of a vehicle throughout the trip which can be accessed in case of any mishap, it is powered by a flow battery that is recharged by the vehicle or car battery itself.

7. Future Scope

- The μ processor ESP 32 is inbuilt with a Wi-Fi module and bluetooth so any extra apparatus for car safety can be attached afterwards also with ease.
- To make this system even more efficient we can programme it using machine learning and AI algorithms.
- The size of this system can be reduce further making it even more accessible.

8. References

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