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Smart Vehicle Management Using IoV

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Abstract—The Internet of things (IoT) is the network of physical devices, vehicles, home appliances and other items embedded with electronics, software, sensors, actuators, and connectivity which enables these objects to connect and exchange data. It is the way in which all things are enabled to talk with each other. Whenever those smart things being connected over internet are restricted to only vehicles, then it is called as Internet of Vehicles (IoV). With continuously increasing urban population and rapidly expanding cities, vehicle ownership has been increasing at an exponential rate. Hence, vehicle management has become a great problem in our day to day life. We attempt to provide an IoV based vehicle management solution to overcome the problem that is prevailing in our daily life.

Keywords— Internet of Things, Internet of vehicles, Vehicle Management, Monitoring, Communication, Server

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I. INTRODUCTION

The internet in today's world is a global phenomenon. With more and more devices becoming internet friendly, vehicle management in transportation working with the internet becomes easier. As vehicle ownership has been increasing at an exponential rate, problems like safety of the vehicle and traffic management arises. It is logical that the monitoring of car, the driver and emergency response to road accidents should also be taken care to make life easier.

The traditional solution offered to this problem is monitoring the vehicle's condition manually. This strategy does tend to fail when it comes to the safety of the driver and the vehicle. This is where Internet of things (IoT) comes into play as it provides a faster and automatic response which would help the driver in emergency situations.

Out of many proposed methodologies with wireless sensor networks in vehicle management, the prospects of Internet of Vehicles (IoV) stands out. We mainly focus on discussing the methodology, advantages and hindrances in creating an IoV.

The basic concept of IoT in smart vehicular management has been accepted and is being put to use to make life easier. The deployment of this concept proposes significant advantages in handling the safety of vehicle, driver and to some extent, traffic. The connection of various hardware devices which include sensors, camera and on board processors to the internet as well as their interconnectivity enables to take decisions via pre-embedded algorithms.

Therefore the objective of this paper is to demonstrate how IoV can be an effective strategy in dealing with the drawbacks of conventional techniques in vehicular management.

II. METHODOLOGY

For the prospects of Internet of Vehicles (loV) to be a reality, the vehicles need to be able to work and

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communicate seamlessly. Communications in this proposal are as follows:

A. Communication between the vehicles and the vehicle owners

B. Communication between vehicles and a centralized server

C. Communication between server and third parties.

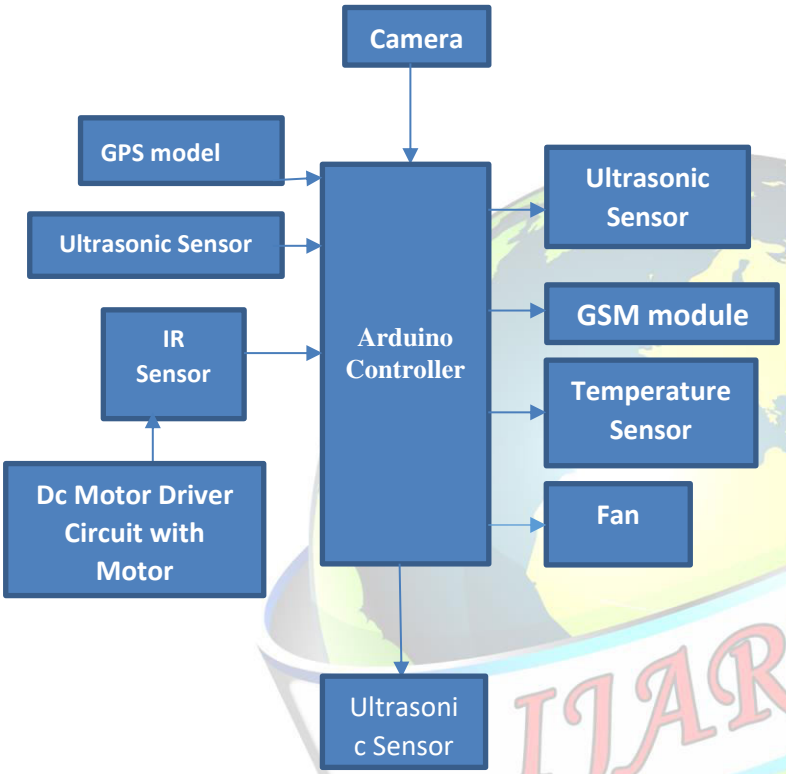

Figure1. Block diagram for the Smart Vehicle system.

To enable these communications following methods are adopted:

A. Communication between vehicles and the Vehicle Owners

To enable the user to receive active updates even when the vehicle is not being used and when the user is away from the vehicle. The system is using the Arduino Uno controller to develop the intelligent system to ensure vehicle's safety and to also control the vehicle in traffic .The information between the vehicle and the vehicle owner is communicated using an android application, connected to cloud space.

The active updates mentioned may involve

a. Towing alert and security alert about the vehicle.

b. Temperature alert about the vehicle.

c. The attributes like proximity, vehicle lock and collision detection.

d. Collision alert (when the vehicle is in motion).

The system consists of IR sensor which is used to detect obstacles and collisions when the vehicle is parked. A DC motor is installed in every tyre to detect towing or theft of the vehicle. An alert message is sent to the vehicle owner if the motor rotates in the stationary state . When the vehicle's temperature exceeds a threshold temperature, the temperature sensor detects it and automatically switches on the fan to lower the temperature. Ultrasonic sensors are installed for detection of obstacles around the vehicle when it is in motion. It also provides the distance between the vehicle and the obstacles, helping the driver to avoid accidents. The alerts are also sent to the vehicle owner through GSM module.

B. Communication between vehicles and a centralized server

The data monitored from the vehicle is relayed to the nearest communication node via an onboard Arduino controller. The node in-turn communicates the data via a satellite to the communications node of the server which monitors breaches. The server stores the data in the database and analyzes the data for the breach. It then provides a suitable solution to the vehicle through the same channel from which it received the messages which is shown in Figure 2.

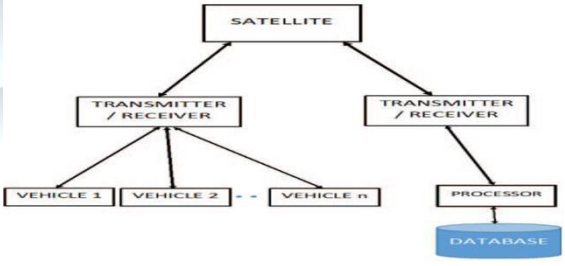

Figure 2. Vehicle to centralized server communication

C. Communication between Server and Third

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Parties

This mode of communication occurs between the server and the third parties including:

1. Emergency response like ambulance, fire-engine
2. Police patrol

Data deemed to be of primary concern are the data regarding vehicular collision, temperature spikes, theft etc. When these data are reported from the onboard controller on the vehicle, to the server, they are forwarded to the respective third parties. The exact coordinates of the vehicle is sent to the third party through Global Positioning System that is installed in the vehicle.These third parties then correspond directly with the vehicle under consideration and take measures to provide necessary assistance.

III. SENSORS USED

A. *Infrared sensor*

An infrared sensor is used to check the surroundings of the car for any obstacles or objects that may cause damage to the car on collision. The implementation of the infrared sensor is done through the sending of infrared signals outwards from the car. On striking an object the value returned is high and a suitable hazard message is displayed to the user. If there is no object or obstacle the value is low and the path is declared safe.

B. *Ultrasonic sensor*

Ultrasonic sensors are being widely used in cars for reverse parking purposes. The same concept is used to increase the safety of the car by the detection of the distance between the car and an obstacle. The implementation of the sensor is done through two signals. Firstly, the echo signal is sent into the atmosphere to check for the object or obstacle of an object is struck by the signal a trigger signal is sent back to indicate the presence of the object. The time taken by the the echo and the trigger signals are calculated. Hence,the total time for the to and fro motion is obtained. The distance is obtained by using the time and speed and of the signals. The value is halved during the calculation because of the up and down movement of the signals.

C. *Temperature sensor*

Temperature sensors, suggestive of their name are used to detect and provide live temperature feeds of the surroundings. Most temperature sensors are analog value based but for practical purposes we require digital values. The temperature sensor reads the values in analog form and calculations are done based on the maximum voltage applied and the number of total values to obtain the equivalent digital temperature. In this paper the temperature sensor serves the purpose of obtaining the live temperature, a predetermined threshold temperature is chosen and on this temperature being crossed the fan of the car switches on automatically. This concept helps in keeping the car cool at all times and preventing over heating of the interiors.

IV. RESULTS

Enabling internet in each and every vehicle on the road can pave way for complete automation of vehicles. The concept of internet of Vehicles (loV) improves the safety of the vehicle, the driver and can be extended to all modes of transport, making a significant difference in the way that communication occurs between different media of transport.

V. CONCLUSION

This paper identifies the potential advantages of implementing the concept of Internet of Vehicles (loV), over the concepts based on traditional Internet of Things (loT) in vehicle management. The research is intended to suggest a more organized and safe method of vehicle management which will help serve the needs of the user.

This study can also be used in bringing up better architectures and strategies for smart vehicle management. This will in turn make an impact on the effectiveness of the monitoring of vehicles and also improve emergency response to traffic incidents.

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