SMART TRANSPORTATION SYSTEM WITH SIMULATOR TESTING

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Abstract: Internet of Things, a colossal network of everything around you and your internet, the trend of today, inspires a striking change in the transportation system. This paper focuses on a self- aware vehicle with internal data analytics, a data-management system to anonymously collect and examine data for better routing plans and early warnings and a simulator to avoid the risk of testing such a vehicle system on road.

Index Terms **- IoT, Database, Android Application, Testing Simulator, Smart cars.**

I. INTRODUCTION

From providing adequate security services for the vehicle to a superior route planner, a smart vehicle system is introduced to lessen the maximum trouble or to enhance more facilities using generalized equipments which includes simulation kit On-Board Diagnostic connector to scan out variable framework of the vehicle with CAN communication link and a Data- management system to continuously receive the statistics of the vehicle and constantly yield the corresponding solutions for that and these data are stored in an organised database which eases the access of it. The system comprises of various sensors which recognizes the faults in the data and diminishes it. The services of these sensors can be collectively called as Sensing as a Service (SaaS). These whole services use IoT as a base for the proper functioning of the system. The hindmost part of the paper presents the smart taxation system.

II. BASE

The Internet emerges as a deep network of technologies such as Internet of things, cloud computing and artificial intelligence, transportation system can be modernized. An IoT based smart network of numerous vehicle with an organised database stored in cloud structures using artificial intelligence to advance the routing methods. To enable vehicles for such a smart network, sensors are used showcasing SAAS. Sensors are inexpensive and therefore, correctly suited for the former network. A meticulous analysis of data received anonymously via mobile networks (3G/4G/Bluetooth) from the smart vehicles accumulated through the sensors, result in early warnings and better routing. A simulator is best suited to avoid the inexorable risks of testing the system in an open road-web and gather performance statistics.

1.1 INTERNET OF THINGS

IoT literally refers to a network of connections between the physical actuality and the internet which leads to the more advanced world. Through IoT, various collected data from the devices can be analyzed and evaluated over the internet to give accurate results in the real time. This interpretation of data further helps in the performance of the whole process and makes it more precise. IoT has a powerful parallel interconnection with all the embedded gadgets placed at different locations and these devices linked with the internet are often called as smart devices. IoT also includes a RFID technology in which a tag is used on the entity to make it unique and identifiable from a certain point. This object acts smartly by putting some intelligence into it. These smart entities are extensively used in IoT.

1.2 SIMULATION

Simulation is creation of a model that can be manipulated logically to decide how the physical world works. It is to provide an experience of reality in closed and restricted environment with the help of manipulation with different senses such as sound effect, 3D visual effects, heat, body movement and smell. With the accelerated advancement of gaming world, a real-time reality experience is accessible virtually. These experiences are not only used in gaming but they are also used to train pilots and astronauts, virtual experiences of healthcare, testing, safety engineering, etc. Hence, it can be used in performance optimization and analysis of the proposed vehicles as it would strike out the risk of dealing with technical issues during on road testing.

III. SMART VEHICLE

To advance the transportation system, there is an urgent need for smarter vehicles. Connected cars offer a new vision for the best driving experience. OBD connector is used to extract the information and display it to the user from the vehicle's internal

computer but still there are functions such as GPS which are not available in the OBD connector. To avail the GPS, GSM modem is used. Many sensors are used for the smarter functioning of the vehicle such as PI camera (when a vehicle is stolen, camera gets activated and captures both the internal and external pictures/videos in HD of the vehicle), door lock sensors (when an unauthorized user tries to access the vehicle, the door lock sensor gets activated and the user is intimated through the SMS), proximity sensor (it records if any human motion is sensed in the vehicle via heat sensing). To handle the ciphering of the chip, Raspberry Pi with Linux based OS is used for ease and cross- platform implementation. Android application is developed in Android Studio in which all the details of the car are shown. In case of car theft, GPS location services is enabled and the PI camera captures the pictures and send it to the users device, all the data is then transferred to the database where the previous records are stored and it may be referred for further investigation.

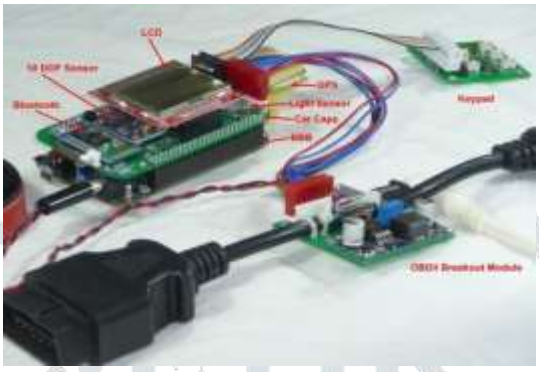

Fig. 1 OBD2 Connector

IV. DATA MANAGEMENT SYSTEM

A provisional name for the data storage and analysis system is Data Management System. As the name suggests, it is to retrieve data from the vehicle or the simulator, preserve it anonymously and later with the aid of artificial intelligence, returns warnings (which includes possible accidents or deficiency in vehicle's health) or solutions to problems(such as shortest path to an Hospital after small accident, aid of vehicle tow and ambulance, etc) which are already encountered. The system initially fetches the information via mobile networks such as 3G/4G/Bluetooth from the vehicle. It'll accept the data in in form of queries to accumulate it in the databases. It leads to a better organisation of data leading to easier searches and data analytics. Artificial Intelligence can then be used to interpret shortest/time-efficient route for vehicles and their destinations. It is also possible to charge a valid fee from users and in return provide them with enquired information, hence turning the system into a city based or larger network. The constant data can also contribute to a fairer taxation system based on the distance covered, parking time, etc.

V. VEHICLE SECURITY APP

This application is introduced for the sake of the vehicle's security which is suitable to install on any android smart phones. This app is parallelly connected with the car's real time location and smartly notifies the driver with any of the mishappenings occurred with the car. It is ultimately a smart tracking system which sends alert signal on disallowed actions taking place. The driver can also operate the lock/unlock system of the vehicle directly through the app. The vehicle consists of door lock sensors as well as the proximity sensors which spots unusual motion inside the vehicle and directly reports the particular action to the driver through this app. On unauthorized handling of the vehicle, the driver can immediately have a track on vehicle's current location with the help of GPS and the camera placed in the vehicle could click the inside and outside pictures of the car and sends these data to a data-management system which helps in tracking the vehicle faster. These functionalities of the app is itself a solution for vehicle's safety.

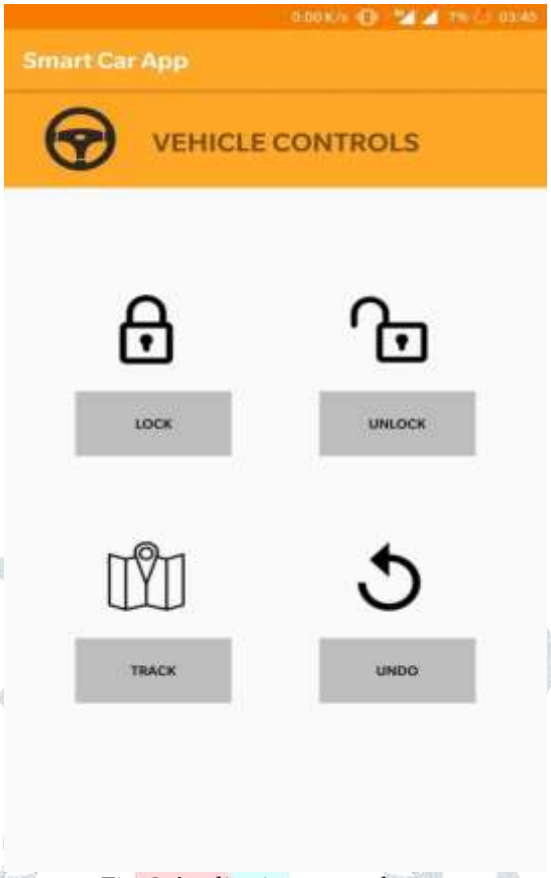

Fig. 2 Application screenshot

VI. VEHICLE SIMULATOR

The simulator is used here to provide a real experience of a vehicle i.e. it provides the realistic imitation of the functioning and the operations of the vehicle. A major problem is encountered during the implementation of the project, that is we cannot test the vehicle practically with its functionality unknown. To overcome this issue, use of on-board Diagnostic (OBD) connector is proposed which is connected through the vehicle's internal computer. OBD connector is used to extract the information and display it to the user (for example if the oxygen level of the vehicle is low, then the OBD connector records it and unveil it in the screen). It is undoubtedly unsafe to drive a car while keeping an eye on untested microcontrollers. Through the CAN bus, the data is transmitted from the OBD connector to the vehicle for which Beagle Bone Black (BBB) is used as a base. BBB is an open source, low cost, development platform for processor development. Realistic data in datasets can be attained if trip data are recorded with the aid of RTR (Real Trip Runner) and is further virtualised via VTR (Virtual Trip Runner) to inspect whether recorded data coordinates with the real data.

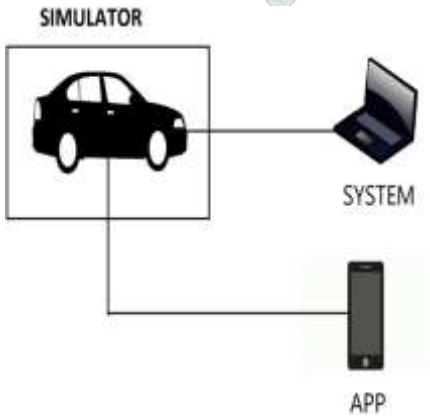

Fig. 3 Vehicle Simulation Prototype

VII. THE REFORMED TRANSPORTATION SYSTEM USING IoT

The whole working system of this project gives the desired result with the coequal interconnection of the above mentioned components. Each component has an integral contribution to yield the best performance of the system. In today's ongoing plot, the real time use of these equipments has not been implemented, this project offers the actual utilization of those hardwares. As the OBD2 connector is used in garages for interpreting the state of the vehicle is taken forward to apply it in real time with the vehicle. These observed data could be potentially used to warn the driver regarding the security, condition and way plans of the vehicle through a well organized data-management system which consists all those data in systematic database for ease of the use. Also, an android studio application is made liable for the ease of handling the reliability of the car directly. Throughout this project IoT has been the groundwork to link these and form a foremost network. Moreover, for testing these services a simulator is used as a prototype to know about the proper working of the desired system and to check its safety. Integrating all these services gives a facilitating and more advance transportation world.

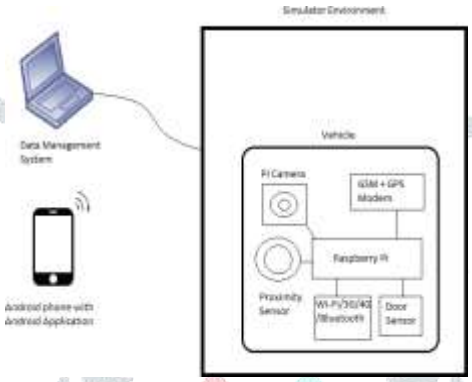

Fig. 4 Reformed Transportation System

VIII. CONCLUSION

The project focuses on upgrading of the transportation system as a whole. With the habitat too dense, real estate too expensive and public finances too fragile, significant network expansion is impossible. Hence, current way of thinking does not works signifying wastage of time, energy and human potential. Therefore, a modernized system using technology to the fullest is proposed. It focuses on concentrating the human potential at vital positions only. It customises vehicle in such a manner that it's an aid instead of liability. Smarter vehicle is now self-sufficient to warn about upcoming problems due to internal faults and with the help of data management system, immediate solutions to real time problems can be accessed. In case of theft, the car can be tracked and its specifics / whereabouts are easily accessible to it's owner via the android application. A simulator is used to avoid the risks of technical faults and to analyse the performance in given scenarios.

IX. FUTURE SCOPE

As a project ahead of it's time, the system cautions about the urgency of the need for a better transportation system. As the proposed system advances the currently existing vehicle system, there is an immediate need for its real time implementation. Further, it can be enhanced by the addition of prominent technologies such as IBM WATSON (which when added to the system, will use cognitive and problem solving skills to implement the proposed technologies in a quick and smart manner), IBM bluemix (which is an open sourced cloud system, when used, it will provide sufficient and secured data storage space). Also, the use of AI in association with IoT concepts, street lights can be connected in the system to provide even the minimalized information, hence making the network deeper and precise. Such advancement in transportation system would be a true contribution to a smarter world.

XI. ACKNOWLEDGMENT

This is to express our gratitude to everyone who contributed in effortless completion of the paper. Firstly, we would like to thank our guide Ms.C.Ashwini for her valuable guidance throughout the process and provide us with all the necessary support that was required to successfully complete our paper. Also, it would not have been possible without the guidance and support of our esteemed computer science department. Lastly, we appreciate the worthy suggestions of our colleagues.

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