Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF VEHICLE TRACKING AND MONITORING SYSTEM BASED ON IoT

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DEDICATION

To my beloved parents, Ab Aziz Bin Hamzah and Paridah Binti Hassan, thank you for supporting me when I continue my studies in UTeM.

Not to forget, my supervisor, Dr Suraya Binti Zainuddin and my fellow friends.

ABSTRACT

The Vehicle Tracking and Monitoring System Based on IoT is a technological solution that enables real-time tracking and monitoring of vehicles using internet-connected devices. The system is designed to provide vehicle owners and fleet managers with the ability to monitor their vehicles' location, speed, fuel consumption, and other performance metrics. The system uses a combination of sensors, GPS tracking, and wireless communication technologies to gather data from vehicles and transmit it to a central server. The data is analyzed and presented to the user through a user-friendly interface that can be accessed from a desktop computer or mobile device. The system provides a range of benefits, including improved vehicle security, reduced fuel consumption, increased operational efficiency, and better driver safety. It is expected that the Vehicle Tracking and Monitoring System Based on IoT will become an essential tool for fleet management in a range of industries, including logistics, transportation, and construction. Hence, this project aims to develop a vehicle management system using an embedded controller to track all collected data, such as vehicle speed, vehicle location and mileage of the vehicle. A microcontroller will be used as the central processing interface with an On-Board Diagnostic (OBD) - II reader to diagnose all of the necessary data for the chosen car. Then, the information will be sent to a cloud server. Finally, after the data has been analysed, a real-time message alert will be sent to the driver and the maintenance team. This outcome of the project intends to improve the driver safety and can indirectly improve the business of rental car company owners.

ABSTRAK

Sistem penjejakan dan pemantauan kenderaan ialah platform perisian yang menjejak, memantau dan mengumpul data untuk mana-mana kenderaan yang menggunakan sistem ini. Sistem penjejakan dan pemantauan kenderaan juga membantu dalam pengurangan risiko yang berkaitan, peningkatan kecekapan, peningkatan output dan pematuhan peraturan. Ia serupa dengan papan pemuka berpusat di mana kita boleh menjejak dan mengurus kenderaan kita dari mana-mana sahaja. Walau bagaimanapun, mungkin sukar untuk mengenal pasti ciri kereta yang pelik, dan mungkin tiada teknologi tersedia untuk memaklumkan pemandu. Selain itu, sistem ini juga mengesan lokasi sebenar kenderaan yang dipilih untuk dijejaki bagi tujuan keselamatan. Sistem pemantauan dengan peranti praktikal pasti akan menjadi penyelamat dalam keadaan ini. Oleh itu, projek ini bertujuan untuk membangunkan sistem pengurusan kenderaan menggunakan pengawal terbenam untuk mengesan semua data yang dikumpul, seperti kelajuan kenderaan, lokasi kenderaan dan perbatuan kenderaan. Mikropengawal akan digunakan sebagai antara muka pemprosesan pusat dengan pembaca On-Board Diagnostic (OBD) - II untuk mendiagnosis semua data yang diperlukan untuk kereta yang dipilih. Kemudian, maklumat akan dihantar ke *cloud server*. Akhir sekali, selepas data dianalisis, makluman mesej masa nyata akan dihantar kepada pemandu dan pasukan penyelenggaraan. Hasil projek ini bertujuan untuk meningkatkan keselamatan pemandu dan secara tidak langsung dapat meningkatkan perniagaan pemilik syarikat kereta sewa.

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First and foremost, I would like to express my gratitude to my supervisor, Dr. Suraya Binti Zainuddin for his precious guidance, words of wisdom and patient throughout this project. I am also indebted to Universiti Teknikal Malaysia Melaka (UTeM) for the financial support throughout the project development which enables me to accomplish the project. Not forgetting my fellow colleague, housemates for the willingness of sharing his thoughts and ideas regarding the project. My highest appreciation goes to my parents and family members for their love and prayer during the period of my study. Finally, I would like to thank all the staffs at the Universiti Teknikal Malaysia Melaka (UTeM), fellow colleagues and classmates, the faculty members, as well as other individuals who are not listed here for being co-operative and helpful.

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CHAPTER 1

INTRODUCTION

1.1 Background

The auto rental industry is thriving these days. This is a highly competitive market, and the demand for these services has increased dramatically in recent years. Entrepreneurs must implement a business strategy that boosts productivity and successfully manages costs for their company to flourish.

The company's assets are automobiles. Monitoring might be a difficult task for the technical team when there are a high number of autos. In general, a big size company will also have a bigger fleet of vehicles to operate. They must manage complex yet complete care for their asset, the car, and ongoing repairs. The company must provide a safe-to-drive vehicle to be no breakdowns, and consumers will be more satisfied and likely to use the service again. As reported in the study (based on *Automotive-fleet.com* authors), passenger vehicles' average monthly maintenance costs increased by 3-5 % in 2018. In addition to labour and replacement parts, which are an expense for 32 % of fleets, there is a substantial cost of maintenance and repairs. Since adopting fleet monitoring software to monitor driver behaviour, 42 % of companies have seen a decrease in the number of incidents involving security. In general, organizations must take better steps to utilize costs and manage their finances to be more viable. rental car companies also need to think about how to use their assets that are rented out to users in which location. This is so that they can always track the rented vehicle so that there is no case of theft or loss of their assets as a company.

With cars out of sight, OBD will operate as a monitoring system to keep automobiles on track to be appropriately used and systematically. This integrated controller will read data from the cars and finally send database management. OBD-II will track the signal and interpret it to the appropriate code based on the operation used in this vehicles management system.

1.2 Problem Statement

The management of commercial motor vehicles such as automobiles, cars, trucks, trailers, and specialize vehicles is known as fleet management. Among the many purposes of fleet vehicle management are enhancing procedures, greater productivity, guaranteeing safety, cost reduction, and improving customer service and satisfaction.

A systematic fleet management system ensures reliable telematics that can monitor driver and vehicles, and another user. This system helps trucks, logistics, and bus companies manage their performance when it comes to safety and efficiency. Typically, the user or driver of the vehicles does not only stick to one user only. Thus, sometimes these deal with problems with tracking which user did the summon. Consequently, this developed system would easily track the vehicle's coordinates, thus revealing the driver at that time.

The fleet management system of this car rental business need to aspect several such as the resource management whereas the vehicle mileage whether it has reached the level of needing service or not, tracking the rented vehicle directly (live) and monitoring the speed of the vehicle used by the user.

All this behaviour generally needs to be updated manually by the users, technicians, or the drivers. Sometimes, cars might have a sudden broke down before the inspection which may leave a bad review for the car rental business's company for serving a risky vehicle for the customers. This might lead risks for the user whether accident etc. All of this are due from the human factor. Thus, this proposed project is hoped to be able to ease the management of vehicles.

1.3 Objective

i. To design a conceptual framework for the developed project.

ii. To develop a prototype of a vehicles management system based on IoT.

iii. To evaluate the functionality of the developed system.

1.4 Scope of Project

i. To design a conceptual framework of a vehicle's management system based on IoT

ii. To identify the components and modules to be utilised in the design.

iii. To develop a prototype of a vehicle's management system based on IoT.

iv. Simulation of the proposed system using Arduino IDE and Blynk

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Living in a developing country has shown to be a big stumbling block for any growing enterprise. The owner will curate the ideal technique to cope with the expanding process and adopt any form of strategy. They will set a tempo that will compromise the condition of growing the firm at the lowest possible cost. To keep expanding and achieving favourable outcomes, the fleet management system business must stick to their key to success of increasing productivity, reducing the man factor that can lead to car breakdowns, focusing on replacing only necessary parts to reduce car breakdowns, and monitoring fuel level to prevent fraud.

Fleet management is the management of commercial motor vehicles such as automobiles, cars, trucks, trailers, and specialised vehicles. Enhancing procedures, increasing efficiency, ensuring safety, lowering costs, and improving customer service and happiness are just a few of the numerous goals of fleet vehicle management. A well-designed fleet management system ensures that telematics can track drivers, cars, and other users. This technology aids trucking, freight, and transit businesses in managing their safety and efficiency. Typically, the vehicle's user or driver does not stick to just one user. As a result, these might occasionally cause issues with determining who summoned whom. As a result, the created system would be able to readily follow the vehicle's coordinates, disclosing the driver at the time. The resource management of the engine oil, the fuel tank level, the car's battery, and the condition of the tyres are all things that a car rental company's fleet management system must consider. All this behaviour must be modified manually by users, technicians, or drivers in most cases.

As a result, the OBD-II acting as an embedded controller used data reading and transmitting to a management database for monitoring purposes. OBD-II evaluated the signal codes and decoded them to the appropriate code. Several routes are employed to acquire details, materials, and critical data for this investigation.

There are several publications, websites, encyclopaedias, handouts, and technical papers available. Most online materials are gathered from websites such as ResearchGate, IEEE, UTeM, Google Scholar, and Mendeley.

2.2 Previous Related Works

2.2.1 Car e-Talk: An IoT-enabled Cloud-Assisted Smart Fleet Maintenance System

Shariq Hussain, 2020 [1] implements the uses of IoT technology by proposing the Car e-Talk that monitor the particular vehicles health. In this work, author present Car e-Talk, an IoT intelligent fleet maintenance system and cloud computing that monitors the health of the vehicle and reports any discrepancies related to the nearest maintenance centres. The system monitors vehicle sub-systems with special sensors. Data are collected and analysed for each registered vehicle and on the cloud platform, trends in the safety of vehicles and historical information are maintained for each vehicle. The information on the vehicle is graphically presented for quick analysis using data visualization techniques. The system proposed allows an individual to manage some or all of the fleet maintenance management tasks.

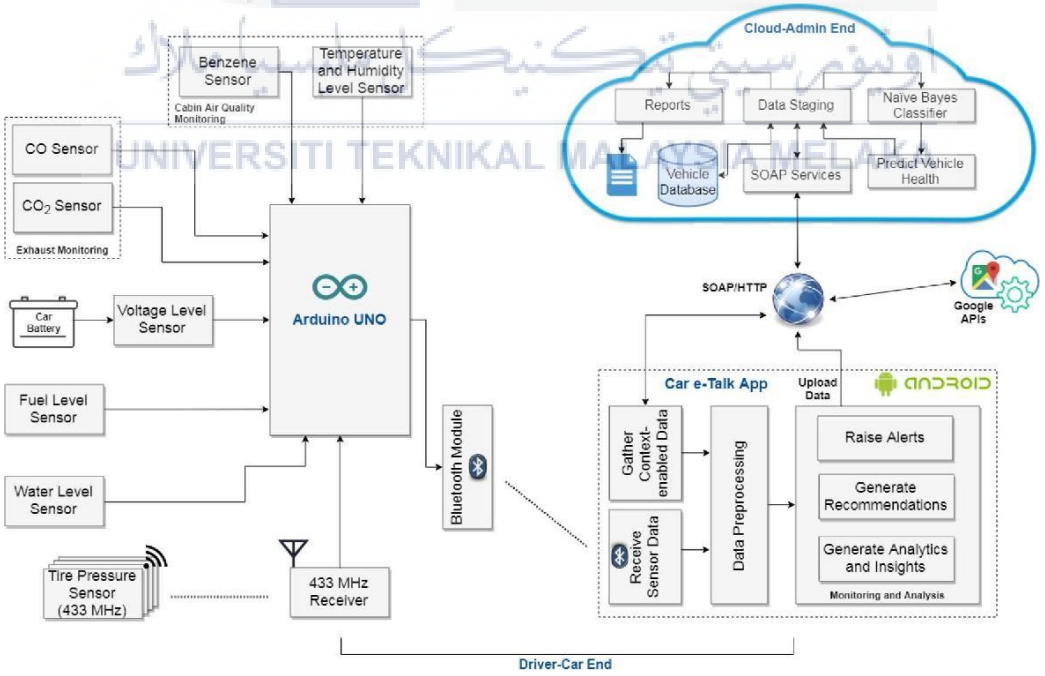

Figure 2.1 architecture of car e-talk

The recommended system must be implemented in order for the research to be focused, consistent, dependable, and successful. The Internet of Things (IoT) has the ability to address the problem statement for this study. A high-level illustration of the project's architecture is represented in Figure 2.1. The key components of this project, which are being developed concurrently, are the driver-car end and the cloud administration end. All of the in-vehicle data that has accumulated over time is stored on cloud-based servers, which is subsequently analysed in order to conduct additional actions. An Arduino controller that is interfaced with the vehicle's computer system is also driving this project. This main controller is also connected to a small number of sensors, which are used to extract specific parameters from the data. Gas sensors, humidity sensors, and voltage sensors are example of sensors that have been installed.

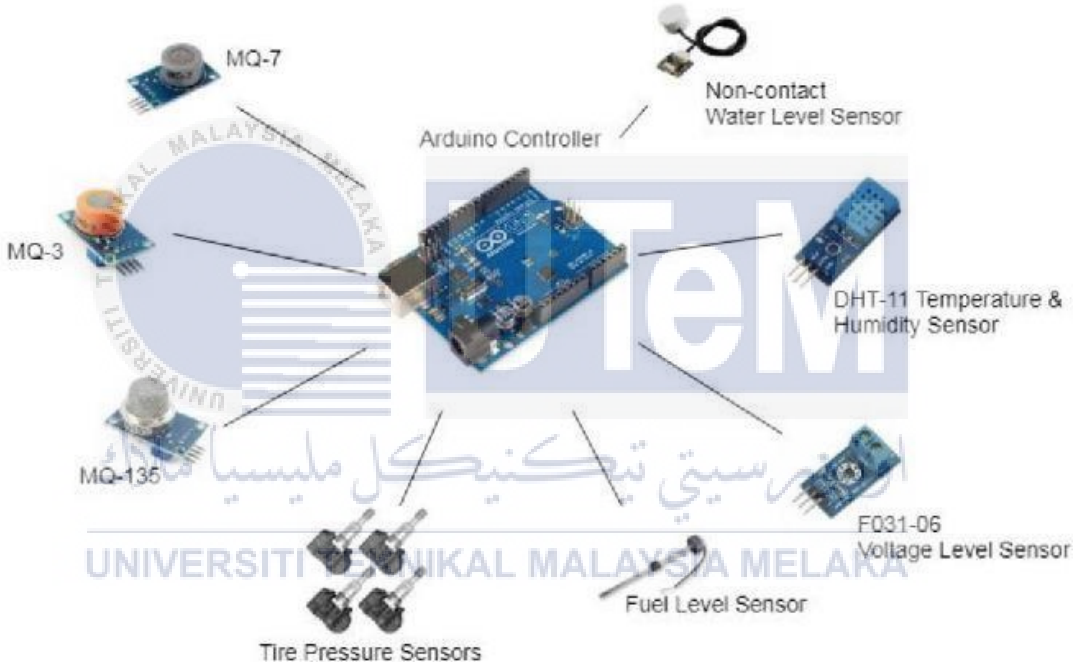

Figure 2.2 Arduino and sensing hardware

2.2.2 Design and Implementation of Fleet Management System Using Novel GPS/GLONASS Tracker and Web-Based Software

Figure 2.3 Fleet Management System Overview

Hamed Saghaei, 2016 [2] utilize a novel approach for measuring and managing a fleet management system is which includes three elements that are GPS/GLONASS-based automatic vehicle locators called Rad100, a GPRS/SMS GSM cellular network and web- based software (called PayaRadyab) to show the exact position of the desired vehicle on different maps. Apart from that, this approach also takes detailed reports of the mission, travelled path, fuel consumption, and so on. The proposed system's most notable features are its global coverage, high accuracy of positioning, ease of operation by the user at any location, and simple energy management. In this study, more than 50 Rad100 trackers as well as a web- based PayaRadyab software were developed. Not only that, their performance and accuracy were validated by practical results in a variety of conditions.

This project is powered by a system called PayaRadyab, which consists of a device called and a tracker. The Rad100 terminal computes and determines the precise location of the desired vehicle. The collected data will then be transferred to the specified web server via the GSM network's GPRS or SMS. Rad100 can obtain GPS information in two ways. Active trackers are instantly relayed to the GSM network and transferred to the PayaRadyab software. Live location and image will be provided automatically. Meanwhile, any journey recorded by

Rad100 can be downloaded later when the vehicle returns to its base for passive trackers. The Rad100 depicts the vehicle's speed and direction.

Figure 2.4 Rad100 Hardware and Box with Embedded Rad100 Tracker

2.2.3 Demo of a Low Cost Fleet Monitoring System

Venecia Alvarez, 2018 [3] provides a relatively low insight into a moderate fleet monitoring system for quasi purposes. The device and the service application are the main character to assemble the system. The device that understands the use of the Raspberry Pi as the main controller scans data from the internal network of the connected vehicle and sends it to a remote service. The primary aim of this research is to gather data from the vehicle and encode it to a Web-based application so that user can instantly reach the collected information. The data obtained from the vehicle, such as GPS coordinates, fuel tank, car speed, and engine state of health, is transmitted to a web server for further processing.

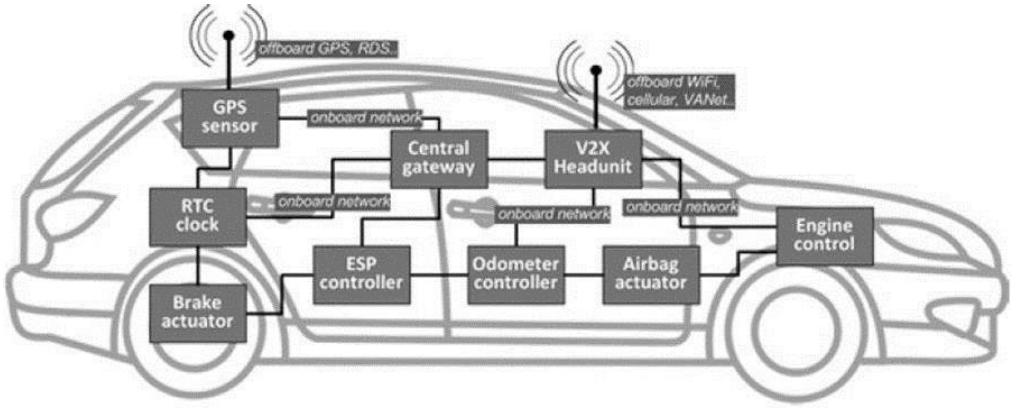

Figure 2.5 Vehicle Network Overview

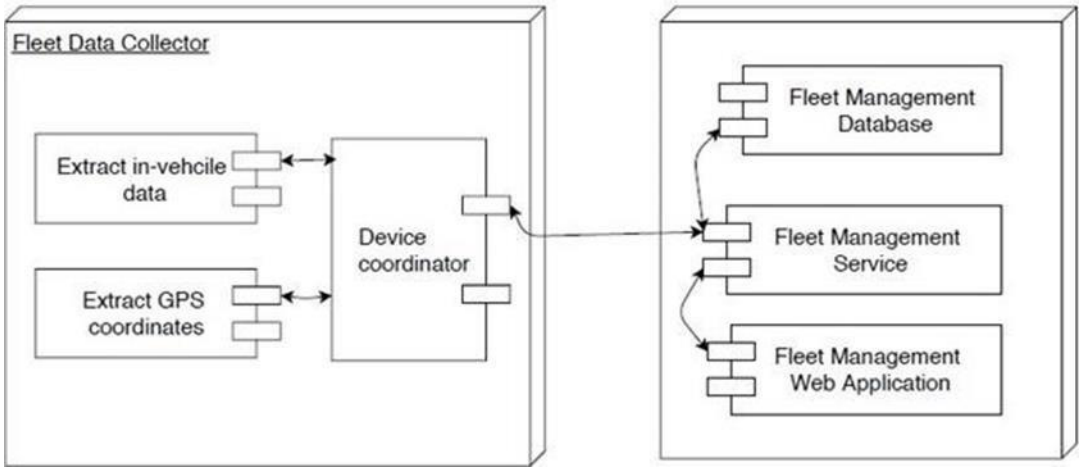

Figure 2.6 System Architecture of Project

The system is composed of four components which comprises of Fleet Data Collector, Service, Database, Web Application and is using Raspberry as the main controller.

2.2.4 Design and Development of On-Board Diagnostic (OBD) Device for Car

Pooja Rajendra Sawant,2018 [4] aim is to develop an OBD device for automobiles that are used to obtain real-time data and vehicle status is a priority. This dependable device keeps track of data from the specific vehicle, such as rpm, engine speed rpm, coolant temperature, pressure, and Diagnostic Trouble Codes (DTC), all of which are critical for maintaining the vehicle's health. Faulty errors can be identified and corrected, thereby reducing the risks associated with them.

KEAZ128 controllers connected externally to the Bluetooth module are used in the proposed methodology of this paper, which is described in detail in the paper. The ISO- 15765 CAN signaling protocol is used by the OBD-II system. A user-friendly DTC was displayed by utilizing a graphical user interface (GUI) that can provide information about the malfunction that occurred in the vehicle. This proposed design is simple and convenient to use.