Faculty of Electrical and Electronic Engineering Technology

Development of Embedded Controller for Fleet Management System

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Bachelor of Electronics Engineering Technology (Industrial Electronics) with Honours

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A project report submitted
in partial fulfillment of the requirements for the degree of
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I declare that this project report entitled “Development of Embedded Controller for Fleet Management System” is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : *fasiha*

Student Name : FASIHA NABILAH BINTI HUSAIMI

Date : 12/1/2022

APPROVAL

I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Electronics Engineering Technology (Industrial Electronics) with Honours.

Signature : shahrizal

Supervisor Name : Ts.Shahrizal Bin Saat

Date : 20/01/2022

Signature :

Co-Supervisor :

Name (if any)

Date :

DEDICATION

DEDICATION

To my beloved parents, Ab.Aziz bin Mat and Che Senah binti Deraman
My beloved siblings and friends. Not to forget my supervisor, Ts.Shahrizal bin Saat

ABSTRACT

A fleet management system is a digital platform used to monitor, diagnose, and manage automobiles. Fleet management also aids in reducing associated risk, the improvement of efficiency, the increase of output, and compliance with regulations. It's similar to a consolidated dashboard where we can monitor and manage all of our fleet and asset data. It is challenging to notice unusual vehicle elements, and there may be no technology that will alert the driver to the problem. As a result, preventing vehicular accidents is difficult since cars cannot promptly deal with their many faulty functions while on the road. A fleet management system with a practical device would undoubtedly be a lifesaver in this situation. As a result, this project aims to create an embedded controller for fleet management that can monitor all of the gathered data, such as car speed, engine oil, tire pressure, oil level, battery and eventually notify the system management. Aside from that, this initiative attempted to track automobile users via summons that occur as the user or driver keep alternating using Global Positioning System (GPS) coordinate. Furthermore, this project aims to reduce vehicle downtime and operating costs, notify the maintenance team using a mobile app when a battery, tire, engine oil, or gearbox oil needs changing.This project uses a micro controller as the central controller, with the ability to interface with an On-Board Diagnostic(OBD) - II reader and diagnose all of the essential data for the desired vehicle. The data will subsequently be transferred to a cloud server. Finally, when the data is examined, a message alert will be delivered to both the driver and the maintenance staff simultaneously and in real- time.

ABSTRAK

Sistem pengurusan kenderaan(SPA) adalah platform digital yang digunakan untuk memantau, mendiagnosis, dan menguruskan kenderaan. SPA adalah papan pemuka gabungan di mana ia dapat memantau dan menguruskan semua data kenderaan dan aset. Pemantauan bahagian kenderaan yang tidak mengalami kerosakan adalah bukan sesuatu yang mudah dan mungkin tidak ada teknologi yang akan memberi amaran kepada pemandu mengenai masalah tersebut. Akibatnya, pencegahan kemalangan kenderaan sukar dilakukan kerana kereta tidak dapat mengatasi banyak fungsi yang rosak ketika berada di jalan raya. Projek ini bertujuan untuk menghasilkan pengendali tertanam untuk pengurusan armada yang dapat memantau semua data yang dikumpulkan, seperti kelajuan kereta, minyak enjin, tekanan tayar, bateri dan akhirnya dihantar kepada sistem pengurusan . Inisiatif ini juga berusaha untuk mengesan pengguna kenderaan yang menggunakan kenderaan ketika saman dikeluarkan menggunakan koordinat Sistem Kedudukan Sejagat (SKS) .Hal ini kerana pengguna atau pemandu sering bertukar-tukar . Selain itu, projek ini bertujuan untuk mengurangkan kerosakan kenderaan dan kos operasi, memberitahu pihak penyelenggaraan menggunakan aplikasi mudah alih apabila bateri, tayar, minyak enjin atau minyak kotak gear perlu ditukar. Ciri ini adalah khusus untuk syarikat kereta sewa. Projek ini menggunakan pengawal mikro sebagai fungsi utama, dengan kemampuan untuk berkomunikasi dengan On-Board diagnostic(OBD) -II dan mendiagnosis semua data yang diperolehi daripada kenderaan. Data kemudiannya akan di kepada pelayan awan. Akhirnya, apabila data diperiksa, amaran notifikasi akan disampaikan kepada pemandu dan kakitangan penyelenggaraan secara serentak dan dalam waktu sebenar

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V	-	Voltage
km	-	Kilometer
Ω	-	Ohm
Km/h	-	Kilometer per hour

LIST OF ABBREVIATIONS

IC	-	Integrated Circuit
IoT	-	Internet of Things
INS	-	Inertial Navigation System
GMS	-	Global System for Mobile Communications
FMS	-	Fleet Managements System
OBD	-	On-Board Diagnostics
RTC	-	Real-Time Clock
GPS		Global Positioning Position
ECU	-	Electronic Control Units

LIST OF APPENDICES

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, passenger vehicles' average monthly maintenance costs increased by 3-5 % in 2018. In addition to labor 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 behavior, 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.

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 a fleet 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 engine oil, the fuel tank level, car's battery and also the condition if this tire. All of this behavior 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 and etc. All of this are due from the human factor.

1.3 Project Objective

The objectives that need to be accomplished in this project are:

i) To develop an embedded controller for fleet management system that are able to monitor all of the acquired data for instance car's speed, car engine oil, tire, and car's battery to notify the system management.

ii) To track automobile users via summons that occur using GPS coordinates.

iii) To reduce vehicle downtime and operating costs, notify the maintenance team using a mobile app when a battery, tire, engine oil, or gearbox oil needs changing.

1.4 Scope of Project

The scope of this project are as follows:

i) Required data will be analyzed and diagnosed by the embedded controller

ii) The maintenance management and the user or driver will be informed about the status of the car. So that further action will be taken and user will be more aware.

iii) The car will be monitored and suitable inspection will be done by the technician.

iv) This will continue for every car used and the management will keep all the data in the database for a continuously monitoring as it is the managements authorities.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Residing in a developing nation has shown to be a significant obstacle for any expanding business venture. Owner will curate the best way and implementing any type of strategies to deal with the process of growing. They will plan a pace to compromise the condition of growing business with least cost needed. Fleet management system business has to stick to their key of success to keep expanding and achieve the favorable outcomes by increasing the productivity, reducing the man factor that can lead to car breakdowns, focusing on replacing only necessary part to reduce car breakdown and monitor fuel level to prevent fraud. Thus, for monitoring purpose, OBD-II functioning as embedded controller utilized data reading and sending the data to management database. The signal codes are analyzed by OBD-II and were decoded to desired code.

During this study, several channels are used to obtain the details, materials and important data. These comprises from numberless of journals, websites, encyclopedia, handout and technical papers. In this pandemic consequence, where everything are using the online platforms, most of the online materials are accumulated from websites for instances ResearchGate, IEEE, UTeM, Google Scholar and Mendeley.

2.2 Previous related Works

2.2.1 Fleet Automation using IoT Logistics

R. Mahalakshmi [1] proposed a study to develop a transportation management company that is utilizing the IoT development to manage fleet management while simultaneously reducing human resource requirements.

This project architecture consists partially of three layers for raw material administration. The first layer contains the truck's sensor information as well as the board's GPS configuration. The user interface and cloud server module are described in the second layer. The third layer provide data such as fuel analysis, engine temperature, fuel usage and vehicle location.

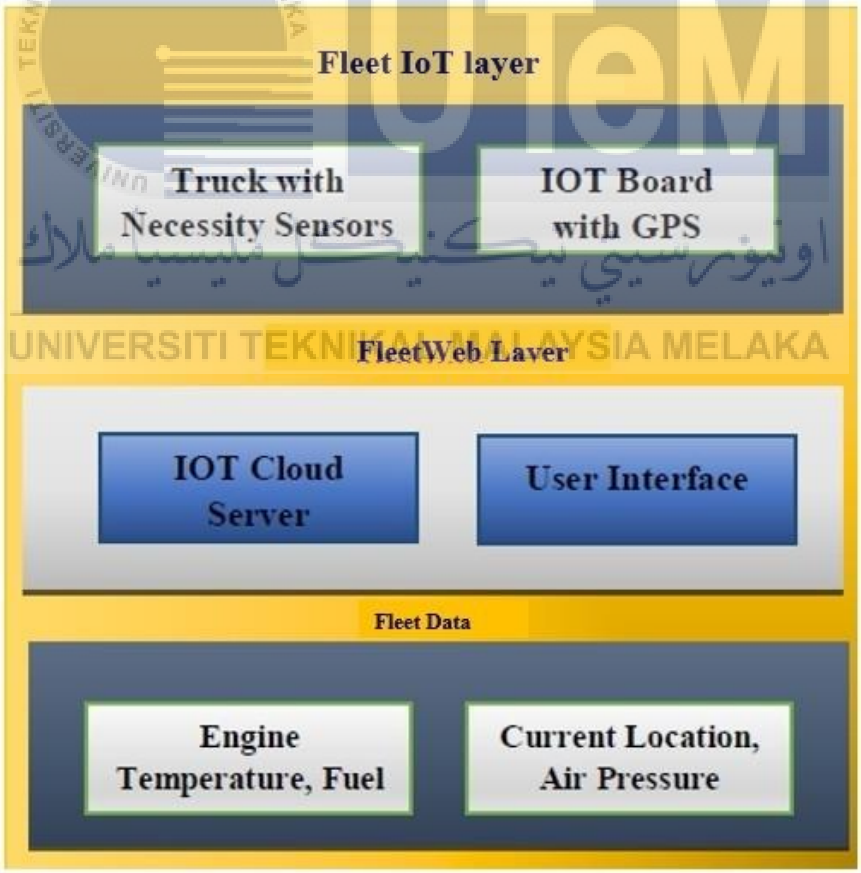

Figure 2.1 Architecture Diagram of the Fleet Automation System

In order to process data, this system employs a Fleet IoT kit. The extraction and accumulation of truck data are made more accessible and more practical by using IoT sensors. The gathered data is then used to diagnose, analyse, and maintain the truck fleet in real-time. For example, truck weight is calculated on smooth surfaces, valleys, and a wide range of road cycles.

Table 2.2 General Characteristics of IoT board

Configuration	Features
Frequency Band	SC20-E
	FDD LTE: B1/B3/B5/B7/B8/B20
	TDD LTE: B38/B40/B41
	WCDMA: B1/B5/B8
	GSM: 850/900/1800/1900MHz
Memory	8GB eMMC+1GB LPDDR3
	16GB eMMC+2GB LPDDR3
Temperature Range	-40°C ~ +75°C
Dimensions	40.5 x 40.5 x 2.8mm
Package	LCC + LGA
Weight	Approx. 9.8g

2.2.2 Security of GPS/INS based On-road Location Tracking Systems

S. Narain [2] research evaluates an Inertial Navigation Systems (INS) -assisted GPS tracking and navigation for road transportation systems to determine their assurances. The invader's goal is to travel to different locations without being detected. The security guarantees of INS-aided GPS tracking and navigation for road transport systems are reviewed in this paper. The possibility to monitor one's location is critical in a vast scope of safety and protection applications.

This project comprises of two servers which are Intel processors and 20GB of RAM to run the algorithms. An attacker's ability to spoof a road network, given a start and endpoint, was tested to determine how far they could get away without being detected. Across each city, 1000 randomly generated paths were created, with the distances between the paths uniformly distributed between one kilometer and twenty-one kilometers. A total of tests was launched to determine the viability of our attack on the transport networks of ten urban centers.

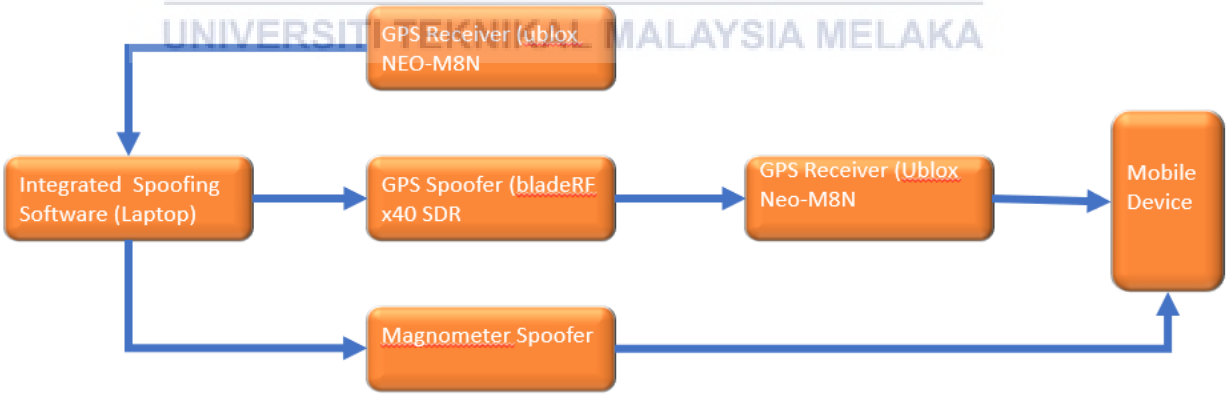

Figure 2.3 Block Diagram of Integrated Spoofing System