UNIVERSITI TEKNOLOGI MARA

The 11th International, Invention, Innovation & Design 2022

INDES 2022

Ushering in the Age of Endemic

THE 11TH INTERNATIONAL INNOVATION, INVENTION & DESIGN COMPETITION INDES 2022

EXTENDED ABSTRACTS BOOK

e ISSN 2756-8733

9 772756 873009

Perpustakaan Negara Malaysia Cataloguing in Publication Data

No e-ISSN: e-ISSN 2756-8733

Cover Design : Nazirul Mubin Mohd Nor
Typesetting : Wan Nurul Fatihah binti Wan Ismail

The 11th International Innovation, Invention and Design Competition 2022

Organised by

Office of Research, Industrial Linkages, Community & Alumni Networking (PJIM&A)
Universiti Teknologi MARA Perak Branch

and

Academy of Language Study
Universiti Teknologi MARA Perak Branch

IoT-BASED LEGACY VEHICLE MONITORING SYSTEM

Lee Wei Peow, Tan Yen Tung, Lee Hui Rong, Wong Wing Chi

Tunku Abdul Rahman University College, Perak Branch Campus

Email: leewp-am19@student.tarc.edu.my

ABSTRACT

Malaysia is one of the countries in the world that does not impose restrictions on the ownership of aged vehicles. To further enhance the safety and driving comfort of legacy vehicles, an Internet of Things smart vehicle system named '(IoT)-based Legacy Vehicle Monitoring System' is designed and developed to fill the gap between legacy vehicles and modern vehicles. A proof-of-concept is being developed to demonstrate the overall working principle of the system in a real-life application.

***Keywords**: IoT, Smart Vehicle System, Legacy Vehicle, Vehicle Monitoring System*

1. INTRODUCTION

Most of the aged vehicles in Malaysia are not equipped with any modern automobile technologies (Owen et al., 2015), such as digital instrument clusters and computer-controlled systems, which leads to a lack of information and feature accessibility to the drivers. Therefore, the needs for comfort and safety are crucial for aged vehicles on the road. An IoT-based Legacy Vehicle Monitoring System is proposed to bridge the gap on aged vehicles, with the following objectives:

i) To provide ease of access to various information aspects of a vehicle.
ii) To increase safety level in operating a vehicle on the road by providing meaningful information to a driver.
iii) To enable a certain level of automation on vehicle features by self-sensing and pre-programmed conditional logic.

2. FINDINGS

An increasing number of vehicles on the market are being developed with various types of advanced assisting features to fulfil the needs of humans to have a good means of transportation in their daily lives. As a direct consequence, the gap between aged vehicles and modern vehicles is getting wider. First of all, modern vehicles with advanced features are relatively expensive, and it is not possible that everyone can afford to purchase them, especially B40 consumers whose average monthly household income is under RM3,860.00 (Radzi et al., n.d.). Besides, the increase of vehicles is also causing a significant rise in the number of road accidents. The latest report by the World Health Organisation (WHO) indicates that 1.35 million people died and 50 million are injured each year due to road accidents (WHO, 2015). However, a vehicle with IoT devices (i.e. sensors) and modern automobile technologies technology can make driving safer by examining the road condition, vehicle's condition and performance, predictive maintenance and warning the drivers at the best possible in order to

reduce and prevent the risk of road accidents (Owen et al., 2015). Not only that, but legacy industries such as automobiles and manufacturing too are now turning to the field of IoT with the intention of improving their business model. The overall IoT enterprise spending grew more than 22% in 2021 to $158 billion (Wegner, 2022). It is expected that more advanced IoT vehicles will be produced instead of conventional vehicles due to the greater benefits being gained by drivers nowadays. Hence, there will be a gap in the safeness of driving on the road due to the difference in terms of vehicle advancement.

To effectively solve this gap, one possible suggestion is to introduce a 'Legacy Vehicle Monitoring System' to upgrade an aged vehicle with modern IoT technology. This can effectively assist the drivers to continuously drive their aged vehicle with better safety features, lower maintenance efforts, and a better driving experience.

3. METHODOLOGY

To demonstrate and evaluate the effectiveness of this proposed IoT system, an emulation is developed. The emulation is used to mimic the system unit including hardware (e.g., various sensors installed on aged vehicles) and application (e.g., GUI control dashboard on both mobile and web applications). A cloud storage solution is used for remote control access between the system unit and applications.

3.1 Proposed IoT System

3.1.1 Sensors and Relays

The IoT system comprises the following sensor types i.e., temperature and humidity sensor, speed sensor, fuel sensor, and light sensor, as well as relays. Each of these plays a significant role in the system by measuring and reading their respective data, as well as triggering actions. The IoT system will take appropriate actions or warn the drivers if any abnormal readings are collected by these sensors. On the other hand, several output devices are being utilised to provide signals or indications to drivers, like LED lights and buzzers.

3.1.2 Web Application

A graphical user interface (GUI) Web-based application is designed as a primary dashboard view, containing all the important information about the vehicle's status and performance as collected through the sensors, and providing feature controls. HTML, JavaScript, and CSS are used to design the GUI. Through the GUI, a driver can view the historical data and analysis to always monitor their aged vehicle's performance. In practice, methods such as a customised Linux-based system with a direct LCD driver can be considered for GUI output purposes. The interface shall be displayed on a voice-enabled and/or touch-enabled display to enable maximum interactivity for the drivers (Zorrilla et al., 2012).

3.1.3 Mobile Application

Besides the web application, for remote controlling and monitoring purposes, a mobile application is also designed and built. A driver can also view various monitoring information about a vehicle, and control certain features and functions of the vehicle through IoT and cloud technology (Govindraj et al., 2018) while the car is on the road. In practice, the mobile application can be enhanced to allow drivers to control their vehicles in terms of features, such as turning on/off the lights or engine, as well as checking details of their vehicles like mileage and fuel level.

3.1.4 Cloud Storage

A cloud storage solution i.e., Firebase Realtime Database is a cloud-hosted NoSQL database that stores data in JSON format. It is employed in the project to store all of the vehicle information such as engine temperature, and also facilitate the remote-control function over the Internet using both mobile and Web applications. Furthermore, it also allows drivers to globally store and synchronize the vehicle monitoring data (Aladwan et al., 2019). Figure 1 shows the overview setup of the IoT-based Legacy Vehicle Monitoring System:

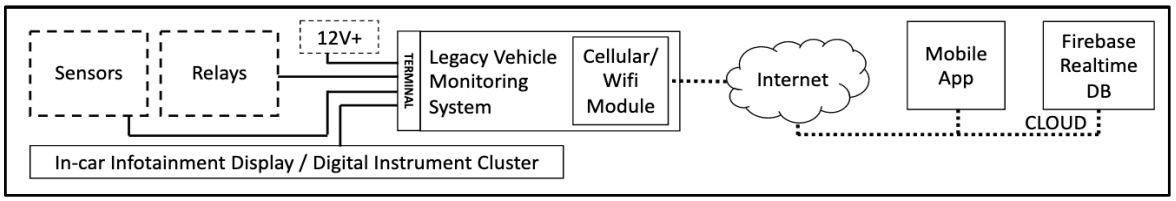

Figure 1 IoT-based Legacy Vehicle Monitoring System

4. CONCLUSION

This research provides a feasible solution for drivers and owners of aged vehicles, with additional features as well as adding a certain degree of automation to their aged vehicles. The needs for comfort and safety are crucial for aged vehicles on the road. After the development and testing, the IoT-based Legacy Vehicle Monitoring System successfully collected all the telemetry (sensor data) from the Firebase. All readings are presented quickly on the dashboard through both mobile and web applications. From the dashboard, drivers will be able to monitor and get immediate feedback on driving conditions and vehicle performance to promote safety first on the road. The objectives are met, however, this IoT system can be further improved to bring about more automation and control features to make aged vehicles smarter and safer on busy roads in this modern day.

REFERENCES

Aladwan, M., Awaysheh, F., Cabaleiro, J., Pena, T., Alabool, H., & Alazab, M. (2019). Common security criteria for vehicular clouds and internet of vehicles evaluation and selection. *Proceedings - 2019 18th IEEE International Conference on Trust, Security and Privacy in*

Computing and Communications/13th IEEE International Conference on Big Data Science and Engineering, TrustCom/BigDataSE 2019, 814–820. https://doi.org/10.1109/TrustCom/BigDataSE.2019.00118

Govindraj, V., Sathiyanarayanan, M., & Abubakar, B. (2018). Customary homes to smart homes using Internet of Things (IoT) and mobile application. *Proceedings of the 2017 International Conference on Smart Technology for Smart Nation, SmartTechCon 2017*, 1059–1063. https://doi.org/10.1109/SmartTechCon.2017.8358532

Owens, J. M., Antin, J. F., Doerzaph, Z., & Willis, S. (2015). Cross-generational acceptance of and interest in advanced vehicle technologies: A nationwide survey. *Transportation Research Part F: Traffic Psychology and Behaviour*, *35*, 139–151. https://doi.org/10.1016/j.trf.2015.10.020

Radzi, M., Mansor, A., Anwar, K., Kassim, A., Zulhaidi, &, & Jawi, M. (n.d.). Willingness to purchase safer vehicles: A study base on Malaysia B40 income group. http://journalarticle.ukm.my/17363/1/11.pdf

World Health Organization. (2015). Global status report on road safety 2015. World Health Organization.

Wegner, P. (2022). Global IoT market size grew 22% in 2021 — these 16 factors affect the growth trajectory to 2027. https://iot-analytics.com/iot-market-size/

Zorrilla, M., Martin, A., Sanchez, J. R., Tamayo, I., & Olaizola, I. G. (2012). HTML5-based system for interoperable 3D digital home applications. *Proceedings - 4th International Conference on Digital Home, ICDH 2012*, 206–214. https://doi.org/10.1109/ICDH.2012.21

Pejabat Perpustakaan
Librarian Office

Universiti Teknologi MARA
Cawangan Perak
Kampus Seri Iskandar
32610 Bandar Baru Seri Iskandar,
Perak Darul Ridzuan, MALAYSIA
Tel: (+605) 374 2093/2453 Faks: (+605) 374 2299

UNIVERSITI TEKNOLOGI MARA

Surat kami : 700-KPK (PRP.UP.1/20/1)
Tarikh : 20 Januari 2023

UNIVERSITI TEKNOLOGI MARA PERAK
TERIMA
25 JAN 2023
Tindakan
Universiti Teknologi MARA Perak
PEJABAT REKTOR

Prof. Madya Dr. Nur Hisham Ibrahim
Rektor
Universiti Teknologi MARA
Cawangan Perak

Tuan,

PERMOHONAN KELULUSAN MEMUAT NAIK PENERBITAN UiTM CAWANGAN PERAK MELALUI REPOSITORI INSTITUSI UiTM (IR)

Perkara di atas adalah dirujuk.

2. Adalah dimaklumkan bahawa pihak kami ingin memohon kelulusan tuan untuk mengimbas (*digitize*) dan memuat naik semua jenis penerbitan di bawah UiTM Cawangan Perak melalui Repositori Institusi UiTM, PTAR.

3. Tujuan permohonan ini adalah bagi membolehkan akses yang lebih meluas oleh pengguna perpustakaan terhadap semua maklumat yang terkandung di dalam penerbitan melalui laman Web PTAR UiTM Cawangan Perak.

Kelulusan daripada pihak tuan dalam perkara ini amat dihargai.

Sekian, terima kasih.

"BERKHIDMAT UNTUK NEGARA"

Saya yang menjalankan amanah,

SITI BASRIYAH SHAIK BAHARUDIN
Timbalan Ketua Pustakawan

nar

Setuju.

27.1.2023

PROF. MADYA DR. NUR HISHAM IBRAHIM
REKTOR
UNIVERSITI TEKNOLOGI MARA
CAWANGAN PERAK
KAMPUS SERI ISKANDAR