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CO_2 Emission Tracking App for Internal Combustion Engine (ICE) Motorcycle

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Abstract

Motorcycle is one of the most widely used transportation in Thailand. Internal Combustion Engine (ICE) is the most common motorcycle type using in Thais daily life. ICE motorcycle is fossil fuel dependence, and one of the most concerned questions about ICE motorcycle is how much CO_2 released from it. In this experiment, CO_2 emission data is collected from tracking platform. CO_2 tracking platform is available on both mobile and web application. CO_2 tracking app will calculate emission data from ICE motorcycle by using mathematical models. The model and parameters of CO_2 emission will be obtained from the manufacturer's specification. From this experiment, we obtained CO_2 emission data from usage in real situations. Not only the CO_2 emission, but also graph of carbon footprint, average CO_2 per distance, and overall CO_2 emission data are collected. Moreover, we also ranked CO_2 emission in experiment, and offer basic reward for that best performance. Best ranking data will be analyzed about driving behavior, route, and model of ICE motorcycle. Analysis of these experimental data could be beneficial to CO_2 emission of ICE motorcycle.

Keywords: CO_2 Emission, Carbon Footprint, Internal Combustion Engine (ICE), motorcycle, Mobile App

Introduction

Motorcycles are a fundamental part of the transportation system, which is essential for the development of the country's economy. However, most of the transportation systems in the Thailand now use internal combustion engine (ICE) motorcycles ((IEA), 2010). The main fuel of ICE motorcycle is oil, which is relied on imports. It is also the source of CO_2 emissions, which is the main cause of greenhouse effect, especially in the traffic congestion (Tamsanya, 2009). In addition, the depletion of oil in the near future and the global warming situation (Tamsanya, 2009).

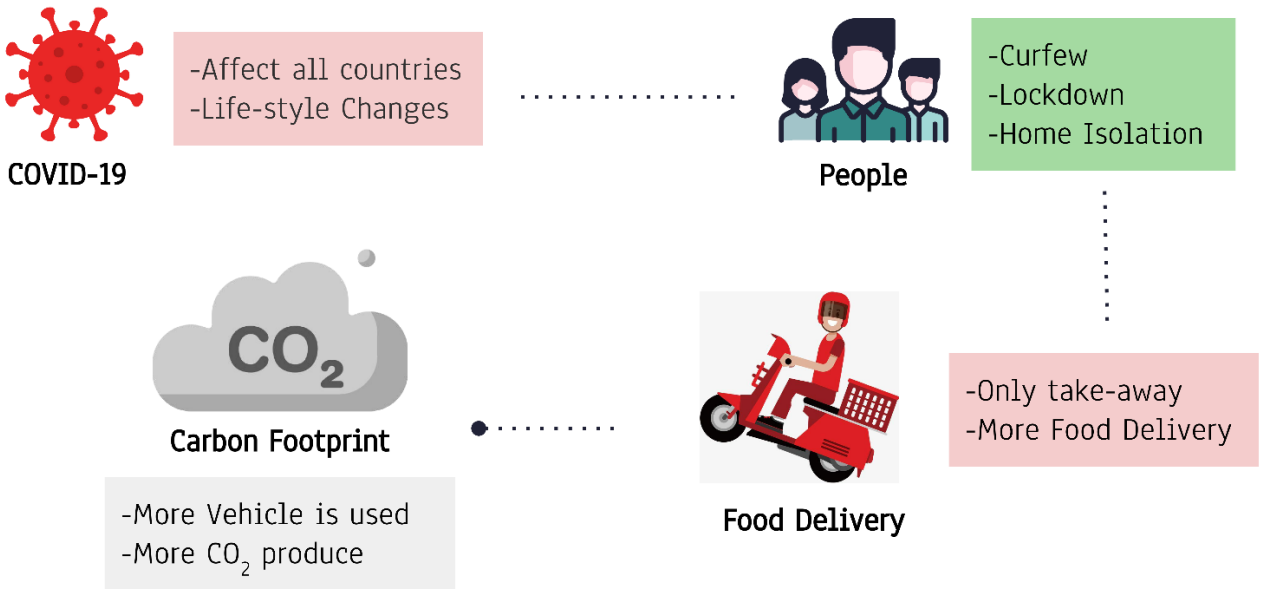

Figure 1 The objective of this experiment is to collect exhaust emissions data. Data from the actual driver such as food delivery will be tracked and analyzed.

Currently, development of sustainable transport systems is focusing on Greenhouse gases, which are the main cause of global warming problem, especially CO_2. One of the most important data is the CO_2 emissions of ICE motorcycle, which affects global warming in the long term. CO_2 emissions data could be used in the analysis of driver behavior that reduces exhaust emissions as much as possible (Atsushi FUKUDA, 2013).

Moreover, the emerging of COVID-19 pandemic greatly impact style of living. People are more rely on delivery application and service during Curfew, Lockdown and Self-isolation situations (Zanettaa et al., 2021). Hence more food delivery process might cause more CO_2 produced in daily life.

The objective of this experiment was to collect exhaust emissions data. Data from the actual driving is used for analyzing driving behavior that causes the least emissions.

Methodology

This research has begun to survey and calculate the consumption rate of motorcycles. By collecting data on the exhaust emission rates of various motorcycle models. Compare the data with the values obtained from the distance driven by the motorcycle and calculate the emissions. The motorcycle used in this experiment is Honda Wave 110i. This model is quite popular especially among the food delivery drivers.

Figure 2 Honda Wave 110i motorcycle is used in this experiment.

Route information is collected by the GPS tracking system, which can tell both the driver's location as well as average speed. The line travels from the starting point until it returns as shown in Figure 3. The measurement of emissions are calculated from the specification of the motorcycle used in the test. Which is obtained from the manufacturer's motorcycle specification. The specification data is shown in **Table 1** (Nilrit et al., 2017).

Table 1 Specification of ICE motorcycle.

General Information	
Category:	Scooter
Year:	2017
Model:	Honda Wave 110i
Engine and Transmission Specifications	
Emission details:	Euro 2
Greenhouse gases:	34.1 CO_2 g/km.
Fuel consumption:	1.47 liters/100 km
Driveline:	Clip type #420 chain

Carbon footprint tracking app will track CO_2 emission of drivers. The app will use GPS signal to determine the location of the driver then calculate CO_2 that produced by certain model of that vehicle.

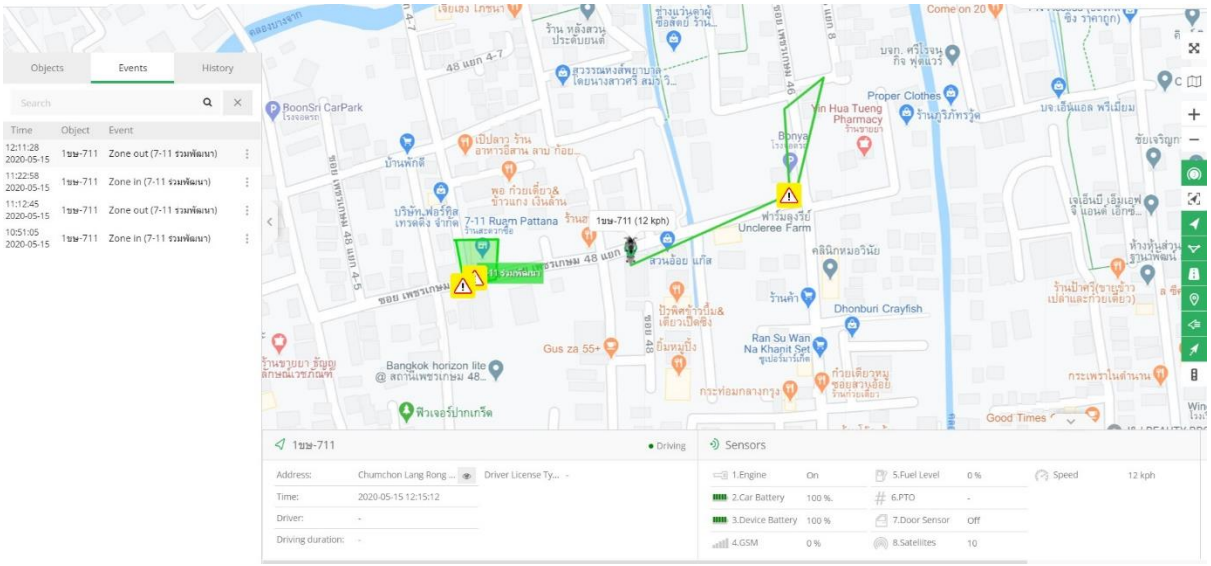

Figure 3 Collecting data from GPS, which includes distance, time and speed.

In **Figure 4**, it shows flowchart of Carbon footprint tracking app. The app need to login to start tracking. After login process, tracking will begin. Tracking system will check if there is any movement or delivery. Then distance from movement will be collected and then transfer to CO_2 calculation. Tracking system will use GPS signal to determine the location of the driver then calculate CO2 that produced by certain model of that vehicle. CO_2 emission will be collected and uploading to cloud storage.

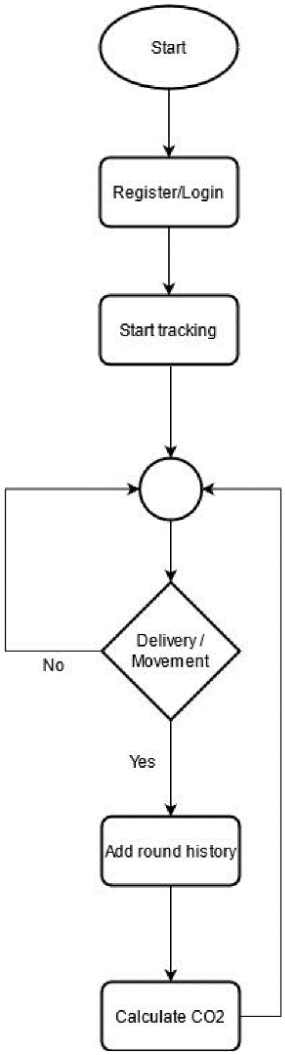

Figure 4 Flowchart of CO2 Emission Tracking application.

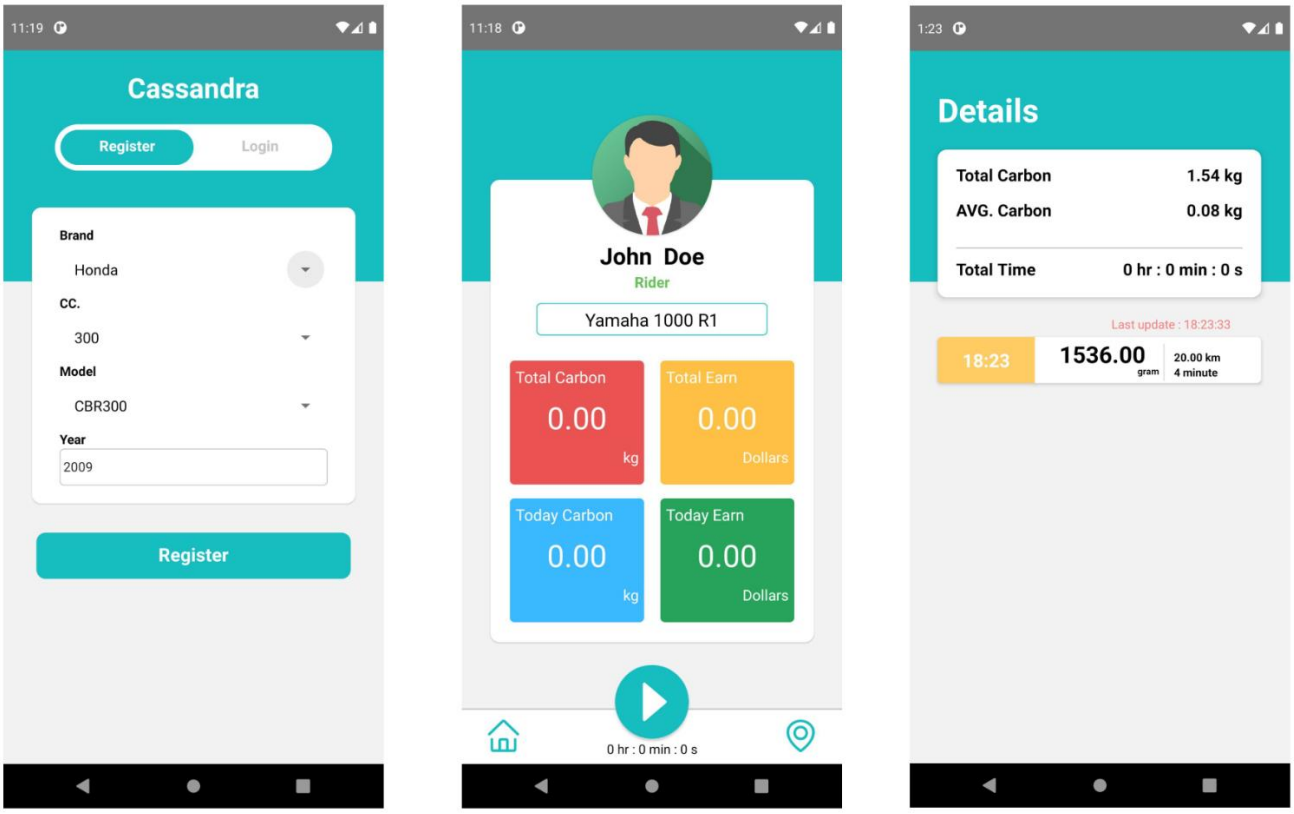

Figure 5 Graphic User Interface of CO_2 Emission Tracking Application.

Driver can check emission anytime from tracking app. After login, activate tracking, app will show details about CO_2 Emission. It will display amount of total emission, average emission per distance. There is no need for additional GPS device if this tracking app installed on smartphone with embedded GPS. Driver also can use this app to track how much they earn from the driving or delivery.

Results and discussion

Emission data from track app will be collected and send to cloud storage. Data dashboard in cloud can be accessed with computer or smartphone. The dashboard will show gathering data from app with GPS tracking system which is described in the previous topic. The sample data is shown in Figure 6. Considering one cycle of motorcycle usage with an average emission rate of 61.27 g/km. Daily emissions were 59.31 g. and the total emissions were 409.44 g.

The dashboard also shows other registed users in the system. Users data will be shown and ranked the most efficent user who can achieved lowest emission rate. In contrast, I will also show user with high emission rate which can be interperted as inefficient driver.

Futhermore, we could utilized these data as benchmark for CO_2 Emission. This app could be greatly improved with CO_2 Emission sensor, more detailed input data such how old the motorcycle is, how many distance traveled. Those data can improve mathematic model of CO_2 emission, then it would give results that are more precise.

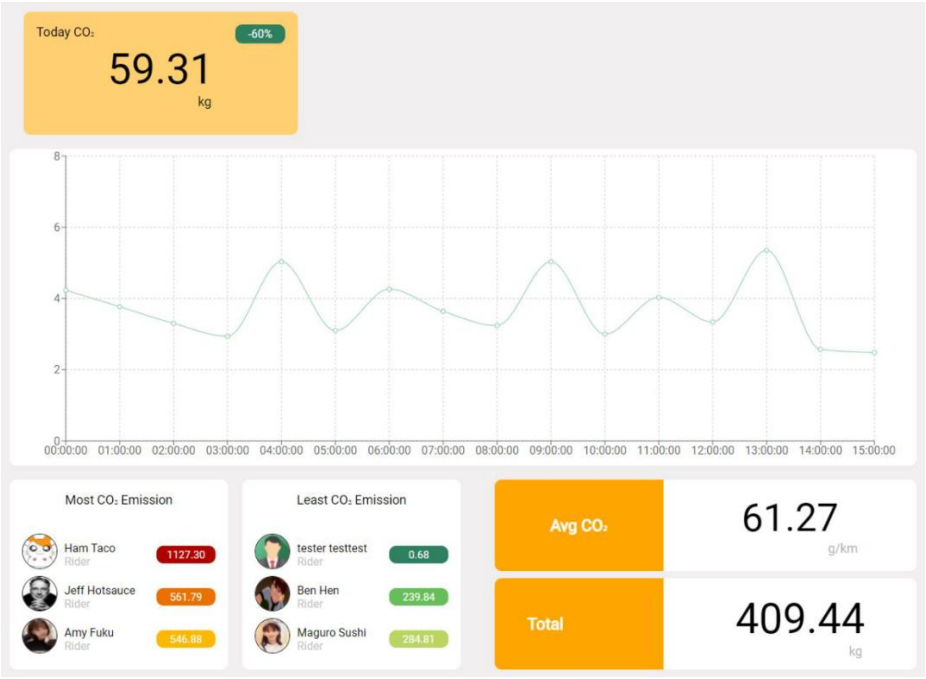

Figure 6 CO_2 Emission Data Dashboard.

Conclusions

In this experiment, we created the app to track the emission data of ICE motorcycles. By using the tracking app that collected data along with the GPS system. Those data will take into calculation to find CO_2 emission and store such data into the cloud storage.

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