Message from the Editor

The editorial team welcomes all readers to our 1st issue of proceeding of Innovative Research, Invention and Application Exhibition (I-RIA 2021) which was held virtually on 5th July 2021 at Universiti Utara Malaysia, Malaysia. The theme of this year is "Technology-Driven Innovations Driving Transition to The New Normal".

This proceeding consists of broad spectrum innovation papers within Internet-of-Things, Social Informatics, Application and multimedia services, Blockchain, Technology in education, Smart Device Design, Health Informatics and Technology, Network and Communication Technology, Pandemic Innovation, Data Science/Analytics, Cybersecurity, Green Technology and other topics in Science and Technology.

All innovation papers in this issue were peer-reviewed, ranging from concept idea and up to applications level. Special thanks to all authors who had contributed their manuscript and presented and showcased their innovative projects during the stipulated sessions. In addition, special thanks to the I-RIA 2021 editorial team for their tremendous works and continuous effort in publishing this issue. We also would like to express our sincere appreciation to the international editorial advisory board and the selected reviewers for their valuable comments and suggestions to ensure the quality of the research paper published in this issue.

The I-RIA2021 issues will be a good platform for exhibitor in the schools, higher institutions and the industries to disseminate their latest findings and discoveries. Last but not least, we also would like to ensure the continuity of the next issues, thus we look forward to receive scholarly written articles from innovators around the world during our next event.

I-RIA2021 Editorial team

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The Design of Real-Time Location Detection Application on Android for Trans Musi to Help the Use of Trans Musi Bus in Palembang City

Salma Salsabila[1]*, M. Ridho Ramadhan[1], Muhammad Naufal Ghiffari Iskandar[1], Suci Dwijayanti[1]

[1]Universitas Sriwijaya,
Jl. Palembang-Prabumulih KM.32, Indralaya, 30128, INDONESIA

* Corresponding Author Designation

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Abstract : Trans Musi is a public transportation used by numerous people in Palembang because of its facilities and the affordable cost. It spreads across all points of the city and provides conveniences, such as bus stop and transit stop for the passengers while waiting for the bus. However, bus rapid transit (BRT) system of Trans Musi still has several obstacles in its implementation, caused in inefficient services, especially in providing real-time position information through applications. Nevertheless, the application that has been developed only allowed users to get information on the nearest bus stop, while information about bus position was unknown and not real-time. Thus, this study addressed this problem by making a Trans Musi Location Detector application design which is integrated with a location detection device of which aims to display real-time information, such as coordinates, speed, time, and route. The methodology used in this study was simulation approach to show how the system works. This application purposes to help users to use Trans Musi, such as accessing the latest bus locations, determining the nearest bus stop, as well as the arrival and departure times of buses at the nearest bus stop. In addition, this application is supported by hardware to obtain accurate information sent to the application. The hardware consists of an electrical box with the main component of a global positioning system which is placed on the bus dashboard, and a Radio-frequency identification (RFID) box which is placed at each bus stop. Besides giving information of bus positions in real-time, this application also has a feature to support the government in implementing health protocols related to physical distancing on public transportation during the COVID-19 pandemic. Such feature provides a full passengers indicator by giving notification of number of passengers on the bus to fulfill the physical distancing criteria.

Keywords: Application, Location Detector, Real-Time, Trans Musi

**Corresponding author: salmaslsma@gmail.com*

1. Introduction

Trans Musi is preferred as public transportation for daily activities in Palembang. In its operation, Trans Musi uses the Bus Rapid Transit (BRT) system where the design, services, and infrastructure are customized to fulfill people needs so that it can improve quality of the system and increase efficiency in the use of public transportation in terms of timeliness. Moreover, Trans Musi departure time is set every 10-15 minutes. There are 150 buses at various points along the route and Trans Musi has 9 corridors service consisting of 275 bus stops spread across Palembang city.

With the facilities provided and affordable cost, Trans Musi becomes a mode of public transportation that is in great demand by the public. However, BRT system of Trans Musi still has several obstacles in its implementation. These cause inefficient services, especially in the availability of information needed by users, such as departure times, travel routes, and the nearest bus stops. Some factors caused this inefficiency were traffic jams, malfunctioning of 50 bus stops and 89 Trans Musi, and also the unavailability of special bus route which can also increase the barrier factor for Trans Musi in its operation. These conditions may cause disruption and delays in operating hours of arrival and departure [1]. Trans Musi experienced departure delays starting from 20 minutes to 41 minutes in a day [2]. Therefore, an application that can find out the real-time position and operational information of Trans Musi is needed by the users.

2. Materials and Methods

This study was carried out using several materials needed to create the actual solution to be implemented and methods how to create the simulation of the system.

2.1 Materials

To create the solution, this study needs several supporting components to perform specific work such as radio frequency identification (RFID), global positioning system (GPS), and microcontroller. Related works are also presented to show critical analysis from the similar works existing before.

a. Radio Frequency Identification (RFID)

RFID is considered as sensing and communication for information system integrated with wireless information and power transfer (WIPT) features. RFID works by collecting radio frequency energy from interrogator to antenna based on a specific frequency used. Then, RFID will activate its chip inside the tag and transfer number of identification back to the interrogator [3]. This study would use Ultra-high Frequency (UHF) type to be placed in each bus stop to precise the measurement of bus arrival time.

b. Global Positioning System (GPS)

The Global Positioning System is a satellite navigation system for determining the position on earth. GPS module used in this study was Ublox Neo-7M. The NEO-7 series combines a high degree of integration capability with flexible connectivity options in one small package. This module is particularly suitable to be applied in industries with stringent cost requirements. The u-blox 7 module uses a qualified GNSS chip according to AEC-Q100 and is manufactured on ISO/TS 16949 certified site [4].

c. Microcontroller

Microcontroller is a small device, also called as computer-on-chip, that controls and performs to control specific process, objects, or events in its electronic circuit with program embedded in. Mincrocontroller consists of central processing unit (CPU), random access memory (RAM), read only memory (ROM), and I/O ports [5]. This study would use microcontroller Arduino Mega for controlling several sensors and components to work. Arduino Mega has its own integrated

development environment (IDE) to perform programming well and has many ports to support sensors used in this study.

d. Related Works

Various studies have been conducted to assist the use of Trans Musi, such as an application to look for the nearest bus stop which aimed to make users easier finding and going to the nearest bus stop [6] and to find optimal departures by adjusting the number of buses operating to minimize the number of passengers on the bus and at the bus stops [7]. In addition, several applications have been developed to assist the use of Trans Musi and downloadable from application stores, such as Trans Musi Mania which displayed bus stops and routes in Palembang city and Trans Musi Kito which showed the routes passed by the buses and bus stops to be displayed on a map. However, those applications only allowed users to get information of the nearest bus stop, while information about the position of the bus was unknown. In addition, the information provided is not real-time, so that users do not know the arrival time of the bus and large possibility of an error in the estimated waiting time. Thus, this study aims to design an application which can help users to find the nearest, locate the position of the bus, and get the accurate information of the departure and arrival time in real time. Besides, this study also proposes a feature that indicates the capacity of the bus to avoid crowd to support physical distancing regulation.

2.2 Methods

The method used in this study was developed in two phases, namely creating a simulation of the application and creating design of the hardware.

a. Creating A Simulation of The Application

The application accessed by Trans Musi users was designed to be used on smartphones with Android platform so that application simulation was needed to show the work process of the application. The simulation of TERASI-LOR application was created using Adobe XD software version 32.2.22.2 (Starter). The sample size of application display used was Google Pixel 3XL with 412 × 847 px.

b. Creating Design of The Hardware

Trans Musi Location Detector (TERASI-LOR) application is integrated with tools on buses and bus stops to detect the bus current location so that the hardware design also needs to be implemented in TERASI-LOR digital product. There are 2 types of hardware used to support application work in obtaining accurate information, namely the electrical box and the Radio Frequency Identification (RFID) box. The electrical box was designed using the SOLIDWORK 2015 application. This electrical box contained the main components, such as the Global Positioning System (GPS), SIM900 module, Arduino microcontroller, Liquid Crystal Display (LCD), ON / OFF button, passenger capacity button, and power supply. This box was installed in the Trans Musi bus on the bus driver's dashboard. Meanwhile, the RFID box was designed using the Proteus application version 8.2.

3. Results and Discussion

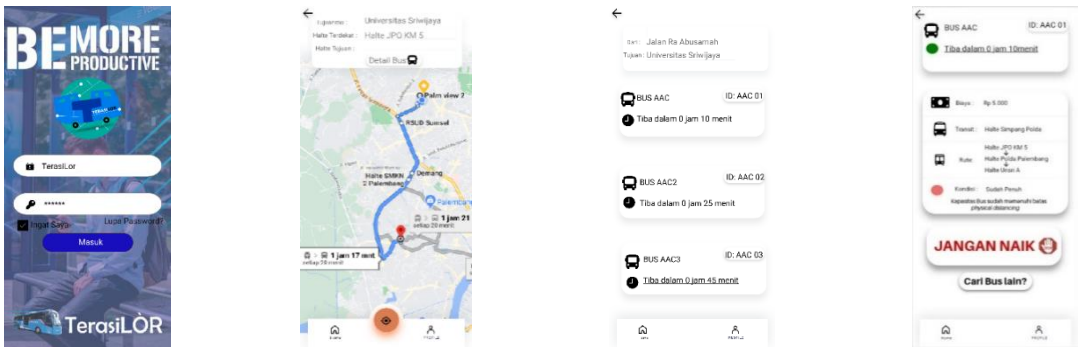
After the methodology of this stucy conducted, results and discussion are presented to give the data in form of simulation and analysis of the idea when it is actually implemented.

3.1 Results

Results of this study are represented by the simulation of application, hardware design for electrical box and RFID box, and also the systematic way how the system works.

a. TERASI-LOR Application

TERASI-LOR application was created in form of a simulation to show the information obtained from the processed data. The process of reading the information began with sending data by the hardware device to the database. Then, the data received was then translated into information that can be understood easily by the users and had a user-friendly interface. This application has two main menus, Home Menu and Profile Menu, respectively. Users can log in the application by using the Log In page as shown in **Figure 1 (a)** and customize the information through user profile settings. Users can get route information with interface as shown in **Figure 1 (b)**. In addition, users can get information about the available buses for the chosen route as in **Figure 1 (c)**. TERASI-LOR application provides real-time information to users and also another advantage of this application is full passengers indicator feature as a form of implementing the physical distancing protocol as shown in **Figure 1 (d)**. This feature allows users to obey government recommendations to keep distancing between one person to another in order to minimize the spread of the COVID-19.



(a) (b) (c) (d)

Figure 1: **(a) Log In Page, (b) Travel Route, (c) Available Buses, (d) Chosen Bus Detail Information**

b. Electrical Box Design

Trans Musi location detector system is supported by hardware. The hardware used consists of two types, namely electrical box and RFID box. The electrical box was a 15cm × 10cm × 8cm hardware placed on the driver's dashboard inside the bus. This device was used to transmit data obtained from GPS to TERASI-LOR application using the Internet of Things (IoT). The design of hardware can be seen in **Figure 2** and **Figure 3**. **Figure 2** shows the top of electrical box. As shown in F**igure 2**, there is an LCD that can display a description of the device condition, an on-off switch to turn the device on and off, a push button to reset and a notification button to indicate full passengers feature on the bus. **Figure 3** shows the inside of electrical box, in which there are several components inside the box. These components consist of a GPS sensor that functions to get location data, an Arduino microcontroller for controlling the component's work, and the SIM900 module for sending data to the server. These components are arranged schematically as shown in **Figure 4**.

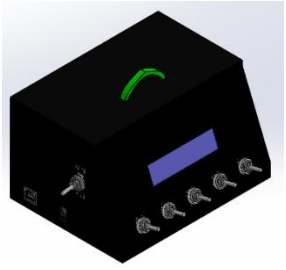


Figure 2: Top View

Figure 3: Inside View

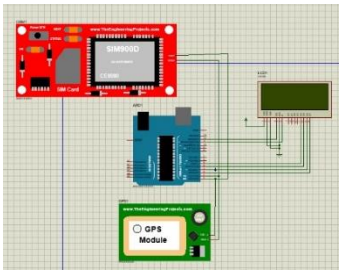


Figure 4: Schematic of GPS Module

c. Radio Frequency Identification (RFID) Box

A RFID box was a 15 cm × 10 cm × 8 cm hardware with the main component of RFID installed at the Trans Musi bus stop. RFID is needed to improve the accuracy by measuring the distance between the arrival of Trans Musi bus to the bus stop. The illustration of RFID box can be seen in **Figure 5**. From **Figure 5**, it can be seen that there is an On / Off switch outside of the RFID box as a button to turn on and off the RFID, and an RFID receiver which functions to detect and read data provided by the installed RFID transmitter on the bus body. Arrangement inside RFID box can be seen in **Figure 6**, in which it contains a microcontroller as an electronic circuit controller. The electronic components in RFID are arranged schematically as shown in **Figure 7**.

Figure 5: Outside View

Figure 6: Inside View

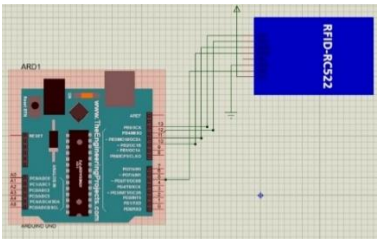


Figure 7: Schematic of RFID Module

d. How System Works

TERASI-LOR system works as follows: Trans Musi Location Detector device was installed on the vehicle in form of an electrical box which is turned on at the same time as the bus engine was started. Then, the driver may do the settings on device via a button in the driver's cabin in case of an error or malfunction occurred, such as GPS cannot get the location or even SIM card was not connected correctly. If there are no errors, users are able to immediately know the current location of the bus and send its location data to the server. Furthermore, the server processes data, such as location data, time, speed, etc., then send the data to Android application to be displayed. Specially for full passenger indicator, the remain seats and the highlight caution are determined by the counters programmed on the cashless payment server. Once a person pays the fee, the server of cashless payment indicator will send the data of number of passengers counted on the bus with certain code to the server of TERASI-LOR application.

3.2 Discussions

TERASI-LOR application helps the users to access the real-time the location and information related to the public transportation. The application provides detail information about bus, such as bus fee, travel route, and real-time precision with color indicator. If traffic jam occurs, red indicator will be on. If the speed of the bus less than 30 km/h, yellow indicator will be on. While if the road is fine, green indicator will be on. Those three color indicators may ease the user to notice the current condition of road. So, the users would know the reason why the bus has not come yet. This application also support full indicator passanger that helps physical distancing implementation in public transportation. The users are notified about the capacity of the targeted bus whether it is full or there are still remaining seats with physical distancing. This feature is really useful for passangers who is worried about to use public transportation during COVID-19 pandemic. Those features are supported with hardware placed in the bus stop and inside the bus itself. The hardware, such as GPS and RFID support to gain the more accurate data to show in the application. In result, the data shown is in real-time and having smaller error comparing to application without hardware support. With real-time and accurate informations provided, users will be more productive and comfortable to travel with public transportation without waiting for so long in the bus stop.

4. Conclusion

Based on the study conducted, the design of TERASI-LOR application has great potential to improve the quality of public transportation services that have bus stops in Palembang City. This application can provide real-time information on the position and arrival time of Trans Musi bus. To apply the real-time principle, TERASI-LOR application is connected via the Internet of Things with hardware, such as GPS in electrical box and RFID box. The overall system design consisting of those hardware and software can be implemented to solve problems that occur in public transportation, especially Trans Musi.

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