Journal of Engineering Technology Vol. 90: 108-111, 2021
ISSN 2231-8798© 2013 UniKLBMI

Development of Vehicle Speed Measurement Using Rfid

Khairi 'Imran Mas'od[1] & Nurul Rodziah Abdul Ghafar[2]
[1,2]Advanced Telecommunication Technology (ATT) Research Laboratory,
Communication Technology Section
British Malaysian Institute
Universiti Kuala Lumpur
53100, Gombak, Selangor, Malaysia

Corresponding email: nurulrodziah@unikl.edu.my

Abstract: Most of the existing speed measuring systems faced with common problems which is their visibility and data storage. With this developed project, it will help to solve the problems while also improve the system by using Radio Frequency Identification technology. The design of the project is fairly simple by using a microcontroller to integrate the Radio Frequency Identification module in the system. The objectives of the project is to have the system not only measure the speed but also to receive the information that is contain in the Radio Frequency Identification tags. If the speed exceed the limit, the information will be displayed on a screen and if it is not exceeding the limit, it will only measure the speed. By applying the technology to the system, it will solve most of the problems. Radio Frequency Identification technology has been around for quite some time and been widely used through a lot of application. And the technology has a lot of potential for wider range of application.

Keywords: IoT, Microcontroller, Speed

1.0 INTRODUCTION

In this day and age, commuting in a vehicle are unavoidable. And this leads to the rise of number of vehicles on the road, which also caused various kinds of traffic issues. Excessive speeding are one of them. In order to reduce the traffic issues, speed measuring devices are deployed. However, these speed measuring devices can be easily bypassed such as by shielding the plate number. Therefore, this project is developed to prevent these act. The main objective of this project is to design a speed measuring system that doesn't require a visual device to identify the vehicles. Instead, it will use an RFID technology that is capable of interacting even when it is not in line-of-sight. This project is meant to improve the current speed measuring device by implementing the RFID technology, which has been widely used. By implementing the RFID technology, it also will eliminate the problems that exist within the existing speed measuring devices, which is the memory space used in order to keep images that contained the vehicles information. Since the RFID does not require any visual data, it will solve the memory storage issues within the existing speed measuring devices. In order to achieve the objective, the right concept and components need to clearly state its function based on the application used. In this project, the MFRC522 is used as the RFID reader, which is used to detect the vehicles that pass through the speed measuring device. However, it is important to understand that this project won't be able to detect multiple vehicles since it is only capable of detecting only one at a time. Similar to the existing speed measuring device.

2.0 LITERATURE REVIEW

RFID technology is a wireless communication technology that uses the radio frequency to identify objects that is equipped with the RFID tags. The technology also has the ability to differentiate the tags if they are placed together. And according to John R. Tuttle, 2019, the RFID tags has memory configured with them which allow the tags to store data and that is how the reader will be able to differentiate them. But, it is important to note that different RFID will have different reading latency. Thus, in this project, it will not be able to measure the speed of multiple vehicles at a time unless a UHF RFID are used. By using an ultra-high frequency it will be able to identify multiple vehicles at a time and this is agreed by both P. Kyung Hwan et al. 2012, and C. Eugen et al. 2008.

P. Kyung Hwan et al. 2012, has proposed a method by deploying only one RFID reader and it will act as both transmitter and receiver, and the equipped the vehicles with active RFID tags. With this method, once the RFID tags are within range of the RFID readers, the tags will immediately send the information contained within to reader, and further actions can be taken if the vehicles violates the speed limit.

However, that method is not agreed by C. Eugen et al. 2008. Instead of only using one RFID reader which act as both transmitter and receiver. They proposed a method by deploying two RFID readers, each act as a transmitter and receiver respectively. Along with the RFID readers, C. Eugen et al. 2008, also decided to deploy transponder as the system's backup if the RFID failed to measure the speed of the vehicle. The transponders in their system will act as the safe-proof mechanisms. C. Eugen et al. 2008, also mention that, having more than just two transmission will provide much more accurate measurement of the speed.

The method proposed by C. Eugen et al. 2008, are agreed by John R. Tuttle, 2019, with the exceptions of deploying transponders. And according to John R. Tuttle, 2019, this method will only able to measure the average speed of the vehicles instead of actual speed.

.

3.0 METHODOLOGY

The methodology of this project include the block diagram, flowchart and circuit diagram of the proposed system. Based on the block diagram in Fig.1, the system will consists of an Arduino Uno, which will control the whole system, two RFID readers for the input and a LCD and buzzer for the system's output. When a vehicle that is equipped with the RFID tags pass through the system. The first RFID reader, which is the "start" RFID reader will trigger a timer counter and the "stop" RFID reader, which is the second reader will stop the timer. The time taken for the vehicle to pass through both of the readers are calculated in the Arduino Uno. If the speed of the vehicle exceed the set speed limit. It will trigger the buzzer and display the vehicle information on the LCD along with its speed. But if the vehicle does not exceed the speed limit, it will only display the speed on the LCD.

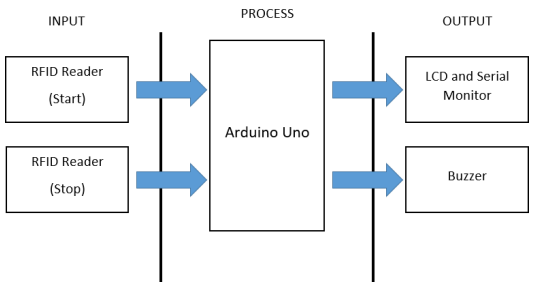

Figure 3.1: Block Diagram

The flowchart in Figure 3.2 represents the flow of the project's process. After activating the system, the RFID readers will transmit continuous signal in order to look for any vehicles that will pass through. If there is a vehicle that pass through the RFID readers, it will begin calculating the speed of the vehicle by using the time taken it takes for the vehicle to pass through both of the readers. If the calculated speed of the vehicle exceeds the set speed limit, it will display the vehicle's information and speed on the LCD, and trigger the buzzer. However, if the calculated speed does not exceed the set speed limit. It will not trigger the buzzer and only display the speed of the vehicle on the LCD.

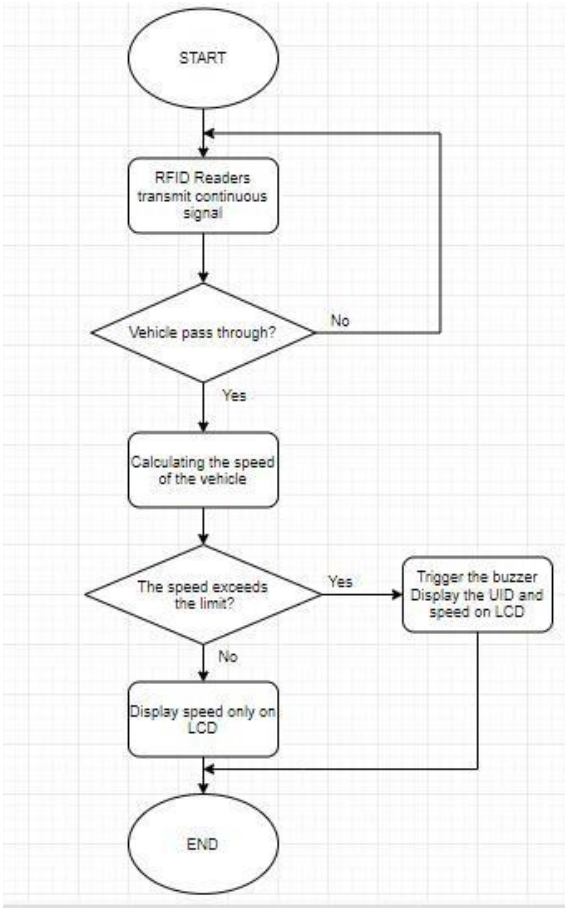

Figure 3.2: Flowchart

Figure 3 shows the circuit diagram of the project. The two RFID readers, buzzer and the LCD are connected to the microcontroller, Arduino Uno. The circuit are

simulated and tested in order to ensure the components are connected and functioning as it is intended.

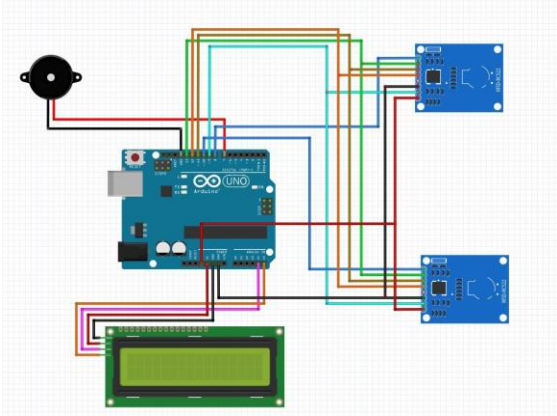

Figure 3.3: Circuit Diagram

4.0 RESULTS AND DISCUSSION

In Figure 4.1 above, its shows the sketch or coding used to configure the project. Firstly, the libraries used needed to be included in order to connect all the devices that is connected to the Arduino Uno are configurable. Among the libraries that is included in the sketch are SPI library, MFRC522 library, LiquidCrystal_i2c library and lastly, Wire library. All of these libraries used has its function. The SPI is used in order to enable the SPI interfaces on Arduino Uno, MFRC522 library is used to configure the RFID readers, LiquidCrystal_i2c library is used to connect the LCD to the Arduino Uno and the Wire library is used to ensure a connection between the LCD and Arduino Uno.

Figure 4.1: Sketch in Arduino IDE

Based on Figure 4.2, it shows the calculation that is used to measure the speed of the vehicle. The speed are measure by taking the time taken for the vehicle to pass through both of the RFID readers, which is shown in the calculation as t2 and t1. Next, it was divided by 1000 in order to convert the time from milliseconds to seconds. This is due to the time used in the sketch are in milliseconds. After that, using the v=d/t formula to calculate the speed. The d in the formula, which is the distance are fixed at 5cm, since that is the distance between the RFID readers. After getting the speed of the vehicle, it was multiply with 3600 to change the answer that is in seconds to hours. And then, it was divided by 1000 to convert from meters to kilometres. This is how the calculation of the speed in the project is done.

```
velocity = t2-t1;
velocity = velocity/1000; // convert millis to s
velocity = (5.0/velocity); // v=d/t
velocity = velocity*3600; // multiply s per hr
velocity = velocity/1000; // divide by m per km
```

Figure 4.2: Calculation for the Speed

When a vehicle exceeded the speed limit that has been set, which is at 4km/h. The RFID readers have read the UID that is contained in the RFID tags that is equipped to the vehicle. And then, it will display the UID on the LCD screen along with the speed of the vehicle as shown in Figure 4.3 and 4.4.

Figure 4.3: LCD displaying the UID and Speed of the Vehicle.

Figure 4.4: LCD displaying the Speed and the UID of the Vehicle.

However, when the vehicle that passes through the system without exceeding the limit, it will only display the speed of the vehicle when it passes through the system. This can be seen in Figure 4.5. But, this doesn't mean that the RFID readers doesn't capture the UID of the vehicle. The RFID readers do in fact captures the UID, and the system has decided not to display the UID since the vehicle does not exceed the speed limit which is 4km/h. The proof to the statement can be found in Figure 4.6.

Figure 4.5: LCD displaying only Speed of the Vehicle.

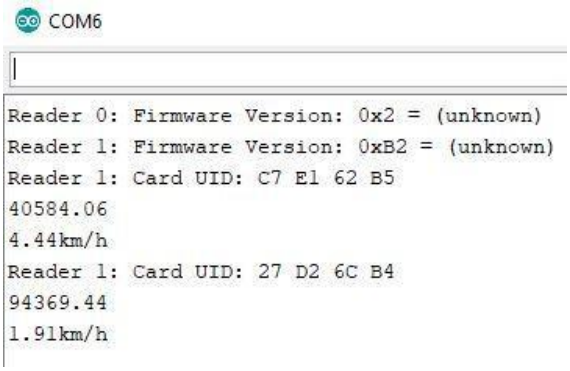

Figure 5: Serial Monitor displaying the UID and Speed of the Vehicles.

5.0 CONCLUSION AND RECOMMENDATION

All the objectives proposed when developing the project are successfully achieved. Among the objectives of the project is to save up the memory space that is used in the existing speed measuring devices. Since the existing devices used the camera devices as a mean to identify, it has to store a huge amount of data in forms of images. However, with the project, it only need to save up a few characters and their speed if the vehicles violates the speed limit. Next, since the project are capable of measuring the speed of the vehicle and identifying the vehicles, it has achieved another objectives of the project that has been proposed.

The developed project can be improve further by improving its functionality or adding more features. To recommend a few improvement to the project, a database or any memory space can be added to the project. These memory space can be used to store the data of the vehicles that violates the speed limit. Other than that, an improvement to the components used in developing the project. The RFID readers used in this project is the MFRC522 RFID reader, this component can be replaced with much more powerful RFID reader, for example an UHF RFID reader. UHF RFID reader used an Ultra-High Frequency, and this will allow the reader to read much further distance and more vehicles at a time, which the improvement on the project are very significant

REFERENCES

C. Eugen, V. Popa, G. Vasile, T. Cornel, T. Cristina, "Speed Measurement of a Moving Object by Using a RFID Location System and Active Transponders", Electronics and Electrical Engineering, no. 8(88) (January 2008), pp. 63-66.

F. Hafeez, M. A. Shammrani, O. A. Shammary, "Smart Vehicles Speed Monitoring System Using RFID", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 4, Issue 4, (April 2015), pp. 1860-1864.

John R. Tuttle, US 10650200B2 (May 2020).

P. Kyung Hwan, K. Tae Young, H. Seok Bong, K. Sung Weon, C. Byoung Gun, L. In Gi, K. Kyung Soo, K. Jung Bum, US 8274371B2 (September 2012)