

The engine starting system for three-wheeled motorbikes using bluetooth based on Arduino Uno

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Abstract

The Arduino Uno-based three-wheeled motorcycle engine starting system aims to make it easier for motorcycle users to turn on and add motorcycle safety features from theft. The contact system and the starter system are controlled through the device. The research method used the development research model developed by Dick and Carey. The development research stages are defined, design, develop, and disseminate. The components needed are a battery, Arduino, Bluetooth, and two relays. The device controls this system through an android application developed by the researcher. The results of testing the engine start system using an Android smartphone are a series of techniques that can work by its function, and a Bluetooth connection on an Android smartphone can turn on the motorcycle engine start system at a distance of 1 to 9 meters. The Arduino Uno-based three-wheeled motorcycle engine starting system effectively minimizes inclination because motorbike users can only use it if they have a device that has the application installed.

Keywords: Android, bluetooth, engine start, motorcycle

1. Introduction

Nowadays, the advancement of technology pushes the boundary to limitless development in communication, transportation, health, and so on because of the human's desire to solve every problem quickly with the maximum result [1]. The development of vehicles is quite fast; since the invention of bicycles, bicycle modifications have been very diverse. After discovering the bike, people began to think that they wanted a driven bike without using human power to find the motorbike. A motorcycle is a two / three-wheeled vehicle driven by an engine and other supporting devices such as a starter system. The motorcycle starter system is a system that makes it very easy for users to start it [2].

The increasing community needs do not be followed by a sufficient number of occupations because many companies are starting to collapse. This situation causes unemployment to soar, leading to community members' higher crime committed. Various types of crimes occur in the community, including theft, murder, robbery, etc. At the same time, theft ranked first as the highest crime. All of this happens due to the unfulfilled citizen's basic necessity.

The development of increasingly advanced technology has made technology developers, especially in informatics, start developing machine control using smartphone applications to control something with a certain distance according to your needs. Technology developers do this to make it easier for humans to use something remotely. There are various kinds of links between devices and controlled items, for example, Bluetooth and wireless. Even technology connected to the internet is often referred to as the Internet of Things. Internet of Things is an idea where all objects in the real world can communicate with others as part of an integrated system using the internet network as a link [3].

Based on the above problems, we must have a high level of vigilance with the goods owned, especially motorized vehicles. The current way of securing motorized vehicles lies at starting the engine. Motor vehicle companies have developed various engine start modifications.

This study aims to reduce the risk of motorcycle theft by changing the engine start method using an android application that is only installed for motorbike owners. The hope is that using the engine start from the motorcycle android application can have a high-security system, and the engine start can be done remotely to make it easier to use [4].

2. Method

This research method is a model to develop a motorcycle engine start that can be controlled at a distance. This study's development model uses the Dick and Carry (1996) development model [5]. Dick and Carey said the development model consists of four stages. The development stages are defined, design, develop, and disseminate. The define step is a stage where the literature studies and field surveys take place—then, the design and development step focuses on how the device will be designed and manufactured. Finally, the disseminate action takes place for testing the final product. The research stages are presented in Figure 1.

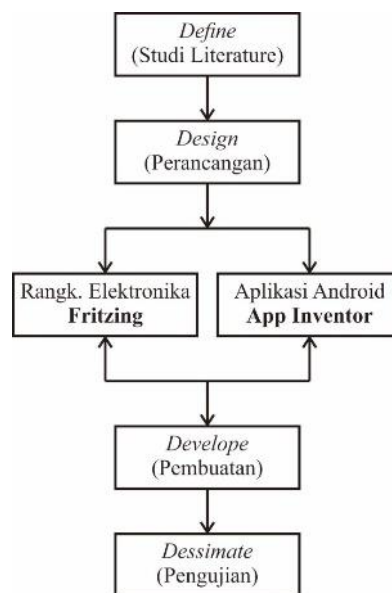


Figure 1. Stages of development research

2.1 Research Stages

The stages carried out by researchers in this study are as follows:

a. Define

At this stage, the researcher conducted a literature search starting from scientific journals and e-books. Researchers match the concept of creating a starter system controlled remotely on a motorcycle.

b. Design

After finding the components suitable for developing a starter system that can be controlled remotely, the researchers made an electronic circuit. Besides, researchers designed an android application using the App Inventor.

c. Develop

This tool consists of two parts: the hardware (electronic circuit) and the software (android application).

d. Disseminate

Testing this tool includes the speed of Bluetooth connectivity and the Android application's ability to start a motorbike from a certain distance.

3. Results and Discussion

This research was conducted based on the Dick and Carey development model stages. These stages consist of four steps, namely as follows.

3.1 Define stages

The defining stage results are the manufacture of a remote motorcycle engine start system using the Arduino Uno as the microcontroller, Bluetooth as the input receiver from the device, the device as an input source, and the output in the form of a relay.

A system is a group of interrelated components to achieve the same goal. Android is an operating system for mobile phones based on Linux [6]. Therefore, designing this tool's central concept uses Arduino Uno and Android smartphones as controllers to quickly start a motorcycle. Furthermore, A microcontroller is an electronic device that functions as a design's brain. There are various types of microcontrollers, one of which is the Atmega family. Arduino is a microcontroller from the Atmega 328 family [7]. The Arduino Uno design can be seen in Figure 2 [8].

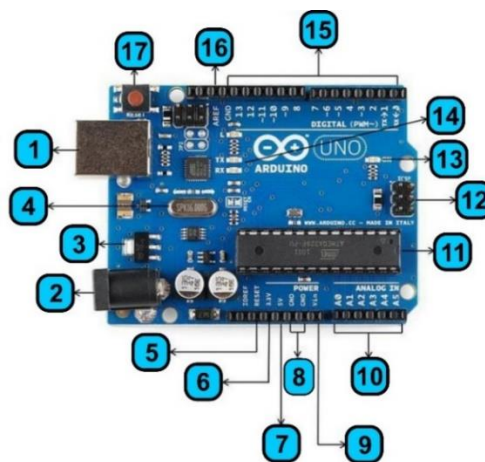


Figure 2. Arduino uno specifications: (1) Power USB; (2) Power jack; (3) Voltage regulator; (4) Crystal oscillator; (5 & 17) Reset; (6, 7, 8 & 9) Pin (3.3, 5, GND, Vin); (10) Analog pins; (11) microcontroller IC; (12) ICSP pin; (13) LED Power indicator; (14) TX and RX LEDs; (15) Digital pins I / O; (16) AREF

The Arduino Uno requires 6 to 20 VDC input. The Arduino Uno consists of 14 digital input-output pins and six analog input pins. Arduino Uno is programmed using the Arduino default IDE (Integrated Development Environment) application. This application helps create, open, and edit source code for Arduino or Sketch. The sketch is a source code that contains logic and algorithms that will be uploaded into the microcontroller IC[9]. The initial appearance of the Arduino IDE software is presented in Figure 3.



Figure 3. Arduino IDE display

Input from Arduino Uno can be in the form of sensors or access from Bluetooth-equipped devices as an intermediary for data transmission. Bluetooth, which is often used, is the HC-05 series, as shown in Figure 4.

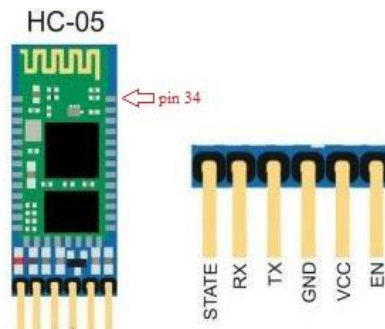


Figure 4. HC-05 Bluetooth module

Motorbikes are one of the most popular means of transportation for residents. The motorbike's shape is small and can move quickly and agile, resulting in more motorbike users than cars. Motorbikes have an electric and manual starter system. The circuit of a motorcycle electric starter system is presented in Figure 5[9].

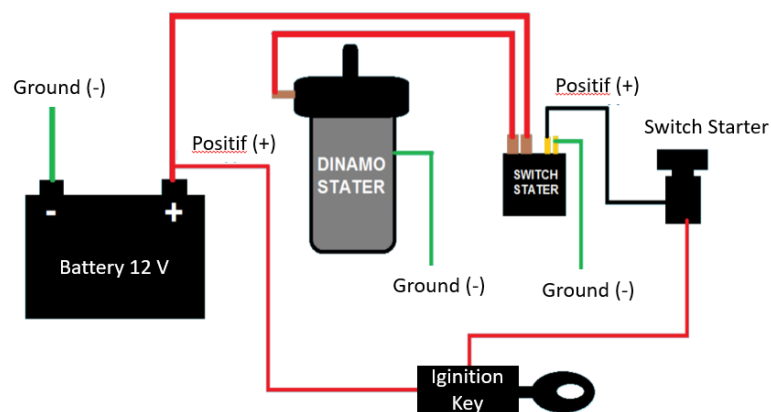


Figure 5. The electric starter system circuit

Arduino emits a current of 50 mA, so if you want to move something, you have to help with a relay. Relay is an electronic component that can drive a switch with a slight current and deliver high-voltage electricity. The relay's physical form can be presented in Figure 6 [10].

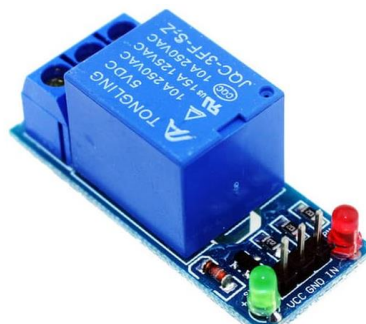


Figure 6. The physical form of the relay

Currently, devices have become one of the primary needs of humans, as evidence by the fact that almost all people have a device to facilitate communication. Over time the device can also control the Arduino Uno. The physical form of the device is presented in Figure 7.



Figure 7. The physical form of the device

There are several types of operating systems circulating in the community, including Android, Apple, Windows, Symbian, Blackberry, etc. Most of the devices circulating in Indonesia use the Android operating system [11]. The Android operating system has several versions, starting with the first version called Froyo, Gingerbread, Honeycomb, Ice Cream Sandwich, Jelly Bean, KitKat, Lollipop, Marshmallow, Nougat, Oreo, and finally Pie. Android application developers began to appear along with the number of Android users. One Android application developer that has a Bluetooth feature is App Inventor.

3.2 Design Stages

The results of the design stage include hardware design and android applications. The results of the hardware design are presented in Figure 8.

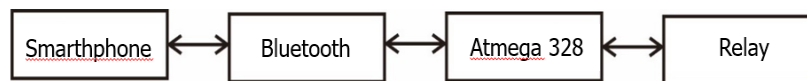


Figure 8. Hardware Design

Based on Figure 8, the input of the Atmega 328 is a device connected via Bluetooth, while the output of the Atmega 328 is a relay connected to a motor starter.

Figure 9 presents the results of designing an android application.

Bluetooth Option	
Connectid-disconnected	
Ignition Key ON	Ignition Key OFF
Starter ON	Starter OFF

Figure 9. Android Application Design

Based on Figure 9, the android application developed has five menus. The Bluetooth options menu functions to select the Bluetooth connectivity to be used. Then, the "Contacts On" and "Contacts

Off" menu applied to activate turn off the contact. Meanwhile, the "Starter On" and "Starter Off" menus were functioned to turn on and turn off the motor starter.

3.3 Develop stage

The manufacture of a three-wheeled motorcycle engine starting system based on Arduino Uno consists of several parts, including the following.

3.3.1 Electronic System

The components used are the battery, switch, Arduino, Bluetooth, and relay. The battery is a DC electricity source; the battery is removed from the motor battery line. Bluetooth functions as an intermediary for electronic circuits in the motorbike with the user via a device. Two relays are used as a switch that connects the contacts and the starter system. The electronic circuit is presented in Figure 10.

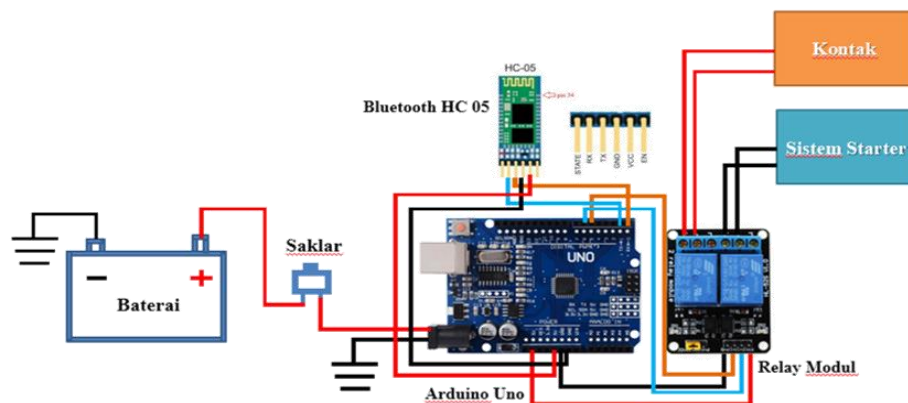


Figure 10. The electronic circuit starting engine system using Bluetooth based on Arduino

3.3.2 Arduino programming

Arduino programming process uses Arduino IDE PC/Laptop software to manage two relays related to the contacts and the motor starter. This programming translates the device's input through the Android application with a relay on Bluetooth's motor. Arduino-based engine start system programming is presented in Figure 11.

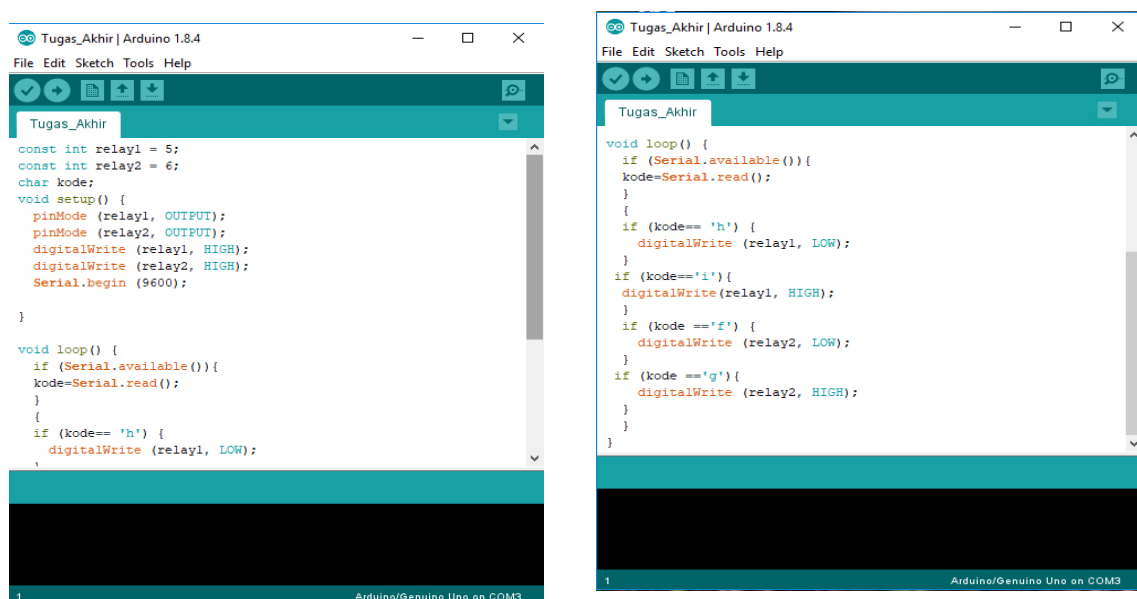


Figure 11. Programming the Arduino-based engine start system

3.3.3 Android Application Development

The process of making this application uses the MIT App Inventor. MIT App Inventor is an open-source web application. The method of making this application is presented in Figures 12, 13, and 14.

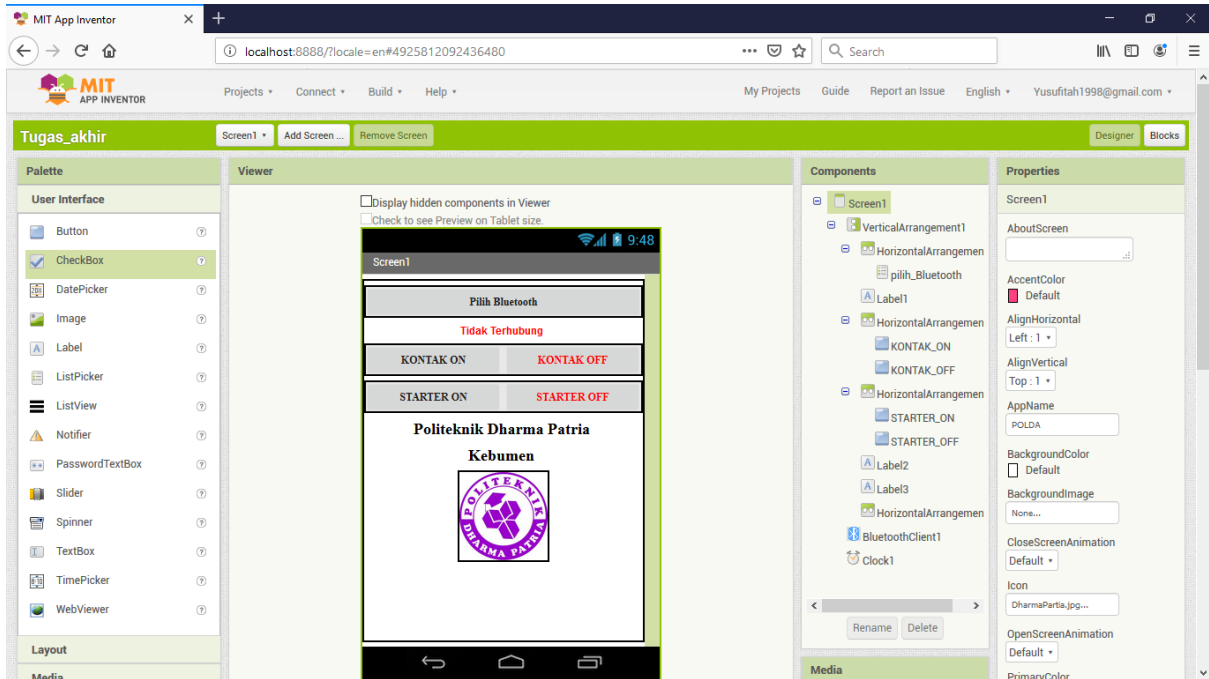


Figure 12. Application design process

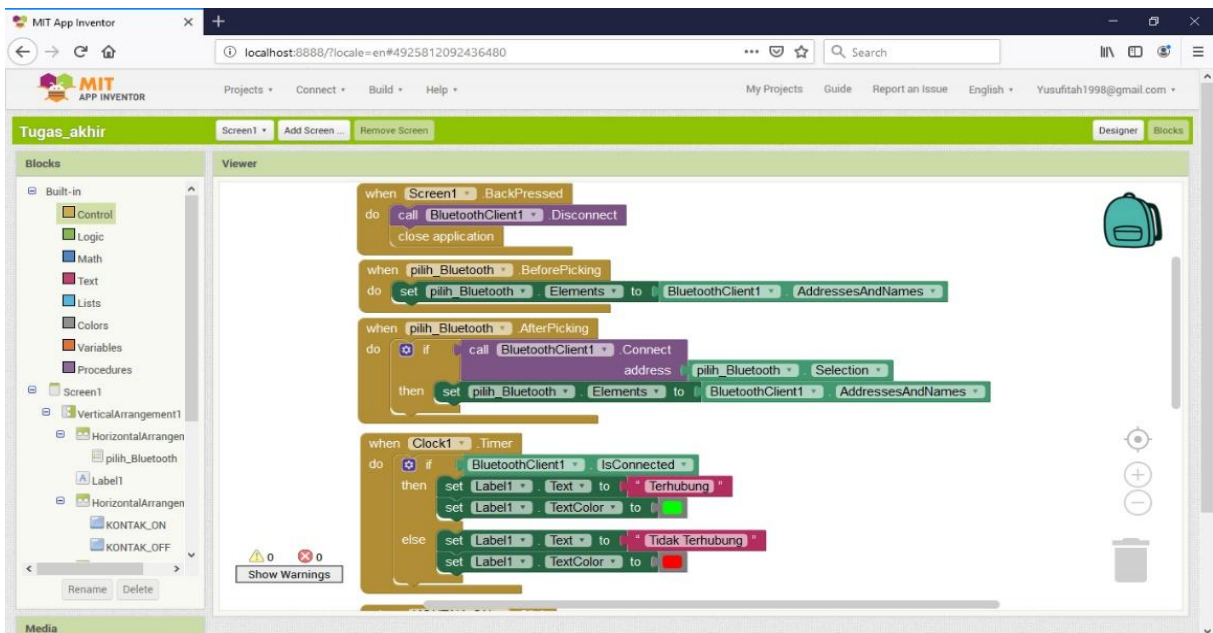


Figure 13. Application design programming process

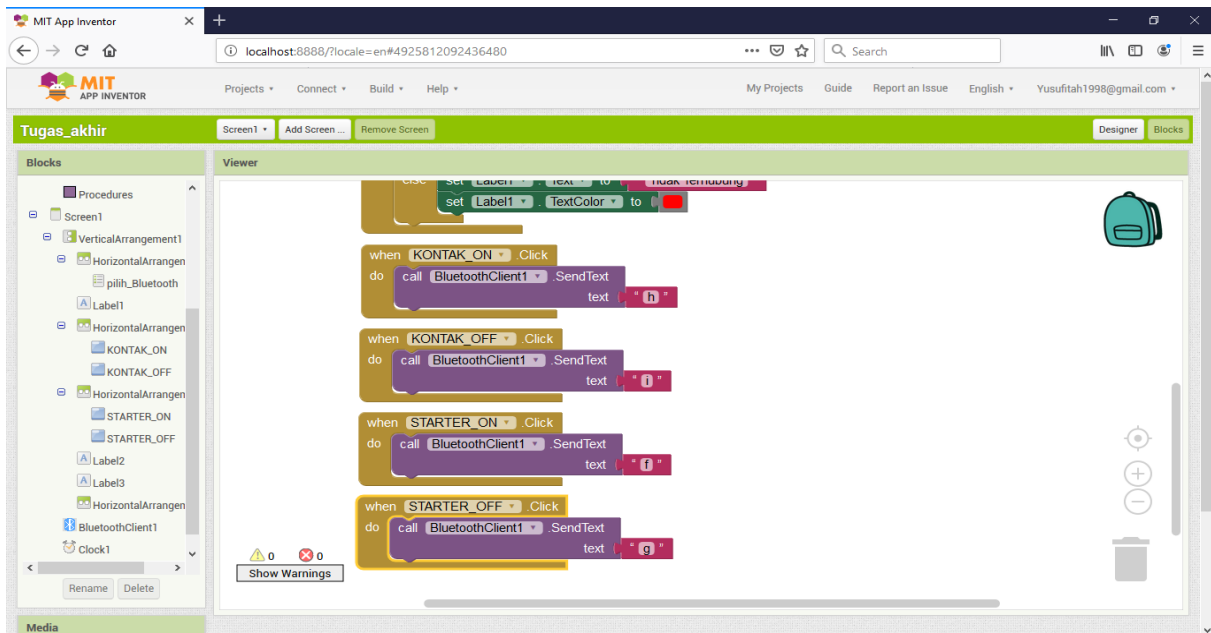


Figure 14. Application design programming process

How the Android-based motorcycle engine start system works is as follows:

- a. When Bluetooth on the android smartphone is active, then open the "Polda" application on the android smartphone.
- b. Then press the Bluetooth select button on the application to connect with Bluetooth on the system.
- c. If Bluetooth is connected, then press the "contact on" button to turn on the motorcycle's contact and press the "starter on" button to turn on the bike,
- d. If the motorbike is already on, press the "contact off" button so that the starter system turns off and minimizes the occurrence of an overdrawn battery.

3.4 Disseminate stages

Application testing [12] ensures that the manufacture of an Android-based motorcycle engine start system can function correctly. Figure 15 provides the results of applying the Arduino-based engine start system on a three-wheeled motor.



(a) (b)

Figure 15. Tricycle Motor: (a) Side View; (b) Front View

The results of the developed android application are presented in Figure 16.



Figure 16. Android application

Testing this system consists of two stages: connectivity between Bluetooth and Arduino and the Android system application's ability to turn on a motorcycle. Furthermore, figure 17 will present the time delay for Bluetooth connectivity with Arduino.

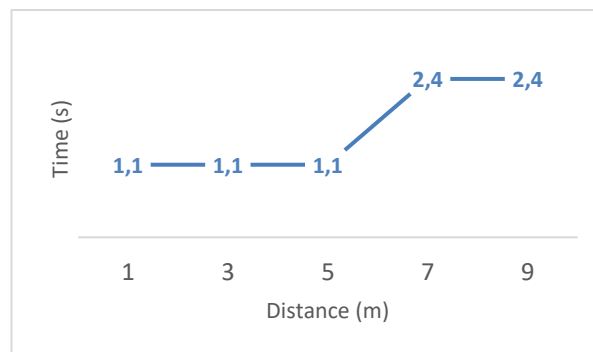


Figure 17. Graph of Bluetooth connectivity delay time

Based on Figure 17, device connectivity to Arduino at a distance of 1 to 5 and 6 to 9 meters is 1.1 seconds and 2.4 seconds, respectively.

The following figure will present the graph of the Android system application's ability to turn on a motorcycle.

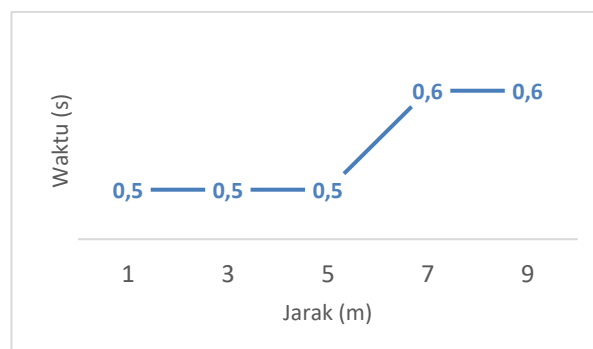


Figure 18. Graph of the ability of the android system application to start the motor

Based on Figure 18, the time needed to turn on the tricycle motor from the Android application with a distance of 1 to 5 meters is 0.5 seconds. Meanwhile, the time required to turn on the three-wheeled engine at a distance of 6-9 meters is 0.6 seconds.

Based on the test results, the Arduino Uno-based starting engine system is quite effective to use because it only requires a reasonably low delay time. Besides, this Arduino-based engine start can reduce the risk of stealing because the key settings are on the device.

4. Conclusion

The conclusions of this study are as follows:

- a. The circuit of the system can work according to its function,
- b. Bluetooth connection on an Android smartphone can turn on the motorcycle engine start system at a distance of 1 to 9 meters.

The Arduino Uno-based three-wheeled motorcycle engine starting system effectively minimizes inclination because motorbike users can only use it if they have a device that has the application installed.

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