MOTORCYCLE ENGINE START SYSTEM USING FINGERPRINT AND VOICE COMMAND

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ABSTRACT

This study aims to design and implement an engine start system using fingerprints and voice commands to turn on and turn off Arduino-based motorcycle controlled using an Android smartphone. This engine start system is designed using Arduino Uno as the main part which is then assembled with devices such as the HC-05 Bluetooth module to connect the Android application with the microcontroller on the motorbike, the FP10MA fingerprint, relay and speaker which are installed on the motorbike’s electrical parts. Making the starter engine system on this motorbike is to make it easier for users to turn on the motorbike without using a key so that they only use voice commands through an application found on an Android smartphone. In the security section, fingerprints are used as a substitute for manual ignition on motorbikes. The results of a series of engine start system tests show that the engine start security system using a fingerprint only takes 2 seconds to start the engine and 3 seconds by using a voice command via bluetooth HC-05 and is able to start from a distance of 16 meters which is controlled via a smartphone.

Keywords: Engine Start System, Fingerprint and Voice Command, Motorcycle

1. INTRODUCTION

a. Background

Motorcycles are a means of transportation that most people use to support their daily activities (Divall \textit{et al.}, 2021). Motorcycles are widely used because they are cheaper and easy to operate. The increasing growth of motorbike users has made the quality of motorbikes even better in terms of technology, for example the use of injection technology systems and engine start systems. The engine start system makes it easy for the user to turn on and turn off the motorbike easily because in general motorbikes are started manually, namely by kick starter, or by pressing the starter switch on the motorbike (Nasrullah, Tafrikhatin and Hidayat, 2021); (Hidayanti, Rahmah and Wiryawan, 2020). Previous Studies on the engine start system had been carried out previously by (Silaban and Lussiana, 2019) in a study entitled “Making a Motorcycle Security Device Using AVR Atmega8535 Microcontroller-Based Password”. In this study a tool was designed that works by matching the password stored in the EEPROM.
memory on the microcontroller and the password entered (Nurhayata, Sutaya and Ariawan, 2021). If the password does not match, the engine cannot be turned on either the double starter or the kick starter and also does not have additional power supply to Arduino so that the motorcycle battery cannot last long.

The difference with this research is that previous research used the Avr Atmega8535 microcontroller which runs the program, while the current research is using Arduino Uno. Voice command and researchers added that the security system uses a fingerprint for motorcycle security and also has an additional battery for the microcontroller. Related research that has been carried out by (Nasrullah, Tafrikhatin and Hidayat, 2021); (Wathoni, Fahrurrozi and others, 2020) in his research entitled "Designing Start Engines on Motorbikes Using Android-Based Bluetooth". In his research, it was explained that the start engine on this motorbike was made using Arduino Uno as the main part which was programmed using Arduino 1.8.4 software. which is then combined with various tools such as the HC-05 Bluetooth module, relay, and jumper cables and then installed on the electrical part of the motorbike to make it easier for the user to heat up and turn off the motorbike. The drawback in this study is that it does not have a double ignition key so that when the smartphone is off the motorbike cannot be turned on. Researchers are currently developing this by making the engine start system use voice commands or voice commands to turn on and turn off the motorbike so that it can save time and energy as well as constraints on the occurrence of Human Errors. In addition, the researchers also added that the security system uses a fingerprint sensor as a substitute for a motorcycle's manual ignition key so that it is safer from motorcycle theft.

This research creates a system that can make it easier for motorbike users to start the engine and also to improve the security system for motorized vehicles. The microcontroller is applied with an android smartphone which serves as a tool to operate the motorbike, turn on the motorbike contacts and turn on and off the engine using a voice command connected to the owner's smartphone to make it easier to start or heat up the motorcycle engine and fingerprint as a substitute for manual contacts that function to start motorcycle ignition, so the owner can use voice commands or fingerprints to turn on the motorcycle ignition. To make it more secure, before the smartphone is connected to Bluetooth, the owner must first enter the password so that he can connect to the Bluetooth.

b. Problem Formulation
How to design and implement a motorcycle engine start system using finger print and voice command?

c. Research Purpose
To Design and implement a motorcycle engine start system using finger print and voice command.

2. THEORY
a. Motorcycle
Motorcycle are vehicles that are driven by technical equipment for their movement, and are used for land transportation (Olugbade et al., 2022). Most motor vehicles use internal combustion engines, but electric engines and other engines can also be used. Motorized
vehicles have wheels, and usually run on roads. Based on Law no. 14 of 1992 what is meant by technical equipment can be a motor or other equipment that functions to convert a certain energy resource into the driving force of the motorized vehicle in question.

b. Motorcycle Starter System

The starter system on a motorcycle functions to provide rotary power for the engine to start the engine's work cycle (Nabil, 2019). The starter system on a motorbike is generally divided into two, namely: an electric starter system and a manual starter system / kick starter.

c. Fingerprint Sensor

Fingerprints are the skin on the palms of the hands or feet covered in small raised lines called friction ridges. Fingerprints have an accuracy rate of 90-95% and are not affected by any conditions or even change throughout life (Afzali et al., 2023). This system uses the FPM10A module which is controlled via the serial port, to control the module. This module with an optical fingerprint sensor has a high-speed DSP processor, a high-performance fingerprint matching algorithm and a large capacity flash chip.

3. METHOD

The engine start system on the motorcycle is made using Arduino Uno as the main part which is programmed using Arduino software, then various tools such as the Bluetooth HC-05 module, Fingerprint FP10MA, Relay and Speaker are combined and then installed on the electrical part of the motorbike (Tamrin, Asrul and others, 2022); (Aman et al., 2023). The essence of making the start engine on this motorbike is to make it easier for users to start the motorbike without using a key so that they only use voice commands via an Android smartphone only.

![Figure 1. Flowchart](image-url)
In the security section, fingerprints are used as a substitute for manual ignition on motorcycles. The following is the block schematic design.

The figure shows several subsystem blocks that are interrelated to support the work of the system to be created. Existing subsystems have different functions but are interrelated. Explanation for each part of the subsystem is as follows:

1) Android application
   This application will be built using MIT Inventor which functions to send commands that have been embedded in each command to a Bluetooth device on the motor which is then executed by Arduino according to the data received.

2) Bluetooth
   This sensor is for communicating android applications with motorcycles that function to send commands to the microcontroller.

3) Arduino
   Serves as the control center of all existing systems, because the main program code is located on the Arduino section. Is part of the controller, all data bytes sent via USB will be read by program codes and stored in the Arduino microcontroller EEPROM. The microcontroller used is the Arduino Uno microcontroller with a flash memory capacity of 32 Kilobyte (Kb).

4) Relay
   Relay is an electronic component in the form of an electronic switch that is controlled by an electric current. In principle, the relay is a switch lever with a wire wound on an iron rod (solenoid), the ignition to be controlled. When an electronic device that is controlled is energized by an electric current, what is produced is to turn on the device. The relay functions as a circuit breaker and connector.

5) Dynamo starter
   The Function of dynamo starter is as a flywheel drive on a motorcycle engine so that it can be started.

6) Fingerprint Sensors
   It Serves as a substitute for a manual ignition key to start the motorbike by detecting fingerprints.
7) Power Supply

It is a flow provider subsystem that will be used in an Arduino Uno-based (two-wheeled) vehicle security system using this Android smartphone.

4. RESULTS AND DISCUSSION

a. Hardware

![Hardware Chart](image1)

Figure 3. Hardware Chart

![Hardware Series](image2)

Figure 4. Hardware Series

1) Bluetooth Module

Picture of the Bluetooth module shown in number 1 is connected to serial communication 2 on Arduino Uno, the rx cable on Bluetooth is connected to the TX port on Arduino and the TX cable is connected to the Rx port on Arduino Uno, using a voltage of 3.3 v (Kumar, Rai and Yadav, 2021).

2) Relay

The relay module shown in number 4 is connected to ports 2(CH1), 3(CH2), 4(CH3), and 5(CH4) on Arduino Uno, the relay requires a voltage of 5v which is connected from Arduino Uno.

3) Fingerprint Sensor

The fingerprint module is shown in number 5 where the voltage source used is 3.3v from Arduino. The communication line used is serial port 10 and 11, the rx cable on the finger is connected to port 10 on the arduino and the tx finger print cable is connected to port 11 on the arduino mega.
4) Arduino uno
Arduino uno as the main voltage and control provider for each module by looping with the program that has been embedded in it (Basu et al., 2020).

b. Software
Controlling the tool from a certain distance requires an application that has been created from the Android Studio editor. The following is a picture of the application display and the function of each command.

![Application Interface](image)

Figure 5. Application Interface

c. Testing System
In doing engine starter there are 2 ways that can be done first through an application that has been made with the Android Studio editor which is connected between a Bluetooth smartphone and the HC-05 on the motorbike, for the function of each button in the application can be seen in Table 1 Function of Each Application Button, the second is by using a fingerprint by attaching a registered finger to the fingerprint module. Testing with the application can be seen in the following table:

<table>
<thead>
<tr>
<th>Distance (m)</th>
<th>Without Obstacle</th>
<th>With obstacle</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Time (s)</td>
<td>Adv</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>Connected</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>Connected</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>Connected</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>Connected</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>Connected</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>Connected</td>
</tr>
<tr>
<td>7</td>
<td>2</td>
<td>Connected</td>
</tr>
<tr>
<td>8</td>
<td>2</td>
<td>Connected</td>
</tr>
<tr>
<td>9</td>
<td>2</td>
<td>Connected</td>
</tr>
<tr>
<td>10</td>
<td>2</td>
<td>Connected</td>
</tr>
<tr>
<td>11</td>
<td>2</td>
<td>Connected</td>
</tr>
</tbody>
</table>
The results obtained in testing the engine start through the application are quite good and fast, the application only takes 2-3 seconds to start the motor.

Table 2. Engine Start Test (Fingerprint)

<table>
<thead>
<tr>
<th>No</th>
<th>Condition</th>
<th>Response Time/Second</th>
<th>Adv</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Clean</td>
<td>2 seconds</td>
<td>Engine Start Success</td>
</tr>
<tr>
<td>2</td>
<td>Clean</td>
<td>2 seconds</td>
<td>Engine Start Success</td>
</tr>
<tr>
<td>3</td>
<td>Clean</td>
<td>3 seconds</td>
<td>Engine Start Success</td>
</tr>
<tr>
<td>1</td>
<td>Dusty</td>
<td>-</td>
<td>Does not Detected</td>
</tr>
<tr>
<td>2</td>
<td>Dusty</td>
<td>-</td>
<td>Does not Detected</td>
</tr>
<tr>
<td>3</td>
<td>Dusty</td>
<td>-</td>
<td>Does not Detected</td>
</tr>
<tr>
<td>1</td>
<td>Wet</td>
<td>2 seconds</td>
<td>Engine Start Success</td>
</tr>
<tr>
<td>2</td>
<td>Wet</td>
<td>3 seconds</td>
<td>Engine Start Success</td>
</tr>
<tr>
<td>3</td>
<td>Wet</td>
<td>2 seconds</td>
<td>Engine Start Success</td>
</tr>
</tbody>
</table>

The engine starter is done by unlocking the handlebar lock. Then several tests are carried out with different conditions. A finger that can start the engine is a clean and wet finger, while a dusty finger cannot be read at all by a fingerprint.

5. CONCLUSIONS AND SUGGESTIONS

a. Conclusions

Based on the results of the research analysis conducted, it can be concluded that the starter engine system is designed using a fingerprint and voice command to turn on and turn off the Arduino-based motorbike. The engine start system has carried out a series of tests where the fingerprint can work according to the design, namely being able to start the motor via Bluetooth from a distance of 16 meters without obstructions with a response time of 2-3 seconds using an application and using a fingerprint takes 2 seconds.

b. Suggestions

In further research so that the performance of the engine start system can be more improve, it can be developed:

1) The use of a fingerprint that can be waterproof (waterprof) so that in rainy conditions the fingerprint still functions properly.

2) The application added a security code and registration features for new fingerprints.

REFERENCES

Afzali, M. U. et al. (2023) ‘Classification accuracy of the event-related potentials-based Brain Fingerprinting and its robustness to direct-suppression and thought-substitution countermeasures’, Applied Cognitive Psychology.


