MOTORCYCLE SAFETY PARKING SYSTEM AT HOME WITH ARDUINO-BASED BLUETOOTH APPLICATION

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Abstract

The community feels that security at this time is not conducive, a lot of theft, robbery and robbery of motorbikes, and resulting in material losses for certain people is considered large. The increasing needs of the community in using safety devices on motorbikes, this has led to the creation of safety devices on motorbikes. This security system uses two microcontrollers that are interconnected by using Bluetooth. Bluetooth will detect a connection between the motorcycle and the house, this connection will continuously issue a signal and disconnected if the motorcycle and the house are not connected. Then the disconnection will be used as input data by the microcontroller and processed, so as to make the alarm sound and the electric motorcycle dies. Then there is a notification via SMS to the owner according to the time period that has been set in the program which is five seconds.

Keywords : Bluetooth, House, Interconnected, Microcontroller, Motorcycle, Safety, SMS.

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Introduction

Theft is a criminal offense from the social phenomena that are always faced by the community, various attempts are made by the authorities as well as the community members themselves to eliminate them, but these efforts may not be realized as a whole. This is because that every crime cannot be eliminated easily, but can only be reduced in intensity and quality [1].

Based on the Jawa POs reportage until mid-year 2019 in Sidoarjo, there have been more than 100 motorcycle theft. The location of the theft was boarded and the area was not installed with CCTV. Most motorbikes parked in front of the house are the target of thieves [2]. Thus the need for the use of safety devices on motorbikes. Responding to this situation in the market, there are already a lot of tools sold to protect motorbike vehicles, from lock locks to alarms. This security device is specifically designed for two-wheeled vehicles, but does not rule out the possibility of being used on four-wheeled vehicles..

The types of motorbikes that are most in demand by thieves are ducks and sport type motorbikes, because thieves can sell the results of stolen motorcycle part by part [3]. While the modus operandi that they do a lot is by breaking the lock on the motorcycle handlebar so that the steering handlebar can be used and the engine can be turned on. Another modus operandi is to lift a motorcycle and put it in a box car.

This research, making an electrical safety system that is with an alarm when there is an attempt of theft, but can secure a motorcycle because of the death of the electrical system [4]. In this case the alarm sounds when the burglar tries to shift the motorcycle.

Thus the need for a more sophisticated and hassle free security system. Connectivity of two Arduino by utilizing Bluetooth [5][6] [7] [8] [9] [10] [11]. Connectivity of the two Arduino is possible to be controlled by entering the desired program, where the first Arduino acts as a master, and the second Arduino acts as a slave [12]. Thus, this connection can be used for motorbike security systems when parking at home. Here you can take advantage of the Bluetooth system that is available in Arduino and sirens as a warning to be connected to the motorcycle so that it will react when the motorbike visits the home. SMS is used as a medium of information for motorcycle owners.

Methods

The design of a motorbike safety system when parking at home with the application of an Arduino-based Bluetooth includes hardware design and software design. Following a block diagram of the system to be worked on.
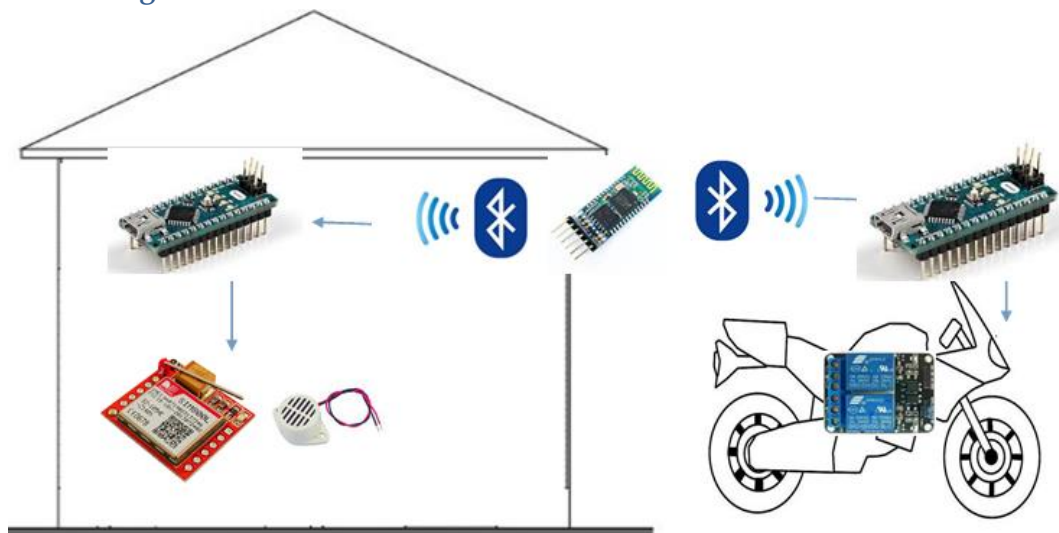
Tool Design

Figure 1. Tool Design

Figure 1. Both Arduino will be connected to each other by using Bluetooth with a peer to peer system, namely by changing the default condition of the manufacturer that has been set as a slave changed to the master condition on one of the Bluetooth modules so that when activated it will look for signals to connect to each other, and when the connection disconnected will trigger each Arduino to activate its output. The first Arduino that is placed at home will activate the alarm and SMS module, while the second Arduino installed on the motorcycle will activate a relay which will turn off the electricity on the motor and sound the alarm. And will continue until the appliance is turned off [13] [14] [15] [16] [17] [18] [19].

Home Appliance Diagram

When parking the motorbike at home will activate the alarm on the motor by pressing the secret button, after that the tool will work according to each block. Broadly speaking, this system is divided into two main parts, namely at home and on the motorbike.
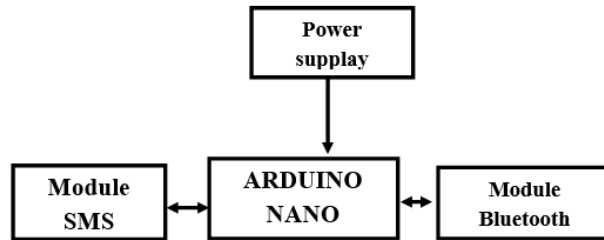
Figure 2. Home Appliance Diagram

Figure 2. Power Supply will be a source of energy that will run a series of devices placed in the house. Arduino Nano is used as the main control that contains a program to run input in the form of signals from Bluetooth and SMS module output. The Bluetooth module functions as an input on Arduino which will also be connected to the device on the motor. The SMS gateway module will send an SMS to the owner if he receives an incorrect signal from the Bluetooth input [20] [21] [22].

Software Design

In designing the Arduino microcontroller program, the C language program is used and the Arduino 1.6.6 Idea software is used. Then compile with * hex format. The following is a picture of Arduino Nano software.
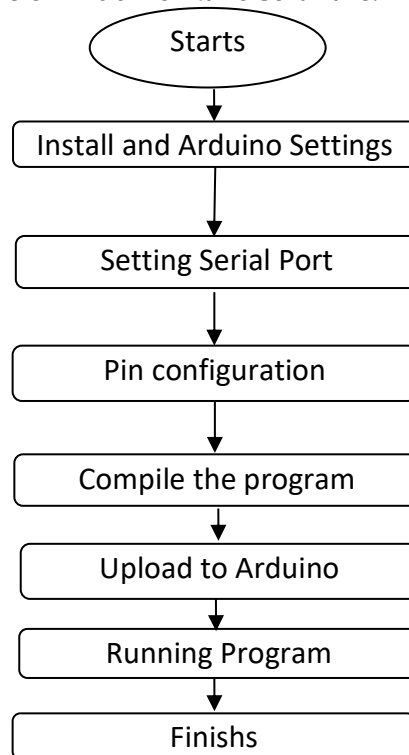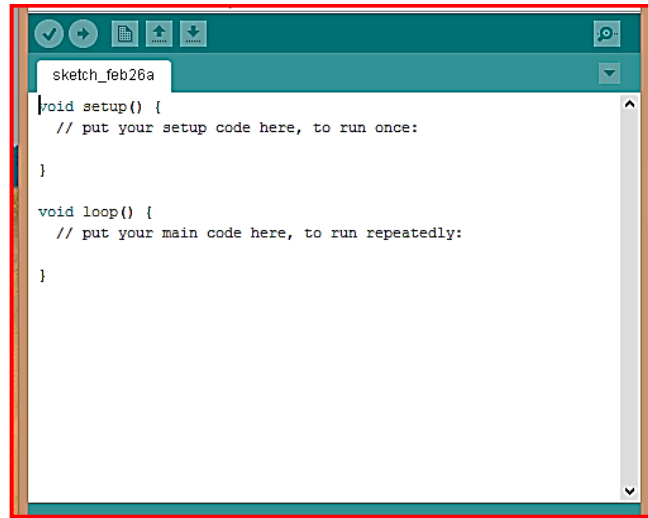

Figure 3. Flowchart Software

Figure 4. Arduino Software

Figure 3. described the beginning of the arduino application process from starting Start, installing and setting the arduino board, setting the serial port, declaring variables and constants, compiling the program, uploading it to the microcontroller, running the program, to finish. If you have problems compiling then an error mark below the program list will indicate where the error lies, as shown in Figure 4.
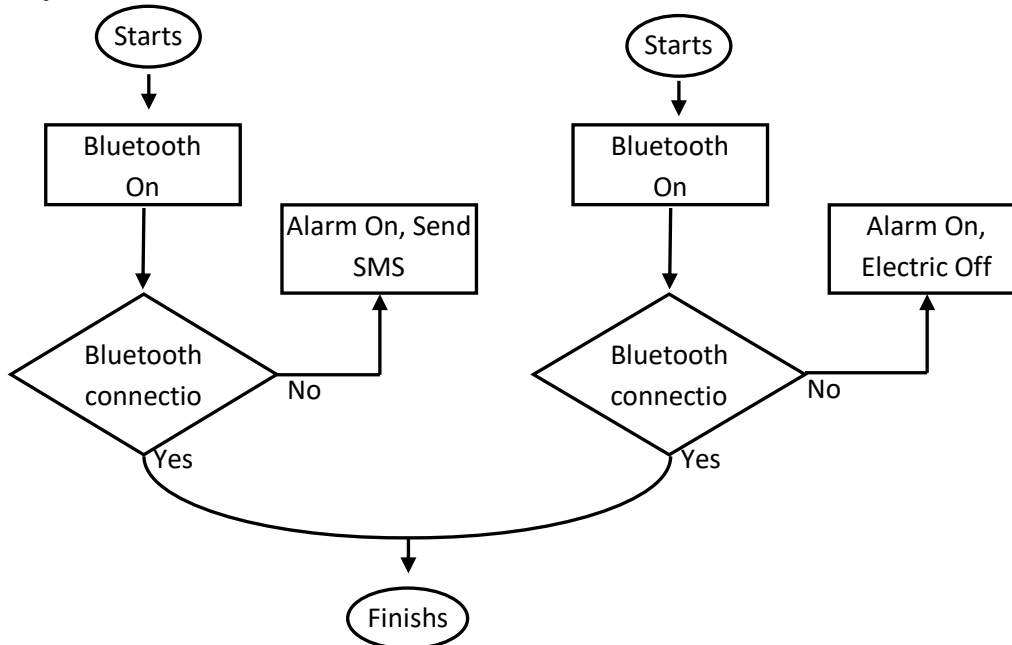
System Flowchart

Figure 5. System Flowchart

Figure 5. explains that the system's overall flowchart starts from starting, setting Arduino com ports, detecting connections between Arduino, and configuring I/O pins, entering the command mode that was previously set by Arduino output, data processing, Arduino output in the form of activating Relay command, Alarms and SMS Modules.
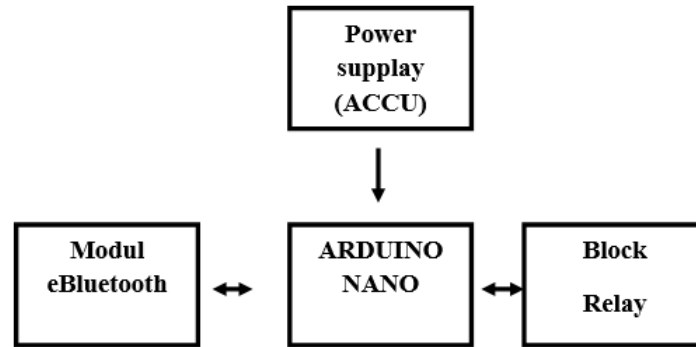
Block Diagram of a Motorcycle

Figure 6. Block Diagram of a Motorcycle

Figure 3. Power supply (ACCU) functions as a source of power for the circuit that is placed in the motor, but this power supply comes from the battery in the motor. Arduino Nano is used as the main control to emit Bluetooth signals and also to move the output in the form of a relay block. The Bluetooth module functions as an input for Arduino which will also be interconnected with devices at home. Relay block as output from Arduino which later will activate the alarm and also to cut off the electricity to the motor.

Results and Discussion

Software Testing

The program used is C language with Arduino IDE as the compiler software. After the program is finished, the sketch program is compiled and uploaded to be tried on the series that was created. Flowchart showing the work flow of the program that is inserted into the Arduino microcontroller is shown in Figure 5. When the 1 phase plug in the appliance at home is plugged into a grid voltage of 220 VAC, then the button to turn on the appliance is ON, after that the tool will Work to emit Bluetooth signals. After that the device is on a motorcycle so that these two devices can be connected via Bluetooth. After the two devices are connected, the motorcycle is safe. When the position of the Motorcycle away from the house, the Bluetooth connection of both devices will be disconnected so that the appliance in the house will sound an alarm and send an SMS notification to the registered mobile number, and the device on the Motorbike will immediately turn off the motor electricity and sound the alarm. The display of the system flowchart test results is shown in Figure 7.

Figure 7. Display of System Flowchart Test Results

Honda NF 125TR (Supra X-125) Motorcycle Test Material

The testing of this tool was carried out in two conditions to compare the range of the Bluetooth module, namely as follows:

1. Indoor (House)
2. Outdoor (Field).

Testing the appliance at home is done by activating the appliance at home and on the motor then shifting the motor away from the position of the appliance at home. Table 1. Shows the response to the condition of the equipment on the motorcycle while at home, then the motorbike is taken away from the house, the results are shown that the Bluetooth connection condition is lost at a distance of 11 meters. This is because it is influenced by a barrier in the form of a wall in the house that affects the range that can be achieved by Bluetooth. The test shows the distance achieved to disconnect a Bluetooth connection is less than the specifications available on the Bluetooth module.

Table 1. Test Results for Home Appliance Installation

No.	Bluetooth connection	Buzzer/ Alarm	Bluetooth distance	Speed	Relay Activation	Incoming SMS	SMS time
1	Connected	No Beeping	2 meters	5 KM/H	Off	There is	10 s
2	Connected	No Beeping	4 meters	5 KM/H	Off	No	0
3	Connected	No Beeping	6 meters	5 KM/H	Off	No	0
4	Connected	No Beeping	8 meters	5 KM/H	Off	No	0
5	Connected	No Beeping	10 meters	5 KM/H	Off	No	0
6	Disconnected	Sound	11 meters	5 KM/H	On	There is	5 s
7	Disconnected	Sound	13 meters	5 KM/H	On	No	0
8	Disconnected	Sound	15 meters	5 KM/H	On	No	0

Outdoor Testing Equipment

Outdoor tool testing is done by placing existing devices in the home in an open space (village field) to compare the effect of the presence of a barrier wall in the house which influences the distance that can be reached by the Bluetooth module. So it is also necessary to change the input power to the device that was previously placed at home, by changing the input power from 220VAC to 5VDC by using a used battery and lowering the voltage to 5VDC using the DC-DC step-down, then conducting experiments as before conducted at home that is by activating the existing tools placed in the middle of the field and on the motor then shift the motor away from the position of the tool placed in the middle of the field.

Table 2. Test Results for Outdoor Equipment Installation

No	Bluetooth connection	Buzzer/ Alarm	Bluetooth distance	Speed	Relay Activation	Incoming SMS	SMS time
1	Connected	No Beeping	0 meters	20 KM/H	Off	There is	10 s
2	Connected	No Beeping	5 meters	20 KM/H	Off	No	0
3	Connected	No Beeping	10 meters	20 KM/H	Off	No	0
4	Connected	No Beeping	15 meters	20 KM/H	Off	No	0
5	Connected	No Beeping	20 meters	20 KM/H	Off	No	0
6	Disconnected	Sound	25 meters	20 KM/H	On	There is	5 s
7	Disconnected	Sound	28 meters	20 KM/H	On	No	0
8	Disconnected	Sound	30 meters	20 KM/H	On	No	0

Table 2. Shows the response of the condition of the equipment on the motorcycle when outside the home and then the motorbike was taken away from the starting place, the results showed that the condition of the Bluetooth connection was lost at a distance of 20 meters. Because there are no obstacles in the form of walls or other objects, the range that can be achieved by Bluetooth will change. The test table shows the distance achieved to disconnect a Bluetooth connection the same as the specifications in the Bluetooth module.

Discussion

The test data obtained from the analysis are Arduino Nano in normal conditions so that it can be used for testing, the connectivity of the two devices has a further range because it uses two Bluetooth modules to be approximately 25 meters. When Bluetooth is blocked by a wall and the motorcycle runs at 5KM/H, the response time of the two Bluetooth devices is lost at a distance of 11 meters. In open spaces or without obstacles, motorbikes run at speeds of 20 KM/H, Bluetooth connections are lost at a distance of 25 meters.

The SMS reception time when the two devices are connected after 10 seconds, according to the program included in the Arduino. And the time of receiving the SMS when the two devices are disconnected is after 5 seconds according to the program.

Making motorcycle safety system hardware is made with a minimum design so as not to spend too much space when mounting on a motorcycle, so it does not change the shape of the motorcycle body and can also be activated easily so as not to interfere with comfort and reduce the safety factor when driving.

Making motorcycle safety equipment software is made as safe as possible, for example by using ULN2003 IC as a relay driver, it needs to be done with the aim that in addition to the tool working optimally, user safety factors must also be prioritized. When both initial devices are turned on, the alarm will sound until the Bluetooth connection is connected, after that both devices will function normally according to the program being run and there is a notification via SMS, and when the Bluetooth connection is broken

then activating the relay and the SMS module, where the relay will turn on the alarm on the bicycle the motorbike and disconnects the electricity causing the motorcycle engine to die, and the SMS module will send an SMS to the owner's number as a warning.

Conclusion

When testing outside the room (village field) and indoors (home), the distance that can be reached by Bluetooth when in the room is close because there are obstacles (walls). Meanwhile, when outside the room the distance is covered far because there are no obstacles, so the number of obstructions will affect the distance of the Bluetooth range. When moving a motorcycle from an existing device at home with low yields a fast response from a Bluetooth connection, while when driving a motorcycle with a high speed slow response from a Bluetooth connection. So that the faster the motorcycle away from the device at home the longer the time needed by Bluetooth to get the connection response. Environmental conditions with the communication provider will affect the sending and receiving of SMS sent by the device to the cellular telephone when there is a danger warning appears. The worse the provider network is available, the longer it will get the danger alert sent via SMS. The safety level of the motorcycle is more secure because it has been fitted with a safety device that can warn the owner and those around when the motorbike is in unsafe condition (stolen).

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