

The development of appropriate technology: Simple double layer vehicle safety system

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Abstract. The high crime rate of motor vehicle theft in urban areas requires additional safety systems installed in our vehicles. The following paper presents an embedded system for vehicle safety. A simple safety with double layer activation ensures the vehicle cannot be turned on by a burglar even though it has damaged the ignition. Utilizing a combination of the drive by touching module and the arduino uno microcontroller, the security system works automatically when the ignition is off. To activate the vehicle, it requires activation of the touch of the hand at a secret point, so that the CKP signal will be sent to the vehicle ECU. At the same time, touch activation continues the 7V voltage as a power microcontroller. Next it is necessary to pair the Bluetooth signal HC-05 module with the vehicle owner's cellphone using the boarduino application. Commands from the cell phone in the form of signals received by the Bluetooth module, will be forwarded to the control unit to activate the actuator so that the vehicle can be turned on. The safety system that was proposed after being designed, built, and tested gave good results as expected.

1. Introduction

The development of the population that is increasing every year, is also directly followed by an increase in the population of motor vehicles, especially in urban areas. The need for motorized vehicles, cars and motorbikes becomes a mandatory requirement for daily activities. Data on cases of motor vehicle theft in urban areas, such as Banjarmasin, shows an increasing trend from 2017 [1]. Explanation from the police, the mode of action of motor vehicle thieves is to lurk and wait for negligence of the vehicle owner who used to forget to pair the security key [2]. Along with the development of increasingly advanced technology at this time, the potential for crime or theft of motor vehicles is increasing. Crimes can occur to the driver, passenger or motorized vehicle [3]. In this study, the authors developed a prototype of an appropriate technology in the form of an automatic safety system on motor vehicles to avoid theft [4].

The drive by touching module application is guaranteed to be effective enough to avoid motor vehicle theft. By using the safety system, the destruction of the ignition will not make the motor vehicle can be immediately turned on, it still requires activation by touch at the secret point. The design of a motorcycle safety system utilizing Bluetooth technology that is configured with supporting devices such as a microcontroller, as a double safety, and connected to the current source on the switch or ignition has been presented on paper [5]. Making a microcontroller-based motorcycle safety



application that has been equipped with a touch switch to lock the ignition, horn, and engine using a keypad combination is described in the paper [6]. The authors propose a vehicle safety system that utilizes SMS microcontroller-based and android-based media to control relays that are able to disconnect and connect the current on the motor vehicle CDI [7]. In other papers the application of Arduino was also developed for vehicle safety in the form of automated speed control [8]. As for the vehicle safety system proposed in this paper, the system works automatically after the ignition is turned off without using an additional switch, combining the double layer security, with the activation of the touch switch and the activation of the bluetooth signal to start the vehicle.

2. Hardware description

The drive by touching module is an automatic safety module for motorized vehicles. The vehicle can only be turned on if the ignition or dual security switch has been activated by getting a touch at a certain secret point. This touch safety utilizes human hands as an electrical conductor to activate switches that work automatically on the vehicle ignition system circuit. In this proposed system the drive by touching module will activate the safety of the first layer of the vehicle's CKP sensor (crankshaft position sensor) signal, as well as supplying electric current to activate Arduino and the Bluetooth module. The recommended working voltage for Arduino is 7 volt, so step down is used to reduce the working voltage of 12 volts coming out of the drive by touching module to Arduino Uno. It is a microcontroller board that is fully controlled by ATmega328. Arduino uno has 14 digital input or output pins (6 of which can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button [9]. Arduino uno board is also supported by arduino IDE (Integrated Development Environment) software.

The main idea is to use Arduino Uno because the vehicle safety system will be programmed with Arduino IDE software. Arduino uno contains everything needed to support a microcontroller, easily connect it to a computer using a USB cable or supply it with an AC to DC adapter or use a battery. Arduino uno R3 uses a microcontroller that is fully controlled by the ATmega328 microprocessor. The microprocessor used is already equipped with an analog to digital signal converter (ADC) so that no external ADC is needed.

The HC-05 bluetooth module is used to receive and forward signals from the cell phone of the vehicle owner to the microcontroller [10]. At this stage synchronization of the Bluetooth signal on the cell phone with the Bluetooth signal on the HC-05 module uses a password. After synchronizing, the next bluetooth module and microcontroller will communicate with each other. The signal on the bluetooth module is received via the RX pin (Receiving Pin) and the signal is sent by the TX pin (Transferring Pin). The TX pin will forward commands from the cell phone to the microcontroller to activate the actuator. Figure 1 shows the relationship between the arduino uno microcontroller and the actuator that is activated, in the form of a relay that continues the incoming flow to the starter system so that the vehicle can be started.

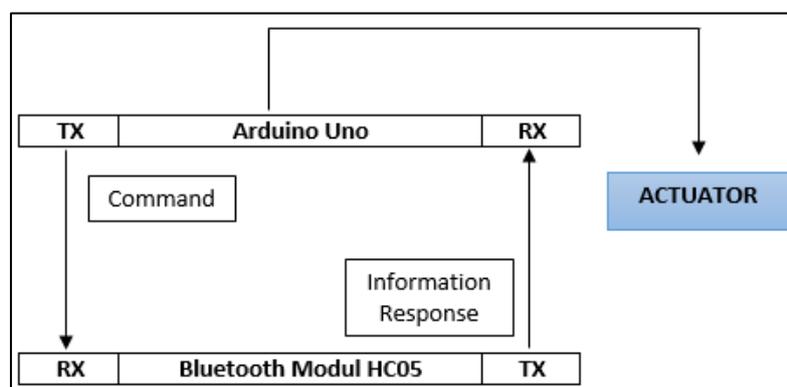


Figure 1. Arduino uno microcontroller and HC-05 module.

3. Software

Arduino IDE stands for integrated development environment which is used to develop. Referred to as the environment because through this software Arduino is done programming to perform functions embedded through the programming syntax. Arduino IDE uses its own programming language that resembles C. The Arduino programming language (Sketch) has been made changes to facilitate beginners in programming from the original language. Before being sold to the market, the Arduino microcontroller IC has embedded a program called Bootlader that functions as an intermediary between the Arduino compiler and the microcontroller [11].

Arduino IDE is made from the JAVA programming language. Arduino IDE also comes with a C / C ++ library called Wiring which makes input and output operations easier. Arduino IDE was developed from a processing software that was remodeled into Arduino IDE, specifically for programming with Arduino. Programs written using Arduino Software (IDE) are called sketches. Sketch is written in a text editor and saved in a file with the extension .ino. The text editor in Arduino Software has features such as cutting / pasting and searching / replacing making it easier for us to write program code. In the Arduino IDE Software, there is a kind of black message box that functions to display status, such as error messages, compiles, and program uploads. At the bottom right of the Arduino IDE Software, shows the configured board and the COM Ports used. The embedded code (see Fig. 2) is developed in a short period of time because the IDE contains inbuilt libraries.

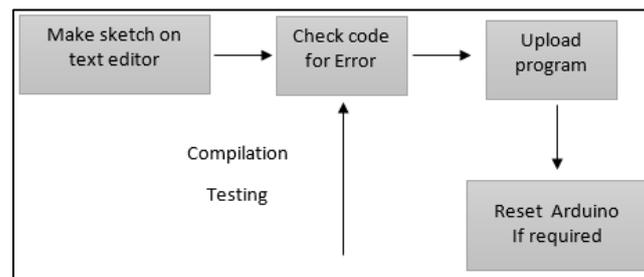


Figure 2. Embedded code development.

4. Implementation and results

Figure 3 shows the flowchart of a simple double layer security system developed. A fully embedded system architecture is shown in Figure 4, when the vehicle is going to start it is necessary to activate hands by touch at the vehicle's secret point. The drive by touching module will activate the first layer of the security system, the CKP sensor signal that goes to the vehicle ECU as the main information that the engine is running, while providing an electric current to activate the control unit (microcontroller). Because the control unit works in the voltage range of 5 - 9 V, step down is used to supply power of 7 V into the control unit, at this time the second layer is active and the HC-05 bluetooth module will send a signal to the cellphone of the vehicle user for pairing Bluetooth connection with a predetermined password. If a Bluetooth connection has been connected, the user will send a signal using the boarduino application that has been installed on the cellphone of the vehicle owner as shown in Figure 5. The signal received by the Bluetooth module will be forwarded to Arduino Uno to provide current to the actuator coil, then the current will activate the system starter as shown in figure 6. Finally the starter switch is on and starts the vehicle as shown in figure 7.

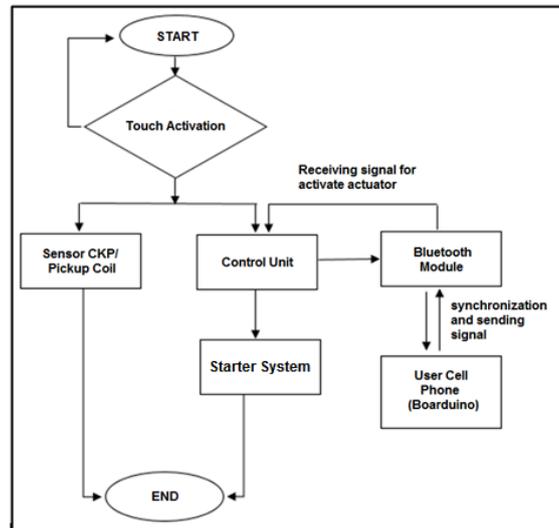


Figure 3. Control flow of the proposed system.

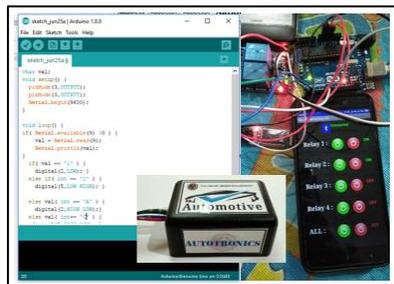


Figure 4. Embedded system architecture.



Figure 5. Cell phone user send signal.

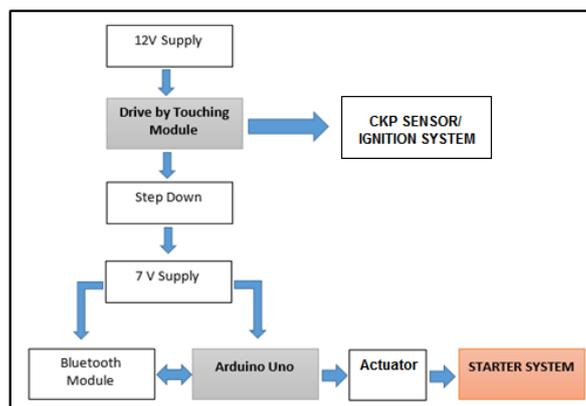


Figure 6. Block diagram of proposed system.



Figure 7. Double layer safety circuit.

5. Conclusion

An embedded system has been designed and tested for safety features from motor vehicle theft crimes using a combination of touch activation and Arduino uno microcontroller. The safety system will work immediately when the ignition is off or the vehicle is turned off. By not using an additional switch to activate and deactivate the safety system, the vehicle owner does not need to worry if at any time is forgotten because the system works automatically. In general, vehicle theft is done in a short time by damaging and connecting the electrical circuit directly to the vehicle starter system. The use of this security system can prevent motor vehicle theft crimes that are increasingly happening in urban areas. The main idea of this system is to create a vehicle safety system that is simple and easy to install, and has a high level of security with two layers of safety. When the vehicle will be stolen, the vehicle will not be able to start even though the ignition has been tampered with, it requires touch activation to send the CKP sensor signal connected to the ignition system. Next microcontroller that gets an electric current will be active and work after getting a bluetooth signal from the vehicle owner's cell phone. The proposed safety system has been designed, built and tested to provide the appropriate results.

6. References

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