Arduino Based RFID Vehicle Tracking for Home Security

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Abstract. The development of security devices has been an important concern for everyone as most devices’ usage are limited at certain places that require verification. Radio-Frequency Identification (RFID) is used to transmit data via radio frequency (RF). The RFID technology is enabled as the main technology in various applications such as automated, collection of wireless data and contactless. Therefore, this study proposes simple design for tracking identifications using well known components like Arduino Uno that used IC Atmega 328p, sticker tag as an RFID tag and RFID ID-20LA. The RFID reader wirelessly communicates with the sticker tag to identify the code where each tag has its own identification number or code. The data from the sticker tag is then sent to Arduino board, which is basically used as a Microcontroller based board. The received data is collected by the Arduino microcontroller in order to compare with valid data that acts as a reader. The reader acts like a decoder where the encoded data in the tag’s integrated circuit is decoded for processing computer host. LCD screen display is used to display the data while the buzzer sound will go off if the valid data is read.

1. Introduction
Nowadays, with the development of economic level and improvement of living standards, a growing number of cars leads to serious problems in our society [1-3]. It will make the space for parking more limited. In this study, we aim to help our society to reduce the problem of limited parking space and safety. As safety is crucial, many security devices are used to increase the security level [1-4]. Many studies have been done about safety devices using android.

In this study, we proposed using Radio-Frequency Identification (RFID) where it forms an automatic identification using magnetic fields to emit the RF signal. It is a fast, affordable and automatic identification technology [5-7]. Researchers have described the RFID technology as a key for automated, contactless, and wireless data collection [8-10]. The major components in RFID are a reader, receiver and tag [8]. It works when the tag captures an electromagnetic field zone of reader, then its ID code is broadcasted along with the illuminator’s ID code to a receiver.

Currently, security devices are very much in demand almost anywhere. This is due to increasing crime rates using copied stickers which leads to the need for car sticker verification. Manual verification by the security personnel’s is not an attractive choice. In this paper, the development of a tracking handheld device that can relay identification from a special sticker through RFID system is discussed. The main focus of this proposed systems is to decrease the invasion rate, to prevent copied sticker and to ease the process of vehicle security checking.
2. System Implementation
The scope of this study is based on RFID technology applied to vehicles by tracking its identification using a special sticker tag which has a silicon chip inside the sticker. The sticker tag is used as transmitter while RFID reader is used as the receiver. Vehicle tracking system block diagram is shown in Figure 1 below. The block diagram consists of Arduino board, RFID tag as a scanner, LCD screen that shows either PASS or FAIL of the scanner which detects the plat number of vehicles, as well as LED, and Buzzer as indicators to show the functionality of the scanner.

![Block diagram of vehicle tracking system](image1)

Figure 1. Block diagram of vehicle tracking system

2.1. Arduino Board
An Arduino board as shown in Figure 2 consists of Atmega 328p with a voltage regulator to regulate voltage to 5V. This Atmega 328p operates with voltage input of 5V. The crystal oscillator used is 16MHz to provide clock input for IC Atmega 328p. LED is used as indicator for power supply. LED will be turned on when the supply power is in good condition, while the LCD screen will display the current condition such as ‘pass’ or ‘fail’ and the buzzer will operate as indicator. The capacitor 100uF at two power line stabilizes the voltage supplied to IC Atmega 328p. The push button is used as a reset button for IC Atmega 328p. Figure-2 shows the Arduino connection with RFID.

![RFID connects to Arduino](image2)

Figure 2. RFID connects to Arduino

2.2. RFID Tag
A Radio Frequency Identification Tag (RFID) is a wireless tag that consists of memory, chip and antenna to exchanges data information with a RFID reader. In this study, the Active tag of RFID is chosen for inventory tracking in car plate number environment. Figure 3 shows the RFID circuit diagram.
Figure 3. RFID circuit

Figure 4 shows the circuit for LCD and RFID. This circuit is designed to display the data coding from Arduino. The potentiometer is used to get a good character display on the LCD. Meanwhile, the RFID connector is used as function of RFID. The LEDs are used as indicator. The first LED functions as a card range indicator and second LED works as a valid RFID tag indicator.

Figure 4. RFID and LCD circuit

3. Methodology
The flowchart in Figure-5 shows how the RFID system works. It starts with the process of RFID attaching the sticker tag. The RFID reader detects the sticker tag and LED will blink. Arduino will analyse the information and buzzer will go off when the RFID reader detects the correct sticker tag. RFID readers are devices that work wirelessly and communicate with tags to identify related data. The antenna of the RFID reader emits radio signals to activate the tag. The RFID tag is a tiny object, with an adhesive sticker that can be attached to or incorporated into a product. For enabling radio frequency signal queries, the RFID tag contains an antenna and magnetic strip to receive and transmit the signal. The tag is built of an Integrated Circuit (IC) that includes memory for processing capability. Basically, the tags consist of two types; the Active tag and Passive tags. The difference between both are the Active tag include internal power supply while the Passive tag is without an internal power supply. The RFID reader functions as a decoder that decodes the data encoded in the tag's IC. Then, for data processing, it is passed to computer host.
4. Results and Discussions

Figure 6 shows the prototype for this study. Basically, the Vehicle Tracking RFID will scan the RFID sticker tag by attaching RFID scanner to the sticker tag. This Vehicle Tracking RFID uses plastic board as a casing. The circuit is protected with plastic board to avoid damages. The RFID reader is placed at the surface of plastic board for the user to scan the sticker easily. The casing was built with suitable design for easy handling.

![Figure 6. The correct tag of LCD display.](image-url)
Figure 6 shows the LCD displaying the result when RFID scans the correct sticker tag. The LCD will display “PASS” and the buzzer is buzzed twice. The LCD also displays the plate number. Meanwhile, Figure 7 shows the result for condition when RFID scans the incorrect sticker tag. The LCD will display “CANNOT PASS”.

From the results, the algorithm successfully identified the RFID and LCD to scan sticker tags. The RFID also read the correct identification number of tag and Arduino could analyze the data to display on LCD screen and trigger the buzzer as indicator output when the correct tag was read. This project has worked as expected.

![Figure 7. Incorrect tag of LCD display](image)

5. Conclusion
The proposed vehicle tracking system has been successfully completed. By using the Arduino based RFID system, security guards can identify the owner of a particular vehicle plate number by simply scanning the card. This work can be further extended as a complete RFID identification to include other applications such as personal details.

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