

SMART MOTORCYCLE SECURITY AND TRACKING USING
ARDUINO AND ANDROID

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“I hereby declare that the work in this project is my own except for summaries and quotations which have been duly acknowledge”

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Specially dedicate to,

My beloved parents, family members, supervisor and friends for your supports, encouragements, understanding, and all the favour, may God bless all of you.

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ABSTRACT

Security is applied to reduce the risk of an accident or protecting against deliberate attacks. Now day, we can see a motorcycle owner always left their motorcycle with only low-tech solution such as use padlock to prevent motorcycle theft. They also always left their motorcycle without any security system especially for small-engine capacity motorcycles because they are not equipped with advanced systems. This has leded the motorcycle being stolen. However, this smart motorcycle security and tracking system are using Bluetooth in security part and use GSM and GPS in tracking part. Bluetooth is needed to use in this system because it has range area for nine until ten meter as a medium wireless communication and GSM has a long range detected as wireless communication.

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CHAPTER 1

PROJECT OVERVIEW

This chapter will explain about the project background, objective to be achieved, problem statement and scope of work.

1.0 INTRODUCTION

This project is about improving a prototype of security system for motorcycle. Smart motorcycle security and tracking system using Arduino and Android is the new technology for safety on the motorcycle in replacement for traditional locks in the motorcycle. The aim of this project is to develop a low-cost security and tracking system for motorcycle using Arduino and Android. This system will apply for low-powered or small-power capacity motorcycles because they are not equipped with advanced systems such as those used in the most high-powered motorcycles. The user has to enter a user ID and password using an Android mobile which connected via Bluetooth. If the user ID and password are correct then the system will allow the ignition. If the user ID and password are entered more than five times then user receive a messages from the system. The user will get the information by messages on their android mobile if there are thief was around their motorcycle and also information about current location of stolen motorcycle. The GPS will be used to tracking the stolen motorcycle location and the tracking information will get from messages in user android mobile that will continue to update for every ten minutes until it have been found as shown in figure 1.1. Wireless communication is used to send commands to the project. In this project, I will use the Bluetooth and GPS as the medium for wireless communication.

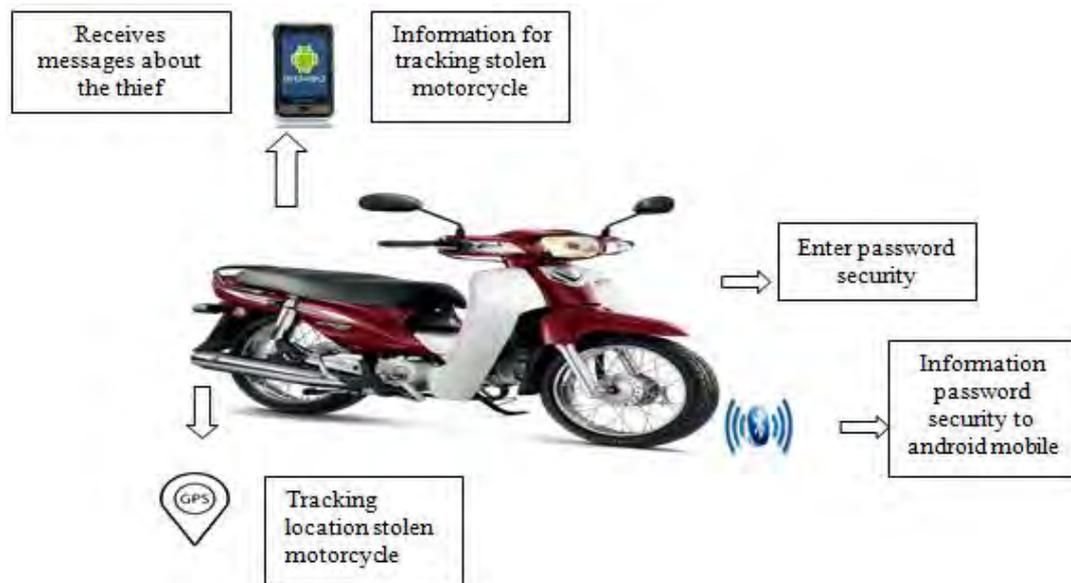


Figure 1.1: Project Overview

1.1 PROBLEM STATEMENT

Vehicle nowadays is very useful in daily life because it is one of valuable properties especially a motorcycle. But motorcycles also have disadvantage which also can be easy prey for a thief. When taking into consideration about the portability of motorcycles and the potential money made from parting it out, so it is no wonder motorcycles are at high risk of theft because the motorcycles do not have a specific security like a car. The bikes nowadays are very easy to be stolen simply by opening the ignition keys with only one key, especially low-powered motorcycles because they are not equipped with advanced systems such as those used in the most high-powered motorcycles. After the motorcycles had stolen, motorcyclists will face the big problem on how to find back their motorcycle as soon as possible before they make a police report. The system can detect the thief around the motorcycle and send the information about their motorcycle through android mobile immediately.

1.2 OBJECTIVES

There are several objectives throughout about this project

- To design a low-cost security and tracking system for motorcycle utilizing wireless communication technologies (Bluetooth, GPS & GSM) using Arduino and Android.
- To develop a prototype that can demonstrate the functionality of the system on real motorcycle.

1.3 SCOPE OF WORK

Hardware

- 1) Do some research on the security system that nowadays used in the vehicles. Research are more focusing towards the wireless and GPS technologies that had apply in security system and how that system are working.
- 2) Study about the type of GPS and choose which are more suitable to use in the tracking system.
- 3) Research about the most suitable Arduino depends on cost and size of prototype later.
- 4) The most suitable component have chosen as the main component for project which are Arduino Nano, GPS module, GSM module, Relay module, and Bluetooth Module based on cost, size and quality.
- 5) Do some wiring modification on the motorcycle to develop a prototype of this system.

Software

- 1) Study and do some practice in Arduino and Android software.
- 2) Arduino software is used for develop the coding for security system and for the Bluetooth system.
- 3) Android software is used to create the system in android mobile for device in tracking system.
- 4) Arduino software is used for develop the coding for security system and for the tracking system.
- 5) MIT App Inventor software is used to create the system in android mobile for device in security and tracking system.
- 6) Design a complete circuit which consists of main components of this project using Proteus software.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter basically discusses about the technology that is implemented in the project and the background of the technology. The reviews about the previous work related to this project were discussed in this chapter. Bluetooth technology, GPS technology and GSM technology are the main core of the project using Arduino and Android technology. So in this chapter, these technologies will be introduced and will be explained why these technologies are used in this project. This chapter also will introduce about the Arduino board technology that used in this chapter. Therefore, the other components that used in this project also will be elaborate more clearly.

2.2 REVIEWS OF PREVIOUS WORK

2.2.1 Vehicle Tracking and Identifying Based on Android [1]

This paper introduces the design of project for providing protection and security based on embedded system technology. This project based on android application which is used to protect theft incident occurred in any situation and intimate through mobile phone via Bluetooth. The main aim of this system is to provide low cost device which is used monitor and track the current location through GPS Technology and intimate to mobile phone via Bluetooth. By using android phone they are used to design an application depend their requirement and perform a specific task which that application to avoid vehicle theft and identifying current location through GPS Technology and getting alertness information through mobile phones via Bluetooth module. This project also provide the system to monitor or keep update the vehicle condition at every moment and also the user or police station can get information through mobile phone when vehicle has been stolen by any person. That system can make the user or police has easy way to find out current

location of stolen vehicle based on advance technology. The main components that have run in this project are ARM 7 LPC2148, Bluetooth Module, android mobile phone application, vibration sensor, GSM and GPS.

They are using ARM 7 microcontroller which controls the all devices and performs a specific task. Collecting the required data from sensors which is attached to microcontroller ARM 7 LPC2148 and monitor each moment at vehicle condition. GPS and GSM Technology have been use to implement the tracking information at current location and intimate to vehicle owner, police station, hospital and also family members. The system also operates and develops the vehicle via Bluetooth Technology in android application that can control the vehicle depending upon corresponding directions. The android application consists of 5 buttons which indicates left, right, forward, and backward and stop. When clicking on button an android application a coded message will generate and it is transmitted to control kit via Bluetooth. The received message at controlling section by the controller will be decoded and it is going to control the vehicle. This project also has controlling sections which apply a vibration sensor that will responses the sound produce at vehicle when accident occurred in vehicle. At the same time, the system going to send a message to nearby hospital and family members through GPS location.

2.2.2 Android Based Universal Vehicle Diagnostics and Tracking System [2]

This project is about the combination of a low-cost hardware unit and a user-friendly Android. The main aim of this system is provide a low-cost means of monitoring a vehicle's performance and tracking by using communicating that obtained data to a mobile device via Bluetooth. After that, the user can monitor fuel consumption and other vital vehicle electromechanical parameters. The vehicle's OBD system and a Bluetooth module are built to have interface between them. That part is for communicates with an Android-based mobile device.

These projects are using AVR microcontroller, Bluetooth module, remote server setup, android application, control unit to complete the system. The Android-based mobile application software utilized to create an on-board vehicle diagnostic system. The mobile application software will interact with the hardware interface unit wirelessly via Bluetooth to acquire desired vehicle parameters from the ECU of the vehicle. Microcontroller is connected to Bluetooth module which is synchronized

with android mobile phone. This project was built an application on android mobile phone which shows the different parameters readings which that reading are send to the remote server of laptop through internet or SMS the readings can be viewed in graphical manner on the server to detect the malfunctioning of the vehicle. The application will development is quick and easy since the Android platform extends a great deal of useful libraries and tools to the developers. This project used the Android mobile application software which designed to perform tasks. Software functioning modules submenu options for some vehicles real-time parameters include throttle position, intake manifold pressure, ignition advance angle, engine speed and vehicle speed.

The microcontroller is programmed to send the measurements on its UART to the Bluetooth module. Bluetooth provides a means to connect devices such as mobile phones over a secure, it unlicensed for short-range radio frequency about 2.45 GHz and to enable the exchange of information between them because this project used the BluCOM-18 Bluetooth transceiver module. It has an approximate range of 100 meters. The Bluetooth module is configured as a Slave and the mobile phone is considered to be functioning as a Master. The microcontroller sends and receives data to and also from the Bluetooth module. The Bluetooth can transmit and receive data continuously as raw binary bytes.

2.2.3 Intelligent Vehicle Control Using Wireless Embedded System in Transportation System Based On GSM and GPS Technology [3]

This project is about GPS and GSM have been used for tracking the vehicles to identify the accident and theft location because the development of satellite communication technology is easy to identify the vehicle locations. The objective of this project is to provide security to the vehicles by using engine locking system which prevents the vehicle from unauthorised access. In this paper, the related technologies are the vehicle tracking and locking systems based on GSM which this system provided vehicle cabin safety, security based on embedded system by modifying the existing modules. This project is provided easy way to find out the exact location of the accident and with the help of server an emergency vehicle can be sent to the exact location to reduce the human life loss. The technique to get the information of place for the vehicle is identified using Global Positioning system

(GPS) and Global system mobile communication (GSM). This is more secured, reliable and low cost. The GPS or GSM Based System is one of the most important systems because it can integrate both GSM and GPS technologies. It is necessary due to the many of applications of both GSM and GPS systems are applying in most of the system and also because of the wide usage of them by millions of people throughout the world.

This project also can detect the behaviour of the driver through sensors whether user is drowsy or drunk, so that occurrence of accident can be prevented. The method for monitor the level of the toxic gases such as alcohol within the vehicle can provide alert information as alarm during the dangerous situations. The SMS sends to the authorized person through the GSM immediately. In this project the method have been used is, the IR Sensor used to detect the static obstacle in front of the vehicle and the vehicle stopped if any obstacle detected. This is avoiding accidents due to collision of vehicles with any static obstacles. Also the related technologies is vehicle tracking and locking systems based on GPS 87 which explores location solution, map matching and data compress the associated with the positioning, shows a program flowchart and predicts the trend of the vehicle location system in the future. GPS works in any weather circumstances at anywhere in the world which GPS receiver must be locked on to the signal of at least three satellites to estimate 2D position neither for latitude and for longitude also to track movement. GPS technology also can work in four or more satellites in sight, the receiver can determine the user's 3D position which for latitude, longitude and altitude. GPS receiver is used for this research work to detect the vehicle location and provide information to responsible and provide information to responsible person through GSM technology. Once the vehicle position has been detected, the GPS unit also can determine other information for example speed, distance to destination, time and other. The table 2.1 shows the summary of the journals that are explained above.

Table 2.1: Summary of Journal

Author	Title	Description
Menugonda Kiran Kumar, B.Santoshkumar[1]	Vehicle Tracking And Identifying Based On Android	Project based on android application which is used to protect theft incident occurred in any situation and intimate through mobile phone via Bluetooth.
Rohitaksha, K., Madhu, C. G., Nalini, B. G., & Nirupama [2]	Android Based Universal Vehicle Diagnostics and Tracking System	Combination of a low-cost hardware unit and a user-friendly Android.
Abinaya, M., & Devi, R. U.[3]	Intelligent Vehicle Control Using Wireless Embedded System in Transportation System Based On GSM and GPS Technology	GPS and GSM have been used for tracking the vehicles to identify the accident and theft location.

2.3 COMPONENT DESCRIPTION

2.3.1.1 Arduino Nano

In electronics technology nowadays, the Arduino is one of the favourite component that had been used widely the technology. Arduino is one of the main part of this project because it can control all the system that conducted by specific coding to run specific application in this project. Arduino is an open-source prototyping platform based on easy-to-use hardware and software. The hardware consists of a simple open-source hardware board designed around an 8-bit Atmel AVR microcontroller, though a new model has been designed around a 32-bit Atmel ARM. The software consists of a standard programming language compiler and a boot loader that executes on the microcontroller. The Arduino can be connected to LEDs, dot-matrix displays, buttons, switches, motors, temperature sensors, pressure sensors, distance sensors, GPS receivers, Ethernet or WiFi modules, or just about anything that outputs data or can be controlled. The Arduino board is made up of an Atmel AVR microprocessor, a crystal or oscillator and have a 5V voltage regulator. Some Arduinos may use a switching regulator, and some, like the Due, are not 5 volt.

Depending on what type of Arduino, it may also have a USB socket to enable it to be connected to a PC or Mac to upload or retrieve data. The board exposes the microcontroller's input and output pins to connect those pins to other sensor or circuits.

In this project, Arduino Nano had been used in this project because the aim of this project is to minimize the size for my prototype that will apply at the real motorcycle. The Arduino Nano are small, complete, and breadboard-friendly board based on the ATmega328 or ATmega168 as shown in figure 2.1. It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one. The Arduino Nano can be powered via the Mini-B USB connection and have 6V until 20V unregulated external power supply which in pin 30 or 5V regulated external power supply which at pin 27. The power source is automatically selected to the highest voltage source. The ATmega168 has 16 KB of flash memory for storing code of which 2 KB is used for the boot loader. The ATmega328 has 32 KB which also with 2 KB used for the boot loader as explain more in table 2.2. The ATmega168 has 1 KB of SRAM and 512 bytes of EEPROM which can be read and written with the EEPROM library while the ATmega328 has 2 KB of SRAM and 1 KB of EEPROM. Each component in the board got their own function. Another types of Arduino are explaining in table 2.3.

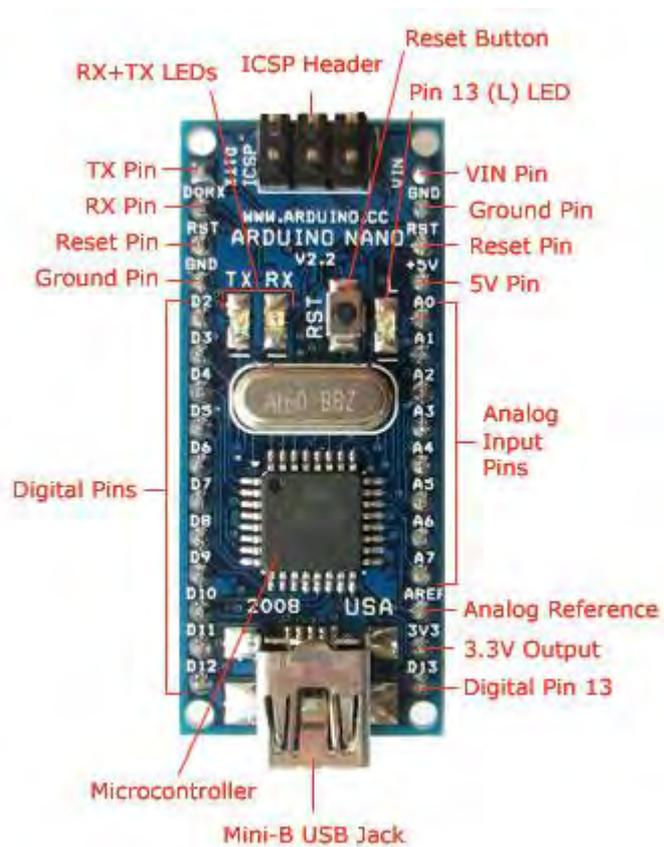


Figure 2.1 : Arduino Nano board

Table 2.2: A List of Specification of Arduino Nano

Specification	Description
Microcontroller	Atmel ATmega168 or ATmega328
Operating Voltage (logic level)	5 V
Input Voltage (recommended)	7-12 V
Input Voltage (limits)	6-20 V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	8
DC Current per I/O Pin	40 mA
Flash Memory	16 KB (ATmega168) or 32 KB (ATmega328) of which 2 KB used by boot loader
SRAM	1 KB (ATmega168) or 2 KB (ATmega328)
EEPROM	512 bytes (ATmega168) or 1 KB (ATmega328)
Clock Speed	16 MHz
Dimensions	0.73" x 1.70"
Length	45 mm
Width	18 mm
Weigh	5 g

Software is the set of instruction that command the hardware task to do and how to do it as shown in figure 2.2. IDE (Integrated Development Environment) software is used to create a set of command that need to be transferred to the board. In the case of the Arduino, the language is based on C or C++ and can even be extended through C++ libraries. The IDE enables to write a computer program, which is a set of step-by-step instructions then upload to the Arduino. IDE software have three main separately parts.

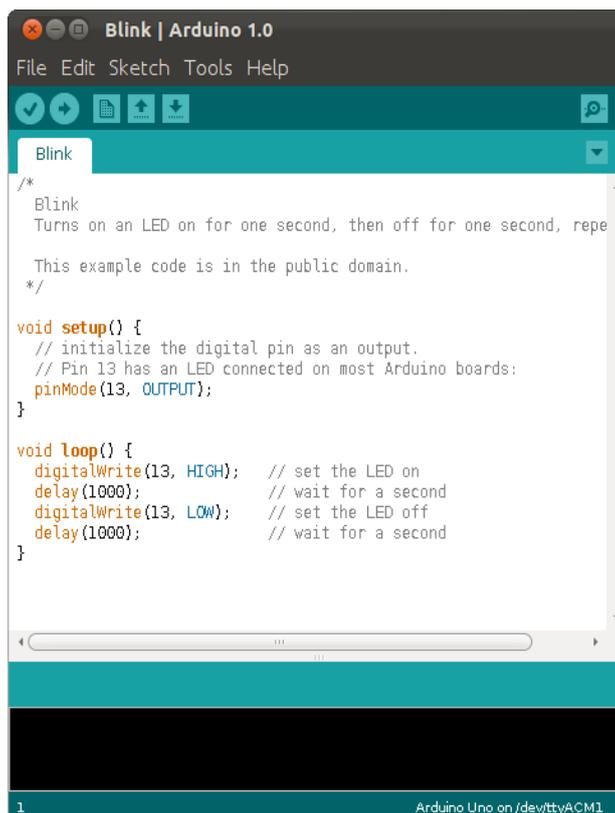


Figure 2.2: IDE Arduino

a) Command Area

This part consists of the items such as File, Edit, Sketch, Tools, Help and Verify icon for verification. The Upload icon is purposely for uploading the program. New, Open, Save and Serial monitor used for sending and receiving of data between the Arduino board and the IDE.

b) Text Area

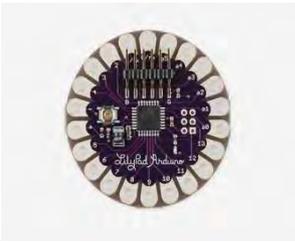
This part where the coding was developed using a simplified version of C++ programming language that make the user easy to write the programming coding.

c) Message Window Area

This part will show the message from the IDE in the black area. It's also basically on verification of the coding.

2.3.1.2 Type of Arduino[2]

Table 2.3: Type of Arduino

Type of Arduino	Picture	Explanation
ArduinoUno	 A standard Arduino Uno board, which is a blue PCB with a USB Type-B port, a DC power jack, and a 5-pin header.	Most common board and the one labelled as the classic Arduino. It additionally based around the ATMEGA328 chip processor and it is compatible with most available Arduino shields.
Arduino Fio	 A small, irregularly shaped Arduino Fio board, featuring a USB Type-C port, a LiPo battery connector, and an XBee module.	An irregular board and is basically an Arduino Mini with an inherent LiPo charger and XBee headers.
Arduino Mini	 A small, rectangular Arduino Mini board with a 24-pin microcontroller and no connectors.	Which have 24-pin microcontroller with no connectors patched which the unit highlights 8 simple pins and 14 advanced pins.
Arduino Lilypad	 A circular Arduino Lilypad board, designed to be sewn into garments, with a central microcontroller and various pins.	The lilypad was initially expected to be sewn into garment but people still have discovered numerous different application for it. The Lilypad can likewise be washed alongside the garments.
Arduino Ethernet	 An Arduino Ethernet board, which is a standard Arduino Uno board with an Ethernet port instead of a USB port.	Basically a typical Arduino Uno where the ATMEGA8 chip and the USB fitting are changed for an Ethernet port.

<p>Arduino Mega</p>		<p>Bigger than the various sheets and offers more advanced and simple pins. It also used the same 5V power supply as the Uno.</p>
<p>Arduino Due</p>		<p>One of the classic Arduino and its offers more features for advanced users. It is faster, has more memory, and have more I/O ports but It does not support many shields. Due to faster CPU, the Arduino Due runs on a lower voltage which 3.3V over the Uno's 5V so its means it cannot always support the same devices.</p>
<p>Arduino Leonardo</p>		<p>Not a common board but still has similar features with the Uno which it include the 5V power supply and the processing power. It is a good board for those who need more input and output ports than the Arduino Uno.</p>
<p>Arduino Nano</p>		<p>Small, complete, and breadboard-friendly board based on the ATmega328 or ATmega168. It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one.</p>