



**Thesis Paper**

# **Security System of an Electric Car**

**Submitted to the Dept. of Electrical & Electronic Engineering,  
SECS, BRAC University**

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# Declaration

We hereby declare that the thesis titled "Security System of an Electric Car" submitted to the Department of EEE, SECS, BRAC University, is our original work. Any information from other sources has been acknowledged in the reference section.

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## **Abstract**

Technology is a blessing to our modern life and has become a part and parcel to our day to day life. It has made our life easier and comfortable by introducing with transport. We cannot even think of a single day without any transport, because it has a great impact in our socio-economic life. Beside of this an important issue has been arisen through the whole world and that is the security of a transport. And it is very obvious that our main concern behind this project is to develop the security system of a transport specifically to develop the security system of an "Electric Car" using the RFID module and the GSM module. This project introduces a new security system which is affordable and user friendly. A user can use this security system in his/her electric car by using an RFID card and a simple text message from user's cell phone. The project is totally based on Micro-controller (Arduino Uno) . Our project co-ordinates both the Micro-controller (Arduino Uno) program for detecting the specific RFID card and the Sim908c for recognizing the specific text code to enable the security system.

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## CHAPTER 1: Introduction

### 1.1 Introduction

The advancement of modern technology decreases the anxiety and the sufferings of mankind rather than increases the comfort, safety and the security. Through these advancements, the world of the transport security system has been developed a lot. So many security systems are already introduced but most of them are highly expensive, not affordable and not available also. But we are introducing such a car security system focusing on “Electric Car” based on RFID and GSM module which is affordable, user friendly and obviously effective.

Using data supplied by the United Nations Office on Drugs and Crime the estimated worldwide auto-theft rate is 65.8 per 100,000 residents. For the 4,429,167,344 people there were a total 2,915,575 cars stolen through the world wide. And it is a matter of worried that, Bangladesh is also included in those countries.

It is highly observed that, maximum car steeling is succeeded with the help of key. Focusing on this factor, we developed our project which provides an extra layer security system. A thief will not be able to steal a car using any kind of keys if the car is installed with our security system. Because, our security system gives an extra layer protection on door lock which creates an obstacle to open the door. So, a thief cannot do nothing even if he having the key.

Here, we are introducing an advanced car security system which will ensure higher safety of a car in a cheap and affordable cost.

### 1.2 Project Objective:

There are so many existing security system nowadays, such as car alarm system, keyless remote entry system, immobilizer, collision avoidance system, vehicle identification number (VIN), GPS vehicle tracking system.

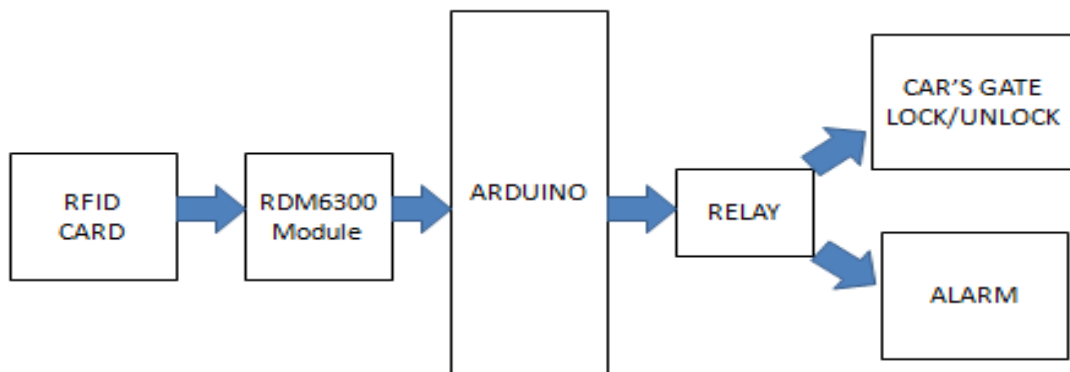
Most of the alarm system ensures that their alarm noise is loud enough to grab people’s attention. The very simplest alarm would have a switch on the driver's door, and it would be wired so that if someone opened the door the alarm would start wailing. The keyless remote entry system is built into an ignition key which needs to press a button on the key to unlock the car doors and another button to lock the doors. This achieved by sending pulses on a particular frequency. The immobilizer plays a major role to improve car security. Having sophisticated technology, they help to reduce car theft by a very significant margin. A collision avoidance system is an automobile safety system designed to reduce the severity of an accident by using radar and camera sensors to

detect an imminent crash. Vehicle Identification Number (VIN) is attached into the parts of a car. This specifically provides the security to prevent of stealing cars with an intention of selling its parts. GPS vehicle tracking system helps to track vehicle easily.

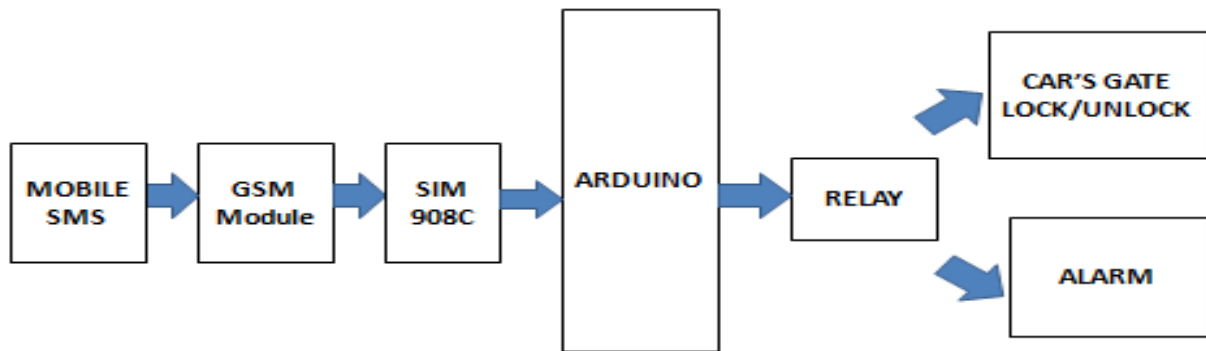
But the most important fact is that, having all these security systems, car theft has not been stopped yet. Even in Bangladesh, car theft has increased than the previous year. Considering the seriousness of the fact, we worked on this project to innovate a new solution for the car security system and especially for the electric car security system combining with RFID Tag and GSM.

### 1.3 Thesis Organization

**FIGURE: BLOCK DIAGRAM OF RFID BASED SYSTEM**



**Figure: 1.3.A-Block Diagram of RFID based system**

**FIGURE: BLOCK DIAGRAM OF GSM BASED SYSTEM****Figure: 1.3.B- Block Diagram of GSM based system**

This project is to develop the security system of a transport specifically to develop the security system of an “Electric Car” using the RFID module and the GSM module. This project introduces a new security system which is affordable and user friendly. A user can use this security system in his/her electric car by using a RFID card and a simple text message from user’s cell phone. The project is totally based on Micro-controller (Arduino Uno). The total project is completed through the different stapes. At first we need to connect the RFID module (RDM6300) with the Micro-controller (Arduino Uno) and the Micro-controller (Arduino Uno) to the Relay. Then the final stage comes up to take the necessary steps using the Relay module. If the RFID card reader accepts the signal from the particular RFID card or keys then the security system will be activated and the door will be opened otherwise it will give an alarm.

Beside of this, we can operate the security system using the GSM module also. In that case, a user can use this security system by sending a simple text message from his/her cell phone to unlock his/her car’s door.



## **CHAPTER 2: System Implementation**

### **2.1 Introduction**

In this section, we have given a brief description of the devices and components that were used for this project. Here we will explain the general working procedure of this project. The major system gears being –

- Microcontroller (Arduino Uno)
- RFID Module (RDM6300)
- GSM Module (SIM908c)
- RELAY Module

We used all these components together for our project .And we get our desirable output from these devices during this project.

### **2.2 System Implementation procedure**

#### **2.2.1 RFID Based System Implementation:**

In this project, our main concern is to ensure the security of an electric car. We used different types of modules to run the project and to connect these modules we used a controller and it is Arduino Uno. This controller is being connected with the RFID module through a serial data connection. We used RDM6300 as the RFID module. The major part of the RDM6300 is the RFID Reader and we specifically used RFID 125 kHz card for the RFID Reader to read data. The RFID Reader cannot read and accept any card except RFID 125 kHz card. RFID is connected with the Arduino using three pins. The first one is GND, the second one is Digital PWM-2pin and the third one is Power Pin-5V. Basically the RFID Reader reads the analog signal from the provided RFID card and sends the signal to the RDM6300 and then the RDM6300 passes the analog signal to the controller.

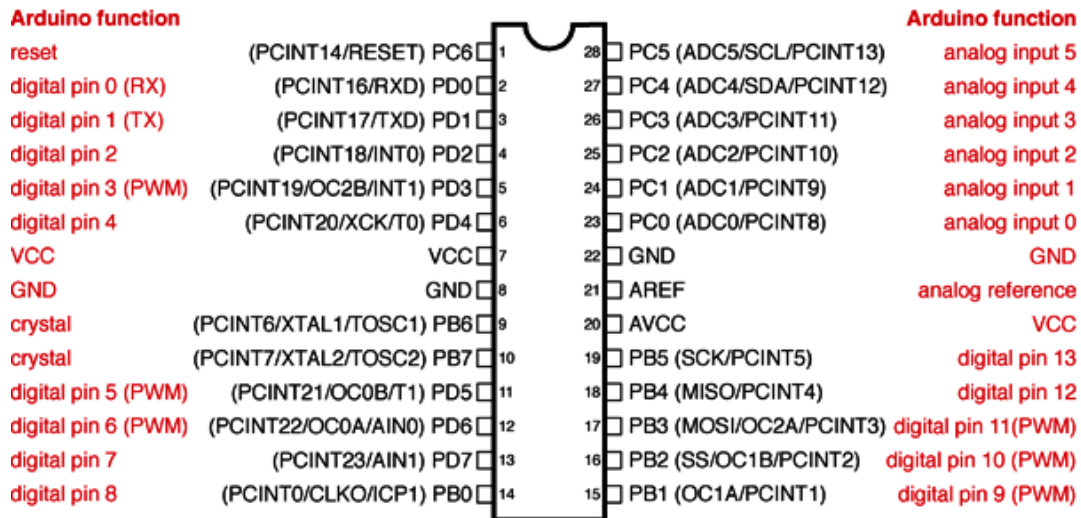


Figure: 2.2.1.A-Pin Configuration of Arduino Uno

This controller receives the analog signal and converts it to a digital signal. Then the controller sends the digital signal using its Digital Pin-2 (PWM).

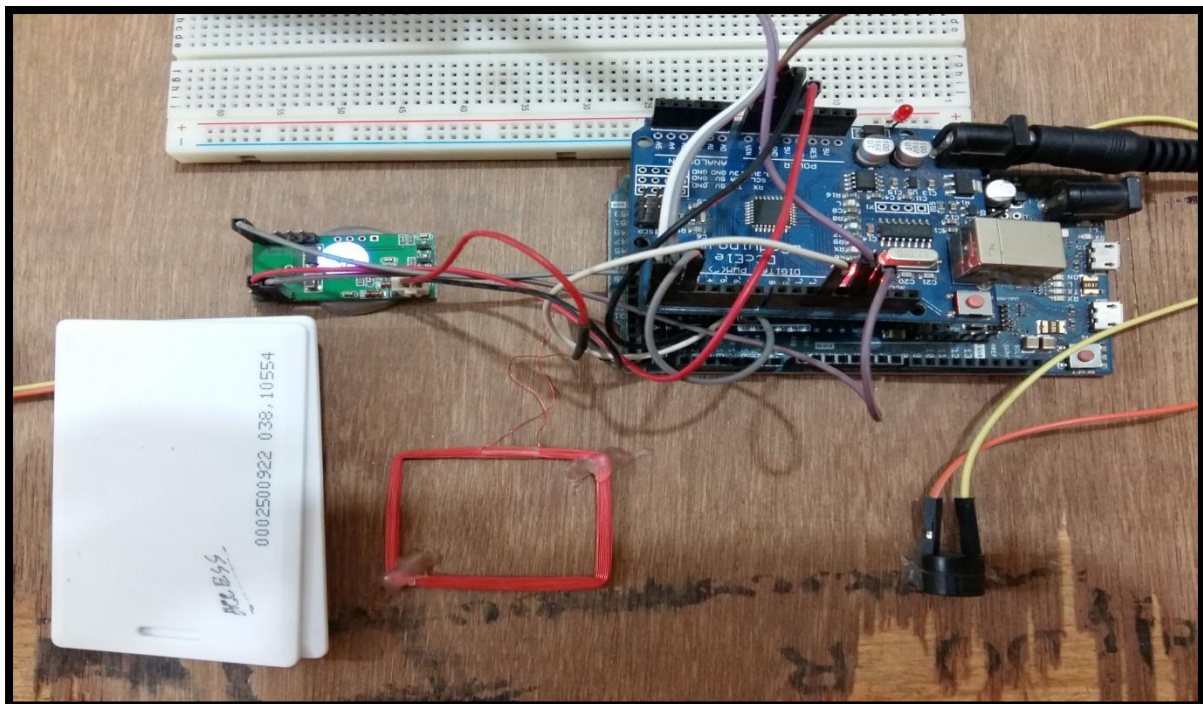


Figure: 2.2.1.B- Project Circuitry of RDM6300 with Arduino Uno

The controller declares the digital output in two ways, one except and the another one is deny. When the RFID card is accepted by the controller then the controller gives an output using its Digital Pin-12 PWM and as a result of the output a car's door lock will be unlocked. But, if the RFID card is denied by the controller, then the controller gives an output using its Digital Pin-11 PWM and as a result of the output the car's door will remain locked moreover it will give an alarm. Normally, the RFID module communicates with the controller (Arduino Uno) through the Digital PWM (Pulse Wide Modulation) Protocol. The PWM performs a task by converting the analog signal to a digital signal. We can do the same task by using a Relay module connected with the controller. In that case, we will get more than two outputs at a time.

### **2.2.2-GSM Based System Implementation:**

Similarly, we used the GSM module (SIM908) in our security system. The GSM module and the controller (Arduino Uno) are connected with RX and TX Pin. These two pins are mainly used for transmitting and receiving the signal. We connected a GSM antenna with the SIM908 GSM connector. And the output comes from the controller Digital Pin-13. Then a simple text message is needed to activate the security system. In that case, the text message will be received by the SIM908 and then the SIM908 will transmit the signal to the controller. After that, the controller will give an output through the Digital Pin-13. If the signal is accepted, the car's door will be unlocked otherwise it will alert the car owner. In case of incoming of a text message, the program reacts depending on the content of the message that could be a configured message. The GSM module is managed by the microcontroller using the lines: RF1 (pin 8 on connector) through which it detects the incoming calls through the Ring Indicator (RI), RC7/RX1 (pin 14 on the cellular board); these last two are the lines, respectively, of reception and transmission of the UART used for receiving and sending SMS messages. The same two lines are used for managing the SIM908, unless the reset and power supply lines. Power supply is controlled by line RC2 that affects pin 1 of the cellular module in order to turn ON and OFF the SIM908 and to enable the phone after initialization. Lines cited before are common to the GSM and GPS section of SIM908.

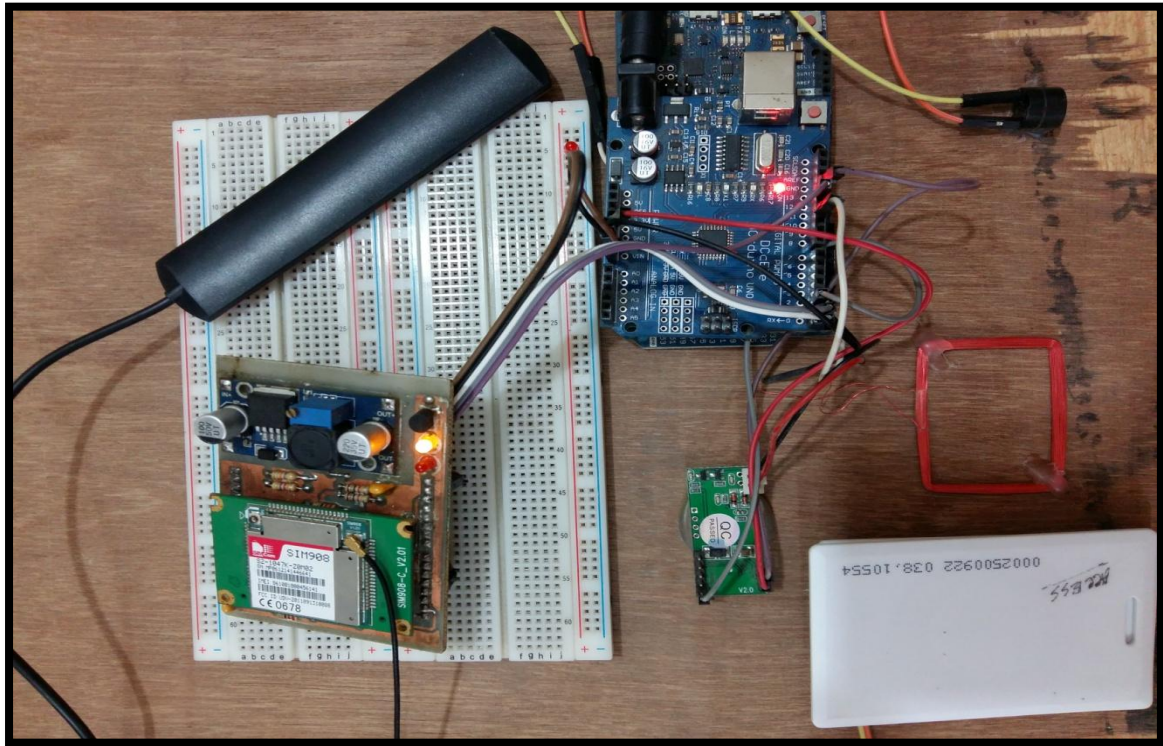


Figure: 2.2.2.A- Project Circuitry of GSM Module with Arduino Uno

The circuit of the localizer is built around two boards, one with the SIM908 on board and the second one including the microcontroller and the battery charger for the lithium battery. To get the GPS working will be necessary to complete the localizer circuit with an appropriate antenna. The circuit includes the mother board, mounting the microcontroller and its circuitry, and the daughter board mounting the communication module, the block named GSM in the schema. The reference numbers associated to the contacts on the GSM block correspond to the pins of the connector linking the daughterboard to the motherboard. The program running in the microcontroller U1, one PIC18LF6722, waits for an incoming event or for the button P1 is pushed. While the button is pressed the line RB1, provided with internal pull-up resistor, switches from logical level 1 to the logical level 0, Both the boards are powered by the switch SW1 from the 3.6 volt Li-ion battery connected to the + and - poles of the PWR connector.

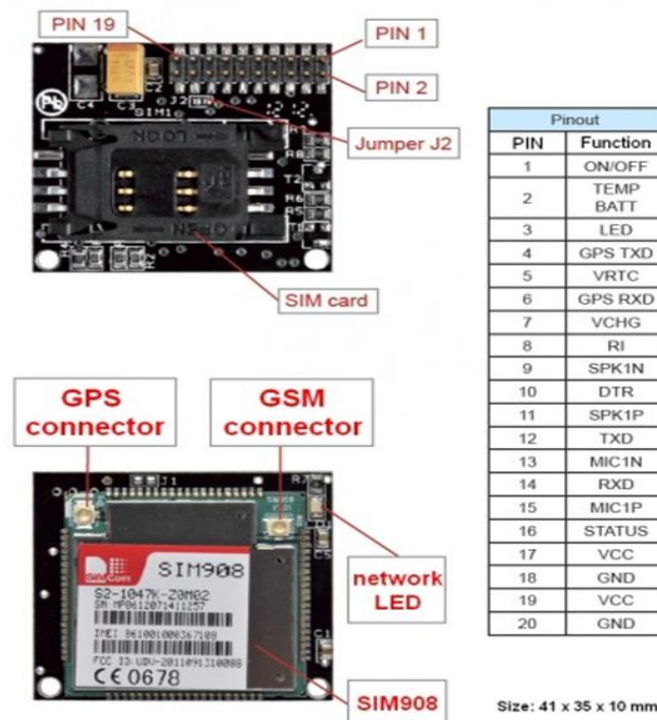
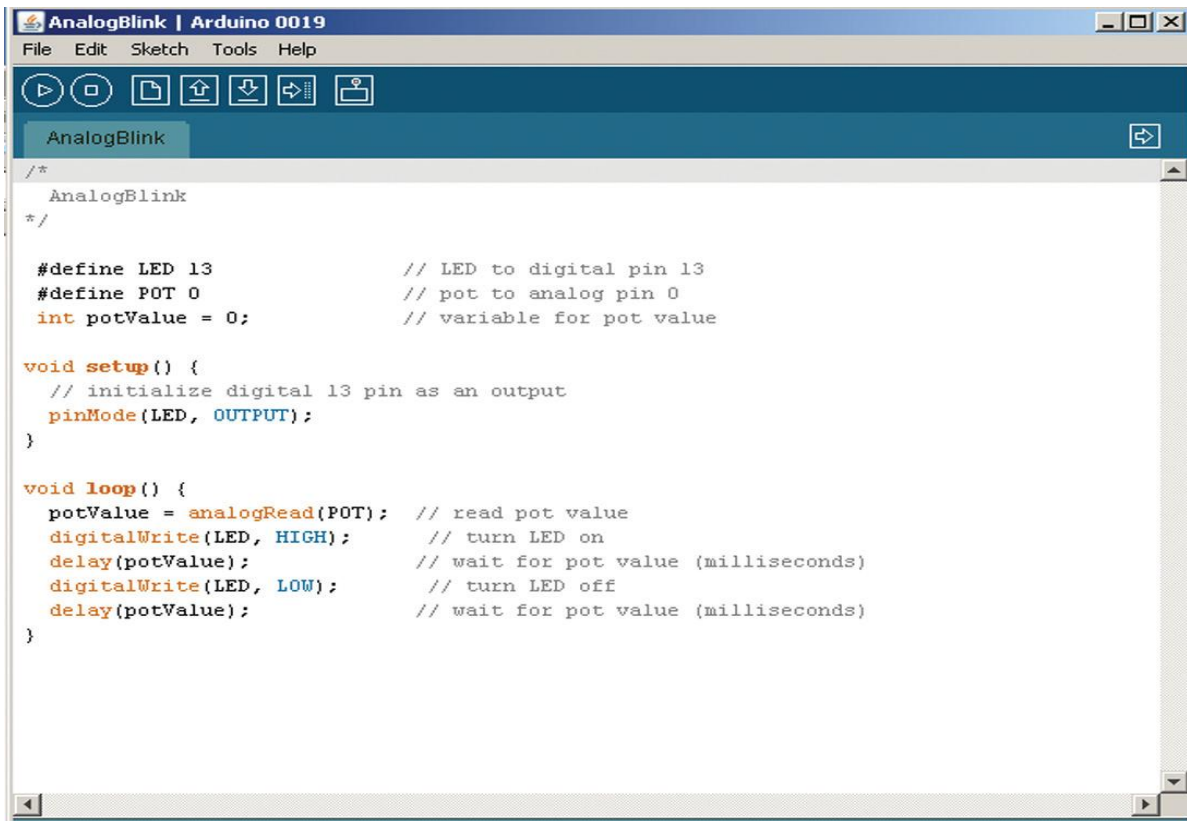


Figure: 2.2.2.B- Pin Configuration of SIM908

Many capacitors inserted along the positive power line filter noises coming from the cellular during transmission that could lock the microcontroller. The power supply comes from a 3.6 volt battery that can be charged by a miniUSB plug that allows recharge from any PC. The power regulator is the chip MCP73831T in SMD version (package SOT-23), it can supply up to 550 mA at 3.6 – 3.7 volt to fully charge a lithium or Li-Po battery with an input supply of 3.75 – 6 volt. The chip charges the battery with a constant current.

For the coding of this project-The Micro-controller (Arduino Uno) integrated development environment (IDE) provides a centralized place to write, compile, and download programs to the Micro-controller (Arduino Uno) board. Using the Micro-controller (Arduino Uno) programming environment is simple. First-time use of the environment requires you to specify the Micro-controller (Arduino Uno) board you are using, and as necessary, the serial port that is connected to the board (the Micro-controller (Arduino Uno)’s USB connection looks like a serial port to your computer). You may then open an existing example program which is called a sketch in Micro-controller (Arduino Uno) parlance, and download the program to your board. Then we need to compile it which prepares the code for downloading to the Micro-controller (Arduino Uno). The Micro-controller (Arduino Uno) IDE calls compiling a program verifying. At the bottom of the text editor is a status window which shows you the progress of compiling (verifying).

If the sketch is successfully compiled, it can then be downloaded to the Micro-controller (Arduino Uno) where it will automatically run once the download is complete.

The image shows a screenshot of the Arduino IDE software. The window title is 'AnalogBlink | Arduino 0019'. The menu bar includes 'File', 'Edit', 'Sketch', 'Tools', and 'Help'. Below the menu bar is a toolbar with icons for running, stopping, saving, uploading, and downloading. The main text area contains the following C++ code:

```
/*
  AnalogBlink
  */

#define LED 13           // LED to digital pin 13
#define POT 0           // pot to analog pin 0
int potValue = 0;      // variable for pot value

void setup() {
  // initialize digital 13 pin as an output
  pinMode(LED, OUTPUT);
}

void loop() {
  potValue = analogRead(POT); // read pot value
  digitalWrite(LED, HIGH);    // turn LED on
  delay(potValue);           // wait for pot value (milliseconds)
  digitalWrite(LED, LOW);    // turn LED off
  delay(potValue);           // wait for pot value (milliseconds)
}
```

Figure: 2.2.2.C- Coding Interface of Arduino uno

## Chapter-3: Result & Discussion

After successfully working on this project, we implemented the security system and got a very positive output. We provided the simplicity in the operation of this security system which has made it more user friendly than the any other security system. We also tried to make it affordable (so that every class of car owners can afford the security system in their cars) and we got the success. In this case, we maintained the quality of product high in a low production cost. Car owners can enjoy the security system a lot because it has no extra maintenance cost. We also focused on comfort and for the reason we used RFID card which is very easy to carry. Providing the security on unwanted entry in the car, it also provides the service to alert the user if the RFID module gets any unauthorized access. Beside of these, the security system also provides a three layer security for the GSM module.

There are always two sides of a coin. When we worked on this security system, we found a problem that if the power system falls down, then the whole security system gets stuck. But we are still working on it to solve the problem and we are very hopeful that we will sort it out and will make it a security system totally problem free.

## **Chapter-4: Conclusion & Future Work**

Using the innovative power, modern technology is introducing so many hi-performed as well as hi-tech cars which are very expensive in price value. Beside of this, stealing car is getting a massive form across the whole world and it is a security threat for the car owners. There are existing so many car security systems now but in this crowd we want to launch a new car security system which is more effective, affordable and easy to maintain as well. The great part of this security system is, it could be used for the both personal and the commercial purpose. There are some commercial organizations like bank, garments etc. whose commercial vehicles carry loads which are financially huge in price value and often they face lose by thefts or dacoits in their commercial transport. Using our security system they can ensure an extra safety and security in their transport.

Beside of this, using our system GPS tracking is possible. Not only that, we do have a future plan to develop the security system also. We will add capacitive touch sensor and human body detection on our security system. Electric car is run by so many expensive components like as solar panel, battery etc and if the components get stolen the owner will face a great problem and lose as well. Beside of this, our security system may also be affected. Thinking about these matters, we have decided to add a capacitive touch sensor in our system so that the car owner can get an alarm if any unwanted attempt is taken. Again, adding the human body detection in our system will help the owner to get notifications about the unwanted entry in the car.

We do believe that our project will introduce an unique security system which will make the electric car owners highly satisfied.



## 4.1 Appendix

### 4.1. A- Micro-controller (Arduino Uno)

The Micro-controller (Arduino Uno) is a microcontroller board based on the ATmega328. The Uno is the latest in a series of USB Micro-controller (Arduino Uno) boards, and the reference model for the Micro-controller (Arduino Uno) platform. It has 14 digital input/output pins 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

#### Specification:

The following are the Micro-controller (Arduino Uno) Specification:

<b>Microcontroller</b>	<b>ATmega328</b>
<b>Operating Voltage</b>	<b>5V</b>
<b>Input Voltage (recommended)</b>	<b>7-12V</b>
<b>Input Voltage (limits)</b>	<b>6-20V</b>
<b>Digital I/O Pins</b>	<b>14 (of which 6 provide PWM output)</b>
<b>Analog Input Pins</b>	<b>6</b>
<b>DC Current per I/O Pin</b>	<b>40 mA</b>
<b>DC Current for 3.3V Pin</b>	<b>50 mA</b>
<b>Flash Memory</b>	<b>32 KB (ATmega328) of which 0.5 KB used by bootloader</b>
<b>SRAM</b>	<b>2 KB (ATmega328)</b>
<b>EEPROM</b>	<b>1 KB (ATmega328)</b>
<b>Clock Speed</b>	<b>16 MHz</b>



Figure-4.1.A: Micro-controller (Arduino Uno)

#### 4.1. B- RDM6300

RDM6300 125KHz card reader mini-module is designed for reading code from 125KHz card compatible read-only tags and read/write card . It can be applied in office/home security, personal identification, access control, anti-forgery, interactive toy and production control systems etc. To explain RFID for the layperson, and we can use a key and lock analogy. Instead of the key having a unique pattern, RFID keys hold a series of unique numbers which are read by the lock. It is up to our Micro-controller (Arduino Uno) sketch to determine what happens when the number is read by the lock. The key is the tag, card or other small device we carry around or have in our vehicles. We will be using a passive key, which is an integrated circuit and a small aerial. This uses power from a magnetic field associated with the lock.

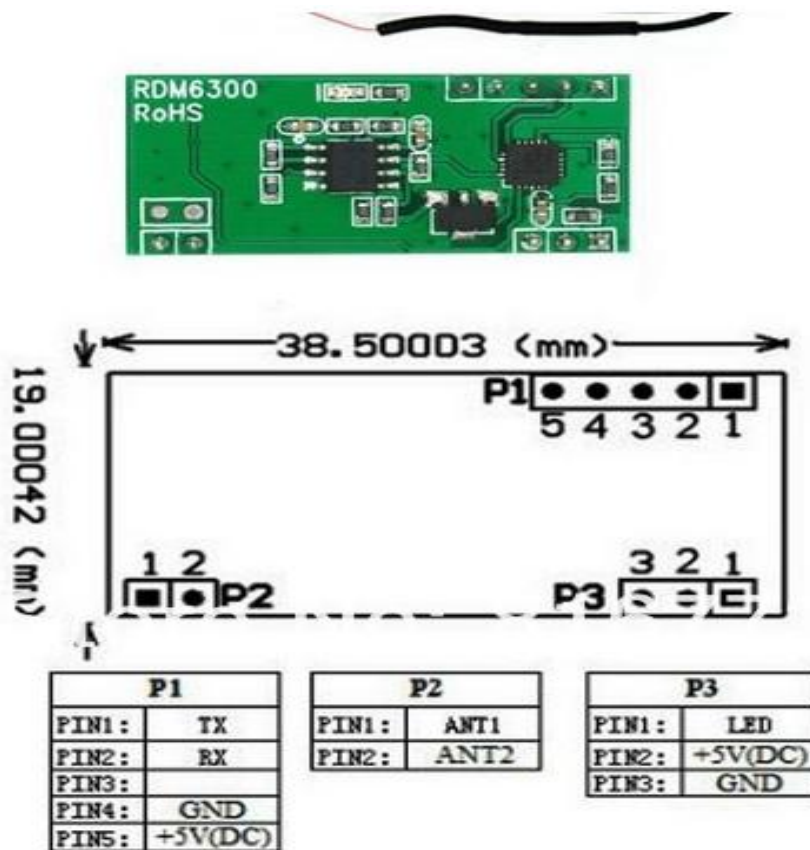


Figure: 4.1.B- RDM 6300 Pin Configuration

**Specification:**

The following are the RDM6300 Specification:

- Support external antenna
- Maximum effective distance up to 150mm
- Less than 100ms decoding time
- Uart interface
- Support EM4100 compatible read only or read/write tags
- Small outline design
- Operation in Digital 5V
- Need External 5V power supply
- RFID module support

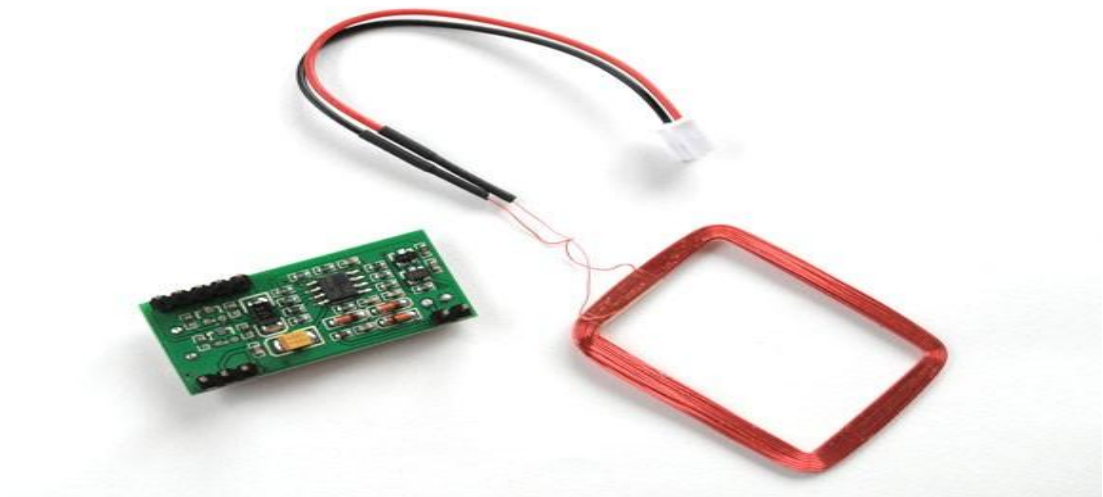


FIGURE: 4.1.B.2- RDM 6300 with RFID Card Reader

#### 4.1. C- RFID Readers:

RFID Readers are composed of an antenna and an electronic module. The antenna is used for communicating with RFID tags wirelessly. The electronic module is networked with the host computer through cables and relay message between the host computer and all the tags within the antenna's range. The electronic module also perform a number of security functions such as encryption/decryption and user authentication, and another critical function called anti-collision, which enables a reader to communicate with multiple tags simultaneously . The reader can send information in two directions: it can read information from a tag and send it to the PC (read mode), or it can read information from the PC and to an RFID tag (write mode).

## RFID Reader Specification

The following are the RFID Reader Specification:

- Reading range: Up to 10 centimeters
- Frequency : 125 KHz
- Interface : RS-232, Baud rate selectable (9600 bps)
- No parity, 8 Data bits, 1 Stop bit
- Dimension : W134.2 x H38.4 x D65.4 mm
- Operating Temperature: 0 to 55 Deg. C
- Storage Temperature: -25 to 65 Deg. C
- Humidity : 5 ~ 95% RH
- The following are the RFID Reader features:
- Power supply 12VDC/AC.
- Read RFID transponder contactless and verify the code number of RFID transponder.

## 4.1. D- RFID CARD

This is a basic RFID tag used for presence sensing, etc. It works in the 125 kHz RF range. These tags come with a unique 32-bit ID and are not re-programmable. Card is blank on one side, smooth, and mildly flexible.

### Specification:

The following are the RFID Card Specification:

- EM4001 ISO based RFID IC
- 125kHz Carrier
- 2kbps ASK
- Manchester encoding
- 32-bit unique ID
- 64-bit data stream [Header+ID+Data+Parity]
- Dimensions of 2.13 x 3.35 x 0.03" (54 x 85.5 x 0.8mm)

#### 4.1. E- GSM MODULE (SIM908c)

SIM908 module is a complete Quad-Band GSM/GPRS module which combines GPS technology for satellite navigation. It is integrated with a high performance GPS-GPRS engine & a GPS engine. The compact design which integrated GPRS and GPS in a SMT package will significantly save both time and costs for customers to develop GPS enabled applications.



FIGURE: 4.1.E-SIM908 Module

**Specification:**

The following SIM908 Specification:

- Quad-Band 850/900/1800/1900MHz
- GPRS multi-slot class 10
- GPRS mobile station class B
- SIM application toolkit
- Supply voltage range:
  - GPRS: 3.2 ~ 4.8 V
  - GPS: 3.0 ~ 4.5V
- Low power consumption
- Dimensions: 30\*30\*3.2mm
- Weight:
  - SIM908:5.2g
  - SIM908-C:11.1g
- Operation temperature: -40 °C to +85 °C
- Specifications for SMS via GSM / GPRS
- Point-to-point MO and MT
- SMS cell broadcast
- Text and PDU mode

**4.1. F- Relay module**

Four 5V relays together in a single board to control 4 loads simultaneously. The relays can be easily switched by microcontroller.



Figure: 4.1.F- 4 channel 5V Relay Module

## Specification

The following Relay Module Specification

- Rated coil Voltage:5V DC
- Operating Frequency:50/60HZ
- Nominal Current:10AAC, 10A at 28V DC
- Maximum Switching Voltage: 250V AC, 28V DC.
- Power Required by the board: Vcc=5V DC(For relay coils),5V DC(For energizing every relay individually)

## Reference:

- 1) "Motor Vehicle Theft" Crime in the United States 2005 Department of Justice — Federal Bureau of Investigation Release Date: September 2006. Retrieved 2009.
- 2) <http://bildr.org/2011/02/rfid-arduino/>
- 3) <http://www.car-theft.org/theft-methods/>
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