RFID Based Anti-theft Protection of Vehicles using GSM and GPS

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Abstract: This paper proposes an idea that counters automobile theft prevention using an embedded system technology which is based on Global System for Mobile Communication (GSM), Global Positioning System (GPS) and Radio frequency identification (RFID). The present-day security system has only a single layer of protection. In this paper, we discuss a system that gives a two-step verification of the user for a higher level of security. This model will also enable the user to access the location of the vehicle in case of theft which will be discussed further in this paper.

Keywords: - *Anti-theft, GPS location, Authentication and GSM modem.*

I. INTRODUCTION

Commercially available anti-theft devices are very expensive & not affordable. Now a day's car theft cases are higher. So, there is a need for a reliable anti-theft device for excellent protection of vehicles. The central locking security system for cars does not prove to provide complete security of the vehicle in case of theft. This paper proposes a more developed system that makes use of an embedded system based on GSM, GPS, and RFID technology. The proposed system can be installed in the vehicle with ease. This system uses the ARM microcontroller which is interfaced with other peripheral devices like GSM, GPS, RFID reader, etc.

II. OBJECTIVE

The objective of this paper is to design an anti-theft system for automobiles based on RFID, GSM and GPS with two step user verification for higher security, to track and locate the vehicle in case of theft and to provide the user a low-cost security feature for their vehicles.

III. LITERATURE SURVEY

In [1], they have discussed a cost-effective and simple vehicle tracking system using global positioning system (GPS), global system for mobile communication (GSM) and smartphone application. They have designed a system that can be operated from the mobile application to track the vehicle in case of theft.

In [2], they have discussed the use of radio frequency identification (RFID) for the protection of cars from theft. They have combinedly used Arduino Uno module and RFID technology. The initial design implementation has been done using Proteus software.

In [3], they have discussed a system to detect car theft. They have proposed a system that will send the GPS location of the car to the police if an unauthorized person tries to steal the car. They have implemented the system using the Intel Galileo gen2 board.

In [4], they have proposed a tracking system that is equipped with GSM, GPS, and microcontroller. They have used fingerprint verification for higher security for vehicle anti-theft protection.

IV. METHODOLOGY

The system architecture with various peripheral devices interlinked to ARM7 microcontroller is shown in **Figure 1**. This system uses the ARM 7 microcontroller at its core which interfaces to other peripheral devices like GSM, GPS, RFID reader, and other components. The system uses a two-step verification process. In the first step, the system will ask for the correct RFID authentication. The RFID reader is interlinked with a microcontroller and GSM modem. When the system scans the RFID tag, if it fails to authenticate the user, it will send a warning message to the user's mobile phone. In the next step, to unlock the door, the one-time password (OTP) is to be entered using the keypad, which is sent by the users registered mobile phone to the system immediately after successful authentication of RFID card. As soon as the password is entered the system compares the received password with the entered password, if the entered password is found to be authentic the system allows for the door to be unlocked.

If the authentication fails the location of the vehicle is sent to the registered mobile number. The GSM modem obtains the location of the vehicle through the GPS unit and sends it to the user of the car in case of theft.

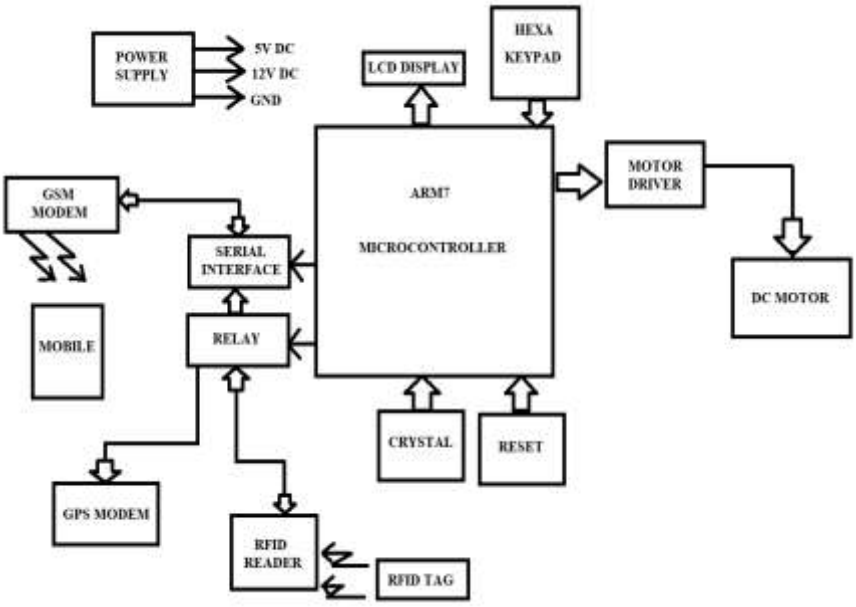

Figure 1: Architecture

V. HARDWARE SPECIFICATIONS

5.1 ARM 7 Microcontroller (LPC2148)

The microcontroller used here is ARM7-LPC2148. It is based on a 16-bit/32-bit ARM7TDMI-S central processing unit which has a real-time emulation and embedded trace support which combines the microcontroller with 32 kB to 512 kB embedded high-speed flash memory. This microcontroller has a 128-bit wide memory interface and a unique accelerator architecture which enables 32-bit code execution at maximum clock rate.

5.2 GPS

The global positioning system (GPS) unit used here is Leadtek GPS 9952 module (LR9552) which is highly sensitive and has a very compact smart antenna module with a built-in GPS receiver circuit. It has a 20-channel global GPS receiver that is designed for a wide range of original equipment manufacturer (OEM) applications. This GPS module is based on SiRFStarIII™ architecture.

5.3 GSM

The global system for mobile communication (GSM) modem used here is a self-contained E-GSM/GSM-GPRS 900/1800 dual-band modem and is GPRS class 10 capable.

5.4 RFID

The radio frequency identification (RFID) unit used here is MFRC522 and it is used for contactless communication which is a highly integrated reader/writer IC working at 13.56 MHz. This supports ISO/IEC 14443 A/MIFARE and NTAG (passively powered NFC tag). A reader/writer antenna is designed to communicate with ISO/IEC 14443 A/MIFARE cards and transponders without additional active circuitry which is driven by MFRC522's internal transmitter.

5.5 4x4 Matrix Keypad

A 4x4 matrix keypad with eight input/output ports is used for accepting the entered password. Peripheral Input/output (PIO) pins configured as output are connected to the rows. PIO pins configured as input with interrupts are connected to the columns. In this configuration, four pull-up resistors can be added in order to apply a high level on the corresponding input pins.

5.6 Liquid Crystal Display (LCD)

The 16x2 LCD screen is used here. LCDs are economical, easily programmable, have no limitation of displaying special & even custom characters, animations and so on. In 16x2 LCD 16 characters can be displayed per line and in this LCD, there are two such lines. Each character is displayed in a 5x7 pixel matrix. The LCD displays characters in two lines with 16 characters per line.

5.7 Motor Driver

The motor driver L293D contains two inbuilt H-bridge driver circuits integrated into a single integrated chip (IC). Motor drivers take a low-current control signal and provide a higher-current signal which makes them one type of current amplifier. This amplified current is used to drive the motor. Both forward and reverse direction operation can be done on two DC motors simultaneously.

5.8 DC Motor
The DC motors are continuous actuators that convert electrical energy to mechanical energy. Here it is used to depict the door lock operation.

5.9 Power Supply Unit
The LM317 voltage regulator IC is used to provide in order to provide the necessary electrical voltage to the system. It is a three terminal adjustable positive voltage regulator capable of supplying in excess of 1.5 A over an output voltage range of 1.2 V to 37 V.

5.10 Relay
The relay is an electrically operated switch. In case several circuits must be controlled by one signal, there we use relays or to control a circuit by a separate low-power signal.

VI. SOFTWARE SPECIFICATIONS

6.1 Keil µVision Software
Keil is a development tool used for several microcontrollers. It is provided by many of the silicon vendors. The Keil generates code for any device that is compatible with the 8051, 251, C16x/ST10, or ARM microcontrollers. Keil constantly updates the database. The programming can be done by using embedded C.

6.2 Flash Magic
Flash Magic is a computer tool for programming flash-based microcontrollers from NXP using a serial or Ethernet protocol. Flash Magic tool requires 10.50 Mb of disk space for installation and works on Windows Vista, 7, 8 & 10.

VII. IMPLEMENTATION

The prototype of the proposed system is shown in **Figure 2** and **Figure 3**. Initially, the device is powered up by the power supply unit which gives a DC current output with different voltages for different hardware components according to their requirements. The two universal asynchronous receiver-transmitter (UART) ports of ARM7 microcontroller (LPC2148) are given to the global system for mobile communication (GSM) modem and relay unit. The radio frequency identification (RFID) reader and global positioning system (GPS) module are connected to the microcontroller via the relay switch.
First, the RFID card is brought near the RFID reader which generates radio frequency (RF) waves that energizes the RFID card for authentication. If the authentication fails a message “Invalid Card” is displayed on the liquid crystal display (LCD) screen and if authentication is successful then a message “valid card” is displayed in the LCD screen and the system waits for a one-time password (OTP) to be sent from users registered mobile number to the GSM modem. The liquid crystal display (LCD) displays a message “Enter password”. If the OTP entered via the 4x4 matrix keypad is correct then the DC motor which represents the door lock system of the vehicle starts rotating and if the wrong OTP is entered then this security system sends the location of the vehicle through GSM modem which uses the GPS module embedded into it for further tracking in case of theft. A reset button is provided in this prototype system to reinitialize the system to its initial state. The flow of this proposed system is shown in **Figure 4**.

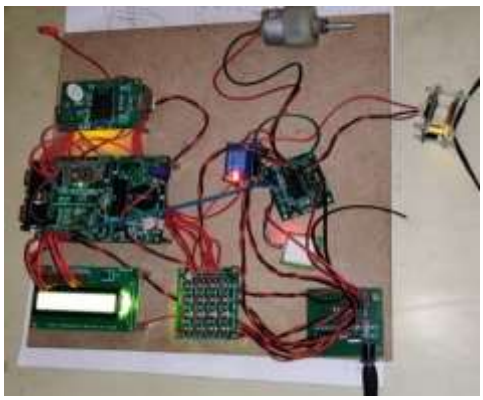

Figure 2: Top view of prototype.

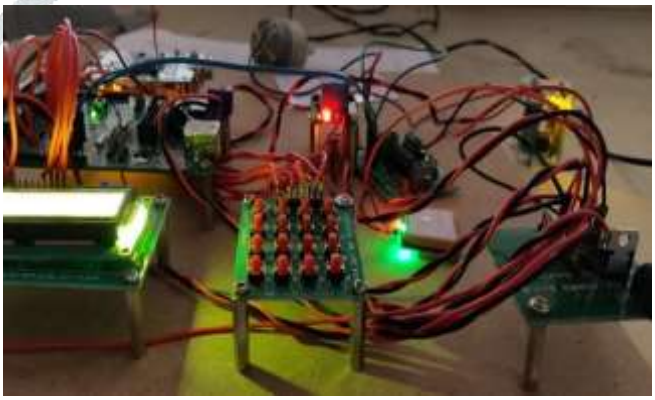

Figure 3: Side view of prototype.

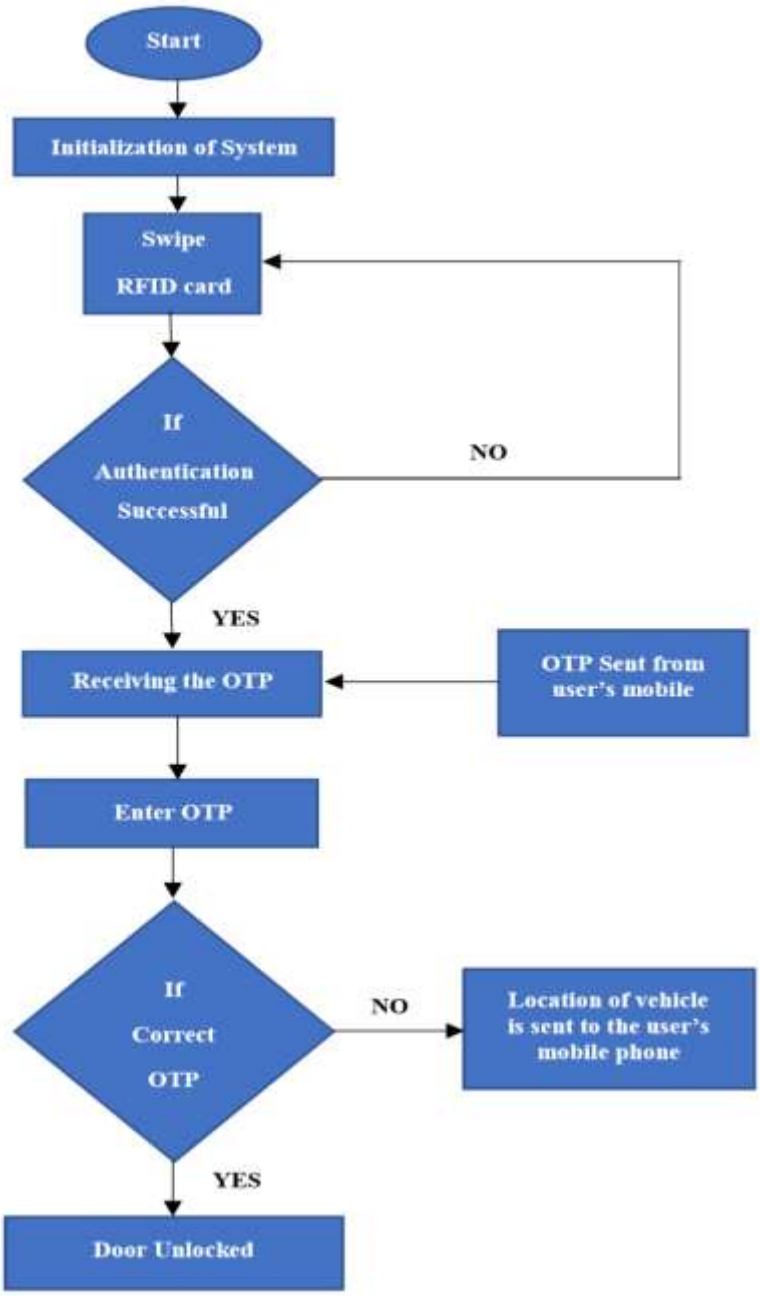

Figure 4: Flowchart of the proposed system.

VIII. RESULT

The system proposed in this paper was implemented by a working prototype and satisfactory results were obtained which is shown in the following figures.

Figure 5: System is requesting for RFID card swiping

Figure 6: System displaying valid RFID card

Figure 7: System receiving OTP from user.

Figure 8: System requesting to enter OTP

Figure 9: If incorrect OTP is entered system sends the vehicle location

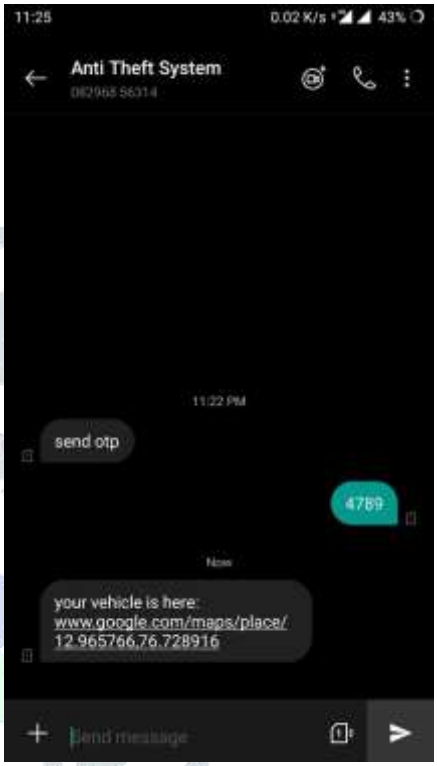

Figure 10: Screenshot of system alert through SMS

IX. CONCLUSION

The security system discussed in this paper will provide higher security to vehicles and makes it difficult for an unknown person to access the vehicle. This anti-theft security system installation into automobiles can be done with ease due to its compact design. It is an attempt to make a low-cost and excellent vehicle anti-theft control system that uses a very low power supply. The future development is that the system should be towards making it more compact and more secure.

X. FUTURE SCOPE

This system can be developed to give higher security to the vehicles in preventing theft by adding some extra features like face recognition and a higher level of biometric authentication. The proposed system is the start, which can evolve to provide higher theft security in the future.

XI. REFERENCES

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