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ANTI-THEFT SYSTEM OF VEHICLE LOCKING AND TRACKING USING XBEE

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A R T I C L E I N F O

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A B S T R A C T

Anti-theft system has become a prime importance in the present automobile industries. An intelligent system is proposed to prevent the theft in vehicles by using XBee transceivers. The system makes use of an GSM unit that is interfaced with an Engine Control Module (ECM) through XBee transceivers. The owner sends a message to the GSM unit which is embedded in the theft vehicle which in turn controls the vehicle's engine by locking the engine immediately. The message from the GSM is processed by the ARM7 based micro-controller and subsequently the information is sent to the Engine Control Unit which in turn slows down the engine and stops it. The position of the vehicle is processed by the GPS and a short message service (SMS) is sent to the owner's mobile. Thus the vehicle can be recovered from the specified location and it is unlocked only when an unlocking message is sent from the owner. The system is effective, cost efficient and reliable.

INTRODUCTION

In modern world as population increases the number of vehicles also increases. This results in more theft of vehicles. Henceforth security systems are much needed to be provided in the vehicles. It provides security to personal vehicles like car by locking the vehicle engine from remote location using GSM (Global System for Mobile Communication) in case of theft. The proposed system consists of two modules. One module containing the master ARM(Advanced RISC Machine) is mounted in the dashboard of the car and the other module containing the slave ARM is mounted in the bonnet of the car. The system in the bonnet is the Engine Control Unit(ECU). This unit continuously monitors the state of the engine and if the engine is being started, information is transferred to the master ARM which makes the GSM send a message to the mobile of the owner. The owner then sends a predefined message to the SIM(Subscriber Identity Module) mounted on the GSM. The ARM processes the message and sends the information to the ECU which subsequently locks the engine. The engine can be unlocked again only when a message is being sent from the owner. The position of the vehicle is specified using GPS(Global Positioning System). The latitude and longitude values are sent to the owner's mobile. Then the owner can retrieve the vehicle from the specified location. The main advantage of the system is that the engine is locked and this makes it easy for the retrieval process.

Hardware Components

1. ARM 7 (LPC2148)
2. GPS
3. GSM(SIM 300)
4. X-Bee transceiver(CC2500)
5. Relays
6. LCD Display

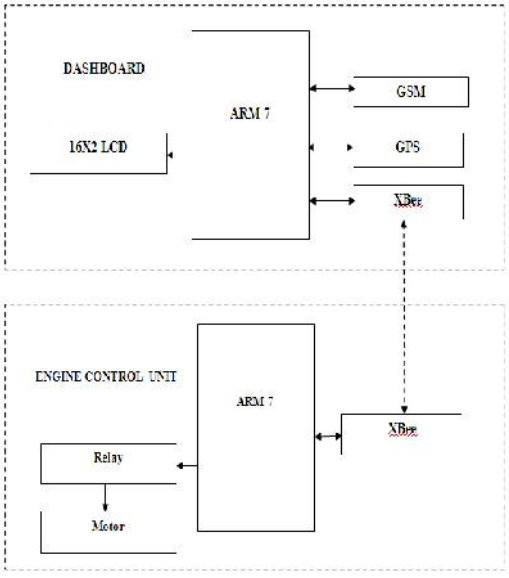

Fig.1 Block diagram of Locking System

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Microcontroller unit

The complete block diagram is as shown in figure1 explains the complete operation of vehicle system. The vehicle system contains hardware peripherals like, ARM7 controller, Relays, 16×2 LCD, GPS, GSM modem and power supply. When the motor is switched on the relay gets closed and this information is sent from the slave ARM 7 to the master ARM 7 through the X-Bee transceiver. The master ARM 7 shown in figure 2 sends a message to the owner. The message from the owner is then processed by the ARM in the ECU.

Features of ARM7 LPC2148

- ARM7 LPC2148 microcontroller with 512 Kbyte program Flash and 32+8 Kbyte SRAM.
- 16/32-bit ARM7 microcontroller in a 64 or 144 pin package.
- 32.768 kHz RTC crystal.
- Onboard Peripherals

  - 2x16 character LCD with background light
  - Joystick switch
  - UART-to-USB bridge interface on UART #0
  - USB 2.0 device interface
  - RGB-LED, each colour can be controlled via PWM Signal.
  - 8 LEDs
  - 8x8 LED matrix, controlled via shift registers in the SPI bus
  - MMC/SD memory card interface
  - Step motor (bipolar driving)

- 60 MHz maximum CPU clock available from programmable on-chip Phase-Locked Loop.
- Dual power supply

- CPU operating voltage range of 1.65V to 1.95V (1.8V +/- 8.3%).
- I/O power supply range of 3.0V to 3.6V (3.3V +/- 10%).
- System Programming (ISP) and In-Application Programming (IAP) via on-chip boot-loader software. Flash programming takes 1 ms per 512 byte line. Single sector or full chip erase takes 400 ms.

Fig. 2 ARM7 LPC2148

GPS Module

Global Positioning System as shown in figure 3 is a system that makes it possible to precisely identify locations on earth by measuring distance from the satellites. This system uses MT 3318 GPS Receiver which contains high gain active patch antenna. The GPS receiver interfaced with microcontroller through the UART1 serial communication. The GPS receiver may track upto 51 satellites simultaneously. The GPS receiver is mounted on PCB along with the 3.3V voltage regulator, transmitter and receiver. The GPS receiver output data is in the form of NMEA (National Marine Electronics Association) standard format.

Fig. 3 GPS Module

GSM Modem

GSM Modem shown in figure 4 can accept any GSM network operator SIM card and act just like a mobile phone with its own unique phone number. Advantage of using this modem will be that you can use its RS232 port to communicate and develop embedded applications. Applications like SMS Control, data transfer, remote control and logging can be developed easily.

Fig 4 GSM Modem

This GSM modem is a highly flexible plug and play quad band GSM modem for direct and easy integration to RS232 applications. Supports features like Voice, SMS, Data/Fax, GPRS and integrated TCP/IP stack.

This system uses SIM 300 GSM module in text mode. This system uses SIM300 GSM module that provide 900/1800/1900MHz Tri-band for VOICE, SMS, DATA, and FAX. This module is operates on AT command. AT command is an abbreviation for Attention command that is recognized by GSM Module. "AT command set for GSM Mobile Equipment" describes the Main AT commands to Communicate via a serial interface with the GSM subsystem of the phone. The GSM modem is

interfaced to microcontroller through UART0 serial communication.

Table I AT Commands

Command	Description
AT	Check if serial interface and GSM modem is working
ATA	Answering an incoming call
AT+CMSS	Send message from memory
AT+CMGD	Delete message

XBEE transceiver

CC2500 is wireless transmitter receiver developed by Texas instruments which is used in 2400-2483.5 MHz ISM/SRD band systems. In this project, the input present at PORTD of transmitter atmega8 is transmitted wirelessly to the PORTD of receiver atmega8. This project shows how to configure registers of CC2500, how to give commands to CC2500 and how to activate transmission or receiver mode of CC2500 via SPI interfacing with avr microcontroller. The CC2500 RF module is a low-cost 2.4 GHz transceiver used in very low power wireless applications. The RF transceiver is integrated with a highly configurable baseband modem. It support OOK, 2-FSK, GFSK, and MSK modulations. It works in voltage range of 1.8 - 3.6V. Two AA batteries are enough to power it. It has 30m range with onboard antenna. It is always used with microcontroller which support SPI communication.

CC2500 is configured via a simple 4-wire SPI compatible interface (SI, SO, SCLK and CSn) where CC2500 is the slave and microcontroller (here atmega8) is used as master. Register access and commands are given serially to CC2500 by atmega8 with spi interface.

Fig 5 XBee transceiver

In SPI, master generate clock and chip select signal. SPI communication involves two shift registers. One in master and other in slave. Data is shifted from master to slave and slave to master in circular manner in synchronous with clock generated by master and at the end of shift operation, data in master register and slave register is exchanged.In CC2500, all transfers on the SPI interface are done most significant bit first. All transactions on the SPI interface start with a header byte containing a R/W bit, a burst access bit (B), and a 6-bit address (A5 – A0).

Relay

The relay as shown in figure 6 is an electromagnetic switch. When relay is activated, then it closes the loop of ignition, hence start the Engine. When relay is de-activated, it opens the loop of ignition, hence stop the ignition of the automobile. A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit.

Fig.6 Relay

LCD Display

A liquid-crystal display (LCD) as shown in figure 7 is a flat panel display, electronic visual display, or video display that uses the light modulating properties ofliquid crystals. Liquid crystals do not emit light directly LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock.

Fig.7 LCD Display

They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

LCDs are used in a wide range of applications including computer monitors, televisions, instrument panels, aircraft cockpit displays, and signage. They are common in consumer devices such as DVD players, gaming devices, clocks, watches, calculators, and telephones, and have replaced cathode ray tube (CRT) displays in most applications. They are available in a wider range of screen sizes than CRT andplasma displays, and since they do not use phosphors, they do not suffer image burn-in. LCDs are, however, susceptible to image persistence.

Working of System

The system consists of two units. The unit containing the master ARM is fixed in the dashboard (shown in figure 8) and the engine control unit (shown in figure 9) is in the bonnet of the vehicle. When the engine is started, the relay gets closed and the ARM in the ECU sends this information to the ARM in the dashboard. Consequently the ARM processes this information and sends a predefined message to the owner.

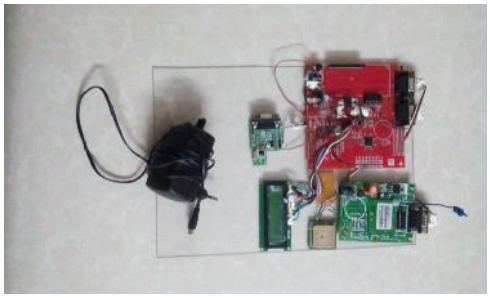

Fig.8 Dashboard Unit

Fig. 9 Engine Control Unit

The owner then sends a predefined message to the SIM mounted on the GSM unit in the dashboard. This information is processed by the ARM and the engine is locked by sending commands to the slave ARM. The position of the vehicle is then found using the GPS and the latitude and longitude values are sent to the owner by using GSM. The engine can be unlocked only by sending another predefined message from the owner's mobile. Since the engine is locked and the car is stopped, it makes it easy for retrieving the vehicle from the specified location.

Software Used

Kiel µvision4 IDE

KeilµVision4 IDE (Integrated Development Environment) is based on windows front end for the C Compiler and assembler. KeilµVision4 is used to write embedded C programs. Embedded C is a high level language, which includes many aspects of the ANSI (American National Standard Institute) C programming language.

CONCLUSION

The vehicle locking and tracking system provides a reliable means of anti theft system by locking the engine and also by providing the information about the position of the vehicle. The developed system is less expensive vehicle tracking control system that could be implemented on any vehicle since the system is developed by using mobile and GSM technology which is operated by sending and receiving messages. The vehicle engine ignition system can be controlled by reading the message received. It also helps the owner of the vehicle to have an easy remote control of the theft vehicle.

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