A CAN BUS RF GUARD SYSTEM FOR VEHICLE

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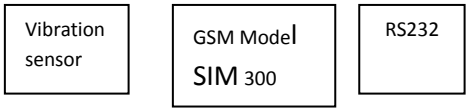
ABSTRACT

Automotive theft has been a persisting problem around the world and greater challenge comes from professional thieves. In this paper, we present an automotive security system to disable an automobile and its key auto systems through remote control when it is stolen. It hence deters thieves from committing the theft. It also effectively prevents stealing of key auto systems for re-selling by introducing four layers of security features written in the form of firmware and embedded on the Electronic Control Units (ECUs). The details of system design and implementation are described in the paper.To reduce the theft rate of the car and meet the intellectualized auto-guard demand of people, we proposed an auto-guard system which combined the radio frequency identify technology and the global mobile communication network. At the same time vibration sensors completed the monitoring function.GSM modem company finished setting and dismissing the prevention of message or call and controlled the car's states remotely through AT instructions. It has showed in practice that compared with the traditional auto guard system, this system could not only stop car theft singly, but also improve the security and reliability. So it has achieved the unity between intellectualized safeguard and remote control.

Keywords—*PIC;RF Transmitter and receiver; GSM module; vibrating Sensors;*

1. INTRODUCTION

Motor vehicle theft is the criminalact of stealing or attempting to steal a vehicle. Every year nearly 36,000 vehicles worth Rs.115 Crore are stolen in India at night.Never leave your vehicle with the engine running or never leave keys in the ignition.Always lock all doors and windows of your vehicle after entering and exiting.If possible install loud alarm systems in your cars shown in[8], so that thieves will be discouraged to break your car. Never hide a spare key in the car.Consider buying smooth, non-flared locking buttons for your car doors. A variety of otherdevises are available to safeguard your vehicle.The only way to prevent theft is by means of Electronic equipment which reduces the possibility of Theft for which this project is designed.



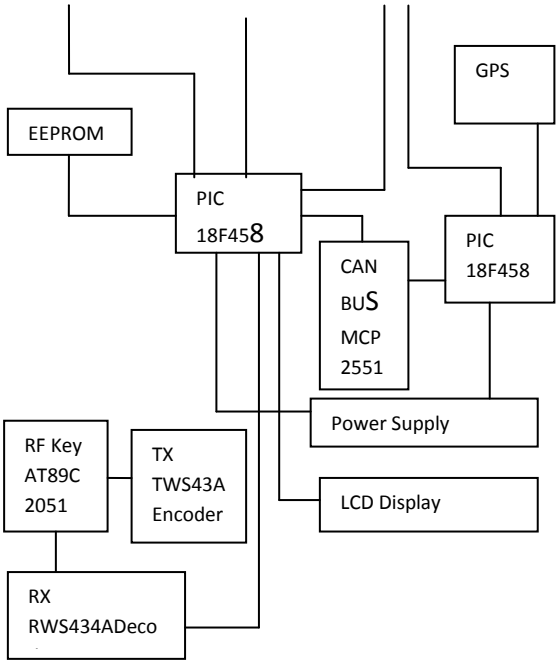


Fig.1. Block diagram of a CAN bus based RF guard system

2.BLOCK DIAGRAM EXPLANATION

A regular power supply is an embedded circuit the function of which is to supply a stable voltage to a circuit that must be operated withincertain power supply limits. The output from theregulated power supply may be alternating or unidirectional, but is nearly always DC.The microcontroller that we are using in our project is PIC18F458, AT89C2051, MC P2551.The heart of our project controller is PIC18F458. The purpose of using this is that it conforms to CAN 2.0B Active Specification and reprogrammable flash memory. The microcontroller that we are using in our project for key unit is ATMEL89C2051.The purpose of using this is that reprogrammable flash memory. Here we use this key unit for generating random data each and every time when the car is unlocked.The transaction of password from key to car is known only to these devices and any intermittent and cannot diagnose the transaction as each

and every time the data is changing.Transmitter unit consist of TWS434A and HT12E encoder. The purpose of transmitter unit is to transmit the random data which is generated by the RF key unit. The purpose of encoder is to convert the original data into another form of data for security purpose.Receiver unit consist of RWS434A and HT12D decoder. The purpose of receiver unit is to receive the random data which is transmitted by the transmitter unit. The purpose of decoder is to cover the data into original format.This sensor is used to send the information when a vibration in a car take place.When the car start to vibrator without any authorization than it give a alertness through message.This system is used to send the message from a controller to mobile.As we programmed in controller it send the data what we wantGPS is the Global positioning system is to determine your position on earth:east- west north-south and vertical (longitude,latitude and altitude).A vehicle tracking system is an electronic unit that has been installed in a vehicle to allow the vehicle to be tracked via GPS technology. The information about the vehicle can be viewed on electronic maps via the Internet or special software.It's the technology where all the data transmitted and received through the data bus.The MCP2551 is a high-speed CAN, fault-tolerant device that serves as the interface between a CAN protocol controller and the physical bus. It provides differential transmit and receive capability for the CAN protocol controller.Typically, each node in a CAN system must have a device to convert the digital signals generated by a CAN controller to signals suitable for transmission over the bus cabling (differential output). It also provides abuffer between the CAN controller and the high-voltage spikes that can be generated on the CAN bus by outside sources (EMI, ESD, electrical transients).It's used to display the value in the display. It shows the output displays normally the operation take place over there.It used to store the data dynamically. It means though the microcontroller is restarted the memory did not erase.RS232 is a serial communication interface that enables the serial exchange of data between a microprocessor and peripherals such as printers, external drivers, scanners, or mice. We use serial communication since we require bit by bit transfer of data.

3.CAN BUS PROTOCOL

CAN bus (**controller area network**) is a vehicle bus standard designed to allows microcontrollers and devices to communicate with each other within a vehicle without a host computer.CAN bus is a message-based protocol, designed specifically for automotive applications. The CAN bus may be used in vehicles to connect engine control unit and transmission, to connect the door locks, climate control, seat control, etc. Today the CAN bus is also used as a fieldbus in general automation environment, primarily due to the low cost of some CAN Controllers and processors.

Fig 2: A simple CAN bus connection

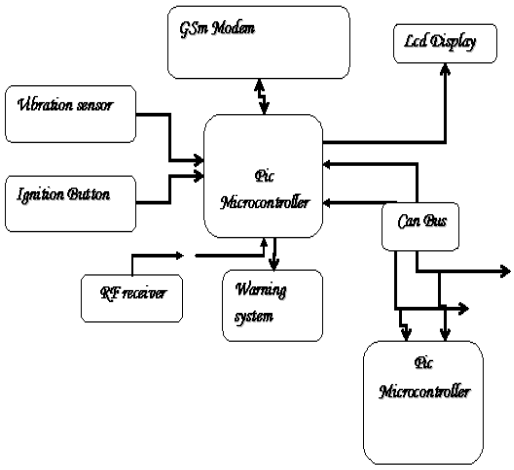


Fig 3: The CarUnit

3.1. A SIMPLE CAN BUS CONNECTION

CAN is a multi-master broadcast serial bus standard for connecting electronic control unit (ECUs).Each node is able to send and receive messages, but not simultaneously. A message consists primarily of an ID (identifier), which represents the priority of the message, and up to eight data bytes. It is transmitted serially onto the bus. This signal pattern is encoded in non-return-to-zero (NRZ) and is sensed by all nodes.The devices that are connected by a CAN network are typically sensors, actuators, and other control devices. These devices are not connected directly to the bus, but through a host processor and a CAN controller.If the bus is free, any node may begin to transmit. If two or more nodes begin sending messages at the same time, the message with the more dominant ID will overwrite other nodes' less dominant IDs, so that eventually only the dominant message remains and is received by all nodes. This mechanism is referred to as priority based bus arbitration. Messages with numerically smaller values of IDs have higher priority and are transmitted first.

4.1GSM

GSM (**Global System for Mobile Communications**) (originally **Group Special Mobile**), is a standard set developed by the European Telecommunications Standards Institute(ETSI) to describe technologies for second generation (2G) digital cellular networks. Developed as a

replacement for first generation (1G) analog cellular networks, the GSM standard originally described a digital, circuit switched network optimized for full duplex voice telephony. The standard was expanded over time to include first circuit switched data transport, then packet data transport via GPRS (General Packet Radio Services). Packet data transmission speeds were later increased via EDGE (Enhanced Data rates for GSM Evolution) referred as EGPRS. The GSM standard is more improved after the development of third generation (3G) UMTS standard developed by the 3GPP. GSM networks will evolve further as they begin to incorporate fourth generation (4G) LTE Advanced standards. "GSM" is a trademark owned by the GSM Association

4.GPS

GPS is the Global positioning system is to determine your position on earth:east- west north-south and vertical(longitude,latitude and altitude).A vehicle tracking system is an electronic unit that has been installed in a vehicle to allow the vehicle to be tracked via GPS technology. The information about the vehicle can be viewed on electronic maps via the Internet or special software.In order to understand how the GPS system works we use for this high school physics. If we send out a pulse of sound or radio waves then we can determine resistance of object by dividing the time it took for reply by the speed of sound.
Distance = speed * time
Time = Distance/ Speed.
GPS works on much the same principle. GPS satellite only transmit timing data pulse, GPS receive units, only receive.GPS signals work in microwaves bands. They can pass through glass, but are absorbed by water molecules and reflect off concrete, steel and rock. This means that GPS unit have trouble operating in rain forest, urban jungle, deep canyons, inside automobiles and roads and in heavy snowfalls-among other things. These environmental obstacles degrade positional accuracy or make it impossible to get a fix on your location.

5. LCD DISPLAY

LCD stands for liquid crystal display, it is a output device used for displaying alphanumeric characters. It is a 16-pin device, which is, separated in to 8 data lines, 3 control lines, 2 power supply lines, 2 lines for back light and last line for contrast adjusting. LCD as a inbuilt memory which is used to store data which as to be displayed which can also be read back. The LCD is differentiated based on lines present, for e.g. 1X16, 2X16, 4X16 etc. The 1X16 means that the LCD as 1 line with 16 characters can be displayed and similarly for other displays.A LCD has two registers namedcommand register and data register. The data register is used to display data in LCD, for e.g. to display data “one” in LCD the data’s should be written in the data register. There are different types of commands like ‘clear screen, cursor blink, start data from first line, start data from second line (each command is represented by its own hex code) etc., which should be written in the command register. In order to display the data “one”, its corresponding ASCII values should be written in the data register.

Control lines
A LCD has only one data bus for both data and command. So in order to differentiate between data and register a control line called RS (register select) is used. If RS is given the value ‘1’ the data is given to the LCD, else if RS isgiven ‘0’ the command is given to the LCD. R/W (read/write) is a control line, which is used to inform LCD that a data is written to or read from LCD. For example if R/W is given the value ‘1’ it means that the data is read from LCD and if R/W is ‘0’ then the data is written to the LCD. E (enable) is a control line, which is used to inform LCD that a data or command is present in the data bus of LCD.The contrast line is used to adjust the contrast of the LCD so that data can be clearly displayed. A potentiometer or preset is used to adjust contrast Power supply lines and LED back up lines are connected to +5v and ground respectively.

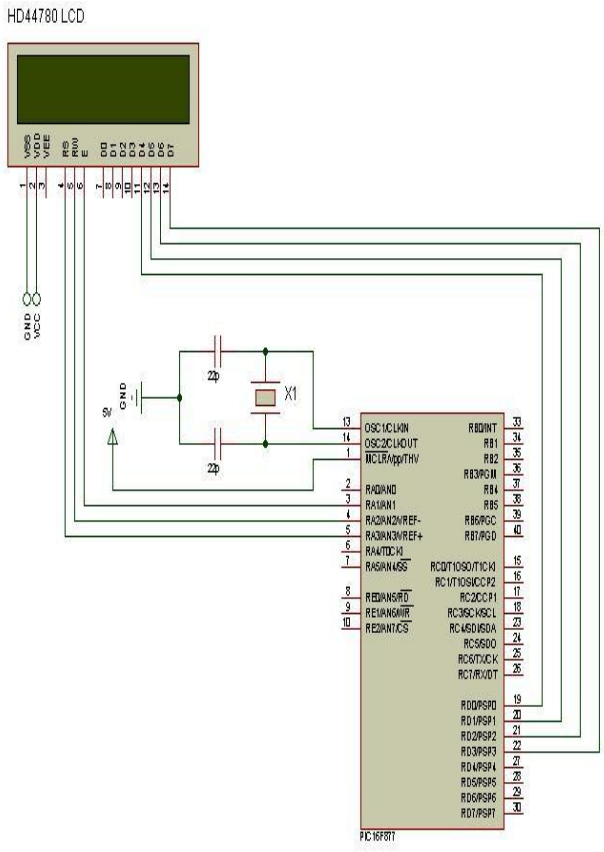


Fig.3 Connecting LCD to Microcontroller

Fig.3.1 LCD display

6.ELECTRONIC TRANSPONDER KEY

A car key or an automobile key is a key used to open or to start an automobile,A transponder system functions around two primary components, the processor/interrogator and a transponder microchip embedded in the head of the ignition key. The processor interacts with the vehicles engine control unit.

When an attempt to start the vehicle is made, the interrogator sends a radio frequency to an antenna usually situated shown in [4] .The radio frequency contains a code number, which is usually made up of a alphanumeric sequence. If the processor recognizes the code sent by the interrogator, the vehicle will be allowed to start. If the code does not match, the vehicle may start temporarily, and then shut down it may not start at all. Whenever you press the button to unlock your car, the exact frequency transmitted by the fob is changed, and the receiver inside the car only grabs onto the particular signal. A controller chip inside the car receives the signal and is responsible for changing the code each time the lock or unlock button is pushed. Before this rolling code system was developed, thieves were able to use electronic devices called "code grabbers" to lock onto your keyfob's unique signal. With rolling codes, the signal is unique every time, rendering a code grabber device useless the numbers generated when the code hops is random.

7. VIBRATION SENSOR

With the help of a simple ceramic piezo-electric detector it is possible to assemble an interesting and useful Impact sensor unit,which can be used to detect impact and vibration on doors, showcases, windows etc. The shock sensor (Ceramic piezo-electric detector) uses a “unimorph” diaphram, which consists of a piezo-electric ceramic disk laminated to a metal disk. The sensor supplies a voltage proportional to the acceleration of the impact or vibration, for example 40mV/G i.e. output is near 2V for 60G impacts. Here a low voltage, low current Impact sensor unit is realized using a standard ceramic piezo-electric detector which drives a monostable multivibrator (IC1) circuit to activate a npn silicon transistor (T1). Open collector output of this transistor switch can be interfaced to an external alarm/switch circuit for further processing. Since current consumption of the circuit is very low (from 5 to 6 mA only) any common 3V button cell can be used to power the sensor unit.When an impact is sensed, the monostable drives the transistor switch to ON, for a finite duration determined by the incircuit values of RC timing components R3 and C2.The M74HC123 (IC1) is an high speed DUAL re triggerable CMOS MONOSTABLE MULTIVIBRATOR (MMV) fabricated with silicon gate C2MOS technology, with all inputs protected against static discharge and transient excess voltage. There are two trigger inputs, negative edge and positive edge. Here, only one monostable part with positive edge triggering (pin 2) is used. After triggering, the output maintains the constable state for the time period determined by the external resistor R3 and capacitor C2.

CONCLUSION

We design a system by which the possibility of a car theft is very less or no theft. First , a can bus based authentication system for each and every car part is proposed wherein the car engine gets started only in case if the car part belongs to the car. Secondly, we design a new innovative car key, the car key transfers a random data each and every time the car is unlocked. The transaction of password from key to car is known only to these devices and any intermittent unit cannot diagnose the transaction as each and every time the data is changing. Thirdly anotherprotective system is developed wherein a car is thefted without starting the car (carrying the car in another vehicle).For this we use a vibration sensor for detecting the vibration levels when the car is not started. If the vibration levels are above a specified limit, an automatic SMS is send to the owner of the car along a powerful siren denoting the Theft of the car. In short our solution is targeted for the automobiles with Controller Area Network (CAN) and Electronic Control Units (ECUs) which are integrated with mechanical parts for good performance

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