Antitheft Security System for Cars Using CAN Protocol

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***Abstract*—** Antitheft security system utilizes an embedded system design with sensors and a GSM to monitor and a safeguard a car. Upon theft attack, it automatically demobilizes the car by by disconnecting the ignition key from the car battery. This makes impossible to start car. In an attempt of theft through car door or boot, the system sends text message to car owner and at same time starts up an alarm. This paper introduces a system that uses ARM as the main controller. This system makes full use of the high-performance of ARM, high speed reduction of CAN bus communication control networks and nodes to achieve full data sharing. Additionally this unit equipped with GSM which communicates to the owner.

***Keywords*—Antitheft Security system, ARM, CAN, Embedded C, GSM**

I. INTRODUCTION

It is important to provide a better security system for vehicles, because many car owners faces problem of theft attack. This gives the better security for car owners and saves many valuable gadgets from theft. Consequently, it is necessary to use on-board monitoring for counteract the problems caused by theft attack. The Controller Area Network (CAN) is a Serial, Asynchronous, Multi-master communication protocol for connecting electronic control modules in Automotive and industrial applications. CAN have many features like low cost, Easy to implement, peer to peer Network with powerful Error Checking, Higher Transmission Rates 1MBitps. The CAN Network is a Peer to Peer Network consisting of different nodes. Different parameters can be monitored by these Nodes and can be updated to the Central Control Unit. Mostly used in Industry and Auto Mobiles in a Hazardous Environment and is reliable. Today, with the improvement of the performance of the car and the continuing development of the control of automotive with the help of electronics control technology, the electronic control of automobile increase rapidly. The traditional forms of peer-to-peer connect between electronic control units and electronic devices cannot meet the need of real time control of distributed system in automobile [1]. Complex electronic circuits bring about difficulties in design, assembly and maintenance even to the extent of unbearable so field-bus technology‘s using CAN help network-based wire communications technology commonly used in automobile. The sophistication and electronic control of modern vehicles require more complex control strategies, thus more electronic control units (ECU) interacting with the physical world through actuators and sensors. Therefore, an in vehicle communication technology connecting these numerous controllers has become essential [2]. With the continuous development of automotive technology and the increasingly high demand for automotive performance, more and more automotive electronic control units are installed. The use of CAN bus to form a network of vehicle electronic control units have become a research hot spot in automotive electronics field [3].

A. CAN BUS

The CAN bus uses inexpensive twisted pair wires to send data. All the nodes are connected to the same line (bus) with small branch lines. All nodes sit serially on the bus which then forms a single line. If any of the nodes fail on the bus, the functionality of the bus will not be affected. However if the line fails, part of the bus will be disconnected and might not work properly.

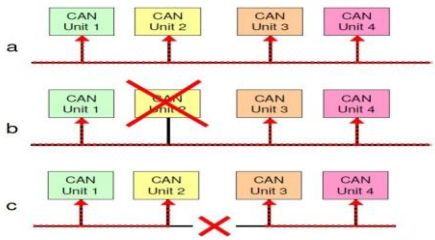

Fig. 1.CAN bus topology

a) Typical setup, b) Bus continues to operate when one unit fails,

c) Main line failing resulting in parts of network gets disconnected and may or may not function properly

Each CAN unit may have completely different functions, data logging, sensor, AD/DA-converter, display. However, all of them will have two components to handle the CAN bus. First is the *transceiver* which receives and sends data on the bus. It sends the data to the *CAN Controller* which interprets the data and determines what it should do with the data (ignore it or pass it along). The CAN controller is thus the intermediary between the CAN bus and the micro processor in the sensor/data logger/display. Since the CAN bus only consists of two wires, virtually any type of connector can be used. This allows more exposed parts of the network to use more durable wiring and connectors.

B. CAN BUS IN AUTOMOBILE

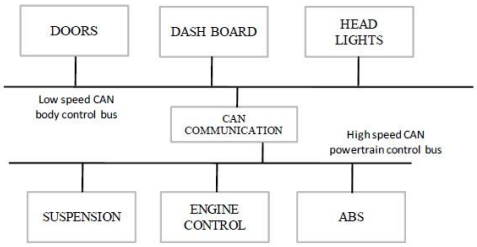

Fig. 2.CAN bus in automobile

CAN is a LAN (Local Area Network) controller CAN bus can transfer the serial data one by one. Fig 2 shows a typical architecture from an automotive. All participants in the CAN bus subsystems are accessible via the control unit on the CAN bus interface for sending and receiving data. CAN bus is a multi-channel transmission system. When a unit fails, it does not affect others. The data transfer rate of CAN bus in a vehicle system is different. For example, the rate of engine control system and ABS is high speed of real-time control fashion of 125Kbps to 1M bps. While, the rate of movement adjustment is low-speed with transmission rate of 10 to 125K bps. Others like multimedia systems use medium-speed rate between the previous two. This approach differentiates various channels and increases the transmission efficiency.

C. CAN BUS FOR VEHICLE DRIVE CONTROL & SECURITY SYSTEM

A typical drive system with the control unit has electronic fuel injection system, automatic transmission systems, antilock braking system (ABS), airbag systems etc. These units are the core components in a modern car system. They are sensitive for time and closed to the reliability and security of the entire system. As each control unit for real-time requirement is based on the data update rate and the control period varies, in order to meet the real-time requirements of each subsystem, it is necessary to achieve the implementation of public data sharing, such as engine speed, wheel speed, and throttle pedal location. The contents include the completion of speed measurement, fuel measurement, A/D conversion, the calculation conditions, the control actuator and a series of processes. That means the sending and receiving data in 1ms must be completed within the electrical control of gasoline in order to achieve real-time requirements. Therefore, the data exchange network must be a priority-based competitive mode, and has a very high speed communication fashion.

II. RESEARCH PROBLEM

Now days in vehicles there is necessity of easy data sharing and interoperability between different control systems and along with the control system vehicle must have to monitor against thefts. As the increasing of the amount of electronic controller and instruments in the modern automotive, it is observed that the vehicle reliability is largely influenced by the complexity of circuit deployed in the control system. In the traditional electric systems use a single point-to point communication approach, this will inevitably result in large pet cabling problem [2]. The vehicle with security system is considered as much safer than other vehicles and that keeps continuously watch and simultaneously communicates to owner. This tends to utilize the availability of GSM network, mobile phone and electronics circuit to achieve an automated system which is programmed to work as a thinking device to accomplish this purpose [6].

Due to the complexity of vehicles, for example, sensors are deployed throughout the entire vehicle with diversified standards, the data within an automotive system are varied such as complex data format, heterogeneous data etc. One solution, a gateway is a bridge to connect various CAN bus with different speed ratio. It is necessary to design an efficient, reliable gateway as well as its data processing system. ARM embedded system have the advantages of low power consumption and reliable utility performance. So it is modem information technology trend that the ARM embedded system is applied to monitor different sensors for automation purpose [3, 4].

The purpose of this study is to aid a better security system of cars with the use of GSM [6]. This system monitors one's car against theft, and has a text message sent to the car owner, telling him that his car is being tampered, and at which part of the car (either doors or boot or logo) is being tampered. The system will also demobilize the car set up and alarm for the people around to notice what is happening.

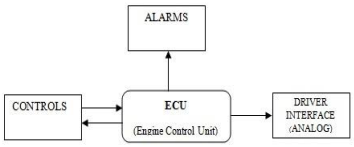

Fig.3.Present System

Above fig.3 shows the present control and security system. Today vehicle was built with analog interface indicating the status of parameters such as temperature, pressure and speed etc. To improve the driver-vehicle interaction digital interface system along with the security system has been designed. As the main security aspect of vehicle is the demobilizing it. If there is attack of theft the car is immediately demobilized.

III. EXPERIMENTAL WORK

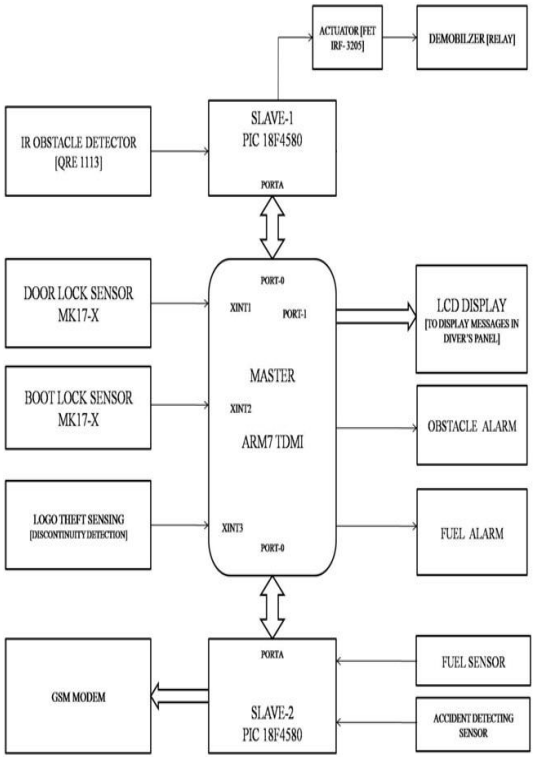

Fig.4 Proposed System

Above figure shows proposed work in this dissertation.ARM7 along with the slaves used for acquire the data from various sensors. Depending on the sensor data collected, the display shows the various statuses of parts of the vehicle. The security is provided with this system, after detecting the door lock opened or boot is opened or vehicles logo has been removed. If anyone from these theft attacks is detected, immediately text message has been sent to owner by using GSM modem. Along with the electronic sensors and the GSM modem this system acts as the "thinking device" for cars [6]. Another important controlling of vehicle is that, for back-up parking, one IR obstacle detector is used. When obstacle is present at back of vehicle and distance of that obstacle is less than 2 meters immediately engine turned off for avoiding the accident. And this facility is activated while owner using car reverse gear only.

ARM AS a MASTER:

The ARM7TDMI-S is a general purpose 32-bit microprocessor, which offers high performance and very low power consumption. The ARM architecture is based on Reduced Instruction Set Computer (RISC) principles. It is the first RISC microprocessor designed for low-budget market. One of the typical products is ARM 7 family that is the most streamlined RISC. Therefore, it's relatively cheap, and the core of ARM7TDMI-S ™ is a low budget- oriented, emphasizing the control of the system. The ARM7TDMI-S processor also employs a unique architectural strategy known as Thumb, which makes it ideally suited to high-volume applications with memory restrictions. It can be used in a variety of areas, such as embedded control, multimedia, DSP and mobile applications. The LPC2119/LPC2129 is based on a 16/32 bit ARM7TDMI-S"CPU with real-time emulation and embedded trace support, together with 128/256 kilobytes (kB) of embedded high speed bash memory. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at maximum clock rate. It contains a 16/32-bit ARM7TDMI-S microcontroller in a tiny LQFP64 package. With their compact 64 pin package, low power consumption, various 32-bit timers,4-channel 10-bit ADC, 2 advanced CAN channels, PWM channels, Real Time Clock and Watchdog and 46 GPIO lines with up to 9 external interrupt pins these microcontrollers are particularly suitable for automotive and industrial control applications as well as medical systems and fault-tolerant maintenance buses. It does not contain MMU (memory management unit). But because of its low price, reliability and other factors, it is widely used in various industrial controllers.

OBJECTIVES:

1) Logo theft sensor- Used for detection of logo theft attack. Now a day's logos of luxurious cars have been stolen in most of cities. There is no any provision presently available for logo theft sensing. Here detection of discontinuity is sensed. Firstly continuity is maintained around logo. Once the logo gets stolen by thief dis-continuity is sensed.

2) Door lock sensor – Used for detection of theft attack on door. If the door opened by thief then alarm is activated and SMS is sent to owner. Presently, only lights are glow on opening of door.

3) Boot lock sensor- Used for detection of theft attack on boot. If the door opened by thief then alarm is activated and SMS is sent to owner. Presently, only lights are glow on opening of boot.

4) IR obstacle detector- Used to sense obstacle within the range of 2 meter for avoidance of accidents while car parking. Presently cameras are provided for back parking. It increases cost and also no any automatic control provision. If obstacle is within the range then alarm is activated.

5) This system developed in digital environment, so it is very fast as well as low cost and also user friendly.

IV. APPLICATIONS

CAN in cars and truck engine control-

1) Networking controllers for engine timing, transmission, chassis and brakes.

2) Networking components of chassis electronics and electronics which make the vehicle more comfortable. Examples of such multiplex applications are lighting control, air-conditioning, and central locking and seat and mirror adjustment.

3) The CAN bus may be used in vehicles to connect the engine control unit and transmission, or (on a different bus) to connect the door locks, climate control, seat control, etc. Today the CAN bus is also used as a field bus in general automation environments, primarily due to the low cost of some CAN controllers and processors.

Jufang Hu, Xinyu, Jiangxi, China [2], presented paper Study on the Embedded CAN Bus Control System in the vehicle and found that they used ARM as the main controller and double gateway in a control computer within a car. This system makes full use of the high performance of ARM, high-speed reduction of CAN bus communication control networks and instrument control so as to achieve full sharing of data between nodes and enhance their collaborative work.

Feng Guo-sheng, Zhang Wei, Jia Su-me, Wu Han-sheng[1] presented paper CAN Bus Application in Automotive Network Control, and performed test for the lighting, direct current electromotor, electromagnetic actuator control node tests and can bus PRI intercession test.

S. Vijayalakshmi [4] in the paper worked for topic Vehicle control system implementation Using CAN protocol and developed system for implementation of a digital driving system for a semi-autonomous vehicle to improve the driver-vehicle interface. It uses an ARM based data acquisition system that uses ADC to bring all control data from analog to digital format and visualize through LCD. The communication module used in this project is embedded networking by CAN which has efficient data transfer. It also takes feedback of vehicle conditions like Vehicle speed, Engine temperature etc., and controlled by main controller. Additionally this unit equipped with GSM which communicates to the owner during emergency situations.

Visa M. Ibrahim, Asogwa A. Victor [6], worked for Microcontroller Based Anti-theft Security System Using GSM Networks with Text Message as Feedback and developed security system for the car against theft. Upon activation, it automatically demobilizes the car by disconnecting the ignition key supply from the car battery. This now makes it impossible for anybody so starts the car, let alone moving with it. In an attempt of theft through the car doors or boot, the system sends text message to the car owner and at the same time starts up an alarm.

V. EXPERIMENTAL RESULTS

Till today I developed only IR obstacle detector node found that the experimental values and theoretical values somewhat matches as per given in the datasheet of sensor. If we implemented one node of CAN bus, we can add the nodes as per our requirement that will quite easy task of adding the number of nodes in CAN bus. Following are the various parameters found during testing of IR sensor

Symbol	Parameter	Test Condition	Typical Value	Measured Value
V_F	Forward Voltage	I_F =20mA	1.2 To 1.6V	1.41 V
I_R	Reverse Leakage Current	V_R = 5V	10 µA	10.37 µA
$I_{C(ON)}$	On State Collector Current	I_F = 20mA, V_{CE} = 5V	0.10 To 0.40 mA	0.33 mA

VI. CONCLUSION

This project introduces the security system with a combination of CAN bus & GSM systems. Security of the vehicle is an important factor because now days we found cases of car theft. For the high performance of embedded technology, high-performance embedded processor is penetrated into the auto industry, which is low cost, high reliability and other features to meet the needs of the modern automobile industry. The proposed high-speed CAN bus system solves the problem of automotive system applications, also has a certain practical value and significance. With ARM as the main controller and it makes full use of the high-performance of ARM, high-speed reduction of CAN bus communication control networks and instrument control so as to achieve full sharing of data between nodes and enhance their collaborative work.

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