A Real-Time Approach for Home Security and Alert System using CAN Protocol

Praveena K S[1], Bhargavi K[2]

[1]*Assistant Professor, Dept. of ECE, VVCE, Mysuru, Karnataka, India*
[2]*Asistant Professor, Dept. of ECE, VVCE, Mysuru, Karnataka, India*

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Abstract - *In this fast pacing world, proportional to the rate of development, crime and theft rates are also on the high. The main objective of this paper is to reduce these activities. Another intention is each year people die or are seriously injured as a result of fires and also will be lost important properties, yet many fires can be avoided by taking fire precautions. If a fire does break out, the effects can be minimized by having effective controls and procedures in place. Hence to develop a sophisticated security and alert system against both theft and firing accidents, the method in this paper can be implemented using CAN protocol and GSM technology.*

Key Words: GSM, CAN, AVR Microcontroller, Fire Sensor, Entry sensor, Arduino Software.

1. INTRODUCTION

The basic idea behind this paper is to develop a sophisticated security and alert system against both theft and fire accidents using CAN (controller area network) protocol and GSM technology. Some necessary steps are need to avoid theft and fire accidents, Hence we i) should make a device which is used to secure the important Properties (money, jewels, etc,.). ii) should make a strong alert system to suppress theft rates at least to certain extent, iii) should keep good communication with to arrest the thief who trying to stole the public and private properties.

The CAN protocol is implemented in real time security and alert system. CAN is a bus standard designed to allow microcontrollers and devices to communicate with each other within an area without a host computer. CAN bus is a message-based protocol, designed specifically for automotive applications but now also used in other areas such as aerospace, industrial automation and medical equipment. Here CAN protocol is used in general automation to develop security and alert system. In general, a conventional fire and anti-theft system has several shortcomings, such as weakness to noise and false alarms. Hence, in order to overcome these shortcomings, Controller Area Network (CAN) based fire and anti-theft safety system is implemented.

2. PROPOSED METHOD

The proposed method in Fig -1 used two sensors, namely fire and entry sensors. If unwanted presence of fire is detected, the fire sensor senses it and the system activates the alarm as well as informs to the local fire station and Authorized person using GSM. Similarly, if the thief tries to enter, the entry sensor informs to controller. After that the controller approaches the sprayer unit to spray the chloroform on thief and activates the alarm as well as informs to the local police station and Authorized person using GSM.
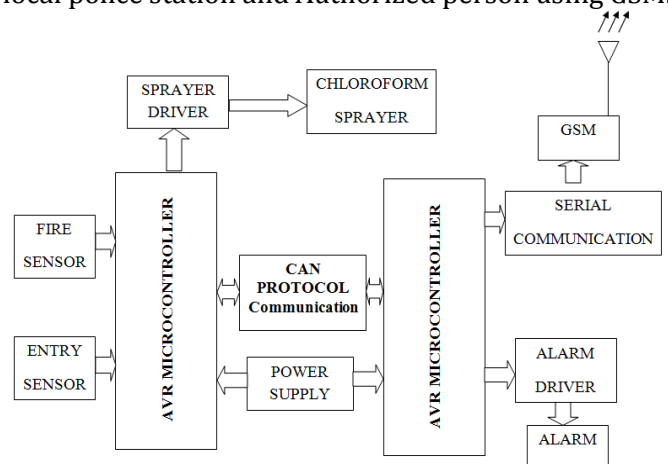

Fig -1: Block diagram of proposed scheme

The fire sensor will be activated through-out the day. But the entry sensor works during non-working hours and night time only.

The Fig -2. Shows the flow chart indicating the operation of the security system of the proposed method.

2.1 Control Area Network (CAN)

The CAN protocol function will have defined, established and communicated using hardware CAN

transceiver (ex MCP 2581). But here another approach has been proposed. To define and establish the CAN protocol function same as in the hardware CAN transceiver. That means to say the ATMEGA8L has the 8KB flash memory. In this flash memory, we can create a buffer memory by including a new library called "new soft serial" in Arduino software.
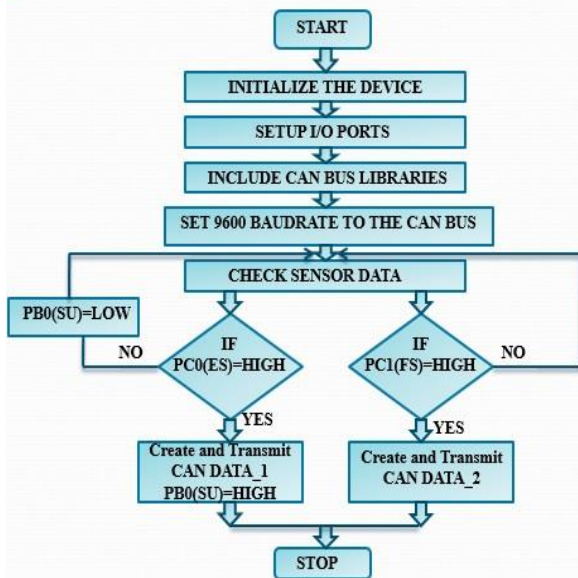

Fig -2: Flow chart for security system

So this new soft serial facilitates all the serial communications like I2C, CAN, USART etc... Here mainly we are considering on CAN protocol communication. So after including the library now have to create two wired CAN bus in any 2 pins of port-D of ATMEGA8L. Now data will be added to data field of CAN frame in the buffer memory before going to send the actual data.

In this way, the bus load can be increased by increasing the nodes (devices) in a single network. CAN can theoretically link up to 2032 devices (assuming one node with one identifier) on a single network. However, due to the practical limitation of the hardware (transceivers), it can only link up to110 nodes (with 82C250, Philips) on a single network. It offers high-speed communication rate up to 1 Mbits/sec thus allows real-time control. In addition, the error confinement and the error detection feature make it more reliable in noise critical environment.

Using the hardware CAN transceiver can connect nearly 110 nodes in a single network. But creating CAN function in code (software) using "newsoftserial.h" library of Arduino it can be increased

up to 1020 nodes in a single network. So this method provides high efficiency, high accuracy, error detection and correction, traffic management, easy to design and eliminates the hardware CAN transceiver. The CAN protocol also avoides the false alarms than the conventional security system. Also, multi-master communication can be studied using CAN protocol here.

2.2 Global System for Mobile communication(GSM)

GSM networks operate in a number of different carrier frequency ranges (separated into GSM frequency ranges for 2G and UMTS frequency bands for 3G), with most 2G GSM networks operating in the 900 MHz or 1800 MHz bands. Where these bands were already allocated, the 850 MHz and 1900 MHz bands were used instead (for example in Canada and the United States). In rare cases the 400 and 450 MHz frequency bands are assigned in some countries because they were previously used for first-generation systems.

2.3 GSM Modem – SIM300

This GSM Modem 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 MAX232 port to communicate and develop embedded applications. Applications like SMS Control, data transfer, remote control and logging can be developed easily.

The modem can either be connected to PC serial port directly or to any microcontroller using MAX232. It can be used to send and receive SMS or make/receive voice calls. It can also be used in GPRS mode to connect to internet and do many applications for data logging and control. In GPRS mode you can also connect to any remote FTP server and upload files for data logging.

Fig -3: GSM SIM300 Module

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.

In this transmitting section the 1st pin is the VCC which is given to operate the Transceiver section. The 2nd pin is transmitter which transmits data to mobile antenna. The 3rd pin is receiver which receive the data to PIC Microcontroller. The 4th pin is antenna. The 5th pin is signal Ground. Transmitter and receiver pins of GSM are connected to Microcontroller pins.
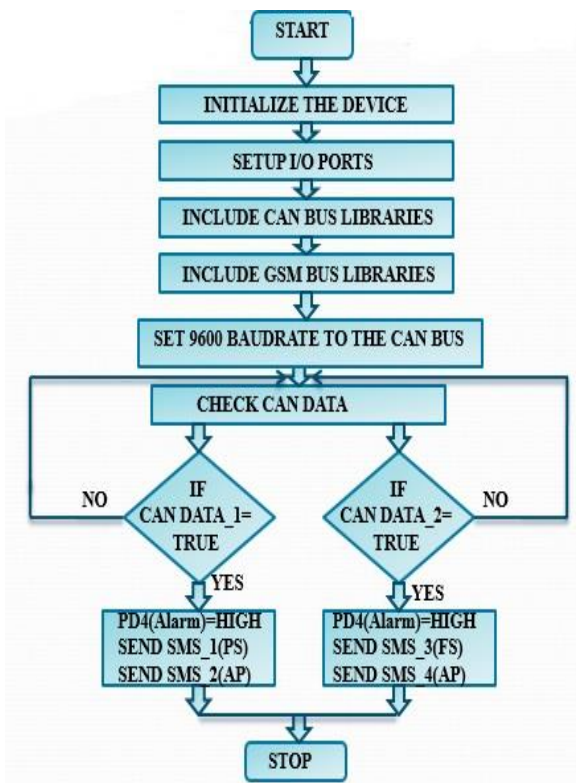

Fig -4: Flow chart for GSM block

The flow of the operation done by GSM module using CAN protocol is shown in Fig -4.
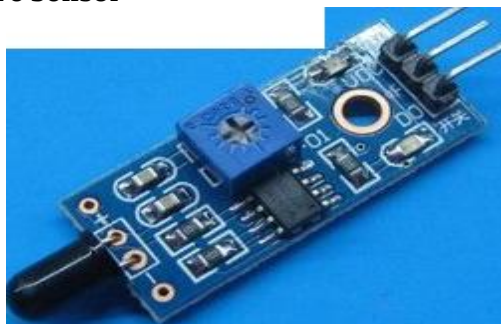
2.3 Fire Sensor

Fig -5: Fire sensor

This fire sensor in the circuit exploits the temperature sensing property of an ordinary signal diode IN 34 to detect heat from fire. At the moment, it senses heat, a loud alarm simulating that of Fire brigade will be produced. The circuit is too sensitive and can detect rise in temperature of 10 degree or more in its vicinity.

2.4 Entry Sensor

Entry Sensor provides real-time recognition of a door or cabinet being open. Standard use is to mount the wired sensor to the frame of a door. Then, mount the matching actuator opposite of the sensor on the door itself. When the door opens, the two components get separate and the sensor will trip. In this paper, PIR Entry sensor is used. It detects motion of humans or animals from as far away as 30 feet. Silent operation for alarms, motion activated nightlights, holiday props. Automatically resets after period of inactivity.

Fig -6: PIR sensor

PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensors range. They are small, inexpensive, low-power, easy to use and don't wear out.

For that reason, they are commonly found in appliances and gadgets used in homes or businesses. They are often referred to as PIR, "Passive Infrared", "Pyroelectric", or "IR motion" sensors.

Passive infrared (PIR) sensors detect motion by comparing the amount of infrared radiation that reaches a pair of detectors. When the two detectors "see" different values, the sensor indicates it as movement of an object, such as a person or an animal. PIR sensors are often used in driveway security systems, which turn on a light (but only at night) when someone approaches the restricted areas.

The PIR sensor itself has two slots in it, each slot is made of a special material that is sensitive to IR. The lens used here is not really doing much and so we see that the two slots can 'see' out past some distance (basically the sensitivity of the sensor). When the sensor is idle, both slots detect the same amount of IR, the ambient amount radiated from the room or walls or outdoors.

When a warm body like a human or animal passes by, it first intercepts one half of the PIR sensor, which causes a positive differential change between the two halves. When the warm body leaves the sensing area, the reverse happens, whereby the sensor generates a negative differential change. These change pulses are what is detected.
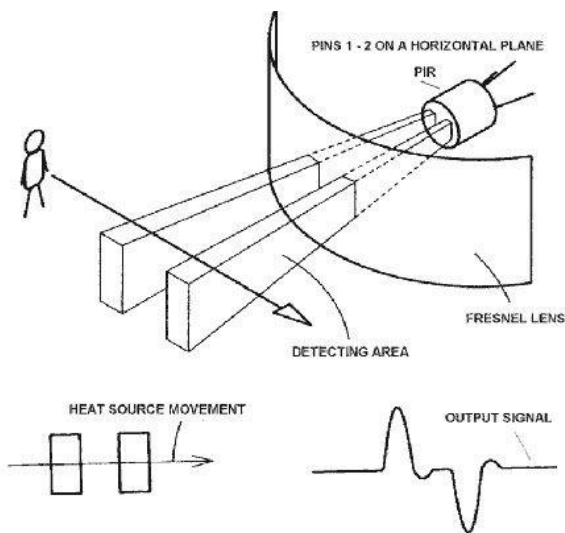

Fig -7: Working principle of PIR sensor

For many basic projects or products that need to detect when a person has left or entered the area, or has approached, PIR sensors are great. They are low power and low cost, pretty rugged, have a wide lens range, and are easy to interface.

A selectable jumper on the sensor lets you set working distance:

- L (for Long) position, the effective sensor distance is up to 30 feet. This increases the sensitivity of the sensor, which may also cause more false triggers.
- S (for Short) position, the sensor distance is up to 15 feet.

For proper operation the sensor should be allowed to warm up of for 20 to 60 seconds after first applying power. This lets the infrared detectors stabilize. The sensor output is not reliable until the sensor has warmed up.

2.5 ARDUINO software

Arduino is a tool for making computers that can sense and control more of the physical world than your desktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board.

Arduino can be used to develop interactive objects, taking inputs from a variety of switches or sensors, and controlling a variety of lights, motors, and other physical outputs. Arduino projects can be stand-alone, or they can be communicating with software running on your computer (e.g. Flash, Processing, MaxMSP.)

The boards can be assembled by hand or purchased preassembled; the open-source IDE can be downloaded for free. The Arduino programming language is an implementation of Wiring, a similar physical computing platform, which is based on the Processing multimedia programming environment.

3. EXPERIMENTAL RESULS

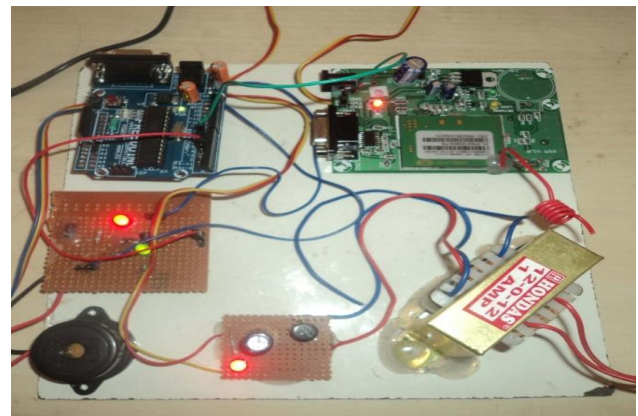The experimental setup is as shown in the following figures.

Figu -8: GSM block (Power supply, GSM 300, ATmega8L2, Buzzer unit)
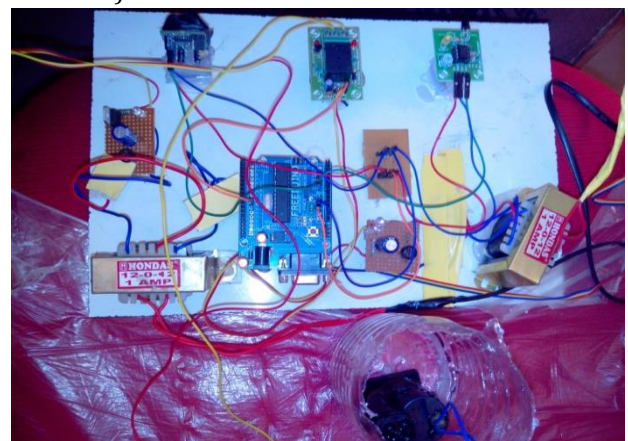

Fig -9: Security block (Power supply, Sprayer unit, ATmega8L1, Fire & PIR sensor)

The proposed system operates as follows: If unwanted presence of fire is detected, the fire sensor senses it and the system activates the alarm as well as informs to the local fire station and Authorized person using GSM. Similarly, if the thief tries to enter, the entry sensor informs to controller. After that the controller

approaches the sprayer unit to spray the chloroform on thief (water pump is used to demonstrate instead of chloroform sprayer) and activates the alarm as well as informs to the local police station and Authorized person using GSM.

4. CONCLUSION

In this paper, we proposed CAN protocol based security and alert system which provides reliability, accuracy, efficiency and high speed performance. Software CAN protocol reduces the device size and it can make the device as compact. GSM SIM300 is used to send messages to remote areas. ATMEGA8L is reprogrammable so that it can be more useful in future to modify the device application based on security. Since we are using CAN protocol on the software basis, hardware requirements can be reduced. Further applications can be included to the same system.

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BIOGRAPHIES

Bhargavi K is working as Assistant professor in VVCE, Mysuru. She pursued her M.Tech from VVIET, Mysore in Digital Electronics and Communication Systems. Her areas of interest are embedded systems, Communication and Networking.

Praveena K S is working as Assistant professor in VVCE, Mysuru. He pursued his M.Tech from UBDTCE, Davangere in Digital Communication and Networking. His areas of interest are image processing, embedded systems, Communication and Networking.