Embedded system based automobile accident prevention

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***Abstract*—Automobile industry shares the dubious distinction of being part of numerous accidents in our daily routine. Our project aims at a real time embedded system based low cost solution to accidents caused by violation of rules and carelessness. The sub-components of our project are ALCOHOL DETECTOR-if the driver is found to have consumed alcohol the vehicle stops, EMERGENCY SYSTEM-accident if any is detected using vibration sensor and using GSM module the area where accident occurs is sent to help center, SECURITY SYSTEM-if theft occurs users can activate central lock, stop fuel flow and identify vehicle's location.**

***Keywords*—MQ303A,TELIT,GPS,GPRS,GSM,DTMF**

I. INTRODUCTION

The world has welcomed with open arms the advent of automobiles. Life has taken a turn along with it driving the path of luxury. With it came the demons of road accidents which are consuming a large proportion of our population. The gates for vehicle thefts have set some infamous records as well. The project uses the advancement in technology to mitigate this crime and provide a safe living sphere.

II. ALCOHOL DETECTOR

A. Need for alcohol detector

It is impossible for police to check each and every vehicle for drunken drivers, so an effective system which automatically prevents drunken driving is needed. This system can be integrated with the ignition system thus allowing only sober people to handle the car.

B. MQ303A

MQ303A is a semiconductor alcohol sensor which detects alcohol in air. This gives an output depending on the amount of alcohol concentration in a puff of air given as input to it. It has high sensitivity, high response time, long life, low cost and short size.

Figure 1. MQ303A

C. Logic circuit for alcohol detection

In the logic circuit of a detector, the output of sensor is connected to inverting input of a comparator (LM 358).the non-inverting input has voltage signal corresponding to the threshold value of alcohol concentration. When the desired alcohol consumption is not exceeded, the non inverting input is higher, output of comparator is +12v so transistor is ON. Thus the input to hex inverter is logic 0 and output is logic 1. Similarly if the alcohol consumption is more, the inverting input is higher, output of comparator is -12v so transistor is OFF. Thus the input to hex inverter is logic 1 and output is logic 0.

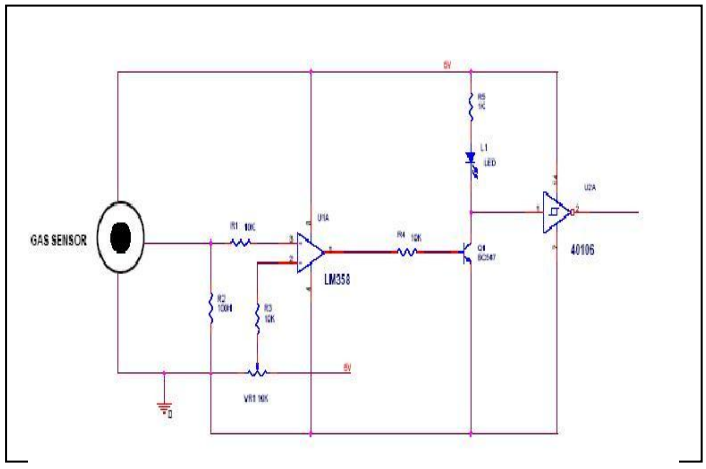

Figure 2. logic circuit for alcohol detection

D. Integration with ignition system

The engine is cranked and hence started by supplying battery power to it for some time. The microprocessor is programmed so that the NC switch opens after 10 seconds which is insufficient for engine cranking. When output from logic circuit is logic1, the microprocessor's program is interrupted and stopped so that switch remains closed and engine cranks. On the other hand when output is logic0 the program continues and opens circuit after 10 secs thus stopping engine ignition.

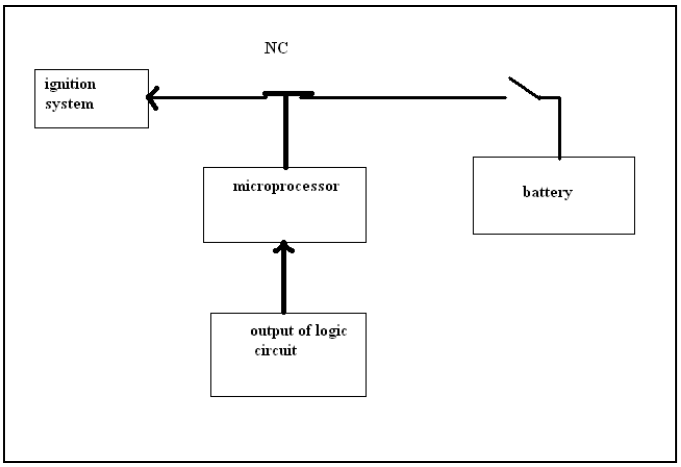

Figure 3. Integration with ignition system

III. SECURITY SYSTEM

A. Concept of micro vehicle blackbox

Micro vehicle black box is a developing concept for anti-theft security system. This works in integration with cell phones. It is compatible with all GSM and CDMA mobiles. This allows two way communication with car and drivers. Unauthorized entry into car detection, car location and immobilization of car is done with this technology.

B. TELIT GM862-GPS GPS/GPRS

Telit operates on Quad band EGSM 50/900/1800/1900MHz with the output power of 2W for class4 (850/900MHz) and 1W for Class 1(1800/1900MHz). Controlled via AT commands according to GSM 07.05,07.07 and Telit enhancements. Uses TCP/IP stack access via AT commands.Supply voltage is 3.22-4.5V DC. It comprises of Sim access profile. Its Dimension is approximately 43.9* 43.9*6.9mm with a weight of 20 grams. Extended temperature range is -40 C to +85 C.Supports Telephony,emergency calls,DTMF,handset and hand free operations,Half rate, fullrate, multirate voice codecs,CLIP,CLIR, point to point mobile originated & mobile terminated SMS. It has a python interpreter with 3MB Non-volatile memory and a 1.5 MB volatile memory integrated inside the module [9]. No external controller is required. It has a 20 channel high sensitive GPS receiver and built-in SIM card holder. This makes the system compact and power efficient. To build a complete working system using this module, only the power source and the antenna is required.

C. Security system with TELIT

1) Location notifier

Telit uses a GPS and Google earth compatible application which is available in markets. This helps to find the location of car at regular instances. The location is then sent to the server of network provider through GPRS facility of GSM using HTTP protocol. Each owner of car is given a login id and password for his car. This id contains the location of the car which is stored in the server of service provider. The owner is also notified via SMS about the whereabouts of the car whenever its location changes. Thus the owner has complete control over his car.

2) Automobile stopper and central locking

Whenever the owner feels that his car could have been stolen he could stop the car and activate central locking via DTMF embedded inside TELIT. The sim card in GPS module will be set to auto attend calls. Calling to the number of the sim card in GPS module automatically connects the caller and the car. Pressing the buttons 1 or 2 sends output to the DTMF decoder IC 8870 which in turn is connected to a microcontroller. Pressing 1 automatically applies break and pressing 2 activates the central locking mechanism.

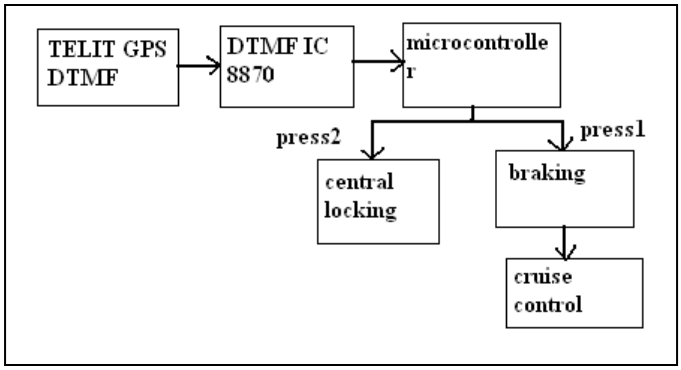

Figure 4. Automobile stopper and central locking

IV. EMERGENCY SYSTEM

A. Vibration sensors

Many types of sensors can be used to sense the vibration that occurs during or immediately before an accident. Piezo electric sensors uses piezoelectric effect to measure pressure, acceleration, strain, force by converting them to electrical charge that displaces the silicon diaphragm attached to it. It is widely used in process control and quality assurance. In

addition to this, uniaxial and triaxial accelerometers are used to measure vibration,shock,displacement in automobiles. MEMS vibration sensors can also be used for automotive mechanical systems.Vibration monitoring hardware are provided by Hansford sensors, IMI sensors, Holykell technology,Kyungwon ferrite Ind.co, etc.

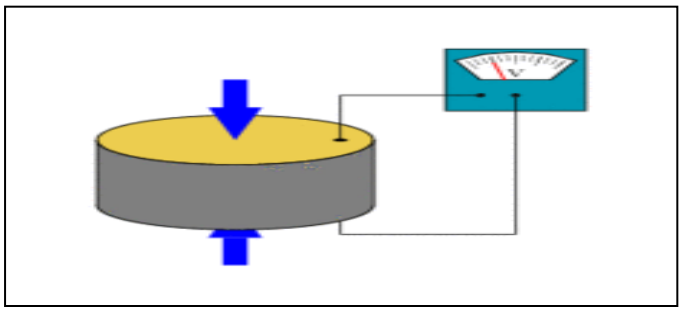

Figure 5. Vibration sensors

B. Working of emergency system

Vibration sensors are fixed to the chassis of the car. Whenever the car meets with an accident the vibration in vibration sensor is more than a threshold value. The output of sensor and threshold voltage are given to a comparator. Whenever the sensor output is greater the GSM module makes an emergency call to 108 and sends its location via SMS.

V. LOW COST SOLUTIONS

The use of the GPRS GSM GPS module reduces cost as only an antenna and power sources are needed. All other equipments used are also available at a cheaper rate.

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