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Emergency Call Grumble Crack Warning Service Using GSM Based On Embedded System

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Abstract

In a critical situation many vehicles face accident, due to this lot of people lost their. After that accident, some life cannot be saved due to lack of information, time and place. Our project will provide an optimum solution to this draw back. E-call is the telecommunication service aimed to provide the automatic notification of the road accident based on the GPS positioning and provision of E-call prioritization within the GSM communication. Suppose when a person met with an accident, the location of the vehicle can be identified by using GPS immediately and emergency number stored in the microcontroller will send accident location as SMS message through GSM modem. Initiative calls from emergency number to relatives, ambulance, police and fire service which are already stored in the server database. With the help of the E-call telecommunication service, the recipient can trace the location which helps to save many life. So, as soon as the recipient reaches the location they will try to save the life of the victim.

Keywords: *GSM, GPS, E-Call, SMS, Crash, Victim, PIC, PSP, PEIE, MTPC, WDT, ICSP, MSD, USART, SPI, IIC, SSP, FEC, STOP,PSAP, CRC.*

I. INTRODUCTION

When a vehicle met with an accident in remote areas such as highways, hilly areas, etc some people's life can be lost due to communication delay about the accident. Our crash notification system is overcome the above drawback and save many people's life. If accident occurred, microcontroller based system will measure accident severity using crash sensor. This

sensor output exceeds the threshold value, GPS identifies the location of the accident.

The PIC microcontroller is programmed to send alert message with longitude and latitude value of the accident location to Public Safety Answering Point (PSAP) using GSM modem. Immediately PSAP will make voice calls to relatives, ambulance, police and fire service which are already stored in the server database. The aim is to improve accident notification and to provide fast emergency assistance.

The goal of this project is to develop an end to end embedded solution which aims at reducing the time it takes for emergency service vehicles to arrive at the accident spot. In the already existing system, if an accident happens it will be intimated to the emergency services by a manual call only. But in the proposed system it automatically call emergency operators in the event of a road accident and helps the emergency response vehicle driver o reach the accident spot quicker by using a google maps navigation guiding device. The service provider arranges for the necessary help. Accident Detection and Reporting (ADRS) which can be placed in any vehicle uses a sensor to detect the accident[1]. The E-Call is a telecommunication service aimed to provide the automatic notification of a road traffic accident, based on precise GPS-based positioning and provision of E-Call prioritization within the mobile communication network [2]. It is nescessary to develop a method enabling detection of the road collision, similar to the one used in airbag systems, based on the signals available from the acceleration sensors[3]. This system features a crash detector and an E-Call box, which can be connected over a wired or wireless link[4].

II. EMERGENCY CALL SYSTEM

The block diagram description of the E-call system is shown in the figure 1. E-Call was described as emergency call generated either automatically via activation of in-vehicle sensor or manually by the vehicle occupants when activated, it provides notification and relevant location information identified using GPS and send this information as SMS message to PSAP using command signal in GSM. ***See figure: 1***

It carries a defined standardized minimum set of data, notifying that incident place and requirement of emergency services. Immediately establishes an audio channel between the PSAP server and emergency services to save accident people life.

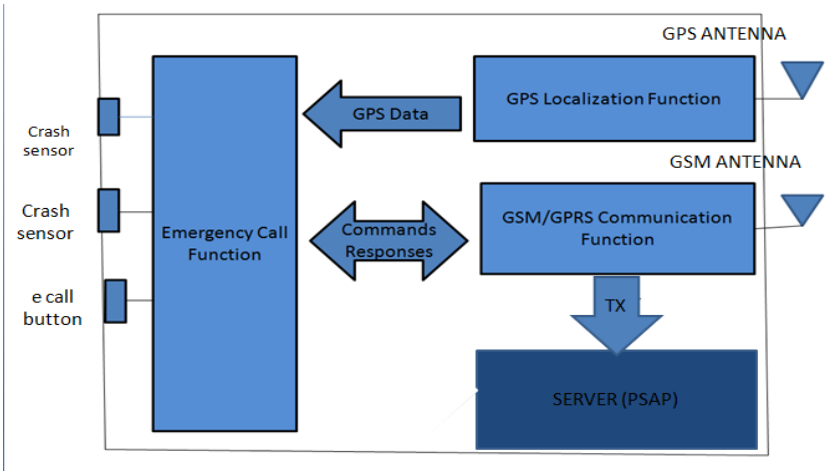

Fig 1 Block diagram description of the E-call System

i) Functioning of E-Call Services

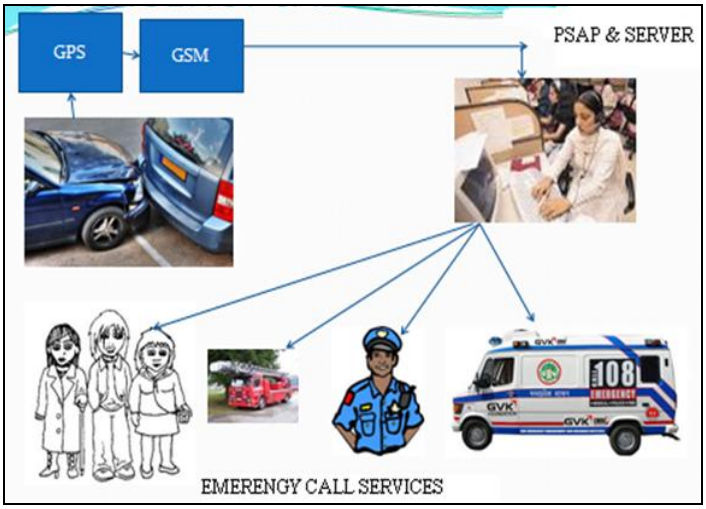

Fig 2 Functioning of E-Call Services

In figure 2 shows the functioning of E-call services, the accident severity is measured by the sensor and identifies the location using GPS. E-call is expected MSD information from GSM and immediately establishment the voice call for emergency services at PSAP. Server databases in PSAP is maintaining the details about the vehicle occupants.

ii) Characteristics of E-Call

E-call is a post incident emergency system that uses the emergency telephone system. E-Call, which triggered from the vehicle, works by creating a priority voice channel

communication between the occupants of the vehicle and a Public Service Answering Point. Before voice contact is established between the PSAP operator and the occupants of the vehicle, E-call sends a 'Minimum Set of Data' about the vehicle and the situation, as data in a voice channel, down the line to the PSAP. E-call then opens the voice channel to enable the PSAP operator to speal to the occupants of the vehicle.

iii) Requirements of E-Call

The data may be sent prior to, in parallel with, or at the start of the voice component of an emergency call.

- The realization of the transfer of data during an emergency call shall minimize changes to the originating and transit network.
- Both the voice and data component of the emergency call shall be routed to the same PSAP or designate emergency call centre.
- The transmission of the data shall be acknowledged and if necessary data shall be retransmitted.
- A UE configured only to transfer data during emergency calls shall not generate signaling to the network besides what is needed to place and emergency call.
- The UE shall indicate at call setup if the emergency call will carry supplementary data.
- The MSD should typically be made available to the PSAP within 4 seconds.
- A call progress indication shall be provided to the user while the SMS transmission is in progress.
- The MIEC and AIEC may be used to filter or route E-Call to a dedicated PSAP operators.
- Throughout the duration of the emergency call and following receipt of the MSD by the PSAP.
- It shall be possible for the PSAP to instruct the IVS to terminate the E-Call.

iv) *E-Call In-Band Modem Architecture*

The E-Call system uses an in-band data modem to transmit the MSD information over the voice path to the PSAP. This approach enables the E-Call solution to be quickly deployed end to end in vehicle IVS's and PSAPs without modifications to the existing cellular and wireless infrastructure. Modem pair consisting of transmitter and receiver at IVS and PSAP

that operates full-duplex and allows reliable transmission of E-call MSD from IVS to PSAP via the voice channel of the emergency voice call through cellular and PSTN network. It is a challenging task to transmit data over the mobile voice channel as required of an in-band modem since speech codes used in digital cellular systems are optimized explicitly for speech signal compression.

After an emergency voice call has been automatically established, the IVS modem receiver constantly monitors the incoming signals from the speech decoder output. The requirement about the modem to be configured in either push or pull mode is beyond the scope of this specification.

v*) Operation of IVS Data Modem*

When prompted by a signal from the PASP operator, the IVS connects the IVS data modem to the input of the speech codec and mutes any speech from the motorist for the duration of MSD transmission to prevent it from interfering with the E-Call data transmission. The MSD information input into the IVS data modem is first appended with Cyclic Redundancy Check (CRC). These bits are then encoded in the Hybrid-ARQ encoder using forward error correction coding to reduce the susceptibility to transmission errors. The Hybrid-ARQ encoder employs a very powerful turbo scheme with incremental redundancy added for each transmission. The signal modulator converts the encoded data into waveform symbols which are especially suitable for transmission through all types of speech encoders employed in present mobile systems, including the GSM full-rate and the various modes of AMR encoders like 12.2,10.2,7.95.6.7. and 4.75 kbps.

vi) Operation of PSAP data modem

The E-call PSAP receiver continuously monitors the incoming signal form the PSTN. When the E-Call data signal is detected the outgoing speech path is muted and the signal demodulator detects the incoming data symbols.

The H-ARQ decoder soft combines the first MSD transmission with any retransmission information and decodes the FEC to determine the information the information bits, i.e., its estimate of the CRC protected the IVS transmitter to provide retransmission with incremental redundancy.

Otherwise, the MSD information is provided to the PSAP operator and the transmitter is notified that retransmission is not or no longer required.

vii) Design Specification

- Resistor R1 and R2 maintain line load regulation.
- At the secondary side of the transformer, Applied voltage = 15V
- Conducting drop across the diodes = 2*0.6 = 1.2V without capacitor: Vavg = (15-1.2)V = 13.8c pulsating DC
- Frequency = 100Hz with capacitor V = Vavg*1.41(from factor) = 19.51V
- Frequency = 0Hz with 7812 voltage regulator: Vo = +12V
- With 7812 voltage regulator: Vo = -12V

III GSM AND GPS

It describes the hardware interface of the SIMCOM SIM300 module that connects to the specific application and the air interface. Figure 3 is shown GSM module and it can be integrated with a wide range of application.

SIM300 functions are described as given below

- Off - SIM300 is not running.
- 64ms On/0.8 sec Off - SIM300 does not find the network.
- 64ms On/3sec Off - SIM300 find the network.
- 64ms On/0.3 sec Off - GPRS communication.

Fig 3 GSM Module

i) SIM card Interface

The SIM interface supports the functionality of the GSM phase 1 specification and also supports the functionality of the new GSM phase 2+ specification for FAST 64 kbps SIM intended for use with a SIM application Toolkit. Both 1.8V and 3.0V SIM cards are supported.

The SIM interface is powered from an internal regulator in the module having nominal voltage 2.8V. All Pins resets as outputs driving low.

ii) GPS

In figure 4, the Global Positioning System (GPS) is a space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites.

Fig 4 GPS Module

iii) GPS output using Trimble GPS studio:

- First GPS device is connected to PC using RS232 cable.
- This is automatically identifies the location of the area using software namely Trimble GPS studio.
- The software output in Figure 5 is displayed the area in the form of longitude and latitude value.
- Google maps specify the location by using the above values.

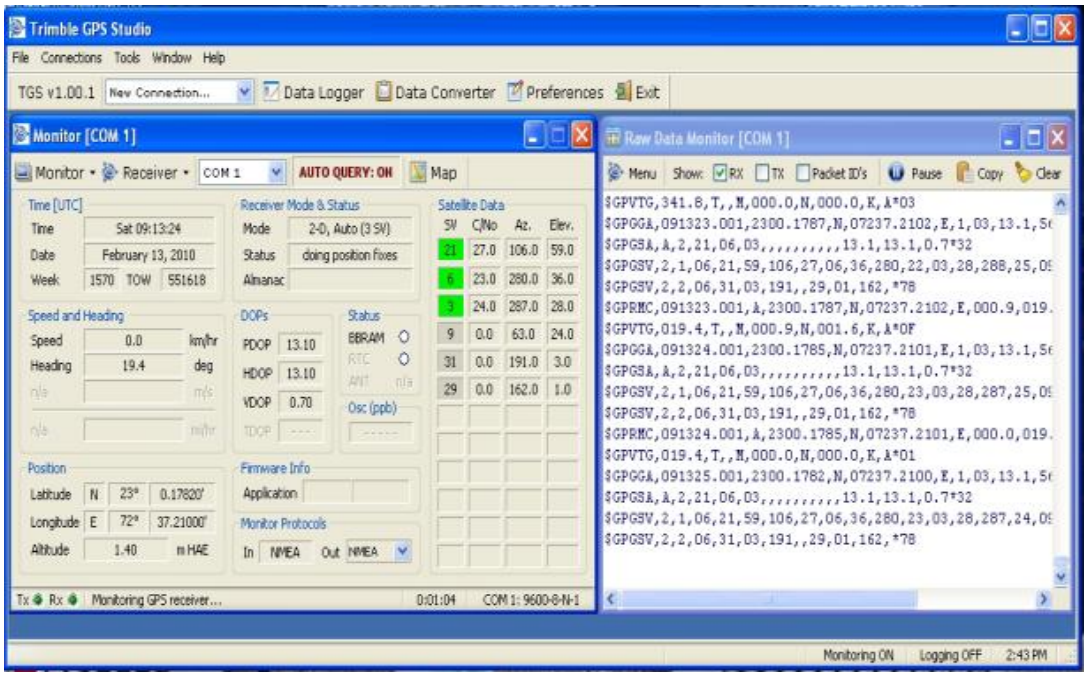

Fig 5 GPS Output

IV CRASH SENSOR

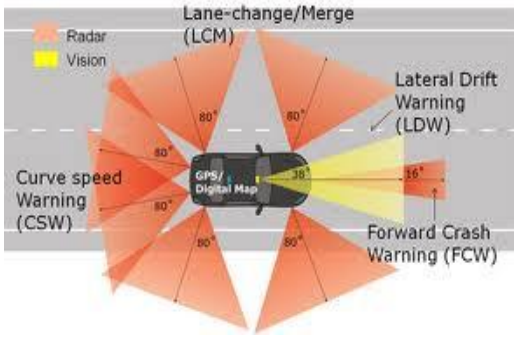

Fig 6 Crash sensor position

In Figure 6, sensors are placed in the car with different position. Radar based six red sensors output is measured with 80 degree severity of the accident and one in front red sensor is used to measure 16 degree accident effect. Vision based sensor is captured with 30 degree accident effect at top of the car and specified in Fig 6 as yellow color.

The following warnings are produced due to accident severity and sensor position.

- Lane-change merge
- Lateral drift warning
- Curve speed warning
- Forward crash warning

i) Threshold value

The following threshold values for different sensor position.

- 50 km/h R & L Side
- 55 km/h L.60° Rear
- 55km/h R.60° Rear
- 60 km/h 0° Rear
- 56 km/h R. 60° Frontal
- 56 km/h L.60° Frontal
- 64 km/h 0° Frontal

V. SOFTWARE IMPLEMENTATION

The CCB software in figure 7 is used to compile the assembly level program for PIC microcontroller. This assembly program is converted into .HEX code and burned into PIC microcontroller using RS232 serial cable.

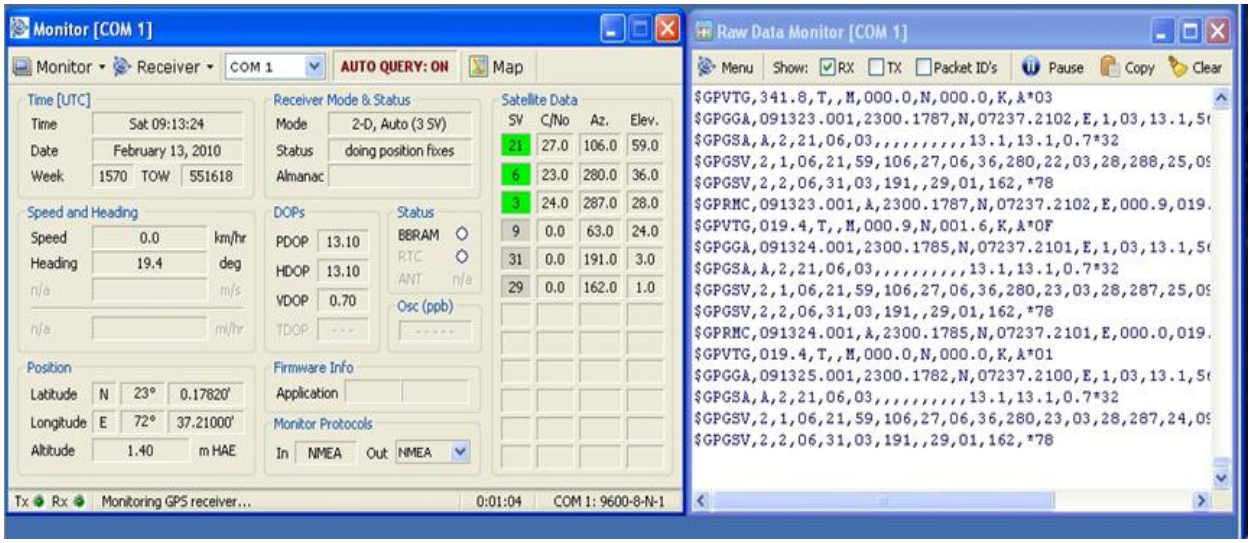

Fig 7 CCB software

VI. HARDWARE IMPLEMENTATION

The microcontroller based E-Call system is implemented and shown in Figure 8. This system contains the following components

- PIC Microcontroller
- MAX 232
- Power supply unit
- GPS
- GSM

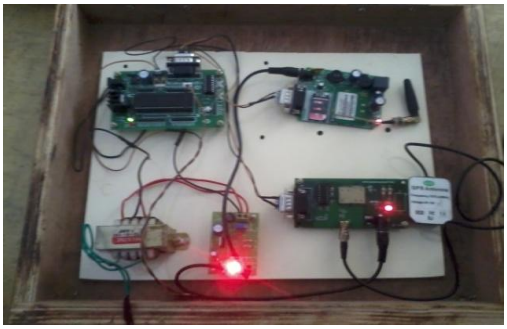

Fig 8 Prototype model

The Figure 9 illustrates about the accident location obtained from the GPS module in the form of latitude and longitude values.

These values are sent to PSAP server through SMS.

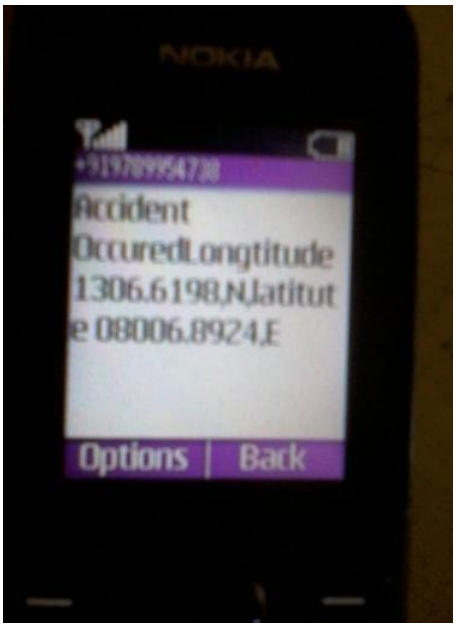

Fig 9 PSAP server SMS

It is a back hand process, where the PSAP server maintains the vehicle user details in figure 10.

S.I	CAR.NO	PH.NO	REL.NO	POLICE	AMBU	FIRE	ADDRESS
1	TN 09 AZ4673	8681954767	9841917772	100	108	101	NO.37 J.B. ESTATE
			9080031115				AVADI
			9940999634				CHENNAI-54
2	PY 08 FE1234	9444082482	9382815890	100	108	101	NO.1\5 K.K NAGAR
			9080031115				CHENNAI-25
			7373881259				
3	TN 09 AX2345	9841917772	9080031115	100	108	101	NO. 234 USMAN ROAD
			9382815890				T. NAGAR, CH-45

Fig 10 Database of PSAP Server

CONCLUSION

The E-Call has presented as a novel contribution to enhancement public and traffic safety, with considerable socio-economic benefits. The E-Call development passed the feasibility, research and standardization, phases and enters the testing and validations phases. The designed E-call system is used to save thousands of automotive accident victim lives and reduces the seriousness of injuries.

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