ISSN: 2349-7300
ISO 9001:2008 Certified
International Journal of Innovative Research in Engineering & Multidisciplinary Physical Sciences (IJIRMPS)
Volume 2, Issue 3, December 2014

Design and Implementation of High Speed FPGA Based Technique For Reduce Accident Using Cell Phones While Driving

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Abstract: ***In our world the majority of accidents happened due to only drunken driver and using mobile phones while driving. The widespread usage of mobile phone is becoming unsafe and dangerous. Mobile phones are wrongly utilized by students in the exam rooms and some peoples are utilized in the hospital which may be very irritating and dangerous for the ill people and those who are heart patients. A wireless jammer is an instrument used to avoid mobile phones from receiving signals from base stations. When we use the jammers effectively, which will disables cellular phones. These devices can be used in practically any location, primarily in places where a phone call would be particularly prohibited because where silence is expected. In our system cell phone jammers are used to stop the usage of mobile phone in driving situations. To avoid accidents and also detect gas leakage in vehicle a new efficient type of mobile jammer is proposed using FPGA. In our proposed system, we make use of RF transmitter, RF receiver and Gas sensors which are interface with the FPGA to avoid the accident while driving.***

Index term: **FPGA, RF transmitter, RF receiver, Gas sensor, Mobile phone.**

I. INTRODUCTION

Mobile phones first appeared in Britain during the 1980s, but were costly and bulky. However, modern mobile phones are small, compact, easy to use and have become an essential part of life for many people. They enable people to maintain contact with family, friends and business associates[1].Using mobile phone while driving creates an accident risk, to the user and to other people on the road, because it distracts the driver, impairs their control of the vehicle and reduces their awareness of what is happening on the road around them[2] [3] [4]. When using a hand-held mobile phone, drivers must remove one hand from the steering wheel to hold and operate the phone [4]. They must also take their eyes off the road, at least a moment, to pick up and put down the phone and to dial numbers.

Fig. 1. Mobile phone use growing a problem of driver distraction

When mental tasks are performed simultaneously the performance of both tasks is often worse than if they were performed separately, because attention has to be divided, or switched, between the tasks [2] [4][8]. When a

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ISO 9001:2008 Certified
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driver is using a hand-held or hands-free mobile phone while driving, must devote part of their attention to operating the phone and maintaining the telephone conversation and part to operating the vehicle and responding to the constantly changing road and traffic conditions[21][22]. The demands of the phone conversation must compete with the demands of driving the vehicle safely [12]. Those that engage in other high-risk behaviors such as drinking and driving, speeding, or not wearing a seat-belt are more likely to use mobile phones while driving, which worsen the impacts of any crash.

As per data registered by Traffic Investigation Wing of Coimbatore city, the accident rate will be increases every year. According to statistics from 2004 to 2006 accident rate in increased by 6.7% and 14% will be increased from 2006 to 2007[22]. In 2013 the road accident will be increased by 19% compared to 2012 as shown in following Table. 1.

Table. I. Comparative statement of road accident cases for the 10 years (up to 30.12.2013) (Tamilnadu city traffic police provides this data for research purpose)

HEAD	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
	REPORTED CASES	R	R	R	R	R	R	R	R	R
304(A) IPC	129	168	239	274	297	267	284	254	263	266
338 IPC	470	471	613	679	646	522	506	517	458	568
337 IPC	365	376	318	427	344	233	267	283	339	350
279 IPC	219	199	136	114	94	76	84	72	68	163
TOTAL	1223	1214	1306	1494	1381	1098	1141	1126	1128	1347

From the above table. I 304(A) IPC shows that status of death due to road accidents, 338 IPC shows that the status of damage of external parts of the human like hand, leg.etc, 337 IPC shows that the status of small injuries due to accident like scratches on human body and 279 IPC shows that the status of vehicle damage due road accidents in Coimbatore city.

II. LITERATURE REVIEW

The concern of distracted driving can be tied to the research carried by Bruyas et al. (2008) which found attention sharing generated by phone use appears to increase the driver's mental workload there by overloading the driver's cognitive capacities and impaired the driving performance. The study carried out on cognitive distraction by Harbluk et al. (2002)[10],Strayer et al. (2003) [11] shows, during the cell phone conversation,

ISSN: 2349-7300
ISO 9001:2008 Certified
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drivers are observed to be looking at the sky much more often, not at the road, traffic, or road signs. It is commonly observed that, while the drivers are in-depth conversation, they simply ignore the other road users and even close their eyes as they are imbibed in their talk. This is counterproductive to driving safely. The outcome of the research carried out by Crundall et al. (2005)[12] show, driver behaviours such as impaired gap judgment, reduced sensitivity to road conditions, poor lane maintenance, and the increase in reaction time to driving-related events can all be as a result of distracted driving. The goal of driver identification task is to classify drivers from their driving behavior characteristics, and distraction detection identifies whether the driver is under distraction due to secondary tasks. The work carried by James (2011) [13] show, driver distraction is an obvious risk and it is not difficult to understand, since everywhere anyone in traffic can look at the people who are constantly in a head-down driving position as they try to dial a number, changing music on smart phone; watch those drivers engaged in conversation who cannot maintain consistent speed, drift towards the center line, or do not move when the light changes from red to green. Appropriately identifying driver distraction in real time is a critical challenge in developing these distraction mitigation systems, especially in detection of cognitive distraction which needs integration of a number of eye movement measures (e.g., blink frequency, fixation duration, and pursuit measurements) and performance measures (e.g., steering wheel movements and lane position) across a relatively long time interval but unfortunately this function was not well developed. The work carried by Chieh-Chih et al. (2013) proposed a system which located the cars on the road on which drivers were distracted, and it provided a warning message to the driver along with it also displayed message (e.g., Distracted !) to the surrounding cars through IVI system that would be visualized on top of their associated vehicles. They implemented system using Face API and an RGB-D camera that could track face and hand postures. The system models and tracks the users face and determines whether or not the driver is looked forward [24]. They model this attentive gaze with a rectangular boundary. When the driver's gaze was within the rectangle, no warning was produced, but when the driver was not looking at the road, the gaze would be shown outside of the rectangular region, and the distracted warning was produced.

III. PROPOSED METHODOLOGY

In our proposed method, to avoid the accident due to using a mobile phone while driving. We are using the mobile jamming technique and also using gas sensors to detect the gas leakage. FPGA processor is interface with mobile phone as well as gas sensor by using Verilog/VHDL coding [18]. Radio Frequency (RF) transmitter and receiver also used for our proposed method [15]. In which RF transmitter is connected to the vehicle, if vehicle is in driving condition RF transmitter send the signal to mobile phone. RF receiver is placed in the mobile phone which receives the signal and sends to FPGA processors. Now FPGA processors disable the keypad, mike and loudspeaker. So we should not attend any call while driving. The notification about the calls will be given to the user. If we want to attend any emergency call, we should stop the vehicle. Then only the mobile keypad, mike and loudspeaker will be enabled. If gas leakage occurs in vehicle like cars, the sensors used to send the signals to the FPGA then door will be opened automatically [20].

IV. SOFTWARE OVERVIEW

The software selection is the very important criteria for the entire project. Software development includes programs written for interfacing of the FPGA with mobile phone vehicle and gas sensors. By using software and hardware fundamentals of the system, the next stage is to understand the software programming is incorporate with FPGA to achieve a desired task [18]. While performing its calculations and control, the FPGA need to be a human friendly. The software has been written in structure manner by using Verilog/VHDL coding in which all the functions are linked to a single main program [5]. These coding are overloaded to FPGA processors to achieve a specific task.

V. HARDWARE DESCRIPTION

In our proposed technique, we have designed a mechanical system which is used to prevent accidents using mobile phone while driving and carbon monoxide detection using sensors [20]. It basically functions on the basis of the interfacing the mobile phone and gas sensor with FPGA processors [18]. The real time implementation of this system is practically very useful to avoid accidents using mobile phones while driving.
A mechanical system is designed using our proposed technology. This system consists of the following units:

- FPGA –SPARTAN 3AN
- RF Module
- Mobile Unit

ISSN: 2349-7300
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- Jammer Unit
- Power supply

A. Block diagram

In our proposed system we are using following block diagram fig. 2 which consists of FPGA processor, RF transmitter, RF receiver and gas sensor. FPGA processor was interfaced with RF transmitter, RF receiver, Gas sensor and mobile phone [15].

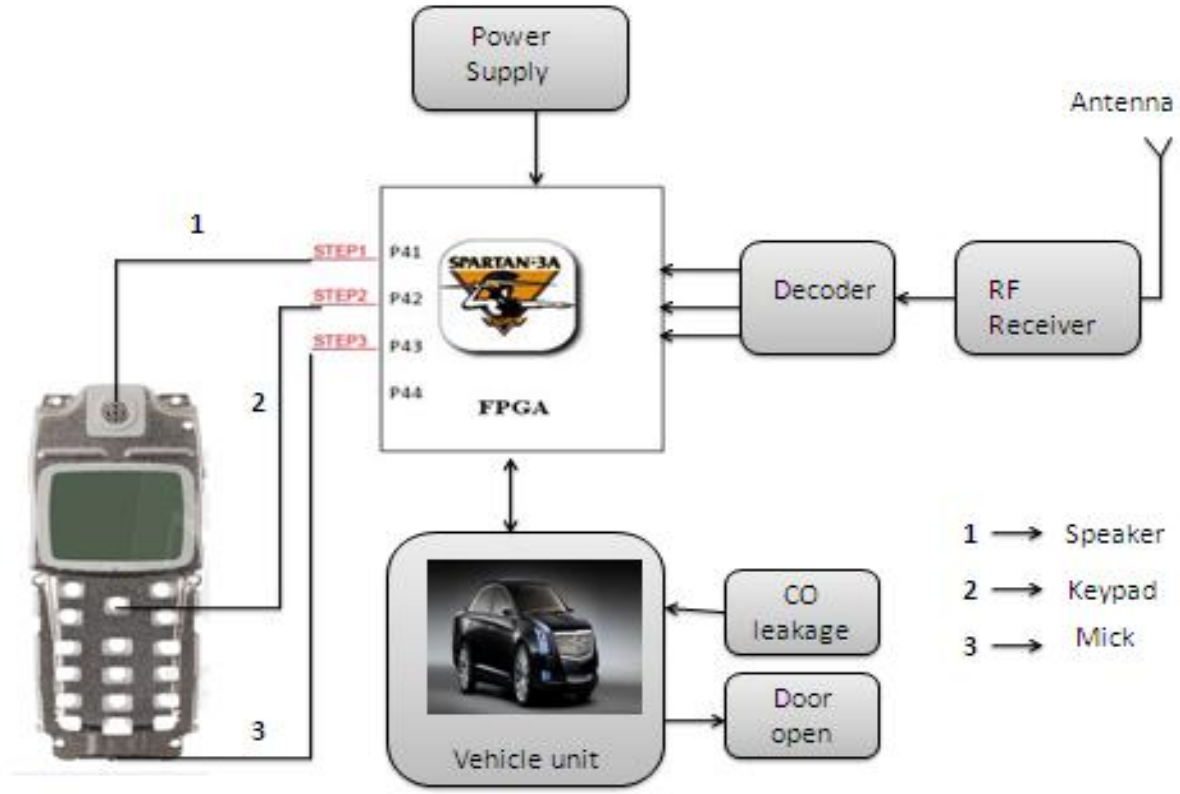

Fig. 2.Block Diagram of Proposed System

Radio Frequency (RF) transmitter and RF receiver also used for our proposed method. In which RF transmitter is connected to the vehicle, if vehicle is in driving condition RF transmitter send the signal to mobile phone. RF receiver is placed in the mobile phone which receives the signal and sends to FPGA processors. Now FPGA processors disable the keypad, mike and loudspeaker. So we should not attend any call while driving. The notification about the calls will be given to the user. If we want to attend any emergency call, we should stop the vehicle. Then only the mobile keypad, mike and loudspeaker will be enabled. If gas leakage occurs in vehicle like cars, the sensors used to send the signals to the FPGA then door will be opened automatically [20].

VI. IELD PROGRAMMBLE GATE ARRAY

In this paper FPGA Spartan 3A is the one of the major part. Why we are used FPGA in our paper, for very easy implementation. As we are using a FPGA, our hardware can be modified whenever we want. A Field-programmable Gate Array (FPGA) is an integrated circuit designed to be configured by the designer. The FPGA configuration is generally specified using a hardware description language (HDL), similar to that used for an application-specific integrated circuit (ASIC)[18]. The Spartan-3AN FPGA family combines the best attributes of a leading edge, low cost FPGA with nonvolatile technology across a broad range of densities. The family combines all the Features of the Spartan-3A FPGA family plus leading technology in-system Flash memory for configuration and nonvolatile data storage[20]. The Spartan-3AN FPGAs are part of the Extended Spartan-3Afamily, which also includes the Spartan-3A FPGAs and the higher density Spartan-3A DSP FPGAs.

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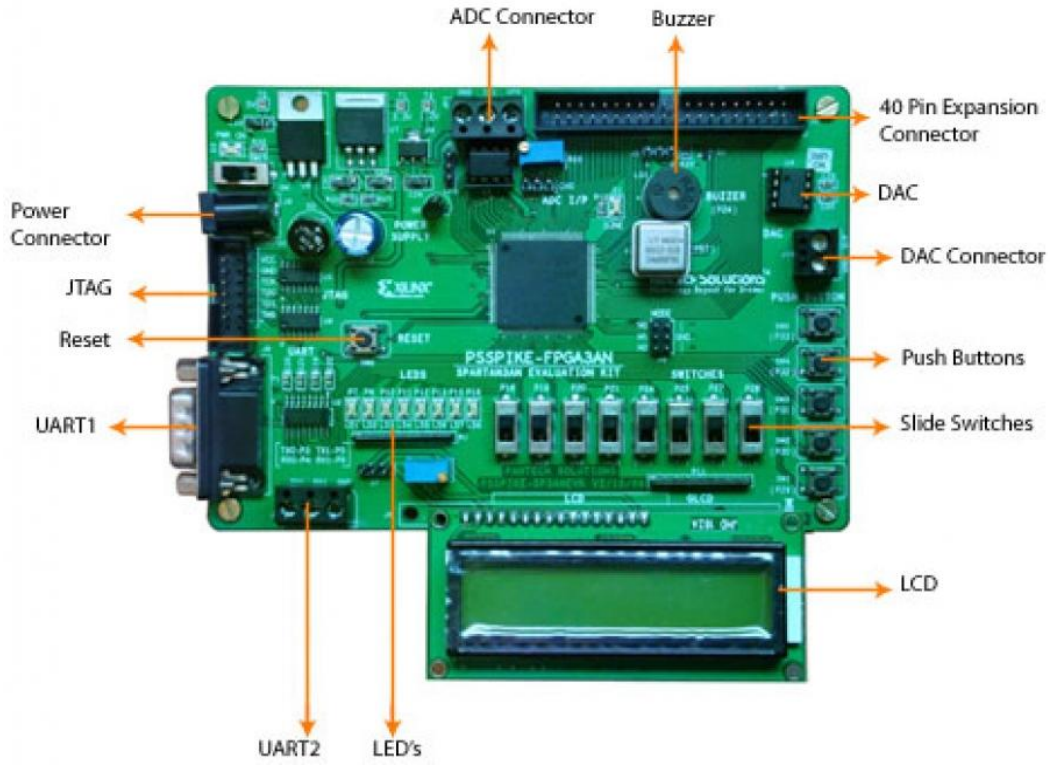

Fig. 3. Spartan-3AN FPGA

The Spartan-3AN FPGA family is excellent for space-constrained applications such as blade servers, medical devices, automotive infotainment, telematics, GPS, and other small consumer products. Combining FPGA and Flash technology minimizes chip count, PCB traces and overall size while increasing system reliability. The Spartan-3AN FPGA internal configuration interface is completely self-contained, increasing design security. The family maintains full support for external configuration. TheSpartan-3AN FPGA is the world's first nonvolatile FPGA with Multi Boot, supporting two or more configuration files in one device, test modes, or multiple system configurations.

VII. RFMODULE

RF module consists of RF transmitter and RF receiver. When the vehicle is started to drive, the RF transmitter send the signal to the mobile. RF receiver is used to receive the signal and send to the FPGA which disables the keypad, mike and loudspeaker of the mobile phone. So, we cannot attend the phone call. In our system, we use RF transmitter TWS-434 and RF receiver RWS-434[15].

A. TWS-434

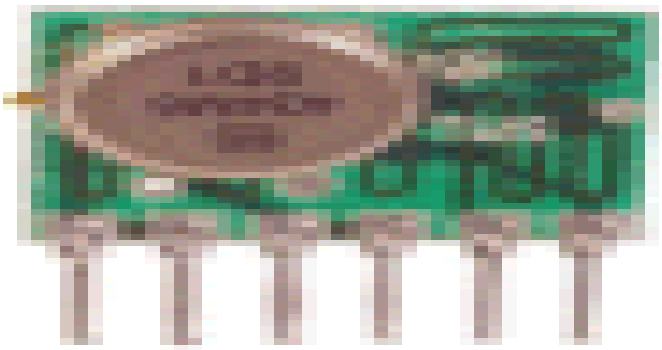

Fig. 4.RF434 Transmitter

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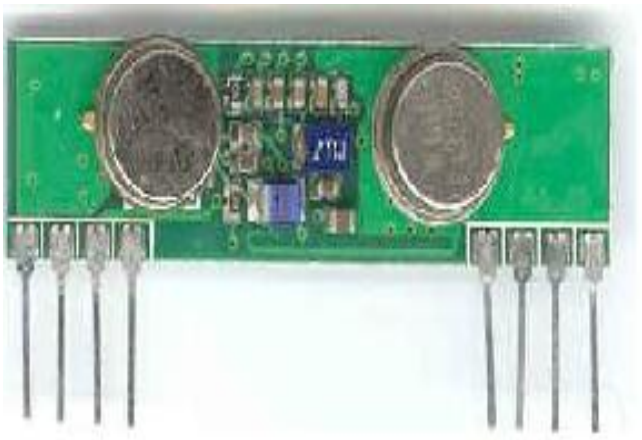

Fig. 5. RF434 Receiver

The transmitter output is up to 8mW at 433.92MHz with a range of approximately 400 foot (open area) outdoors. Indoors, the range is approximately 200 foot[15].The TWS-434 transmitter accepts both linear and digital inputs can operate from 1.5 to 12 Volts-DC, and makes building a miniature hand-held RF transmitter very easy. The TWS-434 is approximately the size of a standard postage stamp.

B. RWS-434

The receiver also operates at 433.92MHz, and has a sensitivity of 3uV. The WS-434 receiver operates from 4.5 to 5.5 volts-DC, and has both linear and digital outputs [15].

VIII. SENSOR MODULE

In our system, Gas sensor is interfaced with FPGA processor. Interfacing with these sensors is done through a 4-pin SIP header and requires two I/O pins from the FPGA [20].

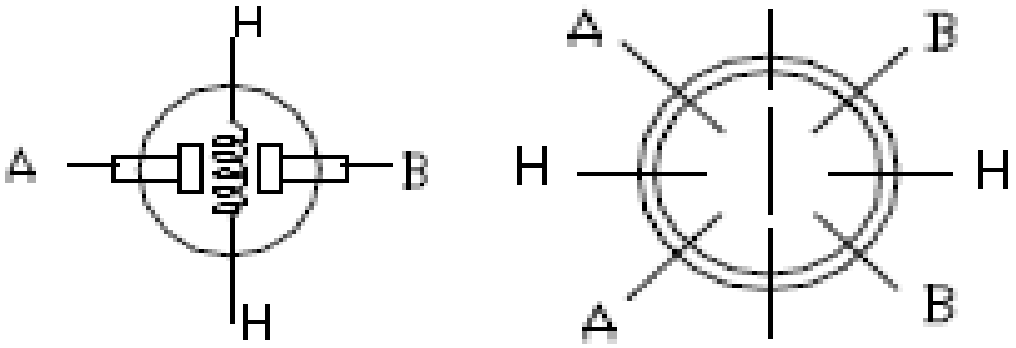

Fig. 6. Diagram of Gas Sensor

If gas leakage occurs in vehicle like cars, the sensors used to send the signals to the FPGA then door will be opened automatically.

IX. MOBILE UNIT

Nowadays, mobile (or cell) phones are becoming essential tools in our daily life. Three main cell phone carriers are available namely; Zain, Orange, and Umniah. The first two use the GSM 900 system, while the third uses the GSM 1800 system. Needless to say, the wide use of mobile phones could create some problems as the sound of ringing becomes annoying or disrupting[26] [27].In this paper, mobile phones are very important part. The person even gets the notification of a call or message while driving, driver can't attend the mobile call or messages, because of keypad disable system of our project. The functions of keypad disable system by transmitter attached in a vehicle. When the vehicle is started the signals from transmitter send to mobile phone. after getting the signal the mobile keypad automatically disable. If driver need to attend the call, should off the vehicle.

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X. JAMMING UNIT

Wireless sensor networks are built upon a shared medium that makes it easy for adversaries to conduct radio interference, or jamming, attacks that effectively cause a denial of service of either transmission or reception functionalities.Keypad disables system of our project. The function of keypad disable system by RF transmitter attached in a vehicle and also mobile having RF receiver.

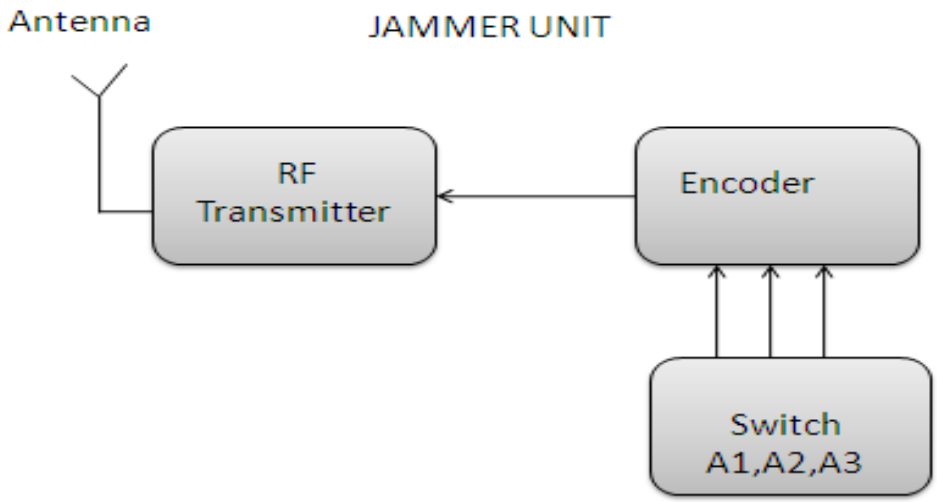

Fig. 7. Block diagram of jammer unit

When the vehicle is started the RF transmitter transmitting the signal to RF receiver of the mobile phone.

A. Antennas- Wire Whip

The WC418 is made of 26-gauge carbon steel music wire that can be soldered to a PC board. This antenna has a plastic coated tip for safety and is 6.8 inches long, allowing 0.1 inch for insertion in a terminal or PC board. In this antenna mainly used to wireless transmission for RF transmitter to RF receiver [18].

Fig. 8.Antenna

XI. ENCODER AND DECODER

The Encoder, which we are using in our paper, is HT12E series, which is a Holtek, made Encoder. The 2^{12} encoders are a series of CMOS LSIs for remote control system applications. They are capable of encoding information, which consists of N address bits and 12_N data bits. Each address/ data input can be set to one of the two logic states [8],[18]. The programmed addresses/data are transmitted together with the header bits via an RF or an infrared transmission medium upon receipt of a trigger signal. The capability to select a TE trigger on the HT12E enhances the application flexibility of the 2^{12} series of encoders. The Decoder, which we are using in our paper, is HT12D series, which is a Holtek, made Decoder. The 2^{12} decoders are a series of CMOS LSIs for remote control system applications. They are paired with Holtek_s 2^{12} series of encoders for proper operation, a

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pair of encoder/decoder with the same number of addresses and data format should be chosen [18]. The decoders receive serial addresses and data from a programmed 2 ^{12} series of encoders that are transmitted by a carrier using an RF or an IR transmission medium [8]. They compare the serial input data three times continuously with their local addresses. If no error or unmatched codes are found, the input data codes are decoded and then transferred to the output pins. The VT pin also goes high to indicate a valid transmission [22]. The 2^{12} series of decoders are capable of decoding information that consists of N bits of address and 12-N bits of data. Of this series, the HT12D is arranged to provide 8 address bits and 4 data bits.

XII. CO GAS DETECTION

Carbon Monoxide (CO) is an odorless, colorless gas that can cause sudden illness and death. CO is found in combustion fumes, such as those produced by cars and trucks, small gasoline engines, stoves, lanterns, burning charcoal and wood, and gas ranges and heating systems[20]. CO from these sources can build up in enclosed or semi-enclosed spaces. People and animals in these spaces can be poisoned by breathing it. High levels of CO inhalation can cause loss of consciousness and death. Unless suspected, CO poisoning can be difficult to diagnose because the symptoms mimic other illnesses. People who are sleeping or intoxicated can die from CO poisoning before ever experiencing symptoms. Red blood cells pick up CO quicker than they pick up oxygen [20]. If there is a lot of CO in the air, the body may replace oxygen in blood with CO. This blocks oxygen from getting into the body, which can damage tissues and result in death. CO can also combine with proteins in tissues, destroying the tissues and causing injury and death.

In this paper we are reduce death strategy of co gas leakage in vehicle. So we are used high sensitivity gas sensor. The gas sensor was programmed by FPGA kit. The gas sensor to detect the CO gas, FPGA to automatically open the vehicle door in a programmed percentage of CO gas.

XIII. RESULTS AND DISCUSSION

We tested our proposed methodology; it gives better result compared with existing methods. The device was able to disable the keypad, mike and loud speaker of the mobile phone while driving. Gas sensor detects the gas leakages successfully. When car is ON condition, the mobile keypad, mike and loud speakers are disabled. So we cannot attend any call. If we want to attend the call, we should OFF the car. Then only the keypad, mike and loud speaker will be enabled. The following Fig. 9shows that hardware configuration and normal stage of our proposed system.

Fig. 9.Hardware Design at ON stage

From the above Fig. 9 shows that when vehicle is OFF condition, the RF Transmitter does not send any signals to the RF Receiver, which indicates that vehicle is not in driving mode. So, the FPGA processor makes the mobile phone keypad, loud speaker and mike will be enabling. So we can attend any call during the OFF condition of the vehicle. When vehicle is in ON condition both the RF transmitter and RF receiver becomes ON automatically.

ISSN: 2349-7300
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From above Fig.10 shows that when the vehicle is ON condition, the RF transmitter send the signal to the RF receiver, which indicates that vehicle is in driving mode. The signal transmitting and receiving process is called wireless communication process. After FPGA processor makes the mobile phone keypad, loud speaker and mike will be disabling. So we cannot attend any calls during ON state mode of the vehicle.

Our proposed system will be applicable for all vehicles, to avoid the accidents using mobile phones while driving. The designed kit can be attached with any part of the vehicles even four wheelers as well as two wheelers.

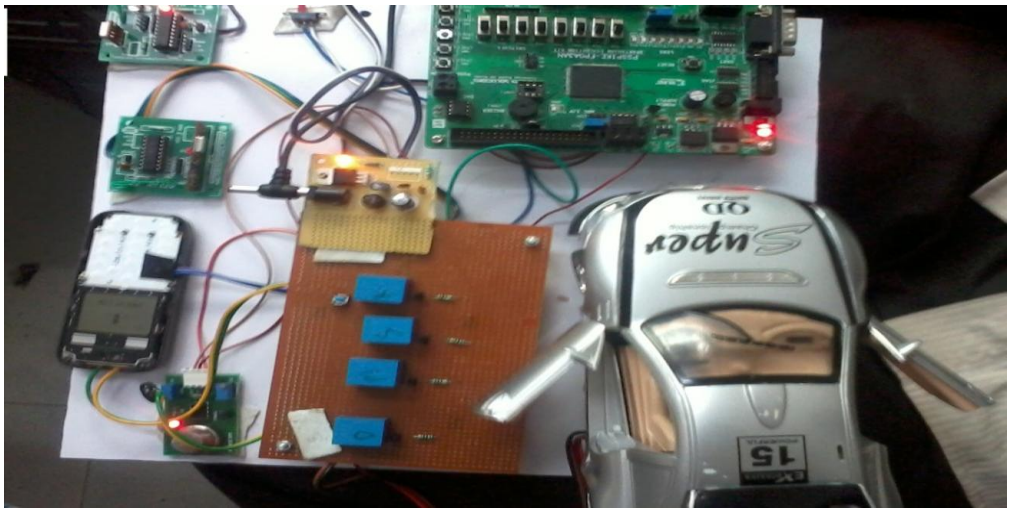

Fig. 11.Synopshot of co gas detection

Our system another application to detect gas leakage occurs in the vehicle Fig. 11. If sensors sense any gas leakage, FPGA processor makes to open the door of the vehicle automatically, because our sensor is interfaced with FPGA to do a particular above task Fig. 11.

XIV. CONCLUSION

In this paper, we conclude the best platform for the prevention of accidents to avoid mobile phones while driving and gas leakages detection by using FPGA. Our Proposed system is working perfectly without affecting the signals from the network. The user can able to get the information regarding calls and messages (SMS, MMS). If we want to attend any emergency calls while driving, should stop the vehicle (car), otherwise we cannot attend the call. Sensors are used to detect the gas leakages occurred in the vehicle and if gas leakage occur the car door will be opened automatically because sensor is interfaced with the FPGA .Implementation of our newly designed system is easy. As we are using a FPGA, our hardware can be modified whenever we want as per our requirements. Hence, our system surely provides much greater benefits and also saving the human life due to avoid the mobile phones, while driving on the roads every day.

ACKNOWLEDGEMENT

We take this opportunity to gratefully acknowledge the inspiration, encouragement, guidance, help and valuable suggestions received from all our well-wishers. First of all we would like to thank to **Mr.R.Ganesh, Traffic police of Coimbatore city** who have helped us and made available much useful information to complete this seminar project report.

We also thankful to **Traffic Investigation Wing of Coimbatore City** who has given valuable support for successful implementation of project seminar. Without their complete support and willing co-operation, this would not have been possible. We are forever obliged to our parents and friends for their encouragement to us and faith in our ability to succeed.

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