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# Automatic Co-driver System for Future Intelligent Transportation System

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**ABSTRACT**

This paper introduces the concept of artificial "CO-DRIVERS" as an enabling technology for future intelligent transportation systems. The design principles of co-drivers are introduced to the general human–robot interactions. Vehicles will communicate automatically with nearby vehicles using ZIGBEE technology. Whenever a front vehicle applies brake or it turns to left or right, the front vehicle sends signals to rear vehicle as BRAKE ON/OFF, TURN LEFT, TURN RIGHT using accelerometer sensor respectively. RF transceiver is kept at some zones for the zone identification and an ultrasonic sensor for each vehicle at front side when it meets an obstacle, so as to reduce the speed of the vehicle to avoid accidents. Speed reduction is done by using Pulse Width Modulation (PWM) technique. Also the GSM module is interfaced to PIC micro controllers are to send the messages from one vehicle to another vehicle in addition to ZIGBEE communication.

***Index Terms:*** CO-DRIVER, ZIGBEE, Accelerometer sensor, Ultrasonic Sensor, PIC, GSM module, RF transceiver, Crash sensor.

## I. INTRODUCTION

In recent years electronic driving aids are designed and developed at an increasing rate. The main reason is to improve safety and avoid accidents at the time of driving. Rash driving is a dangerous activity that will have a serious impact on human and economic principles. But in most of the cases accidents occur due to driver inattention towards driving. According to survey 90% of accidents occur because of driver failure at the time driving. The main cause for this failure is degradation of driver performance due to some factors such as fatigue, drowsiness. There are also some other reasons for the driver degradation performance first reason is alcohol, when driver in drunk condition or suddenly felt unhealthy like sudden heart attacks or other severe health problems then it is difficult to control vehicle during driving ultimately causes accidents.

Various driver assistance systems [1] have been proposed over last decade to improve vehicle control and human safety. Some of them are based on the principle of mutual control between the driver and an automation system [2], [3]. But there is a problem while designing such kind of human-machine interaction system because of manual control vehicle tasks are prone todriver error, and fully machine controlled taskis subjected to wide ranging of limitations.

## II. CO-DRIVERSYSTEM

As we know that "natural" co-drivers already exist. A drivinglicense tutor would be a first obvious example: The tutor has knowledge about thehuman motion schemes and is able to infer the trainee's intentions, thus acting on the vehicle controls in accordance to the trainee's needs, given the context. In ordinary terms, it is obvious that the human co-driver can "understand" the trainee.

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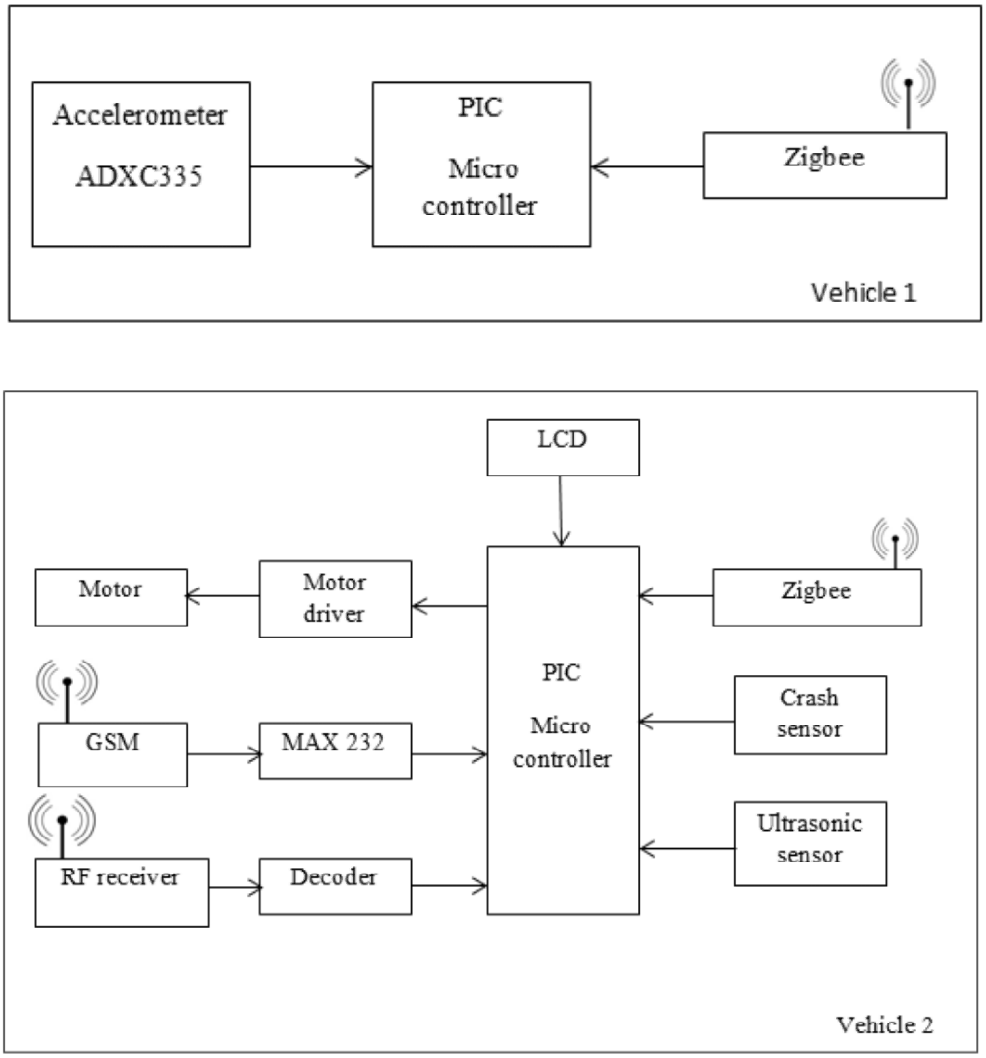


**Figure 1: Block diagram of Automatic Co-Driver system**

The objective is to design an agent that is capable ofenacting the “like me” framework, which means that it must have sensory-motor strategies that aresimilar to humanandthat it must be capable of using them to mirrorhuman behaviour of intentions and human–machine interaction. Developing human motor strategies is a relatively easy step One may take originality from human optimality motor principles. For example, we already used the minimum jerk/time trade off and the acceleration willingness envelope to produce human “reference manoeuvres” for advanced driver assistance systems (ADAS) [4].

## (A) Control Module

PIC controller is used to monitor and control the behavior of vehicle unit using brake sensor, and ultrasonic sensor using Zigbee and to avoid the accident in rash driving. In the front vehicle (vehicle 1) applies brake the vehicle 2 get signal using Zigbee. At the time of signal vehicle 2 compare the ultrasonic values. Based on the ultrasonic values the vehicle 2 is slow or slow down. The RF is used to reduce the vehicle 2 speed at important or emergency areas. The whole process is fully automatic.

## (B) Zigbee communication

The distances that can be obtained by transmitting from one vehicle to the next extend up to about 70 metres, although very much larger distances may be reached by relaying data from one node to the next in a network.The main applications for 802.15.4 are aimed at controlling and monitoring applications where relatively low levels of data throughput are needed, and the possibility of remote, battery powered sensors, low power consumption is a key requirement [5].

### (C) RF transmitter and receiver

The encoder in transmitter section begins with a 4-word transmission cycle upon receipt of a Transmission Enable(TE) as active low. This cycle will repeat itself as long as the transmission enable TE is held low. Once the transmission enables high, the encoder output completes its final cycle and then stops.

The decoders in receiver section receive data that are transmitted by an encoder and the signal on the $D_{in}$ pin activates the oscillator, which in turn decodes the incoming address and data. The decoders then check the received address three times continuously. If the received address codes are matched with the contents of the decoder local address, then the data is decoded to activate the output pins and the Voltage Terminal(VT) pin is set to high to indicate valid transmission. This will last until the address code is incorrect or no signal is received. The output of VT pin will be high only when the transmission is valid. Otherwise it is always low. The HT12D provides 4 latch type data pins whose data remain unchanged until new data is received. The decoder VT is enabled whenever the encoder $D_{out}$ triggers from 1 to 0.

The oscillator is disabled in the stand by state and gets activated when a logic high signal applies to the $D_{in}$ pin. That is to say, the $D_{in}$ should be kept low when there is no signal input.

## III. IMPLEMENTATION OF CO-DRIVER SYSTEM

### (A) Software design (MPLAB-IDE)

MPLAB Integrated Development Environment (IDE) is a comprehensive editor, project manager and design desktop for application development of embedded field designs usingMicrochip PIC,micro MCUs and ds PIC DSCs [6].MPLAB IDE runs as a 32-bit application on Microsoft Windows, which is easy to use and includes a host of free software components for fast application development and super-charged debugging.Choose MPLAB C Compilers, the highly optimized compilers for the PIC18 series microcontrollers, high performance PIC24 MCUs, ds PIC [6] digital signal controllers and PIC32MX MCUs. Or, use one of the many products from the third party language tools vendors. Mostly integrate into MPLAB IDE [7] to function transparently from MPLAB project manager, editor and debugger.

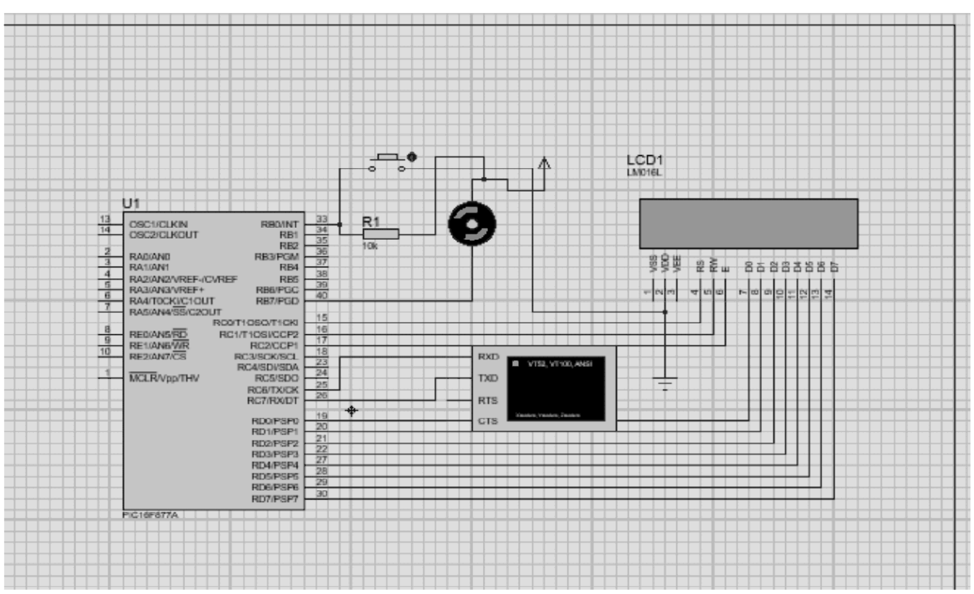


**Figure 2: Proteus circuit simulation**

### (B) Simulation in proteus environment

Proteus 8.0 PCB design combines the ISIS schematic capture and areas PCB layout programs to provide a powerful, integrated and is easy to use suite of tools for professional PCB Design. Proteus 8.0 [8] is a Virtual System Modeling (VSM) that combines circuit simulation and animated components and microprocessor models to co-simulate the complete microcontroller based designs. This is the special tool for engineers to test their microcontroller designs before constructing a physical prototype in real time. This tool allows users to interact with the design using on-screen indicators and/or LED and LCD Displays and all are attached to the PC, switches and buttons.

### (C) Hardware design

The design of co-driver system involves an ultrasonic sensor, accelerometer, crash sensor, GSM module and Zigbee module. All these components are interfaced to PIC controller. The output actions are displayed in LCD screen. The hardware implementation is shown in Fig 3.

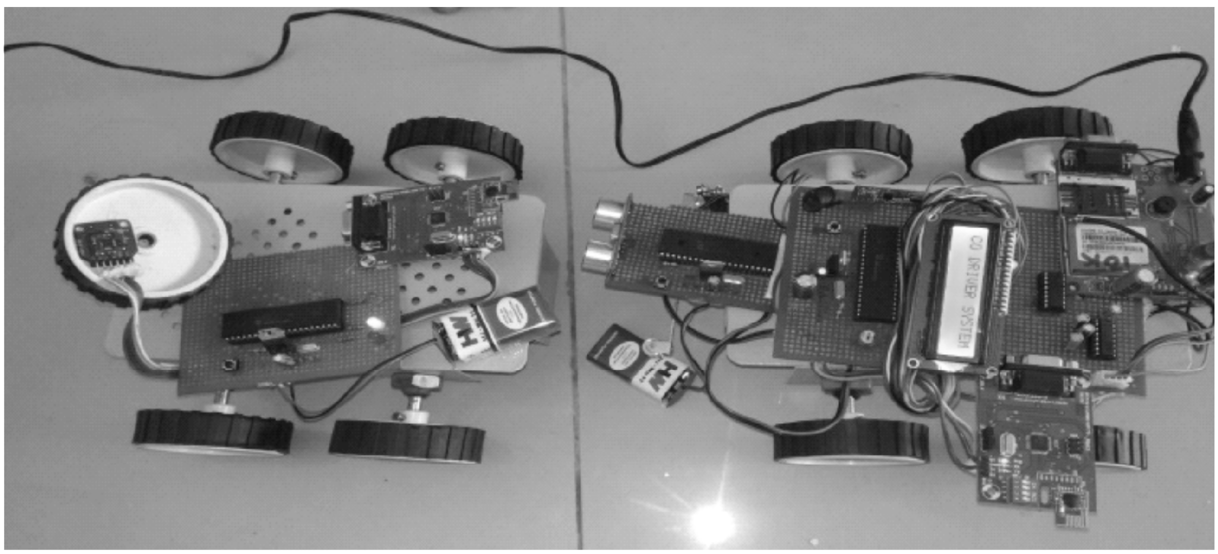


**Figure 3: Implementation of Automatic Co-driver system**

## IV. RESULTS AND DISCUSSIONS

### (A) Simulation results

The simulation is done by using Proteus ISIS environment. Whenever the vehicle 1 turns right/left in the front vehicle and its information is passed through the Zigbee to the vehicle behind it. The information of turning Right/Left of front vehicle [vehicle 1] is displayed in the LCD of the behind vehicle [vehicle 2].

The simulation is done by using Proteus ISIS environment. Whenever the brake is applied in the vehicle1. The information is passed through the Zigbee to the vehicle behind it. The information of applying the brake on and turning left is shown in Fig 4 displayed in the LCD. The information of applying the brake off in vehicle 2 is shown in Fig 5.

### (B) Hardware results

Whenever the vehicle turns right/left in the front vehicle. The information is passed through the Zigbee to the vehicle behind it. The information of turning Right/Left of front vehicle (vehicle 1) is displayed in the LCD of the behind vehicle (vehicle 2) as shown in Fig 6 and Fig 7.

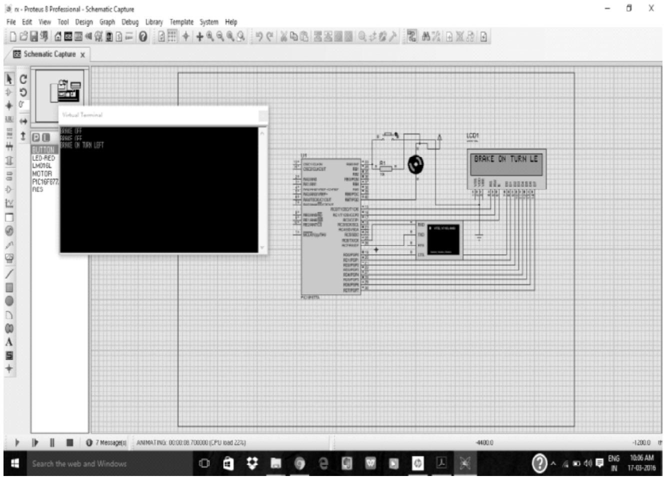


Figure 4: Vehicle1 Communication

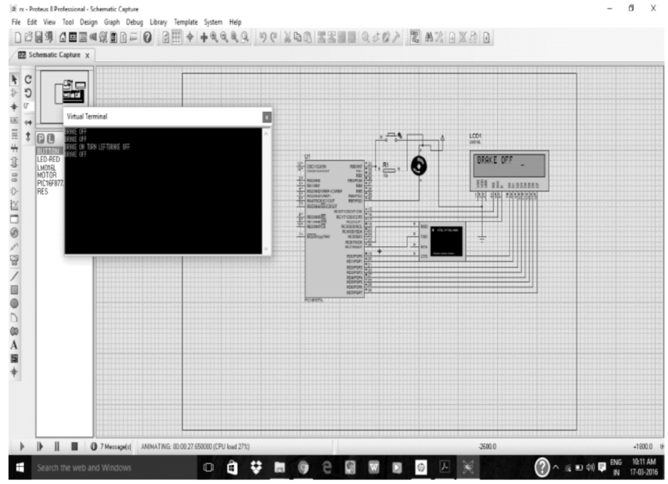


Figure 5: Vehicle 2 Communication

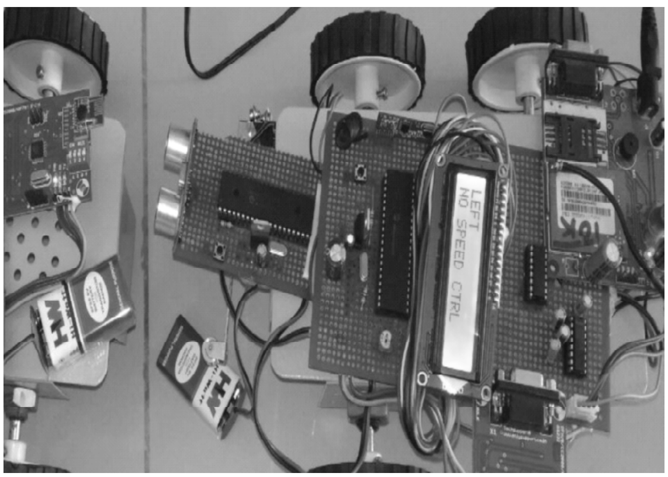


Figure 6: Indication of vehicle1 turning left in vehicle 2 display

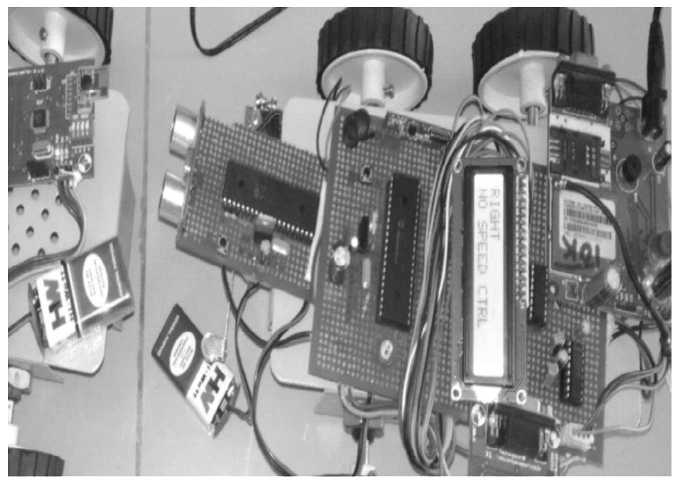


Figure 7: Indicationof vehicle1 turning right in vehicle 2 display

Whenever the vehicle is near to school zone/hospital zone RF senses and displays in LCD of vehicle 2 and is shown in Fig. 8 the speed of the vehicle is controlled by using PWM technique to avoid accidents is shown in Fig. 9.

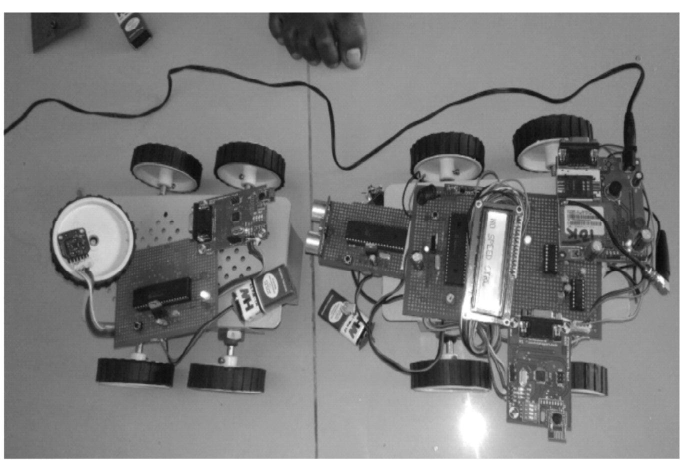

Figure 8: Indication of school zone /hospital zone in vehicle 2

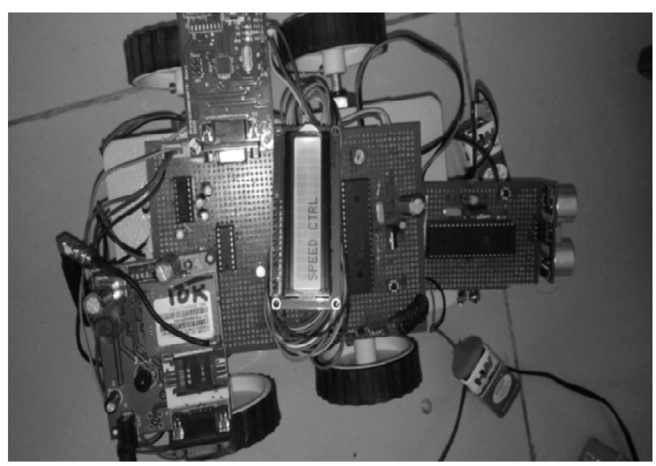


Figure 9: Display of speed control in vehicle 2 at school zone/ hospital zone

Crash sensor is placed in the vehicle 2, whenever the vehicle met with an accident the crash sensor senses and sends the data to the mobile number which is already registered through GSM module and is interfaced to PIC controller as shown in Fig. 10.

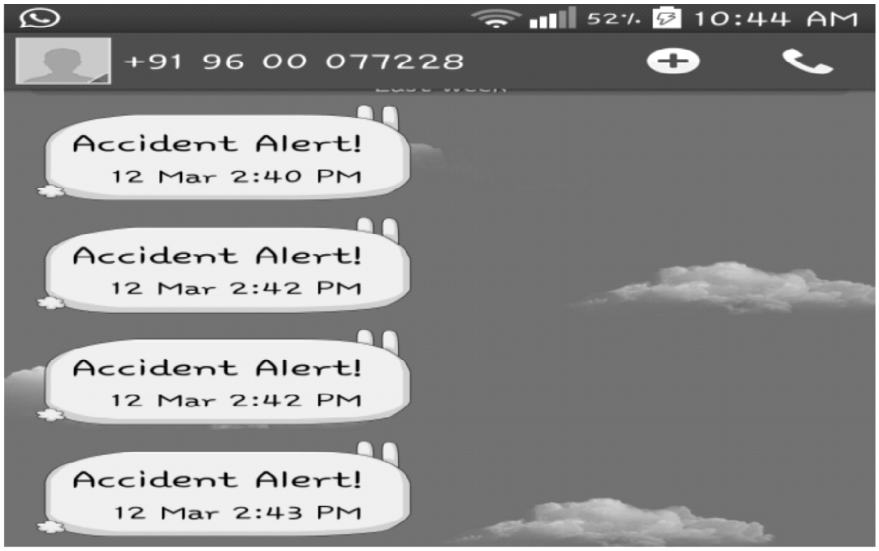


**Figure 10: Sending message that vehicle 2 met with an accident**

## V. CONCLUSION

The co-drivers are potentially suited to more sophisticated applications, where driver and co-driver sensory-motor activities will run in parallel, up to the point at which they are compared. Thereafter, it is up the co-driver to control the vehicle; however, this must be in coordination with the driver's intentions. If necessary, the system may be programmed completely to take over from the driver in certain conditions. In all cases, the driven vehicle should appear to be driven by a human, which is being interpretable to other human road users. The co-driver is thus the enabling technology for implementing the intelligent interactions proposed. The proposed automatic co-driver model is simple, efficient and has more capabilities than other existing techniques.

## ACKNOWLEDGEMENT

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