DESIGN AND IMPLEMENTATION OF PC BASED VEHICLE CONTROL SYSTEM FOR SAFETY

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Abstract—The transportation system becomes more and more important all over the world. In our country, many people injured due to the accidents on Yangon-Mandalay highway. The causes of car accidents are both driver's faults and road construction. To reducethis phenomenon some safety system such as alarm and alert system, obstacle detection system, traction sensing circuit and signboard should be used on the buswith display system for both driver and passengers.Although the signboards have been placed in some dangerous places on highway, there is a chance for accident when bad weather condition occurs. Moreover,the sensing values and seat-belt status for all passengers should also be displayed. This design is implemented using microcontroller PIC18F4550, microcontroller Arduino Pro Mini, RF transmitter module, receiver module, personal computer GUI, varioussensors, Liquid Crystal Display and Alarm and Alert System. The bus system is emphasized on PC based control system which is reliable from several view point such as stability, temperature dependence, comfort, smart and safety for all passengers. The GUI is also designed using C# programming language.

Index Terms—ADXL345 accelerometer, Arduino Pro Mini, Microcontroller, PC based control system

I. INTRODUCTION

Nowadays people are driving very fast; accidents are occurring frequently, we lost our valuable life by making small mistake while driving the highway department.Road facilities are a major concern in the developed world. Recent studies show that one third of the number of fatal or serious accidents are associated with excessive or inappropriate speed, as well as changes in the roadway (like the presence of road-work or unexpected obstacles). Reduction of the number of accidents and mitigation of their consequences are a big concern for traffic authorities, the automotive industry and transport research groups [1].For vehicle safety and safety for passengers in vehicle is an important parameter. Most of the vehicles get accident because no proper safety measures are taken especially at curves and hair pin bends humps and any obstacles in front of the vehicle [2].

In today's the various kinds of vehicles have been introduced to provide convenience in human daily life and due to the development of new technologies it makes the vehicle running fast and accelerating easily. Some problems such as the happenings of accidents due to 1.thef, 2.poor mechanical status and maintenance of the car, 3.the poor weather, 4.the high speed, 5.drowsiness and sleepiness or any such type of driver condition, 6.driver's mistake, 7.loneliness of the driver, 8.problems occur during late night hours [3].According to the data on Yangon-Mandalay highway, there were 259 car accidents, leaving 113 dead and 625 others injured in 2013. From 1st January to 22nd April , there were 115 accidents, killing 62 and injuring 286 others in 2014according to Yangon-Mandalay highway.The reason for choosing this research is to prevent the accidents and dangerous conditions. Therefore many measures to enforce the safety driving and the development of models to monitor driver's behaviours have been proposed and brought in many promising results [3].

There are different types of smart bus systems that have no flexibility over choosing the types and number of sensors used. Thesesystems are rebuilt devices with a limited number of sensors, with a limited area of coverage and with a limited capacity to control the electronic devices. Therefore the idea of smart bus system was proposed, to overcome the limitations of the system already available. The user can choose the number of sensors, type of sensors, the area of coverage of the system along with the number and types of electronic devices to be controlled. The cost of the system can be determined by the user as the cost depends on the hardware in the system.

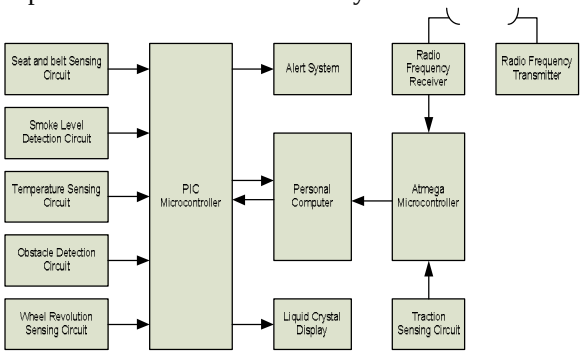

Fig.1. Block Diagram of Vehicle Control Sysem

The block diagram of smart bus system shown in Fig.1 is for overall design of safety system for bus.In this block diagram seat and belt sensing circuit, smoke level detection circuit, temperature sensing circuit, obstacle detection circuit,wheel revolution sensing circuit, traction sensing circuit, radio frequency receiver, radio frequency transmitter, alert system, personal computer and liquid crystal displayare shown. A seat belt remainder system in the bus triggers a warning light on the monitor so that the driver reminds unbuckled seat occupants to fasten their seat belts. The

limited switch is used for sensing whether the seat is occupied or not and it is displayed on the monitor. Traction Sensing Circuit gives the declination angle of the bus and the driver can know it easily. Wheel Revolution Sensing Circuit gives also the actual distance travelled. Obstacle Detector is used for front and back section. Alert system is added too for dangerous conditions. The radio frequency module, the bus will get specific signal from the transmitter placed on dangerous checkpoint. The system was implemented using MPLAB software with Hi-tech C compiler and C# programming based on PIC18F4550 as USB HID. It was tested for stability and satisfactory operation results were obtained.

II. PC BASED VEHICLE CONTROL SYSTEM

The smart bus system is considered with the following implementation of:

- Design for Temperature Sensing, Smoke Sensing and obstacle detection system, traction sensing circuit, wheel revolution sensing and alarm system.
- Design for Limited Switches for seats and belts (In this paper, digital input sensing circuit was implemented).
- Design for wireless transmission for each dangerous checkpoint with separate signal.
- Design for wireless receiver for distinguish incoming signal various checkpoints and alarm system.

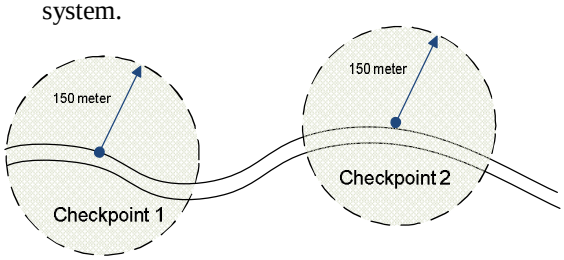

Fig.2. Checkpoint Placement on Highway

The block diagram of bus safety system shown in Fig.3 is to design the safety system for transmitter section. In this block diagram solar panel with battery charger, battery and 5V regulator, microcontroller and radio transmitter are shown. Each radio transmitter on each dangerous checkpoint on highway should transmit different signal so that receiver on bus can distinguish specific checkpoint. Acceptable baud rate for RF module KST-TX01 is 1200. The lunch distance of that module is 150 meter shown in Fig.2.. So the minimum distance between two checkpoints should be greater than 300 meter.

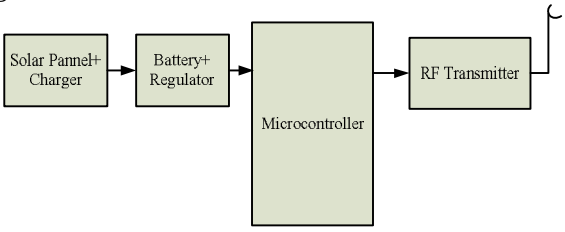

Fig.3. Block Diagram of Transmitter Section

Each checkpoint covers whole circle of 150 meter radius. The transmit signal uses 8 bits wide so number of checkpoints can be extended up to 255 according ASCII code table. Solar panel generates up to 12 Volts, and the battery will store and recharge power to regulator circuit. The 7805 regulator IC circuit will drive microcontroller and RF module with 5 Volts.Necessary circuit diagram is shown in Fig.4.

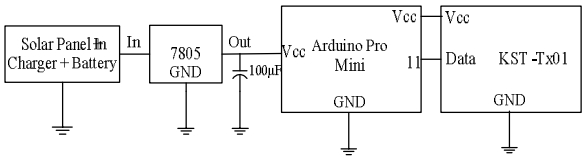

Fig.4. Circuit Diagram of Transmitter Section

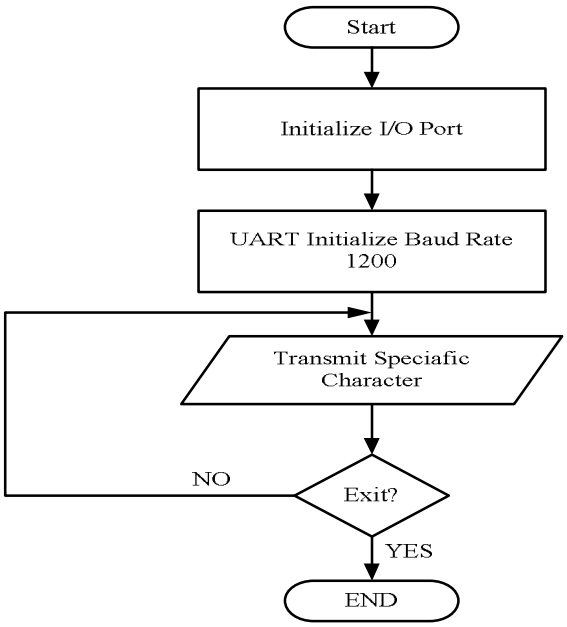

Fig.5. Flowchart of Transmitter Section

The flowchart shown in above is for the operation of checkpoint transmitter. Firstly the microcontroller will initialize input/output ports. And then baud rate 1200 is set up and specific signal for its checkpoint will be generated. Until the program is restarted, the signal will be generate repeatedly.

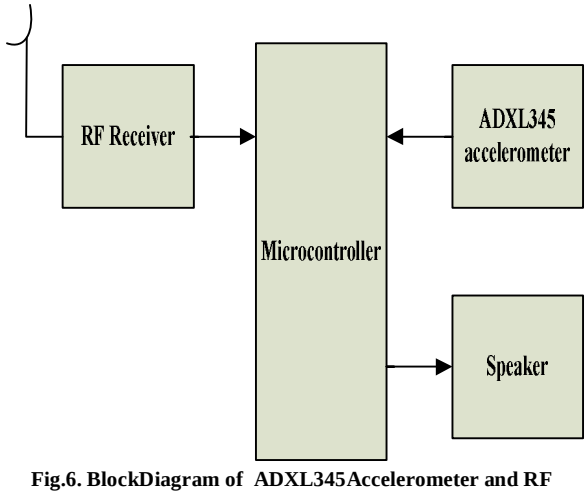

Fig.6. BlockDiagram of ADXL345Accelerometer and RF Receiver Section

The block diagram of bus safety system, RF receiver, microcontroller, ADXL345 accelerometer and speaker are shown in Fig.6.

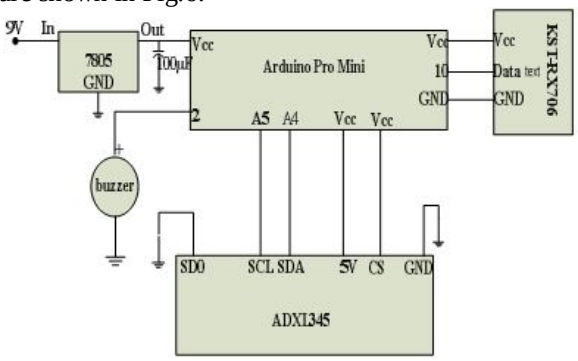

Fig.7. Circuit Diagram of ADXL345 Accelerometer and RFRadio Receiver

USB to RS232 module is used to communicate Arduino with PC. For traction sensing circuit, Arduino pro mini is used with ADXL345 (3 axis) sensor so thatthe dangerous declination angle of the bus will be sent back to PC.The receiver needs to check incoming signal from road-side checkpoint towers placed on dangerous zone. It needs to check the listed or predefined checkpoints. According to check routine the buzzer will make sound. PC display will be updated with checkpoint number.Each radio receiver on bus should distinguish incoming signal whether bus reach dangerous zone or not. Necessary circuit diagram is shown in Fig.7.

Above flowchart represents loop function of traction sensing and radio receiver. Typically baud rate 9600 is used for communication between microcontroller and PC. Another UART communication of 1200 baud rate is used as software serial for radio receiving part. Whenever checkpoint data receive, buzzer will be energizing as beat of alarm signal.

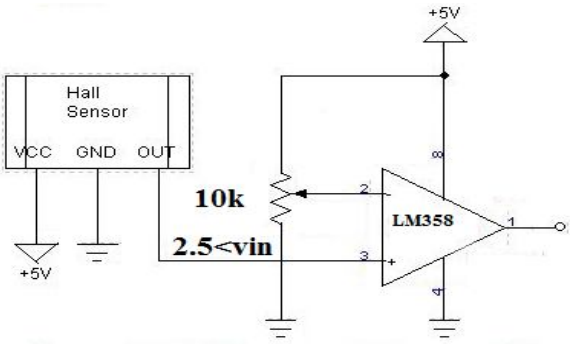

Fig.9. Wheel Revolution Sensing Circuit

Hall sensor is used for wheel revolution counter is shown in Fig. 9. is added and total mile travelled will be displayed on LCD display. To know how far the mile travelled, hall-effect sensor is used.The sensor generates 2.5V normally but when magnet on wheel approaches near to sensor, it will generate greater or less than 2.5V. In above design by turning polarity magnet is placed so that sensor generates over 2.5V. Variable resistor can be adjusted to meet required intensity. LM358 Op Amp is used for compare positive terminal and negative terminal. The output terminal of Op Amp is connected to Arduino digital input pin.

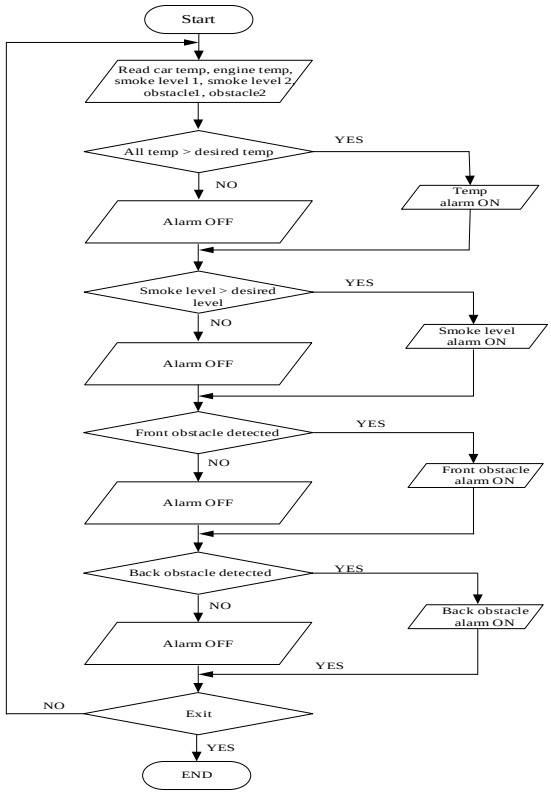

Fig.8. Flowchart for ADXL345 and RF receiver system

Fig.10. Flowchart for Alarm and Alert Control

When program start, it will send car temperature, engine temperature, car smoke level, front obstacle detector and back obstacle detector. If all temperature is exceeded desired temperature, temperature alarm will be ON. If not, temperature alarm will be OFF. And then, smoke level is exceeded desired smoke level, smoke level alarm will be ON. If not, smoke level alarm will be OFF. Therefore, if there is something front and back of the car, obstacles are detected, obstacle alarm will be ON. If not, obstacles alarm will be OFF.

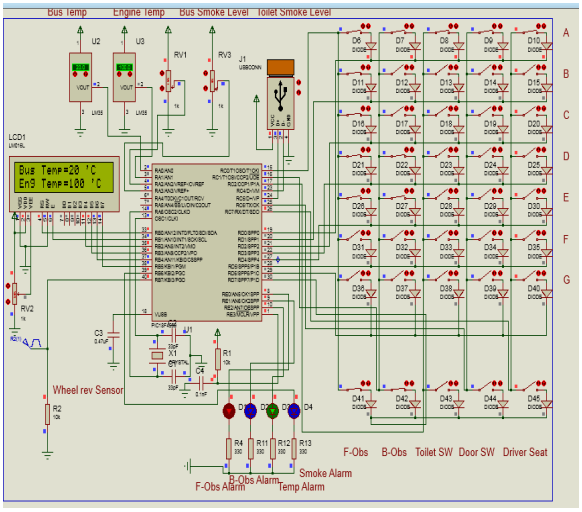

Fig.11. Simulation of the System

USB interface of microcontroller was used to connect C# GUI of personal computer. USB HID (universal serial bus human interface device) was implemented with MPLAB software with Hi-TechC compiler so that no more USB driver needed. LCD Display can be updated easily from GUI control. So any other messages can be applied to all passengers.

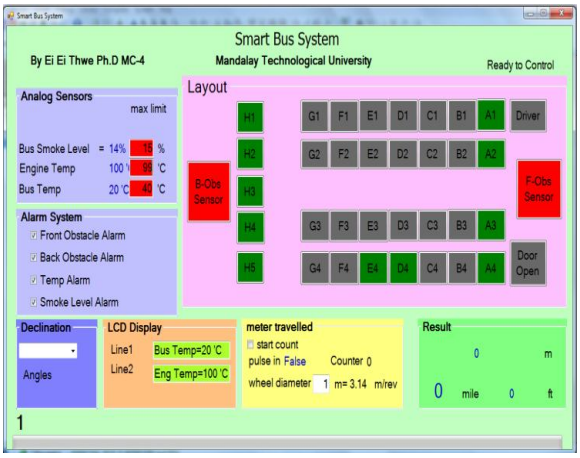

Fig.12. Real Time Control C# GUI for PC Based Vehicle Control System

The GUI was implemented not only for monitoring system but also for dynamic control in the alarm and alert session. Driver can also easily repair message signal on LCD display to passengers. In the running condition shown in Fig.12 software system, passengers are already sat and buckled the signal will be alert is green. If not, the signal will not be alert green (one person or two person etc.) is absent. And then, alarm system is added on the bus. Therefore, also added front obstacle alarm, back obstacle alarm, temperature alarm (engine temperature and car temperature) and smoke level alarm. If there is something front of the car, alarm will ring and front obstacle switch will show red signal. Similarity, if there is something back of the car, also alarm will ring and back obstacle button will show red signal.

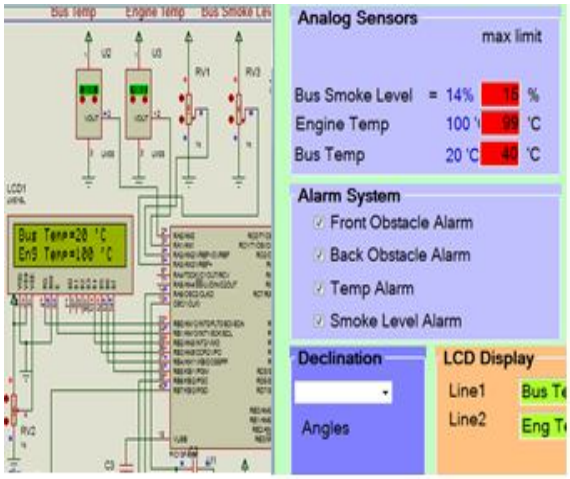

Fig.13. Simulation Test: Alarm and Alert Option

When the input temperature for vehicle and engine is increased over desired limit, the alarm system will start and this condition will be displayed on LCD. It will repeat and check until program stops. The desired limits for temperature sensing can be easily updated while program executing.

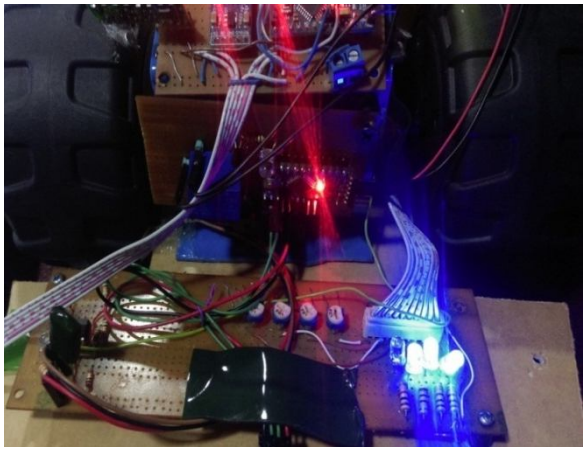

Fig.14. Constructed Design: Alarm and Alert Option

III. CONCLUSIONS

Using Visual C# programming language most effectively achieves the smart bus control system by using graphical user interface. The hardware of the system and computer is interfaced by USB HID. In this system, GUI is developed to monitor and control the system. Hardware of smart bus system is designed

with the prototype. The operation is tested by interfacing with GUI. It can be monitored from computer. It is possible to use as an automated alert system, it also saves time and cost.

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REFERENCES

[1] Ankita Mishra, JyotiSolanki , HarshalaBakshi, PriyankaSaxena and PranavParanjpe, "Design of RF based speed control system forvehicles," International Journal of Advanced Research in Computer and Communication EngineeringVol. 1, Issue 8, October 2012.

[2] Ankita Mishra, JyotiSolanki , HarshalaBakshi, PriyankaSaxena and PranavParanjpe, " Automatic Vehicle Speed Reduction System Using Rf Technology," Deepa B Chavan et al Int. Journal of Engineering Research and Applications www.ijera.com ISSN : 2248-9622, Vol. 4, Issue 4(Version 9), April 2014.

[3] VilemSroval Jr., ZdenekMachacek, RadimHercik, Roman Slaby, VilemSrovnal Intelligent Car Control and Recognition Embedded System.

[4] http://en.wikipedia.org/wiki/Intelligent_vehicle_ technologies.

[5] http://www.circuitvalley.com/2011/09/pic-18f4550-usb-io-input-output-board.html.

[6] http://www.instructables.com/id/USB-Project-USB-Interface-Board-Using-PIC18F455/.

[7] http://pwc.theclarkwebsite.com/PIC18F4550usb.php.

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