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Traffic Stack-Up control using Renesas Microcontroller

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Abstract- **Transportation is an important aspect for social problems like traffic accidents. Then it is needed to increase the efficiency and safety of transport networks and operations. Road traffic results in a huge waste of time and deaths of millions of people. Aim of this work is control accidents save lives. Traffic stack-up is the monitoring and control or influencing of traffic. Two main methods for the traffic stack-up is to maximize the effectiveness of the use of the automobile industry and ensure reliable and safe operation of transport , a possible way to solve this problem is transportation authorities must distribute traffic information to drivers by the message. Point based approach in order to control accidents. Renesas Microcontroller is the main part of this work. Some points will be given to drivers DL/ Car owner DL, if driver commits any mistake, then points given to the DL will be automatically decremented. In each instance, the messages will be sent to a registered mobile number by using GSM module. Rash driving and Traffic signal jump, Alcoholic detection, RFID DL authentication, Speed limit Controlling are the application building on this work. This work will protect Human lives from the accidents, which is a major weapon of Death.**

Keywords-**GSM Module, Renesas Microcontroller, RFID**

1. INTRODUCTION

Now a day accidents is a common feature of deaths. The common feature of accidents will be Rash driving, Signal jump, drunk and drive, minor drivers etc. [1]. According to WHO, Every year on an average 1.3 million people die because of road accidents in which India secures first place by contributing 11% of the total. National Crime Records (NCR) bureau in India on an average 461 people died and 1301 people got injured per day because of accidents.

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The percentage of accidents from 2003-2012 is 51.8% is greater than from 1993-2002. Currently, 3287 people die every day in traffic related accidents and 20-50 million are injured every year on the world's roads. More than half of all road traffic deaths occur among young adults ages 15-44. More than half of all road traffic deaths occur among young adults ages 15-44. Road crashes are the leading cause of death among young people ages 15-29, and the second leading cause of death worldwide among young people ages 15-44. Each year, nearly 400,000 people under 25 die on the world's roads, on average over 1,000 a day. Over 90% of all road fatalities occur in low and middle-income countries, which have less than half of the world's vehicles. Road crashes cost USD $518 billion globally, costing individual countries from 1-2% of their annual GDP. Road crashes cost low and middle-income countries USD $65 billion annually, exceeding the total amount received in developmental assistance. Unless action is taken, road traffic injuries are predicted to become the fifth leading cause of death by 2030 [2].

The proposed work concept is to reduce Rash driving and Signal jump by using Renesas microcontroller. The Renesas controller is a 16-bit 64 pin fully functional microcontroller and minimum instruction execution time can be changed from high speed with ultra low-speed. The proposed work is used for detecting the rash driving (sudden accelerating and braking) by reducing given points to the driver's DL. If the given point approaches zero, the driver would be called by Regional Transport Authorities (RTO) for further actions. This work also extends Point based approach for Traffic signal jump detection, Driving License (DL) authentication using RFID Tags, card reader, Alcohol sense detection using MQ-7 Gas, Alcohol Sensor [5], controlling Speed limits at schools & hospitals using RF transmitter and RF receiver [6]. The technology requires some extent of cooperation of an RFID reader and an RFID tag. The ADXL335 is a small, thin, low power, complete 3-axis accelerometer with signal conditioned voltage outputs [7]. A liquid crystal display is a thin flat electronic visual display that uses the light modulating properties of liquid crystals (LCs). Structure and configuration of MQ-7 gas sensor are composed of micro AL2O3 ceramic tube, Tin dioxide (SnO_2) sensitive layer, Measuring electrode and heater are fixed into

a crust made of plastic and stainless steel net. The heater provides necessary work conditions for work of sensitive components. The enveloped MQ-7 has 6 pins, 4 of them are used to fetch signals, and another 2 are used for providing heating current [5]. DC Motor is a monolithic integrated high voltage, high current this channel driver designed to accept standard DTL or TTL logic levels and drive inductive loads (such as relays, solenoids, DC and stepping motors) and switching power transistors [8]. SIM300 is a Tri-band GSM/GPRS engine that works on frequencies EGSM 900 MHz to send messages to a mobile number. To monitor the density of the traffic, arrangement placed a few sets of IR sensors on the side of the roads. One side IR transmitter will be placed & right opposite to the IR transmitter, an IR receiver will be kept. The RF transmitter and receiver in the transmitter and receiver module respectively operate at the frequency of 433MHz and the Transmitter and Receiver module in the Robotic module and the control unit respectively operate at the frequency of 316 MHz [6].

This work implements Rash driving detection and signal jump, which avoids unnecessary traffic problems and Alcoholic detected, which avoids Drunk & Drive problem. RFID based DL authentication, which avoids the minor drive problem. Speed limit controlling circuit, which avoids rash driving in remote places. GSM module to send and receive messages related to warnings.

2. ARCHITECTURE

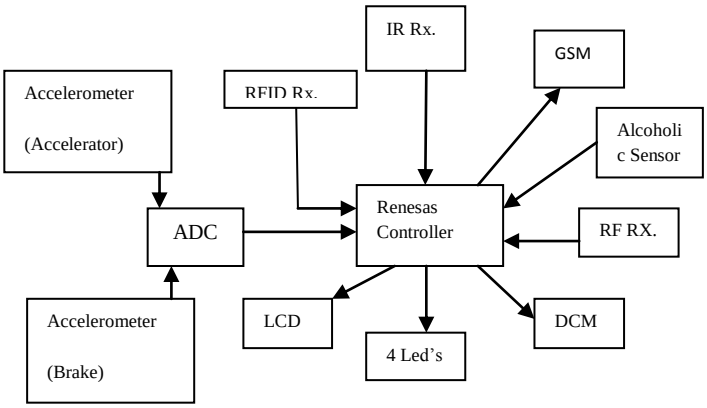

Fig. 1. Block diagram of the work

Main block of block diagram is Renesas microcontroller. It consists of analog to digital converters to convert acceleration and break signals which are in analog form to digital signals. Output of brake accelerometer is sent to 4 Led lights via renesas controller. Output of acceleration accelerometer is sent to DC motor via renesas controller. IR sensors are used to control signal jump and received signals will send to the renesas controller through IR receiver. Alcohol sensor will detect alcoholic signals and send to renesas controller. RFID DL is given to renesas as input. The RF receiver receives speed limit signals and sends to renesas controller. GSM module will receives output from renesas controller and send to driver mobile number. The LCD uses an output device to show messages inside the car with driver.

A.*Renesas Microcontroller*

Renesas is a 16-bit 64 pin fully functional microcontroller. It has general-purpose register: 8 bits × 32 registers (8 bits × 8 registers × 4 banks). Memory comprising ROM capacity of 16 to 512 KB, RAM capacity of 2 to 32 KB, Data flash memory capacity of −/4/8 KB. It has got On-chip high-speed on-chip oscillator: where frequency range can be varied from 32 MHz to 1 MHz, On-chip single-power-supply flash memory (with the prohibition of block erase/write function), On-chip debugs function, and On-chip watchdog timer. On-chip multiplier and divider/multiply-accumulator, On-chip clock output/buzzer output controller. The Controller has got 16 to 120 I/O Ports, 8 to 16 channels 16 Bit timers, 1 Channel Watchdog timer, 1 Channel RTC, 1 Channel 12-Bit interval, Different potential interface can connect to a 1.8/2.5/3 V device [3].

B. *RFID DL Authentication*

Radio-frequency identification (RFID) is an automatic identification method, relying on storing and remotely retrieving data using devices called RFID tags or transponders. The technology requires some extent of cooperation of an RFID reader and an RFID tag. An RFID tag is an object that can be applied to or incorporated into a product, animal, or person for the purpose of identification and tracking using radio waves. Some tags can be read from several meters away and beyond the line of sight of the reader. The basic RFID system consists of three components: 1. an antenna or coil 2. Transceiver (with decoder) 3. A transponder (RF tag) electronically programmed with unique information. The antenna emits radio signals to activate the tag and read and write data to it. Antennas are the conduits between the tag and the transceiver, which controls the system's data acquisition and communication. The antenna is packaged with the transceiver and decoder to become a reader, which can be configured either as a handheld or a fixed-mount device. The reader emits radio waves in ranges of anywhere from one inch to 100 feet or more, depending upon its power output and the radio frequency used. When an RFID tag passes through the electromagnetic zone, it detects the reader's activation signal. The reader decodes the data encoded in the tag's integrated circuit

(silicon chip) and the data is passed to the host computer for processing.

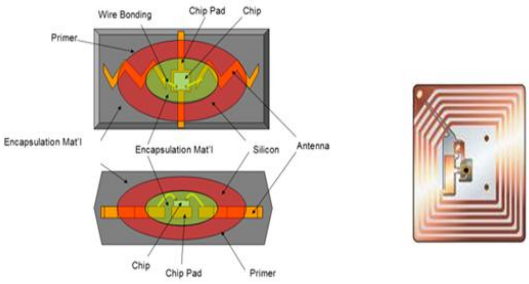

Fig. 2. RFID card reader components

Above diagram indicating RFID Reader and Tag. Reader consists of Wire bonding, Chip Pad, Chip, Encapsulation mark, Primer, Antenna and Tag is the area where we store the DL Number [4].

C. *Alcohol Sensor*

The MQ-7 gas sensor is composed by micro AL2O3 ceramic tube, Tin Dioxide (SnO2) sensitive layer, measuring electrode and heater are fixed into a crust made of plastic and stainless steel net. The heater provides necessary work conditions for work of sensitive components. The enveloped MQ-7 has 6 pins, 4 of them are used to fetch signals, and another 2 are used for providing heating current. Standard measuring circuit of MQ-7 sensitive components consists of 2 parts. One is heating circuit having time control function (the high voltage and the low voltage work circularly). The second is the signal output circuit; it can accurately respond changes of surface resistance of the sensor.

Below diagram indicating alcoholic sensor, this sense the alcoholic content of the driver and produces message to the controller. It will compare inner temperature with outside temperature. If it is greater, it causes alcohol detection otherwise it just ignores. The second is the signal output circuit; it can accurately respond changes of surface resistance [5].

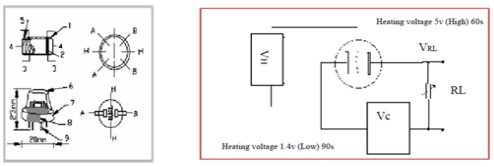

Fig. 3. Alcoholic sensor

D. *Accelerometer ADXL335*

The Accelerometer measures acceleration with a minimum full-scale range of ±3 g. It can measure the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration. The user selects the bandwidths to suit the application, with a range of 0.5 Hz to 1600 Hz for the X and Y axes, and a range of 0.5 Hz to 550 Hz for the Z axis. The ADXL335 is available in a small, low profile, 4 mm × 4 mm × 1.45 mm, 16-lead, plastic lead frame chip scale package. Accelerometer consists of three axes namely X, Y, Z which then indicating the sensitivity of the accelerometer in each direction. It can measure the static acceleration of gravity in tilt-sensing application. Two accelerometers, we used in this work for accelerator and brake systems. DC motor with drive is used to show the intensity of the acceleration. Four Led lights are used to show the intensity of brake applied. The Drive is a device which is used to drive the load [7].

E. *RF Transmitter*

The RF transmitter and receiver are used both in the control unit as well as in the robotic module. The RF transmitter and receiver in the transmitter and receiver module respectively operate at the frequency of 433MHz and the transmitter and the receiver module in the robotic module and the control unit respectively operate at the frequency of 316MHz, the RF transmitter in the control unit is used to transmit the signals which control the robotic module's operations. The transmitter in the robotic module is used to transmit the distance calculated by the SONAR to the controlling unit. The figure below shows the pin out diagram of the RF transmitter. Some of the features of transmitter IC TWS 434 are, Frequency: 433.92MHz, Modulation: AM, Operating voltage: 4.5 - 5.5 V_{DC}, Output: Digital & Linear.

F. *RF Receiver*

The RF receiver in the transmitter module receives the distance related information transmitted by the robotic module. The microcontroller is used to display the distance on the LCD module. The receiver in the robotic module receives the control signals transmitted by the control unit which are used to control various functions of the robot. Some of the features of the transmitter IC RWS 434 are, Frequency: 433.92MHz, Modulation: AM, Operating voltage: 4.5 - 5.5 V_{DC} , Output: Digital & Linear [6].

G. *Wireless IR Sensors*

To monitor the density of the traffic, we will be keeping a few sets of IR transmitter & receiver sensors on the side of the roads.

On the side IR transmitter will be placed & right opposite to the IR transmitter, an IR receiver will be kept. This set of IR transmitter & receiver will be kept on roads at different interval. The IR transmitters are connected to supply, so that they will transmit a high signal all the time. The IR receivers are connected to the comparator circuit, to get digital signals. A low power operational amplifier LM324 IC has been used to develop a comparator circuit. Two sets of LM324 IC have been used in this work. The circuit diagram of the comparator is shown below.

Four Op-Amps are used in this section to compare the incoming signal with 5V Reference signal, Op-Amps thus used as Comparators here [6].

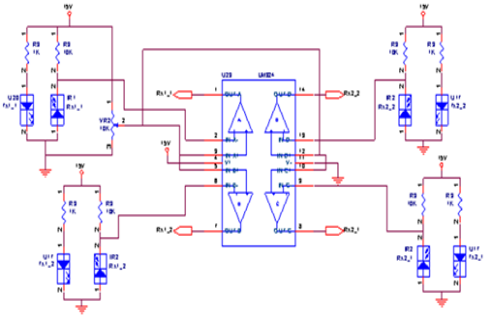

Fig. 4. Comparator circuit

Above figure indicating comparator circuit of LM324IC [11]. It consists of 4 op-amps. Each op-amp is used to measure input speed with threshold speed and causes actions if any overrule occur in it [11]. The IR receivers are connected to the comparator circuit, to get digital signals [11]. A low power operational amplifier LM324 IC has been used to develop a comparator circuit [11].

H. *ALCD*

A liquid crystal display is a thin, flat electronic visual display that uses the light modulating properties of liquid crystals (LCs). Liquid crystal display consists of an array of tiny segments (called pixels) and to present the information that can be manipulated. In general, LCDs uses very lower power than the cathode-ray tube (CRT) counterparts. Many LCDs are ruminants, means that they use only atmosphere light to illuminate the display. The primary factor was size, an LCD consisting of primarily with some liquid crystal material between them of two glass plates. There is no bulk amount picture tube. This gives LCDs practical for applications where size as well as weight is necessary [12].

I. *GSM*

Global system for mobile communication (GSM) is a globally accepted standard for digital cellular communication. GSM is the name of a standardization group established in 1982 to create a common European mobile telephone standard that would formulate specifications for a pan-European mobile cellular radio system operating at EGSM 900 MHz, DCS 1800 MHz and PCS 1900 MHz, SIM300 features GPRS multi-slot class 10/ class 8 (optional) and supports the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4. To get information on SIM card, AT Command is used. The SIM interface supports the functionality of the GSM phase 1 specification and also supports the functionality of the new GSM phase 2+ specifications for fast 64 kbps SIM [9].

3. RESULTS

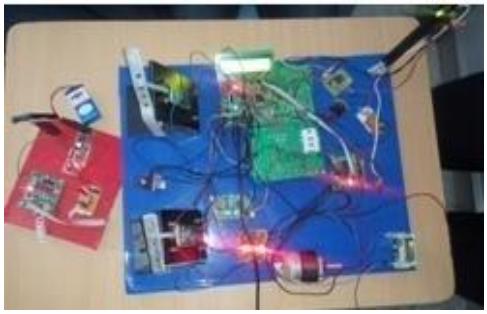

Fig. 5. Proposed module of the work

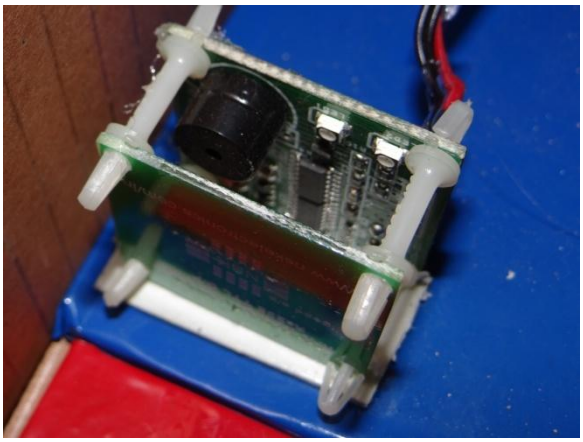

Fig. 6. RFID reader and transceiver. It is used to check the authentication of driver's DL.

Fig. 7. RFID card

It will check the DL authentication of drivers. When this tag comes in contact with electromagnetic field generated by RFID reader it will show message like "VALID" if both EM field matches, if not it shows message like "NOT VALID". Range of RFID tag used here is less than 10m. DL number will be written in the code.

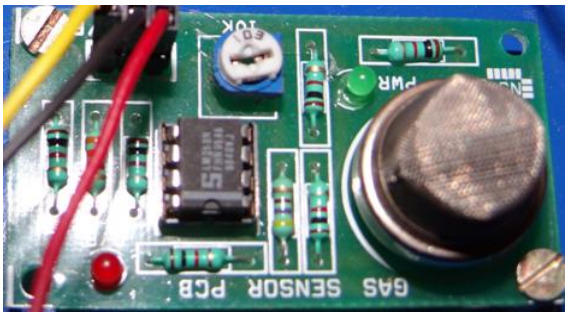

Fig. 8. Alcoholic sensor

The sensor will be covered by HM305 ceramic tube outside, when person breaths for alcoholic check, if he drunk, then the sensitive SNO_2 layer will sense the inside temperature with outside temperature. If outside temperature is greater than inside temperature, then it just passes the signal to chemical electrodes. 1.4 V is the minimum operating sense voltage of SNO_2 and 5V is the maximum voltage. Later Chemical Electrodes checks for -OH content in the signal. If it found any -OH content, it passes the message to the renesas controller and then the controller display message like "Alcoholic" to owner mobile number via GSM module. If not it does not send any signals to the controller.

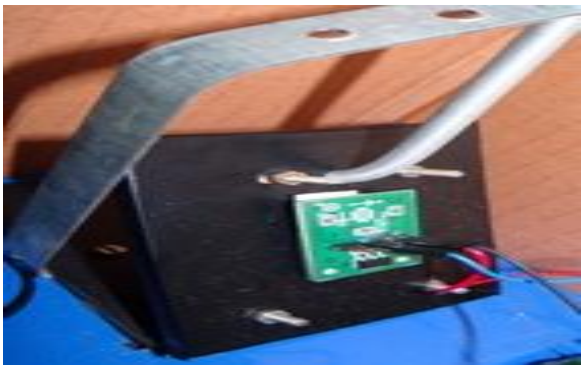

Fig. 9. Accelerometer

We used 2 accelerometers for showing accelerator and brake in this work. The accelerometer will work on the rule of static gravity and stress applied at particular axis. Basically accelerometer contains 3 axes namely: X, Y, Z. Cx, Cy, Cz are capacitors used to store charges at respective axis. When stress crates at any particular axis, its impact will be created at other 2 axes. Depending upon the motion and static vibration we applied amount of charges will be stored in capacitors of other 2 axes. X axis considered to be having full speed acceleration that is at 180 degrees, y axis will be having relatively low speed acceleration comparable to x axis that is at 45 degrees and z axis will be having no acceleration that is at 0 degrees. We had given four positions to detect rash driving detection. If a person moves suddenly from 1-3,1-4,2-4 he considered as rash driver, then the message will suddenly come in ALCD showing like "RASH DRIVING". We can use brake to control the accelerator. DC Motor is used to show the intensity of acceleration applied and four white led lights used to show the intensity of brake applied.

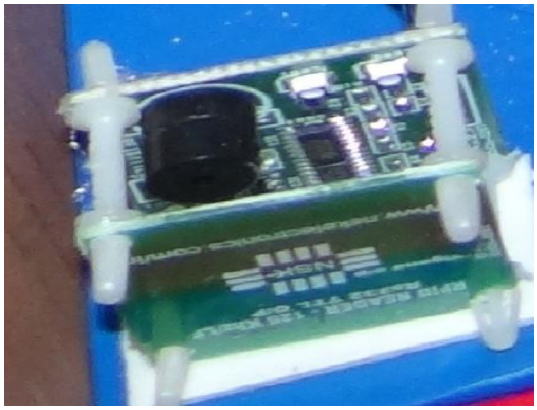

Fig. 10. RF Receiver

RF Receiver will be place inside the vehicle. RF Transmitter will be placed outside the module. This module is used to control speed limit at school, railway gates, and hospital zones. When the vehicle reaches the particular zone that is within 50m radius of RF transmitter which is placed at the road sides of specified zones, RF receiver come to know the maximum speed at current zone. If vehicle not able to control its speed than the reference speed after some delay. A Point will be deducted from the driver's DL. It will send messages to controller about this mismatch. The controller will show a message like "RASH DRIVING" via ALCD.

Fig. 11. RF Transmitter

Fig. 12. Signal jump detection module.

Status of switch will be given to IR transmitter and red, green Led's. During green signal no radiations will be transferred from transmitter to receiver. During red signal, radiation emission active. When any vehicle crosses zebra line potential difference will be broken, comparator IC will getting know this. Then it sends a message to controller and then message will be displayed on ALCD"RASH DRIVING".

Fig. 13.Global Subscriber Module.

It is used to send SMS to user mobile. It is one way transferring, user not able to reply for the message.

Fig. 14.Alpha Numeric Liquid Crystal 16*2 Display.

It is used to display the messages send by the controller to user. It is placed inside the vehicle and right opposite to the driver, where he is comfortable to see the incoming messages.

4. CONCLUSION

This would be the most efficient method to avoid rash driving for the all the vehicles including public vehicles, Cabs, Transport vehicles, etc. It can be safe to assume that in the near future this concept will revolutionize the **automobile world** while simultaneously retaining its low cost advantage. Down the line in a few years we can use this technology for controlling stack-up's of the vehicles since it can be installed at a reasonable cost. We suggest people to use this technology in their vehicles for safety and precaution. Obviously the cost of the vehicle after inserting this device will be higher than normal vehicle, but health is wealth.

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