Safe Driving Using Mobile Phones

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ABSTRACT

As vehicle manufacturers continue to increase their emphasis on safety with Safe Driving Using Mobile Phones (SDMP's), we propose a device that is not only already in abundance but portable enough as well to be one of the most effective multipurpose devices that are able to analyze and advise on safety conditions. Mobile smart phones today are equipped with numerous sensors that can help to aid in safety enhancements for drivers on the road. In this paper, we use the three-axis accelerometer of an Android-based Smartphone to record and analyze various driver behaviors and external road conditions that could potentially be hazardous to the health of the driver, the neighboring public, and the automobile. Effective use of these data can educate a potentially dangerous driver on how to safely and efficiently operate a vehicle. With real-time analysis and auditory alerts of these factors, we can increase a driver's overall awareness to maximize safety.

***Keywords*— Accelerometer, ARM, RF Module, GSM Module, Mobile phone, road conditions, Sensors, Vehicle safety.**

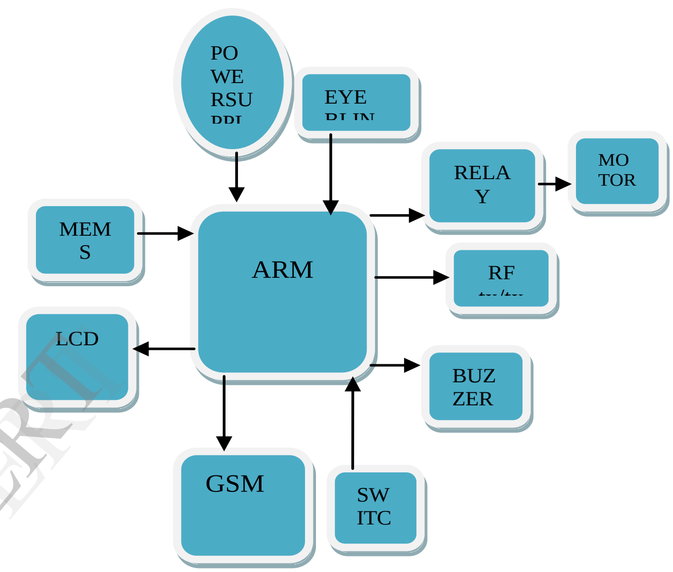

Figure 1: ***Block Diagram of Safe Driving Using Mobile Phones***

1. INTRODUCTION

In the fast-paced society of today, we are focused on arriving at our destination as quickly as possible. However, with this lifestyle, we are not always aware of all the dangerous conditions that are experienced while operating an automobile. Factors such as sudden vehicle maneuvers and hazardous road conditions, which often contribute to accidents, are not always apparent to the person behind the wheel. In recent years, there has been tremendous growth in smart phones embedded with numerous sensors such as accelerometers, Global Positioning Systems (GPSs), magnetometers, multiple microphones, and even cameras. The scope of sensor networks has expanded into many application domains such as intelligent transportation systems that can provide users with new functionalities previously unheard of Experimental automobiles in the past have included certain sensors to record data preceding test crashes, After analysis, crash scenarios are stored and analyzed with real-time driving data to potentially recognize a future crash and actually prevent it.

With more than 10 million car accidents reported in the United States each year, car manufacturers have shifted their focus of a passive approach, e.g., airbags, seat belts, and antilock brakes, to more active by adding features associated with advanced driver-assistance systems (ADASs), e.g., lane departure warning system and collision avoidance systems. However, vehicles manufactured with these sensors are hard to find in lower priced economical vehicles as ADAS packages are not cheap add-ons. In addition, older vehicles might only have passive safety features since manufacturers only recently began to introduce an effective driver assist. Since sensors ultimately add onto the cost of a vehicle initially and cannot be affordably upgraded, we target a mobile Smartphone as an alternative device for ADASs that can assist the driver and compliment any existing active safety features. Given its accessibility and portability, the Smartphone can bring a driver assist to any vehicle without regard for on-vehicle communication system requirements.

2. OVERVIEW OF THE SDMP's SYSTEM

This project is implemented in an effective way to improve the When the driver enters the car the mobile automatically goes into the driving mode. When the driver is getting call for the first time the arm microcontroller detect and gives a pre-recorded voice (the person you are calling is in driving mode). If again the caller is calling for the second time the rf transmitter (TWS-434) in the mobile section send the signal to the rf section (RWS-434)that is placed on the dashboard and the buzzer gets activated . if the driver attends the call the rf section on the dash board sends a signal to the mobile section using the MAX232 and the arm controller activate the relay and decreases the speed of the car.
The other way of accidents causes by drunken driving or sleepy driving. We are also using eye blink sensors. The driver has to wear the eye glasses , if the driver closes his eyes arm receives the signal if the person doesn't open his eyes more 3seconds the buzzer gets activated and the speed of the vehicle gets reduced.

This project mainly consists of two sections which are the mobile section and the dash board section. The mobile section consists arm Micro Controller (ARM7) FAMILY, gsm mobile, relays, rf transmitter and eye blink sensor. The second section dashboard section consists of RF Reciver, LPC2148 MICROCONTROLLER. In this section all the devices are connected to the arm microcontroller. The arm controller receives the signal from the sensors, gsm module, and RF section and controls the devices that are connected. When the RF section receives the signal it sends to the Micro controller and its acts according to the signal.

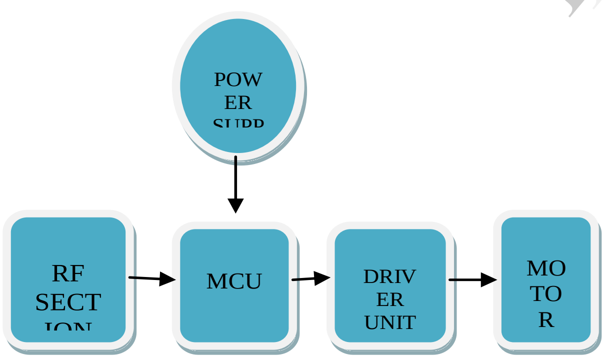

Figure 2: ***SDMP's Module***

3. METHODS

3.1. ARM Processor:

The ARM7 family includes the ARM7TDMI, ARM7TDMI-S, ARM720T, and ARM7EJ-S processors. The ARM7TDMI core is the industry's most widely used 32-bit embedded RISC microprocessor solution. Optimized for cost and power-sensitive applications, the ARM7TDMI solution provides the low power consumption, small size, and high performance needed in portable, embedded applications. The ARM7TDMI core uses a three-stage pipeline to increase the flow of instructions to the processor. This allows multiple simultaneous operations to take place and continuous operation of the processing and memory systems. As the processor is having a high speed it is easy to make the communication between the RF module and the Image acquisition module

Operating modes

The ARM7TDMI core has seven modes of operation:

- User mode is the usual program execution state
- Interrupt (IRQ) mode is used for general purpose interrupt handling
- Supervisor mode is a protected mode for the operating system
- Abort mode is entered after a data or instruction pre fetch abort.

The interrupt setting of ARM supports the DHLS to response to the interrupt coming from the server section.

Interrupt controller

The Vectored Interrupt Controller (VIC) accepts all of the interrupt request inputs from the home server section and categorizes them as Fast Interrupt Request (FIQ), vectored Interrupt Request (IRQ), and non-vectored IRQ as defined by programmable settings. These interrupt settings will give a quick response to the RF decoder. So that address verification will be very faster and signal for image processing will be given to the image acquisition module.

Wireless communication:

RF communication:

Radio Frequency,

Any frequency within the electromagnetic spectrum associated with radio wave propagation. When an RF current is supplied to an antenna, an electromagnetic field is created that then is able to propagate through space. Many wireless technologies are based on RF field propagation

Transmitter:

The TWS-434 extremely small, and are excellent for applications requiring short-range RF remote controls. The TWS-434 modules do not incorporate internal encoding. If simple control or status signals such as button presses or switch closures want to send, consider using an encoder and decoder IC set that takes care of all encoding, error checking, and decoding functions. 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, and will go through most walls.

Figure 3: ***RF Transmitter***

RF receiver:

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.

A 0 volt to Vcc data output is available on pins. This output is normally used to drive a digital decoder IC or a microprocessor which is performing the data decoding. The receiver's output will only transition when valid data is present. In instances, when no carrier is present the output will remain low.

The RWS-434 modules do not incorporate internal decoding. If you want to receive Simple control or status signals such as button presses or switch closes, you can use the encoder and decoder IC set described above. Decoders with momentary and latched outputs are available

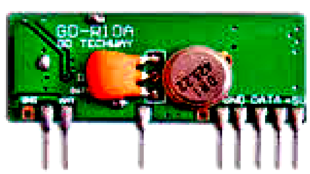

Figure 4: ***RF receiver***

3.2. LPC2148 Microcontroller Architecture

LPC2148 Microcontroller Architecture. The ARM7TDMI-S is a general purpose 32-bit microprocessor, which offers high performance and very low power consumption. The ARM architecture is based on Reduced Instruction Set Computer (RISC) principles, and the instruction set and related decode mechanism are much simpler than those of micro programmed Complex Instruction Set Computers (CISC). This simplicity results in a high instruction throughput and impressive real-time interrupt response from a small and cost-effective processor core.

Pipeline techniques are employed so that all parts of the processing and memory systems can operate continuously. Typically, while one instruction is being executed, its successor is being decoded, and a third instruction is being fetched from memory. The ARM7TDMI-S processor also employs a unique architectural strategy known as Thumb, which makes it ideally suited to high-volume applications with memory restrictions, or applications where code density is an issue.

The key idea behind Thumb is that of a super-reduced instruction set. Essentially, the ARM7TDMI-S processor has two instruction sets:

• The standard 32-bit ARM set.

• A 16-bit Thumb set.

Figure 5: ***LPC2148***

3.3. MAX232:

The MAX232 from Maxim was the first IC which in one package contains the necessary drivers (two) and receivers (also two), to adapt the RS-232 signal voltage levels to TTL logic. It became popular, because it just needs one voltage (+5V) and generates the necessary RS-232 voltage levels (approx. -10V and +10V) internally. This greatly simplified the design of circuitry. Circuitry designers no longer need to design and build a power supply with three voltages (e.g. -12V, +5V, and +12V), but could just provide one +5V power supply, e.g. with the help of a simple 78x05 voltage converter.

The MAX232 has a successor, the MAX232A. The ICs are almost identical, however, the MAX232A is much more often used (and easier to get) than the original MAX232, and the MAX232A only needs external capacitors 1/10th the capacity of what the original MAX232 needs.

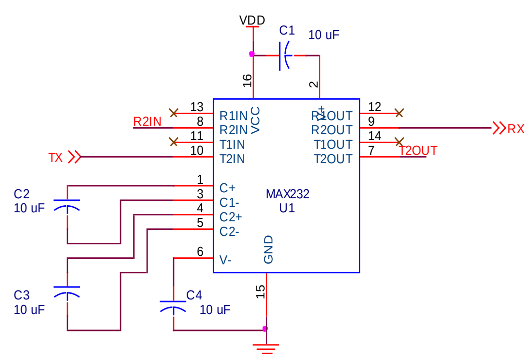

Figure 6: ***MAX 232***

3.4. GSM

A GSM modem is a wireless modem that works with a GSM wireless network. Global system for mobile communication (GSM) is a globally accepted standard for digital cellular communication. GSM is the name of a

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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 900 MHz

GSM provides recommendations, not requirements. The GSM specifications define the functions and interface requirements in detail but do not address the hardware. The reason for this is to limit the designers as little as possible but still to make it possible for the operators to buy equipment from different suppliers. The GSM network is divided into three major systems: the switching system (SS), the base station system (BSS), and the operation and support system (OSS). The basic GSM network elements are shown in below.

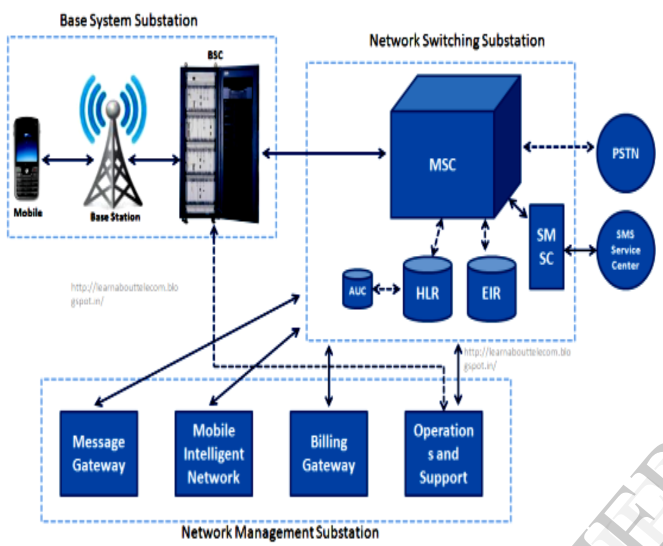

Figure 7: ***GSM network Topology***

GSM modems support an extended set of AT commands. These extended AT commands are defined in the GSM standards. With the extended AT commands, you can do things like:

- ❖ Reading, writing and deleting SMS messages.
- ❖ Sending SMS messages.
- ❖ Monitoring the signal strength.
- ❖ Monitoring the charging status and charge level of the battery.
- ❖ Reading, writing and searching phone book entries.

Sending the message:

To send the SMS message, type the following command:

AT+CMGS="+31638740161" <ENTER>

Replace the above phone number with your own cell phone number. The modem will respond with:

\> (Response from the modem)

You can now type the message text and send the message using the <CTRL>-<Z> key combination:

Hello World! <CTRL-Z>

Here CTRL-Z is keyword for sending a sms through the mobile device. After some seconds the modem will respond with the message ID of the message, indicating that the message was sent correctly:

4. EYE BLINK SENSORS

This switch is activated when the user blinks their eye. It allows individuals to operate electronic equipment like communication aids and environmental controls hands-free. Each blink of the eye is detected by an infrared sensor, which is mounted on dummy spectacle frames.

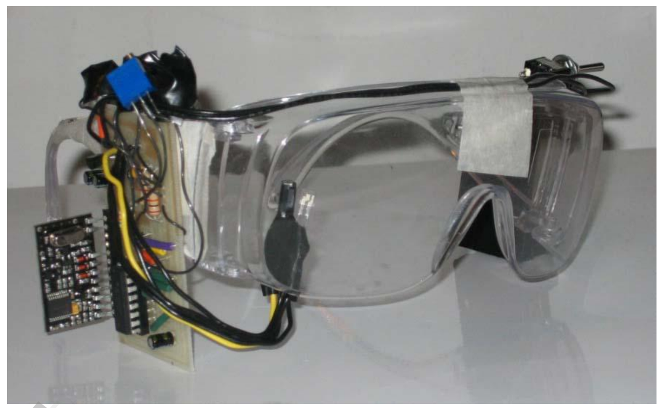

Figure 8: ***EYE BLINK SENSORS***

The eye blink switch can be set up to operate on either eye and may be worn over normal glasses. The sensitivity of the switch can be adjusted to the user's needs and involuntary blinks are ignored. The sensor is connected to a hand-held control unit with a rechargeable battery.

5. LCD

LCD MODULE (2X 16 CHARACTERS):

Dot matrix LCD modules is used for display the parameters and fault condition.16 characters 2 lines display is used. It has controller which interface data's and LCD panel. Liquid crystal displays (LCD's) have materials, which combine the properties of both liquids and crystals. Rather than having a melting point, they have a temperature range within which the molecules are almost as mobile as they would be in a liquid, but are grouped together in an ordered form similar to a crystal. An LCD consists of two glass panels, with the liquid crystal material sandwiched in between them. The inner surface of the glass plates are coated with transparent electrodes which define the character, symbols or patterns to be displayed polymeric layers are present in between the electrodes and the liquid crystal molecules to maintain a defined orientation angle.

One each polarizer's are pasted outside the two glass panels. These polarizer's would rotate the light rays passing through them to a definite angle, in a particular direction When the LCD is in the off state, light rays are rotated by the two polarizes and the liquid crystal, such that the light rays come out of the LCD without any orientation, and hence the LCD appears transparent.

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When sufficient voltage is applied to the electrodes, the liquid crystal molecules would be aligned on a specific direction. The light rays passing through the LCD would be rotated by the polarizes, which would result in activating/highlighting the desired characters.

Figure 9: ***LCD Diagram***

The LCD's are lightweight with only a few millimeters thickness. since the LCD's consume less power, they are compatible with low power electronic circuits, and can be powered for long durations .The LCD's don't generate light is needed to read the display. By using backlighting, reading is possible in the dark .The LCD's have long life and a wide operating temperature range.
One of the most popular output devices for embedded electronics is LCD. The LCD interface has become very simple. This is due to the availability modules for LCDs. The LCD along with necessary controller (LCD Controller) and mounting facility is made available in the module itself. The LCD controller takes care of everything necessary for the LCD. We communicate with the LCD controller with the help of a command set provided by the manufacturer.

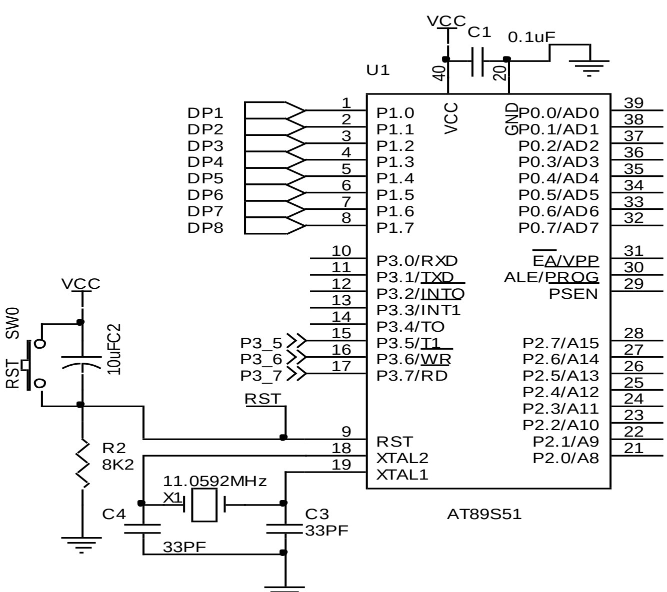

Figure 10: ***Pin Diagram of AT89551***

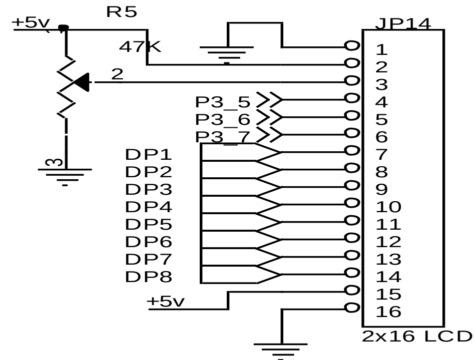

Figure 11: ***LCD Interface***

This circuit consists of a Microcontroller and a LCD. This LCD is operating with an 8-bit data bus. So totally 11 data lines are required (8 Data lines and 3 control lines). The 8 bit data lines are connected to the Port1 and the 3 control lines to the Port3.5-Port3.7. The EN line is called "Enable." This control line indicates to the LCD that we are sending it data. To send data to the LCD, the EN should be low (0) and then set the other two control lines and/or put data on the data bus. When the other lines are completely ready, bring EN high (1) and wait for the minimum amount of time required by the LCD datasheet (this varies from LCD to LCD), and end by bringing it low (0) again.

The RS line is the "Register Select" line. When RS is low (0), the data is to be treated as a command or special instruction (such as clear screen, position cursor, etc.). When RS is high (1), the data being sent is text data, which should be displayed on the screen. For example, to display the letter "T" on the screen we would set RS high. The RW line is the "Read/Write" control line. When RW is low (0), the information on the data bus is being written to the LCD. When RW is high (1), the program is effectively querying (or reading) the LCD. Only one instruction ("Get LCD status") is a read command. All others are written commands so RW will almost always be low.

6. RELAY CIRCUIT

The coil of a relay passes a relatively large current, typically 30mA for a 12V relay, but it can be as much as 100mA for relays designed to operate from lower voltages. Hence a CB amplifier is used to achieve the current rating of the relay.
Transistors and ICs must be protected from the brief high voltage produced when a relay coil is switched off. The diagram shows how a signal diode (e.g. 1N4148) is connected 'backwards' across the relay coil to provide this protection. Current flowing through a relay coil creates a magnetic field which collapses suddenly when the current is switched off. The sudden collapse of the magnetic field induces a brief high voltage across the relay coil which is very likely to damage transistors and ICs. The protection diode allows the induced voltage to drive a brief current through the coil (and diode) so the magnetic field dies away quickly rather than instantly. This prevents the

induced voltage becoming high enough to cause damage to transistors and ICs.

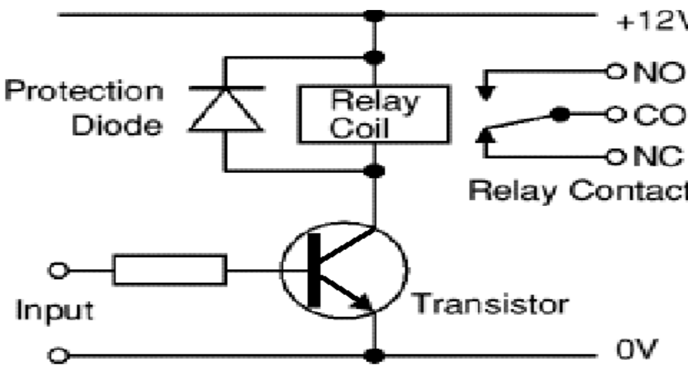

Figure 12: ***RELAY CIRCUIT (IN4148)***

7. CONCLUSION

Mobile phone use while driving is common but controversial. Being distracted while operating a motor vehicle has been shown to increase the risk of accident. Using a mobile Smartphone, we have demonstrated some innovative applications that are integrated inside an automobile to evaluate a vehicle's condition, such as gear shifts and overall road conditions, including bumps, potholes, rough road, uneven road, and smooth road. Our road classification system resulted in high accuracy, making it possible to conclude on the state of a particular road. Along with these findings, an analysis of a driver behavior for safe and sudden maneuvers, such as vehicle accelerations and lane changes, has been identified, which can advise drivers who are unaware of the risks they are potentially creating for themselves and neighboring vehicles. The direction of lane change, as well as safe acceleration, compared with sudden acceleration, was easily distinguishable. Using a multiple-axis classification method for bumps increased the bump and pothole classification accuracy, resulting in a better road anomaly detection system. Being fueled by demand, future advancements in embedded hardware will yield the Smartphone and its sensors to be more powerful devices in terms of processing, sensitivity, and accuracy, paving the way for many more innovative applications. Unlocking its potential in intelligent transportation systems seems only logical as there are conceivably numerous of applications that can help reduce safety concerns on the road. By using this concept we can prevent this problem.

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