

A Pre-emptive Susceptive Design for Drowsy Driving Detection System

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Abstract— Now-a-days there are perceptible road accidents occurring due to many reasons. Carelessness of driver is one of the reasons for accidents particularly during nights. The main objective of our project is to design a system which monitors the driver and acknowledges him if he was sleepy while he is driving a vehicle. This involves an embedded system which is a special-purpose system in which the computer is completely encapsulated by or dedicated to the device or system it controls. The design and development of monitoring and alarming system is described in this paper.

Keywords— eye blink sensor, H-bridge & motor, buzzer or alarm, micro-controller.

I. INTRODUCTION

Basically, the device consists of an eye blink sensor, H-bridge & motor, buzzer or alarm. The eye blink sensor continuously monitor the movement of eye, it calculates the closing time of eye, normally eye blinking time is stored in micro controller, every time sensor sense the closing and opening timings, compare to the original values, if time is more, that information is send to the micro controller, then that time micro controller identify that the person is in sleeping mode, then automatically buzzer will ring to wake up the driver.

This project main aim is to avoid the accidents, and to safely reach the destination.

II. SYSTEM ARCHITECTURE

Firstly, the required operating voltage for Microcontroller 89C51 is 5V. Hence the 5V D.C. power supply is needed by the same. This regulated 5V is generated by first stepping down the 230V to 9V by the step down transformer.

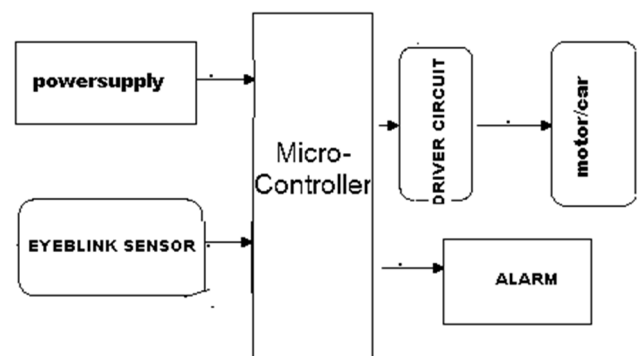
The step downed AC voltage is being rectified by the Bridge Rectifier. The diodes used are 1N4007. The rectified AC voltage is now filtered using a 'C' filter. Now the rectified, filtered D.C. voltage is fed to the Voltage Regulator. This voltage regulator allows us to have a Regulated Voltage which is +5V.

The rectified, filtered and regulated voltage is again filtered for ripples using an electrolytic capacitor 100 μ F. Now the output from this section is fed to 40th pin of 89c51 microcontroller to supply operating voltage.

The microcontroller 89c51 with Pull up resistors at Port0 and crystal oscillator of 11.0592 MHz crystal in conjunction with couple of capacitors of is placed at 18th & 19th pins of 89c51 to make it work (execute) properly.

The eye blink sensor is connected through microcontroller, by using this eye sensor to sense blinking time of eye, eye blinking data is send to the micro controller. The micro controller compare the all the data and send warning signal to the driver circuitry system, then it alert the entire system.

Block Diagram:



III. HARDWARE DESIGN

A. Eye blink sensor

The Classical conditioning of the eye blink response in the rabbit is one of the most advanced models of learning and memory in the mammalian brain. Successful use of the eye blink conditioning paradigm requires precise measurements of the eye blink response. One common technique of eyelid movement detection utilizes measurements of infrared (IR) light reflected from the surface of the eye. The performance of current IR sensors, however, is limited by their sensitivity to ambient infrared noise, by their small field-of-view and by short working distances. To address these limitations, we developed an IR eye blink detector consisting of a pulsing (62.5 kHz) IR light emitting diode (LED) paired with a silicon IR photodiode and circuit that synchronously demodulates the recorded signal and rejects background IR noise. The working

distance of the sensor exceeds 20 mm, and the field-of-view is larger than the area of a rabbit's eye. Due to its superior characteristics, the new sensor is ideally suited for both standard eye blink conditioning and for studies that utilize IR-containing visual stimuli and/or that are conducted in an environment contaminated with IR noise.

A number of eye blink recording techniques have been developed to monitor different aspects of the response. The oldest method, still commonly used, monitors the movements of the nictitating membrane or external eyelids with direct mechanical linkage to a displacement transducer lever (Gormezano, 1966; Patterson and Romano, 1987; Bracha et al., 1993; Perrett and Mauk, 1995). Although, these techniques are simple and provide excellent information about the position of the eyelid or nictitating membrane, they require direct mechanical contact with the eyelid. This contact produces mechanical stimulation of the eye which can confound the experiment. In addition, lever systems are sensitive to inertial artefacts.

A second common method of eye blink recording utilizes infrared (IR) photoelectric sensors. This approach measures IR light reflected from the surface of the eye (VanDer car et al., 1969; Thompson et al., 1994; Li et al., 2003). A typical IR eye blink measurement device consists of an IR light emitting diode (LED), which illuminates the eye surface, paired with an IR photodiode that detects IR light reflected back from the eye. Since the rabbit (New Zealand White) eyelid reflects more IR light than does the cornea, eyelid closure corresponds with increased IR reflection, which, in turn, leads to increased current through the photodiode.

An ideal IR eye blink detector should have several important properties. To detect the full range of eyelid movement, the IR LED should completely illuminate the surface of the fully opened eye, and in addition, the field-of-view of the IR photodiode should encompass the whole eye area. Some currently used detectors rely on commercial proximity sensors that not only must be positioned close to the eye but also emit a narrow IR beam resulting in incomplete coverage of the full range of eyelid motion (Thompson et al., 1994). To increase the area view of the original IR detector, a double sensor head system was developed.

B. Eye blink detector

Principle of operation:

The IR sensor was constructed of a paired IR LED and IR photodiode. The sensor was attached to the implanted holder and positioned in front of the eye. During eye blink detection,

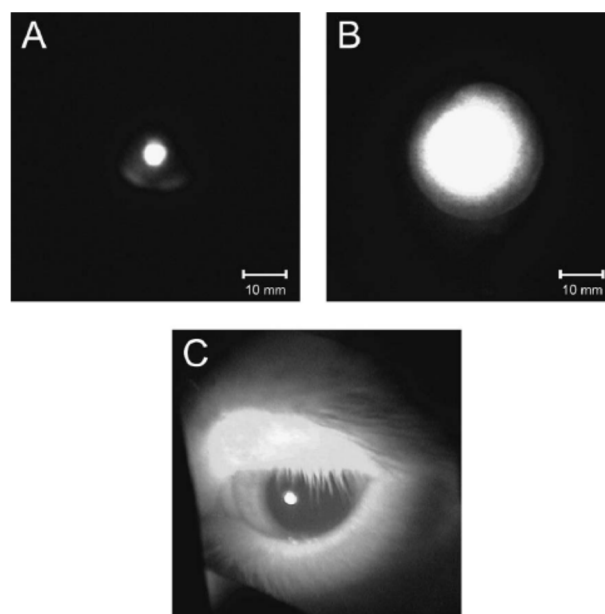
IR light from the LED illuminates the eye and reflected IR light induces an electrical current through the IR photodiode. As the eyelid closes, increasingly more IR light is reflected on the IR sensor head.

The sensor is comprised of an infrared LED and a photodiode held by an aluminium block at an angle allowing a working distance to the eye of approximately 20mm from the front edge of the block (Fig. 1) compared to a working

distance of 4mm required with the OPB704 used by Thompson et al. (1994). Since the Osram SFH485-2 IR LED (Digital key, 475-1112-ND) used in this sensor has a reported 20° half-angle, the field of illumination at a working distance of 20mm has a diameter of approximately 20mm.

This field of illumination is significantly larger than what is produced by the OPB704 (Thompson et al., 1994; Fig. 2A). The maximum calculated radiant intensity of the SFH485-2 LED is 4.46 mW/cm² at the distance of 20mm from the eye.

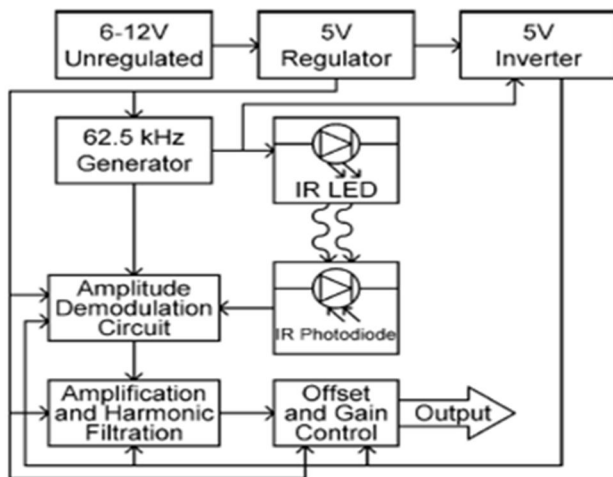
According to the ICNIRP Statement (2000), exposure to this radiant intensity does not represent any known health risk. Based on our experience, the IR light in the described setup does not produce any discomfort in experimental subjects. The silicon photodiode, an Osram SFH229fa (Digital key, 475-1079-ND), has a reported 17° half-angle field-of view. The sensor is connected to the detector circuit using a pair of 1.5m thin and flexible shielded cables. A two-conductor cable (Coroner Wire, NMUF 2/30-4046SJ) is used for the photodiode and a four-conductor cable (Coroner Wire, NMUF 4/30-4046SJ) for the LED. To increase the current carrying capacity of the LED cable, two leads were used for both the LED anode and cathode.



C. Eye blink detector circuit

The sensor eliminates ambient IR noise by using high frequency, pulsed IR illumination, much like a carrier wave in an amplitude-modulated radio (Fig. 3). Because the illuminating LED is pulsed at a high frequency (62.5 kHz), changes in reflectivity of the eye during a blink cause modulation of the amplitude of the reflected IR carrier wave. The modulated output of the

Photo diode is amplified to a usable level and then run through a product detector circuit. This produces a signal containing the desired demodulated information, as well as undesirable high frequency content around the carrier frequency and also higher harmonics of the carrier. The phase synchronization normally needed with product detector circuits is inherent in the design since the frequency of switching is derived directly from the same oscillator as the LED drive pulses, and hence is perfectly in phase with the LED pulses.



The signal is then filtered to remove the higher frequency content, completing demodulation, and is scaled and adjusted for offset as desired by the user. Detailed schematic of the circuit is provided in Fig. 4. U3 is a timer, producing pulses at approximately 62 kHz. Transistor Q1 allows the low drive strength timer chip to drive a higher current infrared LED (LED1). U4: B and U5 amplify the signal as received by PD1, the photodiode, and they filter the signal to remove content significantly less than the modulation frequency.

This is important, as the primary source of interference is likely to be light in the 60 Hz range produced by conventional light sources. U7 is a CMOS analogue switch, which forms the main demodulation element. U6 provides additional amplification as well as filtration of high-frequency noise from the carrier signal. U4:A then provides further filtration and a mechanism for adjusting the gain and offset of the final signal. U1 and U2 form the power supply; an important feature is the use of the carrier frequency from U3 to drive the switching of voltage inverter U2, which causes the switching noise on the -5V power supply line to match the carrier signal rather than being out of phase with it which would cause destructive interference.

D. Micro controller Module

The program for a microcontroller is normally stored on a memory IC called EPROM or in microcontroller IC itself. An

EPROM (electrically programmable read on memory) is a special type of IC that does nothing more than store program code or other data that is not lost when power is removed traditionally. Software programmed into an EPROM which is then physically inserted into circuitry of hardware. The microcontroller accesses the program stored in the EPROM and executes it. This allows the program to be made available to microcontroller without need for a hard drive, floppy drive or any of other circuitry and software necessary to manage such devices.

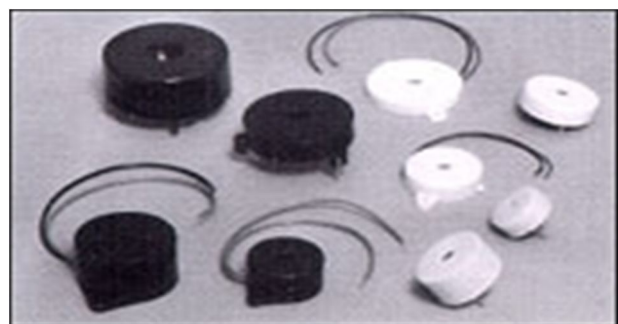
In recent years a growing number of micro controllers have offered the capability of having programs loaded internally into the microcontroller IC itself. Rather than having a circuit that includes both a microcontroller and external EPROM it is now possible to have a microcontroller which store program code internally.

The AT89C52 provides the following standard features: 4 Kbytes of Flash, 256 bytes of RAM, 32 I/O lines, two 16-bit timer/counters, five vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator and clock circuitry. In addition, the AT89C52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes.

E. BUZZER

The "Piezoelectric sound components" introduced herein operate on an innovative principle utilizing natural oscillation of piezoelectric ceramics. These buzzers are offered in lightweight compact sizes from the smallest diameter of 12mm to large Piezo electric sounders. Today, piezoelectric sound components are used in many ways such as home appliances, OA equipment, audio equipment telephones, etc. And they are applied widely, for example, in alarms, speakers, telephone ringers, receivers, transmitters, beep sounds, etc.

ULN2003 is a high voltage and high current Darlington array IC. It contains seven open collector Darlington pairs with common emitters. A Darlington pair is an arrangement of two bipolar transistors. ULN2003 belongs to the family of ULN200X series of ICs. Different versions of this family interface to different logic families. ULN2003 is for 5V TTL, CMOS logic devices.

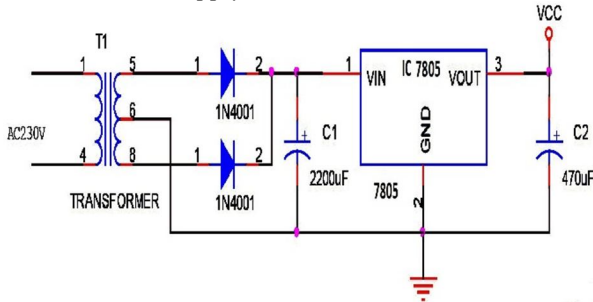


These ICs are used when driving a wide range of loads and are used as relay drivers, display drivers, line drivers etc.

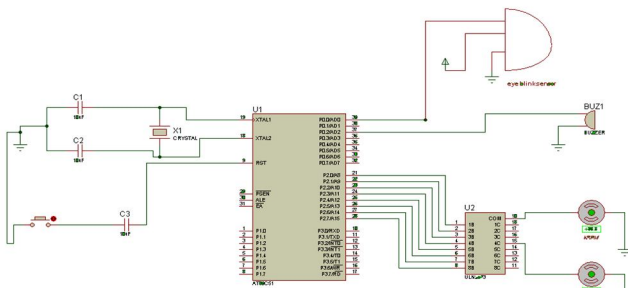
ULN2003 is also commonly used while driving stepper motors. Each channel or Darlington pair in ULN2003 is rated at 500mA and can withstand peak current of 600mA. The inputs and outputs are provided opposite to each other in the pin layout. Each driver also contains a suppression diode to dissipate voltage spikes while driving inductive loads.

IV. SCHEMATIC DIAGRAM

A. Power Supply



B. Complete Schematic



V. CONCLUSION

The project “A preemptive susceptible Design for Drowsy Driving Detection” has been successfully designed and tested. It has been developed by integrating features of all the hardware components used. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit.

Secondly, using highly advanced IC’s and with the help of growing technology the project has been successfully implemented.

Finally we conclude that “A preemptive susceptible Design for Drowsy Driving Detection” is an emerging field and there is a huge scope for research and development.

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BIOGRAPHY



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