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MONITORING DRIVER GAZE AND EYES OFF THE ROAD DETECTION SYSTEM USING RASPBERRY PI3

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ABSTRACT:
Company's business processes may require the service for 24 hours a day. However, this could cause some problems. For example, in Situbondo, a worker lost his hand because of drowsiness while working in a wood cutting machine. A young even lost his life because working in a sleepy condition. Car driving is very prone to accident due to drowsiness. According to Directorate General of Land Transportation, Department of Transportation, accident that occurred in Indonesia is 93.52% caused by drowsiness. The project is built around MCU. Here we are using eye blink sensor. By default the vehicle will be in running condition. During this time if the person closes the eyes automatically the vehicle will be in halt condition, the updated message will be displayed on the 16x2 LCD. The Position will be messaged using GSM respectively interfaced to the controller.
Keywords: GSM, IR Sensor, Raspberry-Pi.

I. INTRODUCTION

Driver monitoring has been a long standing research problem in computervision and automotive driver monitoring system applications. Broadly speaking, there are two approaches to estimate gaze direction: one is Techniques that only use the head pose and the second is those that use the driver‟s head pose and gaze. For systems that rely only on head pose estimation the processing complexicity increases in regard to the software requirement and for those that relay on head pose and gaze estimation are grouped into hardware and software based approaches Active Appearance Models (AAMs) for facial feature tracking and head pose estimation and 3D eye-model was used for accurate gaze estimation, both of these relay on near-infrared (IR) illuminators to generate the bright pupil effect. This system is not person-independent and must be calibrated for every system configuration and driver. Besides their complexicity of integration and implementation these systems are too expensive to be installed in mass-produced cars and they require periodic re-calibration because vibrations cause the system calibration to drift over time. Proposed Design: To overcome the above constraints the current work proposes a new method of Eyes off Road (EOR) detection system that is much simpler compared to the previous designs and due to which they are greatly inexpensive and mass producible. The proposed system does not require any driver-dependent calibration or manual initialization and works in real time, during the day and night. The system also provides the choice of localization and can result in an effective design which offers a prospect to develop a complete automotive driver monitoring

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systems that would be affordable to maximum number of automotive variants and easily accessible and modifiable according to various utility vehicles.

II. SYSTEM ARCHITECTURE

Fig.1 shows the System Architecture.

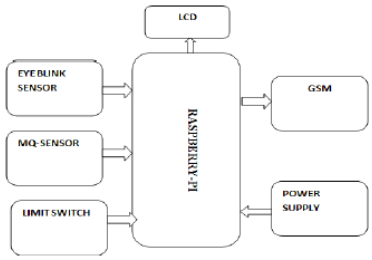

Fig.1. System Architecture.

III. IMPLEMENTATION

A. Hardware

Raspberry Pi (ARM 11): The Raspberry Pi is a credit-card sized computer that plugs into your TV and keyboard. It is a capable for little projects, and for many of the things that your desktop PC does, like spreadsheets, word-processing and games. It also plays high-definition videos. We want to see it being used by kids all over the world to learn how computers work, how to manipulate the electronic world around them and, how to program. The original Raspberry Pi is based on the Broadcom BCM2835 system on a chip (SoC), which includes, Video Core IV GPU, RAM of 512 MB. The system has Secure Digital (SD) socket for boot media and persistent storage. A SoC consists of the hardware, described above, and the software controlling the microcontroller, microprocessor or DSP cores, peripherals and interfaces. The design flow for Soc aims to develop this hardware and software in parallel as shown in Fig.2.

Fig.2. Raspberry Pi Board.

GSM: GSM is a digital mobile telephone system that is widely used in Europe and other parts of the world. GSM uses a variation of Time Division Multiple Access (TDMA) and is the most widely used of the three digital wireless telephone technologies (TDMA, GSM, and CDMA). GSM digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own time slot. It operates at either the 900 MHz or 1,800 MHz frequency band. GSM is the de facto wireless telephone standard in Europe. GSM has over one billion users worldwide and is available in 190 countries. Since many GSM network operators have roaming agreements with foreign operators, users can often continue to use their mobile phones when they travel to other countries. The message formats supported are text mode and PDU mode. In PDU mode, a complete SMS Message including all header information is given as a binary string (in hexadecimal format). Therefore, only the following set of characters is allowed: {‘0’,’1’,’2’,’3’,’4’,’5’,’6’,’7’,’8’,’9’, ‘A’, ‘B’,’C’,’D’,’E’, ‘F’}. Each pair or characters is converted to a byte (e.g..’41’ is converted to the ASCII character „A“, whose ASCII code is 0x41 or 65). In Text mode, all commands and responses are in ASCII characters. The format selected is stored in EEPROM by the +CSAS command.

Eye Blink Sensor: The eye-blink sensor works by illuminating the eye and/or eyelid area with infrared light, then monitoring the

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changes in the reflected light using a phototransistor and differentiator circuit. The exact functionality depends greatly on the positioning and aiming of the emitter and detector with respect to the eye.

Features:

- EYE BLINK indication by LED
- Instant output digital signal for directly
- Connecting to microcontroller
- Compact Size
- Working Voltage +5V DC

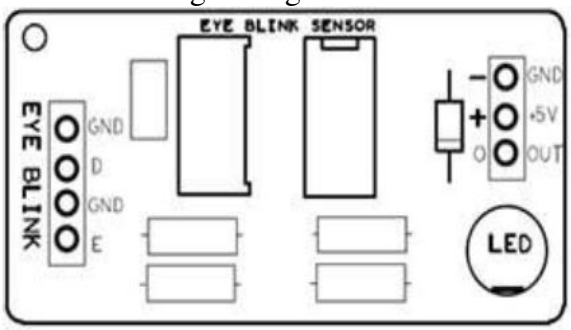

Fig.3. Application:

- Digital Eye Blink monitor
- Vehicle Accident prevention.
- Suite for real time driving applications
-

TABLE I: Specification

Parameter	Value
Operating Voltage	+5V DC regulated
Operating Current	100mA
Output Data Level	TTL Level
Eye Blink	Indicated by LED and Output High Pulse

PIN Details: Board has 3-pin connector for using the sensor. Details are marked on PCB.

TABLE II: PIN Details

Pin	Name	Details
1	GND	Power Supply Ground
2	+5V	Power supply Positive input
3	OUT	Active High Output

Using Sensor:

- Connect regulated DC power supply of 5 Volts. Black wire is Ground, Next middle wire is Brown which is output and Red wire is positive supply. These wires are also marked on PCB.
- To test sensor you only need power the sensor by connect two wires +5V and GND. You can leave the output wire as it is. When Eye closed LED is off the output is at 0V.
- Put Eye blink sensor glass on the face within 15mm distance, and you can view the LED blinking on each Eye blink.
- The output is active high for Eye close and can be given directly to microcontroller for interfacing applications.

Eye Blink Output: 5V (High) → LED ON When Eye is close. 0V (Low) → LED OFF when Eye is open.

Working: The exact functionality depends greatly on the positioning and aiming of the emitter and detector with respect to the eye. For example, a relatively robust detection of blinking is easy to achieve by arranging the detector so that it is near the eyelid, mounting the detector to the rubber eyecup of an HMD has this effect. Detection of saccadic eye motion is more difficult but is still easier than detection of absolute position, due to the characteristically rapid change in the light reflected from the eye surface during the saccadic jumps.

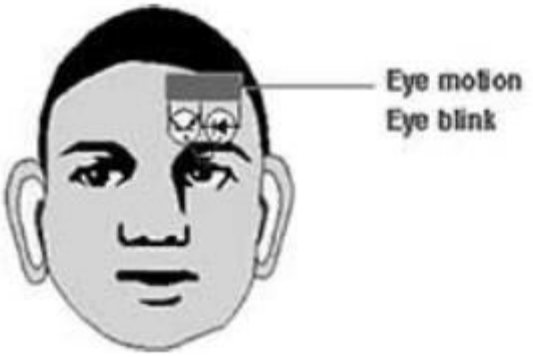

Fig.4. MQ-3 Sensor: The MQ-3 alcohol sensor consists of a tin dioxide (SnO2), a perspective layer inside aluminium oxide micro tubes (measuring electrodes) and a heating element inside a tubular casing. The end face of the sensor is enclosed by a

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stainless steel net and the back side holds the connection terminals as shown in Fig.5. Ethyl alcohol present in the breath is oxidized into acetic acid passing through the heat element. With the ethyl alcohol cascade on the tin dioxide sensing layer, the resistance decreases. By using the external load resistance the resistance variation is converted into a suitable voltage variation. The circuit diagram and the connection arrangement of an MQ 135 alcohol is shown below.

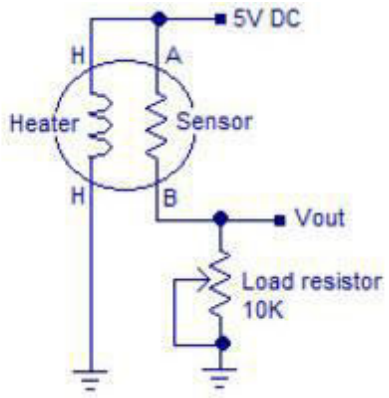

Fig.5. MQ-3 Circuit Diagram.

Limit Switch: In electrical engineering a limit switch is a switch operated by the motion of a machine part or presence of an object. They are used for controlling machinery as part of a control system, as a safety interlocks, or to count objects passing a point.[1] A limit switch is an electromechanical device that consists of an actuator mechanically linked to a set of contacts. When an object comes into contact with the actuator, the device operates the contacts to make or break an electrical connection. Limit switches are used in a variety of applications and environments because of their ruggedness, ease of installation, and reliability of operation. They can determine the presence or absence, passing, positioning, and end of travel of an object. They were first used to define the limit of travel of an object; hence the name "Limit Switch". Standardized limit switches are industrial control components manufactured with a variety of operator types, including lever, roller plunger, and whisker type. Limit switches may be directly mechanically operated by the motion of the operating lever. A reed switch may be used to indicate proximity of a magnet mounted on some moving part. Proximity switches operate by the disturbance of an electromagnetic field, by capacitance, or by sensing a magnetic field. Rarely, a final operating device such as a lamp or solenoid valve will be directly controlled by the contacts of an industrial limit switch, but more typically the limit switch will be wired through a control relay, a motor contactor control circuit, or as an input to a programmable logic controller. Miniature snap-action switch may be used for example as components of such devices as photocopiers, computer printers, convertible tops or microwave ovens to ensure internal components are in the correct position for operation and to prevent operation when access doors are opened. A set of adjustable limit switches are installed on a garage door opener to shut off the motor when the door has reached the fully raised or fully lowered position. A numerical control machine such as a lathe will have limit switches to identify maximum limits for machine parts or to provide a known reference point for incremental motions.

B. Software

The software is used to design and developed is QT creator which is used to make efficient GUI application. Qt Creator is a good example of an application that mixes different user interface technologies. In fact, it uses all of the three different approaches described below. Qt Creator uses the traditional Qt Widgets such as menus and dialogs as a basis of the user interface, Qt Quick amongst others for the welcome screen, and Qt WebKit for presenting the Qt reference documentation.

Qt Creator includes a project manager that uses a cross platform project file format (.pro). A project file can contain information such as what files are included into the project, custom build steps and settings for running the applications. Qt Creator includes a code editor and integrates Qt Designer for designing and building graphical user interfaces (GUIs) from Qt widgets. The code editor can parse code in C++ and QML languages... It is possible to compose and customize the widgets or dialogs and test those using different styles and resolutions directly in the editor.

Raspbian Operating System:

Raspbian is a free operating system based on Debian optimized for the Raspberry Pi hardware. An operating system is the set of basic programs and utilities that make your Raspberry Pi run. However, Raspbian provides more than a pure OS: it comes with over 35,000 packages, pre-compiled software bundled in a nice format for easy installation on your Raspberry Pi. The initial build of over 35,000 Raspbian packages, optimized for best performance on the Raspberry Pi, was completed in June of 2012. However, Raspbian is still under active development with an emphasis on improving the stability and performance of as many Debian packages as possible. The Raspberry Pi primarily uses Linux kernel-based operating systems Raspbian (recommended) – Maintained independently of the Foundation; based on ARM hard-float (armhf)-Debian 7 'Wheezy' architecture port, that was designed for a newer ARMv7 processor (or one with Jazelle RCT/ThumbEE, VFPv3 and NEON SIMD extensions built-in) whose binaries would not work on the Rapberry Pi, but Raspbian is compiled for the ARMv6 instruction set of the Raspberry Pi making it work but run more slowly. It provides some available deb software packages, pre-compiled software bundles. A minimum size of 2 GB SD card is required, but a 4 GB SD card or above is recommended. There is a Pi Store for exchanging programs. The Raspbian Server Edition is a stripped version with other software packages bundled as compared to the usual desktop computer oriented Raspbian.

IV. CONCLUSION

System achieved an accuracy above 90 % for all of the scenarios evaluated, including night time operation. In addition, the false alarm rate in the on-the-road area is below 5 %. Our experiments showed that our head pose estimation algorithm is robust to extreme facial deformations. While our system provided encouraging results, we expect that improving the facial feature detection in challenging situations (e.g., profile faces, faces with glasses with thick frames) will boost the performance of our system. Currently, we are also working on improving the pupil detection using Hough transform-based techniques to further improve the gaze estimation.

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