SLUMBER DETECTION OF VISUAL ACTIVITY USING ARM 9

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Abstract—Slumber detection is to implement the driver attentiveness in cars. The project is to monitor the driver’s eye movement by using webcam and EOG channel respectively. Embedded project is to design and develop a low cost feature which is based on embedded platform for finding the driver drowsiness. Specifically, Embedded System includes a webcam placed on the steering column which is capable to capture the eye movements and EOG placed at the forehead of the Driver to find out the visual activity. If the driver is not paying attention on the road ahead and a dangerous situation is detected, the system will warn the driver by giving the warning sounds and also control the vehicle slowly by applying the break with required time delay.

Index Terms—EOG, WEBCAM, SC32400 (Friendly ARM), GSM MODEM

I. INTRODUCTION

The proposed Project is mainly used to give warning sounds as well as control the vehicle. Embedded System uses ARM9 32-bit micro controller has a feature of image processing technique as well as Analog to Digital Conversion. Image processing is any form of signal processing for which the input is an image, such as a photograph or video frame; the output of image processing may be either an image or a set of characteristics or parameters related to the image. Analog to Digital Conversion is the technique to convert the signals such as analog signals coming from the EOG and convert it into digital signals. Embedded System is going to use S3C2440 based micro controller to process visual information of driver [1].

Slumber Detection is implemented through EOG sensor. This Sensor is placed at forehead of driver used to detect the Visual Information and That Information is transformed to S3C2440 Microcontroller.

A.S3C2440 microcontroller

S3C2440A 16/32-bit RISCmicroprocessor. SAMSUNG’s S3C2440A is designed to provide hand-held devices and general applications with low-power, and high performance microcontroller solution in small die size. To reduce total system cost, the S3C2440A includes the following components.

The S3C2440A is developed with ARM920T core, 0.13um CMOS standard cells and a memory compiler. Its low power, simple, elegant and fully static design is particularly suitable for cost- and power-sensitive applications. It adopts a new bus architecture known as Advanced Micro controller Bus Architecture (AMBA). By providing a complete set of common system peripherals, the S3C2440A minimizes overall system costs and eliminates the need to configure additional components. The integrated on-chip functions that are described in this document include:

1. around 1.2V internal, 1.8V/2.5V/3.3V memory, 3.3V external I/O microprocessor with 16KB I-Cache/16KB D-Cache/MMU
2. External memory controller (SDRAM Control and Chip Select logic)
3. LCD controller (up to 4K color STN and 256K color TFT) with LCD-dedicated DMA
4. 4-ch DMA controllers with external request pins
5. 3-ch UARTs (IrDA1.0, 64-Byte Tx FIFO, and 64-Byte Rx FIFO)
6. RTC with calendar function
7. Camera interface (Max. 4096 x 4096 pixels input support. 2048 x 2048 pixel input support for scaling)
8. 130 General Purpose I/O ports / 24-ch external interrupt source
9. Power control: Normal, Slow, Idle and Sleep mode
10. On-chip clock generator with PL

II. HARDWARE DESIGN OF SLUMBER DETECTION

Fig. 1 Block Diagram

B. Electro-oculography (EOG)

EOG is a usual method for registering eye movement. It is based on the fact that the eye acts as an electrical dipole between the positive potential of the cornea and the negative potential of the retina. In normal conditions, the retina has a bio-electrical negative potential related to the cornea.

Thus, rotations of the ocular globe cause changes in the direction of the vector corresponding to this electrical dipole. The recording of these changes requires placing five dry flat electrodes on the face around the eyes, as can be seen in Figure 1. This figure shows the position and names of each electrode used (VU, VL, HR, HL and REF).

Fig. 2 Electrode Location

Two electrodes are placed on the right and the left of the eyes (HR and HL) to detect horizontal eye movement. Vertical movements of the eyes are detected by two electrodes placed on the top and bottom parts of the eye (VU and VL). The reference electrode (REF) is placed on the forehead. Finally, the ground (GND) is placed on the ear lobe [19].

C. Web cam

A webcam is a video camera that feeds its image in real time to a computer or computer network. Unlike an IP camera (which uses a direct connection using Ethernet or Wi-Fi), a webcam is generally connected by a USB cable, FireWire cable, or similar cable.

Their most popular use is the establishment of video links, permitting computers to act as videophones. The common use as a video camera for the World Wide Web gave the webcam its name. Other popular uses include security surveillance, computer vision, video broadcasting, and for recording social videos.

Webcams are known for their low manufacturing cost and flexibility, making them the lowest cost form of video telephony. They have also become a source of security and privacy issues, as some built-in webcams can be remotely activated via spyware.
III. WORKING

Embedded project is to design and develop a low cost feature which is based on embedded platform for finding the driver drowsiness. Specifically, the project includes a webcam placed on the steering column which is capable to capture the eye movements. The controller keeps logic0 when the driver closes his eyes and keeps logic1 when he opens his eyes. If the controller takes logic0 and logic1 continuously indicates that driver is in active position.

In this system we can find out driver drowsiness by using ARM9 board with less power consumption.

Secondly, The EOG sensor is placed at fore head of a driver to find out visual activity. If the driver is not paying attention on the road ahead and a dangerous situation is detected, the system will warn the driver by giving the warning sounds by connecting the alarm and also control the vehicle slowly by applying the break with required time delay to the micro controller. The ARM 9 32 BIT Microcontroller has a feature of Image processing as well as Analog to digital conversion.

IV. SOFTWARE REQUIREMENT

The System Setup and Configurations like Boot Options, Connecting Peripherals and Setting up Hyper Terminal and also different application Software development like Qt – Embedded, Opencv and Linux.

D. Qt-embedded

Qt is a cross-platform application framework that is widely used for developing application software with a graphical user interface (GUI) (in which cases Qt is classified as awidget toolkit), and also used for developing non-GUI programs such as command-line tools and consoles for servers.

E. Opencv

OpenCV is an open source Computer vision . The library is written in C and C++ and runs under Linux, Windows and Mac OS X. There is active development on interfaces for Python, Ruby, Matlab, and other languages. OpenCV was designed for computational efficiency and with a strong focus on real-time applications. OpenCV is written in optimized C and can take advantage of multi core processors.

F. Linux

Linux refers to the family of Unix-like computer operating systems using the Linux kernel. Linux can be installed on a wide variety of computer hardware, ranging from mobile phones, tablet computers and video game consoles, to mainframes and supercomputers.

Linux is the leading server OS, accounting for more than 50% of installations. Desktop use of Linux has increased in recent years, partly owing to the popular Ubuntu, Fedora, and open USE distributions and the emergence of net books and smart phones running an embedded Linux.

V. EXPERIMENTAL RESULTS

The system was tested on 15 people, and was successful with 12 people, resulting in 80% accuracy. Figure below shows an example result of finding the eyes.

Fig: Slumber detection using arm 9
The drowsiness detection system based on the blinking analysis and correct detections of “very drowsy” states, which corresponds to a level of drowsiness greater. The number of awake states is different from the number of awake states described. Indeed, “awake” means any state classified as 0 or 1 by the expert while, “awake” means states classified as 0 by the expert.

VI. CONCLUSION
The project “Slumber Drowsiness detection of visual activity using ARM 9” has been developed by integrating features of all the hardware components and software 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 ARM9 board and with the help of growing technology the project has been successfully implemented.

We can also identify drowsiness by considering blinking time of eye using camera for continuous monitoring of eye conditions. It can alert and track the location through GSM Modem and also control the vehicle slowly by applying the break with required time delay.

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REFERENCES


