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AUTOMATIC DROWSY DETECTION SYSTEM USING HUMAN BIO SIGNALS

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***Abstract*—Drowsiness detection system is based on identifying suitable driver-related and/or vehicle-related variables that are correlated to the driver's level of drowsiness. The system uses electroencephalogram (EEG) signals. An electroencephalogram (EEG) is a test used to detect abnormalities related to electrical activity of the brain. In this paper a new approach based on bio-signal sensing was used for real time accident avoidance. A embedded system with real time bio-signal processing technique was proposed. The bio-signals sensor module consists of EEG sensor. This procedure tracks and records brain wave patterns. Small metal discs with thin wires (electrodes) are placed on the scalp and then send signals to a computer to record the results.The received real time sensor data is compared with the pre-determined data stored in the processor memory and the decision was taken. This can provide warning to the driver by giving alarm.**

***Index Terms*— EEG,MSP430,ADS1299,CC2540-Bluetooth module.**

I. INTRODUCTION

Drowsiness is transition state between awaking and sleep during which a decrease of vigilance is generally observed. After staying awake for 24 hours straight, a person will be about as impaired as if he had had enough alcohol to be legally drunk in most states, a study says.

In one experiment, participants stayed awake for 28 hours. In the other, they drank alcohol every half hour until they reached a blood alcohol concentration of 0.10 percent. That's the drunken-driving standard in most American states. Every half hour, the subjects took a computerized test of hand-eye coordination. Results showed that after 24 hours of sleeplessness, participants were about as impaired as they were at the 0.10 percent level of blood alcohol. After 17 hours, they were about as impaired as they were with an alcohol level of 0.05 percent, which many Western countries define as legally drunk, the researchers said.

The design of a drowsiness detection system is based on identifying suitable driver-related and/or vehicle-related variables that are correlated to the driver's level of drowsiness. The purpose is to detect an abnormal behavior of the car, due to the driver drowsiness. To overcome these problems, researches have focused on systems using sensors monitoring drivers' awareness.

One widespread technique to monitor the driver state is the use of a video camera. Indeed, a lot of information can be extracted from the driver face to monitor fatigue such as gaze, frequency and duration of eye blinking and yawning or percentage of eyelid closure. A lot of examples using camera to monitor the driver state can be found in the literature. These kinds of systems focus on the drivers' visual attention. Face, mouth and eye tracking algorithms are used to detect the face.

However, many differences can be observed between drivers, which makes it hard to monitor fatigue with only one feature . An interesting way of merging the different features is used by Jietal. They use probabilistic networks which allow all features to contribute to the decision of the level of attention. Moreover, external factors contribute in these networks to determine the level of attention.

The electroencephalogram (EEG) and the electro-oculogram (EOG) are mainly used to study drowsiness. Yet, several researches have focused on other physiological indicators such as the electrocardiogram (ECG) to monitor drivers' heart rate or the drivers' temperature.

Electroencephalography measures the electrical activity of the brain from electrodes placed over the scalp. Drowsiness appears into the EEG spectrum by an increase of activity in the frequency bands predominantly in the parietal and central regions of the brain. In the same time, a decrease of activity in the band can also be observed, as beta activity increases.

II. SYSTEM DESIGN

The system consists of an transmitting section and a receiving section. The transmitting section consists of EEG sensor,ADS1299,MSP430G2553 ,Power source and a CC2540 Bluetooth module. The receiving section consists of TIVA C Series ,CC2540 Bluetooth module, Clock source and PC. The signals from the EEG sensor is fed to ADS1299 for A/D conversion and given to msp430 for further processing.

2.1 HARDWARE:

The general hardware structure of the transmitting and the receiving section of EEG system is shown in the fig1 & 2.

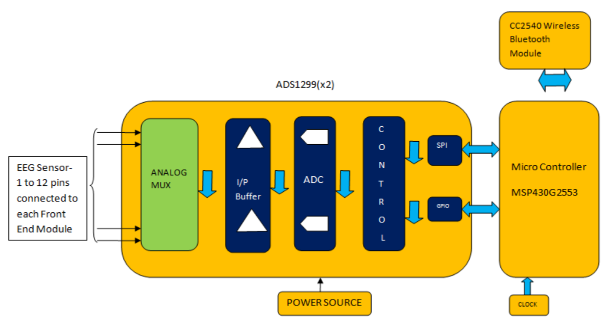

Fig1: EEG Transmitter Unit

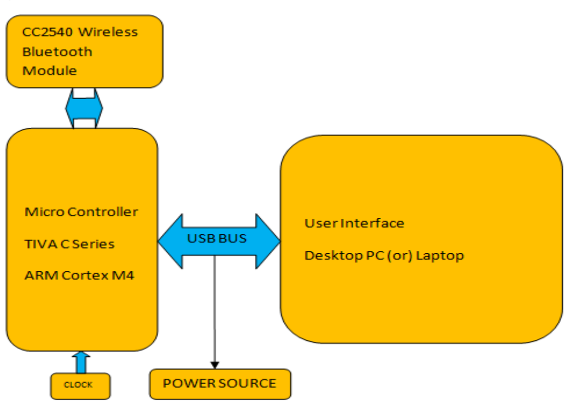

Fig 2: EEG Receiver Unit

The system consists of an EEG which records of electrical activity along the scalp. The signals from EEG is fed into the ADS1299 for analog to digital conversion. ADS1299 is a low noise, multi-channel,24bit delta sigma ADC with built in programmable gain amplifier. The ADS1299 enables the creation of medical instrumentation system at reduced size, power and overall cost After the A/D Conversion it is fed into MSP430 for further processing. The drowsiness signals are captured and the values are stored as a database in MSP430. That value is compared with the signal which is captured and alarm signal is given when the signal matches.

2.2 SOFTWARE

CCS 6.0.1 Studio

Code Composer Studio is an integrated development environment (IDE) that supports TI's Microcontroller and Embedded Processors portfolio. Code Composer Studio comprises a suite of tools used to develop and debug embedded applications. It includes an optimizing C/C++ compiler, source code editor, project build environment, debugger, profiler, and many other features. The intuitive IDE provides a single user interface taking you through each step of the application development flow. Familiar tools and interfaces allow users to get started faster than ever before. Code Composer Studio combines the advantages of the Eclipse software framework with advanced embedded debug capabilities from TI resulting in a compelling feature-rich development environment for embedded developers.

ALLENGERS VIRGO

Allengers Virgo series of EEG test systems are designed using state-of-the-art technology and more than 25 years experience in design and manufacturing of medical equipment. Advanced digital signal processing and brain mapping techniques are highlights of Allengers EEG.Facility to send EEG data through e-mail. Light weight and compact amplifier comfortable for adults and children.USB 2.0 Ethernet interface enables Desktop or laptop based acquisition stations. Synchronized high-resolution MPEG-4 video. Flexible Photic Stimulator based on high intensity LEDs.

III. ALGORITHM

Step1: Include the header file.
Step2: Initialise all the variables .
Step3: Stop the watchdog timer

Step4: Set the crystal oscillator to 16MHZ.
Step5: Set the direction registers for port 1 and port 2.
Step6: Select the bits 1,2,5,6,7 for spi communication.
Step7: Initialise USCI state machine and set the baud rate to 9600
Step8: Set all the values for enabling ADS1299.
Step9: The values of drowsiness is captured and stored as a database in MSP430.
Step10: when a person is feeling drowsy the values generated will be compared with the stored value.
Step11: If it matches then alarm will be issued to alert the driver.

IV. RESULTS

The hardware implementation is shown in Fig 3. The system consists of a MSP430 and ADS1299. The signals from EEG is given to ADS1299 and from there to msp430 after ADC operations.

Fig 3: ADS1299 withMSP430.

Status Bits	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
FFFFFFFFF	000009AD	000008C2	000009C2	907	0000095C	956	000009AE	9.0
FFFFFFFFF	000009AA	000008C2	000009C4	0000090A	0000095C	955	000009A8	9.0
FFFFFFFFF	000009AD	000008C3	000009C3	909	0000095C	952	000009AA	9.0
FFFFFFFFF	000009AB	000008C3	000009C0	908	0000095F	951	000009AA	9.0
FFFFFFFFF	000009AD	000008C4	000009BD	907	0000095C	951	000009A9	9.0
FFFFFFFFF	000009AE	000008C6	000009BE	907	0000095A	955	000009AC	9.0
FFFFFFFFF	000009A9	000008C5	000009C4	909	0000095B	952	000009AA	9.0
FFFFFFFFF	000009A9	000008C5	000009C2	0000090A	0000095C	952	000009AB	9.0
FFFFFFFFF	000009AA	000008C5	000009C0	0000090C	0000095C	952	000009A9	9.0
FFFFFFFFF	000009AB	000008C6	000009C2	0000090B	0000095A	950	000009AB	9.0

Fig 4. Generation of ADS values

The device through which the brain waves are detected using the electrodes placed on the scalp

Fig 4. Electrode placement

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