Design and Development of Warning System for Drowsy Drivers

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Abstract- A Real-Time accident prevention system has been proposed in which the drowsy condition of the driver can be detected and appropriate action will be performed for each condition automatically. There are different ways to detect drowsiness one of them are using camera that points directly towards the driver's face and monitors the driver's eyes in order to detect fatigue. We have developed a drowsy driver detection system using Brain Computer Interface ,the system deals with EEG Signal obtained from the brain ,when rhythms are plotted on PC we can see the fluctuations of rhythms when subject is falling to drowsy or deep sleep in accordance with a appropriate voltage under normal condition and drowsy condition are read on software application, using these voltage under two states we have developed a warning tone for drowsy driver .However, the current BCI system is developed to detect the drowsiness ,cognitive state and when drowsy state arises a warning tone is generated to alert the driver from the drowsy state .

Index Terms- Brain Computer Interface, Cognitive,Drowsy,EEG,Warning System

I. INTRODUCTION

The Technology made shrink down everything , in concern in the field of Automation the automobiles has tremendously grown up every year & in accordance with this road accident also grown up due to drowsy driving , Although advance technology in transportation researchers ensuring safety, however the safety of a vehicle is an important task for automotive industries & researchers .Warning tones for preventing accidents is one of the design of safety systems, these warning tones for preventing accidents is an attracting in the public [2]. In concern safety is first priority for the public, several people are dead and some are seriously injured due to drowsiness, 55- 60 % related to drowsiness causing serious accidents on the roads, falling to drowsy drivers losing their abilities in controlling vehicles. in such cases the driver encounter to accidents, therefore it is essential to develop a warning tone when driver falling into drowsy for preventing drowsy accidents. There are many methods which have been developed warning tones and being used for drowsiness detection by means of physiological parameters like pulse rate, eyelid movement and head movement , perhaps current technologies have developed and implemented eye blinking, eye closure and head movement for monitoring alertness. The main aim of the project is to develop a prototype of warning tone for drowsy drivers, the focusing point in the design is monitoring drowsier in the form of voltage levels of EEG signals of both under normal condition and drowsy condition ,two voltage levels are taken as reference & warning system is developed which is enough to avoid a car accident in drowsy condition.

II. RELATED WORK

Many Techniques developed to analyze the driver drowsiness [9]-[11]. In this paper the driver drowsiness & warning tone is based on the monitoring changes in the human cognitive state & provide biofeedback to the driver when drowsy state arises [13]-[15] . In this study a real time drowsy detection algorithm is developed and most previous case for EEG based drowsy detection is designed and developed, a detection and alert model for all subjects. Although these models may not be able to predict accurately in the cognitive state. The subject dependent system shows variations in EEG Spectra, due to different factors such as electrode displacement, skin electrode impedance and external noises, the EEG spectra in theta rhythm reflects the changes in the cognitive state these changes motivated us to develop warning system based on EEG Spectra [7] in theta rhythm with variations in the voltage levels for different EEG spectra.

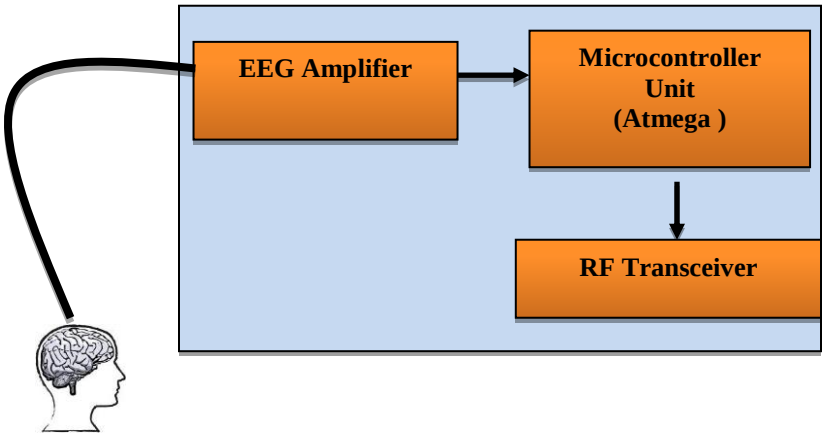

Figure 1: Data Acquisition Unit

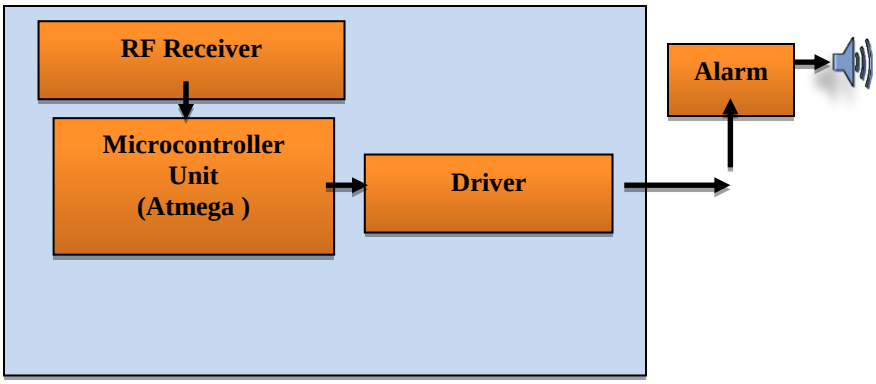

Figure 2 : Data Processing Unit

The EEG data obtained from the EEG electrode, and then amplified by EEG Amplifier which operates at +/- 5v is instrumentation amplifier. The programmed interrupts to controller unit are send to optoisolator circuit which take switching action for both normal and drowsy condition later data send to the Driver circuit to drive the data to alarm, soon after receiving the EEG Data, it will be monitored and analyzed by our drowsiness detection algorithm. If the drowsy state of the driver is detected, a warning tone will be triggered to alarm the driver.

The proposed algorithm comprises of 2 stages, the first stage is EEG data processing which includes capturing raw EEG voltages under normal & drowsy condition and data processing over the controller. The second stage is capable of judging drowsiness and warning system, 7.5 Micro Volts are considered as the normal condition i.e. wake up state & above 10 Micro Volts is considered as drowsy condition, during the experiment we monitored the variations in brain rhythms in both cases i.e normal & drowsy condition. In the final stage we programed the controller to respond when 7.5 Micro Volts as an interrupt when drowsy arises it is read as normal & displayed on LCD and when it is in drowsy condition i.e 10 Micro Volts set as drowsy when above 10 Micro Volts subject falling to drowsy & buzzer triggered to alarm to alert the driver.

III. PROPOSED ALGORITHM

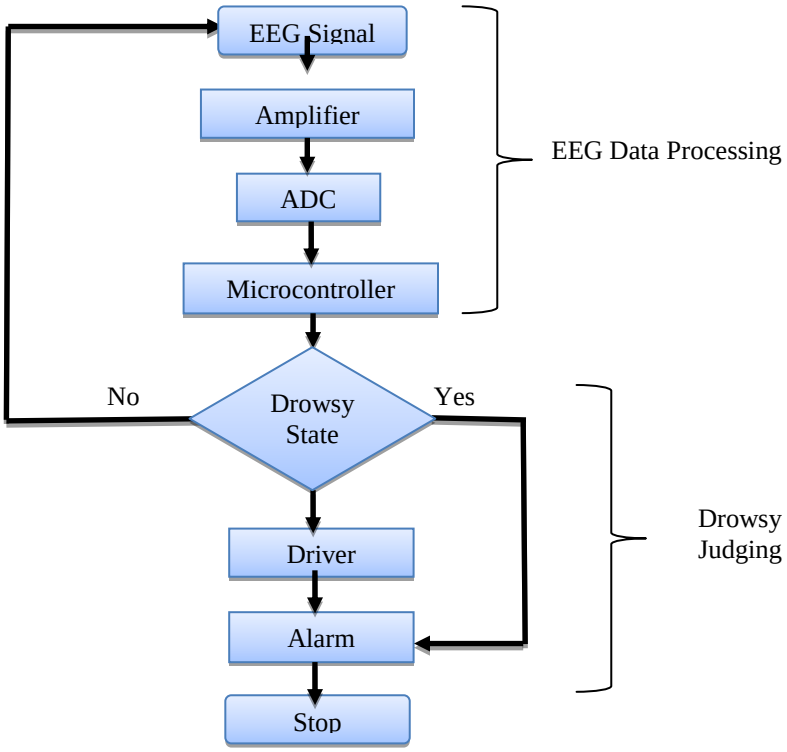

Figure 3: Proposed Algorithm

In the above figure 3, the first stage is EEG data processing which is done by using 3 electrodes in that 2nd electrodes placed on frontal lobe & 3rd electrode to ground , these three electrodes connected to EEG Amplifier and the output is given to PC and noted down the voltage for each rhythm. The second stage is the drowsiness, the appropriate amplitude levels are read on the software application , this window is scaled to detect the behavior of brain rhythms under different condition. The Final stage is warning System, Similarly the voltage levels are captured from the EEG Software Application. To detect the drowsy condition we first detect the normal state and cognitive state. We have connected the electrode to subject head, start recording the brain rhythms. The next step is to capture the voltage levels in accordance with fluctuations in brain rhythms [6], monitoring both values after 7.5 Micro Volt driver failing to drowsy state slowly, when driver is completely under drowsy state. i.e 10 Micro Volts are recorded and above this state 10 Micro Volts are sleepy state and alarm is triggered to alert the driver from drowsy.

IV. RESULTS & DISCUSSIONS

1.Experiment Design

To verify the Feasibility of our proposed warning system for drowsy driver, an experiment is designed for testing here a car is suspended on strong base so that the car can take a motion, the signals from the electrodes travel to the high frequency filter this removes radio frequency noise picked up on the electrode wires. The instrumentation amplifier amplifies the difference of the two electrodes and sends that as a driven signal to the analog to digital converter. The controller we used is AT89C52 which is a low-power, high-performance CMOS 8-bit microcomputer with 8K bytes of Flash programmable and erasable read only memory (PEROM). The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 and 80C52 instruction set and pin out.

Figure 4: Experimental Setup

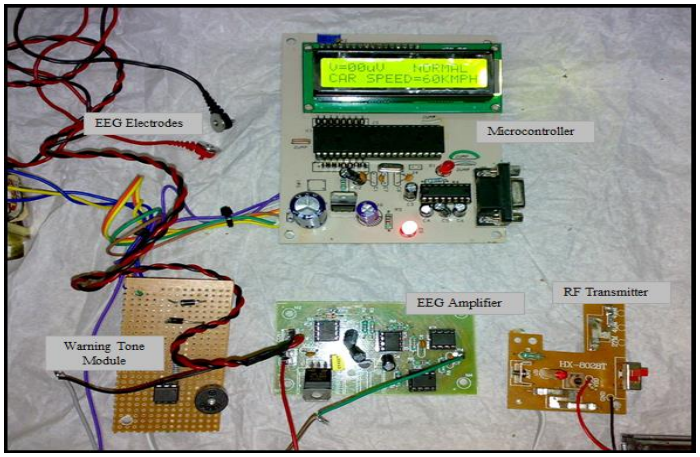

Figure 5: Hardware Setup

The AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional.

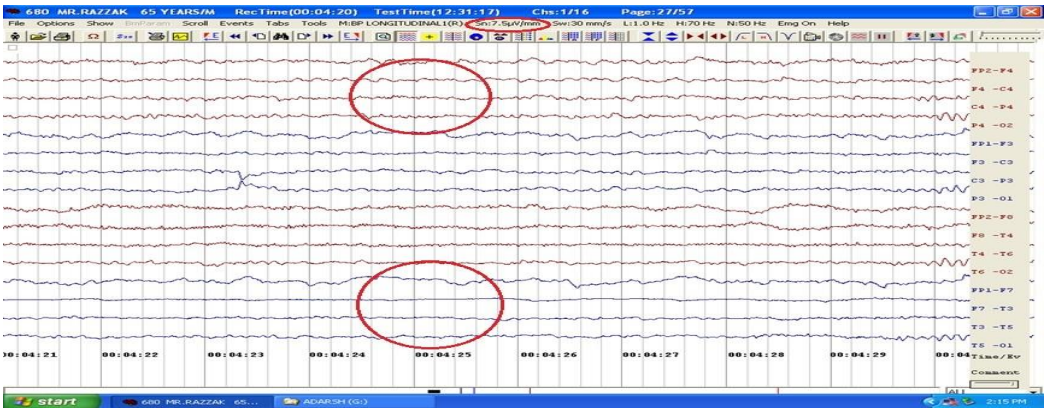

Figure 6: Brain Rhythms Under Normal Condition

the electrodes used is about 23 channel electrode , the application enabled with frequency reading, voltage reading , and recording the rhythm , Rhythm are grouped by frequency amplitudes are about 100µV max, in general the above picture rhythm's captured in normal position , the subject is 65 yr's old , the picture replicates that under normal condition the rhythms are reading normal condition here by we can see rhythm's under normal condition it is showing as 7.5 micro volts .

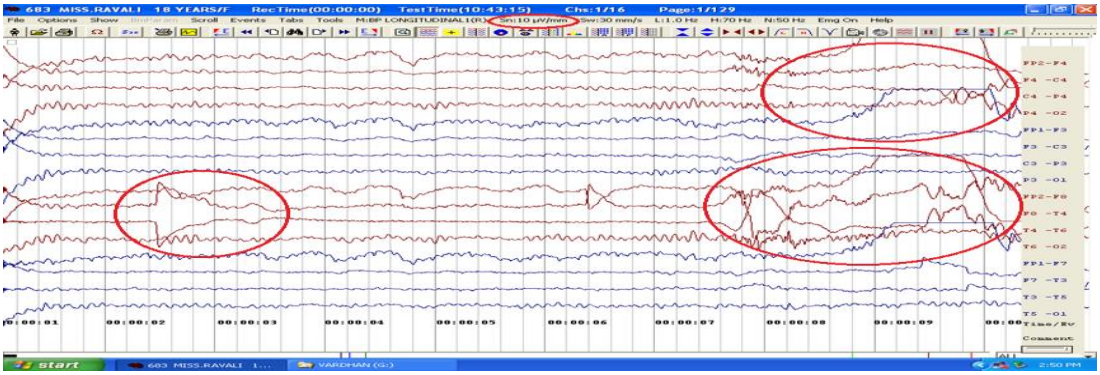

Figure 7: Brain Rhythms Under Drowsy Condition

The above picture rhythm's captured in normal position , the subject is 18 yr's old , the picture replicates that under normal condition the rhythm's are reading normal condition here by we can see rhythm's under Drowsy condition it is showing as 10 micro volts .

Figure 8:Working Model of Hardware under Drowsy

The Fig 8 depicts the experimental setup of warning system under and Drowsy condition. The Data transmission from Car and the module is carried out with RF Transceiver with 42 MHz High Frequency . the two voltages fluctuate from high and low (under drowsy and normal condition) are connected to optoisolator, during normal condition the behavior of the optoisolator isolate to a logic 1 state and during drowsy condition optoisolator isolate to logic 0, an appropriate warning is triggered automatically under drowsy and normal condition.

V. Conclusion

The Non-invasive System is to localize the brain rhythms and monitor the drowsiness, we developed the Warning System for drowsy drivers. During monitoring the system is able to judge the variations in rhythms in accordance with the voltage under normal & drowsy condition. When a driver is drowsy above the voltage variations is up to 10 Micro Volts in theta rhythm, an alert signal is triggered to alert the driver. This technology is completely accident prevent system & highly secured this can be used for transportation, as it is wired communication from brain to external devices, sometime driver may feel disgust in continuously wearing the electrodes .

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