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The Brain Signal Detection for Controlling the Robot

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ABSTRACT

This project discussed about a brain controlled robot based on Brain–computer interfaces (BCI). BCIs are systems that can bypass conventional channels of communication (i.e., muscles and thoughts) to provide direct communication and control between the human brain and physical devices by translating different patterns of brain activity into commands in real time. With these commands a mobile robot can be controlled. The intention of the project work is to develop a robot that can assist the disabled people in their daily life to do some work independent on others.

Keywords — EEG Sensor, BCI – Brain Computer Interface, Robot movement, RS232, Relay Driver, Communication Module, Embedded Platform.

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I. INTRODUCTION

In this Project we are analyzing the brain wave signals. Human brain consists of millions of interconnected neurons. The patterns of interaction between these neurons are represented as thoughts and emotional states. According to the human thoughts , this pattern will be changing which in turn produce different electrical waves. A muscle contraction will also generate a unique electrical signal. All these electrical waves will be sensed by the brain Wave sensor and it will convert the data into packets and transmit through Bluetooth medium. Level analyzer unit (LAU) will receive the brain wave raw data and it will extract and process the signal using Matlab platform. Then the control commands will be transmitted to the robotic module to process. With this entire system, we can move a robot according to the human Brain Wave Electroencephalography (EEG) is the measurement of electrical activity in the living brain. In this project we used a brainwave sensor MW001 to analyze the EEG signals . This design discuss about processing and recording the raw EEG signal from the Mind Wave sensor in the MATLAB environment and through Zigbee transmission control commands will be passed to the Robot section. Mind wave sensors are not used in clinical use, but are used in the Brain Control Interface (BCI) and neuro feedback (one of biofeedback types). The BCI is a direct communication pathway between the brain and an external device to provide direct communication and control between the human brain and physical devices by translating different patterns of brain activity into commands in real time.

The existing system is not having any remote control operation, Depend on others to operate and No muscle contraction sensing and the proposed system is having the Brain wave analysis for the signal which are taken from the human brain as shown in the block diagram, is having controlling of the robot using Human thoughts, Self controlled and operating facility for not to depend on others to operate and having Bluetooth communication between the operating system and brain wave sensor.

II. BLOCK DIAGRAM

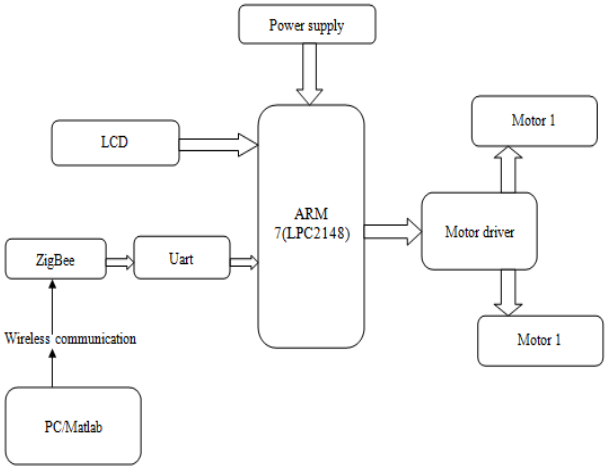

Figure 1.Block Diagram

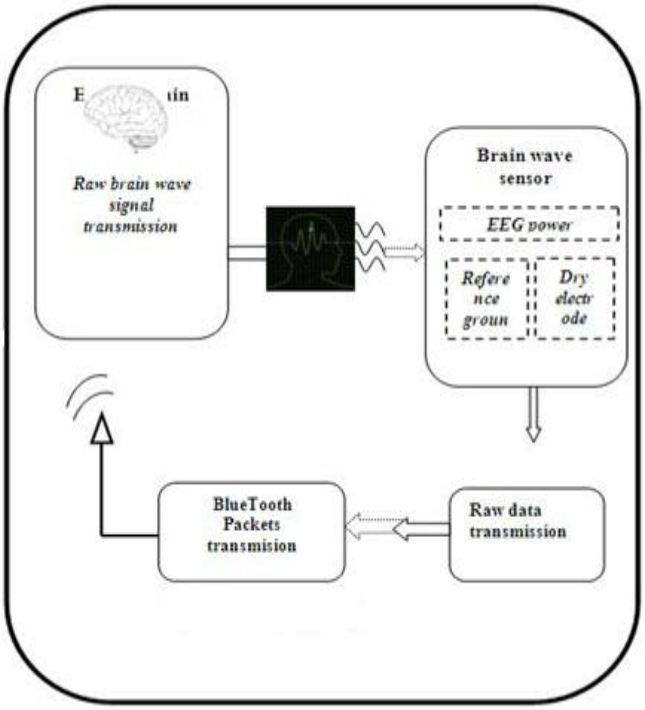

Fig a: Brain computer interface section

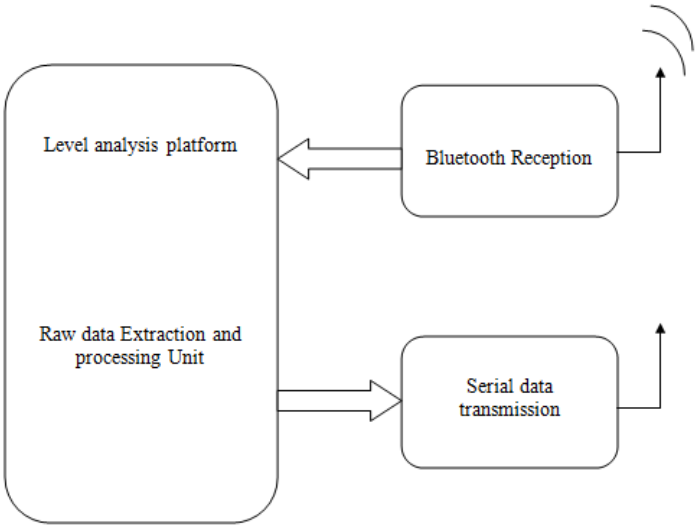

Fig b: Data processing unit

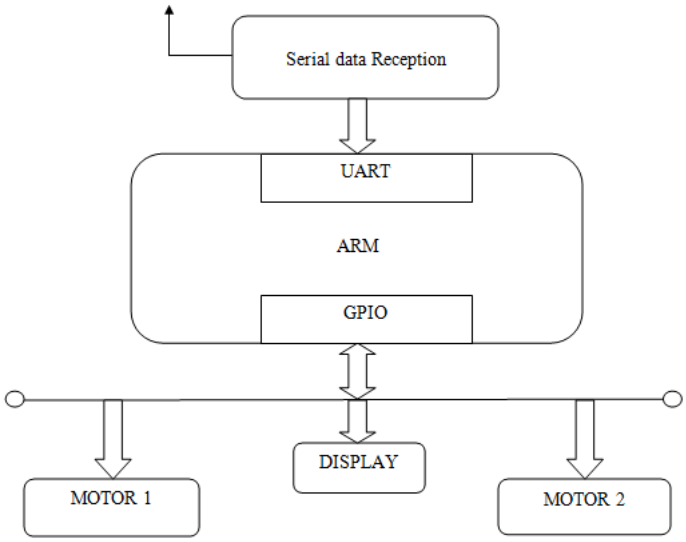

Fig c: Robot Unit

III.DESIGN AND IMPLEMENTATION

This project uses two important platforms. 1. Coding Platform and 2. Execution Platform. These platforms are discussed below

1. Coding Platform: In this project a brain computer interface system is used which will do the key role in the entire operation. For the BCI system, we are using the MATLAB and for brain wave sensor and Processor communication neurosky is used.The BCI will process in the following way. For calculating the blinking levels we need to use a brain wave sensor support a neurosky product which is called mindo4 initially we have to take the data from the brain by using neurons position and should store in the brain wave sensor.The supportable sensor in the

MATLAB is given in the form of the following data function.

connectionId1 =calllib('Thinkgear','TG_GetNewConnectionId');

Initially we need to check that sensor is connected or not. The mind wave sensor software will provide the information about the sensor connection. If the sensor is connected we are entering in to the MATLAB section for checking the blinking levels of person.

Once the blinking levels will calculated it will be send to MATLAB. Whenever MATLAB reads an blinking values it will convert into digital values because for micro controller understanding purpose the values should be in digital format. After calculating the blinking values, we need to check whether it will cross the set point in the database. As an acknowledgement we will get the following help dialogue.

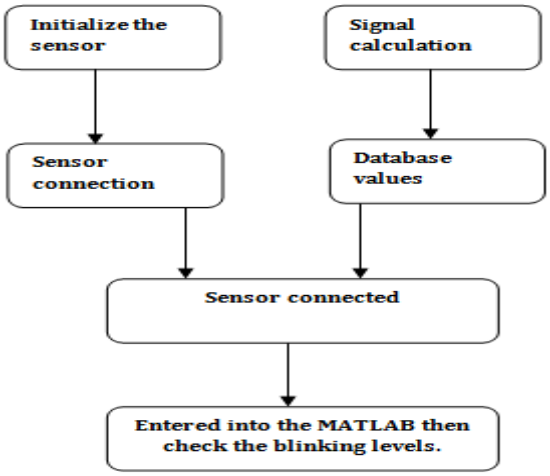

Fig d: BCI Software architecture

```
if(data_BLINK (j) > 90)
        if(Drive mode == 1)
        fopen(serial One);
        fwrite (serialOne,'Q');
        fclose (serial One);
            End;
```

Then pre-processing will be done within the blinking levels and the database values which involves, Similarity checks and probability finding. Here similarity checking is nothing but the comparison between two blinking values by calculating the change between the input and data base values. Then the result will be shown on the MATLAB.

```
if(data BLINK (j) > 90)
%           if(Drive mode == 1)
            fopen (serial One);
            fwrite (serialOne,'Q');
            fclose(serial One);
%           end
        end
```

Drowsiness, eyes open and eyes closed are closely connected to alpha activity. once sleepiness forces the eyes to shut, alpha waves are strongest encephalogram brain signals have reported that in sleepiness state alpha activity mainly seems in os space and particularly magnitude of alpha2 wave like a better alpha band (11~13Hz) increases. However, supposing traditional adults have their eyes open notwithstanding they drowse, alpha changes of can't be explain one thing logically.

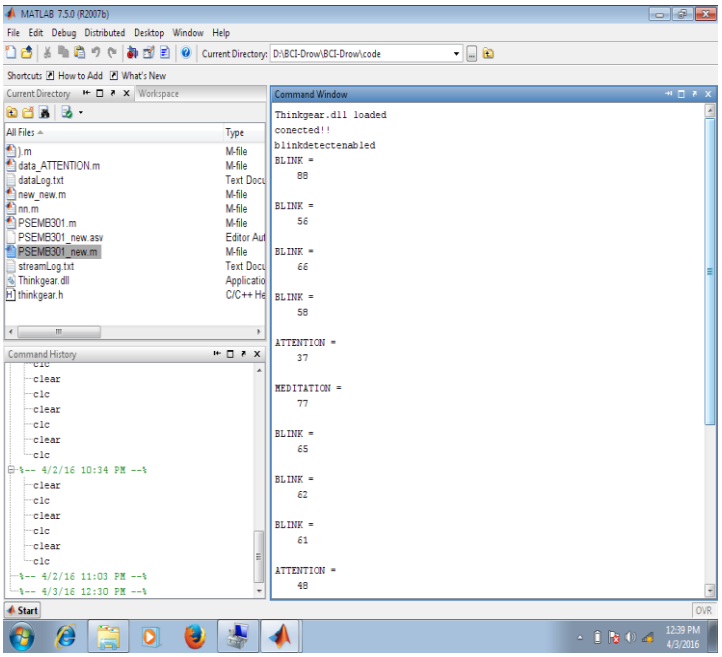

Fig e: BCI running image

2. Execution Platform:

This half consists of ARM core processor as a main unit, Brain wave device system, Ignition unit, PC, alert section and a shown unit. This modules with coming up with and implementation technique is given below. ARM processor is employed for dominant the system. Here we have a tendency to square measure victimization the LPC2148 series, which has 2 UART. In UART0 we'll interface the GPS receiver to induce the orbital info and in UART1 we will interface the computer for image process. Then the ignition driver circuit is connected to the GPIO pin of ARM. Interrupt routine code is employed to visualize whether or not we have a tendency to have gotten any serial interrupt (i.e.,) from owner any command is returning or not. For this project we have a tendency to square measure having some interrupt checking commands 'Q' and 'X'.The interrupt routine code for command checking is given within the column below. Once ARM processor receives a command 'Q' through
UART1, then the processor can move the motive force circuit. Attributable to this the engine is going to be move instantly. Next, if the processor receives a command 'X', then UART0 receiver interrupt is going to be enabled. So, this worth within the information base can compare mechanically the motive force management unit can stop. This interrupt routine code is going to be checked by the processor endlessly that will increase the potency of the

project. These interrupt checking technique must tack the vector address. that the vector address configurations for each UART square measure given below. The Vectored Interrupt Controller (VIC) takes thirty two interrupt request inputs and directly programmable assigns them vectored IRQ. VICIntSelect may be a register that have the management of all interrupt registers. As we have a tendency to square measure victimization the UART0 interrupt and UART1 interrupt we've to simply modify the sixth and seventh little bit of the VICIntSelect register. When facultative for every interrupts separate slot ought to be enabled for process. thus whenever associate interrupt is returning from the device, then ARM processor will directly jump to the interrupt routine to process the command.. due to this facility ARM will handle the various interrupts from the device and might do the individual functions with none fault.

IV. WIRELESS PLATFORM

3.1 BCI system:

The main purpose of the current chapter is to review recent advances within the EEG field. to grasp these developments it'll initial be necessary to detail the physiological basis of the EEG signal. After, vital problems related to knowledge acquisition, signal process, and quantitative analyses are going to be mentioned. the most important portion of the chapter are going to be dedicated to reviewing rising supply localization techniques that are shown to localize EEG activity while not postulating a priori assumptions concerning the amount of underlying sources. As we are going to discuss, maybe the best advancements within the EEG field within the last 5-10 years are achieved within the development of those localization techniques, especially once utilized in concert with high-density EEG recording, realistic head models, and different purposeful neuro imaging techniques. The time unit temporal resolution of electroencephalogram permits scientists to analyze not solely fluctuations of electroencephalogram activity (i.e., increases/decreases) as a operate of task demand or subject samples however conjointly to differentiate between practical repressive and excitant activities. Low frequencies (e.g., delta and theta) show massive synchronal amplitudes, whereas electroencephalogram frequencies (e.g. beta and gamma) show tiny amplitude owing to high degree of asynchrony within the underlying somatic cell activity. In adults, the amplitude of normative electroencephalogram oscillations lies between ten and a hundred (more ordinarily between ten and fifty; Niedermeyer, 1993). Within the following section, a quick review of varied electroencephalogram bands and their supposed practical roles are going to be given. The review of the muscular and physiological basis underlying the generation of varied electroencephalogram oscillations.

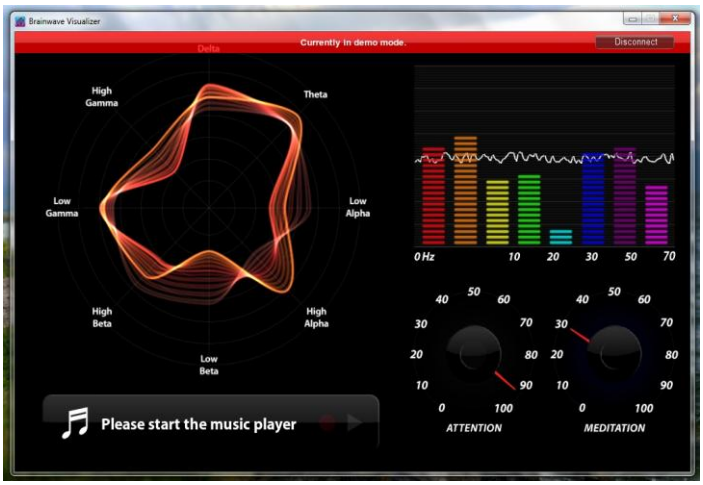

Fig f : Sensor status indicator

V. DESIGN FLOW

The flow diagram of Brainwave Controlled Robot unit is shown in figure. It shows all the step by step functions of robot, how it will be controlled by using brainwave signals. After Switching on the Brainwave headset and the Robot kit, the processor will initialize and the headset will starts sensing the neurons signals and after sensing the signals it will transfer them to through the Bluetooth and the acquisition module will receive the signals in the processor and in the processor the EEG signals comparison will be done if it is yes then the robot will move according to the signals or else it will go to the relay circuit and robot movement will be there and the process will be stopped.

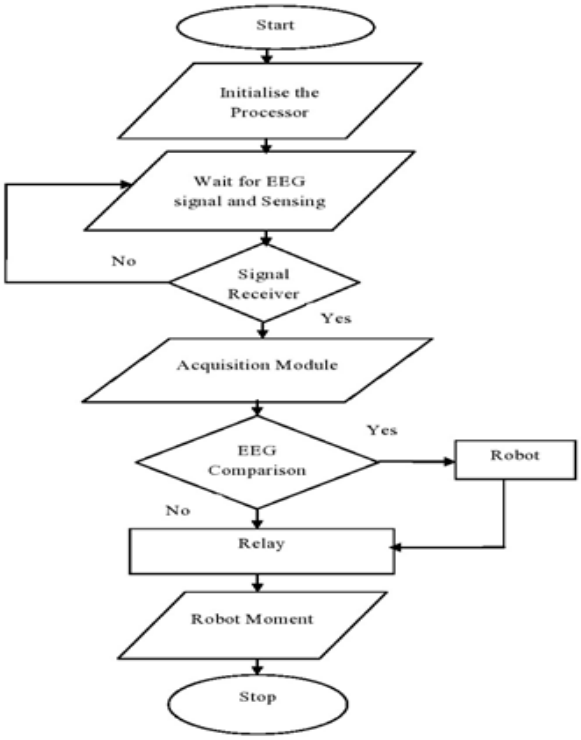

Figure : Flow chart

VI. Result And Analysis

The research and development of brain-controlled mobile robots have received a great deal of attention because they can help bring mobility back to people with devastating neuromuscular disorders and thus improve their quality of life. In this paper, we presented a comprehensive up-to-date review of the complete systems, key techniques, and evaluation issues of brain-controlled mobile robots. After implementing the Mindwave Controlled robot I've checked the results with NeuroSky headset, as I expected the headset doesn't give the 100% accuracy of brainwaves but it is too good for its price and it can give up to 95% accuracy of brainwaves. After installing all the Neurosky software's in PC, after connecting the Headset with PC through PC using Bluetooth, we need to wear the headset to the head and then we need to open the Matlab Code and run the program, after clicking run the program in the command window of matlab it will show the brainwave is connected and blink is detected and after that it will show the attention values and Blink values which is shown in figure 8 and figure 9.

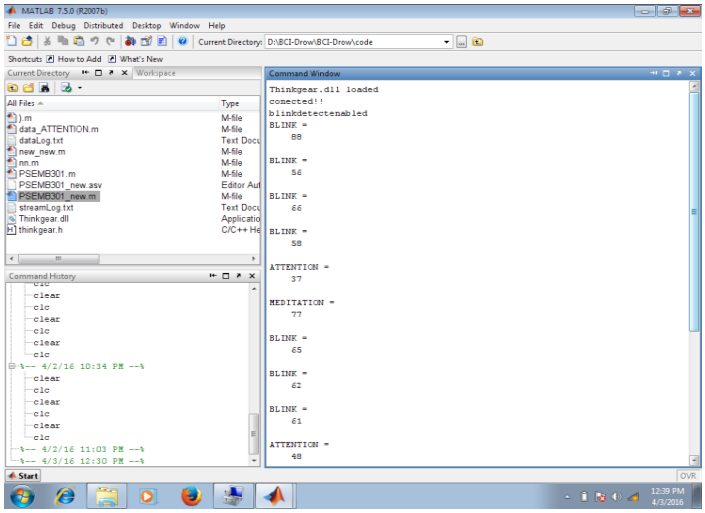

Figure 8 : Screenshot of Attention level and Blink level

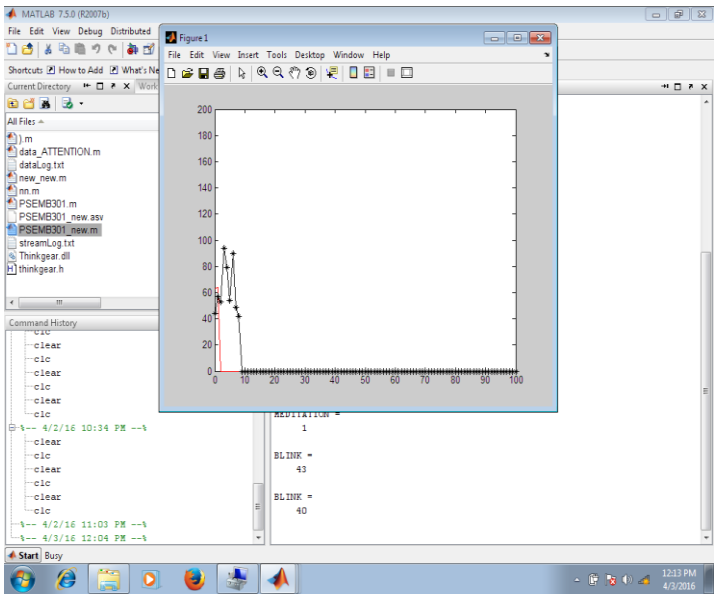

Figure 9: Screenshot of Graph (Black: Blink level, Red: Attention level)

After getting these attention and blink values a graph will be generated and In the graph there will be two signals, the Black Signal is Blinking level and the red signal is Attention signal shown in figure 9. From here these signals will be transferred to the Robot through Zigbee wireless transmission, the signals will be collected by Zigbee receiver and sends to the processor, the processor decodes the signals as per Brainwave signals and according to the signals the Processor gives the commands to the motor wheels of the robot, according to the signals the robot will move forward, right and left and the robot is self controlled.

VII. Conclusion

The research and development of brain-controlled mobile robots have received a great deal of attention because they can help bring mobility back to people with devastating neuromuscular disorders and thus improve their quality of life. In this paper, we presented a comprehensive up-to-date review of the complete systems, key techniques, and evaluation issues of brain-controlled mobile robots.

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