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Virtual Helper Bot For Mind Controlled Wheel Chair

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***Abstract*—— This paper presents the virtual helper bot for mind controlled wheel chair with speech interpretation and recognition interface for the physically challenged people. The design, architecture and a system concept to provide a smart electronic aid for physically challenged people are proposed here. The objective of this paper is to provide an efficient bot that answers simple technical and general questions using a Speech Interpretation and Recognition Interface (SIRI) . The bot is attached to a Mind Controlled wheel chair that operates by processing of the Mind Wave signals. This enables to provide virtual assistance to the disabled person using it.**

The proposed device uses an electro-encephalography (EEG) kit to interface the signals from the brain. This EEG signal is then read by the NeuroSky Mind Wave Reader to detect blink, attention and meditation level which are further used to drive the wheelchair. The Query Search Module is implemented using an Artificial Intelligence Interface and a USB Microphone. The prototype consists of a wheel chair with Arduino board, sensors and Raspberry Pi development board. The proposed wheel chair helps the physically challenged people to overcome mobility impairment

***Keywords*: Arduino Controller,Micro controller, Raspberry Pi, Electro-Encephalography**

I. INTRODUCTION

Technological advances in every sector have become too conspicuous to go unnoticed. Harnessing the power of technology to create & scale social change is the responsibility of every individual in this field today. One such important factor that requires our attention is the challenges of the differently abled. People with disabilities meet barriers of all types. However, technology is helping to lower many of these barriers. Mobility Impairment is one of the most obvious issues the disabled people face today. The existing technologies definitely make it easier for them to move about. However, many features that are required by these people in their day to day lives have still not been incorporated in these existing systems. It has great scope in many fields and can add a variety of features in existing mind controlled wheel chair models.

The proposed system provides an efficient bot that answers simple technical and general questions using a Speech Interpretation and Recognition Interface (SIRI) and provides virtual assistance to the physically challenged people.

This Wheel chair can be used in hospitals and old age homes for semi paralyzed and mute people to move.

METHODOLOGY

In order to achieve the goal, the work has been categorized as follows:

Helper Bot

- Convert voice to text using stt engine
- Use the text for initiating a query / action
- The query is send to Wolfram Alpha computational engine
- The data is received and output using tts engine

Mind controlled wheel chair

- The BMI collects data based on the thoughts
- The data is send to a microcontroller
- Based on the experimental values action is started
- Complete the requested action by controlling the motor using microcontroller

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II. BLOCK DIAGRAM

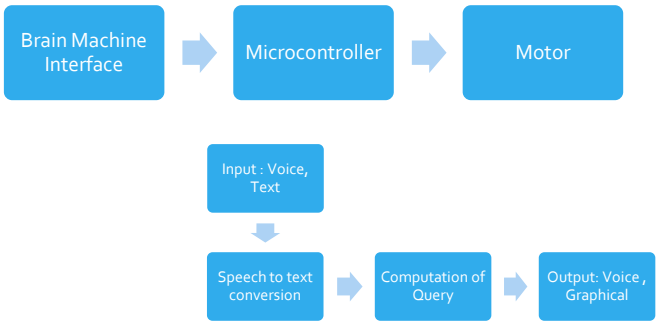

Fig 1 Block diagram of module.

Figure 1 shows the block diagram of helper BOT along with mind controlled wheel chair. The proposed system aims to control two motors using relays that function according to the outputs of the microcontroller. This microcontroller takes inputs from the Mind Wave Reader and using the code written in Arduino it processes the EEG signals to detect blink, attention and meditation level which are further used to drive the wheelchair.
The Query Search Module is implemented using an Artificial Intelligence Interface and a USB Microphone. This entire system uses 9V battery for Arduino unit, 1.5 V battery for Raspberry Pi Unit and a power bank for . Such low power requirements make this system easily portable and efficient.

THE MIND WAVE MOBILE

The Mind Wave Mobile measures and gives EEG power spectrums (such as alpha waves, beta waves, etc), NeuroSky eSense meters (attention and meditation) and eye blinks as outputs. This device incorporates a headset, an ear-clip, and a sensor arm as shown in figure 2. The ear clip is mounted with headset's reference and ground electrodes and an EEG electrode is mounted on the sensor arm which rests on the forehead above the eye (FP1 position). It can be operated with a single AAA battery having 8 hours of battery life.

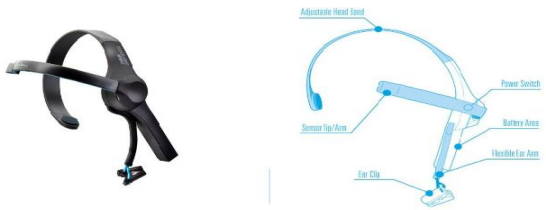

Fig 2 Nuero Headset

ARDUINO

Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. In simple terms, the Arduino is a tiny computer system that can be programmed with your instructions to interact with various forms of input and output.
The Arduino Uno is an ATmega328P microcontroller board having 14 digital input/output pins. 6 pins may be used as PWM outputs, 6 pins for analog inputs. It has a 16 MHz ceramic resonator, an USB connection, a power jack, an ICSP header, and a reset button. It can be easily connected to computer with an USB cable. It can be powered with an AC-to-DC adapter or battery.

HC-05 BLUETOOTH

A HC-05 Bluetooth module is used to communicate between the mind wave mobile and Arduino. This module has 6 pins out of which two pins are used for power supply, Vcc and Ground. The pins Tx and Rx are used to transmit and receive the data between Arduino and Bluetooth module. The I/O pin number 34 (Key pin) is used for programming the Bluetooth module. Transparent data mode and AT command mode are two programming modes. The pin details of the Bluetooth module are shown below in Figure 3.

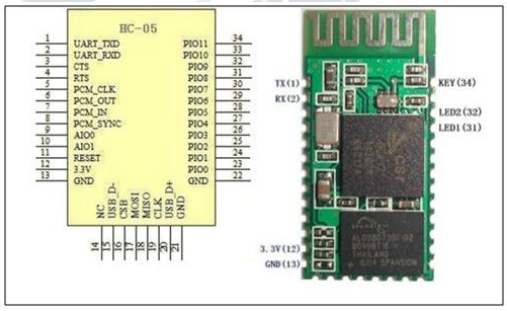

Fig 3 HC-05 Bluetooth chip

III. WORKING PRINCIPLE

The proposed EEG-based wireless brain wave system is shown in Figure 4.
The hardware of this system consists mainly of two major parts: a wireless physiological data acquisition module and an embedded signal processing module. In this proposed work , Brain- Computer Interface (BCI) technology is used to analyze the mental activities of brain using EEG signals . The key work of this paper is to

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analyze the brain signals. Human brain consists of millions of interconnected neurons. This neuron pattern will change according to the human thoughts. At each pattern formation unique electric brain signal will form.

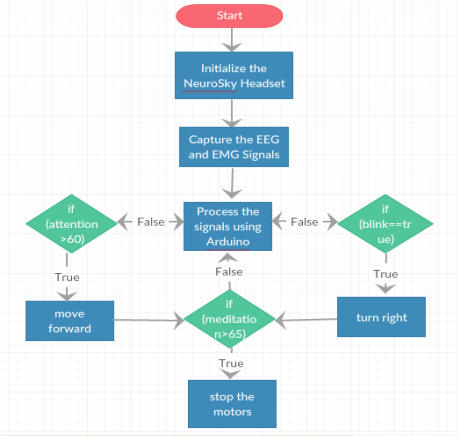

Fig 4 Flow diagram of working principle

IV. WHEEL CHAIR MODULE

The proposed device uses an EEG kit (electro-encephalography) to interface the signals from the brain as shown in figure 5 .These signals will help us to differentiate the attention and concentration of the user. The electrical activity produced by neurons in the brain from the scalp is recorded by the EEG. The brain cortex produces very small electrical voltages (1-100 micro volts on the scalp).EEG doesn't read the thoughts of a human being , but it can tell a person's general state.

Fig 5 Working of headset

Sensors detect faint brainwave signal safely and passively	Neurosky technology interprets meaning of Brain signals	Brainwaves are then processed and used in the microcontroller

V. QUERY SEARCH MODULE

For the Query Search Module, the input is recorded through a portable mic/headphone as speech commands. The online artificial intelligence platform converts the speech command to textual format.

This is then searched in the various modules. If the keyword is one of 'who'/'what'/'when' then the following phrase is run in Wolfram Alpha API. The result is the converted to speech via the Espeak engine to be sent through audio output devices. The block diagram representation of the query search module is shown in figure 6 .

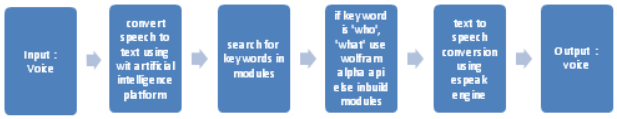

Fig 6 Block diagram for search module

VI. TEST RESULTS

The circuit is rigged up as shown in Figure 7, and the results obtained are tabulated as test cases.

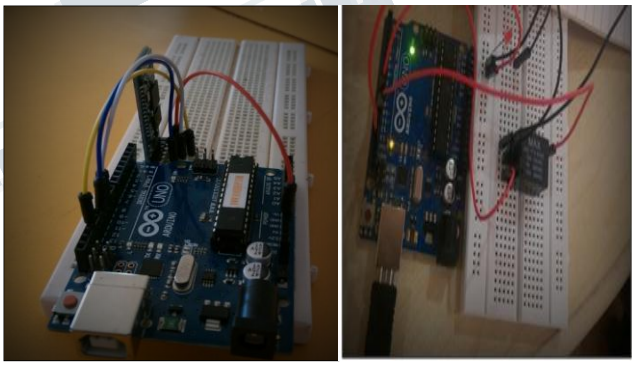

Fig 7 Completed circuit

Test case 1
Test Case Name: JASPER TESTING
System: AI Platform
Short Description: Test cases for the Voice recognition software.

Test no	Input	Output Text Converted	Pass/Fail
1	Person 1: "What is	"what is the time"	Pass

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	the time?"		
2	Person 2: "What is a tie?"	"what is a time "	Fail

Test case 2
Test Case Name: Query Search Module
System: Wolfram Alpha and Inbuilt functions Short Description: Testing of the Query Search Module

Test no	Input Query	Output	Pass/Fail
1	"Who is Jon Snow?"	"He is a fictional character in JR Martin's novel series, son of Lynna Stark"	PASS
2	"What is the time?"	"10:20 p.m."	PASS

Test case 3
Test Case Name: BCI Test
System: NeuroSky Reader and Wheel Chair Module
Short Description: Mind Controlled Wheel Chair Module

Test no	Input	Output	Pass/Fail
1	Eye Blink	Wheelchair right motor switches On	Pass
2	Attention=75(>60)	Wheel Chair both motors switch On	Pass

VII. CONCLUSION

The paper proposed the design and architecture of a new concept of smart electronic bot that answers simple technical and general questions using a Speech Interpretation and Recognition Interface. The bot is attached to a Mind Controlled wheel chair that operates by processing of the Mind Wave signals. This enables to provide virtual assistance to the disabled person using it. The bot can answer basic queries of the user and can also help the user solve basic mathematical equations.

Fig 8 Virtual helper Bot

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