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Robot Assisted Brain Wave Sensor Network in Smart Home Environment for Elderly Persons

S.Ravi Teja, S. Alekhya, Prof. Dr. P. Rama Koteswara Rao, Prof. & Hod Dr. K. V.Sambasiva Rao
Department Of CSE,
NRI Institute of Technology,
Pothavarappadu, Krishna Dt, AP, India

***Abstract*-Human brain consists of millions of interconnected neurons. The patterns of interaction between these neurons are represented as thoughts and emotion-al 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 which is shown in data processing unit. Then the control commands will be transmitted to the robot which is the assistive robot. With this entire system, we can move a robot according to the giving instructions to the robot and it can be turned by blink thoughts and it can be turned by blink muscle contraction. Electroencephalography (EEG) is the measurement of electrical activity in the living brain. In this project we used a brainwave sensor 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 WIFI 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). 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 . This project work consists of a Processor using brain wave sensor and alert unit obstacle detection unit as hardware parts and an effective brain signal system using Matlab platform. Now, the owner has to check whether the robot move or not. If he is a not walking then the robot will automatically start. But if he is normal mode then the vehicle will run and there is no alert. Once the car received blinking command it will stop regardless the place. Further, if the owner wants to move the vehicle he has a need to come normal mode. This will help to avoid the movement during in person. 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. This project at Matlab, explains that silent speaking in the sense of this platform is "conscious effort to say a word, characterized by subtle movements of internal speech organs without actually voicing it." The process captures signals from the brain to the muscles when the user intentionally vocalizes internally. The device later connects such signals with an external computing device. Similar to speech recognition systems, it allows the user to make orders to such devices, but without saying anything.**

***Keywords*-Brainwave sensor EEG, Wi-Fi, brainwave visualizer, Smart Sensors, Processors, Assistive Robot, Care givers.**

I.INTRODUCTION

In India, the elderly population around the world is steadily increasing. The number of people 60 years old and older increased to almost 900 million in 2015 and forecasted to reach 2 billion by 2050. In India, at present, the total count for male and female is 51 mil-lion and 53 million. Existing hospitals, care centers and other institutions currently provide care for many physically disabled and elderly patients. These are very expensive and feasible. Older and patients would prefer to stay in the comfort of their home where they feel more confident than moving to any expensive adult care or healthcare facilities. Hence, if older adults are able to complete self-care activities on their own, it will encourage them to maintain independence and provide them with a sense of accomplishment and ability to enjoy independence longer. The best way to support them is to provide a physical environment that promotes active aging through the use of innovative technologies, such as Artificial Intelligence

(AI), Brain waves, smart homes and assistive robots. This project proposal provides a self-care activities solution with a brain wave controlled assistive robot, Artificial Intelligence and cloud services. The World turned into new visualizations with innovative projects and technologies.

II. TECHNOLOGIES

1. Artificial Intelligence
Artificial Intelligence is a way of making a computer, a computer-controlled robot, or a software think intelligently, in the similar manner the intelligent humans think.AI is accomplished by studying how human brain thinks, and how humans learn, decide, and work while trying to solve a prob-lem, and then using the outcomes of this study as a basis of developing intelligent software and systems.

2. Internet of Things
The Internet of things is the network of physical devices, vehicles, home appliances, and other items embedded with electronics, software, sensors, actuators, and connectivity which enables these things to connect, collect and exchange data, creating opportunities for more direct integration of the physical world into computer- based systems, resulting in efficiency improvements, economic benefits, and reduced human exertions

3. Cloud computing
Cloud computing is shaping the cyber world and evolves as a key computing and service platform for sharing resources including platforms, software applications and everything in the form of services. Although it brings our age unparalleled computing ability and economic benefits, the application of cloud computing is still limited currently in the cyberspace due to the cloud services can only reside in cloud instead of our daily life environment. In fact, there are still a plethora of physical position based on-site service demands that cloud computing could help little due to the “cyber limita-tion”.

4. Android application
The controlling device may be any an-droid based Smartphone/tab etc having an android OS. The android controlling system provides a good inter-active GUI that makes it easy for the user to control the device. The transmitter uses an android application required for transmitting the data. Our project propos-es a wheelchair that can be handled remotely through an android based device. The control device is inte-grated with a cloud that allows capturing and reading the commands. The wheelchair may then be operated as desired as commanded through the android applica-tion

III. SYSTEM ARCHITECTURE

Fig 1 System Architecture.

The main theme of our project is mainly consideration on physically handicapped and older people in urban areas. With the help of new invention ROBOTIC-AI, the disabled persons can easily make their lives free with comfort and perfection. Not only this, but also they can exit from mental tension for their illness. They can implement their activities of themselves without any effort and support of others. We can ob-serve clearly from the architecture, with the help of ALTER-EGO device, brain sense captures each and every thought of disabled and sends information to the robot.

The brain sensor is a inbuilt to ALTER-EGO device in head part. For example, if the patient thinks to have medicines, this information send to the robot and plays major action for the result. The robot receives the information by Bluetooth module. If brain sense fails to work, then the robot receives information from android application which is inbuilt to wheel-chair via WIFI through the cloud based server. The android application performs the activities like vocal recognition, remote control functioning. In case of patient is in inactive mode, all this system is organized by operator and reports to the robot through cloud. The operator is the person who monitors the entire system is accomplishing correctly.

1. Methodologies:
The first methodology is direct interaction between the brain activity of the user and robot is detected by Electro Encephalography (EEG) gadget called "ALTER EGO" head-set. It comprises of an electrode situated in frontal position of the user's scalp. The corresponding values are recorded by the elec-trode by detecting the electrical activity of the brain at a rate of 512 SPS (samples per second). The values recorded and then transmitted through Bluetooth medium. EEG-ALGO software is used to examine this EEG signal. Information from ALTER EGO Mind Wave head set can be stored and later by applying signal conditioning procedures we acquire the

different brain waves like alpha, beta, theta and delta. These signals are ana-lyzed in EEG-ALGO application. Depending on the attention, blink and meditation level an appropriate algorithm is applied for distinguishing the robot commands. This process is directly giving instructions to robot by the brain sense which helps to control patients mind without any assistive.

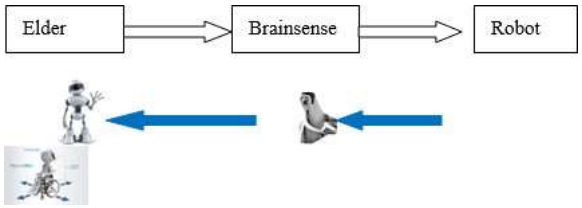


Fig 2 First Methology.

Second methodology is if brain sense does not work properly , it leads to battery drain. In that case we use mobile application to control the robot. Patient can control the robot their own and give instructions to the robot via WIFI module through the cloud data base.

Fig 3 Second Methology.

2. Peripheral Description

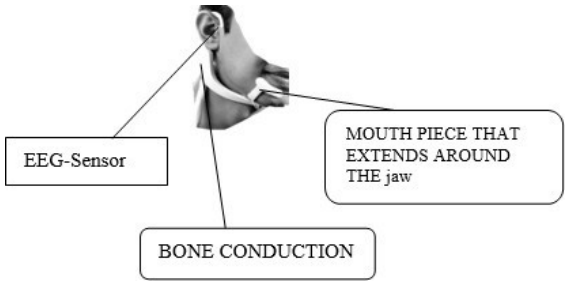
Brainwave Headset which is provided by ALTER EGO technology and those signals will be transferred by using Bluetooth which is there in the Mind wave headset, for this Mind wave headset need to give power using an AAA battery. The Mind wave headset comes with Power switch, a sensor tip, flexible ear arm and a ground connection ear with a mouthpiece that extends around the jaw line to just below the lip. In this Headset they use Non-invasive sensor that won't cause any pain to the User who were the headset.

After inserting an AAA bat-tery switch on the Mind wave headset using the power switch the LED indicator will on and if the Red color light not on con-dition the headset is powered not on and not connected to with the robot Bluetooth. If the Blue color not blinking that means the headset is powered on and connected. If the red or blue color blinks fastly it shows that the Battery getting low. Data transmitted by the Mind wave headset will be received by the Robot Bluetooth receiver. After the analysis of this data, this data will be sent to the robot module using serial data transmission i.e. using Bluetooth module. In that robot module there will be an Bluetooth receiver will receive the data which is transmit-ted by the Bluetooth transmitter. According to the data received by the Bluetooth the ARM processor will give the directions to the robot which are connected with a relay and a driver circuit.

Alter-Ego

The goals of Alter Ego are to cognitively augment hu-mans, change the way people communicate with one another, and enable a discreet gateway to digital information (services and applications) where the interaction is intrinsic rather than something extrinsic. Our current interfaces are a barrier to ef-fortless and private human-machine communication. People either have to shift their attention away from their surroundings to type, or they have to say their private messages out loud, in public with the BRAIN COMPUTER INTERFACE(BCI). Alter Ego overcomes these barriers by allowing users to silently and seamlessly interface with a computer without the need for ex-plicit actions.

It enables a method of human-computer interac-tion without obstructing the user's usual perception, thereby letting the user remain present in her surroundings. The Alter Ego headset captures the neuromuscular signals that occur when people intend to speak. It then uses a neural network to recon-struct the word. The system can read those facial signals with 92 percent accuracy. The headset is worn on one ear with a mouthpiece that extends around the jaw line to just below the lip. The earpiece contains a pair of bone-conduction head-phones that transmit vibrations through the bone to the inner ear. The Alter Ego could be used for controlling IOT devices, virtu-al- and augmented-reality apps.



3.Principle of BCI

A BCI has an input (e.g. electrophysiological activity from the user), an output (i.e. device commands), components that translate input into output and a protocol that determines the onset, offset, and timing of operation. Signals from the brain are acquired by electrodes on the scalp or in the head and pro-cessed to extract specific signal features (e.g. amplitudes of evoked potentials or sensory-motor cortex rhythms, firing rates of cortical neurons) that reflect the user's intent. These features are translated into commands that operate a device (e.g. a

sim-ple word processing program, a wheelchair, or a neuroprosthe-sis).Success of BCI operation depends on the interaction of two adaptive controllers, user and system. The user must develop and maintain good correlation between his or her intent and the signal features employed by the BCI and the BCI must select and extract features that the user can control and must translate those features into device commands correctly and efficiently.

IV. SENSOR DESCRIPTION

It is an efficient means it has a tendency to divide brain-controlled mobile robots into 2 classes consistent with their operational modes. One class is termed "direct manage-ment by the BCI," which implies that the BCI interprets graph-ical record signals into motion commands to regulate robots directly United Nations agency first developed a brain-controlled robotic chair whose left or right turning movements are directly controlled by corresponding motion commands translated from user brain signals whereas imagining left or right limb movements, and tested this technique in real-world things. The robotic platform is illustrated also used a BCI based on motor imagery to build a brain-controlled mobile robot, as illus-trated which might perform 3 motion commands which is blink, meditation and attention together with turning left and right and going forward, and valid this automaton during a planet.

V. CONCLUSION

The signal generated by brain was received by the brain sen-sor and it will divide into packets and the packet data transmit-ted to wireless medium. Level analyzer unit (LAU) will receive the brainwave raw data and it will extract and process the signal using Matlab platform. Then the instructions will be sending to the home section to operate the module. The project operated with human brain assumption and the on off condition of home appliance is based on changing the muscle movement with blinking.. 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 thoughts and it can be turned by blink muscle contraction. The research and develop-ment 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 im-prove their quality of life. Improving the BCI system perfor-mance to make brain-controlled mobile robots usable in real-world situations

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