

***DEVELOPING A SYSTEM FOR PARALYZED PERSON
THROUGH A BRAIN COMPUTER INTERFACE***

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1.0 Team Details

a. Team Members – Roles & Responsibilities:

STUDENT NAME	ROLE	JUSTIFICATION
SUBHASH S	TEAM LEADER & TECHNICAL	EXPERIENCED IN WORKING WITH ROBOTICS PROJECTS,IOT RELATED PROJECTS AND HAS GOOD UNDERSTANDING OF RESPECTIVE TEAM MEMBER SKILLS & CAPABILITIES.
PRAJWAL N SRIVATSA	TECHNICAL	HAVE WORKED WITH THE COMPONENTS RELATED TO IOT AND HAS ENGAGED ON COLLECTION OF DATA IN THE DESIGN PROCESS.
SIDDESH S	TECHNICAL	GOOD UNDERSTANDING OF DESIGN AND TECHNICAL PROBLEMS.
ULLAS A	OPERATIONS	HAVE GOOD UNDERSTANDING OF PERFORMANCE OF THE ONGOING DEVELOPMENT.
VAISHAK C V	MARKETING	ACTIVE MEMBER OF MARKETING TEAM AT TEDx OF OUR COLLEGE AND HAS GOOD UNDERSTANDING OF PUBLIC MINDSET.
SHARANAPPA	OPERATIONS	HAS HANDS-ON EXPERIENCE ON IOT RELATED PROJECTS.

2.0 Business Details

a. Project Abstract:

The basic problem of a paralyzed person is communication of his needs to the caretaker. In this study we have come out of a solution to such problems. BCI (Brain Computer Interface) can be viewed as a permanent solution and also the suitable approach for those patients with paralysis who cannot communicate even the basic need like food, water etc. Using this BCI device the patients can be able to communicate efficiently and effectively. BCI does not require any physical movement to work on, this device can be determined using brain activities based on EEG signals. In this study we focused on developing a practical BCI paradigm to enable binary communication of patients.

b. Market Analysis:

➤ Customer need identification:

According to the data we cumulated, latest census (2011) showed us that an overall of 2.21% of country's population has different kinds of disabilities. That means 26.8(2.68 crores) million people are suffering from one or the other type of disability. There are 1.5 crore disabled males and 1.18 crore disabled females in India. This includes people with hearing related disabilities, vision related disabilities, speech impairment. More than 490,000 cases of paralysis were recorded during 2000—2017 in India.

➤ Serviceable addressable market (SAM) identification and justification:

A notable gap of communication exists between a paralyzed person and his/her caretaker because of speech impairment, problem with muscular control or any other effect of paralysis. The person might be struggling to express his thoughts in action to the caretaker. He/she might not be able to indicate any emergency.

These days, people mostly depend on the medical electronics equipment for simple needs like blood pressure test, sugar level test, body temperature and many more medical parameters.

Our product acts like a bridge of communication between the paralyzed person and his/her caretaker. Hence, our product must be essentially promoted through medical electronics market. This interface between the brain of a paralyzed person and a digital equipment helps the person to meet his basic needs. By this process, the command we select on our mind will be brought down to voice commands out of a speaker attached to the brain computer interface and also a message will be sent to the cellphone of the caretaker.

➤ Product differentiation with respect to competition and justification:

There are quite a large number of brain computer interface devices in the ongoing market. They are also called brain machine interface devices. They convert the EEG signal to a form which is suitable to operate a software/hardware.

Our device stands out because, it specially facilitates the paralyzed individuals. We make use of GSM here to indicate the caretaker of the paralyzed person other than converting the EEG signals into voice commands.

➤ Understanding of your customer and user:

Customer: Medical electronics equipment manufacturers.

User: Paralyzed person and his/her caretaker.

➤ Distribution channel identification:

The device is a wearable and is worn by the paralyzed person. It consists of a speaker which gives out the user's command. It also has a setup of GSM to send messages to the caretaker's cellphone.

3.0 Technical Details

a. Product Brief:

➤ Core technical innovation:

In the present days people are suffering with a lot of health problems. A normal person can express his feelings by saying it. But the deaf and dumb people who are suffering from paralysis cannot say what they need because their motor nerves are effected. So to overcome this problem and to help paralyzed people with the help of BCI system we get to know what they feel and what they need.

➤ Uniqueness of our Project:

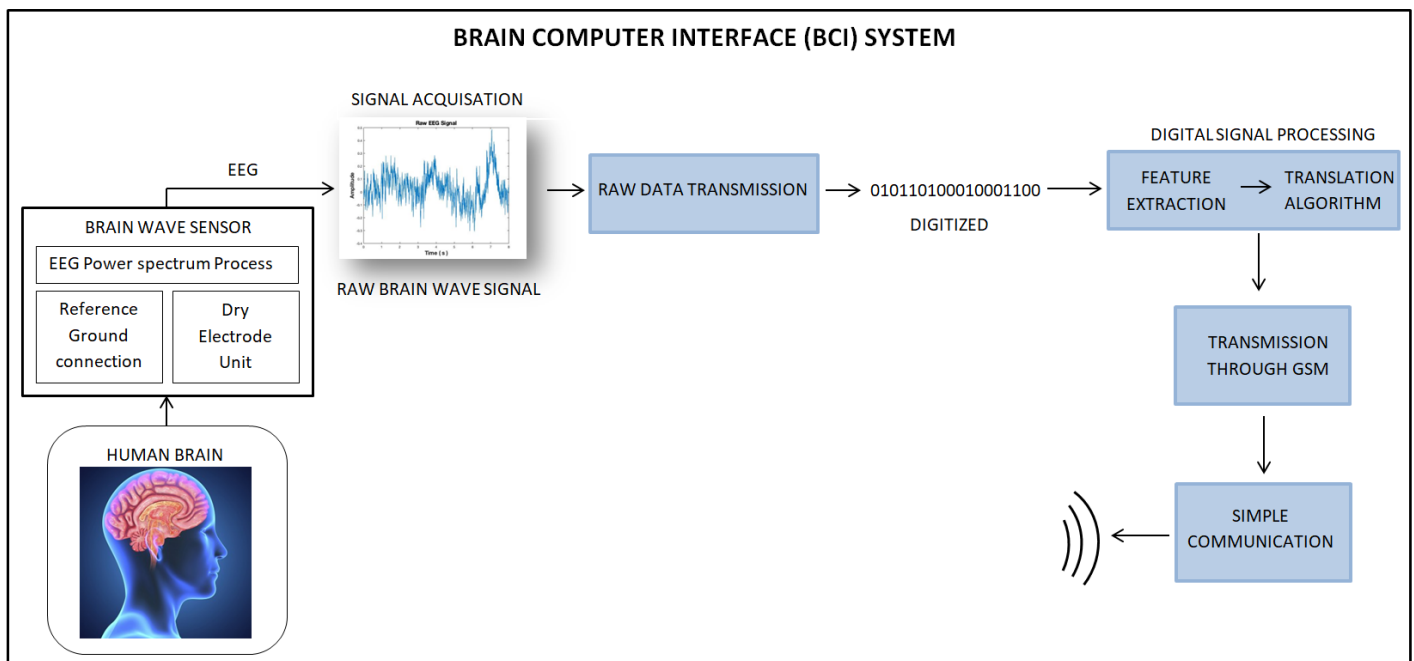
Many of the projects which are developed are related to BCI are between a normal person or performing some experiments on the specimen they have got the output. But in our project with the help of the same device depending on the range frequencies that we get we determine what that person requires can be sent to their care taker.

➤ Objective:

The main objective of our proposed project is with the help of Brain Computer Interface (BCI) between paralyzed person and device and send the received information in the form of message to the care taker.

b. Proposed Design:

➤ Block Diagram:



- BCI is usually a very complicated control measurement. During this process of measurement of brain signals, many problems arise at the stage of signal acquisition, signal processing and in controlling the device.
- The recording of brain's electrical activity over a period of time is called EEG signal (electroencephalogram).
- At first the brain signals are fetched from the brain through EEG signals. The measurement of these EEG signals are very difficult because these EEG signals have very small amplitude waves (micro volts). The position of electrodes will also be crucial in this stage.
- These EEG signals are digitalized and sent it to the most important stage if the BCI system is the DIGITAL SIGNAL PROCESSING stage.

It has 2 blocks

1. FEATURE EXTRACTION and
2. TRANSLATION ALGORITHM.

- The Feature extraction algorithms are based on frequency analysis (DFT) and Higher Order Statistics (HOS) also in connection with the wavelet transform and Auto aggressive model.
- DFT operates based on freely selected portions of signal. For each time Discrete Fourier Transform is calculated.
- In Translation Algorithm it takes the abstract feature vectors from EEG signal which reflects the specific aspects which encodes the message a user wants for communication and transforms these vectors into application device command. The goal of the Translation algorithm is to maximize the performance of the Application.
- In These bluetooth packets, the signal is transmitted to the external receiver .
- Through the external receiver the caretaker of the paralyzed person can communicate or know what the person is trying to tell easily through GSM Transmisson or via speaker.

c. Innovativeness of the Proposed Solution:

EEG Aspect introduces some of the core aspects of EEG based BCIs it explain why EEG is a popular technology BCIs along the generic challenges associated with EEG signal processing.

This brain activity recorded via EEG is typically classified into 5 Different types depending on the predominant frequency content of the signal summarized as follows

- delta activity : $f < 4\text{hz}$
- theta activity : $4\text{hz} < f < 7\text{hz}$
- Alpha activity : $8\text{hz} < f < 12\text{hz}$
- Beta activity : $12\text{hz} < f < 30\text{hz}$
- Gamma activity : $f > 30\text{hz}$

Through this activity's we can innovate this project .Common spatial pattern (CSP) is one of the most common feature extraction methods using MI EEG classification .CSP is a spatial filtering method used to transform EEG Data into a new space where the variance of one of the classes is maximized While the variance of one of the classes is maximized where variance of the Other classes is minimized.

The aim of this subsection is to provide a brief summary of the various Classification techniques used in literature . SVMs and LDA were observed to be widely used classification in

the literature with the performance of the SVM Classifier found to be superior when compared to various classifier such as LDA ,k-NN, Naive bayes and regression tress. The average classification of the proposed method using the SVM classifier was 96.20%.

This above tends to innovate the proposed solution.

d. Impact of the proposed solution:

- The biggest impact of Brain Computer Interface(BCI) on paralyzed person is that the BCI reads the brain's blood oxygen levels and enables communicating by deciphering the thoughts of person who are totally paralyzed and unable to talk.
- This Brain Computer Interface works on Electroencephalography graph which measures the electrical activity on different parts of brain of a person and visual traces on oscilloscope screen.
- Thus BCI involves the process of acquiring the brain signals, analyse them and translate them into commands that are relayed to output devices that carry out desired actions.
- Brain Computer Interface (BCI), which is invasive, could transform the lives of such patients and allowing them to express feelings to their loved ones.