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Mind Controlled UAV

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***Abstract*—Brain computer interface (BCI) is a technology that enables a user to interact with the outside world by measuring and analysing signals associated with neural activity, and mapping an identified neural activity pattern to a behaviour or action. In this work, an BCI system was developed where the operation of a quad copter is controlled by identified brain concentration and eye blink patterns. A portable electroencephalography (EEG) headset is used to acquire neural signal around forehead and both eyes. Acquired EEG data are sent to a data processing computer wirelessly and processed in real-time. Identified brain concentration and eye blink patterns are associated with quadcopter operation commands and transmitted to the remote control that is modified to interface with the computer. The BCI system was evaluated by an experiment study and classification accuracy was calculated. Experimental results indicate that the system can achieve the expected performance without using EEG data from all channels and complicated data processing algorithms.**

***Index Terms*— BCI, quad copter, blink pattern.**

I. INTRODUCTION

Brain Computer Interfaces enable the use of brain waves to control computer-based external devices. It can however, be difficult to trigger a specific brainwave, and it might not be repetitive enough to be used in such a manner. EEG is used to record brain waves, where the parts of the recorded signal that is related to eye movements are normally considered to be artefacts (undesired). In this work, however, EEG recordings of eye movements are used to create datasets for training a machine learning algorithm, used for controlling a drone in real time. The different set of attention values are recorded with the eye blinks and patterns in them are decided for a specific movement of the drone on reproducing such fix patterns sends control command to drone. Which enables the disabled people to control drones or such devices.

II. MOTIVATION

The Mind controlled drone is another best way which will help paralyzed people to do their own work easily, result of which they give not feel weaker in front of normal people. In future we can continue to make more electronic devices to work on mind control so that it will become easier to manage or handle such devices. This brings the science fiction and real world closer to each other.

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We get idea from project developed by Dr. S. N. Omkar sir from UAV Lab, Department of Aerospace Engineering, Indian Institute of Science, Bangalore.

III. Problem Domain

Drone like devices require hands to handle them which restricts disable people to use such devices. The EEG device fix the brain waves which are further processed using certain algorithm to find out attention value and eye blink.

IV. Problem Defination

Nowadays, there are people with health problems that are not able to use some parts of their bodies, as tetraplegia or some types of paraplegia. The project tries to be a pilot project orientated to more wide uses of Brain Computer Interface (BCI) technology, having a development of brain control.
Daily life common actions and activities could be a real problem for people with any mobile disability: shopping, walking or even taking a bath, the smallest movement can suppose difficulty and pain both physical and mental. The paralytic's and that third parties' life levels are another direct problem from disabilities, which are affected by a daily economic, time and social costs. currently drones are used by people who are able to use their hands to give inputs through different controllers. The people with problems of hand was kept away from such a useful device. By using current system they can not provide inputs by moving sticks or pressing keys.

V. Statement

To fly drones we require hands to move the sticks to provide input which is impossible for people with hand disability. .

VI. Objectives Of Bci

- The goal of the Brain-computer Interface is to develop a fast and reliable connection between the brain of a severely disabled person and a personal computer.
- The 'Brain Gate' device can provide paralysed or motor-impaired patients a mode of communications through the translation of thought into direct computer control.

VII. Innovative Content

As reproducing the same brain condition again and again is very difficult but calculating attention values and detecting eye blinks is very easy as compare to the first case hence, rather than using the training method for specific movements we are using pattern method based on attention values and eye blink.

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IX. Problem Solving

As our brain is very complex it is very difficult to catch a specific thought out of our brain. So we use the performance matrix techniques to calculate attention values of a specific person using EEG headset. Also the EEG headsets can detect facial expressions like wink, smile, eye blinks hence, we decide patterns of the above readings e.g. If we want to move drone left then we can set a pattern of three high attention values and a eye blink after that. In such a way we can set different patterns for different movements of the drones.

X. Applications

A. Robotics Control

During the last decades, electro-biological signals have become the focus of several research institutes. The brain signals obtained non-invasively from the scalp through electroencephalography (EEG) have previously been used for tasks such as controlling a cursor and spelling a word. An EEG-based brain-computer interface (BCI) can also be used to command a semi-autonomous robotic arm by means of motor imagery (MI). The BCI detects the intention to move and provides online feedback to the user. At the same time, the feedback can be used as trigger for different pre-programmed robotic motion tasks. For discrimination of MI, the method of common spatial patterns (CSP) turned out to be highly efficient. Aim is to present a way to optimize the on-line classification accuracy of a MI-based BCI system by choosing an optimal time window for calculating the CSP. The results showed that for the analyzed datasets the best classification accuracy was achieved with a 4 second time length.

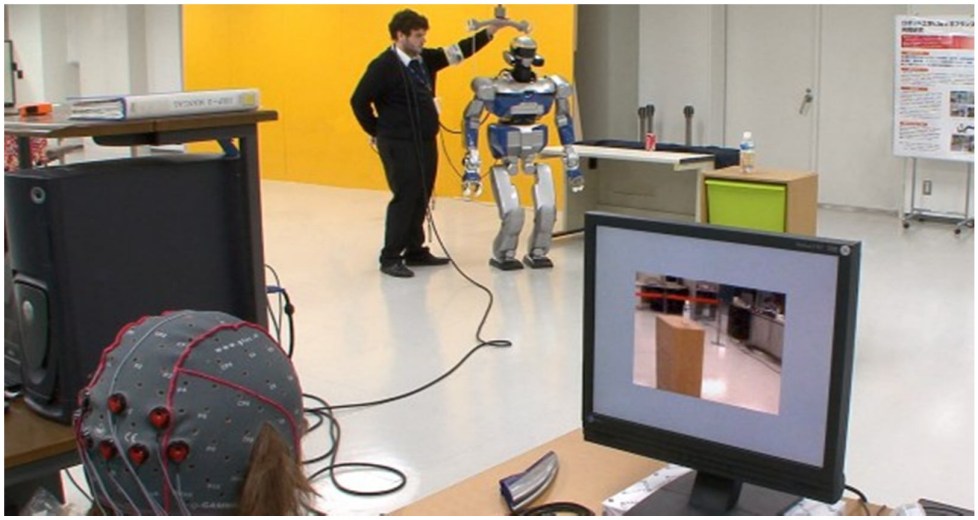

Fig 1. Robotics Control

B. Medical

Healthcare field has a variety of applications that could take advantage of brain signals in all associated phases including prevention, detection, diagnosis, rehabilitation and restoration. Mental state monitoring function of BCI systems has also contributed in forecasting and detecting health issues such as abnormal brain structure (such as brain tumor), Seizure disorder (such as epilepsy), Sleep disorder (such as narcolepsy), and brain swelling (such as encephalitis). Tumor, which is generated from uncontrolled self-dividing of cells, could be discovered using EEG as a cheap secondary alternative for MRI and CT-SCAN. EEG-based Brain tumors detection systems have been the main subject of the researches in , while has been concerned with identifying breast cancer using EEG signals.

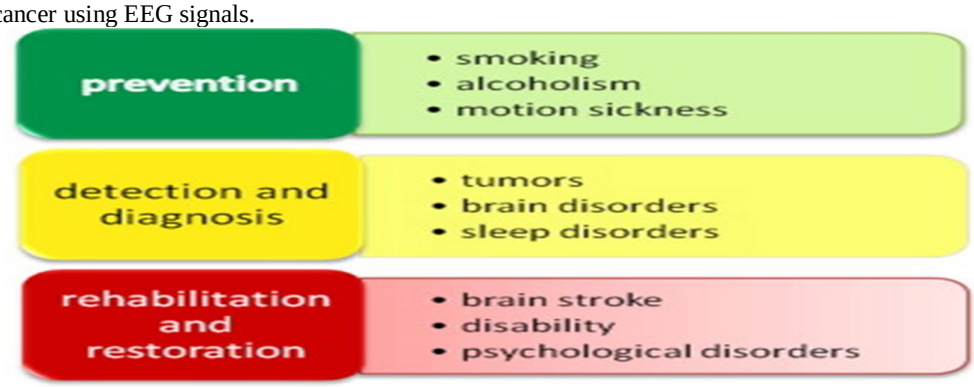

Fig 2. medical detection of diseases

Fig 3. medical use

C. Educational and self-regulation

Neurofeedback is a promising approach for enhancing brain performance via targeting human brain activity modulation. It invades the educational systems, which utilizes brain electrical signals to determine the degree of clearness of studied information. Personalized interaction to each learner is established according to the resultant response experienced. Learning to self-regulate through non-invasive BCI has also been studied. It provides a mean for improving cognitive therapeutic approaches. The research in has analyzed the feasibility fMRI for the emotional regulation, while has suggested the use of hybrid rtfMRI–EEG BCI to fight the depression feeling as well as other neuropsychiatric disorders through training sessions. Furthermore, EEG based emotional intelligence has been applied in sport competitions to control the accompanying stress as examined in . In BCI technology has been elaborated in self-regulation and skill learning via functional Magnetic Resonance Imaging (fMRI) neurofeedback.

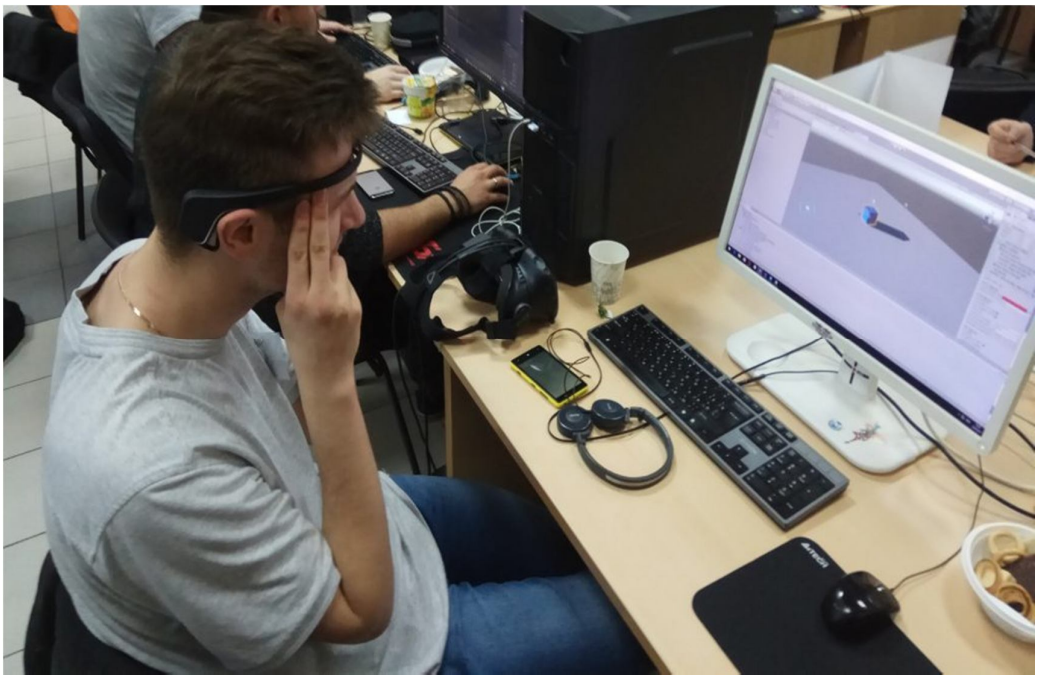

Fig 4. Educational and self-regulation

D. Problem Solution Design

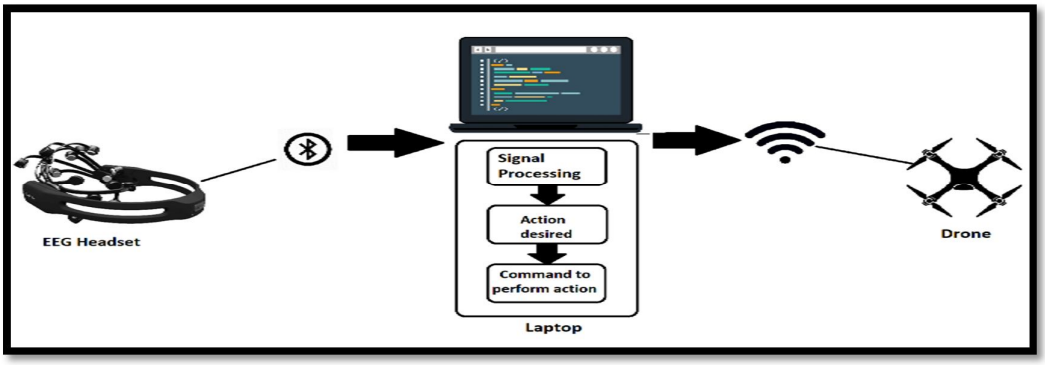

Figure. System design

TABLE I. BRAIN WAVES

Names of Brain waves	use
Delta	occur during sleep,coma
Theta	Correlated with emotional stress (frustration and disappointment)
Alpha	Reduce amplitude with sensory stimulation or mental imagery
Beta	Can increase amplitude during intense mental activity
Mu	Diminishes with movement or intention of movement
Lambda	Correlated with visual attention

XI. CONCLUSION

A BCI system was implemented based on the Headset Epoc+ Emotiv to control the flight of the drone. The SDKs of the manufacturers allow the development of varied applications, this facilitates the research work. The more trained the user with the Headset the more successful the mental commands detected. For a better identification and classification of the trained mental commands, automatic learning algorithms could be applied. Variations in user thinking did not affect drone control.
Future applications for these BCI systems are: the prosthesis control in the medical field, the training of pilots in the aerospace field and treatment of mental illnesses, applications of interactive games, etc.

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