MIND DRIVEN TANK THE FUTURE OF WARFARE

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***Abstract*— Thought is fundamental human activity, which can be recognized by analyzing brain signals. This chapter considers the development of EEG-based brain-controlled tank, which can serve as powerful aids for physically disabled people. Since these cars will rely only on what the individual is thinking they will hence not require any physical movement on the part of the individual. It captures EEG (electroencephalogram) signals from the driver's brain using EEG head set which contains three electrodes. The instructions for the movement is programmed and stored using Arduino Uno and the connection between head set and Arduino is established using Bluetooth (HC05). The instructions from the brain is displayed on a Android App. The output from the Arduino is connected with driver motor (L298N). The project is focused on scope of BCI in the transportation filed and also for encouraging disabled people for driving. The human brain constantly generates electrical impulses. These electric currents are often referred to as brain waves. EEG (electroencephalography) is a bioelectrical measurement used in the biomedical field to study the human brain. Through this research, a sensor system will be developed that can detect brain waves non invasively and transmit signals wirelessly via a Bluetooth connection. The detected EEG signal will be displayed in graphical form using signal parameters. Brain Computer Interfaces (BCI) is a technology that allows taking action on a computer based on brain waves. Brain waves are recorded by electroencephalography so they can be processed by a computer. There have been many studies using BCI including analysing brain waves in humans.**

***Keywords*— BCI, NEUROSKY MINDLINK, ARDUINO UNO, MOTOR DRIVER**

I. INTRODUCTION

In the ever-evolving landscape of warfare, technological advancements have always played a pivotal role in reshaping the strategies and tactics employed by military forces. This groundbreaking integration of the human mind and cutting-edge technology promises to revolutionize the way wars are fought. Mind-driven tanks, equipped with neural interface systems, have the potential to create a new era of warfare characterized by unparalleled accuracy, enhanced decision-making capabilities, and reduced human intervention on the front lines. This project aims to explore the multifaceted aspects of mind-driven tanks, delving into the underlying technology, ethical considerations, strategic implications, and the broader societal impact of this futuristic concept.

II. RELATED WORK

Survey on BRAIN CONTROLLED CAR FOR DISABLED USING EEG (RAISA VARGHESE1 SAIKRISHNA D2, NEETHAL EPHARAM, SHAHAS AHAMED Assitant professor, Dept. of CSE, Sahrdaya College of Engineering and Technology, Kodakara, Kerala, India, Oct 2016): In this paper, considers the development of EEG-based brain controlled car, which can serve as powerful aids for physically disabled people. Since these cars will rely only on what the individual is thinking they will hence not require any physical movement on the part of the individual. It captures EEG signals from the drivers brain using EEG head set which contain three electrodes. The instruction for the movement is programmed and stored using ARDIUNO and the connection between head set and Arduino is established using Bluetooth.[1]

Brain Controlled Vehicle (Shreyash Shrivastav, Praveen Yadav, Mahendra Pratap Verma) April 2019:

In this paper, Physically disabled individuals continually depend on their family members for their everyday movements. There is a ton of research proceeding to help these individuals control their movements using brain signals. For acquiring the brain signals we utilize a method called as electroencephalogram (EEG), which deals with the electric signals produced in the mind, by extricating these pulses we can follow the condition of the psyche, for instance meditation, attention. An electroencephalogram (EEG) provides us with various frequencies which can be additionally decoded as the state of mind. For the general population with inabilities, it very well may be executed for anything which should be dealt with for movement through wheels.[2]

Conversion of EEG Activity Into Cursor Movement by a Brain Computer Interface (George E.FabianI, Dennis J. McFarland, Jonathan R. Wolpaw, and Gert Pfurtscheller, Member, IEEE, Aug 2018):

In this paper, The Brain computer interface uses amplitude in beta frequency bands over sensorimotor cortex to control movement of cursor. Trained users can cursor move in one or two dimensions. The primary goal of this research is to provide a new communication ans control option for people with server motor disabilities. This study used offline analysis of data. This collected data during the system operation to explore methods for improving the cursor movement accuracy.[3]

Brain Controlled Robot Cars (R.S. Shekhawatla, Rajat Sharma2b and Ravi Rao2 Assistant Professor Department of Electrical Engineering, B. K. Birla Institute of Engineering Technology, Pilani, India, August 2021):

In this paper, Robot Car is that device that can be remotely controlled using the user's brain signals. This system uses BCI (Brain-Computer Interface) to provide communication between our brain and the robotic car. To acquire data It uses an Electroencephalogram headset. Classifies and interprets the data set on the hardware and achieves desired commands on the robotic car (based on the provided classification). The data is transferred through a Bluetooth module, while the commands are executed by Arduino.[4]

Design and Implementation of Low Cost Intelligent Wheelchair (Mohmmad Faeik Ruzaji, S.Poonguzhali Center for Medical Electronics, Department of Computer Engineeroing) April 2019 :

In this paper, The wide spread prevalence of lost limbs and sensing system is of major concern in present day due to wars, accident, age and health problems. Intelligent wheelchair is developed to help of patients by using speech recognition system to control the movement of wheelchair in different directions. By using voice commands and also the simple movement of the patient's fingers with all control. In this system automatic obstacle detection is done using an ultrasound system. Which help the patients to apply a temporary brake, in case any obstacle suddenly comes in the way of the wheelchair.[5]

Real Time EEG Based Cognitive Brain Computer Interface For Control Application via Arduino Interfacing. Rahima Mahajan ,Dipali Bansal (7th International Conference on Advance in computing Communications, ICACC 2017,August 22-24,2017,Cochin India):

In this paper, Cognitive neuroscience is being widely explored to develop more interactive brain computer interfaces for control applications. An attempt has been made to translate a cognitive activity (deliberate eye blink)of human subjects captured via electroencephalography (EEG) into action. Channel power spectral and the highest peak related features have been extracted to identify eye blink related instances. A significant rise in event related potential is observed across frontal lobes of cerebral cortex. The developed model has been deployed in arduino using simulink to control output devices independently. The results demonstrate the feasibility of cognitive control network to translate deliberate intentions into commands via EEG based BCI for rehabilitation of physically challenged patients. [6]

Adaptive Threshold of EEG Brain Signals fir IOT device Authentication ABDELGHAFAR R. ELSHENAWAY AND SHAWKAT K. GUIRGUIS (June 29,2021):

In this paper, a new authentication method has been proposed for the IOT devices. This method is based on EEG signals and hand gestures. The primary objective is to establish a robust and secure authentication mechanism for IoT devices by tapping into the distinctive features of EEG brain signals. EEG signals are electrical patterns generated by the brain and are unique to each individual, providing a biometric marker for authentication. The proposed authentication system is adaptive, meaning it can dynamically adjust its threshold for accepting or rejecting signals based on the evolving characteristics of the user's EEG patterns. This adaptability is essential to accommodate natural variations in brain signals due to factors like fatigue, stress, or changes in mental state over time. [7]

Nonlinear Adaptive Robust precision pointing control of Tank Servo System. SHUSEN YUAN, WENXIANG DENG, JIANYONG YAO, (Member, IEEE) AND GUOLAL YANG. (January 25,2021):

In this paper study on control of tank servo systems pointing high performance with parametric uncertain nonlinearities (nonlinear friction, backlash and structural flexibility) and uncertainties. This study, the first step is to create a mathematical model that accurately represents the nonlinear dynamics of the tank servo system. This model should consider factors like friction, backlash, and other nonlinear effects that influence the system's behavior. Building on this model, the research focuses on the design of nonlinear control algorithms. These algorithms need to be capable of handling the inherent nonlinearities in the system. Techniques such as sliding mode control, feedback linearization, or other advanced nonlinear control strategies are explored.[8]

III. METHODOLOGY

1. BCI(Brain Computer interface): A Brain-Computer Interface (BCI) is a technology that allows for direct communication between a human brain and a computer or machine, without requiring the use of traditional input devices such as keyboards or mice. In the case of a mind-controlled tank, a BCI could be used to allow a human operator to control the tank using their thoughts. The process typically involves placing sensors on the scalp that can detect the electrical activity of the brain, known as electroencephalography (EEG).

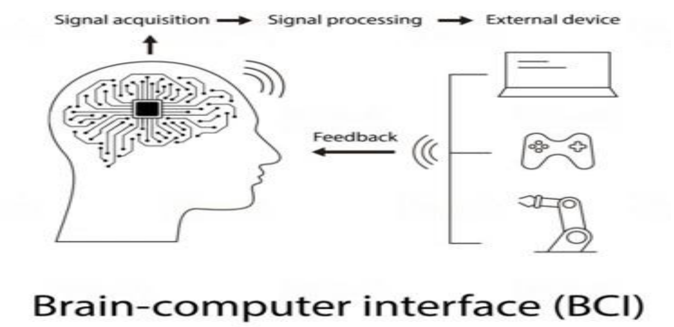

Fig: BCI Working

2. EEG(Electroencephalography): The NeuroSky Mindlink device is a brain-computer interface (BCI) that uses electroencephalography (EEG) to detect brain activity. In the case of mind-controlled tanks, the Neurosky Mindlink device is used to detect the user's thoughts and translate them into commands for the tank. This allows for precise and intuitive control of the tank, as the user can simply think about the desired movement or action and the tank will respond accordingly. EEG Signal Processing: The processing and analysis of real time acquired EEG signals is performed in MATLAB (2016b) workspace. The proposed approach is developed and implemented using Core i3 processor with speed 2.40 GHz. At first acquired EEG responses are imported to MATLAB workspace. Distinct epochs of the acquired dataset locked to actions of interest are extracted to study the corresponding EEG-dynamics. The volunteer eye blink related signals attained by each of the 14-electrodes of emotive headset are extracted. It can be observed that eye blink related variations in EEG are maximum captured by first four frontal channels viz., AF3, AF4, F7 and F8.

The similar instances have been observed in eye blink signals attained from other subjects. Thus, EEG captured at frontal channel AF3 has been utilized for further analysis and development of Arduino interfaced on-off control of LED. The extracted signals at frontal channels are scaled by subtracting the mean value of signal from original signal.

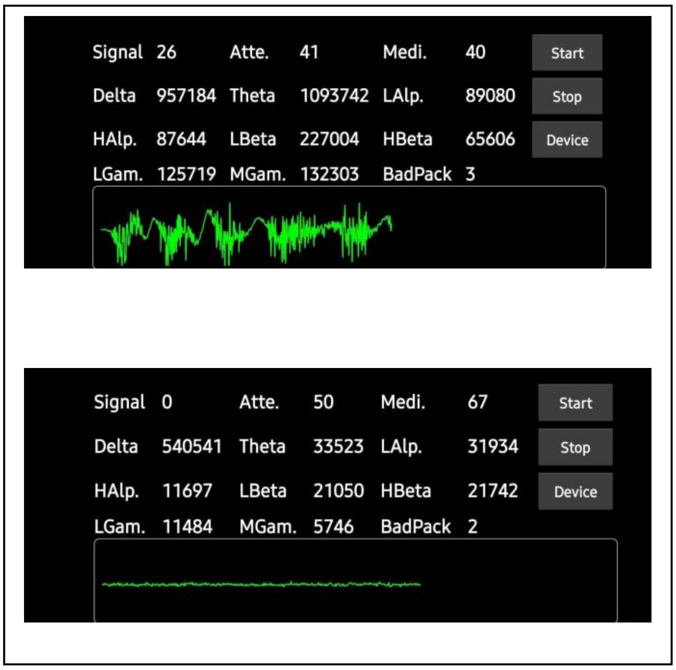

Fig: Signal Detection and Analyzation

IV. RESULTS AND DISCUSSION

Commands	**Attention**	**Meditation**
Forward	20-40	>50
Backward	80 - 100	>80
Left	40 - 60	>60
Right	60 - 80	>65

TABLE: Analyze frequency and set Command

Command	1	2	3	4	5	Total
Forward	8/10	7/10	6/10	8/10	7/10	80%
Backward	6/10	5/10	4/10	7/10	6/10	60%
left	7/10	8/10	8/10	9/10	7/10	82%
Right	5/10	7/10	8/10	6/10	6/10	70%
Total	65%	70%	75%	80%	68%	

TABLE 2 : Real time testing data

The results from the NeuroSky MindLink device indicate varying success rates for executing commands based on attention and meditation levels. Across multiple trials, "Left" commands consistently achieved the highest success rate at 82%, followed by "Right" (70%), "Forward" (80%), and "Backward" (60%). Notably, attention levels generally fell within specified ranges for each command, except for "Backward," which consistently exceeded the upper limit (>80). Meanwhile, meditation levels remained consistently high across all commands, potentially influencing users' ability to focus and execute commands accurately. Despite fluctuations in success rates across trials, the overall effectiveness of the Mindlink device in executing commands remained moderate to high, suggesting promise for further refinement. Further analysis could explore factors contributing to variability in performance and potential enhancements to improve reliability.

V. CONCLUSIONS

In conclusion, the development of mind-driven tanks heralds a new era in warfare, where human cognition merges seamlessly with machine intelligence, reshaping the dynamics of military operations. As this technology continues to evolve, it is imperative for military institutions, researchers, and policymakers to collaborate, setting ethical standards and international regulations that uphold the principles of safety, security, and human dignity in the face of this transformative military innovation. The future of warfare has arrived, and the responsible integration of mind-driven tanks into military strategies will shape the landscape of global security in the years to come.

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