e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:05/Issue:12/December-2023 Impact Factor- 7.868 www.irjmets.com

SURVEY ON MIND DRIVEN TANK THE FUTUTRE OF WARFARE

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DOI : https://www.doi.org/10.56726/IRJMETS47789

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 signals from the human 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. There have been many studies using BCI including analyzing brain waves in humans.

Keywords: BCI, Neurosky Mindwave, 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 Electroencephalogram-based brain controlled car, which can serve as powerful 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 (Shreyansh Srivastava, 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]

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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. Shekhawat1a, 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 (Mohammed Faeik Ruzaij, S.Poonguzhali Center for Medical Electronics, Anna University, Chennai-600025, India abnalfratain@yahoo.com, poongs@annauniv.edu, 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 BCI 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. Arduino can be used as the microcontroller to interface with the EEG acquisition system and process the signals in real-time. Here's how Arduino is utilized in such a system: Data Acquisition, Signal Processing, Feature Extraction, Control Signal Generation, Communication with External Devices [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.

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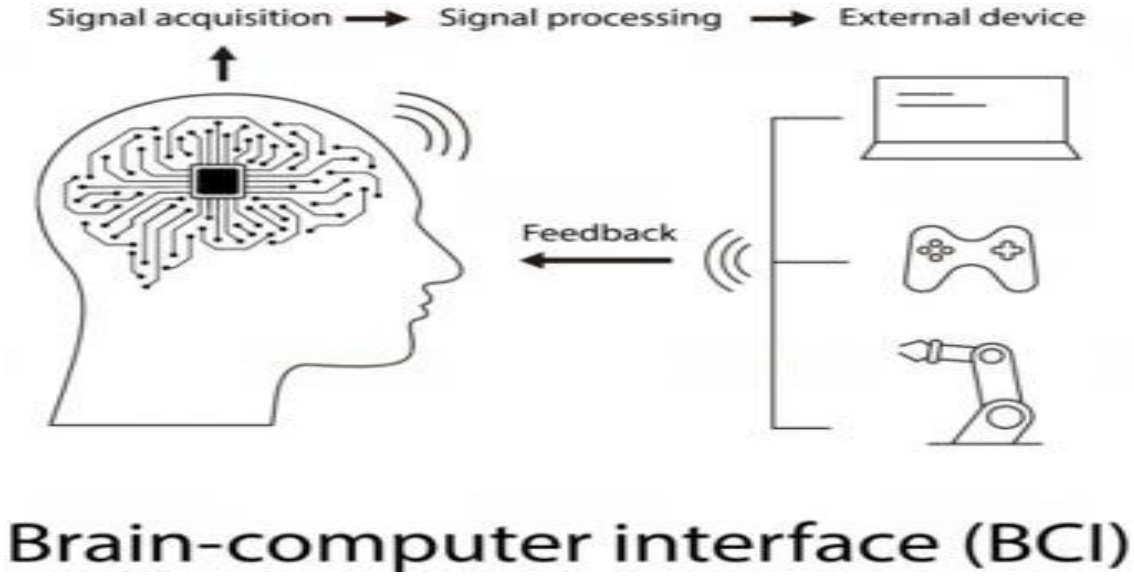
These algorithms need to be capable of handling the inherent nonlinearities in the system. Techniques such as sliding mode control, feedback linearization, or other advanced nonlinear control strategies are explored.[8]

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).



Brain-computer interface (BCI)

2. EEG(Electroencephalography):

The NeuroSky device is a brain-computer interface (BCI) that uses electroencephalography (EEG) to detect brain activity. In the case of mind-controlled tanks, the Neurosky 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: In the realm of EEG signal processing using MATLAB, the process is a cohesive journey aimed at uncovering valuable insights from raw brain electrical activity. This integrated approach seamlessly blends various steps to meticulously analyze and interpret the EEG signals. The initial phase involves data acquisition, where MATLAB serves as a versatile platform for interfacing with EEG hardware devices. Through functions and toolboxes, researchers can collect and store the raw EEG signals obtained from electrodes strategically placed on the scalp.

Moving forward, the preprocessing stage takes center stage to refine the raw data. MATLAB's array of filtering tools, including functions like pop eegfiltnew, facilitates bandpass and notch filtering. This step is crucial to isolate specific frequency bands of interest while eliminating undesired artifacts, ensuring a clean dataset.

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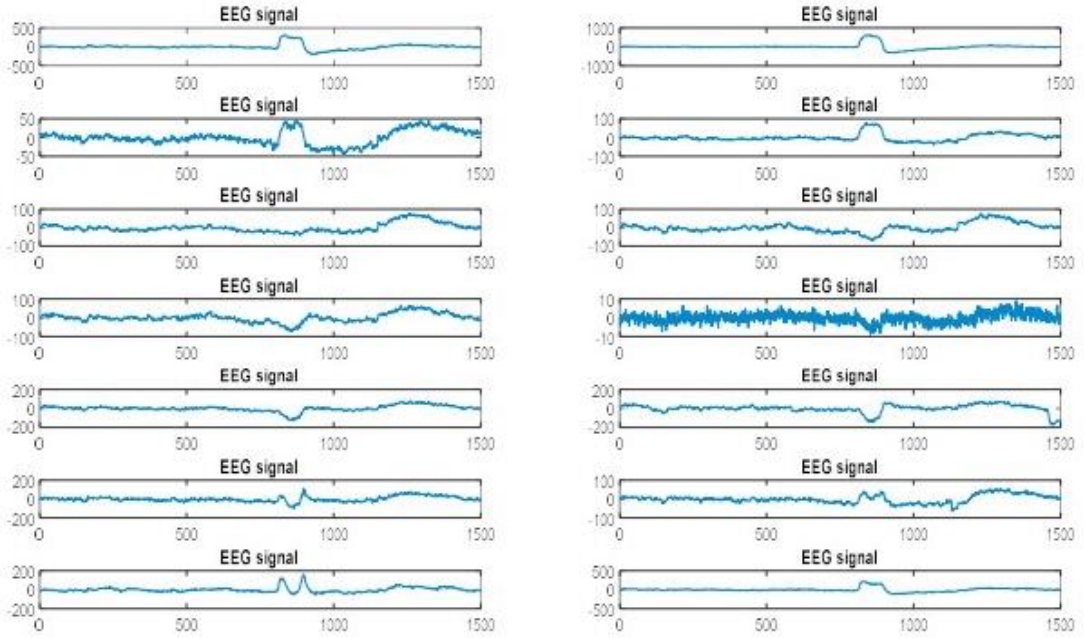

IV. MODELING AND ANALYSIS

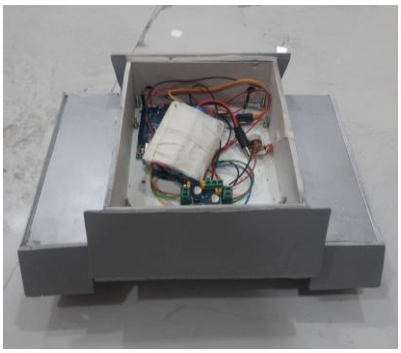

Figure 1: Model

The current implementation of the mind-driven tank control system showcases the feasibility of using Bluetooth technology for brain-computer interface applications. The upcoming upgrades, including the transition to Zigbee, are expected to further enhance the system's capabilities, addressing range limitations and offering a more robust and versatile mind-driven control experience.

Advantages:

1. **Wireless Control**: Bluetooth enables wireless communication between the soldier's BCI device and the tank's control system. This eliminates the need for cumbersome physical connections, providing greater freedom of movement for the operator.
2. **Low Power Consumption**: Bluetooth technology has evolved to be more energy-efficient, contributing to reduced power consumption compared to traditional wired connections. This advantage extends the operational lifespan of the mind-driven tank without frequent interruptions for recharging or battery changes.
3. **Ease of Integration**: Bluetooth is a widely adopted and standardized technology, making it easier to integrate into both BCI devices and tank control systems. This facilitates seamless communication and compatibility across various hardware components.
4. **Cost-Efficiency**: Implementing Bluetooth technology can be cost-effective due to its widespread adoption and the availability of affordable components. This contributes to a more accessible and economical deployment of mind-driven tank technology.

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V. RESULTS AND DISCUSSION

TABLE 1. Results of data analysis from the classification of motor imagery and eye movements from Mindwave Mobile 2.

Classification	Attention	Meditation	High Alpha
Forward	40–60	≥ 60	≤ 12000
Backward	≥ 60	≤ 55	≤ 12000
Turn Left	40–70	≥ 60	16000–38000
Turn Right	≥ 60	≤ 55	16000–38000
Default	Etc.	Etc.	Etc.

TABLE 2. Results data from participants.

Command	1	2	3	4	5	Total
Forward	6/9	9/9	7/9	8/9	7/9	82.22 %
Backward	8/9	6/9	7/9	6/9	6/9	73.33 %
Turn left	4/9	4/9	5/9	3/9	5/9	46.67 %
Turn right	2/9	1/9	1/9	2/9	2/9	17.78 %
Total	55.56 %	55.56 %	55.56 %	52.78 %	55.56 %	

In this section we present the data of EEG Neurosky Mindwave trial results which was carried out to 5 normal people consisted of: 1 is the researcher of this paper, 2 people who rarely used the device, and 2 more who never used the device. The trial was performed for 5 minutes and the subjects were asked to do 36 kinds of movement including 4 types of classification which were moving forward, moving backward, turning left and turning right with 9 repetitions for each, the movements were performed randomly depended on the will of the trial subjects. The results of the trial are described in Table 2. From the data obtained, the results were relatively good for moving forward, backward, and motionless. This was because of the basic data of imagery motor itself, while for turning right and left even though they were similar with moving forward and backward but there was additional continuous eye motion needed, so the data obtained for moving forward and backward were not good. We added the eyes motion because we found the difficulty if we only used 1 EEG channel. When we only used 1 channel, it was difficult to classify the data more than 3 classifications, because when we concentrated to move a limb, if there was only 1 channel reviewed then the way we concentrated to move other limbs would be similar so it needed one more trigger to create 3 classifications. But for the eyes movement, there should be further optimization because when the data is a turn movement, but because the data transmission from PC to Arduino runs continuously and eyes movement is only counted as a trigger, so when the Arduino pass the command to motor driver, the motor driver has done the next operation to Tank.

VI. CONCLUSION

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.

ACKNOWLEDGEMENTS

It is a great pleasure to acknowledge those who extended their support, and contributed time for this project work so far. While the project is still in progress, We would like to thank my project guide Mrs.Pradnya.K. Bachhav for his valuable and skillful guidance, assessment and suggestions from time to time improved the quality of work in all respects. We also thankful to Mr. Sandeep. G. Shukla, Head of Computer Engineering Department for his timely guidance, inspiration and administrative support without which our work would not have been completed. We also thankful to the all staff members of Computer Engineering Department and Librarian, Guru Gobind Singh College of Engineering and Research Center, Nashik.

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VII. REFERENCES

[1] Controlled Wheelchair Based on Brain Computer Interface Using Neurosky Mindwave Mobile 2 [K. Permana, S. K. Wijaya and P. Prajitno] Department of Physics, Depok 16424, Indonesia

[2] Survey on BRAIN CONTROLLED CAR FOR DISABLED USING EEG [RAISA VARGHESE1, SAIKRISHNA D2,NEETHAL EPHRAM3, SHAHAS AHAMED4 1Assistant professor] Dept. of CSE, Sahrdaya College of Engineering and Technology, Kodakara, Kerala, India

[3] Brain Controlled Vehicle [Shreyansh Srivastava1, Praveen Yadav2, Mahendra Pratap Verma3 1, 2, 3Department of Electronics and Communication, IMS Engineering College, Ghaziabad, U.P] International Journal for Research in Applied Science & Engineering Technology (IJRASET) ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887

[4] Analysis of Brain Wave Activity Realtime Using NeuroSky Sensors With LabVIEW[Destra Andika Pratama, Masayu Anisah, Richi Agung Pratama] PROtek : Jurnal Ilmiah Teknik Elektro Volume x. No x, May xxxx https://ejournal.unkhair.ac.id/

[5] Real Time EEG Based Cognitive Brain Computer Interface for Control Applications via Arduino Interfacing[Rashima Mahajana, Dipali Bansalb] 7th International Conference on Advances in Communications & Computing, ICACC 2017, August 22-24, 2017, Cochin, India

[6] Adaptive Thresholds of EEG Brain Signals for IoT Devices Authentication [ABDELGHAFAR R. ELSHENAWAY AND SHAWKAT K. GUIRGUIS] Received June 5, 2021, accepted June 20, 2021, date of publication June 29, 2021, date of current version July 21, 2021

[7] Nonlinear adaptive robust precision pointing control Servo Systems of Tank [SHUSEN YUAN1, WENXIANG DENG 1,2, YAOWEN GE1, JIANYONG YAO 1, (Member, IEEE) AND GUOLAI YANG1] Received January 8, 2021, accepted January 16, 2021, date of publication January 25, 2021, date of current version February 10, 2021

[8] A Hybrid Asynchronous Brain-Computer Interface Combining SSVEP and EOG Signals [YajunZhou , ShenghongHe, QiyunHuang, and YuanqingLi, Fellow, IEEE] IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING, VOL. 67, NO. 10, OCTOBER 2020

[9] Controlling an anatomical robot hand Using the BCI Based on Motor Imagery [H.M.K.K.M.B.Herath1 and W.R.deMe12] Correspondence should be addressed to H.M.K.K.M.B.Herath; kasunherathlive@gmail. com Received 8 January 2021; Accepted 13 July 2021; Published 4 August 2021

[10] Brain Controlled Wheelchair: A Smart Prototype Muhammad Ahsan Awais1, Mohd Zuki Yusoff1, Norashikin Yahya1, Sheikh Zeeshan Ahmed2 and Muhammad Umair Qamar21 Centre for Intelligent Signal & Imaging Research (CISIR)

[11] Z. T. Al-qaysi, B.B. Zaidan and M.S. Suzani, Comput. Methods Programs Biomed. 164, (2018).