iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 **Issue:** VIII **Month of publication:** August 2021

DOI: https://doi.org/10.22214/ijraset.2021.37401

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue VIII Aug 2021- Available at www.ijraset.com

Controlling Wheelchair Using Brain as Biosensor

Chandana V[1], Manya M[2], S G Vaishnavi[3], Srinivas S[4]
[1, 2, 3, 4]Dept. of Electronics and Communication Engineering, NIE Institute of Technology, Mysore-570018

Abstract: This project discusses about wheel chair controlled by brain based on Brain–computer interfaces (BCI). BCI's are systems that can bypass conventional channels of communication (i.e., muscles and thoughts) 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. The intention of the project is to develop a robot that can assist the disabled people in their daily life to do some work independent of others. Here, we analyse the brain wave signals. Human brain consists of millions of interconnected neurons, the pattern of interaction between these neurons are represented as thoughts and emotional 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 are sensed by the brain wave sensor and different patterns are used for controlling a wheel chair.
Keywords: BCI, EEG, Motor Driver, Muscle activity, Health parameters, Motor rotation

I. INTRODUCTION

Paralysis is the inability whether temporary or permanent to move a part of the body. In almost all cases, paralysis is due to nerve damage, and it is not because of injury to the affected region. For instance, an injury in the middle or lower regions of the spinal cord is likely to disrupt function below the injury, including the ability to move the feet or feel sensations, even though the actual structures are as healthy as ever. Because of this in patients at least one of the following symptoms results. The brain is unable to relay a signal to an area of the body due to injuries to the brain. Brain-Computer Interface (BCI) also known as "direct neural interface" can provide a direct communication and interaction channel between the user's brain and the computer. BCI helped to direct in assisting, augmenting, or repairing human cognitive or even sensory motor functions. BCI provides a new direction to construct an interactive system which can translate human Channel based on brain waves and muscles to allow users to communicate without movement with the external world. A BCI system is just to translate EEG signals from a reflection of brain activity into user action through system's hardware and software.

II. LITERATURE SURVEY

Cecilia L. Maeder; Claudia Sannelli; Stefan Haufe; Benjamin Blankertz: Pre-Stimulus Sensorimotor Rhythms Influence Brain–Computer Interface Classification Performance**:** The influence of pre-stimulus ongoing brain activity on post-stimulus task performance has recently been analysed in several studies. While pre-stimulus activity in the parieto-occipital area has been exhaustively investigated with congruent results, less is known about the sensorimotor areas, for which studies reported inconsistent findings. In this work, the topic is addressed in a brain-computer interface (BCI) setting based on modulations of sensorimotor rhythms (SMR). The goal is to assess whether and how pre-stimulus SMR activity influences the successive task execution quality and consequently the classification performance. Grand average data of 23 participants performing right and left hand motor imagery were analysed. Trials were separated into two groups depending on the SMR amplitude in the 1000 ms interval preceding the cue, and classification by common spatial patterns (CSPs) preprocessing and linear discriminant analysis (LDA) was carried out in the post-stimulus time interval. i.e., during the task execution. The correlation between trial group and classification performance was assessed by an analysis of variance. As a result of this analysis, trials with higher SMR amplitude in the 1000 ms interval preceding the cue yielded significantly better classification performance than trials with lower amplitude. A further investigation of brain activity patterns revealed that this increase in accuracy is mainly due to the persistence of a higher SMR amplitude over the ipsilateral hemisphere. Our findings support the idea that exploiting information about the ongoing SMR might be the key to boosting performance in future SMR-BCI experiments and motor related tasks in general. Recently, several studies have investigated the effect of ongoing oscillatory activity preceding an event on subsequent processing and task outcome performance. The reported effects vary extensively according to the investigated task. Numerous visual perception electroencephalography (EEG) studies link improved performance in stimulus detection to decreased amplitude in the alpha frequency band (around 7–13 Hz) over parieto-occipital areas.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue VIII Aug 2021- Available at www.ijraset.com

Murat Akcakaya; Betts Peters; Mohammad Moghadamfalahi; Aimee R. Mooney; Umut Orhan; Barry Oken; Deniz Erdogmus:Noninvasive Brain–Computer Interfaces for Augmentative and Alternative Communication:Brain-computer interfaces (BCIs) promise to provide a novel access channel for assistive technologies, including augmentative and alternative communication (AAC) systems, to people with severe speech and physical impairments (SSPI). Research on the subject has been accelerating significantly in the last decade and the research community took great strides toward making BCI-AAC a practical reality to individuals with SSPI. Nevertheless, the end goal has still not been reached and there is much work to be done to produce real-world-worthy systems that can be comfortably, conveniently, and reliably used by individuals with SSPI with help from their families and care givers who will need to maintain, setup, and debug the systems at home. This paper reviews reports in the BCI field that aim at AAC as the application domain with a consideration on both technical and clinical aspects.

C Guger, H Ramoser, G Pfurtscheller:Real-time EEG analysis with subject-specific spatial patterns for a brain-computer interface (BCI):Electroencephalogram (EEG) recordings during right and left motor imagery allow one to establish a new communication channel for, e.g., patients with amyotrophic lateral sclerosis. Such an EEG-based brain-computer interface (BCI) can be used to develop a simple binary response for the control of a device. Three subjects participated in a series of on-line sessions to test if it is possible to use common spatial patterns to analyze EEG in real time in order to give feedback to the subjects. Furthermore, the classification accuracy that can be achieved after only three days of training was investigated. The patterns are estimated from a set of multichannel EEG data by the method of common spatial patterns and reflect the specific activation of cortical areas. By construction, common spatial patterns weight each electrode according to its importance to the discrimination task and suppress noise in individual channels by using correlations between neighboring electrodes. Experiments with three subjects resulted in an error rate of 2, 6 and 14% during on-line discrimination of left- and right-hand motor imagery after three days of training and make common spatial patterns a promising method for an EEG-based brain-computer interface.

III. OBJECTIVES

Independent mobility is a necessity to live everyday life for human beings. A person with physical challenges has restricted mobility. For these people, Brain Computer Interface (BCI) provides a promising solution. The major design objectives of this project are to reduce user effort in controlling the wheelchair, to ensure the safety during movement., designing a smart wheelchair using inexpensive hardware and open source software, to monitor the activity of the person in real time using sensors and the designed system should be portable for the user.

IV. BLOCK DIAGRAM

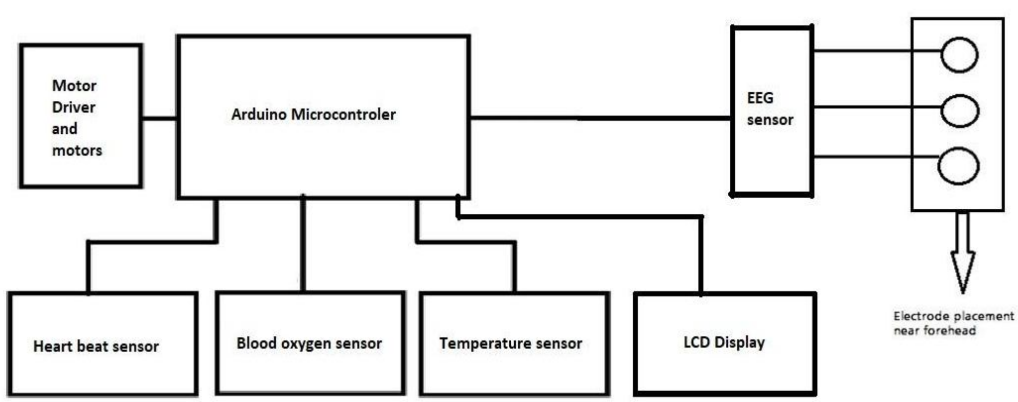


Fig. 1: Block diagram of Brain Controlled Wheelchair

The brain of the system is Arduino microcontroller. The system is designed to control the movement of wheel chair using EEG sensor. EEG sensor intercepts and measures the electrical signal sent by brain to control muscle movement. The electrodes from EEG sensors are attached near forehead. When a person tries to move the muscle at which the electrode is placed, the signal is intercepted. The system is designed to recognize different patterns of muscle movement. These patterns are used to control the direction of wheel chair. Depending on the pattern, the wheelchair moves in the respective direction.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue VIII Aug 2021- Available at www.ijraset.com

V. FLOWCHART

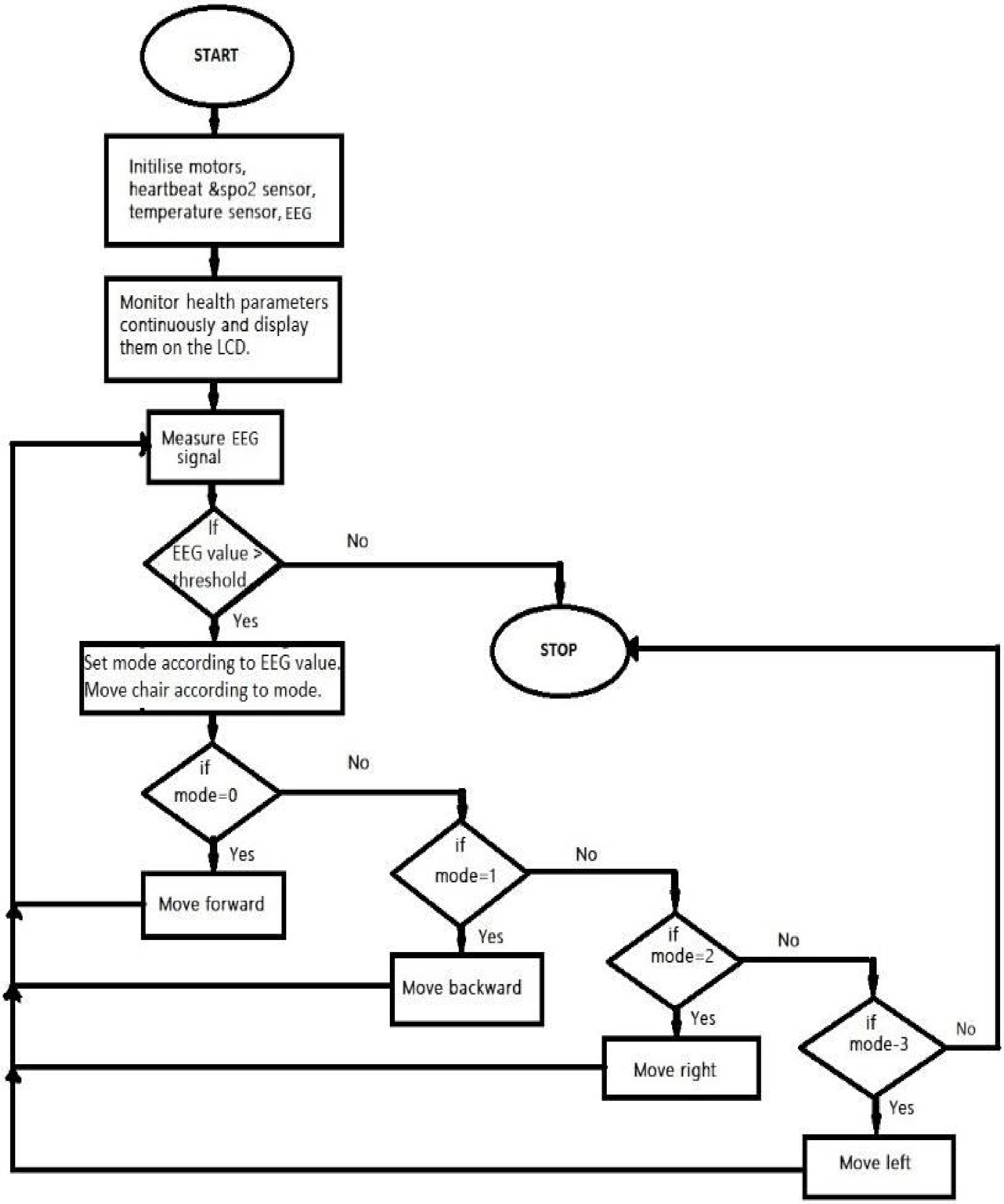


Fig. 2: Flowchart of the whole system.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue VIII Aug 2021- Available at www.ijraset.com

VI. DESIGN IMPLEMENTATION

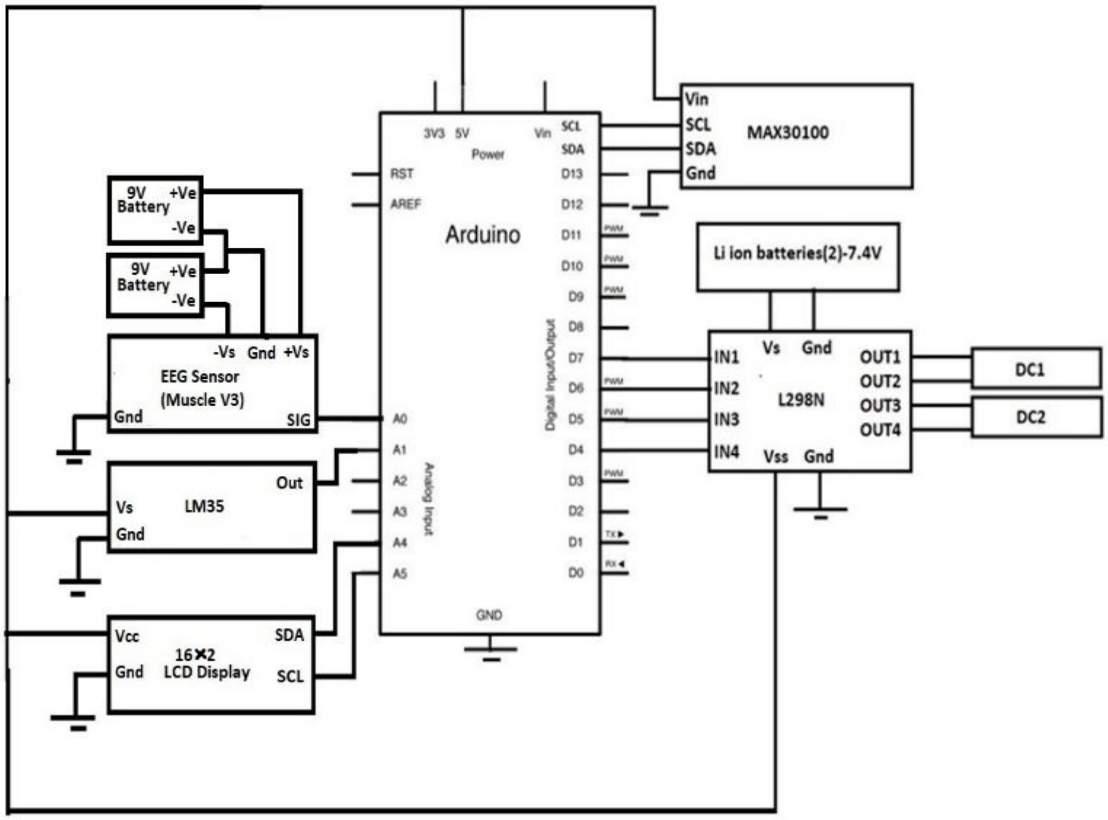


Fig. 3: Circuit diagram of Brain Controlled Wheelchair

The electrodes of the sensor in placed on the patient's forehead. The patient sitting on the wheelchair moves their eyes. EEG sensor senses the muscle movement and passes the signal as input to the Arduino. Arduino controls the DC motors attached to it for movement of wheelchair. The motor driver attached to the Arduino drives the DC motors. Motors rotate according to the direction sensed by EEG sensor.

VII. ADVANTAGES

The wheelchair without the tiresome turning of the wheels is a simple step ahead of the electric wheelchairs. It proves beneficial for every individual for locomotion purposes without the need of manual labour. The simultaneous EEG acquisition may detect any substantial improvement in the condition of the body.

VIII. APPLICATIONS

The developments in the field of brain-computer interface area juvenile step towards the improvements of the wheelchair. The wheelchair controls only 2 wheels whereas the same condition may be used to drive a car with 4 wheels. The day-to-day gadgets may be evolved to work using mind waves.

IX. RESULTS

1) *Case 1:* Temperature and Heartbeat is measured continuously and displayed on LCD screen. An example is shown in Fig. 4 and Fig. 5
2) *Case 2:* Direct modes can be changed by concentrating greater than 1 second and less than 2 seconds. The modes are FORWARD, BACKWARD, RIGHT and LEFT. The different modes are shown in Fig.6, Fig.7, Fig. 8, Fig. 9 respectively.
3) *Case 3:* The wheelchair can be moved in set direction mode by concentrating for more than 2 seconds. The different views of the model are Front View,Side View, Top view and Isometric View as shown in Fig. 11, Fig. 12, Fig. 13, Fig. 14 respectively.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue VIII Aug 2021- Available at www.ijraset.com

Fig. 4: Temperature sensor reading showing 85 degrees Celsius

Fig. 5: MAX30100 sensor readings showing pulse rate as 102 bpm and oxygen concentration as 95%

Fig. 6: Display showing wheelchair moving in FORWARD direction

Fig. 7: Display showing wheelchair moving in BACKWARD direction

Fig. 8: Display showing wheelchair moving in LEFT direction

Fig. 9: Display showing wheelchair moving in RIGHT direction

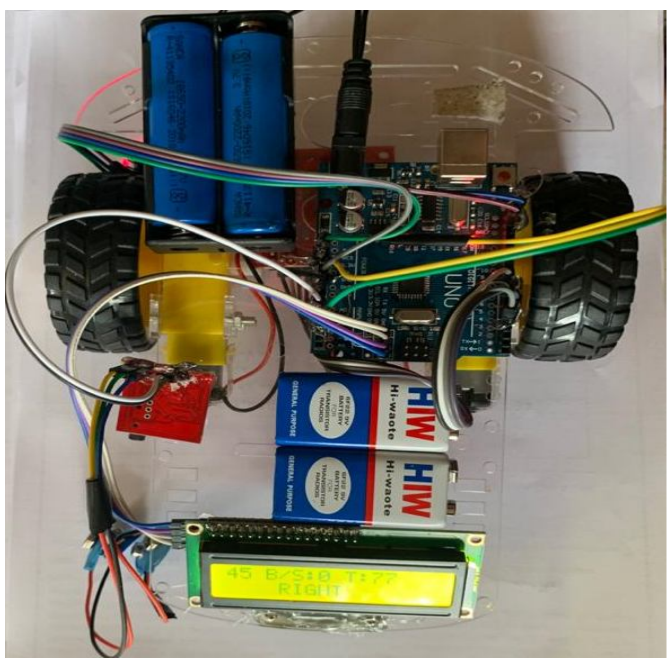


Fig. 10: Working model of wheelchair controlled using brain as bio-sensor

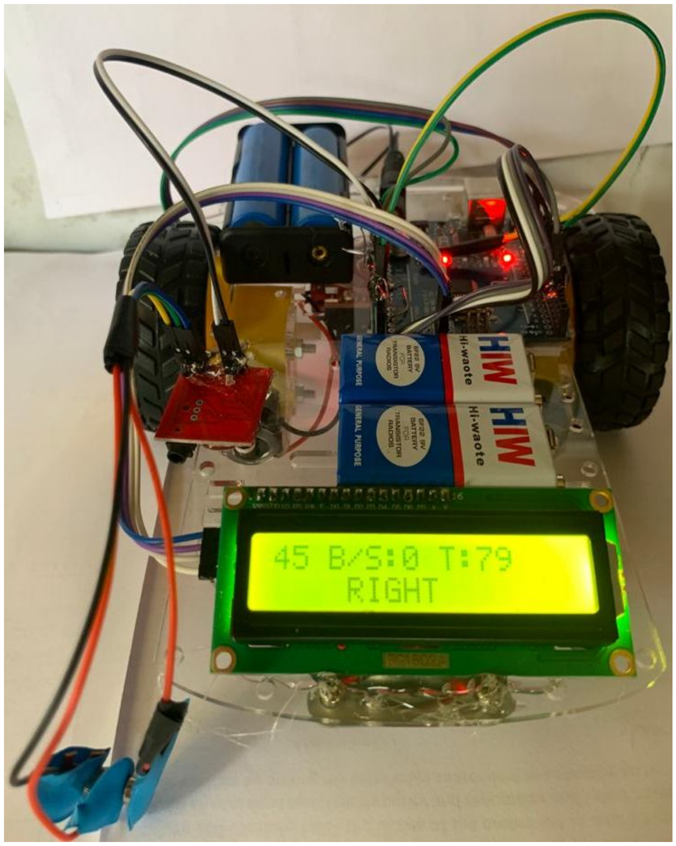


Fig. 11: Front View of the model

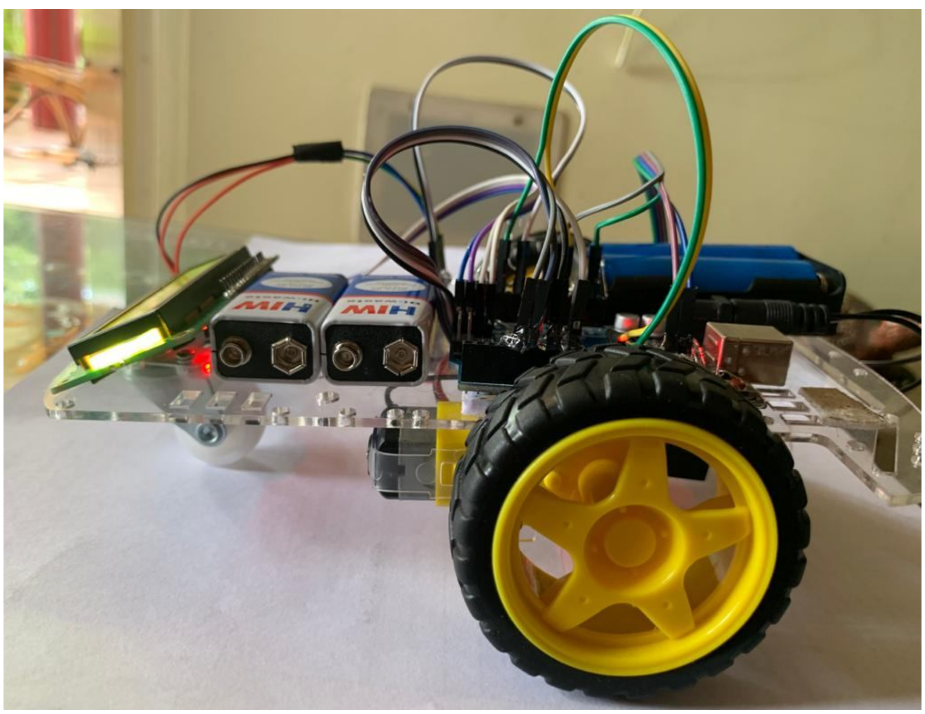


Fig. 12: Side View of the model

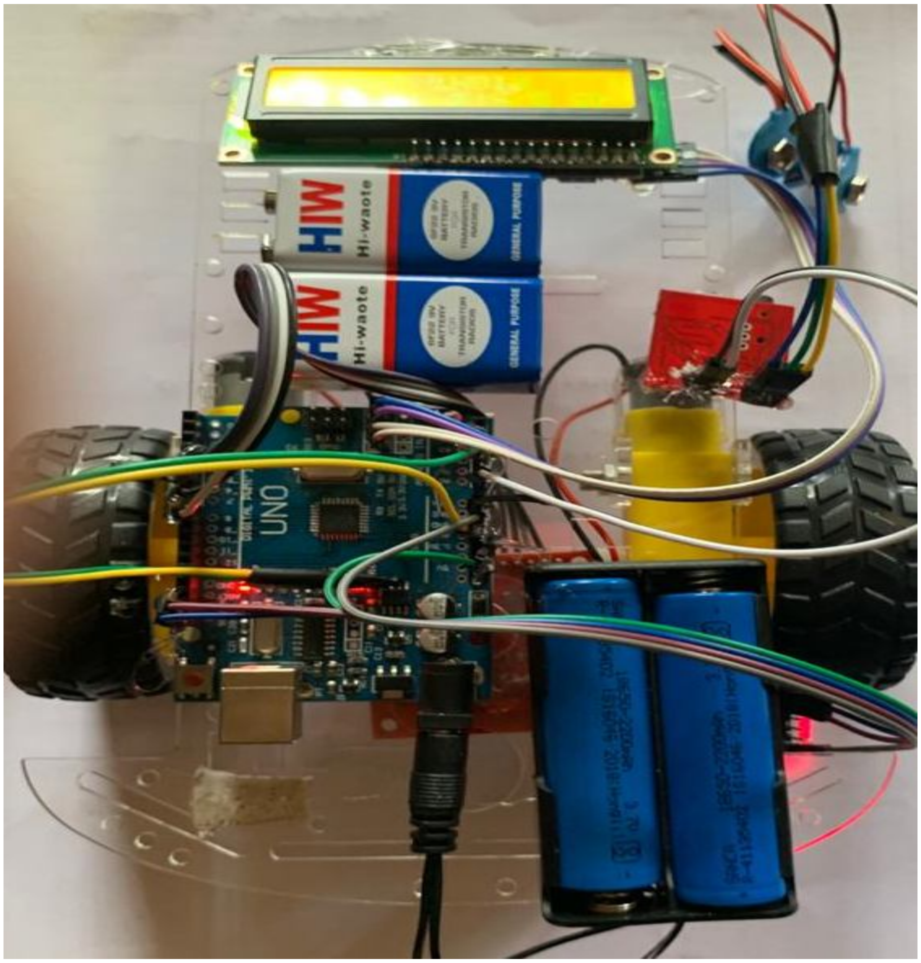


Fig. 13: Top View of the model

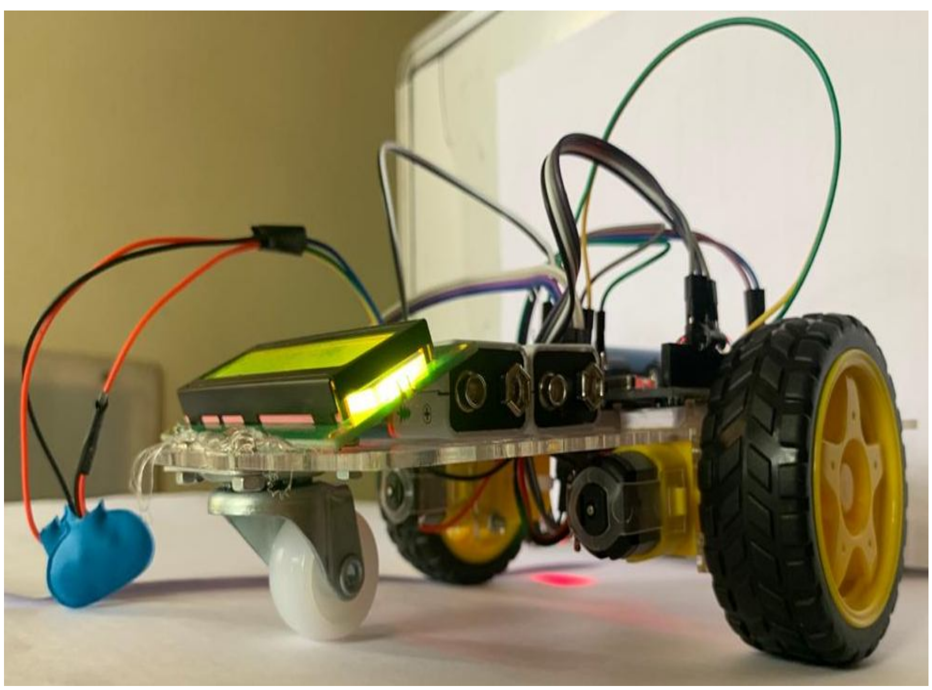


Fig. 14: Isometric View of the model

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue VIII Aug 2021- Available at www.ijraset.com

X. CONCLUSION

To meet the design objectives, a portable brain controlled wheelchair using Arduino and Mindwave headset is designed. The major aim of the project is to control the electric wheelchair in different directions (forward, left and right) by using eye blink and attention level values from the EEG signals. This project is user friendly design to meet real world target reaching tasks, where users may need to turn the wheelchair in left or right direction in steps and then moves to forward. In the typical setting as moving forward, turning left/right, there is a good chance of examining all combinations of commands, such as non-control & control, move forward & stop, turn & move forward, just as in real wheelchair control.

REFERENCES

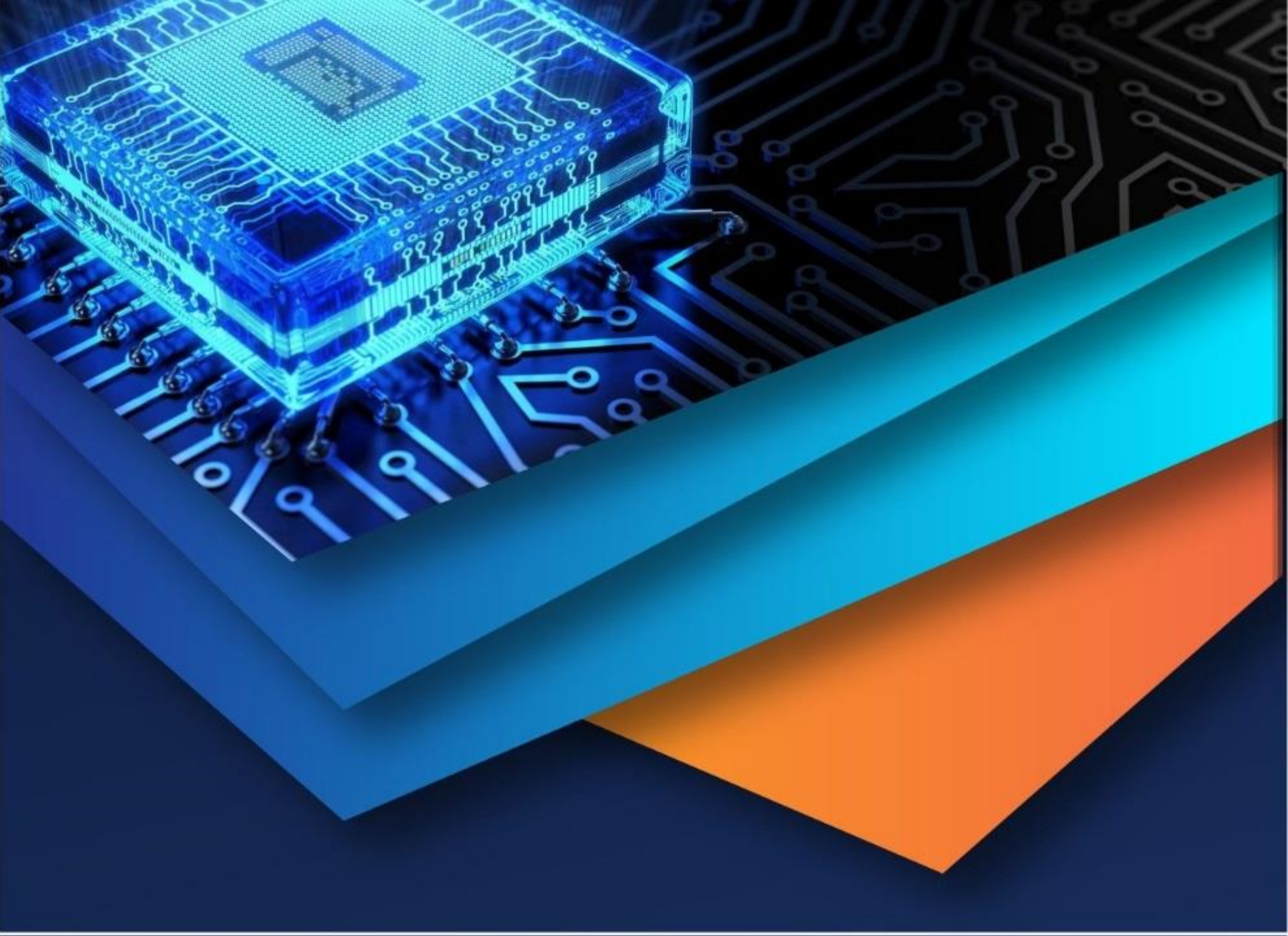
[1] Van Drongelen, B. Roszek, E. S. M. Hilbers-Modderman,M. Kallewaard, and C. Wassenaar, “Wheelchair incidents,” Rijksinstituutvoor Volksgezondheid en Milieu RIVM, Bilthoven, NL, Tech. Rep.,November 2002, accessed Februaury, 2010.

[2] Frank, J. Ward, N. Orwell, C. McCullagh, and M. Belcher, “Introduction of a new NHS electric-powered indoor/outdoor chair (EPIOC)service: benefits, risks and implications for prescribers,” Clinical Rehabilitation, no. 14, pp. 665–673, 2000.

[3] R. C. Simpson, E. F. LoPresti, and R. A. Cooper, “How many people would benefit from a smart wheelchair?” Journal of Rehabilitation Research and Development, vol. 45, no. 1, pp. 53–71, 2008.

[4] T. Carlson and Y. Demiris, “Collaborative control for a roboticwheelchair: Evaluation of performance, attention, and workload,” IEEE Transactions on Systems, Man, and Cybernetics, Part B: Cybernetics,vol. 42, no. 3, pp. 876–888, 2012.

[5] Rebsamen, C. Guan, H. Zhang, C. Wang, C. Teo, M. Ang, and E. Burdet, “A brain controlled wheelchair to navigate in familiar environments,” IEEE Transactions on Neural Systems and Rehabilitation Engineering, vol. 18, no. 6, pp. 590–598, dec. 2010.



10.22214/IJRASET

INDEX COPERNICUS

45.98

IMPACT FACTOR:
7.129

IMPACT FACTOR:
7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)