International Journal of Scientific Research in _____ Research Paper
Computer Science and Engineering
Vol.8, Issue.6, pp.50-56, December (2020) E-ISSN: 2320-7639

Brain Computer Interface Based Robotic Car Using Raspberry Pi

Umme Habiba Maginmani[1*], Mujamil Dakhani[2]

[1]Dept. of Computer Network & Engineering, Secab Institute Of Engineering & Technology Vijayapura, VTU Belgavi, Karanataka, India
[2]Dept. of Computer Science & Engineering, Secab Institute Of Engineering & Technology Vijayapura, VTU Belgavi, Karanataka, India

[*]*Corresponding Author: ummehabibamaginmani786@gmail.com*

Available online at: www.isroset.org

Received: 04/Dec/2020, Accepted: 15/Dec/2020, Online: 31/Dec/2020

Abstract- In our society we will see that there are more individual who suffered from various diseases like paralysis in such situation they cannot talk and unfit to move from one place to another and at the same time they are not capable to communicate to other for their daily essential needs , but in such cases they can utilize their eyes for communication and sometimes their use their head to convey their messages. In this paper we shows that how our proposed methods which works under the principle of Brain Computer Interface.
Our model gives confidence to those individual for controlling their wheelchair to the spot by just blinking of their eyes. By employing this method these individual need not to be more dependent on their guardian when they need of, and they can drive their wheelchair themselves. As soon as we start running the program, wheelchair begin to moves from their position and command is provided through the blinking of eyes.

Keyword- Brain, Brain Computer Interface, Wheelchair, Eye Blink, Raspberry Pi, Bluetooth, Mind-wave mobile, Brain sense.

I. INTRODUCTION

The Brain computer Interface (BCI) which is acting as a channel of communication utilized for interaction among the brain of human and a computer. We employ an Electroencephalography (EEG) technique just by deploying an electrode cap that will be placed on the skull area of the user for the EEG signal acquisition, which later captured and translated into the command by the raspberry pi which helps the wheelchair movement. BCI monitor the EEG waves coming from brain. The EEG– Electro-encephalo-graphy which is non-invarsive technique will monitor an Electrical property of the Brain together with skull.

The Neurosky Mind-wave mobile which does the estimates function coordinated EMG activities that the strength of the blinks. Once brain waves are measured it will then delivers to brain computer interface unit which will be then analyzed and amplified and classified into alpha, beta, gamma waves then "raspberry pi" controller will direct the movement of wheelchair.

The Raspberry Pi which is a MasterCard precise solitary computer or SoC which utilizes ARM1176JZF-S center, simply a framework on a chip, which offer a technique for locating all the basic hardware which are required for running a pc on a chip. Raspberry Pi uses an Operating system for its working. Raspberry provides an option for storage which is utilized to accumulate the boot-loader. "Linux Kernels & file systems" will set up as an "embedded systems". A "SD/MMC card" space is put up for this basis. Once boot-loader start ,the Raspberry Pi will be perform as per the application program

II.LITERATURE SURVEY

In this section, similar studies which is carried out by other author has been explored and method employed by them during their research work and working principle utilized are reviewed.

"S.S. Pujari, M.S.Patil, & S.S.Ingleshwar" [1] in their study of "Remotely controlled autonomous robot using Android application" they shows that they designed a robot for those families who are working that will remotely monitor their children as well as be in touch with use of camera. Raspberry Pi 3, camera module, Wi-Fi &Bluetooth innovation utilized via the Robot. The Robot was characterized as heart to Raspberry Pi,& coding is done by utilizing python language.

"M. R. Mishi, R. Bibi, and T. Ahsan" [2] in their research paper "Multiple motion control systems of the robotic car based on IoT to produce cloud service," structured an automated vehicle. Arduino-Uno & Raspberry-Pi be utilized in cooperation to direct robot. "GPS" was likewise utilized to follow the vehicle & separations involving the hindrance & the way they are estimated. In this way, multi-movement framework was managed.

"D. Chakraborty, K. Sharma, R. K. Roy, H. Singh, and T. Bezboruah" [3] in their research paper named "Android application based monitoring and controlling of movement of a remotely controlled robotic car mounted with various sensors via Bluetooth," they proposed a structured and built up an automated vehicle utilizing sensors and Bluetooth innovation. They had built up correspondence between brilliant gadget and the robot. On account of the telephone camera, they had watched the living creatures. The deterrents the other way were kept from crashing into the ultrasonic going sensor. Pictures captured via camera then stored in the storage & evaluated.

"S. J. Lee, J. Lim, G. Tewolde, and J. Kwon" [4] in their article "Autonomous tour guide robot by using ultrasonic range sensors and QR code recognition in an indoor environment," they defined that how they structured an independent automated vehicle utilized Arduino-Uno-R3 for robot's cerebrum. Likewise, "Bluetooth module and the ultrasonic sensor" was utilized in their work as specified in their study. Robot checking the put QR-codes which be in motion with the street into self-ruling structure because of the QR-codes. Likewise furnished right to be heard correspondence with the Android gadget in the Text-to-speech aspect. Additionally stirred through the assistance of a ultrasonic-sensor with no striking items near it, and then run data be gathered. All together to the robot movement to be even, but it is limited next to PID calculation.

"E. Amareswar, G. S. S. K. Goud, K. R. Maheshwari, E. Akhil, S. Aashraya, and T. Naveen" [5] in their paper "Multipurpose military service robot," they show a blueprint of robot utilized for the armed forces.in their study they show that the robot act as metal detector and played explosives detection role, with the help of android device camera. The structure of robot is build by utilizing "Android device, Bluetooth module, a microcontroller (Arduino Uno), DC motors, motor driver, wireless camera and metal detector". Planned a robot utilized for the military zone. On account of the metal locator, the robot assumed a significant job in the discovery of explosives, and the environmental factors could be seen on account of the camera of the pre-owned Android gadget. This robot framework comprised of "Android gadget, Bluetooth module, a microcontroller (Arduino Uno), DC engines, engine driver, remote camera and metal identifier".

"Premkumar, Keerthi, and K Gerard Joe Nigel" [6] in their proposed system "Smart Phone-Based Robotic Arm Control Using Raspberry Pi, Android, and Wi-Fi." they defined that how they structured automated arm controlled utilizing Raspberry Pi. The principle reason for this robot was to add the human arm charachteristic to the robot arm. Raspberry Pi was the code which is written by utilizing Python language that gave arm development. With the Android application, the client stirred the robot arm in the proffered path. Automated arm control was given along these lines. The Android application was written in Java. Subsequently, the correspondence between the Android application and Raspberry Pi was given by the Wi-Fi association. This correspondence stirred the robot arm to the specified direction that is either right or left.

"Zain Anwar Ali , M. Tanveer, Habib Shaukat and Saad Anwar" [7] in this paper "Android Operated Robotic Arm " these author presents a strategy for scheming a automatic-arm utilizing an application works on android platform. These android-telephone and raspberry-pi board is associated via Wi-Fi. That why this structured amed as the automated-arm as it plays out a similar action as work hands of human.

III.EXISTING SYSTEM

In the existing system, each application is developed utilizing Matlab, Arduino Uno and Raspberry Pi, it need a computer or android mobile phone for processing of signals & preparing application through Matlab.

IV. PROPOSED SYSTEM

It is not as easy for those individual for moving a mechanical wheelchair, in which various of them usually utilize for their movement. So there is need to design a wheel-chair that is intelligent and offer effortless mobility. In this paper we are attempt to shows that how we propose a Brain Controller Wheel-chair, which utilizes the signals captured from the brain of individuals and then processes them to control the wheel-chair.

V. SYSTEM ARCHITECTURE

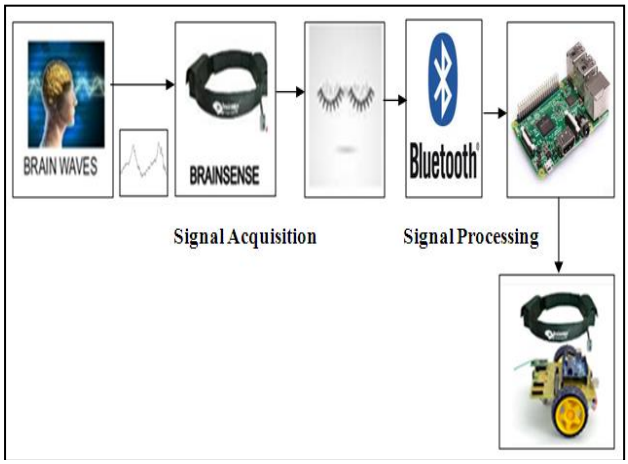

Figure 1: structure of brain controlled robotic car using raspberry pi

VI. TECHNICAL SPECIFICATIONS

6.1 Hardware Required

- Raspberry Pi
- Mind-wave mobile or Brain sense
- Robot chassis (Motor, Driver IC)
- Batteries
- HDMI display screen

6.2 Software Required

- Raspbian OS
- SD card Formatter
- Win32 disk imager

6.1.1 Raspberry Pi

The Raspberry Pi is a cheaper, credit-card sized estimated PC which interfaces with a screen of PC or TV, and operated with a standard keyboard and mouse. It is a fit little gadget that empowers individuals of any age to study computing, and to make sense of how to work with the programming language like Scratch and Python.

The Raspberry Pi is a "Broadcom BCM2835 SOC" structure on chip board. It is a littler than ordinary PC and it is used to run different activities. It arrives outfitted with a "700MHz, 512MB of SDRAM and ARM1176JZF-S" center CPU. The raspberry pi USB 2.0 port utilized basically for exterior information accessibility decision. Ethernet is a key entryway to interrelate with various contraptions and the web in model B. It describe control from downsized scale connector of USB, with a base degree of 2.5 watts. It contains structures and focused chip to revive the control of image figurings.

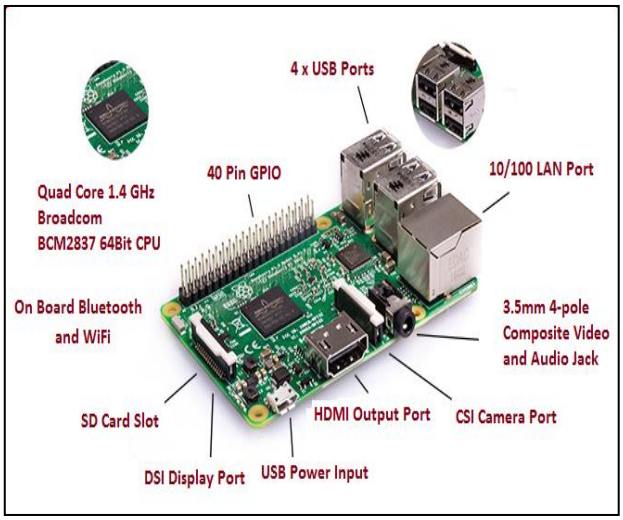

Figure 2: Raspberry Pi

There are Four power modes of Raspberry Pi

- Run mode – The ARM11 core functionality and central processing unit (CPU) are accessible and powered up.
- Backup mode – the principle center time-keepers are shut down (CPU parts that process directions are done running)
- Shutdown mode – in this mode there is no supply of power.
- Inactive mode – the center is shut down and left powered on for all caches.

6.1.2 Brain Sense

Brain sense is also called as Mind-wave mobile. Brain-sense is the gadget which is workings under the standards of BCI. The Brain-Computer Interface used for examining intelligence with "EEG – Electro-encephalo-graphy", the investigation of the electrical movement of mind neurons & creating activated brain applications by utilization the gadget.

In present era, each manufacturing is attempting to manufacture "Artificial Intelligence bots" which are exceptionally canny than individual, which might be a danger to Humans. Then again, a few enterprises are attempting to improve the human, utilizing this BCI innovation. Businesses, for example, Neura-link by Elon Musk, who design the thinner electrode, which is fixed in the region of the cranium, which is then utilized for observing the activities of brain.

Brain-sense is likewise a BCI gadgets, in which electrodes are Non- invasive in their nature. It means that the Electrodes was simply positioned in the cranium of the brain, rather than invasive types of electrodes that is infusing the electrode hooked on the tissues of the human mind and further-more it is a dry-electrode, which doesn't need any prior use of gel.

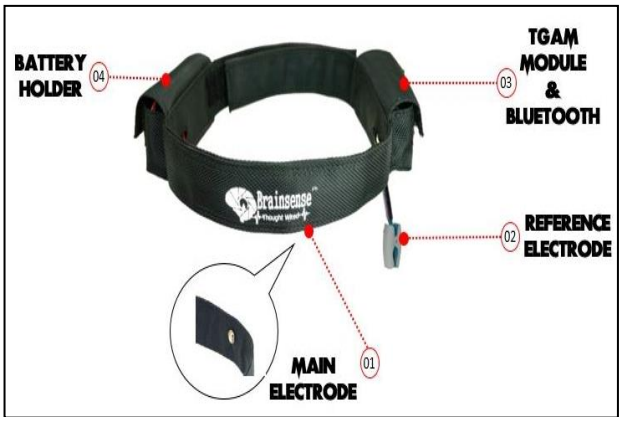

Figure 3: look of Brain Sense

6.1.4 HDMI display screen

The display screen is utilized so as to show the eye blinking and tracking movement. The screen is for the most part significant for the overseer. It can direct him along the best possible arrangement of the item. For the best possible display, we have decided to utilize HDMI LCD show screen.

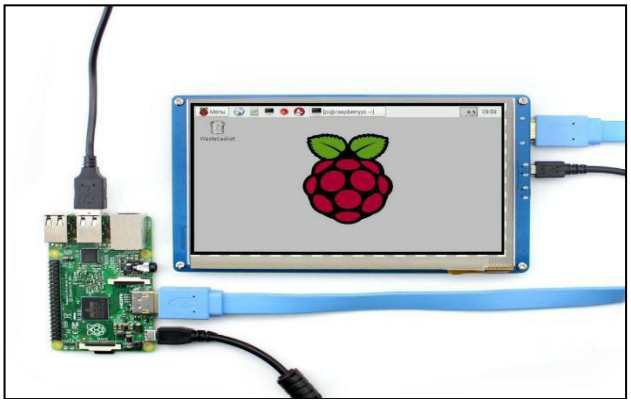

Figure 5 : HDMI LCD Display Screen

6.1.5 Robot chassis (Motor, Driver IC) Chassis

robot chassis make use of Plywood, acrylic, or metal plate because these are robust for holding the robot together and can shaped easily. below figure shows an example of the FR4 sheet (Epoxy Resin) which is used with the robot chassis. the reason for using FR4 (epoxy resin) is easy to cutting,light weight strong and good looking.

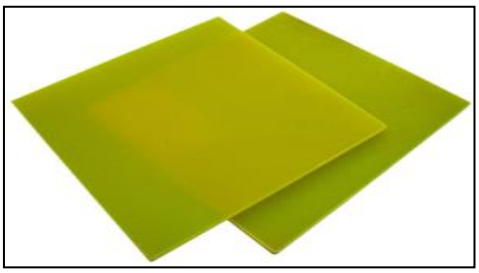

Fig 6:FR4 sheet (Epoxy Resin)

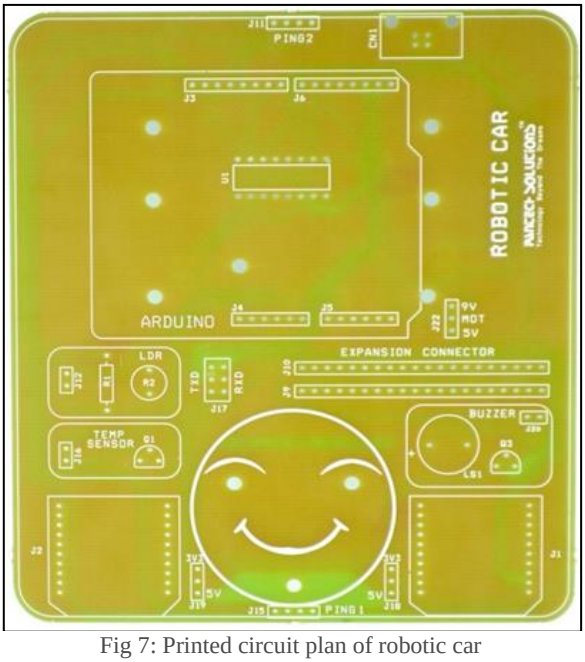

Fig 7: Printed circuit plan of robotic car

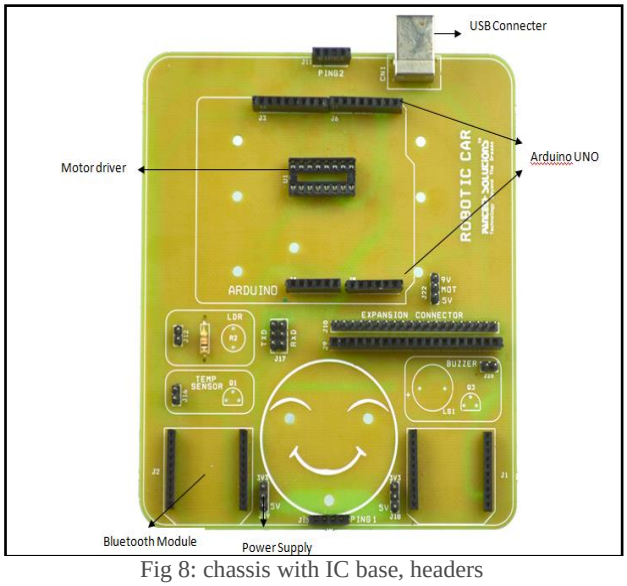

Fig 8: chassis with IC base, headers

DC Motors

DC motot usually having limited rotation it is utilized to rotate the motor to a particular direction. DC motor will move the wheel of robot in specified direction. The Parallax (Futaba)which allow the continuous rotary motion of the DC motor is an ideal for our requirement, which allows indistinguishable centering of two DC motor easily.

Fig 8: DC motor with L brackets

below figure shows Attaching of DC Motors to L brackets, for this we need to put together two L-shaped Brackets to every servo with the help of screws

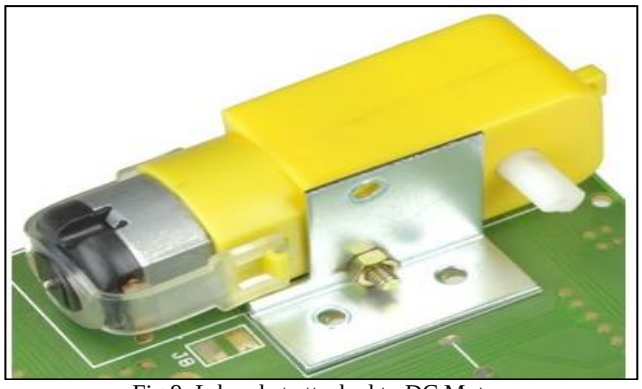

Fig 9: L-bracket attached to DC Motor

6.1.6 Batteries

A plain 4XA battery holder is attached to the flipside of the chassis by making a hole in the focal point and then placing a “3X10mm screw” by the holes and build up the battery holder to the chassis as shown in the below figure.

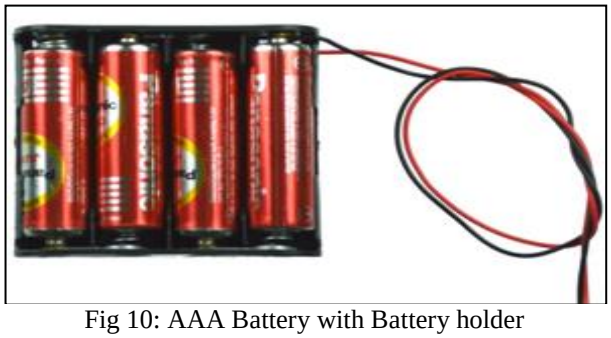

Fig 10: AAA Battery with Battery holder

6.2 Software Required

6.2.1 Raspbian OS

Raspberry Pi OS is officially known as “Raspbian OS” a “Debian-based PC” working framework for Raspberry Pi. Commencing 2015 it has authoritatively specified by the Raspberry Pi Foundation as the basic functioning structure

for the set of Raspberry Pi single-board PCs. The first Raspbian OS was prepared by "Mike Thompson and Peter Green" as a at no cost endeavor. The basic structure was done in June 2012..

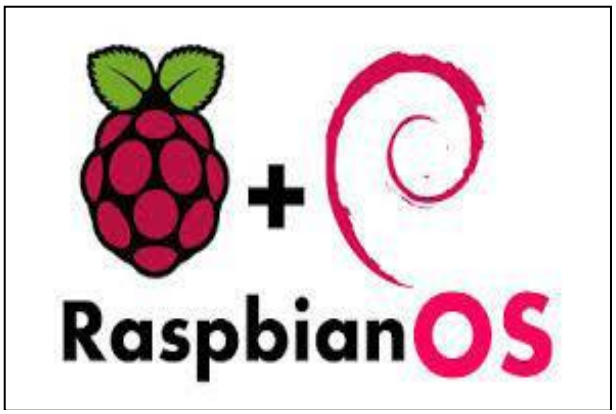

Figure 11: Raspbian OS logo

Past version of Pi OS have been 32bit and dependent on Raspbian center, taking the name Raspbian. Since ongoing 64bit versions no longer utilize the Raspbian center, the name has been changed to Raspberry Pi OS for both 64bit and 32bit variants.

6.2.2 SD Formatter

How To Format Pi SD Cards Using SD Formatter of Rasberry Pi

i. First Insert your SD card & run application of "SD-Formatter".
ii. Next step is to enabling "Size Adjustment". As we are explicitly interested keen on reestablishing the genuine limit of the card click "Option" and turn "Format Size Adjustment" to "ON"
iii. Then. Press on "Format" to begin the procedure..
iv. Click on Finish.

6.4.3 Win32 disk imager

To run "Win32 **disk** imager" we have to Download "Win32DiskImager" from " http://sourceforge.net/projects/win32diskimager/files/latest /download " slot in our SD-Card and afterward run "Win32DiskImager.exe". It might provide a blunder message on start-up, yet we have to regularly disregard it. It may discover our drive of the SD-Card or if does not manually we need to select. choose the document "#.img" file with images that you want to utilize & afterward push "write". When it finishes we are all set, embed our SD-card into the Raspberry Pi.

VII. METHODOLOGY

The proposed system utilizes Raspberry Pi for its working, it doesn't need for the Matlab application which is usually employ for the preparation of the signals. The Raspberry Pi which will comes with built-in Bluetooth, so that it does not require for an exterior Bluetooth. once the system turn ON ,the wheel-chair start its movement, at this position by having one eye-blink, wheel-chair will turn to left direction and when two-blink is discovered the direction of the wheelchair is turned to right . If it recognizes for some abnormal blink of eyes then at that the wheel-chair will stops as a result.

We utilize an Electroencephalography (EEG) technique just by deploying an electrode cap that is brain-sense that will be placed on the skull area of the user for the EEG signal acquisition, which later captured and translated into the command by the raspberry pi which helps the wheelchair movement. BCI monitor the EEG waves coming from brain. The EEG– Electro-encephalo-graphy which is non-invarsive technique will monitor an Electrical property of the Brain together with skull. The Neurosky-Mind-wave mobile which does the estimates function coordinated EMG activities that the strength of the blinks. Once brain waves are measured it will then delivers to brain computer interface unit which will be then analyzed and amplified and classified into alpha, beta, gamma waves then raspberry pi controller will control the movement of the wheelchair. As shown in the below diagram Robotic Car is attached to the Raspberry Pi through GPIO pins,includes built-in Bluetooth. Mind-wave mobile or Brain-Sense which additionally has inbuilt Bluetooth, is associated with Raspberry Pi.

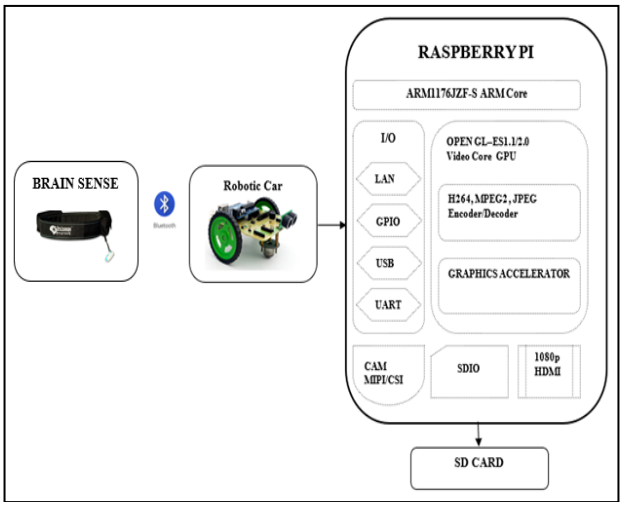

Figure 12: Block Diagram

VIII. RESULT AND ANALYSIS

In this framework, Raspberry Pi goes about as an inside, which these applications needn't bother about working with any PC/Laptop by Matlab. It is littler than normal PC, it will practice the gesture by its individual. Exactly after the system commence to run, wheel-chair stir normally, when one blink is perceived vehicle turns its direction to left, if two blinks is recognized vehicle turns to the right. If any abnormal blink is recognized vehicle stops normally. Since Raspberry Pi is having inbuilt Bluetooth, it doesn't requires any outside Bluetooth for any application. Essential use of this system is for incapacitated people, by this system they can prepared to move their wheel-chair, with their own decision with no conditions.

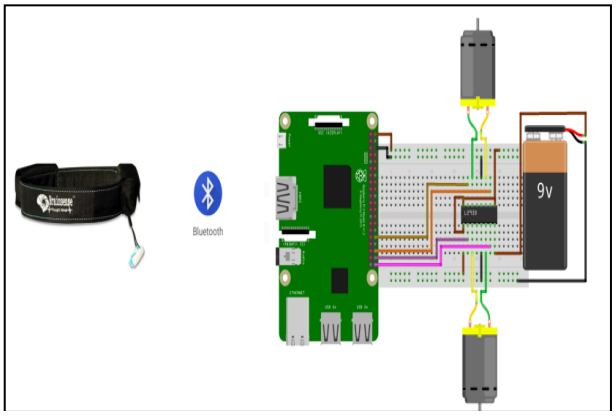

Figure 13: Circuit Diagram

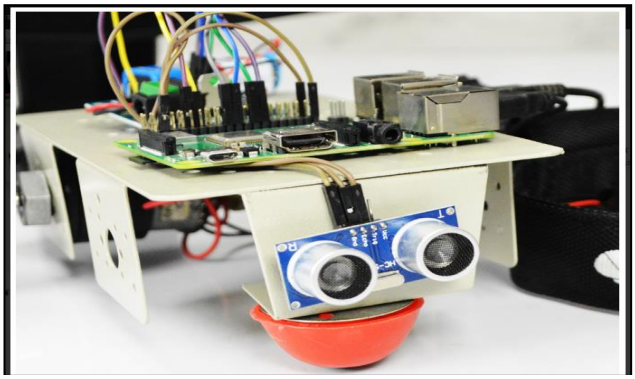

figure 14: look of Robotic Car

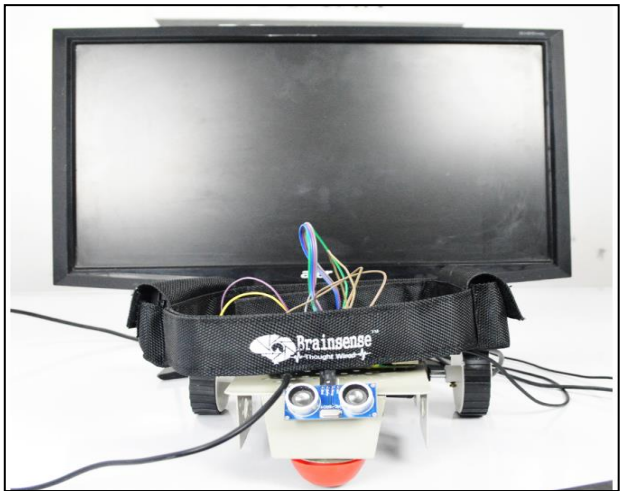

figure 15: Interfacing robotic car with screen

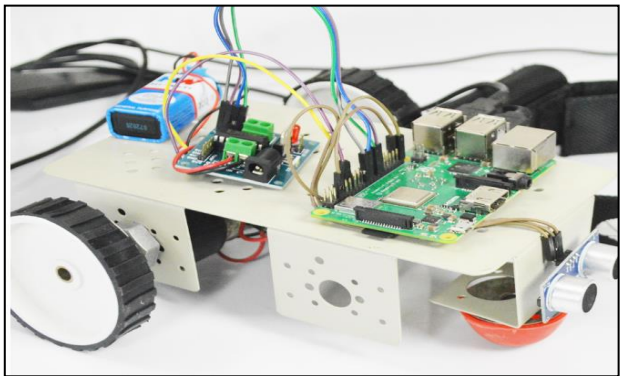

figure 16: configuration of robotic car

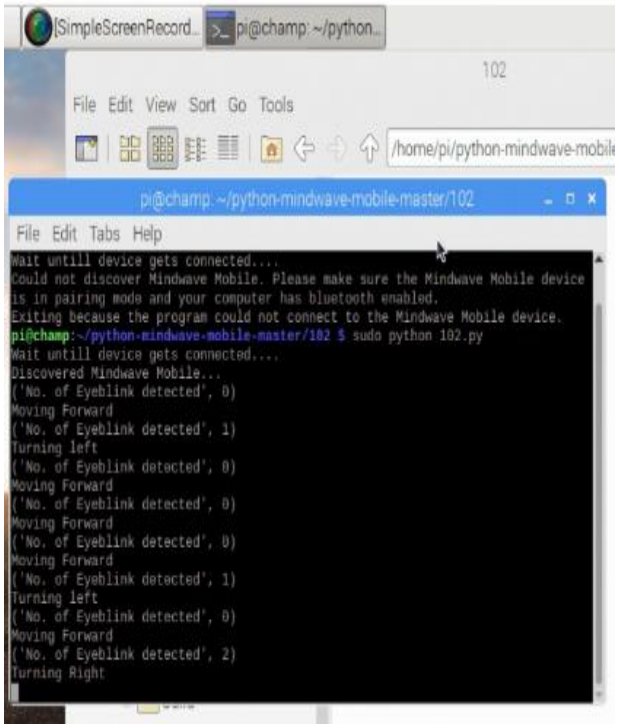

figure 17: Output result of detected Eye blink

IX. CONCLUSION

Many research article was proposed to address the “robotic car with Arduino Uno, Raspberry pi and Android platform”. This paper plans to draw out an answer for the deadened individuals with no mischief to their body remotely or inside In this paper it shows how this system can be effectively reconfigurable for different constraint like attention, meditation and including various blinks for development in additional commands.

The proposed scheme plans to draw out an answer for the paralyzed individuals with no damage to their body remotely or inside. It over weigh the recently evolved models in this field since not any of the parts are in direct contact with the patient's body henceforth it certainly will end up being more secure. Utilization of Raspberry pi is basic and furthermore Eye Blink robotic car: Assisting System for Paralyzed growing hugely in the market today. The instrument had points of interest over the more established traditional tools.

BCI will monitor EEG-waves from the Brain. EEG (Electro-encephalo-graphy) monitor an Electrical property of the Brain alongside the skull. The force of Eye-blink varies for each individual; we can re-configure the code for high precision for blink identification.

REFERENCE

[1] S. S. Pujari, M. S. Patil, and S. S. Ingleshwar, “Remotely controlled autonomous robot using Android application”, **2017** IEEE International Conference on I-SMAC (IoT in Social, Mobile, Analytics, and Cloud) (I-SMAC), PP. **460-933,10 feb 2017**.

[2] M. R. Mishi, R. Bibi, and T. Ahsan, "Multiple motion control systems of the robotic car based on IoT to produce cloud service," **2017** IEEE International Conference on Electrical, Computer and Communication Engineering (ECCE), **2017**.
[3] D. Chakraborty, K. Sharma, R. K. Roy, H. Singh, and T. Bezboruah, "Android application based monitoring and controlling of movement of a remotely controlled robotic car mounted with various sensors via Bluetooth," 2016 IEEE International Conference on Advances in Electrical, Electronic and Systems Engineering (ICAEES), **2016**.
[4] S. J. Lee, J. Lim, G. Tewolde, and J. Kwon, "Autonomous tour guide robot by using ultrasonic range sensors and QR code recognition in an indoor environment," IEEE International Conference on Electro/Information Technology, **2014**.
[5] E. Amareswar, G. S. S. K. Goud, K. R. Maheshwari, E. Akhil, S. Aashraya, and T. Naveen, "Multipurpose military service robot," **2017** IEEE International Conference of Electronics, Communication, and Aerospace Technology (ICECA), **2017**.
[6] Premkumar, Keerthi, and K Gerard Joe Nigel. "Smart Phone-Based Robotic Arm Control Using Raspberry Pi, Android, and Wi-Fi." IEEE International Conference on Innovations in Information, Embedded, and Communication Systems (ICIIECS), **doi:10.1109/iciiecs. 2015.7192973**, **2015**.
[7] Zain Anwar Ali , M. Tanveer, Habib Shaukat 2 and Saad Anwar , "Android Operated Robotic Arm", *Universal Journal of Control and Automation*, vol. **2**, no. **1**, pp. **13**, **2014**.
[8] B.O. Omijeh, R. Uhunmwangho and M. Ehikhamenle. "Design Analysis of a Remote Controlled Pick and Place Robotic Vehicle", International Journal of Engineering Research and Development, volume **10, 2014**, pp. **57-68**.
[9] P. Ritika and K. Narender. "Android Mobile Phone Controlled Bluetooth Robot Using Microcontroller" International Journal of Scientific Engineering and Research (IJSER), Volume **2**, Issue **7**, , pp. **14-17**. **2014**
[10] J. Bhuvaneshwari, A. Mohnish,, G. Rohan, B. Chetan. "Voice Controlled Robotic Vehicle", International Research Journal of Engineering and Technology (IRJET), Volume **04**, Issue **06** , pp. **191-193**, **2017**

AUTHORS PROFILE

Umme Habiba Maginmani pursed Bachelor in Computer Science and Engineering from Visvesvaraya Technological University Karnataka India in 2015. She pursed Master in Computer Network and Engineering from Visvesvaraya Technological University Karnataka India. Her main research work focuses on Cyber Security, Machine Learning ,Robotic and IoT, Data Mining.

Mujamil Dakhani pursed Bachelor in Computer Science and Engineering from Visvesvaraya Technological University Karnataka India in 2012 and Master in in Computer Science and Engineering from Visvesvaraya Technological University in 2014. He is currently working as Assistant Professor in Department of Computer Science and Engineering in Secab Institute of Engineering and Technology Vijayapura Karnataka India since 2014. His main research work focuses on Machine Learning, IoT, Artificial Intelligence. He has 6 years of teaching experience.

