

Wireless Robotic car control through human interface using eye movement

Hafiz Muhammad Attaullah ^{1*}, Iftikhar Ahmed Javed²

¹ Faculty of Engineering & Technology University of Sindh Jamshoro, Pakistan

² Department of Photonics Engineering, Technical University of Denmark

ABSTRACT

Technology and advancement is increasing day by day but it seems to benefit majorly the fit and physically young/strong people. The physically/mentally specially abled and old aged persons are generally devoid of these technological benefits. Their life is already a struggle and day to day work causes more havoc to its functioning. The most basic difficulties like performing their daily routine tasks like to move from one place to another are also a big issue. There are several parameters in humans which are a gift by Almighty so that those can be used to overcome the disabilities in one way or another. In this study we have designed and developed a robotic car for the persons who are specially abled using state of the art low-cost devices. The device designed to target those who cannot walk but have well functional eyes. The eyes are the main point of the proposed system. This is an eye controlled robotic car which can be controlled by eye and its gestures to move around.

Keywords: handicapped persons, eye movement, Arduino, Wi-Fi, Robotic Car

1. INTRODUCTION

In the last decade we have witnesses' very wide range of technology changes and advancements like in the field of education, health care sector, information technology and others. All these intended to provided humans life more better assistance [1-4].

There are approximately 1 billion or more persons who are suffering from any type of natural or unnatural disability. Making it 15% of the total world's population [5]. These people are also a part of our society and must not be ignored by technological advancement. The disability is introduced by birth or after facing

any adverse condition. Life becomes altogether different for them with respect to several activities. As life cycle goes on the age also increases s with time. The aging majorly affect the elderly people who are not able to frequently move from one place to another [6]. There are persons who have no disability in their eyes and are easy to use eyes as a way of communication.

Min *et al.*, (2002) developed, 2 Human Machine Interfaces for handicapped persons by Force Sensing resistor (FSR) [7]. They have used four criteria for their design. The criteria are low-cost, human friendly design, intuitive Drive function and easiness of wear ability. Jung *et al.*,

(2005) have introduced "Intelligent Sweet Home" [8]. The study proposed hardware especially based for handicapped and elder persons. Their system is focused on provision of solutions in terms of healthy monitoring, mobility/ motion assistance to the handicapped persons. They also have designed and developed mechatronics robot, intelligent wheelchair to increase the comfort. Ishii *et al.*, (1995) have designed and developed a meal assistant provider robot [9]. They have done this for helping handicapped persons. Their developed robot has the capability to handle many types of food. It can be controlled using head motion of the user end has hand mechanism also which helps the user to interface with the machine. Khan *et al.*, (2019) in their recent study have developed a robotic arm now this robotic arm based on leap motion controller [10]. The leap motion controller is a three-dimensional sensor which is able to capture 3D movements of human hand. This information is sent to Arduino which in return turns ON the motors to start the movement of the robotic arm. This looks like an ordinary robotic arm but this was developed with an intention to provide assistance to those handicapped persons who cannot walk. This hardware was useful in a sense that by just using hand the robotic arm worked as per instructions and as per the movement. For example, if a glass has to be grabbed which is at distance, then the robotic arm moves and then it is guided to grab the glass by the user and robot grabs the glass.

The proposed work is basically targeting these handicapped persons and this is state of the art technological use of equipment's available. We target those persons who are handicapped like

they cannot walk or move their arm but have no any problem in their eyes.

2. METHOD AND MATERIAL

2.1. Research Design

The robotic car was designed to help elderly and specially abled people by making an eye operating device for performing day to day hustle. The device was prepared at RPA automates repetitive tasks so human personnel can focus on higher-value work. Use cases can be simple (automated responses) or complex (automating thousands of things). So, RPA is a steppingstone to more advanced intelligent process automation.

2.2. Hardware component

Taking reference from previous studies, the best for hardware were used to build this robotic car.

2.3. Electromyography Sensor

Electromyography (EMG) Sensor is a component which measures the electrical activity of muscles (figure 1a). This muscle could be at rest position and/or in contraction. It is used in several applications like for identification of neuromuscular diseases, motor control disorders, assessing low-back pain, kinesiology and many others. It is also used as control signal in prosthetic devices [11].

2.4. ESP32 DEV

ESP32 development board is basically a series of low-power system-on a-chip (SoC) microcontroller (figure 1b). It is a low-cost device. It has Wireless Fidelity (Wi-Fi) and dual-mode built-in Bluetooth [12].

2.5. Arduino

It is an open-source electronics platform which is built on hardware and software which are easy to be used. It is used in various projects due to its simple interface making it easier to use. We have used Arduino Uno in this project with total 14 digital input/output pins. It is operated at 9 volts(v) battery which can be given to it by Universal Serial Bus (USB) port or an external power source. This Arduino Uno is based on Microchip Atmega328P (figure 1c). It can be used for programming which can be done using Integrated Development Environment (IDE). This IDE can be easily downloaded from Arduino website. Its programming language is C language [13].

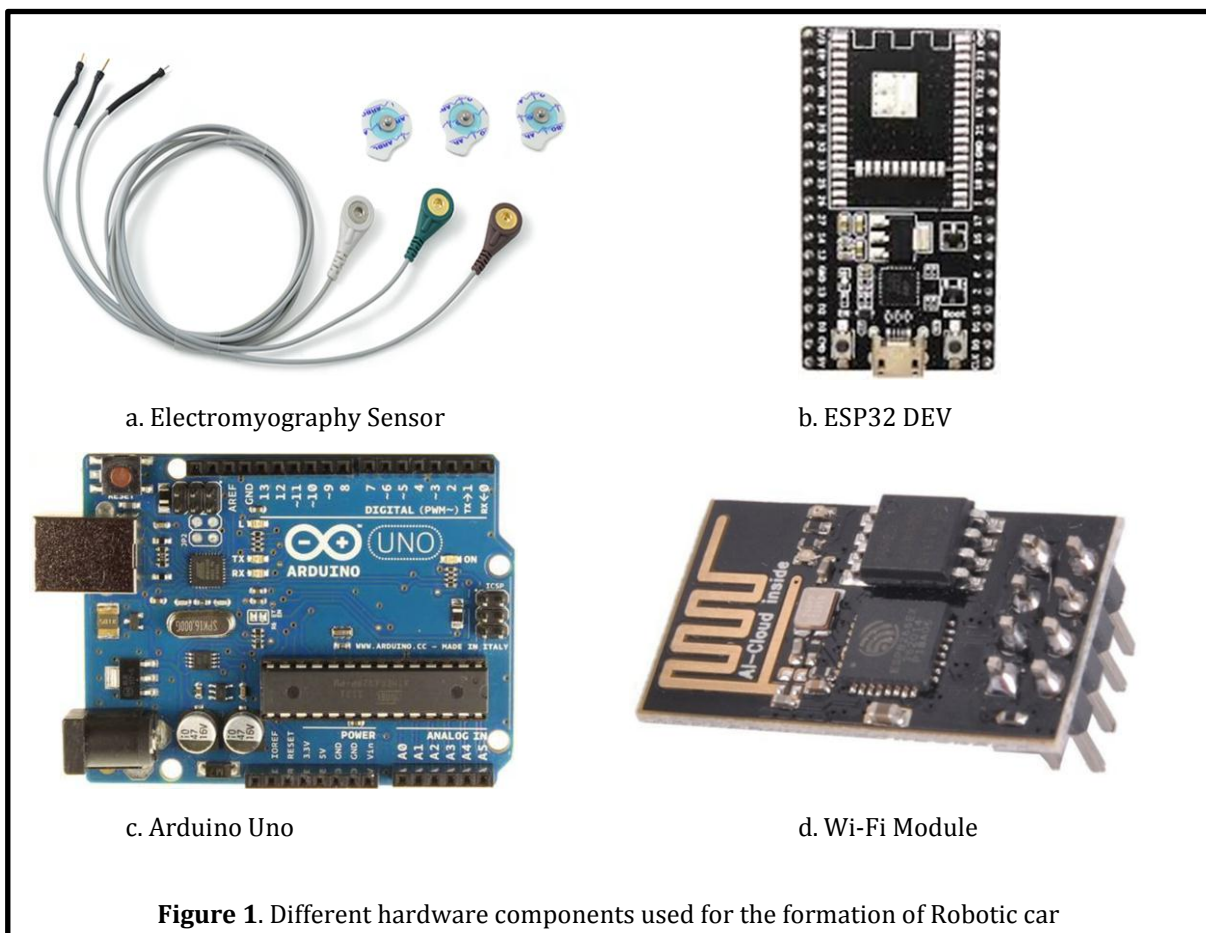
2.6. Wireless Fidelity Module

ESP8266 Wireless Fidelity (Wi-Fi) is a self-contained SoC having with TCP/IP protocol stack integrated to it (figure 1d). It can provide any controller device to access Wi-Fi network. The reason that makes it so useful is that just out of the box it can be used with Arduino. This is because it has pre-programmed firmware and if connected to Arduino, it provides data access as a normal Wi-Fi Shield [14].

More components which are used are batteries and Wi-Fi routers. The Wi-Fi routers are used to provide Wi-Fi to the ESP8266 Wireless Fidelity module at the transmitting end and to ESP32 development board at the receiving end.

2.7. Functioning

The robotic car was well assembled and the prototype was total 7 steps to complete the



working. If it fulfil all the 7 steps the robotic car is working properly.

3. RESULTS AND DISCUSSION

The well assembled completely working model of Robotic car was successful set using the four major hardware devices (figure 2). As it can be observed that it is a car which is pure automatic and is called a robot. This robotic arm performs its operations based on the muscles and eye movements of the operator.

- i. It can be observed that there are a total of 7 steps towards completion of the proposed robotic car to work propoerly.
- ii. In this step the system initializes itself and power is supplied to all the components used.
- iii. In this the user has to move his/her eye or any muscle which is intended for the operation of the proposed robotic car. If there is no movement then no action is

taken and if there is any movement then the data is moved to next step

- iv. In this step the EMG sensor analyzes that what type of data has been tried to be generated. After it anazises then it forwards data to next step.
- v. In this step Arduino receives signals from EMG sensor and then processes it further and then sends it to next step.
- vi. Here the Wi-Fi module transmits the received signal via Wi-Fi to the transmitting end
- vii. At the receiving ESP32 receives signal and then provides it to the robotic car.

The robotic car performs actions

This is a prototype as it was developed at low-cost level with minimum cost and with lesser range of components. As it can be seen that it is operated on 4 AA sized batteries. So in terms of power consumption, it is also very economical.

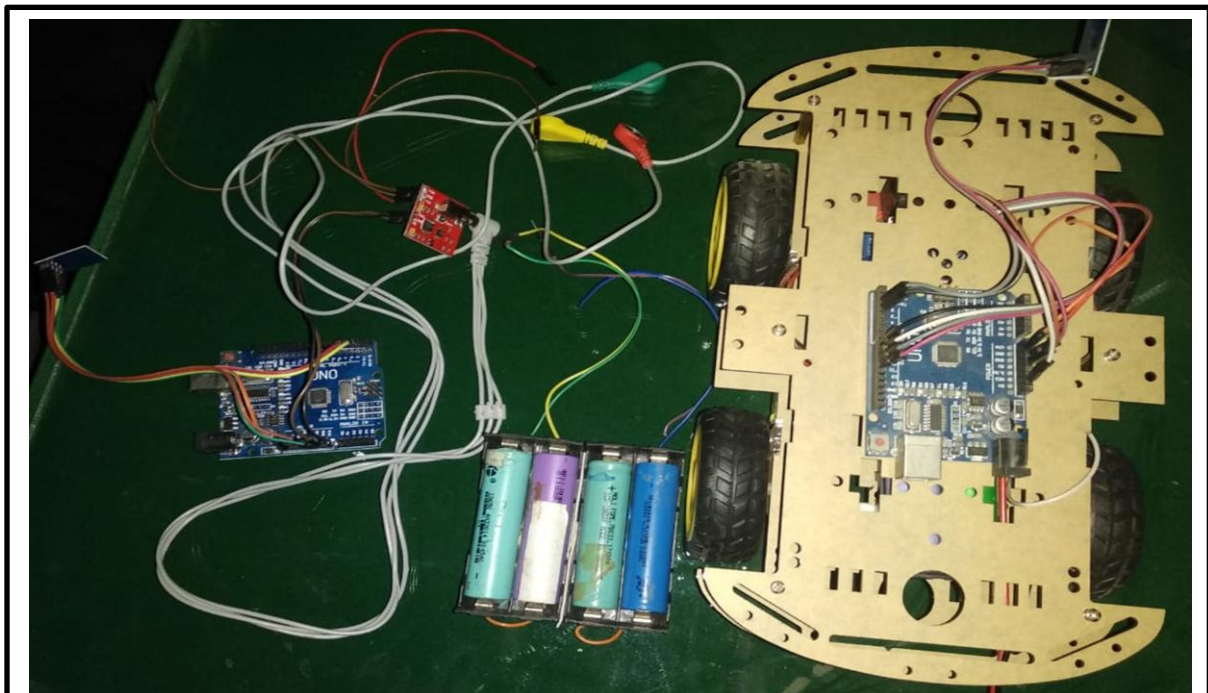


Figure 2. Well assembled and working Robotic car

The EMG sensors connected to the human body for their muscle movements and the signals are sent to Arduino which sends them to robotic car for operation.

4. CONCLUSION

In this paper we present a robotic car based on Arduino for the handicapped person so that they can control vehicle through their eyes. The proposed system uses Arduino Uno which is a low-cost microcontroller option with an easy option of C programming language in order to program it. This hardware is very useful and indeed very helpful to handicapped persons to control the robotic car remotely.

5. ACKNOWLEDGEMENT

NA

6. CONFLICT OF INTEREST

The authors have declared that there is no conflict of interest.

7. SOURCE/S OF FUNDING

NA

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