ACTION IN A NUTSHELL

Optimized Solution For Special needs

KEYWORDS: ACCESSIBILTY - ALGORITHM - FINGERS - ESP

INTRODUCTION

Disabilities is an umbrella term, covering impairments, activity limitations, and participation restrictions. An impairment is a problem in body function or structure; an activity limitation is a difficulty encountered by an individual in executing a task or action; while a participation restriction is a problem experienced by an individual in involvement in life situations. Disability is thus not just a health problem. It is a complex phenomenon, reflecting the interaction between features of a person's body and features of the society in which he or she lives. Overcoming the difficulties faced by people with disabilities requires interventions to remove environmental and social barriers.

Currently around 10% of the world's population, or roughly 650 million people, live with a disability and 90% of children with disabilities in developing countries do not attend school - (UNESCO). The presence of large disable people populations is present in both most leading and poorest countries. For instance, according to the UN Development Program (UNDP). The World Bank estimates that 20 per cent of the world's poorest people have some kind of disability, and tend to be regarded in their own communities as the most disadvantaged.

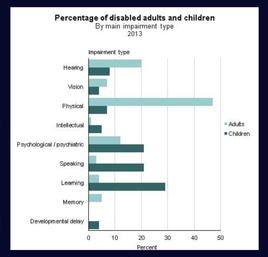

Fig.1

A major review done highlighted the high percentage of physical impairment as shown in (Fig.1). These outrageous statistics of disabled people with physical impairments initiated a real concern about developing solutions to increase the accessibility of such global issue such as manual wheel chairs. However, the wheel chairs showed some drawbacks like high level of strength require, short distance movement and difficulty in wheels manipulating.
Here, we introduce a new algorithm based on the movement of fingers to achieve the desired accessibility for the disabled people with physical impairments.

TEST PLAN

After a lot effort done constructing our prototype with an accurate design to simulate the process of moving the wheel chair with the best access to disabled people, the test plan was conducted to check whether the accessibility reached the requirements or not. Secondly, the test plan targeted the efficiency of our prototype using affordable materials, the least energy supplied to prevent the risks and possible disadvantages.

The test plan was measuring the variation of angles within the motion of the finger and recording the data to test the accuracy of the algorithm in achieving the intended motion.

Hypothesis:
When someone loses a sense of the five, it was hypothesizing that the others compensate for it. All we are doing is intimidating them for a faster and efficient compensation.

MATERIALS AND METHODS

MATERIALS

Name	Quantity	Picture
Breadboard	1	
H-Bridge L293D Motor Driver	1	
Batteries with battery holder	4	
Wheels	2	
Motors	2	

Name	Quantity	Picture
ESP32	1	
MPU6050 Module	1	
Jumper wires	15	
Car Frame	1	
Arduino IDE	Software	

METHODOLOGY

We made the car frame with two wooden plates then we put the two wheels in the back and a ball bearing.
We connected the DC Motors to the wheels then connect it to the H-Bridge and connect a battery to it.
Get a ground wire and 5V wires from the H-bridge to connect on the ESP32.
Connect the MPU6050 Module to the microcontroller. The 3.3v power wire to the 3.3v power wire in the ESP32 and the ground wire in the MPU6050 to the ground wire in the ESP32.
We wrote a code for the MPU6050 module to make it sense the three axes correctly and try it.
We wrote the final code for the car movement in addition to receiving of the signals of the sensor and test the project.

RESULTS

After the testing the accuracy of our prototype and collecting the resulted data, it was found that the prototype achieved the desire of reaching the perfect accessibility for both immobile adults and children.
The results was collected as the following:

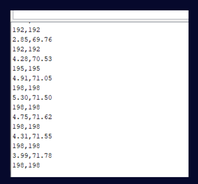

Fig.2

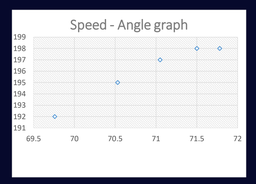

Fig.3

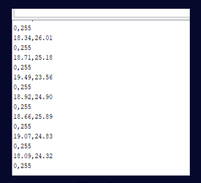

Fig.4

Fig.5

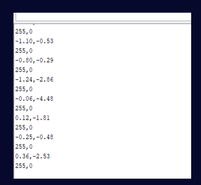

Fig.6

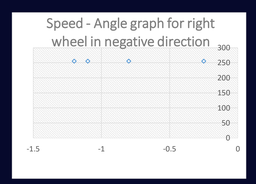

Fig.7

Firstly, the variation within increasing the angle in both horizontal, vertical axes and the speed of wheels showed a direct relation until the maximum speed reached. Secondly, the variation within increasing the angle in horizontal, vertical axes in both positive-negative directions and the speed of one wheel showed a constant relation. It was demonstrated that the accuracy of the algorithm was successfully achieved.

ANALYSIS AND DISCUSSION

Action in a nutshell is the hope of Egypt to help all the people with special needs to facilitating the communication between them and others and give them their rights.

The first thing to search about in the project was the ESP32 which is the microcontroller used in uploading of the code and start all of the functions inside the prototype using Arduino IDE and Micro Python. Also, it's from the best microcontroller due to its low-cost and integration with Wi-Fi and dual-mode Bluetooth including built-in antenna switches, power amplifier, low-noise receive amplifier and power management modules.
MPU 6050 was connected to the ESP32 which is usually consists of accelerometer and gyroscope.
Accelerometer is an electromechanical device used in measure the acceleration force which is dynamic in case of a RC car to sense the movement of the finger. Acceleration is the measurement of the change in velocity, or speed divided by time (a = delta v / t), it works on the principle of piezo electric effect for example, there are three pairs of opposite walls in a cuboid and each pair corresponds to an axis in 3D space: X, Y and Z axes. Depending on the current produced from the walls, the direction of inclination and its magnitude could be determined.
Gyroscope is a device used in sense the angular velocity applied to a vibrating element. Also, the angles are detected using it. All these signals were sending to the ESP32 to translate it then send it to the motors to make the car move.

The MPU6050 communicates with ESP32 through I2C protocol. It connected to ESP32 as shown in **Figure (5).** The MPU6050 module has a 3.3V pin. So, it connects to 3.3V pin in the microcontroller and the GND of the MPU6050 was connected to the GND of the microcontroller. When human's finger moves the angles of the finger sent to the ESP as shown in **Figure (6).**

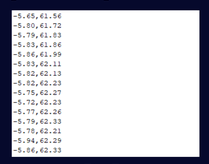

Fig.5

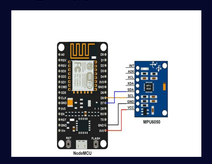

Fig.6

Dc Motor is a rotary electrical machine that converts direct current electrical energy into mechanical energy and the motor is consists of two magnet poles on is South and other is North and the positive and negative signs show where the DC current is applied. It connected to ESP32 as shown in **Figure (7).**

An H-bridge is built of four switches that control the flow of current to a load. In the image above, the load is the M connecting the two sets of switches. Using one current source, you can drive current in two directions by closing two switches.

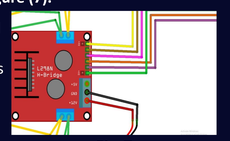

Fig.7

CONCLUSION

It could be demonstrated that, through the application of our prototype, our solution contributes in solving the addressed problem of giving the perfect accessibility for disabled people specifically with physical impairment. Our introduced algorithm, which made to recognize the required movement by the disabled individual, was tested and the preliminary results were outstanding proving the achieving of an innovative project fulfilled the intended action with the least effort and highest efficiency. Finally, by these demonstrations accompanied with the astonishing results, it is clear that our project would be applicable in real life as a smart wheel chair with perfect accessibility for movement and action daily activities for immobile adults and children with physical impairment.

FUTURE PLANS

We take in consideration to make the control more suitable for our project such as:
Having another microcontroller (ESP8266) with connecting the MPU6050 to it to receive the signals. In addition, putting the MPU6050 on the finger and ESP8266 on the hand inside a glove. Then, putting a LED sensor over the glove. So, all the angles and the speed of the motor will be shown on its screen and making the first microcontroller (ESP32) connected to the car and the motor as well making a cloud that receive any data. Connect the two microcontrollers to this cloud and make ESP8266 is the server and ESP32 is the client. So, the signals will be sent to the ESP8266 then uploaded on the cloud and ESP32 will receive this data and translate it to the motors and the car will be moved.

RESEARCH SOURCES

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ACKNOWLEDGEMENT

This project would not have been possible without the help of god and the support of many people we are especially grateful to the cooperation of all experts who allowed us to interview them and provided us with valuable information and answered all our inquiries without hesitation. We would like to thank Eng. Mohamed Abd El-Mageed (Chairman of IEEE HTI SB), Dr. Gamal for his great effort with us in addition to IEEE HTI SB for their financial aid to us.

FOR FURTHER INFORMATION

Ahmed Jaheen – 18005@stemegypt.edu.eg
Omar Khattab – 18134@stemegypt.edu.eg