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Design and Implementation of Smart Wheelchair for Quadriplegia Patients Using IOT

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ABSTRACT: Quadriplegia is a pathological condition identified through completely or partly paralysis of the limbs and torso. Smart wheelchair is an innovation that has an intention to create a difference for the activities of the people who are restricted by movement and by their body actions. In this paper, the proposed is an idea to ease those patients, who was not able to do hand movements in a way that they can move a wheelchair. Three different modes are proposed which instructs the patient in free movement and information transmission to the person nearby and to the cloud services. To provide the movement of wheelchair in desired direction an accelerometer-based hand movement based button is designed in the mobile application. Patients can transmit the requirements and the information to their relation or any other person ones through hand gesture using RF transmission. Third mode provides the information to the cloud which can be accessed by the doctor for diagnosis.

KEYWORDS: Arduino Uno Microcontroller, LCD, Driver IC, Motor, ATMEGA328, Accelerometer, LCD, Alarm, Transmitter and receiver

I.INTRODUCTION

Quadriplegia is a kind of paralysis caused by serious injury or illness which results in the partial or total loss of limbs and lower acme. Paraplegia is another variant of quadriplegia but it doesn't induce the arms which results in the loss of sensual activity and controlled movements. On the other side, quadriplegia will weaken muscles affecting limbs. Generally, quadriplegia starts in the brain nerves or in spinal cord or in both regions. The spinal cord sends the signals to the brain and receives signal from the brain and the brain interprets these signals. An injury can restrict this transmission so that a signal doesn't process and be interpreted by the brain. Brain injury can destroy the brain's ability to interpret signals. Quadriplegia is an unpredictable disease that can be affecting any age group of people. Some factors can greatly affect outcomes after an injury such as age, caring, first aid, etc.

Although some patients experience significant improvements quadriplegia is an incurable disease. This means no surgical procedure drug can guarantee to the proper functioning of movements. The strength of moving is a basic requirement in our lives, so this project aims to provide aid to quadriplegic patients who are partially disabled. As specified by the Population and Housing Census 2010 of the National Institute of Statistics and Geography (INEGI), individuals with some sort of disability. A patient who was not able to move their appendages either upper part or lower part of the body, but can move their eyes, hand and tongue. So, we came up with a proposal to form a smart wheelchair that can provide free movements to the patients and support nearer ones using sensors and motors and

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also by using IOT.The requirement to succeed in the new module that allows more regular cooperation with a wheelchair has motivated this paper. In this paper, a smart wheelchair model is presented that can help quadriplegia patients, who are not able to move their limbs and their body. In the second mode, it works like a notification system that simply displays information about the patient to the nearer one according to the accelerometer direction. In the third mode, information is transferred to the cloud in case of emergency situations, so that a timely diagnosis can be performed by the doctors from the cloud data.

II. PROPOSED METHOD

In this mode, our proposed wheelchair works as a simple chair with DC motor on the basis of direction provided by the patient with accelerometer. Accelerometer provide x, y and z direction position or co-ordinates corresponding to the movement of hand gesture. If the patient wants to move in the left direction, then its left motor turn 'off' and with the help of right motor which rotate in clockwise direction and the chair moves in left direction. If patient wants to move in right direction, then its right motor turns 'off' and with the help of left motor that can move in anticlockwise, so that the wheelchair rotates rightward. And to move forward both motor 'on' and rotate in clockwise direction. To move in backward direction both motors rotate in anticlockwise direction. If the patient move his hand glove in forward direction, then it transmits a message to the receiver, he or she requires some water. In this mode, accelerometer provides the x, y and z coordinates and corresponding to the coordinates RF transmitter transmits a message to the receiver. At the receiver side four modules are used such as Arduino Uno, LCD, RF receiver and alarms those are connected with a power supply or battery. When RF transmitter transmits a signal wirelessly from the sender side to the RF receiver receives the signal and displays a corresponding message on LCD and alarm rings. In this mode, a Wi-Fi module named ESP8266 which can transmit or receive a signal globally using a cloud service UBIDOT. When the signal transmits to the cloud, the receiver unit receives an alert message corresponding to the hand gesture position of the patient.

III. METHODOLOGY

Accelerometer provide x, y and z direction position or co-ordinates corresponding to the movement of hand movement by the controller. If the patient wants to move in left direction, then its left motor turn 'off' and with the help of right motor which rotate in clockwise direction and the chair moves in left direction. If the patient wants to move in right direction, then its right motor turns 'off' and with the help of left motor that can move in anticlockwise, so that the wheelchair rotates rightward. And to move forward both motor 'on' and rotate in clockwise direction. To move in backward direction both motors rotate in anticlockwise direction. Arduino is a computer hardware equipment and software company, project, and user community that designs and manufactures microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world.

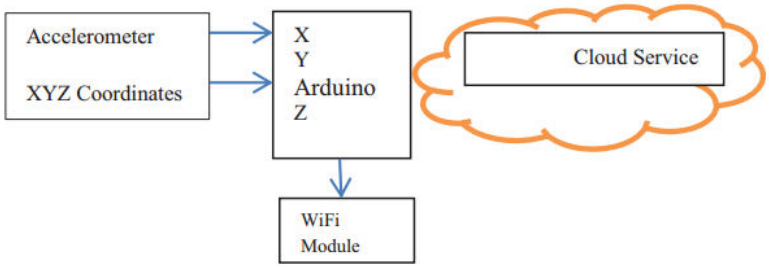

Fig 1. Block Diagram of Proposed Method

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IV.SIMULATION RESULTS

A. SOFTWARE REQUIREMENTS

Proteus 8 Software which requires Windows 7 or 10 operating system to function. Proteus isn't a name that rings a bell. If we work in the medical field we've probably heard of it because it's a bacteria genre which, 9d includes different species such as mirabilis or vulgaris that reside in our digestive tract. But beyond microbiology, in the software sector, it turns out to be one of the most ac claimed electronic design programs by engineering students and electronics professionals, capable of offering us an advanced simulation of electronic circuits and microprocessors. It's one of the most complete electronic tool packs on the market as in its version 8.5 (the newest of them all), it allows us to create from our PC all sorts of PCBs or printed circuit boards using almost 800 different microprocessors.

B. SYSTEM READY – In this command, the power to the wheelchair is switched on and it total system starts to work and wheel chair wait for the command from the user and in the LCD it shows as “SYSTEM READY”.

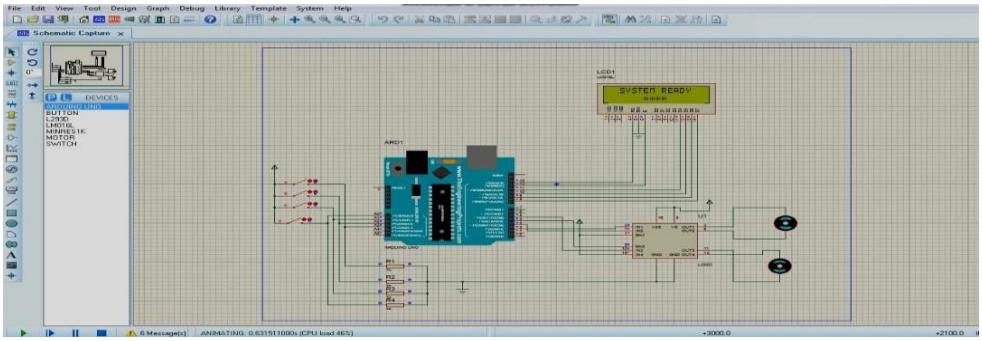

Fig 2. System Ready

C. FORWARD MOVEMENT - When this command is given, both the motor starts to run in forward direction and the wheelchair moves in reverse direction and in the LCD, it displays as “FORWARD”.

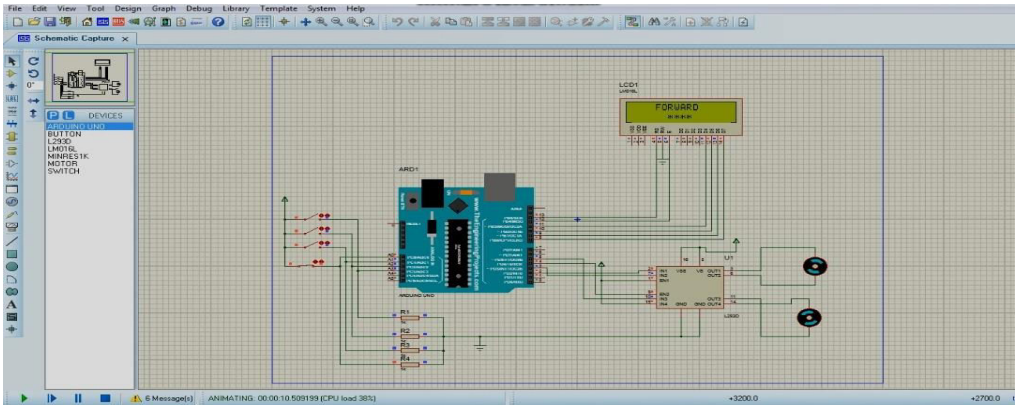

Fig 3. Forward Movement

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D. REVERSE MOVEMENT – When this command is given, both the motor starts to run in backward direction and the wheelchair moves in reverse direction and in the LCD, it displays as "REVERSE".

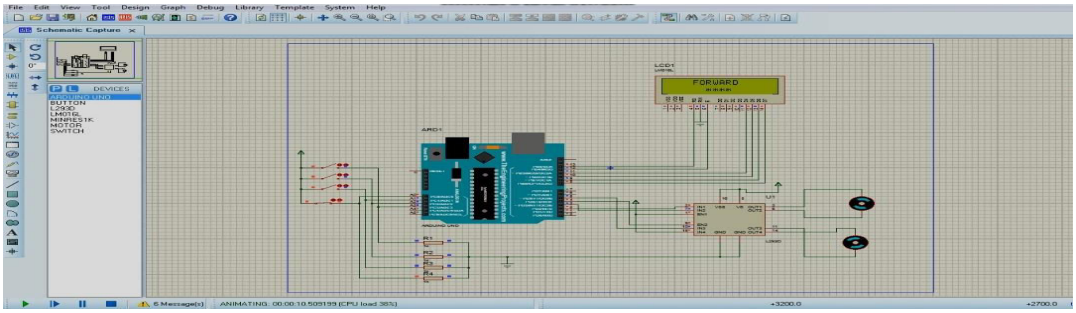

Fig 4.Reverse Movement

E. TURNING LEFT- When the "Turning Left" command is given. The right motor starts rotating in the reverse direction and the left motor rotates in forward direction. This kind of movement moves the wheelchair to rotates effectively.After, the movement In LCD display shows as "LEFT".

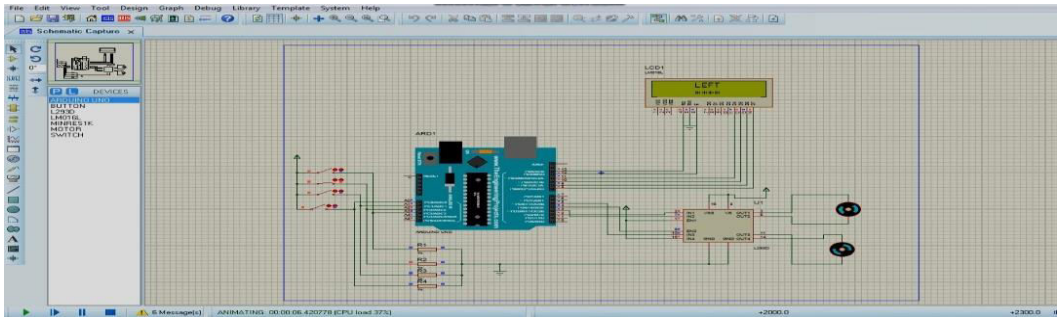

Fig 5. Turning Left

F. TURNING RIGHT- When the "Turning Right" command is given. The right motor starts rotating in the forward direction and the left motor rotates in backward direction. This kind of movement moves the wheelchair to rotates effectively. After the movement In LCD display shows as "RIGHT".

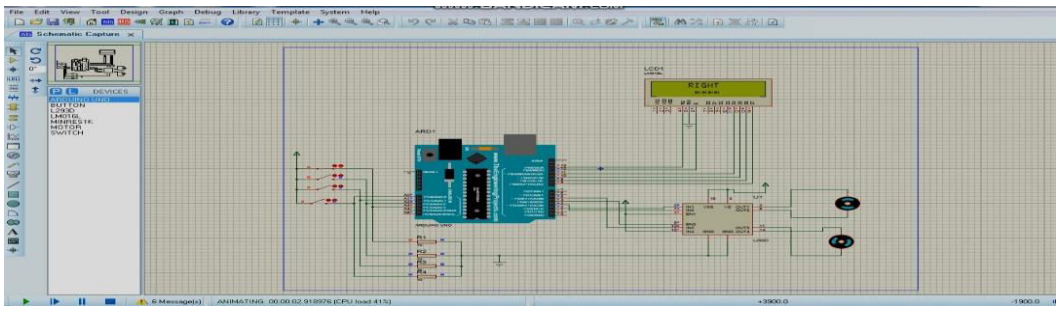

Fig 6. Turning Right

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V. HARDWARE IMPLEMENTATION

Fig 7. Hardware Implementation

A power supply is an electrical device that supplies electric power to an electrical load. The primary function of a power supply is to convert electric current from a source to the correct voltage, current, and frequency to power the load. A Hand band is used with mobile phone to control the motor and its direction of the motor. Wireless communication is among technologies biggest contribution to mankind. It is enhanced to convey the information quickly to the consumers. A transmitter is used to transmit the signal from the user, and a receiver receives the command and does the action. All the commands and the movements are transmitted to another person whose number is linked with it. The message will be conveyed to the authorized person for the patient by using their mobile number. In case any emergency situation occurs, it will send the message to the other person who is connected to the mobile application.

VI. CONCLUSION

In this prototype, the accelerometer is used to provide the directions to the wheelchair and some cloud services are used to provide data wirelessly to the nearer ones. The proposed system based on the Arduino controller is found user-friendly, and easy to use. The IoT-based technology is made ease of the system for the end-users who are using this. The motors were successfully controlled and the wheelchair works according to the commands given as per instruction. This prototype of the system works successfully as implemented in the real-time scenario. The implementation of the actual system with a patient in a wheelchair is under implementation and yet to be developed.

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