The economical design of a hand-gesture and bluetooth controlled wheel-chair by integrating indigenous components: mobility aid for the disabled

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The economical design of a hand-gesture and bluetooth controlled wheel-chair by integrating indigenous components: mobility aid for the disabled

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Abstract. Millions of people around the world are handicapped and most of the amputees belong to a war struck third world regions. Any amputee who is unable to walk needs prosthetics which are costly or wheel chairs for movement. Manual wheel chairs are not easy to use. Most of the people cannot afford high quality motorized expensive wheel chairs. Keeping all this in mind, a very economical hand gesture-controlled wheel chair design is proposed. This wheel chair reads the signal sent from control glove and can also be switched to mobile application control where needed. The overall implementation design has simplicity and robustness which are dire features of wheelchair applications.

1. Introduction

The percentage of disabled people has increased in the world now-a-days. The disability could be by birth or due to some medical or accidental reason. The aim of this paper is to provide economical design of hand-gesture controlled wheel chair using Flex as sensor. It will help the physically disabled people in moving from one place to another just by giving direction from the hand. Specifically, in third world countries, many people are suffering from disability, there are people whose lower half of the body is paralyzed. The proposed design will add on to the comfort and make the life of people bit easier. In this era of fast growing technology and healthcare, there are still considerable amounts of physically challenged and elderly who find it difficult to move around in their house. The disabled people always find difficulties in moving from one room to another and even to do that the handicapped person was dependent on someone else who will push the wheelchair manually and take the handicapped person from one place to another. With the Hand Gesture Controlled Wheelchair the handicapped person is independent and he does not have to ask for help from any other person to move his wheelchair. A person will become independent by using a gesture-controlled mobility aid. This paper gives an overview of the work done in this field up till now, followed by the implemented method, results and conclusion.

2. Related Work

The traditional manual force driven wheel chairs require a lot of energy for movement. Also, they are bulky and cause the patient to be dependent on another person for the mobility. A lot of progress is being made in integrating technology and electronics to make designs of wheel chair more user friendly. Microelectro-Mechanical systems (MEMs) controlled sensors have been explored to see its applicability in gesture-based technology [1]. Gayatri et. al. employed MEMs based control system in

their robot prototype for basic pick and place operations [2]. Ugale and Chandwaker worked on the Leap motion sensor for search and rescue robots which will be useful aid in natural disaster aid [3]. A gesture-controlled system for wheel chair and other robotic applications is the future of control schemes [4, 5]. The control of mobility through angular head movement captured by electronics is done by Babu and Anusha [6]. There are visual based techniques which do not require any external hardware like glove or other controller for sending signals for drive. A robot control is designed which implies visual recognition as a control signal. Wang et. al. developed adaptive algorithms to recognize facial feature as a control of robot [7]. Kaura et. al. also explored image processing using finger count and direction of palm to control robot [8]. Now all these techniques and methods have their own pros and cons. Most of these techniques require a complicated design and are quite expensive to implement. The design proposed in this paper is not only advanced but also very economical as compared to remote controlled wheel chairs available in market.

3. Methodology

The proposed prototype design is shown in figure 1. The wheel chair can be controlled be giving specific hand gestures or through mobile application. For hand gesture control flex sensors are implemented with wireless communication for which ZigBee module was used. Flex sensors are ideal for repetitive bending and deflection applications. They are robust, precise and ergonomic. Refer figure 2.

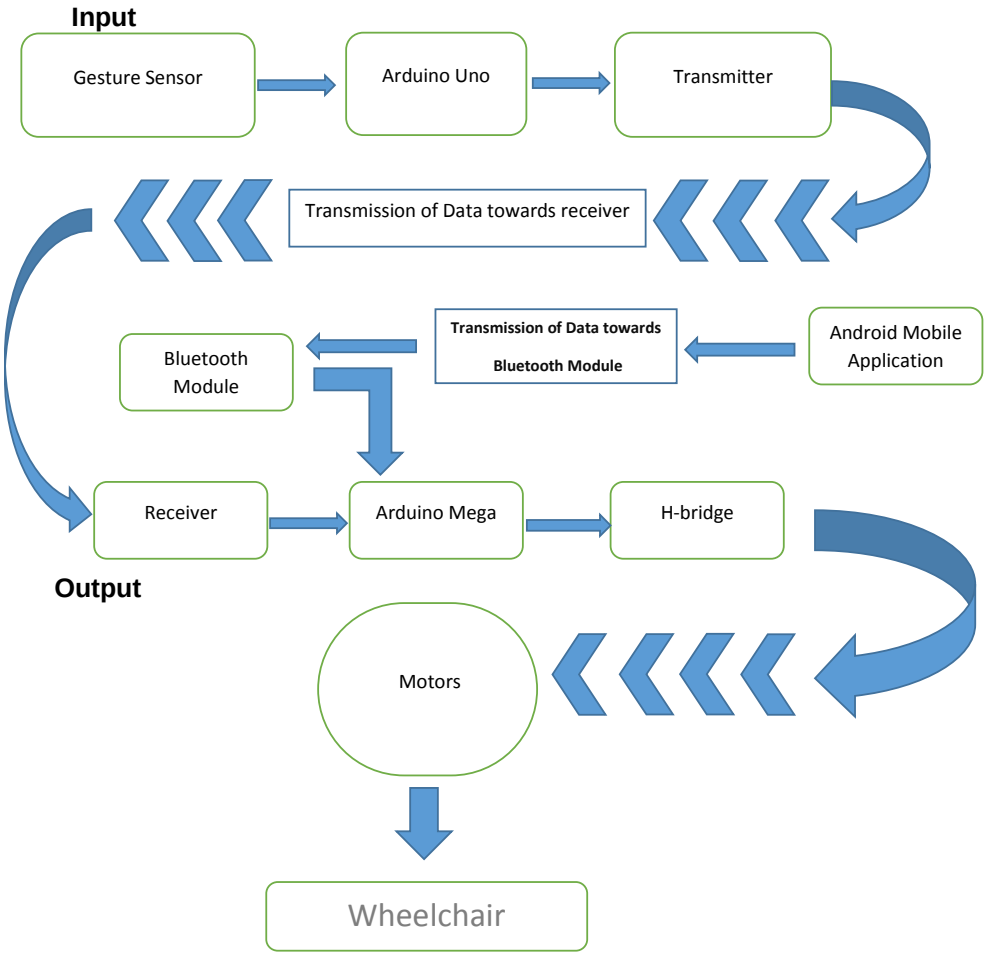

Figure 1. Flowchart of proposed wheel chair control system.

The transmitting end consists of flex sensors from which deflecting value of resistance is obtained and after processed by Arduino, required instructions are ready to transmit from zigbee x2c series module.

Figure 2. Indigenous wheelchair prototype (Left), Schematic design of flex sensor control & the hardware of flex sensor-based control glove (right).

Receiving end has major components which are Arduino Mega, 2x Ibt2 motor driver, Bluetooth module, ZigBee S2C module. Instructions from Transmitter are received by ZigBee on receiving end and send towards Arduino Mega using serial pins than according to these instructions H-Bridges controls wheelchair through motors. Controlling wheelchair using android Application is an

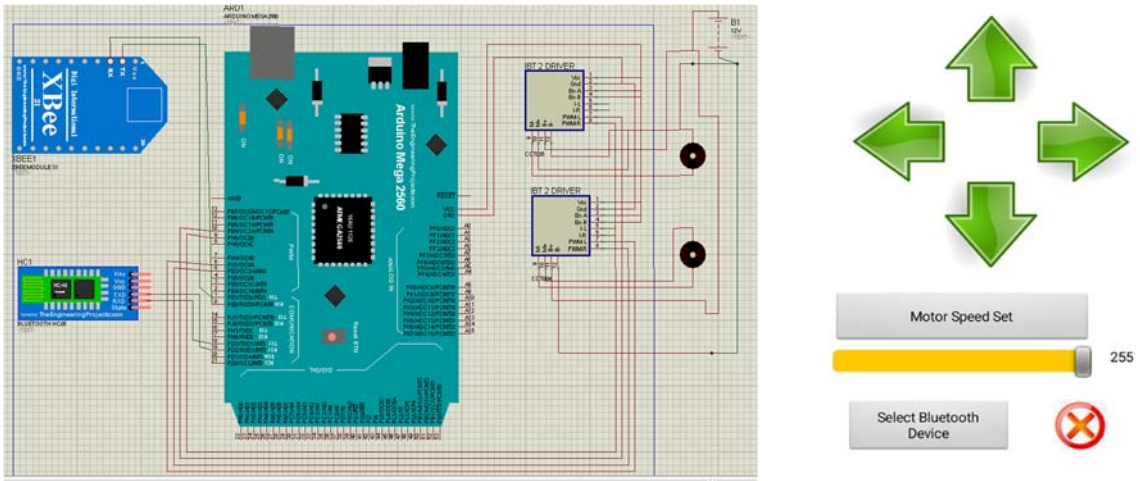

Figure 3. Complete schematic design of proposed technology (left); Interface of Bluetooth control of wheel chair (right).

additive feature of this prototype. For this purpose, Bluetooth module was used. After connecting its serial pins with Arduino Mega it was ready to communicate with Mobile, which has this app for controlling it from mobile. See figure 3.

Figure 4. Specified gestures for Stopping; moving Forward; turn Left (left to right).

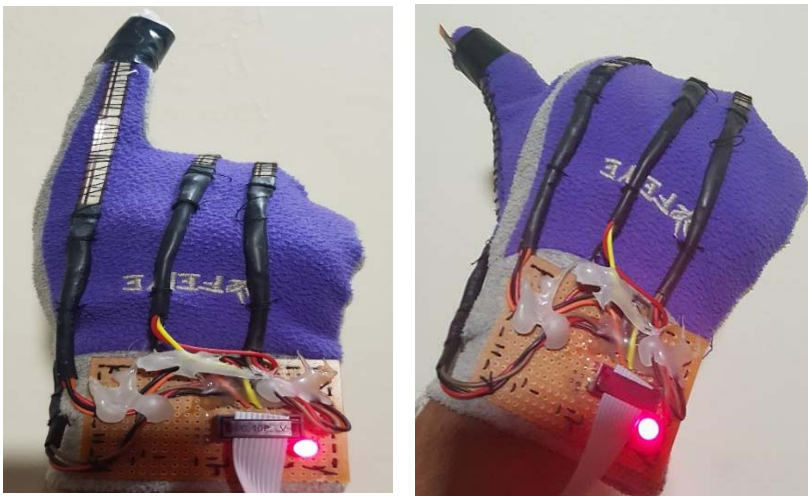

Figure 5. Specified gestures for Right turn; Reverse (left to right).

The gesture control of wheel chair for moving forward, backward, left and right is shown in the figure 4 & 5.

4. Conclusion

The economical prototype of gesture-controlled wheel chair was successfully tested for results. This wheel chair design provides force free mobility by implementing flex sensors-based control glove with and additional option of using smart mobile application for driving the wheel chair. Its features are its simple and easy to implement design which is also robust. This system can be operated both indoors and outdoors. For future work, one can make this wheelchair water and weather resistance. And improve its mechanical design for moving on stairs. Voice or head motion control for this wheel chair may also be explored.

5. References

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