International Journal of Psychosocial Rehabilitation, Vol. 23, Issue 05,
2019 ISSN: 1475-7192

Medical Assistance System for Differentially Abled People using Arduino Lilypad

[1]Hara Prasad Tripathy, [2]Priyabrata Pattanaik, [3]Susanta Kumar Kamilla

Abstract--- *An assistance system for providing medical aid to differentially abled people has been presented in this paper. It is controlled by wireless gestures. The gesture is detected by a sensor (accelerometer) and it is responsible for controlling the robot that provides assistance and a wireless command will be given by a microcontroller which depends on the value of a sensor for moving it to the particular location. The whole process is divided into two parts: a circuit for transmission and another for receiving. The association of a part to a patient is one of the most important part of a medical assistance system and transmission circuit in this case is wearable. Thus it is easy to use. This project uses Arduino Lilypad for enabling a transmitting circuit to be wearable and it is the chief controlling microcontroller. This circuit is worn on that part of the body of a patient which is intended for making a gesture. The wireless transmission of data is done by RF module and Arduino IDE.na is used for programming.*

Index Terms--- *RF module, accelerometer, Arduino Lilypad, gesture.*

I. INTRODUCTION

There are various ways of controlling a robot in this era. Controlling a robot through gesture is one of the ways and the technology becomes smarter with the incorporation of wearable technology. This work provides easy assistance to differentially abled people by using gesture controlled system for assistance. Apart from medical assistance, this work finds it implementation in heavy industry and military field as well. Previous works[1][2] are based on gesture control which has an automated wheelchair[2][3] but it does not implement Arduino Lilypad. The bulky and complicated transmitter section is used in the systems previously used, which makes it difficult to carry and as a result difficult implementation. This work uses Arduino Lilypad. The special design is done for e-textile. Thus the transmitter part is made light in weight by making is suitable as a wearable technologies. The size is similar to silver dollar's size. The lilypad can be stitched to a patch of cloth and the cost of total board and gesture is made low. It is easy to carry the transmitter section and it is cheaper and thinner than the previously proposed systems. The system proposed in this paper comprise of Arduino lilypad, accelerometer, motor driver, DC motor and encoder/decoder. RF module is used for making the system wireless. The 'X, Y, Z co-ordinates' are generated by accelerometer which is used for gesture detection and later on microcontroller is fed with it[4]. The command is sent by encoder to the transmitting section. The

Department of Engineering, Siksha 'O' Anusandhan (Deemed to be University), Bhubaneswar
haraprasadtripathy@soa.ac.in, priyabratapattanaik@soa.ac.in, sushantakamilla@soa.ac.in

Received: 10 Nov 2018 | Revised: 20 Dec 2018 | Accepted: 02 Jan 2019

signal is received by receiver module and it is sent to the decoder[5]. The analog signal is decoded and the digital data is sent to motor driver, which helps in controlling the movement of motor[6]–[9].

II. BLOCK DIAGRAM

The block diagram given in figure 1, explains the overall working diagram of this work. There are two parts of the complete work: one is a transmitter section and another one is receiver section. Transmitter comprise of an accelerometer associated to an Arduino lilypad. The output from accelerometer changes based on the gestures. An encoder is used to encode these values and RF transmission module is used for transmitting it further. The receiver circuit consist of 'RF receiver module', decoder, motor driver and motors. A decoder used at the receiver end is used for decoding the received values [10]. A motor driver IC is associated to DC motors which controls the motion of wheels.

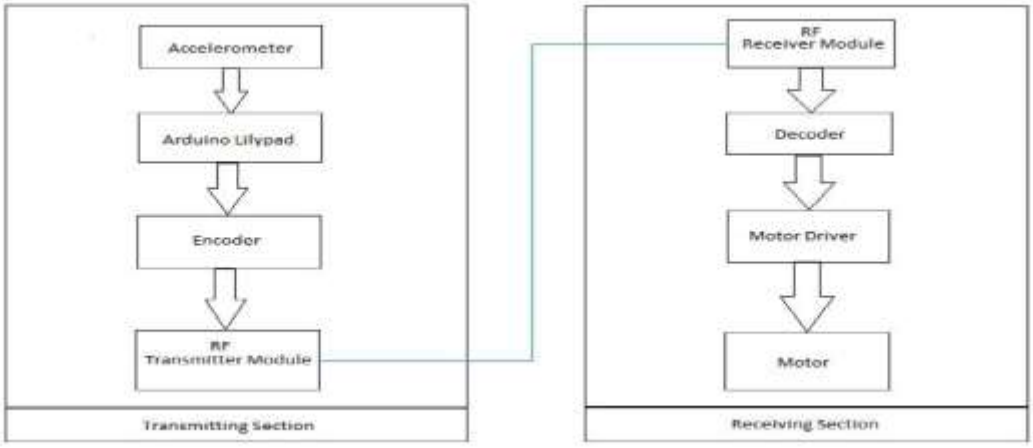


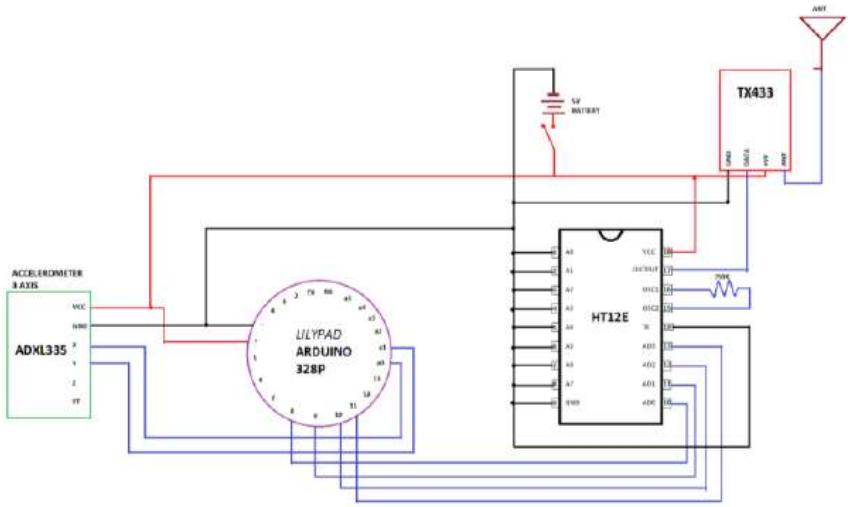
Fig. 1 Block Diagram

III. TRANSMITTER SECTION

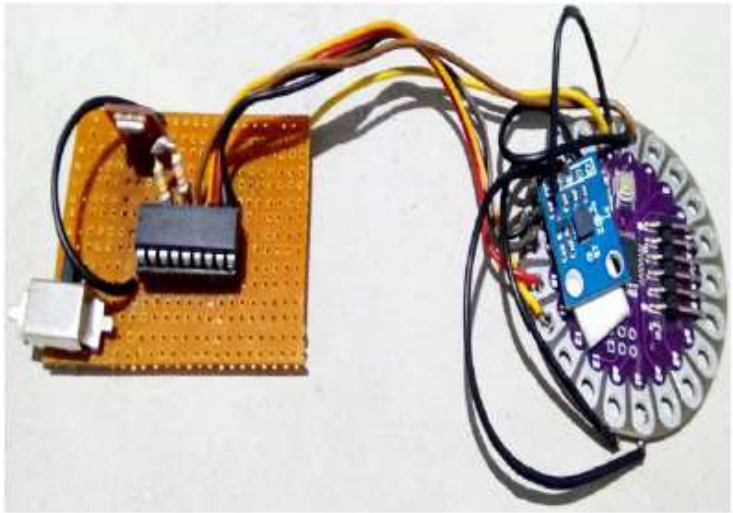
The transmitter section consist of four parts such as microcontroller, accelerometer, transmitter module and encoder. The acceleration across three axis is measured by an electromechanical device which is known as accelerometer. The velocity, position, orientation and vibration of an object is detected by the accelerometer. The associated object has X, Y and Z coordinates which are provided by the device used here 'ADXL335'. The gesture in this work is detected by X and Y coordinates used here and it is given to a microcontroller. The figure 2(a) shows the diagram of this circuit. The pin X of accelerometer is connected to lilypad's a0, pin Y is connected to a1, VCC is connected to lilypad's '+' and GND is connected to '-'. The microcontroller used here is Atmega 328P in ArduinoLilypad. The Ardino IDE has the gesture controlling algorithm. Then it is uploaded to a microcontroller. The X and Y coordinates are obtained from accelerometer based on the algorithm of a microcontroller, the decision is sent to

Received: 10 Nov 2018 | Revised: 20 Dec 2018 | Accepted: 02 Jan 2019

encoder in the digital format. This circuit uses HT12E encoder. The division of 12 bits is done into 8 address and 4 data bits. The secure transmission of data is ensured by using address bits having Pin no 1 – Pin no 8. The algorithm says that data pins are AD0 to AD3 (Pin no 10 to Pin no 13) and 'HIGH' and 'LOW' is sent to these pins. The encoder having output pin no 17 is connected to the pin 'Data' of the receiving module. The cycle of data transmission keeps on repeating when the enable pin of transmission (Pin 14) is connected to ground. The process of data transmission is made wireless by using a transmitter- receiver module of 433 MHz. The figure 2(b) illustrates the circuit of transmitter section [11].



(a) Circuit diagram of a transmission section



(b) Implementation of Arduino Lilypad with transmitter section

Fig. 2 Transmission Section

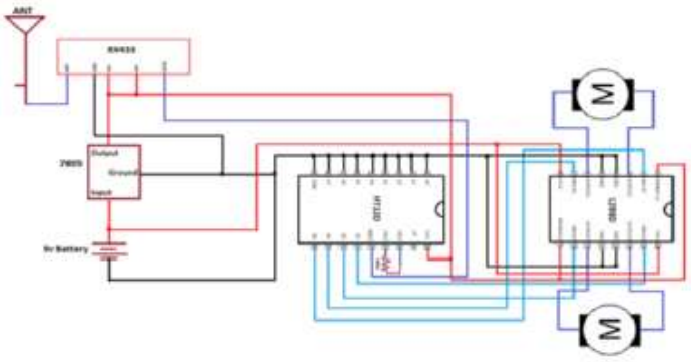
Received: 10 Nov 2018 | Revised: 20 Dec 2018 | Accepted: 02 Jan 2019

IV. RECEIVER SECTION

The following parts are comprised in the receiving section such as receiver module, motor driver IC, decoder, DC Motor and Voltage Regulator as in figure 3(a). The analogue signals are received by the transmitter and decoder sends it through a 'DATA' pin. This project uses HT12D. The address bits of an encoder are kept in low state and the address pins of a decoder (Pin no 1- Pin no 8) are connected to the ground. The comparison of serial data received from receiver module is done with local address bits and the decoding of received data is done if it is matched. The analogue signal is converted to a digital signal and it is sent to motor driver IC. A high signal is produced on pin VT which validates the transmission of data. The two 'H bridge driver circuit' are there in an IC L293D of motor driver [12], [13]. This helps to move motors in different directions i.e., clockwise and anticlockwise directions. Table 1 shows the motion of motor based on the log inputs. An input of voltage regulator7805A is connected to a source of 9volt and it yields the stable output of 5V. The total number of DC motors used are four and IC L293D of motor driver has been used. Figure 3(b) shows the receiver circuit.

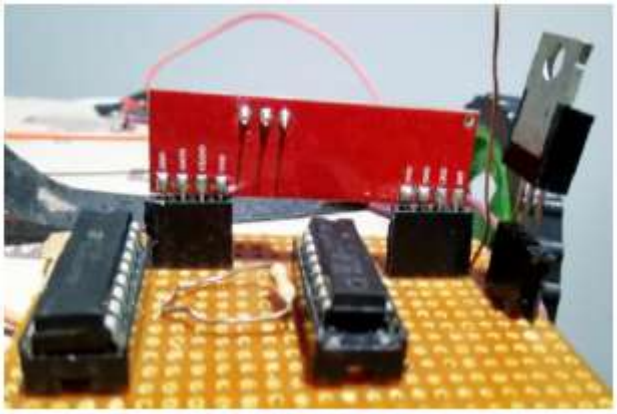
Table 1 Movement of motor based on input logic

Input Logic	Movement
00	STOP
01	Clockwise
10	Anti- Clockwise
11	STOP



(a) Circuit diagram of the receiver section

Received: 10 Nov 2018 | Revised: 20 Dec 2018 | Accepted: 02 Jan 2019



(b) Receiver section in hardware

Fig. 3 Receiver Section

V. IMPLEMENTATION IN SOFTWARE

The Arduino UNO is used to implement the software part. The figure 4 illustrates the flow chart of software implementation. The co-ordinate values are sent by accelerometer according to the gestures of hand after initializations. The execution of gesture algorithm to check the specific values of x and y co-ordinates and based on this decision is taken about the direction of motion of medical assistance system.

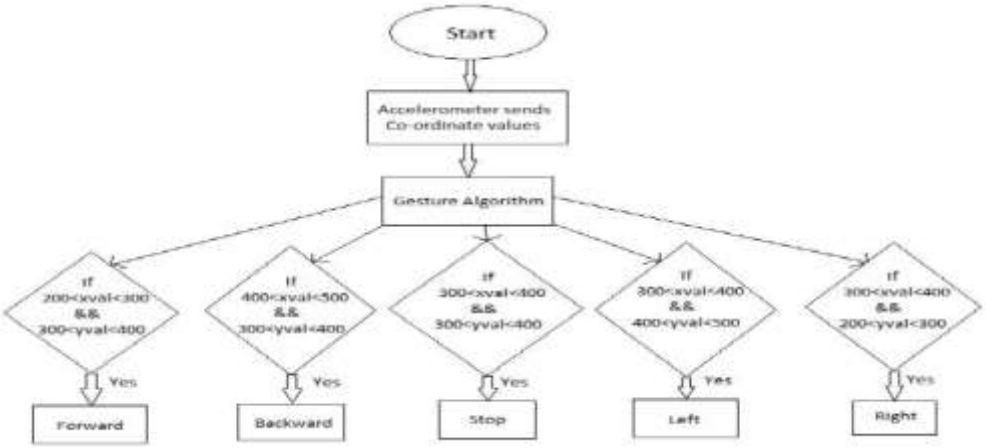


Fig. 4 Flow chart

The accelerometer is tilted and X co-ordinate value is generated ranging between 200 to 300 and the value of Y co-ordinate ranges between 300 to 400 then 'HIGH' is sent to AD0/AD2 and 'LOW' is sent to AD1/AD3 of HT12E

Received: 10 Nov 2018 | Revised: 20 Dec 2018 | Accepted: 02 Jan 2019

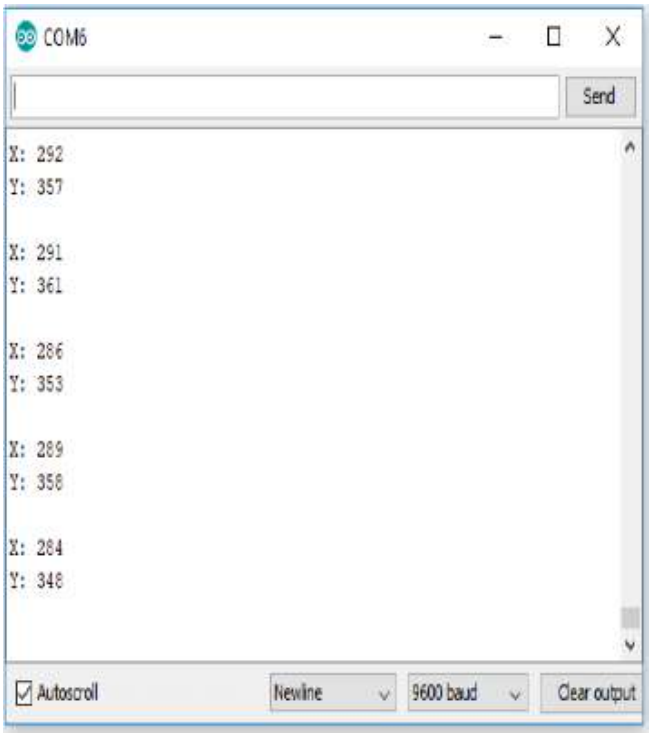
encoder and it leads the motion of car in forward direction. The figure 5(a) and (b) shows the values of ARDUINO IDE.


```
if((xval > 200 && xval < 300)&&(yval>300 && yval<400)) //forward
{
digitalWrite(out1,HIGH);
digitalWrite(out2,LOW);
digitalWrite(out3, HIGH);
digitalWrite(out4,LOW);
}

if((xval > 300 && xval <400)&&(yval>400 && yval<500)) //left
{
digitalWrite(out1,HIGH);
digitalWrite(out2,LOW);
digitalWrite(out3, LOW);
digitalWrite(out4,HIGH);
}

if((xval > 300 && xval < 400)&&(yval>200 && yval<300)) //right
{
digitalWrite(out1,LOW);
digitalWrite(out2,HIGH);
digitalWrite(out3, HIGH);
digitalWrite(out4,LOW);
```

(a) Gesture

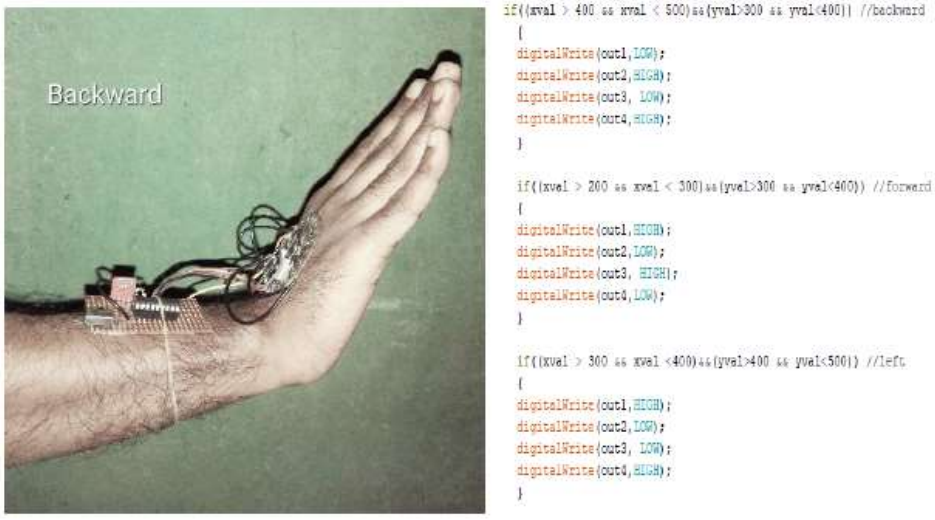


(b) Values of co-ordinates for forward motion

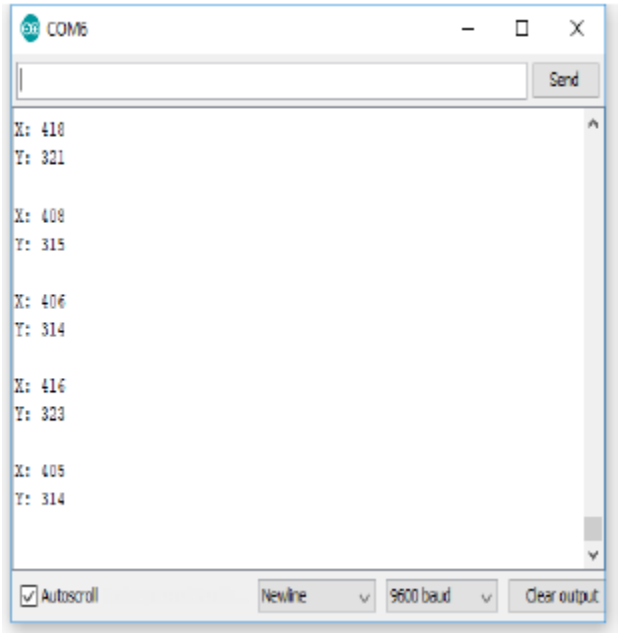
Fig. 5 Forward Motion

Received: 10 Nov 2018 | Revised: 20 Dec 2018 | Accepted: 02 Jan 2019

The accelerometer is tilted in opposite direction and the value of X co-ordinate is generated lying in between 400 to 500 and the value of Y co-ordinate is generated lying in between 300 to 400 then 'LOW' is sent to AD0/AD2 and 'HIGH' is sent to AD1/AD3 of HT12E encoder. This leads to the backward motion of a car[14], [15].



(a) Gesture



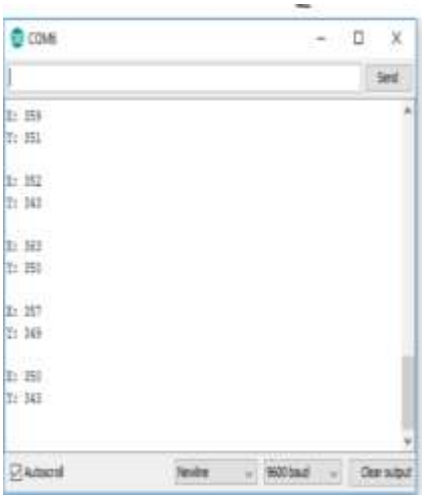
(b) Value of co-ordinates for backward motion

Fig. 6 Backward Motion

Received: 10 Nov 2018 | Revised: 20 Dec 2018 | Accepted: 02 Jan 2019

The parallel positioning of accelerometer leads to the values of X and Y coordinates ranging in between 300-400 and 'HIGH' is sent to encoder's data pin for stopping the car. The figure 7 shows the value of gesture and coordinate values for stop command.

(a) Gesture



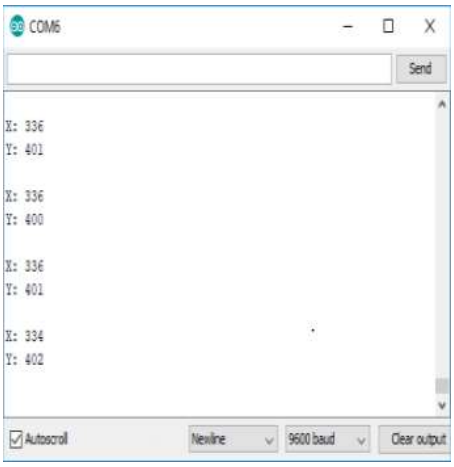
(b) Values of co-ordinate for stopping the car

Fig. 7 STOP

In this case, the tilting of accelerometer with ground is in perpendicular direction. The value of X co-ordinate lies in between 300 to 400 whereas the value of Y co-ordinate lies in between 400-500 then 'HIGH' is sent to AD0/AD3 and 'LOW' is sent to AD1/AD2 of the encoder. It leads to the motion of car without altering its axis.

Received: 10 Nov 2018 | Revised: 20 Dec 2018 | Accepted: 02 Jan 2019

(a) Gesture



(b) Value of coordinates for left motion

Fig. 8 Left Motion

The alignment of accelerometer in perpendicular direction opposite to the direction of ground having value of X coordinate between 300-400 and value of Y coordinate lying between 200-300. Then 'low' is sent to AD0/AD3 and 'High' is sent to AD1/AD2 of encoder. The car moves without alteration in its axis.

VI. CONCLUSION

A medical assistance system based on hand gesture is presented in this paper. It is designed for differentially abled people by using 'arduino lilypad'. It is a wearable device and the size and weight of its transmitter section is small. The movement of medical assistance is controlled by the gestures such as forward, left, right, backward, stop, left.

Received: 10 Nov 2018 | Revised: 20 Dec 2018 | Accepted: 02 Jan 2019

REFERENCES

[1] N. Kawarazaki, D. Stefanov, and A. I. B. Diaz, "Toward gesture controlled wheelchair: A proof of concept study," in IEEE International Conference on Rehabilitation Robotics, 2013.
[2] Y. Rabhi, M. Mrabet, and F. Fnaiech, "Intelligent Control Wheelchair Using a New Visual Joystick," J. Healthc. Eng., 2018.
[3] R. Xu, S. Zhou, and W. J. Li, "MEMS accelerometer based nonspecific-user hand gesture recognition," IEEE Sens. J., 2012.
[4] V. V Pande, N. SUbale, D. P. Masurkar, N. R. Ingole, and P. P. Mane, "Hand Gesture Based Wheelchair Movement Control for Disabled Person Using MEMS," 2014.
[5] S. Swayamsiddha, A. Banerjee, and J. Chowdhury, "Adaptive Hand Gesture Controlled Wireless Wheelchair using ZigBee Protocol," in National Conference on Knowledge, Innovation in Technology and Engineering (NCKITE), 2015, pp. 201–203.
[6] Y. M. Jain, S. S. Labde, and S. Karamchandani, "Gesture controlled wheelchair for quadriplegic children," in 2016 3rd International Conference on Systems and Informatics, ICSAI 2016, 2017, pp. 121–125.
[7] R. K. Megalingam, S. Sreekanth, A. Govardhan, C. R. Teja, and A. Raj, "Wireless gesture controlled wheelchair," in 2017 4th International Conference on Advanced Computing and Communication Systems, ICACCS 2017, 2017.
[8] S. Landge, V. Yadav, A. Tripathi, A. Chaugule, N. Naik, and J. Chavan, "Accelerometer based Gesture Controlled Wheelchair," Int. J. Comput. Appl., vol. 161, no. 10, pp. 9–12, 2017.
[9] A. R. Shaari, M. Nordin, M. Jani, A. Syukri, and M. Yunus, "A Smart Wheelchair Prototype Based On Hand Gesture Control," J. Eng. Sci. Res., vol. 1, no. 2, pp. 209–214, 2017.
[10] Y. Rabhi, M. Mrabet, F. Fnaiech, and P. Gorce, "Intelligent joystick for controlling power wheelchair navigation," in 2013 3rd International Conference on Systems and Control, ICSC 2013, 2013, pp. 1020–1025.
[11] Y. Rabhi, M. Mrabet, F. Fnaiech, P. Gorce, I. Miri, and C. Dziri, "Intelligent Touchscreen Joystick for Controlling Electric Wheelchair," IRBM, 2018.
[12] S. Nasif and M. A. G. Khan, "Wireless head gesture controlled wheel chair for disable persons," in 5th IEEE Region 10 Humanitarian Technology Conference 2017, R10-HTC 2017, 2018, vol. 2018-January, pp. 156–161.
[13] . R. C. M., "VOICE AND ACCELEROMETER CONTROLLED WHEEL CHAIR," Int. J. Res. Eng. Technol., vol. 03, no. 15, pp. 290–292, 2015.
[14] N. Chen, X. Wang, X. Men, X. Han, J. Sun, and C. Guo, "Hybrid BCI based control strategy of the intelligent wheelchair manipulator system," in Proceedings of the 13th IEEE Conference on Industrial Electronics and Applications, ICIEA 2018, 2018, pp. 824–828.
[15] Z. Su, X. Xu, D. Jiawei, and W. Lu, "Intelligent wheelchair control system based on BCI and the image display of EEG," in Proceedings of 2016 IEEE Advanced Information Management, Communicates, Electronic and Automation Control Conference, IMCEC 2016, 2017, pp. 1350–1354.

Received: 10 Nov 2018 | Revised: 20 Dec 2018 | Accepted: 02 Jan 2019