International Journal of Advanced Research in

Electronics, Communication & Instrumentation Engineering and Development

Volume: 1 Issue: 2 08-Feb-2014,ISSN_NO: 2347 -7210

DESIGN AND DEVELOPMENT OF A HAND-GLOVE CONTROLLED WHEEL CHAIR USING ZIGBEE

Author Name: Dr .S. Padmapriya (Guide) (per 1st)Affiliation ,
Authors Names:1.G.Aravind Kumar, 2.M.Prasanth, 3.K.Sajith Mohamed(per 2nd) Affiliation

[1](1st Affiliation) HOD-Information Technology,Prathyusha Institute Of Technology And Management,Thiruvallur, Tamil Nadu,INDIA;
[2](2nd Affiliation)Students of Information Technology,PrathyushaInstitute Of Technology And Management,Thiruvallur, Tamil Nadu,INDIA;

Email:padmapriya.sha@gmail.com,sajithmohamed537@gmail.com,

edvinprasanth@gmail.com,Aravind.kumar937@gmail.com

Abstract:

Wheelchairs are a way of reincarnating the purpose of life in the lives of disabled people and elderly people. Effective and efficient ways of delivering a cost-effective and affordable wheelchair to the common masses, which is not only at par with the present day technology, but is much easier to use are presented herewith.

Replacement of the popular joystick stick controlled wheel chair with a hand-glove control system for easier maneuvering by bending the fingers, is discussed in this paper. Intended users control the system by wearing an instrumented glove fitted with flex or bend sensors for controlling the movement and direction of the wheelchair.

Uni-directional wireless communication exists between the instrumented gloves and the controller which is sandwiched between the user's seat and the wheels.

The technologies presented in this paper suggest a wide domain of possibilities to a wide variety of users. In addition, it also aims at making a cost-effective chair so that more hi-tech wheelchairs are made use of, widely, by people with disabilities.

1.INTRODUCTION

The methodology consists of a thorough study and analysis of electric powered and joy-stick controlled wheelchairs, and the control law used to maneuver these vehicles. Also, incorporated in the methodology is a study of the working of the bend sensors popularly known as flex-sensors. Figures 1and 2 show the block diagrams representing the complete system. It consists of a flex-sensor circuit, a wireless transmitter and receiver combo, microcontrollers, a motor driver circuit and motors.

The arrangement consists of two sub-systems. One is the hand-glove and the other the lies beneath the seating base of the chair.

A. ON THE HAND GLOVE

The bending of the mems-sensors attached to the hand-glove initiates the process. As the hand are bent and hence the mems sensors, a voltage is developed across the constructed mems sensor circuit. This voltage is fed into the Arduino Funnel I/O Board which comes with an inbuilt X-Bee wireless transmitter socket and a microcontroller. The microcontroller does the necessary calculations (works as an analog to digital converter and converts the data into serial data) and sends the signals serially through the X-Bee transmitter, using the Zigbee wireless communication protocol. The glove further consists of two components, a bend sensing circuit and a transmitting circuit. The bend sensing circuit is essentially a simple voltage divider circuit. A resistor is connected in parallel with the mems sensor, across the supply voltage. When the user bends his finger, the resistance of the sensor increases. The more the bend, the more the resistance and hence the voltage across the sensor varies. This varying voltage is fed into the microcontroller and is given by,

$$V = \frac{Rflex}{Rflex + R} Vsupply$$

Where,

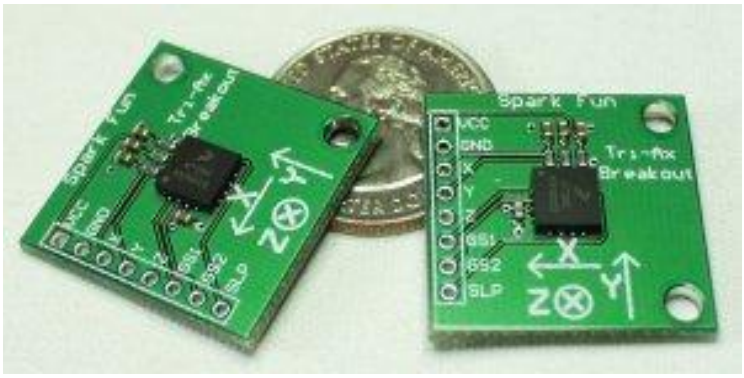
Rflex=Resistance of mems sensor

Vsupply= Supply voltage

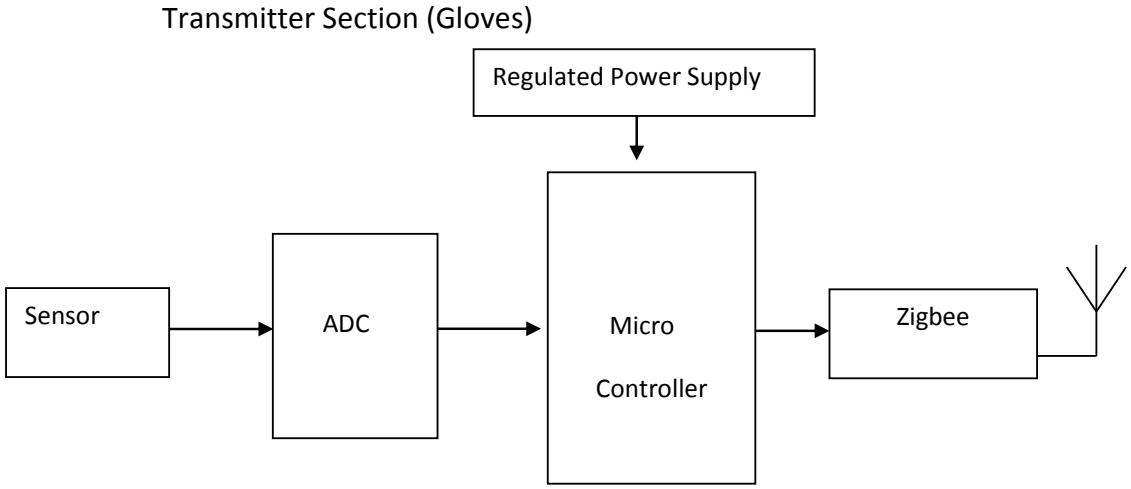
R=Resistance connected parallel to mems sensor

MEMS Sensor:

Volume: 1 Issue: 2 08-Feb-2014,ISSN_NO: 2347 -7210



BLOCK DIAGRAM: <u>TRANSMITTER SIDE</u>



B. UNDERNEATH THE WHEEL CHAIR

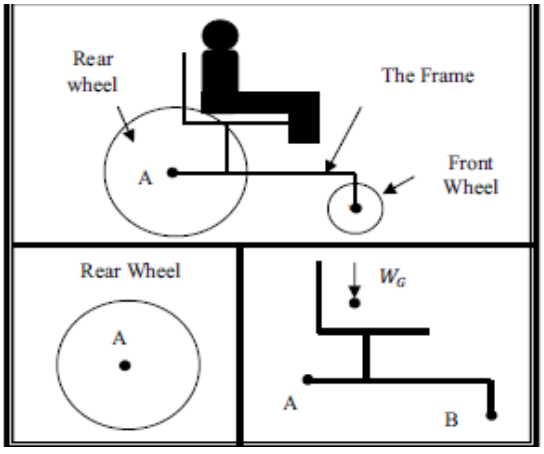
On the other end, beneath the wheelchair, another circuit is constructed that consists of an X-Bee receiver and its shield. The shield acts as interface platform between X-Bee receiver and microcontroller board. The receiver receives the signals sent by the transmitter and passes them onto the microcontroller board which has another built-in microcontroller. The microcontroller evaluates and analyses the signals, based on the instruction codes which have been programmed into it and accordingly sends the signals to its PWM output and the H-bridge circuit or the motor driver. The function of the motor driver circuit is to control the direction of rotation of the motors. Through the H-bridge the motors receive the instructions and act consequently, having

complete control over the speed and direction of rotation of the motors. Hence, the wheelchair begins to move according to the movement or bending of the user's fingers. Once the voltage is received by the microcontroller, it needs to be transmitted over to the other side of the system, which is the wheelchair, underneath which lies the main controller board, the microcontroller, along with the motor-drivers and other circuitry. This is done by the transmitting circuit present on the hand-glove, hence realizing wireless communication between the chair and the glove. The wireless transfer protocol used is Zigbee, since it is easier to use and the wheelchair doesn't require a long-range communication.

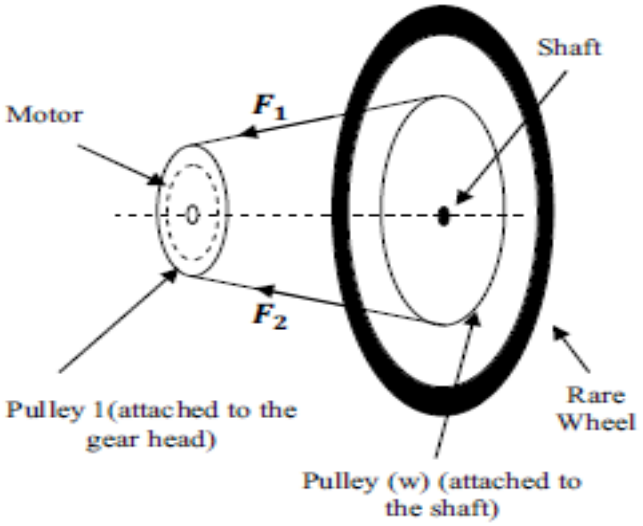
The most significant component in this design is the mems sensor, because it requires negligible force to bend the sensor, which in turn causes the motion of the wheelchair. This small force overcomes the limitation provided by the traditional joystick control of wheelchairs making it easier for people with

severe disabilities to maneuver the vehicle. The mems sensors are embedded into the instrumented gloves, with each finger having a different function. The bending of the index finger causes the chair to move forward. As the finger is bent more, the voltage across the divider-circuit increases and so does the

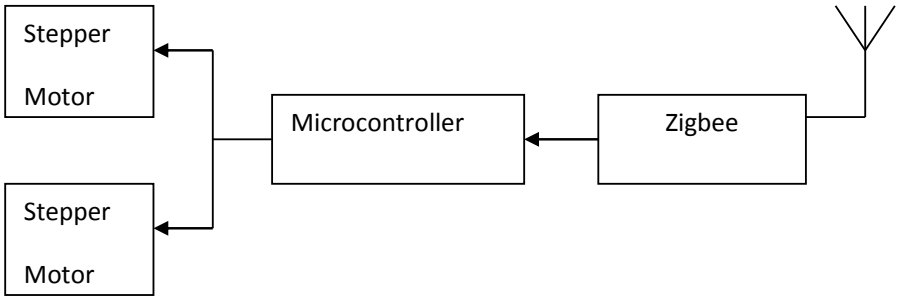
speed of the vehicle. The rest of the fingers are used to move the chair right, left and backwards. There is a tolerance provided for the abnormal bending because of the tendency of the fingers to follow the one which is bent, although vaguely. I fall four fingers are bent at a time, the microcontroller is programmed such that it will halt all the operations and the chair will come to a standstill.

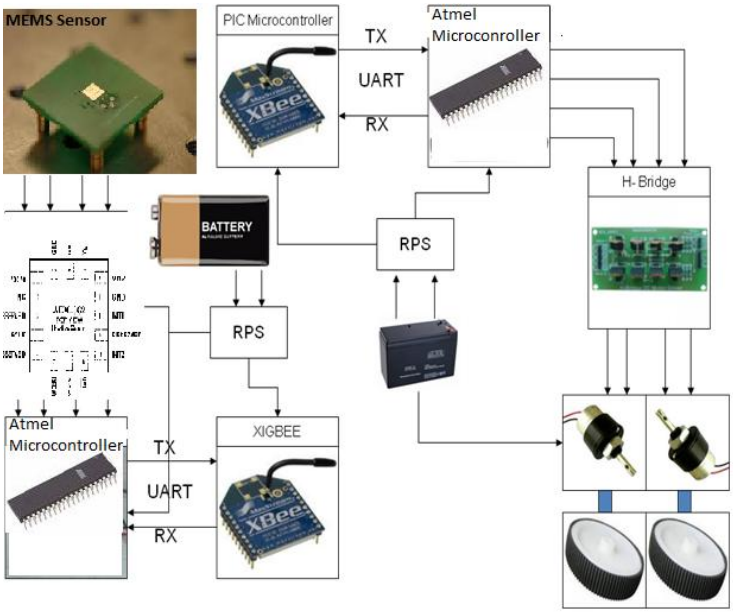


Volume: 1 Issue: 2 08-Feb-2014,ISSN_NO: 2347 -7210



BLOCK DIAGRAM: RECEIVER SIDE





Drawbacks of Existing System

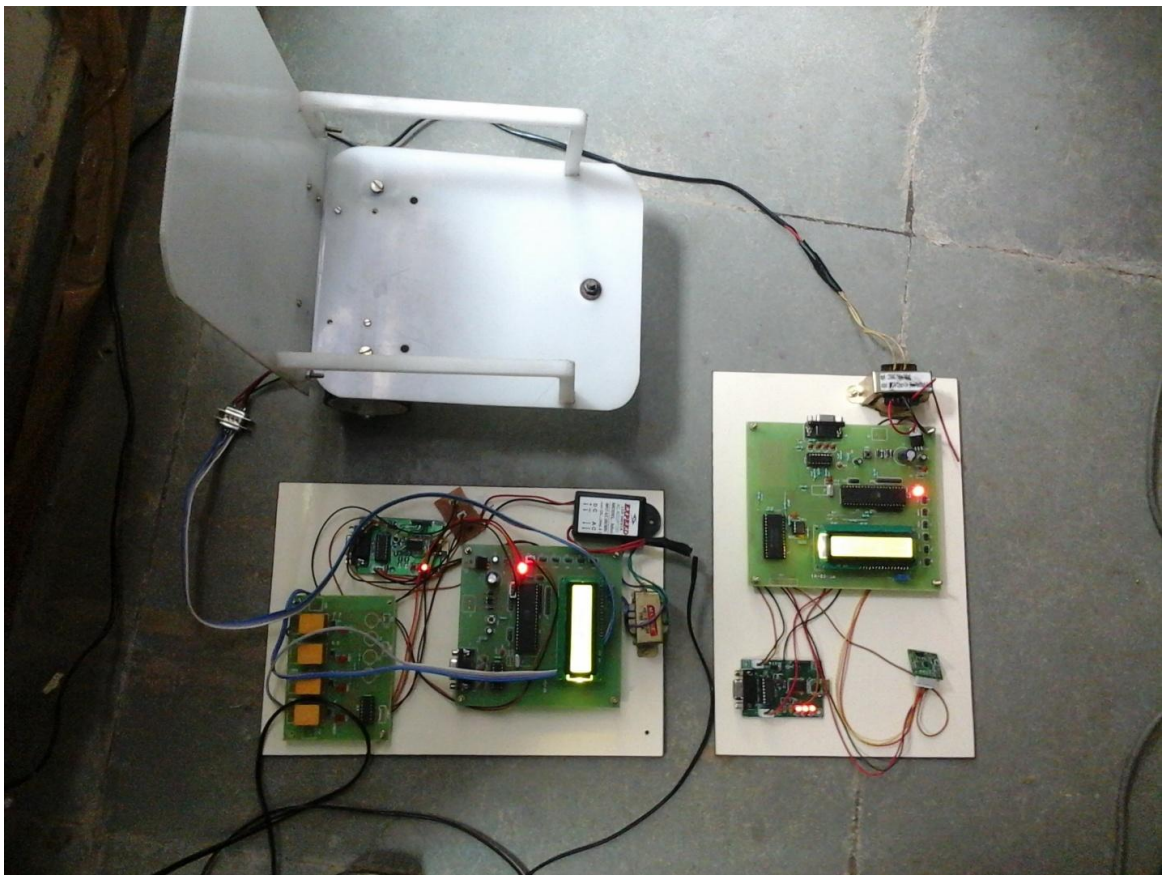
- Joysticks are used to control the direction.
- By using joystick, only 45 degree rotational movement is possible.
- Bluetooth is used as the communicating medium.
- With the use of joystick , the system model becomes increase in size.
- Only supports 10m Range.
- Cost of the system is more, thus make difficult to reach people of all category.

3, MAIN FEATURES

- Hand-Glove is used to control the movement.

- Sensors are used to collect the information of the handle movement.
- Accurately captures the slit movement and rotations.
- Zigbee is used as the communicating medium.
- Since it is concentrated on short distance communication, Bluetooth is proved to be more effective than ZigBee.
- Less power consumed.
- Compact to hand.

IMAGE



CONCLUSION:

Here a novel method for wheel discussed. A prototype of the system has been developed which is believed to provide better control to people with severe disabilities in comparison to the traditional joy stick control because of the lesser amount of force require to manipulate the hand-glove in contrast to the joystick.

References

- T.G.Zimmerman et al., "A Hand Gesture Interface Device." Proc. Human Facttors in Computing Systems and Graphics Interface, ACM Press, New York, April 1987.
- Burdea, G., "Research on Portable Force Feedback Masters for V i a l Reality", Proc. Of Virtual Reality Worlds Con. , Stuttgart, Germany, pp. 317-324, Feb. 1995.
- Burdea, G., Zhnang, J.. "Actuator System for Providing Force Feedback to. a Dexterous Master Glove" (1997), US. Patent No. 5,143,505.
- Keyur Desai, John D. Enderle. Motorized Chair (2000) University of Connecticut.

BIOGRAPHY

Dr. S. Padmapriya

Dr.S.PadmaPriya received her BE (Electronics and Communication) from Madras University in the year 1991. And M.Tech (Information Technology) from Punjab University and M.E.(Embedded Systems) from Anna University, and Ph.D. (Computer Science) from Berhampur University . She has been the member for evaluation committee for projects and served has Resource coordinator for Bharathidasan University and IGNOU. She has published papers in many national level conferences on embedded systems. She is now presently Heading over the Information Technology Department in Prathyusha Institute of Technology and Management.

1.G.Aravind Kumar final year B.tech(IT),Prathyusha Institute of Technology and Management

2.M.Prasanth final year B.tech(IT),Prathyusha Institute of Technology and Management

3.K.Sajith Mohamed final year B.tech(IT),Prathyusha Institute of Technology and Management

Volume: 1 Issue: 2 08-Feb-2014,ISSN_NO: 2347 -7210