DESIGN AND DEVELOPMENT OF A DATA GLOVE FOR THE ASSISTANCE OF THE PHYSICALLY CHALLENGED

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ABSTRACT

This project provides a mechanism for controlling wheelchair and home appliances for physically disabled people by way of movement of fingers.

A person suffering from paralysis or any serious injury may not be able to move around and accomplish simple tasks such as switching on/off tube-lights, fans etc. A helper may be required to be present with the patient at all times. Our project serves the purpose of making the patient self-sufficient and devices an easy way for him to go about his work.

The device is a convenient, flexible and reliable mechanism to help the patient control a wheelchair-motion. It also includes a mechanism to control various appliances.

A hand glove fitted with flex sensors is worn by the patient. Just by bending his fingers, he can switch on/off appliances and also control his wheelchair movement. Also, the entire setup is wireless and therefore gives the patient control over appliances in a 30m radius.

Keywords: Flex Sensor, X Bee, Wireless, Arduino, H-Bridge, motor control.

1. INTRODUCTION

The Goose’s story by Cari Best was a story that touched our heart, when we read it for the first time as a kindergartener. The struggle for a physically challenged goose in the story mirrors the scene around us where the disabled were incapable of performing their daily routine tasks that are thought normal and easy to do by others.

The preexisting technologies are insufficient or too cumbersome for a challenged person to operate easily. The voice recognizing control of wheelchair being the easiest to master but the cost of it easily surpasses all its benefits. The other control mechanisms of the wheelchair being tongue operated or joystick controller are too difficult to manage.
This made necessary of development of a control device which is easy to master, cheap and portable. The paper introduces with construction of a mechanism using the bending of flex sensors to control the wheelchair motion and which can be further added upon by adding modules like emergency call system or appliance control wherever necessary.

2. THE BLOCK DIAGRAM

![Block Diagram]

Fig 1: Block Diagram

3. COMPONENTS

- Flex sensors

  It is a variable printed resistor on a thin flexible substrate. When the substrate is bent, the sensor produces a resistance output correlated to the bend radius—the smaller the radius, the higher the resistance value.

![Flex Sensor]

Fig 2: Flex Sensor
ARDUINO

Arduino is a popular open-source single-board microcontroller, descendant of the open-source Wiring platform, designed to make the process of using electronics in multidisciplinary projects more accessible. The hardware consists of a simple open hardware design for the Arduino board with an Atmel AVR processor and on-board input/output support. The software consists of a standard programming language compiler and the boot loader that runs on the board in Fig 3.

Arduino hardware is programmed using a Wiring-based language (syntax and libraries), similar to C++ with some simplifications and modifications, and a Processing-based integrated development environment.

Fig 3: Arduino board

XBee/ZigBee

XBee/ZigBee is a specification for a suite of high level communication protocols. It uses small, low-power digital radios based on an IEEE 802 standard for personal area networks. It is simpler, less expensive and covers more area than other WPANs, such as Bluetooth. It targets radio-frequency (RF) applications requiring a low data rate, long battery life, and secure networking. It has a defined rate of 250 kbps best suited for a single signal transmission from a sensor or input device. AXbee pro module is shown in Fig 4.

Fig 4: XBee Pro
H-BRIDGE

An h-bridge is an electronic circuit that enables a voltage to be applied across a load in either direction. These circuits are often used in robotics and other applications to allow DC motors to run forwards and backwards [2]. H bridges are available as integrated circuits, or can be built from discrete components. An H bridge is built with four switches (solid-state or mechanical). When the switches S1 and S4 (according to the Fig 4) are closed (and S2 and S3 are open) a positive voltage will be applied across the motor. By opening S1 and S4 switches and closing S2 and S3 switches, this voltage is reversed, allowing reverse operation of the motor.

Using the nomenclature above, the switches S1 and S2 should never be closed at the same time, as this would cause a short circuit on the input voltage source. The same applies to the switches S3 and S4. This condition is known as shoot-through.

![Fig 5. H Bridge](image)

The H-bridge arrangement is generally used to reverse the polarity of the motor, but can also be used to 'brake' the motor, where the motor comes to a sudden stop, as the motor's terminals are shorted, or to let the motor 'free run' to a stop, as the motor is effectively disconnected from the circuit.

The following table summarizes operation, with S1-S4 corresponding to the two operating modes can be represented as in Fig 6 switches S2 and S3 are open and hence the motor rotates left. While in Figure 7 when switches S1 and S4 are open the motor rotates in the opposite direction.

Fig 5 shows the actual picture of H–bridge. We have used the L293D chip in the H-bridge supposed to drive the motor.

![Fig 6](image)

![Fig 7](image)
Fig 8: H-bridge Driver Chip L293D

- **Relays**

  A relay is a switch which is operated by electricity. It is usually an electromagnetic device. When a small trigger voltage is applied to a relay, power supply to the device is switched on. When the trigger voltage is removed, the power supply for the device is also cut off. Some relays can be triggered directly by a microcontroller output.

4. **ADVANTAGES**

   - No need for a person to remain with the patient at all times
   - Can also be used for patients paralyzed neck down (who can’t even use their fingers), by simply replacing the hand glove with a head mask
   - Additional functions like sounding an alarm etc. can be added easily.
   - ZigBee covers more distance compared to transmission using IR rays (which is used in remote controls)
   - Easy to use
   - Cost effective

5. **CONCLUSION**

   Our prototype adheres to all aforementioned specifications. Test results indicate that the sensor is not too sensitive to the input which means that the probability of the user unintentionally triggering the device is very low.

6. **REFERENCES**


7. AUTHORS

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