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Glove controlled Wheelchair

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Table

Wheelchairs

Roughly 3.6 million people(aged 15 or older) are using a wheelchair

Using a manual wheelchair can cause repetitive strain injury, Mostly shoulder and wrist

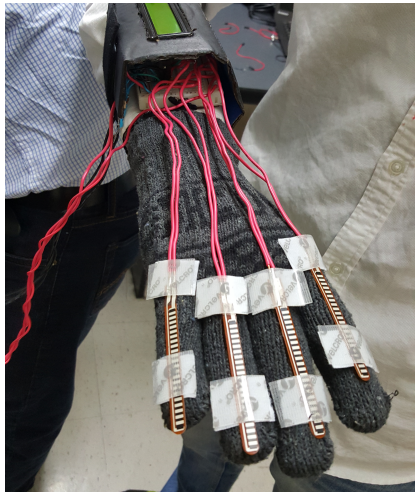
Electric Wheelchair

- Electric Wheelchair was invented in early 1900s
- Conventional Control - Joystick control

Controlled by Fingers

Gloves that is attached with flex sensors

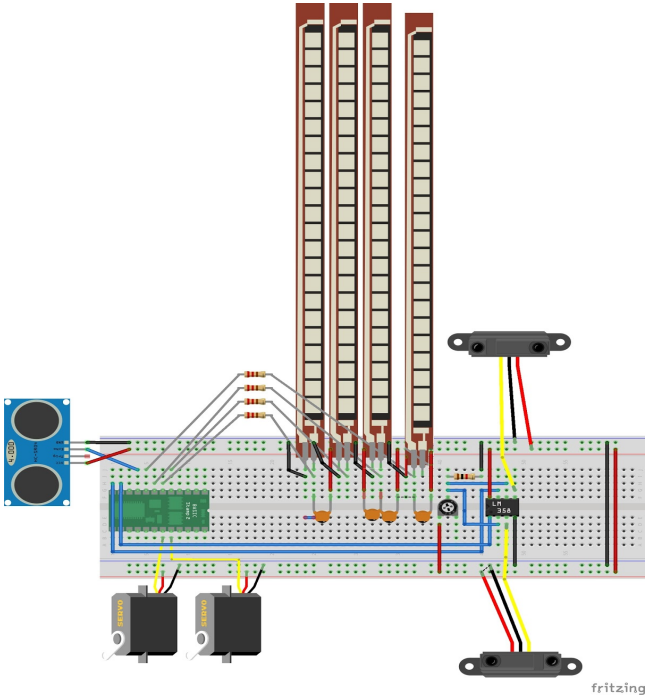
Read movement of fingers to control motion of wheelchairs



```
'Flex Sensor1
F1:
  HIGH 0 'hold pin 0 high to charge capacitor
  PAUSE 1 'charge capacitor for 1/1000 of a second
  RCTIME 0, 1,fs1 'measure discharge time of flex resistor through capacitor
  'fs1=fs1**scalecon1+500
  temp = fs1*/439 - 2572
  fs1 = fs1 - temp
  fs1 = fs1/2

  RETURN
```

Circuit Diagram



Why not go further?

Ultrasonic sensor

- It will detect an obstacle in front of the wheelchair


```
DO WHILE (ul1 < 20)                    'Obstacle detection
  PULSOUT LeftServo, 750               ' Left Servo Move Pulse Value
  PULSOUT RightServo, 750              ' Right Servo Move Pulse Value
  DEBUG CR,"STOP UltraSonic"
  SEROUT lcd, 84, [12]
  PAUSE 5
  SEROUT lcd, 84, [128,"STOP2 Ultrasonic"]
  PAUSE 10

  GOSUB ping
 PAUSE 20
LOOP
```

Cliff Detector

IR-sensor

Detect the back and the front cliff.

```
'IR sensor
IRS:                                    'Check for IR Sensor 1 and 2 HIGH
  DO WHILE(IN6 = 0) OR (IN7 = 0)
  PULSOUT LeftServo, 750                ' Left Servo Move Pulse Value
  PULSOUT RightServo, 750               ' Right Servo Move Pulse Value
  DEBUG CR,"STOP IR Sensor"
  SEROUT lcd, 84, [12]
  PAUSE 5
  SEROUT lcd, 84, [128,"CLIFF DETECTED"]
  PAUSE 5
  PAUSE 20
  LOOP
```

How to interface with User?

Monitor the statues of wheelchair

- Forward
- Back
- Right
- Left
- Stationary
- Cliff Detected etc..

Safety

Two fingers movement (here 3 and 4) will stop the motion of wheelchair and put it in suspended mode.

```
IF (fs3 < 450) AND (fs4 <450) THEN  'Stop switch
  DO
  IF(fs2 < 450) AND (fs1 < 450) THEN  'Reset the stop switch
    SEROUT lcd, 84, [12]
    PAUSE 5
    SEROUT lcd, 84, [128,"Reset Cleared"]
    PAUSE 5
    DEBUG "reset cleared"
    GOTO main
  ELSE
    DEBUG "reset"
    SEROUT lcd, 84, [12]
    PAUSE 5
    SEROUT lcd, 84, [128,"STOP1 Switch"]
    PAUSE 5
    GOSUB f3
    GOSUB f4
  ENDIF
  LOOP
ENDIF
```

Bill of Material

Bill of Material for Mechatronics Term Project				
Item	Cost per Item	No of Item	Total	Mass Production
Flex Sensor	7.49	4	29.96	20
IR Sensor	12	2	24	16
Wires	3	3	9	3
Ultrasonic	15	1	15	12
Boebot Chasis	59	1	59	40
Total			136.96	91

Advantage and Disadvantage

- Pros
  - People who have RSI on their wrist can control wheelchair easily
  - Wearable
  - It can use as little as two and at most four fingers so the system can be customized for different users.
- Cons
  - The glove is wired so it is clunky and obstrusive

References

Brault, Matthew W., “Americans With Disabilities: 2010,” Current Population Reports, P70-131, U.S. Census Bureau, Washington, DC, 2012.

Cooper, R and **Boninger, Michael Lee** and **Robertson, R** (1998) *Heavy Handed: Repetitive strain injury among manual wheelchair users.* Team Rehab Report, 9 (2). pp. 35-38.

THANK YOU