Jeremy Mah

860990799

Custom Lab Report

**High Level Description**

In this custom lab I decided to build a system that represents people with wheelchairs moving on an incline or decline. The idea was to invent a wheelchair that could automatically level the seat so when the wheelchair is going uphill or downhill, the seat would adjust to the position of what it would be if the wheelchair was moving on flat ground. The system has both a manual and automatic mode to adjust the seat. It also comes with three choices of speeds and an option to return to your original position if you were in manual mode. This system uses an accelerometer and gyroscope to determine the slope it is on. An LED Matrix is used to read calibrated data from the accelerometer/gyroscope and shows the magnitude of steepness. The menu is displayed on an LCD screen and is easily navigated through by using buttons from the keypad. The system also has two buttons that manually controls the seat position.

**User Guide**

When the system is initialized, the LCD screen will display the main menu, the LED matrix will display the magnitude of the slope it is on. The default mode is manual and the default speed is normal. The gyroscope/accelerometer is attached to a separate breadboard along with the stepper motor, so tilting that will create the representation of a slope. In automatic mode, the stepper motor will adjust itself accordingly.

Main menu:

The main menu uses four buttons: A,B,C,D

The LCD screen will display the options.

Automatic mode:

The system starts in manual mode.

Tilt the breadboard and the stepper motor will adjust the seat.

You cannot reset your position when you are in automatic mode.

Manual mode:

The system starts in manual mode.

There will be two buttons to press.

One button rotates the chair up, the other button rotates the chair downwards.

You can only use the option to reset your position in Manual mode.

Speeds:

Default speed is normal.

The other two speed options are Fast and Slow.

LED Matrix:

Two middle lines are purple means it is on level ground.

If the slope is uphill, then the lights will go up, and vice-versa

Green lights means it is a light slope

Yellow means its a pretty steep slope

Red means its too steep for any practical use

If the slope is changed at a faster rate than the accelerometer/gyroscope reads, the system would need to catch up. When putting the breadboard back on leveled ground, it might take an extra second for the accelerometer/gyroscope to adjust. The system was built to represent real world situations, so creating a slope that is unrealistic, such as flipping the breadboard upside down will cause an error.

**Technologies and components**

* AVR Studio 6
* AVRISPmkII
* 1 ATmega1284
* 1 MPU-6050 / GY-521
* 1 Keypad
* 1 16x2 LCD Screen
* 1 Stepper motor
* 1 Potentiometer
* 2 Buttons
* 1 8x8 RGB Matrix
* 4 Shift registers
* 1 Transistor Array
* 24 330 Ohm Resistors

**Link to Demo Video**

[**http://www.youtube.com/watch?v=FcKqEvOQD0w**](http://www.youtube.com/watch?v=FcKqEvOQD0w)

**Link to Source files**

Project.c

Project.c is the main file where my project is coded in. The three state machines are for controlling the LCD, Stepper Motor, and the GY-521. I have a function named draw() that controls the LED Matrix.

keypad.h

Description: Keypad functions

https://drive.google.com/file/d/0B3pcEuCgMKPfamdRRUwyUGUyckE/edit?usp=sharing

lcd.h

Description: LCD functions

https://drive.google.com/file/d/0B3pcEuCgMKPfWkdsLUJUbWdIVUU/edit?usp=sharing

bit.h

Description: Has the bitwise functions

https://drive.google.com/file/d/0B3pcEuCgMKPfempTRF81bU56b0U/edit?usp=sharing

i2cmaster.h

Description: Header file for i2c(TWI)

https://drive.google.com/file/d/0B3pcEuCgMKPfOTFGWEJIaTRfaWs/edit?usp=sharing

twimastertimeout.c

Description: File for i2c(TWI) with the functions

https://drive.google.com/file/d/0B3pcEuCgMKPfSHJXLTVGUGdPemM/edit?usp=sharing

mpu6050.h

Description: Header file for MPU-6050/GY-521

https://drive.google.com/file/d/0B3pcEuCgMKPfZkx3d3pCRTVCRmM/edit?usp=sharing

mpu6050.c

Description: File for MPU-6050/GY-521 with functions used to calibrate the GY-521

https://drive.google.com/file/d/0B3pcEuCgMKPfTDRiZW9rb2gwcTQ/edit?usp=sharing