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EC450 Final Project
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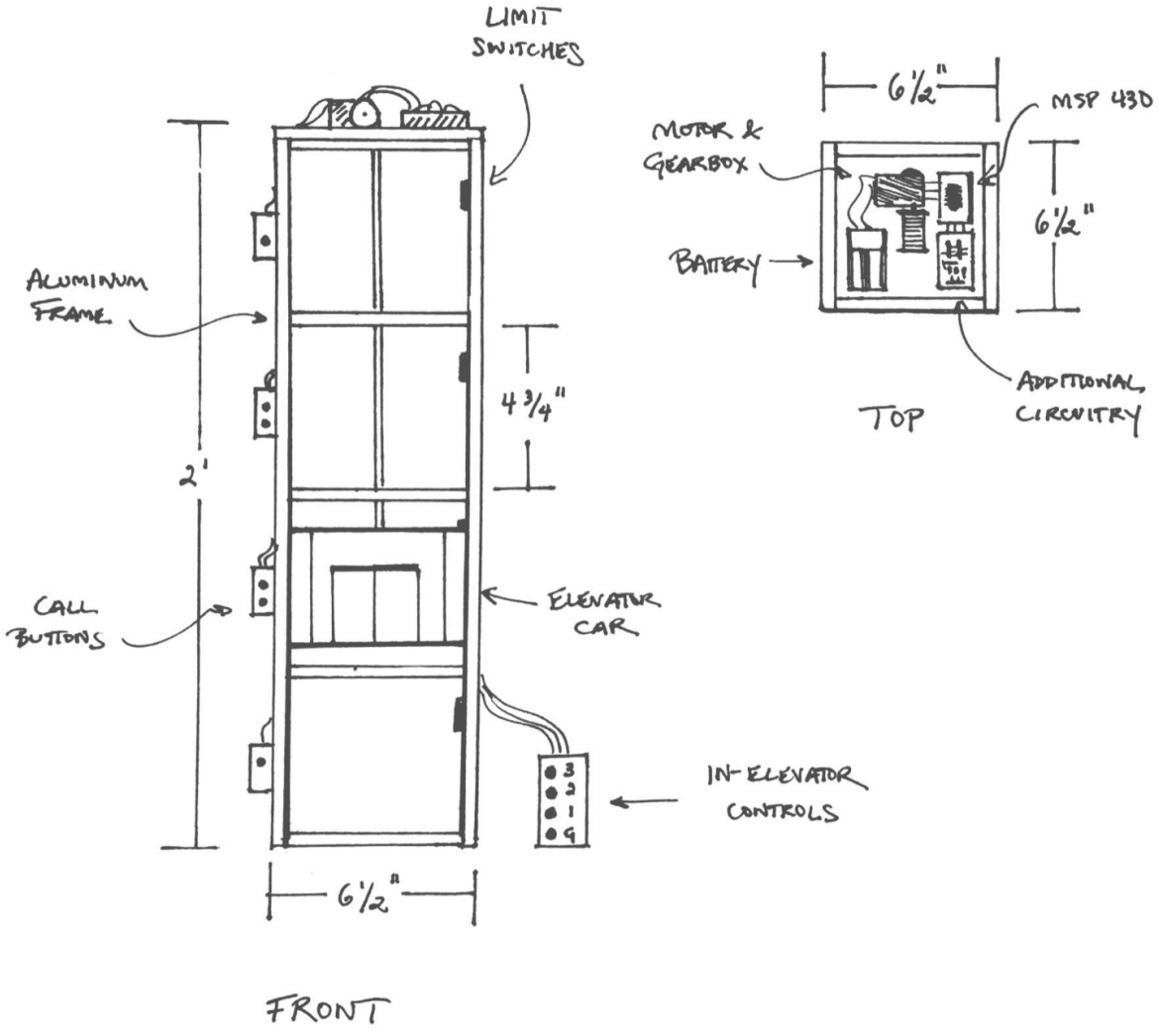
Final Project Proposal

I. Overview:

We propose designing and building a dynamic elevator control system. The system will include:

1. A 2-foot tall aluminum structure with 4 floors and a moving elevator car.
2. A motor, gearbox, and wire spool driven at variable speeds using pulse width modulation, operating in both directions using an h-bridge system.
3. Bi-directional limit switches to accurately detect the position of the elevator car.
4. Additional circuitry to encode the switches, buttons, and to drive a 7-segment display.
5. A sophisticated control algorithm that dynamically adjusts elevator speed and optimizes stops when ascending and descending.



II. Design:

The MSP430 will be responsible for driving the motor and responding to system feedback and user input. System feedback is primarily the limit switches that detect elevator position, allowing the controller to adjust elevator speed and direction. User input will include call buttons and in-elevator controls.

In this project we will utilize all 16 GPIO pins. Given the limited resources available on the MSP430, we will use several encoders to reduce the number of pins needed to responds to input. Collectively we have 6 outputs and 14 inputs, compressed to fit on the 16 pins as follows:

Motor Control (3 pins):

0. PWM to drive motor *
1. Forward direction enable **
2. Reverse direction enable **

6x On-Structure Call Buttons (4):

3. 8-3 encoder enable
4. 8-3 encoder addr 0
5. 8-3 encoder addr 1
6. 8-3 encoder addr 2

* These pin numbers are not indicative of the final pin assignments that will be used.

** Will also be used to light two LEDs indicating that the elevator is going up or down.

4x In-Elevator Controls (3):

7. 4-3 encoder enable
8. 4-3 encoder addr 0
9. 4-3 encoder addr 1

4x Limit Switches (3):

10. 4-3 encoder enable
11. 4-3 encoder addr 0
12. 4-3 encoder addr 1

1x 7-Segment Display (3):

13. addr 0
14. addr 1
15. addr 2

<u>Motor Control</u>

We will use a 3V motor coupled to a gearbox to raise and lower the elevator car. Motor speed will be regulated using pulse-width modulation (PWM) driven by Timer_A. Motor direction will be controlled using an h-bridge circuit made with 4 transistors.

<u>On-Structure Call Buttons</u>

6 buttons mounted to the physical structure will be pressed by the user to call the elevator car to a specific floor. Floors 1 and 4 have only one button (up and down, respectively) while floors 2 and 3 have both up and down buttons.

<u>In-Elevator Controls</u>

Since the elevator car is too small for the user to interact with, the floor-select buttons in the elevator will be simulated on a panel attached to the structure. 4 buttons will let the user select one or more floors in the structure to travel to. All user-related call buttons (on-structure or in-elevator) will be handled by the port 1 interrupt.

Limit Switches
4 limit switches will be used to monitor the absolute position of the elevator car at each floor. This will provide feedback to the controller to adjust the speed of the elevator or stop it. The switches on floors 1 and 4 will also prevent the elevator car from traveling past the physical limits of the structure.

7-Segment Display
A single 7-segment display will indicate which floor the elevator car is currently on and which direction the car is travelling. This display will be mounted to the top of the structure (not shown in picture).

III. Materials:

Description	Quantity	Total Cost
IC 74LS148N 8-3 Priority Encoder	3	$3.57
IC 74LS47 BCD to 7-Segment Driver	1	$0.50
SS-5GL2 Limit Switches with Roller	4	$7.80
Tactile Pushbutton Switches	10	$2.90
3V DC Motor and Gearbox Kit	1	$11.95
14’ of 1” 80-20 Aluminum Stock	1	$26.35
L-Brackets for Aluminum Stock	16	$39.80
1/4”-20 Fasteners for Aluminum Stock (4pk)	4	$16.25
Fishing Line	1	N/A
Foam Board	1	N/A
PCB Prototyping Boards		N/A
Assorted Wire		N/A
Hot Glue		N/A
Zip Ties		N/A
6V Battery Pack and Batteries	1	N/A
Plywood Stock	1	N/A
Transistors	8	N/A
Total Estimated Cost		**~ $109.12**

All materials will be sourced through the Tinker Lab, our lab kits, and personal funds.