

**Complete System Level Block Diagram
For the Active Suspension System**

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Software

The active suspension system project contains both software and hardware design. For the software portion of the project, there are three major modules: the motion module, calculation module, and the interaction module. The motion module contains the software programs that provide the linear actuators with the necessary commands to make the platform move up, down, or gyrate. The calculation module obtains data entered by the user and uses that data to calculate the distance moved by the platform, the acceleration, and the velocity at the centroid of the platform. Figure 1 shows the placement of the actuators on the platform relative to platform position.

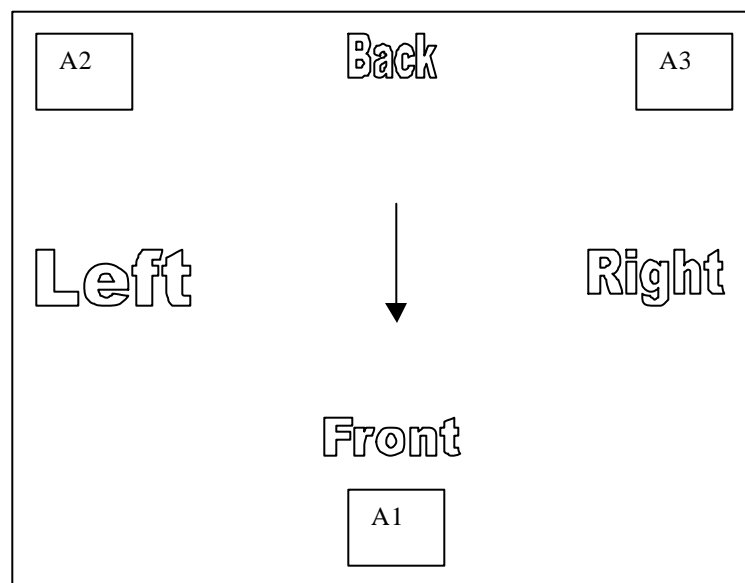


Figure 1: Arrangement of the Actuators on the Platform

The interaction module contains a module to initialize the LCD display, a module to display prompts to the user, and a module that will interpret the user input. The program to initialize the LCD already exists and few modifications will be done to this program. Next, the user will be asked to enter the desired motion (i.e. up, down or

gyrate) and the maximum distance the user would like the platform to move. The user's input will then be processed and the appropriate module will be executed. Figure 2 shows how this process will proceed.

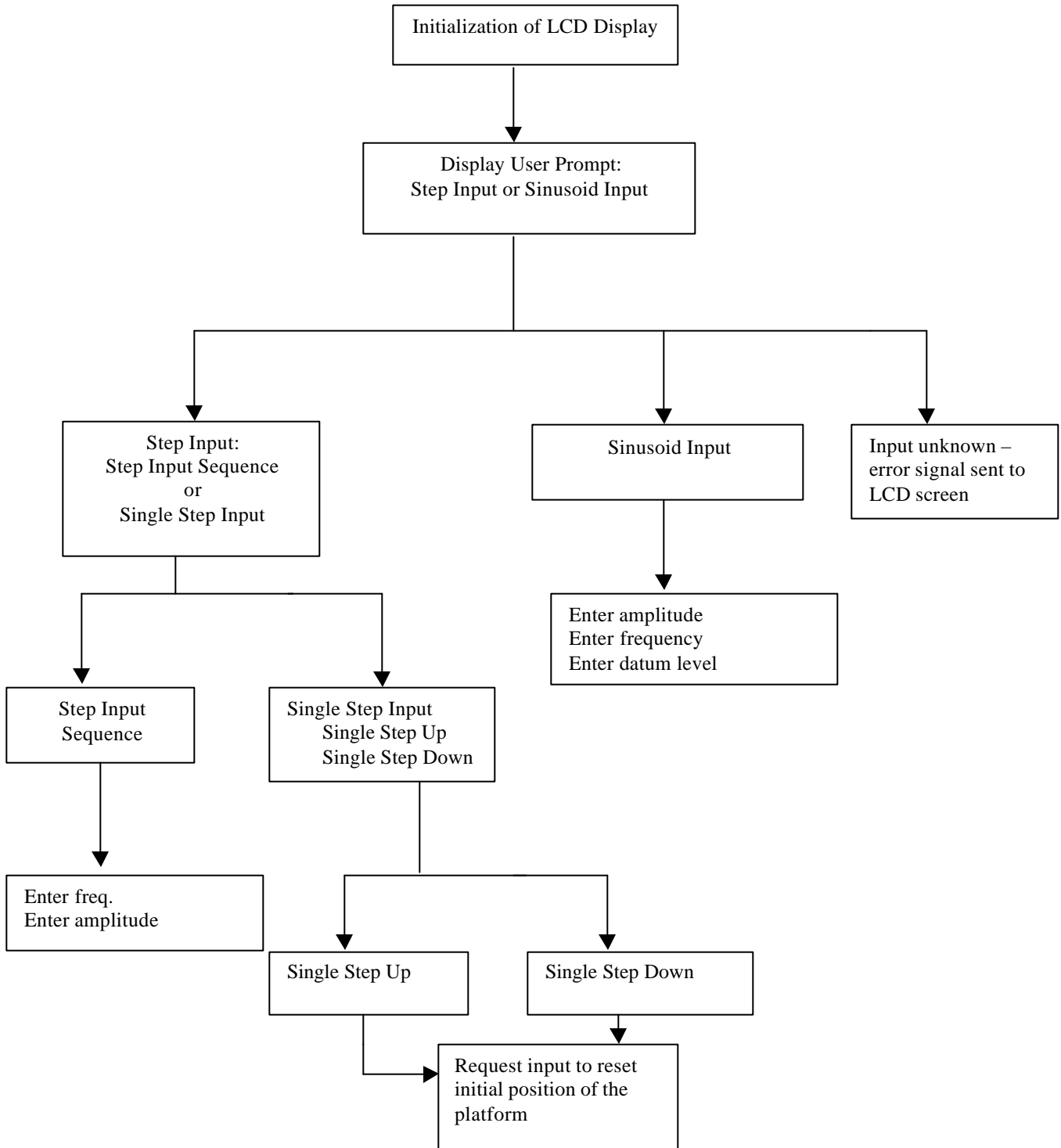


Figure 2: The software flowchart for Linear Actuator Behavior Selection

If the input entered by the user is recognized, a program is chosen; if not an error message is displayed. If the platform is unable to perform the requested motion an error message will also be displayed.

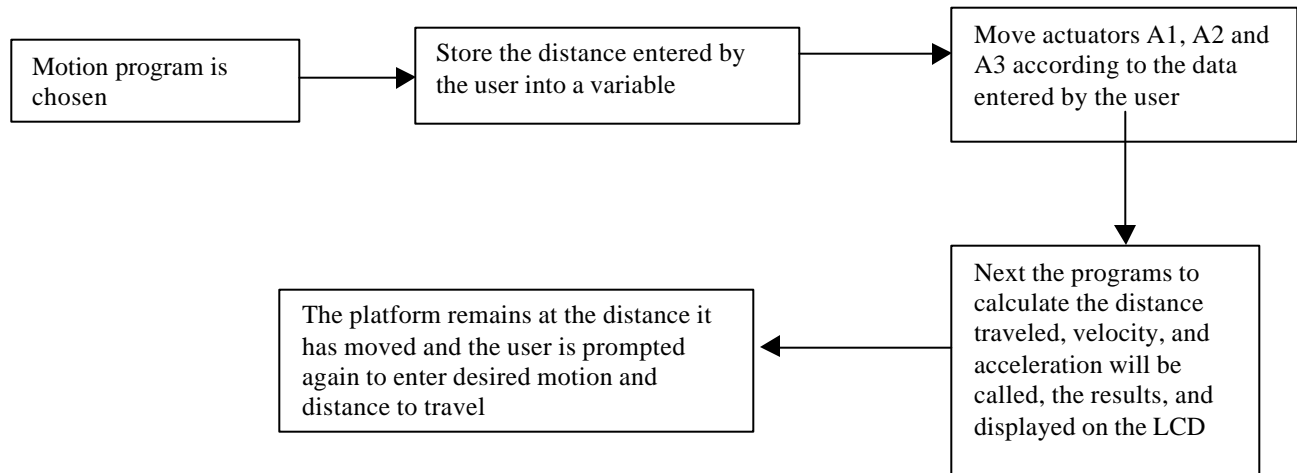


Figure 3: The flowchart for the motion modules

Regardless of which input is selected, the software modules follow the same sequence of commands. But the platform will perform different movements depending on which type of input is selected. If a sinusoidal input is entered the platform will move in a continuous motion up and down in relation to the input data entered about the amplitude and frequency. A step input will make a single step up whereas a square wave will make steps up and down in relation to the amplitude and frequency.

The sensor, which is integrated with the actuator hardware, will obtain the linear position of the platform and store the position in another variable. This variable and the will be used in the calculation module to compute the distance moved by the platform, the acceleration, and the velocity at the centroid of the platform.

When the microcontroller is first started, the platform will start at an initial position. The platform will move the desired distance entered by the user and then moves to the initial position entered by the user and waits for another instruction from the user. When another desired motion is entered, the platform will return to the initial position and then perform the desired motion. The distance module will subtract the starting position from the distance entered by the user. This will provide the desired distance the platform is to be moved. However, this distance will need to be compared with the initial linear position as recorded by the sensor minus the linear position of the actuator when the motion is started.

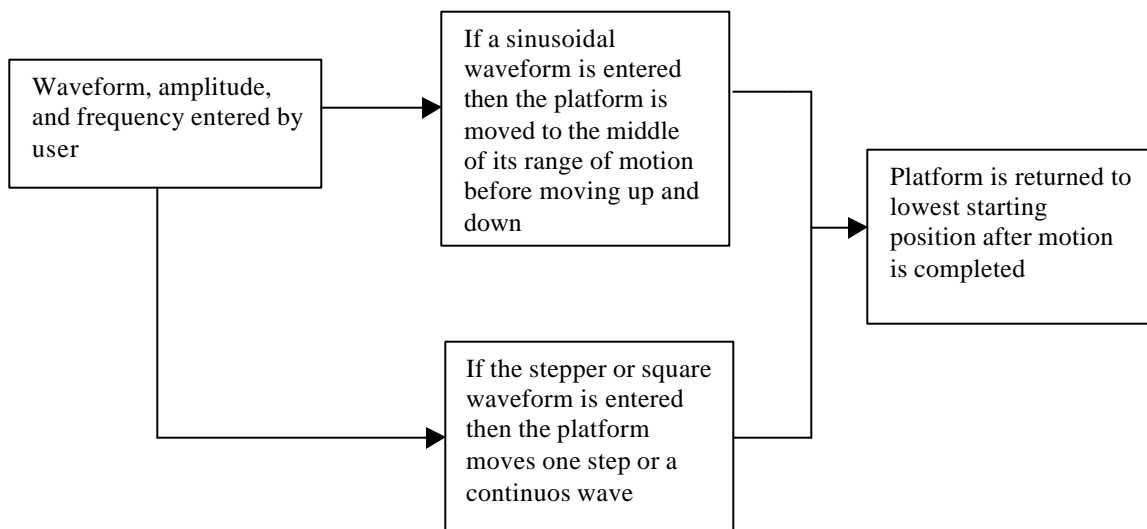


Figure 4 : Flow chart for Displacement

The next module will be the velocity measurement (refer to figure 5). This module will take the displacement (as shown in figure 4) and divide it by the time that the platform took to move.

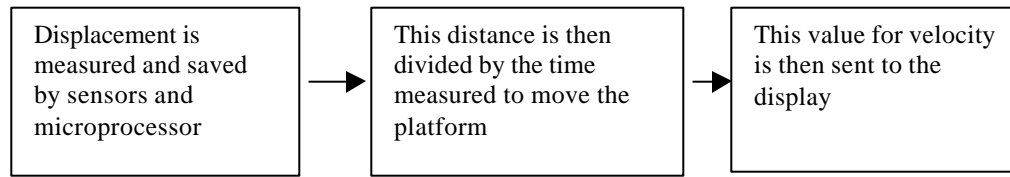


Figure 5: Flow chart for Velocity Calculation

The final calculation is acceleration. Since acceleration is the derivative of velocity, dividing the velocity calculated above by the time will give the acceleration measurement.

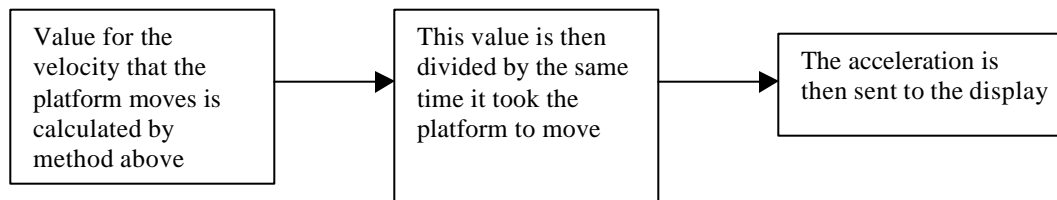


Figure 6: Flow chart for Acceleration Calculated

Hardware

A block diagram with the necessary hardware is shown below. A sine wave, square wave, or step wave will be fed to the input to provide a range of motion that can be selected. The actuators will move in accordance with what is selected. A maximum and minimum height will be designated for a range of motion to keep the platform from exceeding its limits. For a sine wave, the platform will be raised to the center of the range of motion and then begin to move. For the other input waveforms, the starting point will be the lowest possible point in the range of motion.

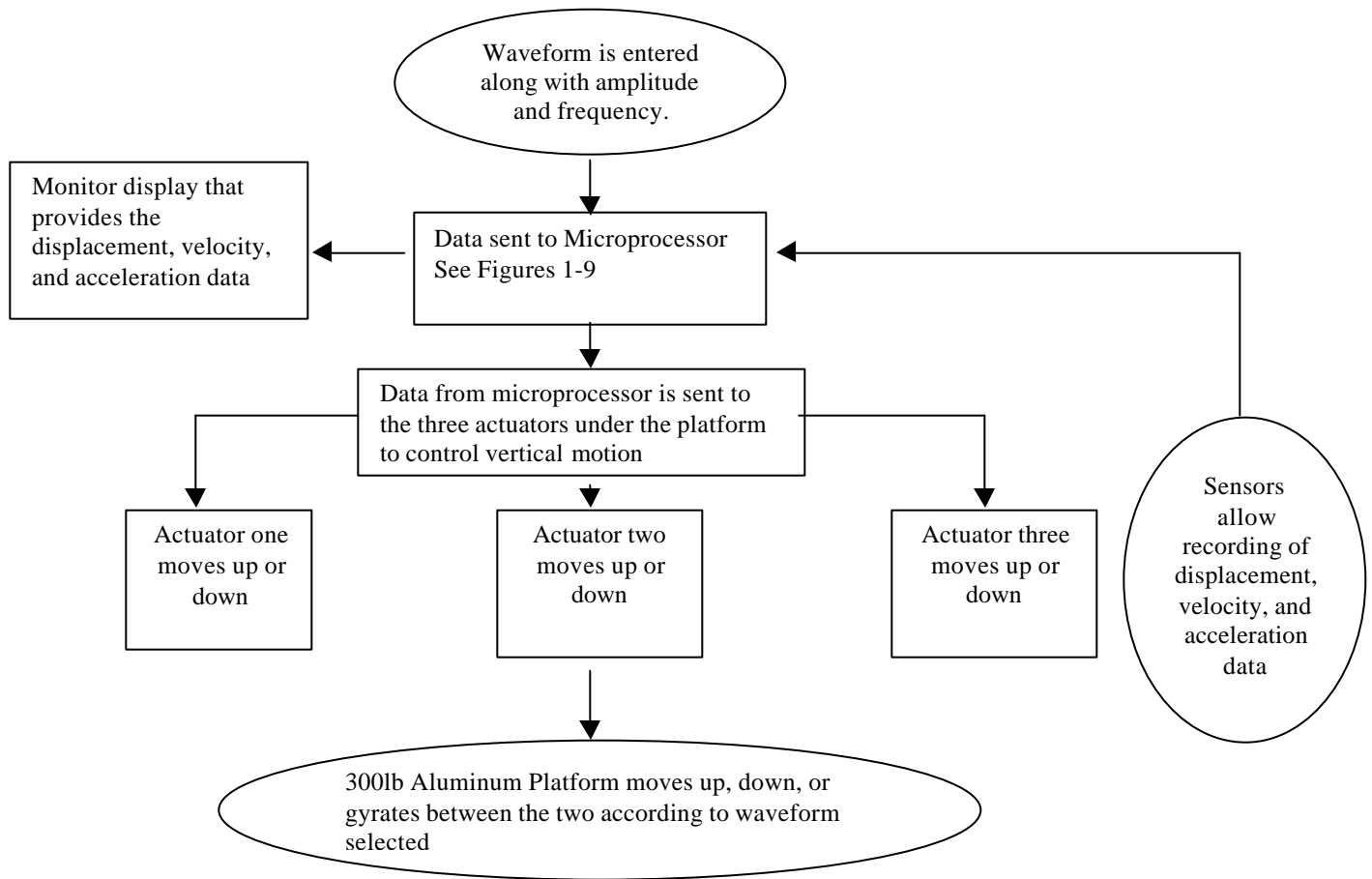


Figure 7: Block Diagram of Hardware