



Design and Development of an in-Vitro Cell Stretching Bioreactor



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Introduction

- ❖ This project aims to develop a low-cost equibiaxial cell stretching device to simulate mechanical stress on cells in laboratory environment to study cellular mechanobiology.
- ❖ Equibiaxial means “equal on both axes” so this project aims to simulate the mechanical stress on cells equal on both axis.
- ❖ With this project researchers can simulate the mechanical stress on cells in laboratory environment for study and research purposes.

Solution Methodology

- ❖ According to the motors’ working frequencies and the expected speed from the stretching device, I calculated the timer period for the 8kHz from the formula given below.

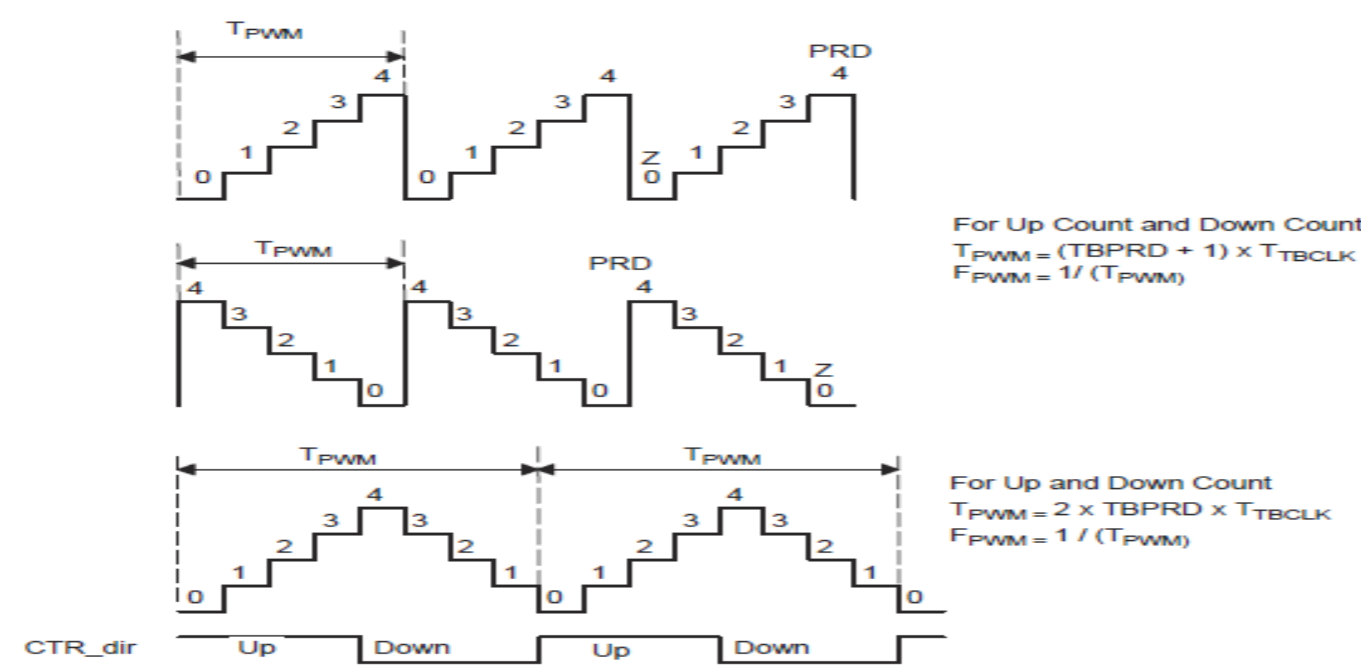


Figure 1: Formula for the time periods of C2000 microcontrollers.

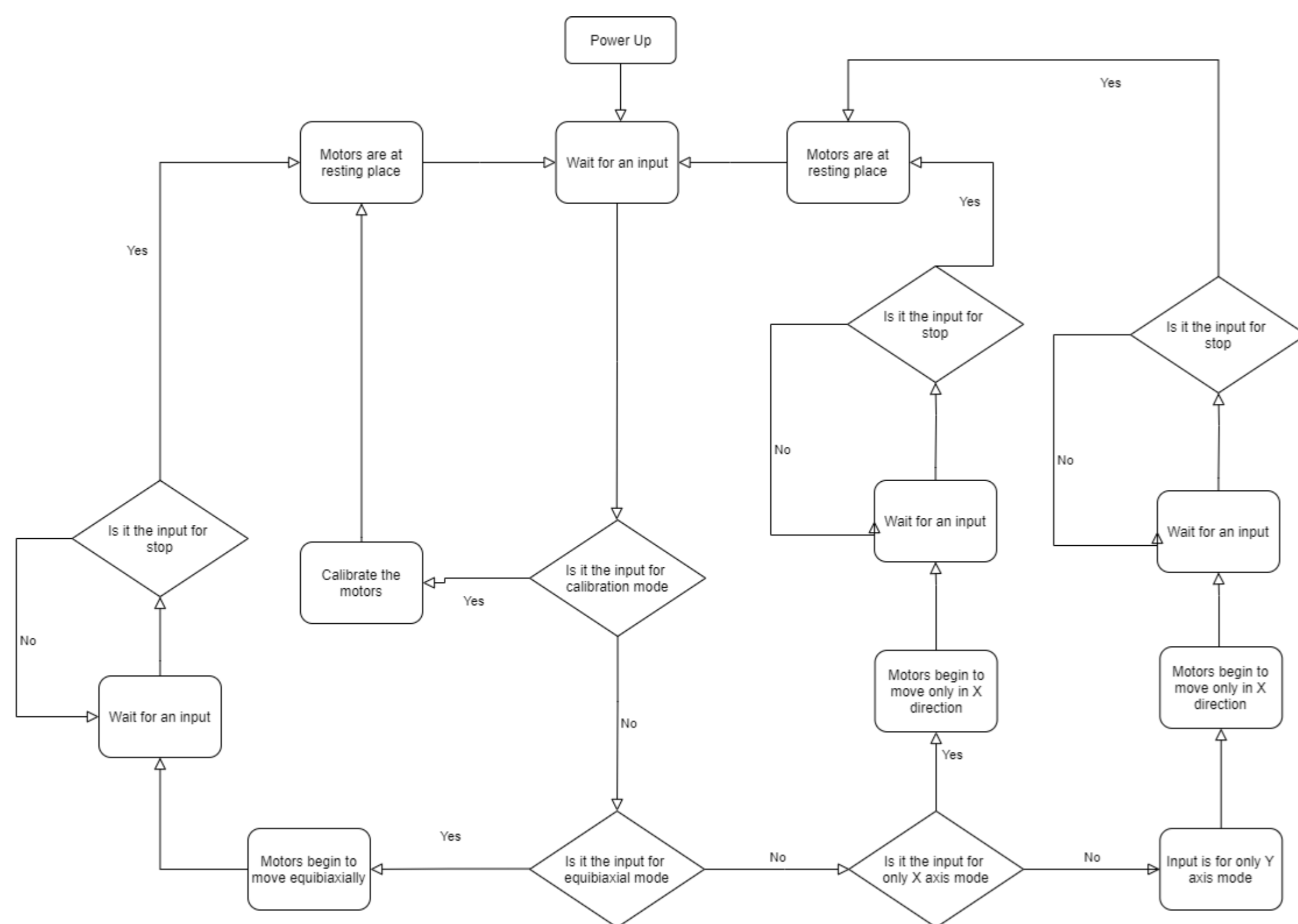


Figure 2: Flow Chart Diagram of How The System Works

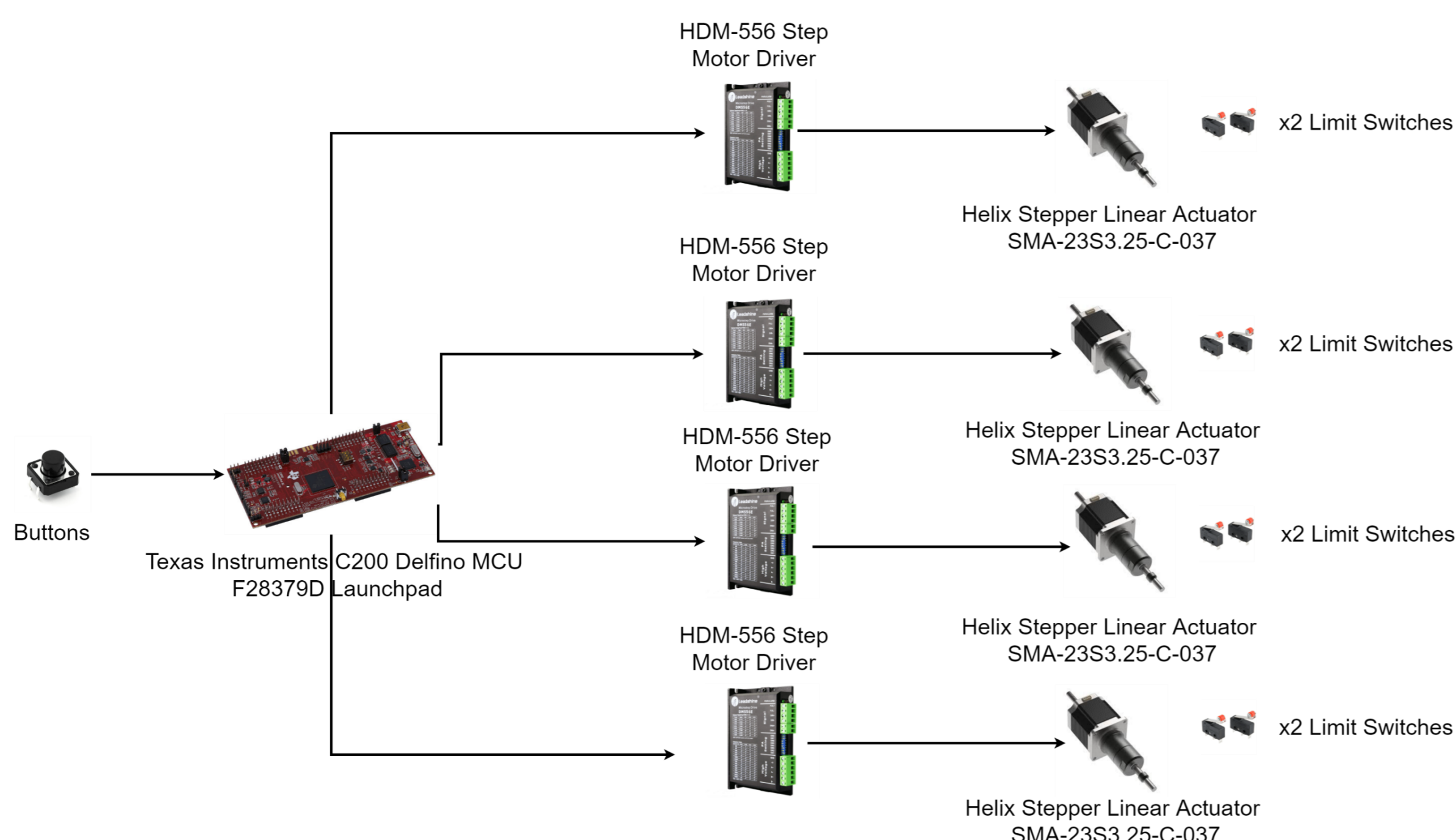


Figure 3: Final Design Diagram

Specifications and Design Requirements

- ❖ It is to design a device that will expand on the membrane in real time according to the mode received from the user.
- ❖ The movements of the motors should be synchronized with a real-time clock.
- ❖ User should be able to choose any mode at any time for any time period.

Application Areas



This project can be used in universities for educational purposes. This project can also be used in research facilities for experimenting.

Results and Discussion

- ❖ Cell stretching device works properly
- ❖ Stretches the membrane about %20 (1 cm).
- ❖ User can choose between 4 modes.
- ❖ Calibration mode, when the corresponding button is pushed, moves all motors to the limit switches than at the center so before starting the cell stretching, user can see the all of the motors are working properly and at the same place so it can move simultaneously.
- ❖ Equibiaxial Stretching mode, when the corresponding button is pushed, stretches the cell on the both axes simultaneously and equally.
- ❖ Stretching only in X direction mode, when the corresponding button is pushed, stretches the cell on the on the X axis
- ❖ Stretching only in Y direction mode, when the corresponding button is pushed, stretches the cell on the on the Y axis.
- ❖ After the start motors bring membrane to its’ initial condition with the feedback from limit switches.
- ❖ This project can be improved with a graphic user interface and more accessible different speed modes..

References

- <https://www.ti.com/> C2000 Delfino MCU F28379D LaunchPad™ development kit Data Sheet and User Guide
- <https://ieeexplore.ieee.org/> TMS320F28335 DSP programming using MATLAB Simulink embedded coder: Techniques and advancements
- <https://pubs.rsc.org/> Cell stretching devices as research tools: engineering and biological considerations

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