Development of Human Enhancement (Exoskeleton)

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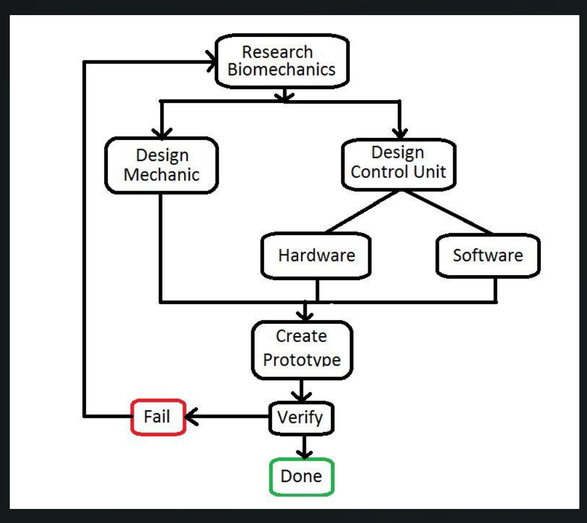
Abstract

Developed of human enhancement as the name of our group project, are focusing on creating the prototype that can support basic human movement consisted of sit to stand, stand to sit and walking. By researching an information on human enhancement and exoskeleton we clearly seen that the cost of this kind of equipment is very expensive so the main objective is to lowering the cost and we wish that it will be useful.

Objective

- Creating the low cost power assist device.
- Design the adjustable length exoskeleton frame.
- Due to limited time and resources we are now mainly focusing on sit to stand state.

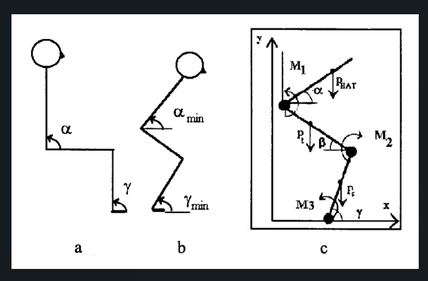
Methodology



Process diagram

- Biomechanics

In order to design mechanic and control unit we need to research in biomechanics to understand human movement and range of motion.



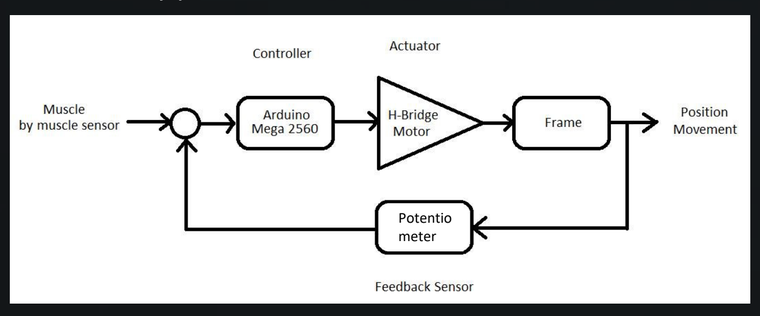
(a) kinematic analysis of sit-to-stand task; (b) strategy indexes; (c) four-segment planar.

- Mechanic

Our design based on motion control knee split device which support by Phramongkutklao hospital.

- Control Unit

Our designed control unit diagram is start with signal from muscle sensor, then sent to the arduino board to process the information for control H-Bridge which connected to the power supply and H-Bridge control the motor power to assist user and detect position of the motor by potentiometer and send the feedback to the Arduino board.



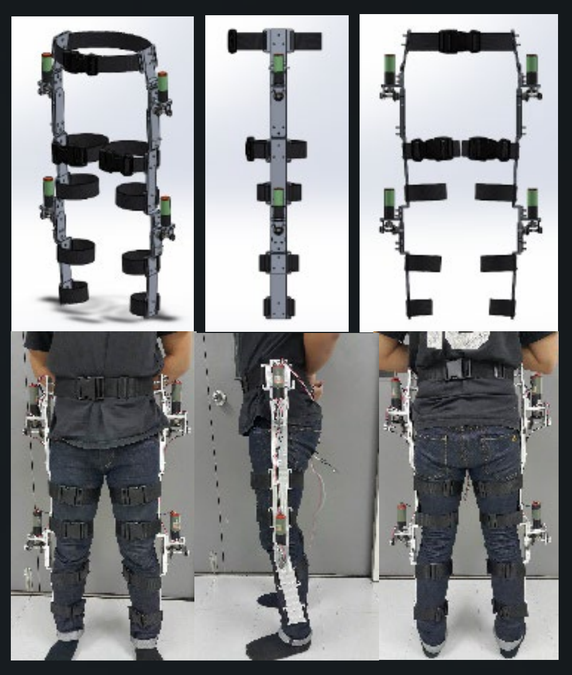
Muscle sensor

We decide to use muscle sensor in order to control power assist device by technique of evaluating and recording the electrical activity produced by skeletal muscles

Acknowledgement

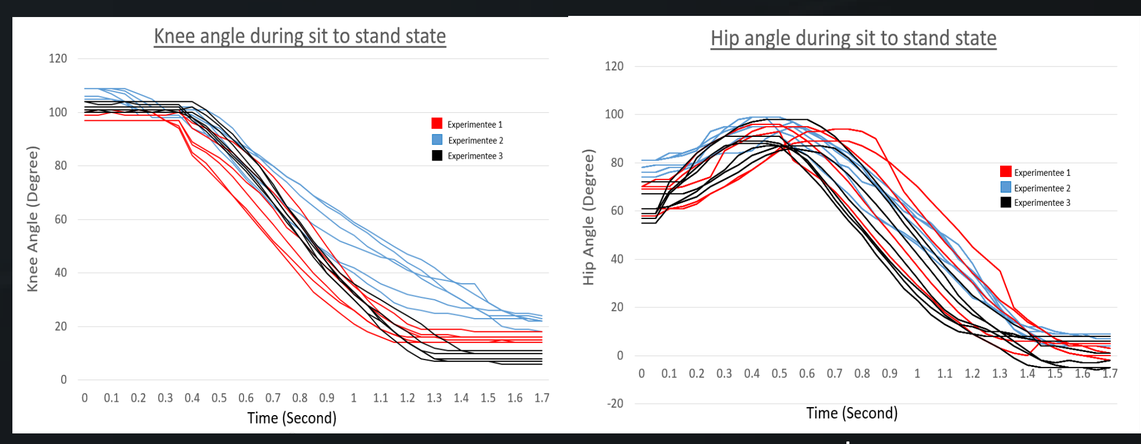
Mr. Tayard Deesudchit, MD from Chulalongkorn hospital

Result

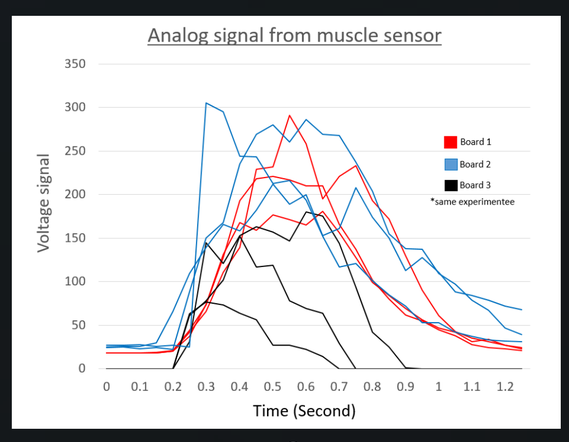


- Mechanic

After spent many hours in designing and inspecting , our prototype frame is still not suit 100 % fit with human body but it is good enough to collect the data for control condition and able to used as a power assist device.



a b



c

- Control condition and unit

(Graph a,b): We collected the angle data during sit to stand motion with 3 trials for each person, from the result its shown that the trend is about the same so we can use these data as control conditions to activate and deactivate the motor during sit to stand state.

(Graph c): According to the graph from the muscle sensor with the same experimentee but difference muscle board it is obviously that the value is not reliable enough to use as control condition for motor power so we decided to use it as a trigger instead.

Conclusion

According to the value that obtain as shown in the graph, we clearly see that sit to stand motion can be controlled by constant condition due to the range of motion are not vary (3 times for each experimenter) but the result from muscle sensor are spread of therefore muscle sensor are used as a trigger instead of control the motor power of the sit to stand motion. In the same manner we tested our prototype with walking to received the angle of potentiometer but we are facing with a lot of uncontrolled factor which may required more sensor in order to control the walking state.