

## rME3: Susko/Hawkes Babybot for home use

This project has the potential to radically change the lives of babies born with movement disorders!!!

Cerebral Palsy (CP) is the most common developmental disorder associated with lifelong motor impairment and disability. It is broadly defined as a brain injury occurring before the age of 2 that affects movement abilities. For people with CP, the only way to repair the damaged brain is rehabilitation. Rehabilitation robots have the following advantages over standard therapy done with physical therapist: 1) the volume of training can be an order of magnitude higher than similar tasks performed by a therapist 2) new and precise kinematic and kinetic diagnostics can be quickly recorded prior, during or after training 3) the generation of big data can predict rehabilitation treatment response and tailor interventions automatically 4) minimizing the reliance of in-person therapy can lend itself to home-based systems. However, it is not known whether robotic rehabilitation could help infants with CP, in fact robotic systems have never been tried with infants.

This project is to create the first-ever in-home rehabilitation robot for infants with established risk for movement abnormalities (most of which will be diagnosed with Cerebral Palsy). It will build on work done by capstone teams from the past two years. This will be the third year of this project being run through capstone, but not because the past projects have not been successful, in fact, they each were award winners (top 2 projects from each year).

Year 1 of this project was an outstanding success, winning the coveted ME Most Innovative Award from the judges at the end of the year Design Expo. The system used around 30 independent motors to create a shape-shifting crib surface to create an environment that fosters movement for infants (see figure 1 below). It used a motion detection system to understand the position and orientation of the infant such that the crib would be able to adapt to the infant.

Figure 1



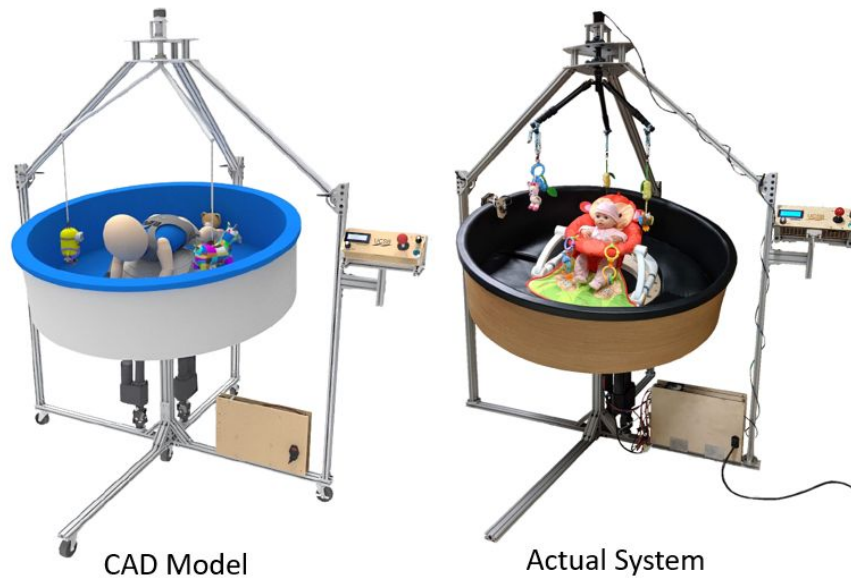
Full Babybot System view



Babybot demonstrating a baby roll using a life-sized infant dummy

Year 2 of this project saw a shift in the paradigm for delivering therapy to infants, attempting to recreate ball therapy that is done in the clinic. The team worked with local and nation-wide physical therapists to understand the needs of the product then executed with remarkable success. The project won “Best Mechanical Engineering Project” at the Design Expo last year and was the best project seen by Dr. Susko in 4 years. Figure 2 shows the second year’s device.

Figure 2: 2018-2019 Babybot (FitNest)



Your project is to come up with a new design that improves on previous versions by meeting the following specifications:

- Must be small enough to be used in the homes of infants with cerebral palsy (previous designs have been very large)
- Should be as close to the ground as possible
- Easy to transport
- Implement integrated sensing abilities and a remote control

This project will require interest in product design, machine design, mechatronics, robotics, sensors, and control systems.