

BabyBot: Rehab Device for Infants with Cerebral Palsy

Project Sponsor: Susko and Hawkes Labs

Broadly defined as a brain injury occurring before the age of 2, Cerebral Palsy (CP) is a disorder caused by a static brain injury incurred before the age of 24 months that affects 1 in every 300 children in the U.S. Often the only way to repair the damaged brain is rehabilitation. The objective of 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). With the progression of Covid-19, the need for rehabilitation robots have only become more apparent but with it comes some additional benefits: the volume of training can be an order of magnitude higher, new and precise kinematic and kinetic diagnostics can be quickly recorded, and the generation of big data can predict rehabilitation treatment response.

Over the last 3 years, 3 Capstone teams have developed 3 entirely different designs for the BabyBot, each improving on the performance of the previous designs while also addressing key issues that were identified. All iterations were highly successful, with awards won every year since its conception and hopefully more to come this year!

The Year 1 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). Year 2 of this project saw a shift in the paradigm for delivering therapy to infants, attempting to recreate ball therapy done in the clinic by placing the child in a nest and tilting the platform. Year 3 has been an evolution of both the years. Turning from just a Mechanical Engineering to a Multidisciplinary Mechanical Engineering and Electrical Engineering project, BabyBot sought to evolve into a project that can be ready for use in the home. This involved developing a remote controller on a tablet, downsizing the system, and improving the safety.



BabyBot Year 1



BabyBot Year 2



BabyBot Year 3

In its 4th year running, BabyBot intends to be taken further than ever with the intention of becoming ready for use in both homes and the office of a local therapist. To achieve this, the team needs to develop a design that addresses the following needs:

- Designing a data collection system - As mentioned before, one of the biggest benefits of automated therapy is the ability to collect and analyze data. Requiring creativity to decide what data could be beneficial and the technical skills to implement the necessary hardware (e.g., sensors and possibly a custom PCB) and software, this is a valuable portion of the project.
- Additional dimension(s) of movement - The design will need to include certain types of movements (e.g., bouncing up and down) in addition to what has been demonstrated in previous iterations. This will add additional complexity to the controls and mechanical design of the device.
- Preparing the device for patient testing and use - The ultimate goal for this year is to make Babybot ready for patient testing. Not only does this mean meeting the size, weight, and electrical specifications, but it also means creating a system that will keep the patient involved in the machine in the form of gamification of therapy for the infants.
- New Venture Competition - For interested members (not required), the project is poised to not only be developed technologically but also from a business perspective. That is why BabyBot is entering into the New Venture Competition (NVC) where members can help determine market needs and develop a business model.

Skills and interests for this project include:

- Machine Design
- Mechatronics and Robotics
- Control Systems
- Mobile Embedded Systems
- PCB Design
- Product Design