

Arduino Hulk

ETECH-100 Final Project

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Background:

When tasked to create some form of assistive technology using the arduino kit our minds instantly went to the special needs children we all went through school with. Everyone of us could remember many times when these kids were excluded throughout school because of something out of their control. This project set out to help special needs kids with limited motor skills and lack of concentration to be able to improve on these skills in a fun and rewarding way.

To find more information on what was needed we took trips to our middle/high school's as this was the target age we were seeking to help, 12-18 years of age. After talking with educational aids it was clear that the solution to the problem should include; patterns, memorization, fine motor skills exercises and some form of real life engagement that they will be able to use for the rest of their lives. We believe that all of those points have been met with the completed "Arduino Hulk" project.

As the title suggests we have used the combination of a an arduino kit and and small hulk action figure. The arduino is a small programmable circuit board that we used to run servos when the correct variation of switches were placed in the correct positions.

For additional background on a similar project we used the University of Buffalo with their federally funded project called "Let's Play". This project brings toys similar to what we have made. the only thing is these toys are made for extreme special needs cases or special needs pupils ranging from 3-11 years old. We are looking at the demography of 12-18 years old. To meet this criteria we choose a Hulk action figure for it relatability to kids wanting to play with it and a button a switch process so the pupil will learn basic switch pattern to operate switches and basic memorization skill. With this the pupil will have a better chance of living in an environment where they could possibly work for rewards due to founded memorization skills.

Design Description:

As the title suggests we have used the combination of an arduino kit and and a small children's hulk action figure. The arduino is a small programmable circuit board that we used to run servos when the correct variation of switches were placed in the correct positions. A full parts list can be found below:

Parts List:

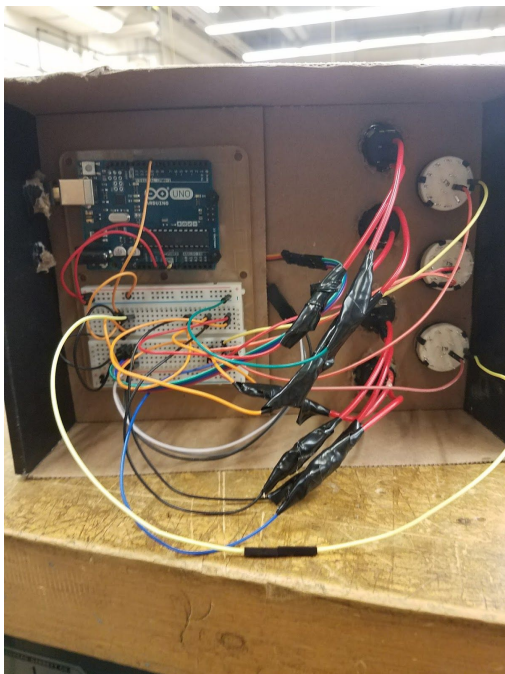
- Hulk Action Figure- purchased from walmart- \$10
- Arduino- provided for class
- 4-Rocker Switches-purchased from amazon-\$15
- 3- Dial Switches- purchased from amazon- \$12
- 2- servo motors-included with arduino kit
- Wire extensions
- Miscellaneous wire connectors
- Hot glue

To begin, a small section of the upper back was removed using an abrasive cut-off wheel to expose the interior of the body (seen is first image below). the plastic supports were ground away to make room for

the servo motors. The arms were removed and the joints were edited to attach to the servo motors using glue.



Before reassembly we drilled down through the torso to make way for wiring. To reduce costs we used the arduino kit packaging as the base for the structure. The switches were implanted into the box structure with the arduino glued to the underside of the arduino packaging (seen in image 2 and 3). The hulk was then attached to the top of the box with its feet hot glued to the top. You can see this in the final image.



With limited knowledge of arduino programming we found it easier to wire the switches in series to produce the desired switch pattern with a standard given swept pattern program rather than to find a way to program the arduino. This way caused us to have limited switch settings and positions, this was partially due

to the arduino not putting enough power out to run all switches but only run two switches, which we believe was the loss of power in the wires between the switches, servos, and the arduino board itself. We believe this was acceptable for the prototype but we would like to improve on in updated versions and possibly add a moving head, more compact design, and even a voice application to talk to the user.

Design Analysis:

For this whole project to work efficiently we added 7 buttons of different pattern and added it in series on circuit board so we have to guess the correct pattern to make hulk work. Similarly we programmed it through arduino with two servo motors connected to the arms. Through the completion of this we ran into several issues:

Some of the problems that we faced during its making was that the product needed bigger servo motors to move the heavy arms. We also needed a better connection between the servo motors and the arms which could be achieved with the above mentioned servos having a larger shaft.

In the end the biggest problem was with the breadboard. We needed a breadboard with higher power output. While trying to connect all seven switches we accumulated too much resistance from the mass of wires and switches. This in turn led to even lower power reaching the servo motors. Because of this we were only able to use two of the switches in the final prototype.

There were also aesthetic issues with the hulk after implanting the servos into the body. To fix this we would eventually make our own molds. But this is something that would not come until the product was ready for mass production. Another aesthetic issue was the wiring that once made into a production piece we would move through the leg of the hulk figure if we planned to stick with the base and figure model.

Creating a single piece self-contained action figure is something we would seriously pursue in the future as well. One of our original ideas was to make the circuits and switches be contained within the action figure itself. By doing this we could fix all of the aesthetic issues and create a much smaller footprint. We believe this design would make the toy more interactive and more enticing to the desired audience.

Conclusion:

Arduino Hulk is still a prototype, but it is ready to be taken to the next step. It is not next level technology that will revolutionize the toy industry, but it is a tool to help improve the lives of special needs children so that they can adapt to a world that is ever changing. This toy can be used for the simple entertainment that it provides, it certainly had us, the creators, intrigued and ready to continue working on it. But it also serves as an instrument to help those with disabilities or troubles with fine motor skills. A simple increase in our funds and time, and the Arduino Hulk could see so much more improvement. Moving on with furthering the device, a higher output circuit board and larger servos would be added to the next prototypes. This would fix the power output and and the arm connection issues.

Together this hulk cost around \$60.00, with the switches, toy, and buttons. With that money there was also leftover parts that could be used to make even more models. Arduino Hulk doesn't even stop at just the Hulk. Other toys can be used for every kid's dreams. If there is a toy of it, then you can be sure there can be an Arduino Version. Hulk was the most inspiring for us because his power to overcome any obstacle goes along with kids that need help overcoming their own obstacles. Hopefully with the arduino Hulk, kids will be able to Smash through their difficult times and become stronger.