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Background

Our team is researching and building Adaptive Technology human interface devices to help people living with disabilities interact with computers. Adaptive technology (AT) is a device or component which is specifically designed for persons with disabilities. Human Interface Devices (H.I.D) is a method by which a human interacts with an electronic information system either by input or output. Computers have dropped in price, grown in capability, and leapt into consumer markets in the past few years. Adaptive Technologies which help persons living with disability interface with a computer have been left behind in this regard.

Design Approach

We established our marketing and engineering requirements based upon UNICEF's World Report on Disability. UNICEF states, "Manufacturing or assembling [AT] products locally, using local materials, can reduce cost and ensure that devices are suitable for the context." Priority of the design was for cheap and readily available materials and techniques—allowing for the product to be easy to build and modify. Consumers should be able to assemble the device themselves with relative ease. Additionally we wanted to build a product with equivalent or better functionality without increasing complexity of user interaction. The design should be durable and adhere to the standards of current AT marketable solutions.

Requirements

Open Source Design

- ♦ Require only items available to common makerspaces
- ♦ Easy to iterate and customize
- ♦ Low cost requirements for parts and machinery

Easy to Operate

- ♦ Must provide as good or better functionality than existing solutions

Reliable

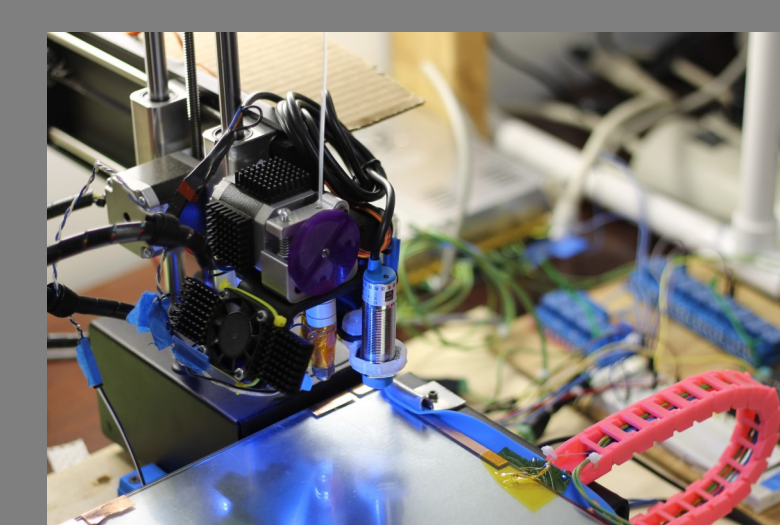
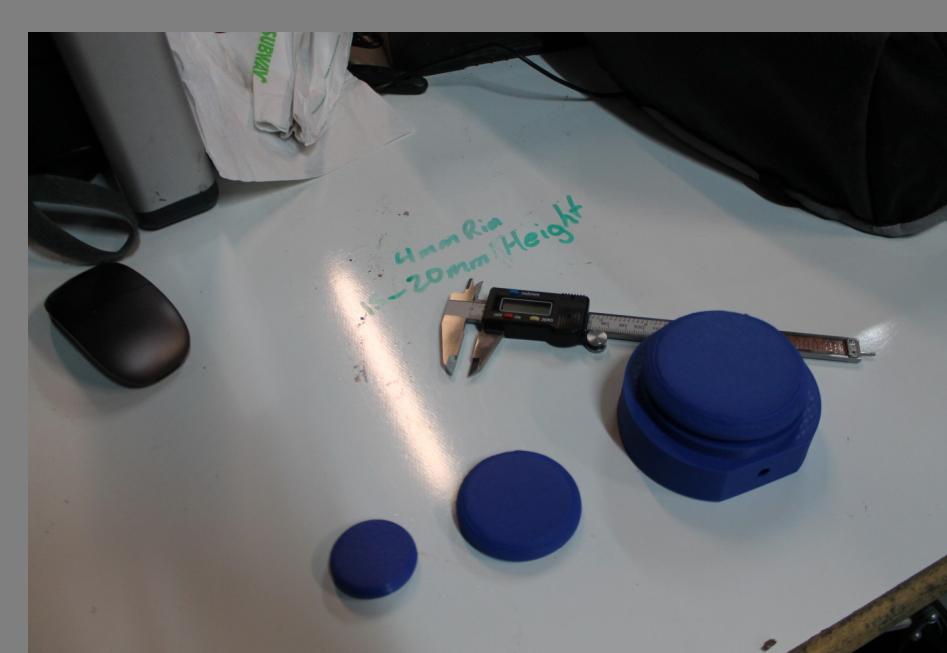
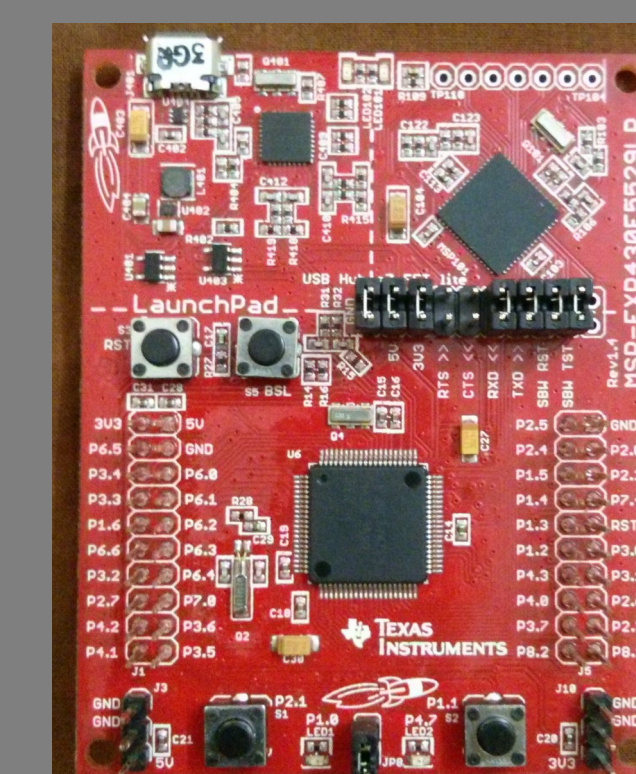
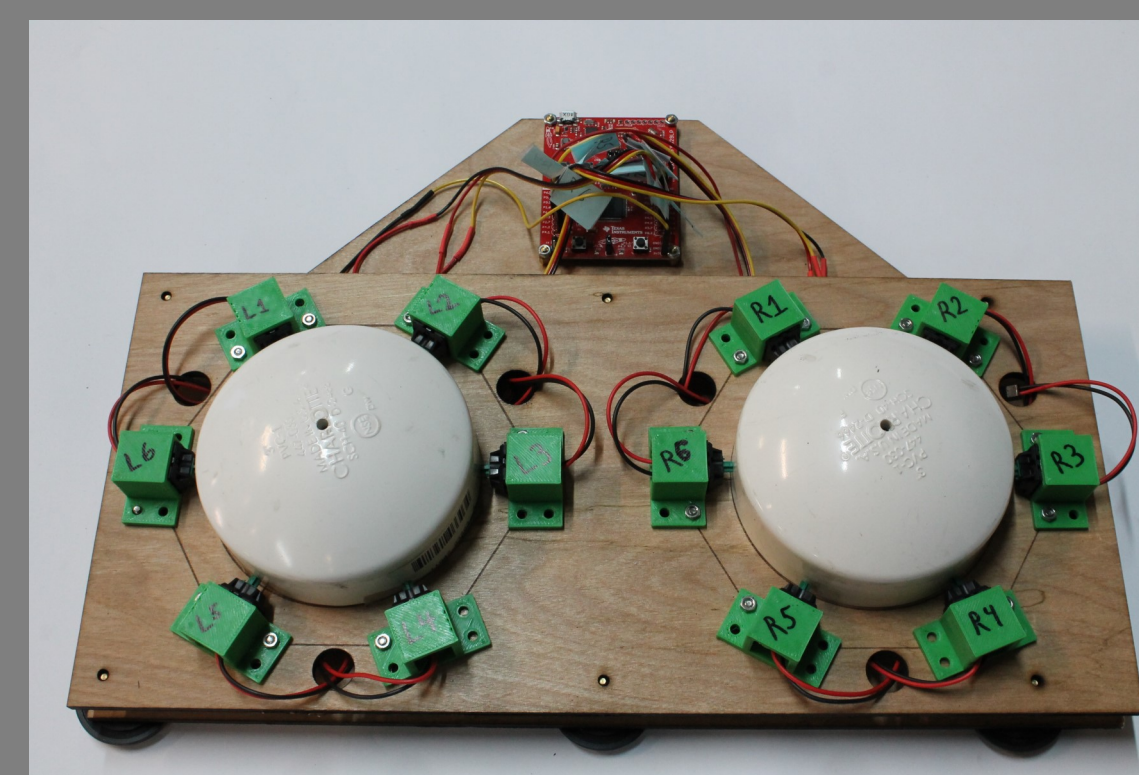
- ♦ Must accept improper input and have a robust mechanical design.

Obstacles

- ♦ Material Defects
- ♦ Mechanical Defects
- ♦ Operator Overhead

Future Work

- ♦ Serialization
- ♦ Remote Support
- ♦ Wireless Systems



Summary and Major Results

The goal of the Adaptive H.I.D. team was to design a set of adaptive interface devices for modern computers with readily available consumer machinery and products. The product has a focus on affordability, iterative design, and easy operation. We are providing the systems designed during the class, along with our case study on the viability of this approach to manufacturing. This includes working prototypes of input devices for the handicapped and software enhancing prototypes from a simple I/O peripheral to a more useful tool such as predictive text. Additionally, we are providing the physical systems to a local benefactor, United Cerebral Palsy of Huntsville.

Product Cost Estimate

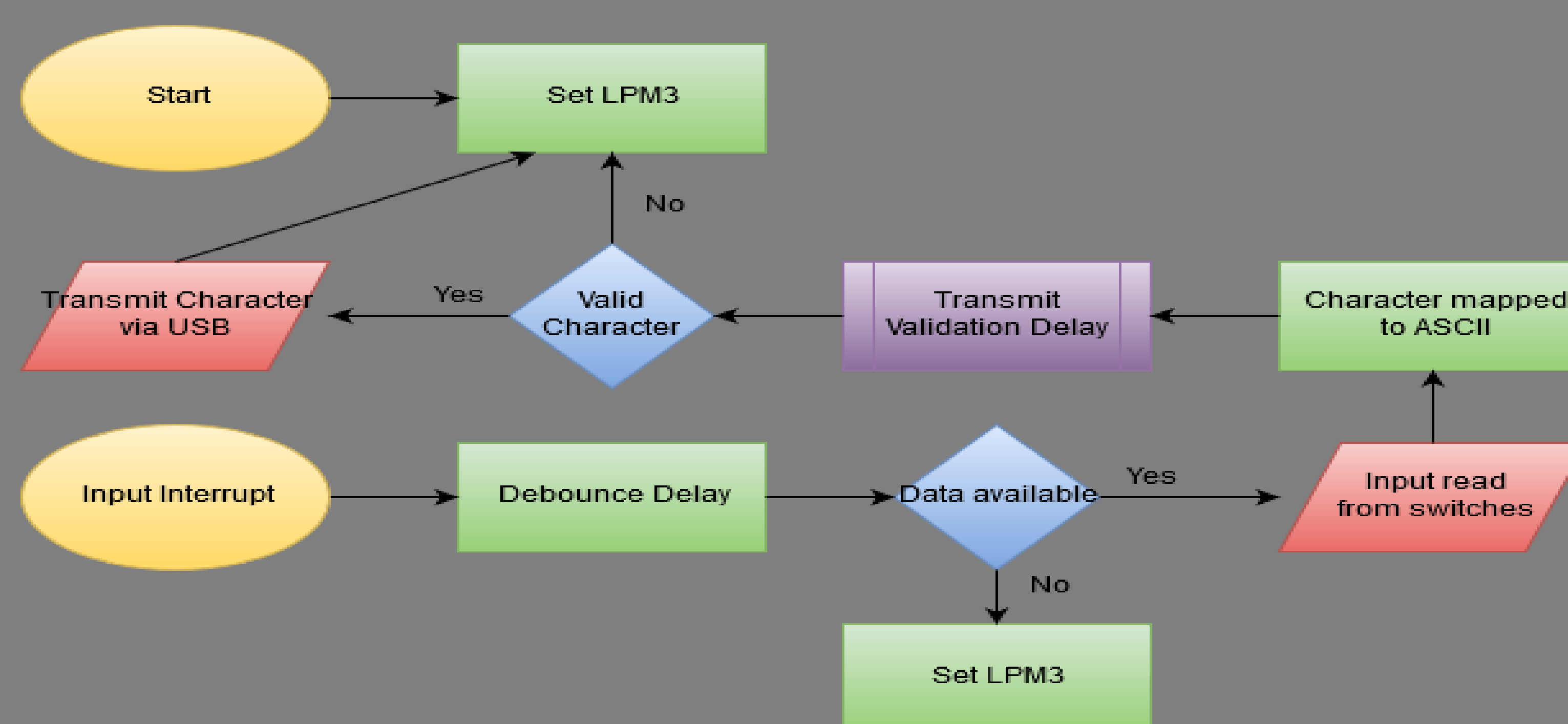
AT Keyboard—\$41.50

| | |
|-------------------------|---------|
| 16 x Cherry MX Switches | \$16.00 |
| 2' x 4' Plywood | \$6.00 |
| 2 x Handles | \$10.00 |
| 1 x MSP430F5529 | \$12.00 |

AT Button—\$9.00

| | |
|----------------------|--------|
| 1 x Cherry MX Switch | \$1.00 |
| 1 x 3.5mm Mono | \$0.50 |
| 0.3kg PLA | \$7.50 |

Keyboard Hardware Decomposition



Conclusions and Lessons Learned

Solutions available are expensive and difficult to obtain. There is a distinct need for human interface devices which meet many AT requirements and are available to wider audiences for more reasonable cost. The most significant differences between competing products versus our product is the low price. We strive to encourage others to create and publish an open source product that will allow people develop custom, low cost AT wherever a makerspace is available. Ultimately, the goal is to have other people become interested in creating Adaptive Technology.

