

Semester Two Work Package

The big picture for the spring semester is designing the packaging of our additional hardware components, implementing the design, and finally adding all required functionality to the software component of the program. In terms of work delegation between team members, we will have both general areas (such as hardware or software) each team member will focus on as well as specific project assignments. In comparison to our team, I have the most hardware experience so consequently will be spearheading the physical implementation of our product. However, in addition to this I will be helping with other tasks including software development.

Listed below are the tasks needed to be performed along with a more detailed breakdown of their elements.

- **Design layout and mounting of all required hardware inside the keyboard**
 - Description:
 - The location and mounting of our capacitive touch boards, Arduino microcontroller, and wiring must be designed with the constraints of the keyboard case. Although not preferred, if space turns out to be too limited an additional case must be designed to accommodate.
 - Currently the major components needing fit besides wiring are five MPR121 Capacitive Touch Sensor Breakout boards, and an Arduino Nano.
 - This will require some experience in CAD software which I will be brushing up my skills in. Detailed dimensions of the keyboard enclosure will also be required to properly design the fitments. Other specs such as key travel will determine wire slack and routing.
 - Required resources:
 - A CAD program will most likely be used to plan the layout of our hardware and rudimentary wire routing. This program is planned to be either Dassault Systems' CATIA or SOLIDWORKS depending on availability on university computers.
 - Performance measurements:
 - All components have a designated designed place with the retention of a reasonable keyboard form factor. In other words, minimal additions are added to the final size of the keyboard.
 - The unit is self-contained with no external devices or additional elements the user must interact with.
- **Assembly and wiring**
 - Description:
 - The success of assembly of hardware will directly be affected by how much time is spent planning in the design and layout phase. This phase will require basic electronics skills such as soldering, wiring, PCB mounting and handling as well as other more general skills in areas like fastening methods.
 - Required resources:
 - Wire in the proper gauge. This needs to be determined with capacitance, flexibility, and durability as requirements.
 - Heat shrink and insulation.

- Mounting materials such as adhesive and screws.
 - Electronics equipment and tools such as soldering irons, cutters, heat guns, screw drivers, pry tools.
- **Assessment on the feasibility of individual finger tracking**
 - Description:
 - Research and development on the addition of individual finger tracking will be performed to determine if this is possible and feasible in our time and budget. Whether the capacitance readings from each sensor will be enough to distinguish between fingers or additional sensors such as a camera would be required needs to be addressed in the assessment. This functionality is an extension to the current design giving it a lower priority with time allocation. Research will assist in the deciding the merit of investing further time into implementing this feature into our product.
 - Required resources:
 - Research on the internet
 - Testing results on the capabilities of our sensor hardware with the assembled keyboard.
 - Performance measurements:
 - The assessment will be considered a success given a clear viability verdict of this proposed feature.
- **Design of capacitive keys**
 - Description:
 - Determining how to add and connect a conductive amount of material to the keycaps needs to be determined. As a result of the properties of capacitance, the user's finger should not need to come in direct contact with a conductive surface connected to a touch sensor input. So, it might be possible given enough sensitivity to have a sort of conductive pad underneath the keycap which would be connected to a touch sensor. The nature and thickness of the conductive pad needs to be determined through testing and calculations. The calculations should only require basic physics equations and researching material properties and values.
 - Required resources:
 - Aluminum foil tape or similar conductive material,
 - Wire.
 - Solder.
 - Performance measurements:
 - Non-altered look and feel of the keycaps.
 - Accurate and consistent capacitance readings.
 - Cost effectiveness of solution using common materials and methods