Senior Design Bi-Weekly Status Report; Spring 2024
March 30 2024

Group: 27
Project Title: Machine to Human Vision
Client: Sami Bensallam

Team Members:

Sami Bensellam	| Project Lead
Alexander Black	| Hardware Lead
Jacob Burns	| Software Development
Yogi Chander	| Software/Hardware Integration
Jacob Lyons	| Component/System Design
Sergio Perez-Valentin	| Software Lead

Weekly Summary:

Our project is now fully complete regarding all the different parts being tested for use. We are at the stage of putting everything together into one cohesive and user friendly design that accurately relays depth information back to the user. Our progress on the Software Side is 92% complete. On the camera side our progress is 99% as we have a fully functional wearable camera that is up to standard with our requirements. We are coming into some issues regarding the hardware side with the vibration motor integration, so our progress lags behind being only 70% complete. Finally, our wearable vibration motors are the most challenging, as we have yet to get a design ready, lagging behind at 50% completion.

We have our first mobile prototype where we were able to identify object location using the vibration motors. And in the coming two weeks, we should be able to have our final prototype.

Past Week Accomplishments:

- Constructed several current boosting circuits on the solderable breadboard and attached motors - Alexander
- Completed the head mounting mechanism for the stereoscopic camera and tested it for ideal functionality and user comfort - Jacob Lyons
- Tested usability of motors on the back as an alternate mounting location - Alexander, Sergio, Jacob Burns
- Tested solderable breadboard circuits with raspberry pi and camera integration - Alexander, Sergio, Jacob Burns, Yogi
- Tested and quantified real time testing with different scenarios on the realsense depth software. Had objects stand at different distances and measured to make sure data was accurate and what we expected. - Sergio, Jacob Burns
- Finalized visual window for testing purposes and added haptic motor support. All software done except for tuning curve of motors vibration to distance, but motors need to

be fully integrated physically before done. (More of a preference rather the quantifiable). - Sergio
- Started integrating motors into vest. - Sergio

Individual Contributions:

Name	Individual Contributions	Weekly Hours	Total Hours
Sami Bensellam	Organized the team to complete different tasks such that the project is done on time and is usable. Ordered all of the final parts for the project, specifically for vibration motor expansion to a five by five grid. Sleeves and for making the stereo camera wearable. Modified the software such that it runs consistently over 30 fps.	20	49
Alexander Black	Made and tested solderable breadboard circuits, tested potential back mounting	15	42
Jacob Burns	Tested solderable breadboard circuits with Raspberry Pi code. Tested the usability of a 5x3 camera grid as opposed to a 4x4 grid. Helped test the new option of having the haptic motors on the wearer's back.	15	42
Yogi Chander	Made initial prototype for a PCB that takes Adafruit hat output PWM signals and outputs voltage to the haptic motors. Currently working on new version of PCB that uses smaller components and uses surface mount footprints instead of through-hole footprints. Also working to make new PCB snap onto output pins of the Adafruit hat	15	44
Jacob Lyons	Finalized the head mounting design by ordering and utilizing an additional bracket screw that allows the stereoscopic camera to connect to the head strap. Stripped unnecessary parts from the head mounting mechanism to simplify the user’s	9	35

	experience in wearing the head mount. Assisted in connecting the motors, Pi, and camera together and practiced soldering to later assist Alex and Jacob Burns		
Sergio Perez-Valentin	Finalized the depth sensing software. Integrated dynamic haptic motor support to the software so it allocates vibration power accordingly based on the cell distribution specified. Added local coloring to cells in visualization window to easily see what depth objects that realsense camera was detecting per cell. Helped quantify if the data we were getting was correct in a real environment. Started integrating motors into vest to later be attached to Raspberry pi.	12	44

Pending Issues:

- The solderable breadboard circuits do not work with the same efficiency as the circuits in a normal breadboard. This issue must either be fixed or circumvented with the PCB
- Have the PCB arrive and begin testing with all 16 motors
- Managing wires without user pulling them is resulting to be difficult.
- The scripts cannot run without booting and running the script manually. Restricts mobility and usability of the device.
- No testing was done where the Battery is connected to the Adafruit hat and simultaneously connected with the Raspberry pi for a fully mobile system

Plans for Coming Weeks:

- Alexander Black:
    - Continue working on solderable breadboard and attempt to fix the issue where they cannot generate as much current as expected
    - Extend the additional motors we have received
    - Continue working on testing motor-camera integration
- Jacob Lyons:
    - Debug and optimize the scripts running on the raspberry pi to ensure they run correctly with all 16 motors with optimal frame rate and latency
    - Solder components and wires on the finalized circuit, particularly with the current amplifier board.
- Yogi Chander:
    - Finish PCB design that fits Adafruit hat and has all 16 resistor circuits embedded onto board
    - Write a bash script for raspberry pi to get D435i script working on Raspberry Pi without connecting Raspberry pi to a monitor

    - Help find the best way to embed haptic motors onto sleeves or wearable vest
- Sami Bensellam:
    - Complete the power requirements for the project and do testing with the battery we currently have.
    - Make the system mobile such that it does not require a monitor and keyboard.
    - Finish additional testing for the adafruit hat such that we are able to use 25 motors.
- Jacob Burns:
    - Integrate haptic motors into the back of the vest and test the viability of this option.
    - Help tune the software to work at the desired vibration level at any distance.
- Sergio:
    - Continue integrating haptic motors into vest. Connect lead wires and manage them around vest for easy plugging into the raspberry pi. Start integrating a tuning curve for user to customize how much depth vibration based on distance of objects. More user personalization.

Midterm Feedback

Summarize the feedback you received (both written and verbal).

The feedback we received was to primarily have a greater emphasis on testing. This was stressed both in writing and during our meeting. This includes testing the components such as the camera and motors, however it was mostly in reference to user testing. It is not clear at this point whether navigating will be as simple as wearing the device and being able to avoid obstacles cleanly, so we need to begin testing with the motors to see if it is possible to discern movement and changes in vibration.

Describe any new insights your team generated based on this feedback.

Insights found is that we didn't have any quantifiable data. We were just assuming that everything worked. Therefore, we design and implemented testing plans moving forward to edits the different components we're working correctly, and most importantly, usable by an impaired user. We were taking to long to test on our target user and now that we are, we are seeing greater strides in progress.

What steps are you taking based on the feedback?

We have begun responding to this feedback by testing motors placed on the back and attempting to discern movement across the cameras view. Additionally, this served as a prototype test for our complete design. Initial results are looking positive as we are able to detect the correct objects with the new cell coloring visualizer described earlier.