ELECOMP CAPSTONE SUMMIT
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THE UNIVERSITY OF RHODE ISLAND

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Transaction Processing via Speech (Headless Terminal)

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Project Motivation

Lottery terminals have been processing transactions via touchscreen interfaces for many years with online terminals. Tasks range from manually entering wagers using the interface to using playslips to process wagers. This project will explore the feasibility of developing a headless lottery terminal to process wagers. This would entail removing the current touchscreen based terminal interface and replacing it with a hands-free terminal that can understand voice commands and respond with appropriate speech responses.

Key Accomplishments

- **High Level Design Document:** A document outlining the important design decisions for the system was compiled. This included the design of our hardware and software of both our initial prototype and of the eventual final design.
- **Activity Diagrams:** These diagrams were created to represent how the logic of our software is implemented within the terminal. They show the flow of actions that are involved when obtaining a lottery ticket, or accessing the terminal in general.
- **Use Case:** Detailed all the possible flows of events as the user interacts with the terminal. It includes information on what specifically the terminal will output or expect to hear from the user at particular junctures.
- **Prototype block/wire diagram:** Created a wiring diagram (**Fig. 1**) shows the hardware that is involved within the system from the microphone input to the printer output, and the different connections that made between the different hardware components and peripherals.
- **Speech-to-text (STT) software:** Chose CMUSphinx as our speech-to-text engine since it could be run entirely offline. Of its many adjustable settings, we adjusted the acoustic model, language model, and dictionary of the recognizer to gain better recognition accuracy.
- **Implemented quick pick:** A lottery quick pick is a lottery ticket purchased for one draw with six random numbers. Our lottery terminal is able to recognize a command for a quick pick with relatively high accuracy. Options are also given to print for multiple boards and draws should the customer request them.
- **Implemented manual picks:** When requesting a manual pick, the user is able to specify the exact numbers that they would like to print on their lottery ticket. This process of choosing numbers can be repeated multiple times for however many boards the customer would like to purchase. Then the terminal will ask how may draws the user would like.
- **Implemented login, logout, and create user:** A new user can be created while logged out. After logging in, the user is then able to fully utilize the multitude of implementations the terminal is designed for. At any point, the user can also log out so that another may log in.
- **Implemented automated trainer:** The user is able to enter a training mode to teach the recognizer how to process different sounds. The terminal will prompt the user to say a number and when the user says that certain number, the terminal records the user saying it and plays it back to the user to ensure that the recording sounds correct.
- **Software Consistency Testing:** Tests were ran in a quiet room while running speech recognition while speaking into the microphone. We observed the output as well as other potentially relevant information to determine how we could improve the accuracy and run time of our speech recognition software.
- **Driving LED Indicator:** Successfully decoupled LED data stream from audio stream (which otherwise would use the same PWM peripheral on the Raspberry Pi). Implemented LED indication specified in our use case.
- **Connected printer:** Successfully established connection with point-of-service (POS) printer and printed wagers on it.
- **Designed enclosure:** Designed an enclosure in Solidworks for housing all of the hardware components of the project. Currently plans to 3d print this enclosure are underway. An exterior view of this enclosure design is shown in **Fig. 2**.
- **Final System Tests:** Made sure that all of our internal systems are running reliably and consistently. These tests will include running through every scenario that our Use Case Document dictates, and making sure that our hardware and software are performing as they should. The final system hardware (sans enclosure) is shown in **Fig. 3** .

Anticipated Best Outcome

The Anticipated Best Outcome for our project is a functional prototype lottery terminal capable of receiving and processing voice commands and translating them into terminal functions. It will interact with a retailer in a natural way, allowing them to place wagers hands-free. When more information is needed to perform a task, the system will ask questions to obtain the information necessary. It will monitor the state of the terminal and communicate with the retailer when physical intervention is required, and will be able to process and print a requested quick pick lottery in under 4 seconds.

Project Outcome

The Anticipated Best Outcome was achieved.

Figures

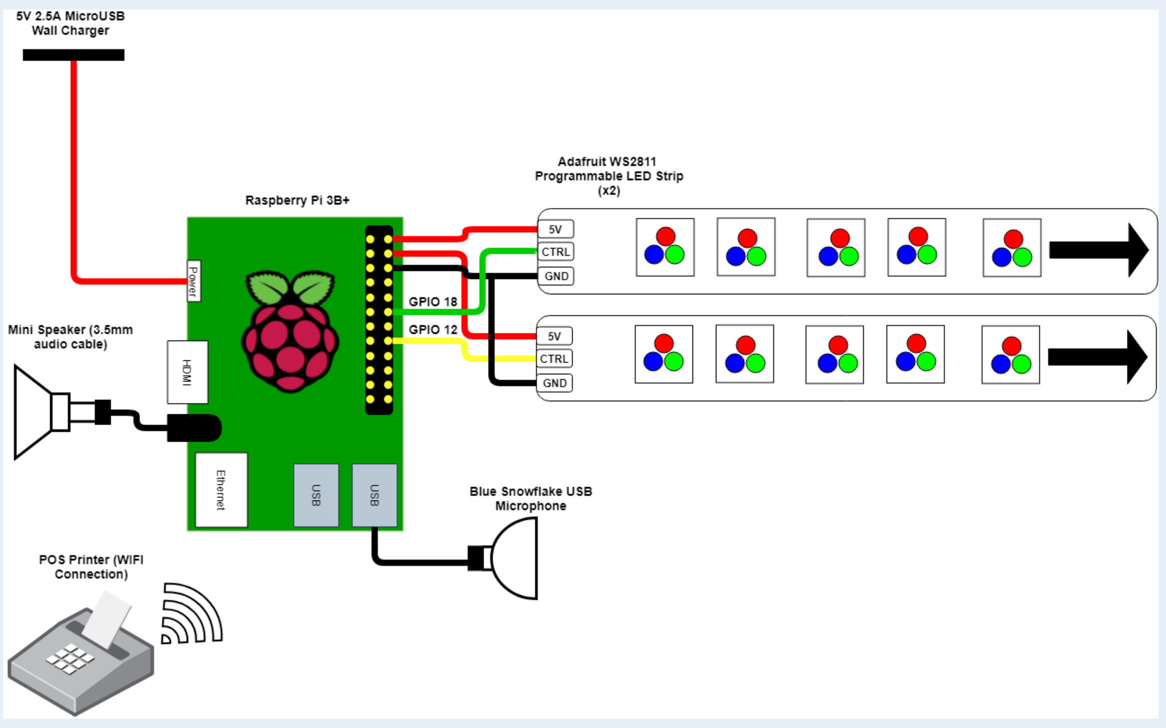

Figure 1: Wire diagram describing the hardware setup.

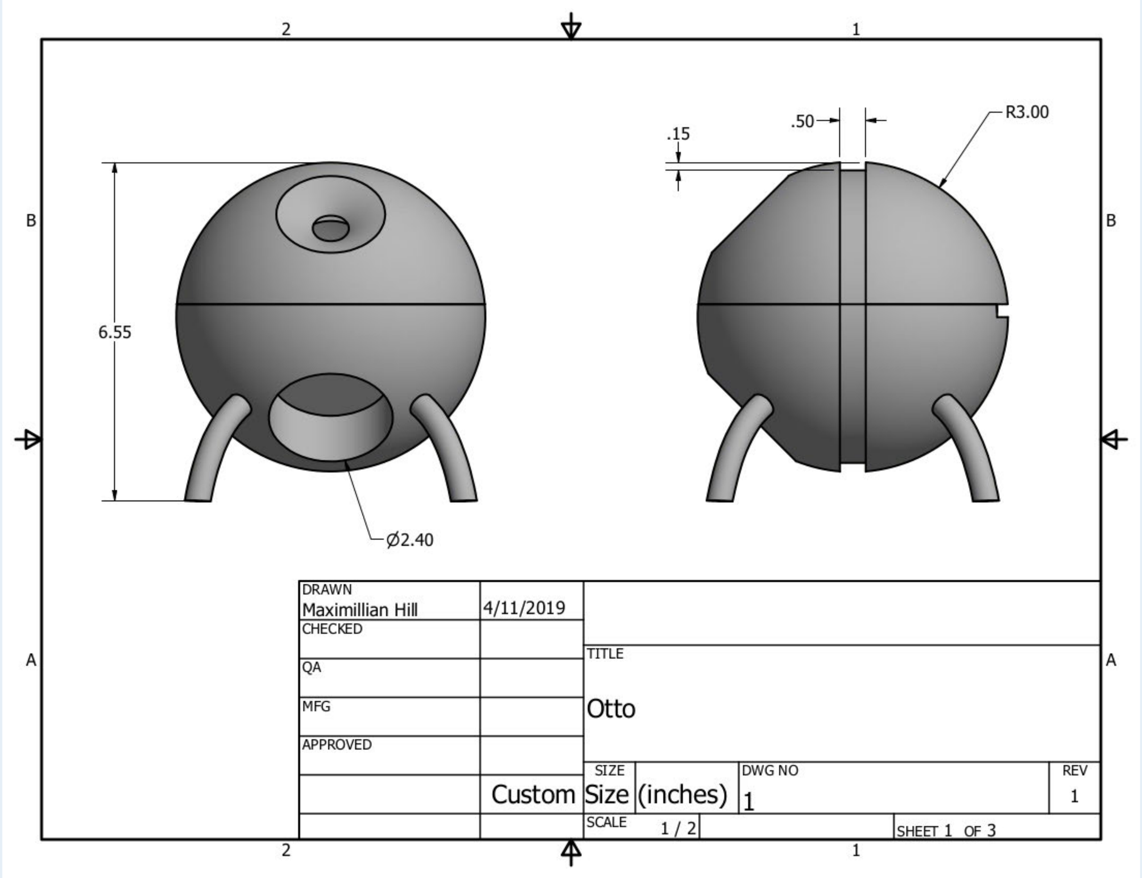

Figure 2: Technical drawing delineating dimensions of prototype hardware enclosure design.

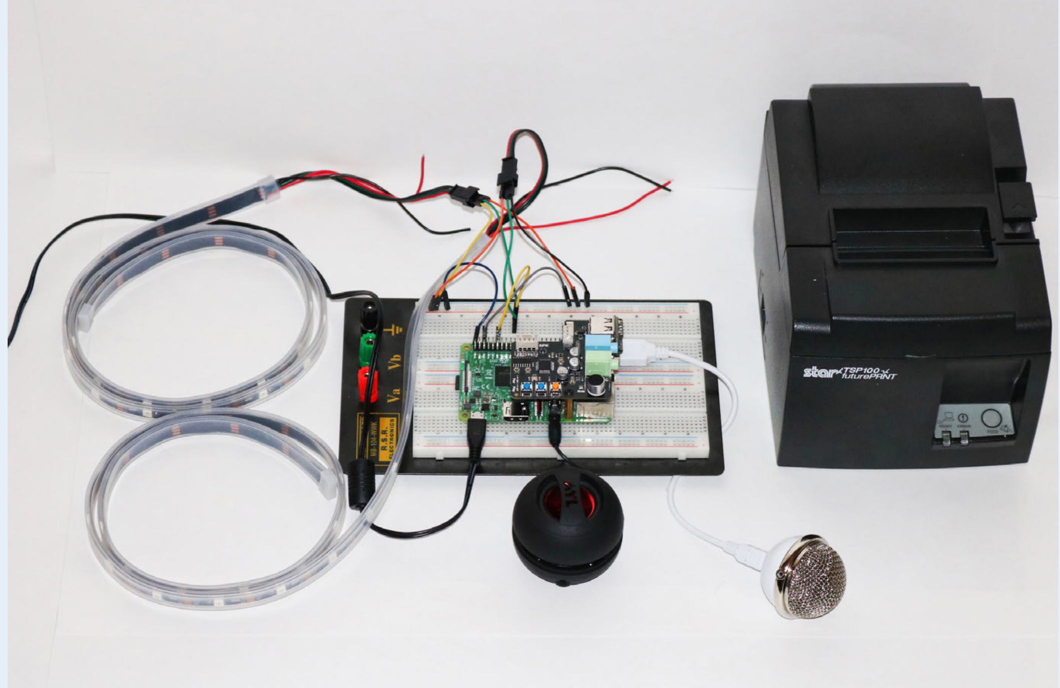

Figure 3: Necessary hardware displayed outside of enclosure.

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