

rfgrid: An Interactive RFID Display

ECED Group 8: Burak Ozter & Mark Hooper

Project Sponsor: Dr. Colin O'Flynn

Introduction

Rfgrid is a device that can detect the presence, absence, position and unique ID of RFID tags using an array of RFID readers embedded beneath a projection surface. Visual and Audio feedback can be generated by a projector mounted above the device making rfgrid an interactive RFID display.

System Components

Applications:

Three applications were created to demonstrate some practical use cases of the rfgrid platform.

Drum Sequencer

Each RFID tag is configured to display an icon and produce a specific sound sample when detected. Features tempo, volume, pause, play, load and record controls. Each control can be adjusted using an RFID tag.

Chess

Each tag corresponds to a specific chess piece and will produce the corresponding visuals in the location of an RFID tag placed on the board.

Tabletop Role-Playing Game

Placing a character on the edge of the projection surface will cause the background to scroll in that direction, allowing for games larger than an 8 by 8 configuration to be played. Using an hourglass prop with RFID tags embedded, we can incorporate turn sequences. The map will automatically scroll to the location of the player whose turn it is. The other side of the hourglass can be used to look around the map. Two cube props can be used to spawn enemies, kill enemies, enable/disable scrolling features, play up to three unique soundtracks and mute all sounds.

Graphical User Interface:

Allows the user to load and edit the settings of an application from a list of available applications. The GUI can launch some calibration tools use to adjust the outline of the projected screen (display calibration tool) and select/scale a background image to ensure proper alignment with the locations of the RFID readers embedded beneath the projection surface. Features a tag scanner, where the ID of the tag can be read, and the images and sounds can be configured by the user without requiring programming knowledge.

Game Engine:

Used by all applications to draw tag images in the correct location, play sounds, communicate with the hardware using the customized rfgrid communication protocol via a serial connection.

Device Hardware:

Electronics

Two custom PCB's were designed and fabricated to allow for the connection of 64 RFID readers to an Arduino UNO. The Arduino Shield PCB allows for the connection of up to 16 Modular Reader Arrays. The Modular Reader Array PCB can accommodate 16 RFID readers, ensuring that only one reader at a time can access the SPI bus.

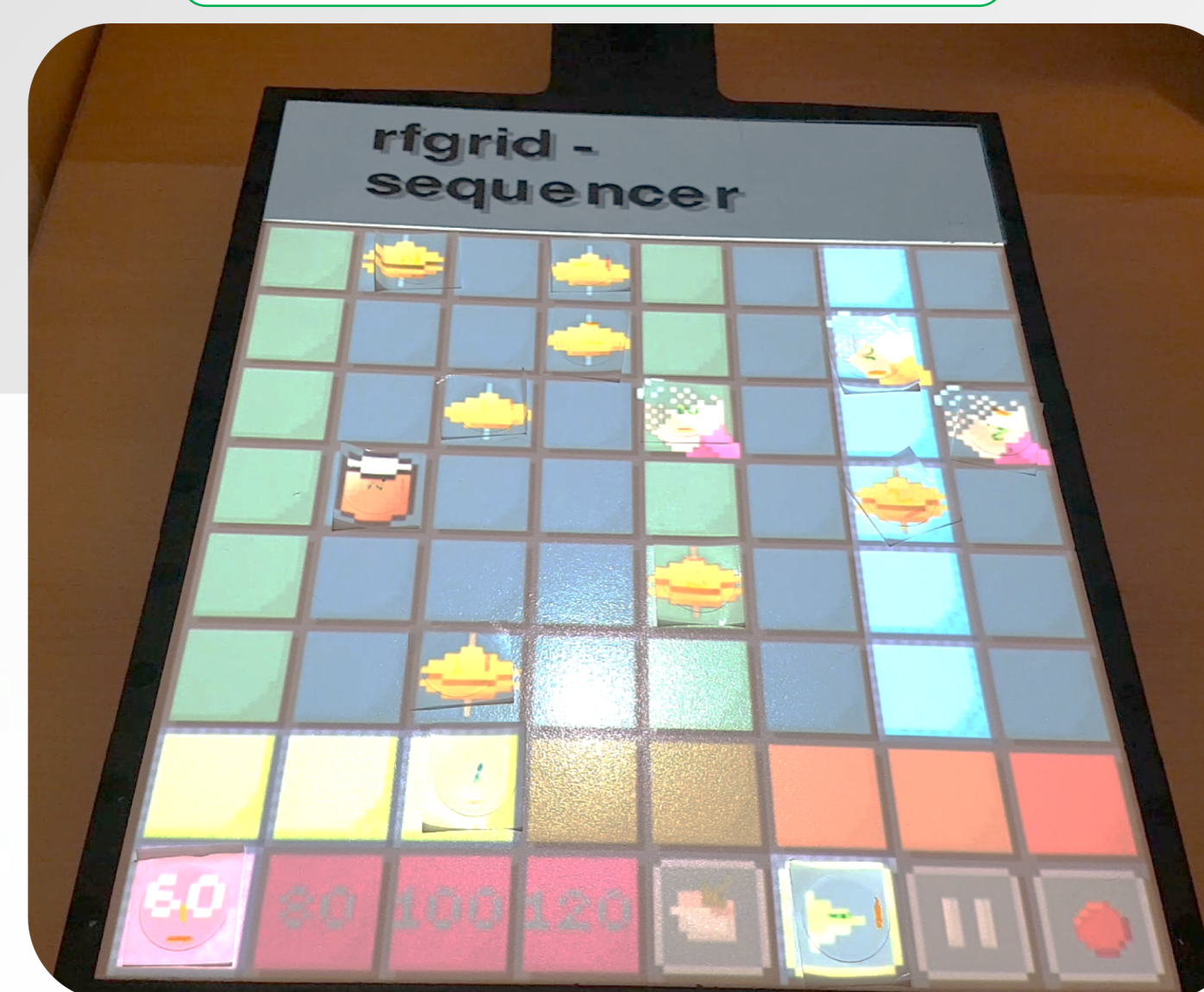
Enclosure

A customized 3D Printed enclosure houses all of the device electronics, a projector mount made from extruded aluminum and a projection surface on which visuals from the projector are displayed.

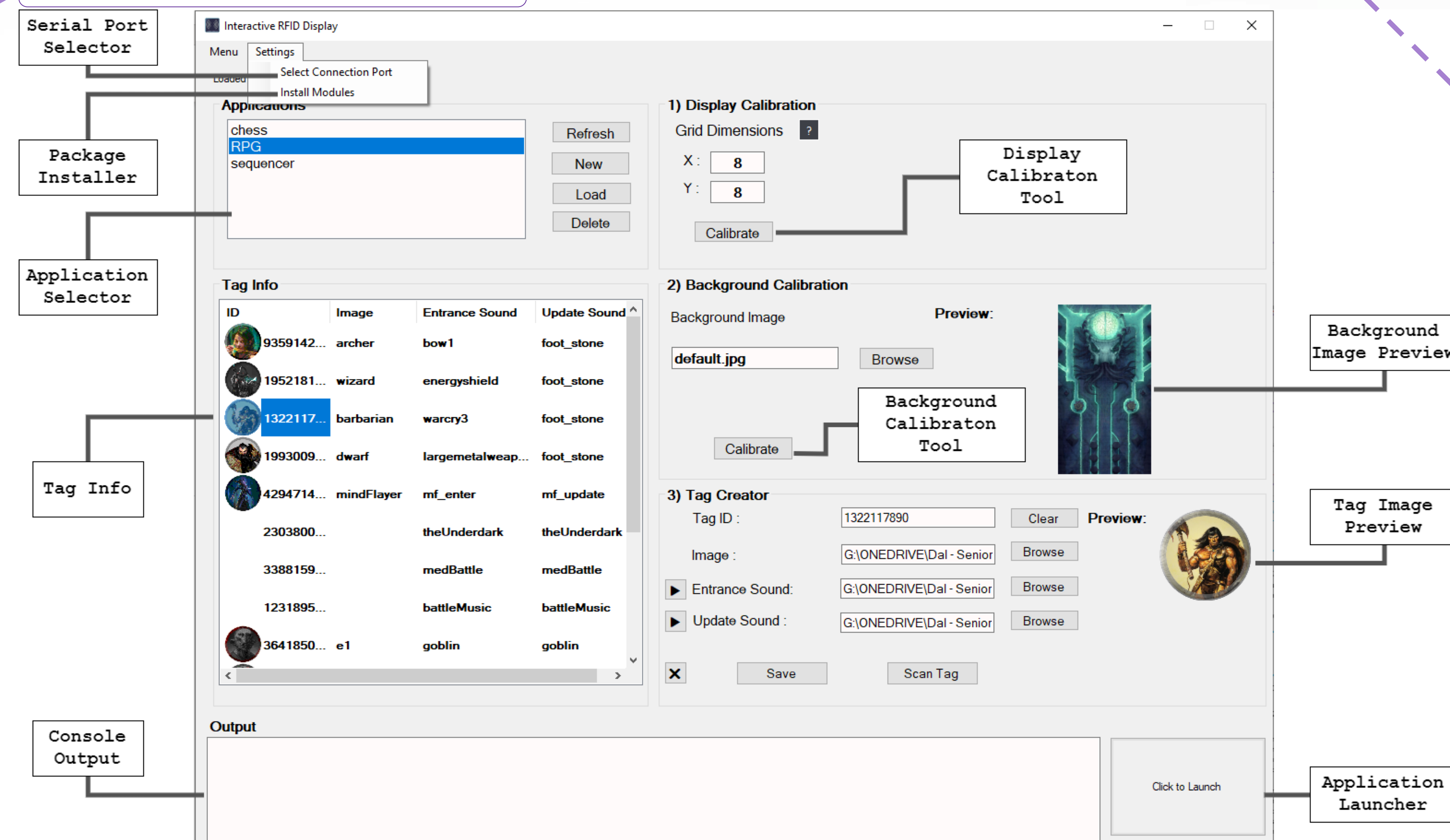
Conclusion

In two semesters of hard work, we were able to produce a completely original hardware platform, implement a customized real-time communication protocol, develop a specialized game engine, produce a GUI application with an installer and write three distinct use case applications. By far the best part of this project was having the freedom to develop something new that we came up with ourselves. Though this project is far from being a viable commercial product, we intend to pursue this further after graduation.

Applications



Graphical User Interface



Device Hardware

