Requirements Document
RSA Display for RSA Spectrum Analyzers 2022-2023

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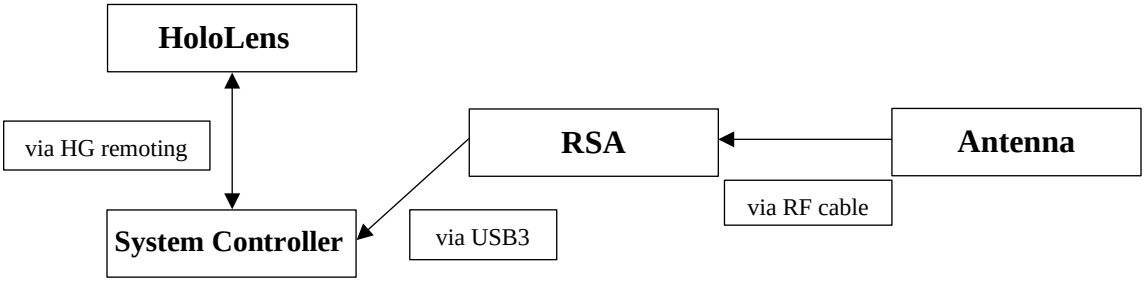
Introduction

We are a UP capstone team creating a hands-free heads-up mobile/portable display in which the signal graphs would be displayed on the HoloLens mixed reality smart glasses to make signal hunting easier and more effective for engineers. The previous capstone, the team was able to establish a serial connection between the HoloLens and their server which meant they were able to display live data on the HoloLens. As we pick up this project, we plan to optimize the program and allow for the user to be able to control the device through hand gestures and voice commands. Our goal for this project is to make signal hunting easier and safer for engineers as they won't need to walk around with their hands full, looking into a laptop screen. Through this project, we hope to gain experience working with a large pre-existing codebase and graphical user interfaces.

We're also looking forward to working with the AR and RSA hardware.

Two previous Capstone teams have also worked on this project. The previous team was able to get the HoloLens working with data on the screen. However, it currently runs at around 3 fps. Our goal is to optimize their code and add new features where needed.

Product Overview



HoloLens: Displays RSA data to the user in AR, data is passed from the laptop via Unity and displayed on the HoloLens with the Holographic remoting application.

System Controller: Processes RSA data and converts it into graphical data that can be passed to HoloLens. Additionally, it also manages configuration and control of the RSA.

RSA + Antenna: Detects frequency readings from the surrounding area. Antenna causes readings to be applied directionally.

Functional Requirements

- HoloLens Display: A user will need to be able to view live spectrum traces overlaid onto their field of vision using the HoloLens display. The display rate must be at minimum 15 frames per second.
- Parameter Configuration: An engineer will be able to adjust center frequency of capture, frequency span of capture, and amplitude range of capture using no more than one hand.
- Interface Display: The system shall be capable of displaying a DPX bitmap in the user's field of vision.

Non-Functional Requirements

- Interface Display: The system should be capable of displaying a DPX trace in the user's field of vision.
- Spectrum Detection: An engineer using the system should be able to control the direction of the signal capture antenna without using their hands.

User Interface(s)

- Once we have access to the lab, we will use last year’s UI and make changes to it as needed.
- We plan to add specific control UIs such as hand gestures, voice recognition, and virtual keypad.
- Essential values that can be controlled through the UI are RSA Frequency, Span, and Amplitude.

Preliminary Sprint Schedule

Sprints	Sprint Goals
Sprint 1	• Get previous Capstone team's version of product working.
Sprint 2	• Live demo with Tektronix Clients (to show current state and discuss future requirements). • Optimize current frame rate to >= 5 fps. • Additionally, we would like to investigate converting the project to only Unity rather than using a python server.
Sprint 3	
Sprint 4	
Sprint 5	
Sprint 6	
Sprint 7	
Sprint 8	

High-level Technical Specifications

HoloLens Display: The HoloLens shall display live spectrum traces as read from the RSA. The UI will be built in Unity and displayed on the HoloLens through a serial connection.

RSA300/RSA500-series: The RSA series are real-time spectrum analyzers developed by Tektronix that uses a laptop to display spectrum and signal analysis. To set it up, connect the RSA to the laptop using a USB3 cable, and connect the RSA to an antenna via an RF cable. For better experience, it is recommended to install SignalVu-PC on the laptop so it will be easier to see the graphical representation of the signal data. The RSA also has its own API such that developers can use a variety of commands for projects like this. Its main features are as follows:

Parameter Configuration: The RSA allows for configuration of values, the most significant to the project being center frequency of capture, frequency span of capture, and amplitude range of capture. A method must be developed which allows for a user to adjust these variables using at most one hand. A possible route for implementation is allowing for voice control support.

Interface Display: As the RSA is constantly making readings, the product must allow its displayed data to be updated as these readings are made. A DPX bitmap is a way of communicating this change to HoloLens and shall be supported as the method of relaying data.

Spectrum Detection: The RSA requires an antenna to make readings in the field. A backpack has been constructed by the previous team which allows for an antenna to be mounted to it, allowing for hands-free readings. The antenna used in the product makes its readings directionally, meaning that it must point in the direction of the desired reading. A device should be included in the backpack which allows for adjustment of the antenna direction so that accurate readings can be made.

Budget

- No current budget.

Facilities

The team will require access to a lab in Shiley Hall to use and store equipment relating to the project. This includes HoloLens and four RSA's. Software to be used includes Unity, SignalVU, and the RSA API, which is all free to access and download. Tektronix has provided the team with additional documentation on the RSA and its API.

Ethical Considerations

Currently, we do not see any ethical issues with use or mass adoption of the HoloLens for the purpose of radio interference hunting. There could be some ethical problems with how the HoloLens' are manufactured, and parts are gathered.

Conclusion

The goal of this product is to continue production of a hands-free method of interacting with an RSA and its data. The main user of this product will be signal interference field engineers. The main way that this interaction will be available is through HoloLens, which allows users to have data, such as graphs of RSA readings, displayed on top of their field of view. A significant struggle encountered by the previous team is establishing a serial connection between the RSA and HoloLens, which is critical in displaying live readings to users.

References

Rsa306b: Compact and portable. RSA306B USB Real TimeRF Spectrum Analyzer | Tektronix. (n.d.). Retrieved September 3, 2021, from https://www.tek.com/spectrum-analyzer/rsa306