DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
THE UNIVERSITY OF TEXAS AT ARLINGTON

PROJECT CHARTER
CSE 4317: SENIOR DESIGN II
FALL 2021

RAYTHEON TEAM
WIDROS

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REVISION HISTORY

Revision	Date	Author(s)	Description
0.1	07.28.2020	RCA	document creation
0.2	07.29.2020	DT, JS, JP, RCA, TF	complete draft

CONTENTS

LIST OF FIGURES

1 PROBLEM STATEMENT

The endgame of this project reflects the teams and clients desire to scan access point WiFi signals which will indicate what ranges and location each have. In doing so, we can use this valuable information for logistics, access point placement, and many other applications not described in this project.

2 METHODOLOGY

To solve our problem the team will be continuing development of the access point scanning script and the Augmented Reality code base. The database infrastructure is capable of collecting, storing, analyzing, and transmitting environmental data. The database infrastructure will be built off of an SQL network that will sniff out access points signals and transmit that data up to the SQL database. It will also host APIs that are accessible for retrieving required information to render in augmented reality onto a HoloLens II, via C script. The Augmented Reality side will use the data that the SQL database stores and display it to the user.

3 VALUE PROPOSITION

WiDROS could optimize access point placement. This would have applications in not only residential settings, but business settings as well. WiDROS can monitor access points and create appropriate placement responses to the signals received. These signals would contain information on the current status of various access points, business or residential, that are currently in use. This makes WiDROS an excellent monitoring system for various purposes. There are client-proposed use cases such as rendering access point ranges and placement in augmented reality which can be used to analyze a system in real time.

4 DEVELOPMENT MILESTONES

All known milestones for this project.

Provide a list of milestones and completion dates in the following format:

- Project Charter first draft - 08/2021

- System Requirements Specification - 08/2021

- Architectural Design Specification - 10/2021

- Detailed Design Specification - 10/2021

- CoE Innovation Day poster presentation - 12/2021

- Final Project Demonstration - 12/2021

5   BACKGROUND

The current business use case of this project is to be able to monitor access points and create appropriate responses to the signals received. Ideally these signals will help to give information on the current status of the access points that are currently in operation, making it an excellent monitoring system to keep track of optimal access point placement, and dead spots. Furthermore, there are additional use cases which can be found for the data collected such as rendering WiFi dome signals in augmented reality, which could be used to analyze an incomplete WiFi coverage system and find a solution to fix it. The current customer for this project is Raytheon. They have been the sponsor of this project for several years now and want us to work on this technology to help them improve their monitoring systems. There are currently existing relations between the customer and past development teams that will be connected to the current team working on this assigned project.

6   RELATED WORK

FEA, or finite element analysis, is a computerized method that is able to predict how a certain element will react to physics forces such as heat, vibrations, or fluid flow. Structural analysis of elements can be done prior to actually constructing its concept. FEA is usually only done on computer-generated graphics, however, three engineers developed an integrated platform to be able to perform real-time FEA simulations in augmented reality (Huang, Ong, Nee 2015). They discussed how an AR system typically has three fundamental modules which are tracking, rendering, and interaction. The WiDROS team took from this source that the first steps into starting the project was choosing the method of how to track the wireless networks necessary, how to render them into the Unity program, and the way in which the user was to interact with the environment.

    Another related work was done by students in a telecommunication science laboratory in Maryland, USA where they discussed the ways such that human operators could get assistance from Microsoft Hololens to perform network operation tasks. They developed three applications, their first being a three-dimensional network visualizer that was able to distinctively display network typologies in two levels of detail: a global view and local network view. From their global view, the application can simulate alerts where attention is required to get the userâs attention. Once the user has interacted to indicate theyâd like to address the alert, their program switches from a global to a local view of the region of wireless networks (Beitzel, Dykstra, Toliver, Youzwak 2017). This application was similar to the project objective assigned to WiDROS. Along with the team also having to detect wireless networks, they too utilized the Unity game engine as their core development platform. However, this project was different in a way such that the WiDROS team was assigned to only pick up wireless network data from a building at the University of Texas at Arlington and the program would run the wireless domes being visualized right on the building, so the user physically has to be standing in front of the building at the University of Texas at Arlington.

7   SYSTEM OVERVIEW

The goal of the WiDROS Augmented View is to provide a user with an AR representation of various WiFi data signals. The WiDROS Augmented View will consist of three major systems: the Raspberry Pi, the SQL database, and the AR data projection. First The Raspberry Pi which will serve to collect a wide range of signal data to be triangulated on and displayed to the user. This data will include WiFi network data. After collecting this data the Raspberry Pi will send it over our SQL database to be stored. The Raspberry Pi will also store the most recent signals locally to send to the AR projection in the event of a temporary service loss. The second Major System will be the SQL database. The database performs three roles. First it will communicate between the Raspberry Pi, and the Hololens II sending data between these devices. Second it will perform operations on the raw data taken from the Raspberry Pi to convert

it into information that will be useful to the user. Third the SQL database will keep a record of all data recorded on the Raspberry Pi and store those records. In the event of an error the SQL database will be able to reboot itself to resume service. The final system is the AR Data Projection. This system will use the SQL database to pull stored records and display them to the user in real time. This data will have been operated on by the SQL database prior to being sent to the AR projection. The data will be displayed on the Microsoft Hololens II. The User should be able to view an overview of all the WiFi data signals currently being displayed.l. Below is a diagram of these systems that outlines their interactions and the data sent between them.
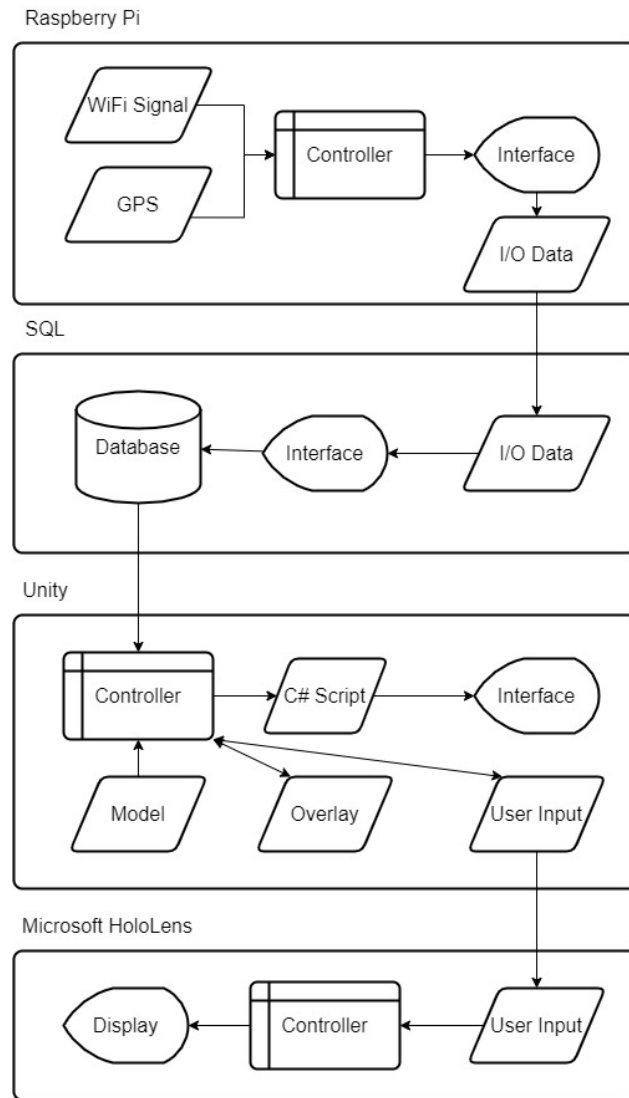

Figure 1: System Overview

8   ROLES & RESPONSIBILITIES

The stakeholders of the project:

- Raytheon Company

Point of contact from the sponsor or customer:

- Jesse Lee

Project team members and their roles:

- Tiffany Frias (Product Owner)

- Renato Cruel Amado (Scrum Master)

- Joell Soriano (Software Developer)

- Daniel Tam (Software Developer)

- Joshua Pearson (Software Developer)

If performance from either of the individuals currently assigned to the expressed roles is not up to expectations, the team holds the right to pullback their given title and pass it on to another member of the team. Also, if a member willingly agrees to swapping roles with another member and that particular member wants the role, then that is allowed.

9 COST PROPOSAL

For this project, there were two major expenses: the monthly fee for Amazon Web Services (AWS) and the Microsoft HoloLens II. The Amazon Web Services (AWS) was a major component in this project as this would be the tool used to set up the API endpoints, and the transfer of data from sensors to the cloud services and to the HoloLens II. However, since the EE no longer needed the AWS, the subscription got canceled and our team ended up using a SQL database. The Microsoft HoloLens II will serve as the AR device used for the project, this as been provided to us by Professor Conly, at no cost.

9.1 PRELIMINARY BUDGET

1. Amazon Web Services (AWS) - 150 dollars per month (cancelled)
3. Microsoft HoloLens II (free)

9.2 CURRENT AND PENDING SUPPORT

1. University of Texas at Arlington - 800 dollars
2. Raytheon - 150 dollars per month

10 FACILITIES & EQUIPMENT

The lab space being used for this project will consist of the given lab inside of the University of Texas at Arlington for senior design projects. This lab will be used as the general meeting area for our team to discuss and develop the project. In addition to our team´s lab space, the team may be required to demo the project´s capabilities at Raytheon´s facility.

Special equipment needed for the project are as follows:

- 1. Raspberry Pi

- 2. Microsoft HoloLens II

- 3. Drone Phanton I

- 4. Open Source Software

The equipment mentioned above are already present on campus. If a case arises where it requires us to use special equipment that are not in our team´s possession, we will reach out to the appropriate team and borrow it from them. Any equipment that cannot be borrowed will be purchased.

11 ASSUMPTIONS

The list below contains assumptions that will be crucial to the team´s ability in continuing optimal development.

- Data of satisfactory quality will be transmitted from the Raspberry Pi to our SQL database, and thereafter to Unity via a C script.

- Access will be granted to the customerâs network credentials for deployment.

- Access to the previous code for WiFi dome deployment, as well as to the HoloLens II emulator with the application.

- Access to the previous Bitbucket and Jira account.

12 CONSTRAINTS

The following list contains key constraints related to continuing implementation and testing of the project.

- Final prototype demonstration must be completed by December 3rd, 2021

- The customer will not provide network architects to assist in development.

- Total expenses must not exceed 800 dollars as well as the supplementary budget offered by the customer.

- The team will be provided one Raspberry Pi at a time, plus a GPS tracker.

- Due to COVID, one team member will have the physical HoloLens II headset at a time.

- Due to COVID, in-person meetings will be limited, and schedule will be adjusted as necessary based on obligations team members have outside of this project.

13 RISKS

This section should contain a list of at least 5 of the most critical risks related to your project. Additionally, the probability of occurrence, size of loss, and risk exposure should be listed. For size of loss, express units as the number of days by which the project schedule would be delayed. For risk exposure, multiply the size of loss by the probability of occurrence to obtain the exposure in days.

For example:
The following high-level risk census contains identified project risks with the highest exposure. Mitigation strategies will be discussed in future planning sessions.

14 DOCUMENTATION & REPORTING

14.1 MAJOR DOCUMENTATION DELIVERABLES

14.1.1 PROJECT CHARTER

The initial version of the project charter is planned to be delivered on July 9, 2021 but is subject to change.The final version is expected to be delivered on December 3, 2021. Any changes to the project charter will be done when a major change is noticed by the team that requires parameters to be modified within the document.

Risk description	Probability	Loss (days)	Exposure (days)
Availability of data at all times	0.50	20	10
Not having the Raspberry Pi on hand for data to be sent	0.20	14	2.8
Internet access not available at installation site	0.30	9	2.7
Not knowing Unity	0.09	14	12.6
Hardware bugs of board and/or Hololens	0.50	14	7

Table 1: Overview of highest exposure project risks

14.1.2 SYSTEM REQUIREMENTS SPECIFICATION

The initial version of the system requirements specification is planned to be delivered on July 30, 2021 but is subject to change. The second version is expected to be delivered on December 3, 2021. Any updates will be made when the customer requests the change.

14.1.3 ARCHITECTURAL DESIGN SPECIFICATION

The initial version of the architectural design specification is planned to be delivered on July 30, 2021 but is subject to change. The second version is expected to be delivered on December 3rd, 2021. Any updates will be made when the customer requests the change.

14.1.4 DETAILED DESIGN SPECIFICATION

The initial version of the detail design specification is planned to be delivered on October 25, 2021 but is subject to change. The second version is expected to be delivered on December 3, 2021. Any updates will be made when the customer requests the change.

14.2 RECURRING SPRINT ITEMS

14.2.1 PRODUCT BACKLOG

Items will be added to the product backlog from the SRS based on current customer needs. They will also be prioritized by the customer and updated by the scrum master. All decisions to update the backlog will be made by the team collectively and confirmed by the team lead. The software used to maintain and share this information is Microsoft Teams.

14.2.2 SPRINT PLANNING

There will be a total of 7-10 sprints depending on conditions faced during the project. The sprints will be planned via group meeting at the end of the previous sprint. This meeting will be led by the team lead.

14.2.3 SPRINT GOAL

The team lead will decide the sprint goals based on what the customer expresses to the product owner in the weekly meetings.

14.2.4 SPRINT BACKLOG

The team lead decides which items makes it into the sprint backlog. These items will be discussed in group meetings over Teams conference and documentation will be maintained on a sprint board via Microsoft Teams.

14.2.5 TASK BREAKDOWN

Individual tasks will be voluntarily claimed by each team member. If necessary, individual tasks will be assigned by the team lead based on the product ownerâs expressed needs for the project. The work done into a task will be tracked in hours collaboratively on the documentation in Microsoft Teams.

14.2.6 SPRINT BURN DOWN CHARTS

A designated team member will be the one generating the burn down charts for each sprint. They will be accessed through Microsoft Teams.

Figure 2: Example sprint burn down chart

14.2.7 SPRINT RETROSPECTIVE

The sprint retrospective will be handled at the same time as the next sprint planning. The team lead will produce the document during this meeting containing all the pertinent information.

14.2.8 INDIVIDUAL STATUS REPORTS

Individual status reports are expected from each team member every sprint following the sprint reviews. Members will be given a rating in participation, communication, professionalism, work quality, and overall scoring.

14.2.9 ENGINEERING NOTEBOOKS

N/A

14.3 CLOSEOUT MATERIALS

Closeout Material will be delivered on December 3, 2021. Besides the documents mentioned above, a poster, demo video and CSE blog post will also be submitted.

14.3.1 SYSTEM PROTOTYPE

As established by previous teams, the initial prototype infrastructure will be deployed and field tested before a final infrastructure is provided to the customer.

14.3.2 PROJECT POSTER

For the final project poster, we will display the design and implementations of our software infrastructure.

14.3.3 WEB PAGE

There will be a final private web page available for the customer to view the data stored in the cloud.

14.3.4 DEMO VIDEO

The demo video for this project will show a captured feed of the Sensorium as viewed by a user.

14.3.5 SOURCE CODE

The source code will be submitted with the final product itself.

14.3.6   SOURCE CODE DOCUMENTATION

Code will be documented within the programming file itself. READMEs will be provided within each directory to know each directory´s indented functionalities.

14.3.7   HARDWARE SCHEMATICS

N/A

14.3.8   CAD FILES

N/A

14.3.9   INSTALLATION SCRIPTS

N/A

14.3.10   USER MANUAL

The user manual will be used as established by previous teams. A virtual copy of all instructions needed to deploy the infrastructure will be provided to the customer upon completion.

REFERENCES

Beitzel, S., Dykstra, J., Toliver, P., amp; Youzwak, J. (2018). [PDF] exploring 3D cybersecurity visualization with the Microsoft hololens: Semantic scholar. undefined.

Huang, J. M., Ong, S. K., Nee, A. Y. C. (2015). Real-time finite element structural analysis in augmented reality.â¯Advances in Engineering Software, 87, 43â56.