

# UNCC\_WORK Project – Progress Report

Date	Revision	Author	Comments
2021-03-01	A	Zachary Zaleski	Original Document

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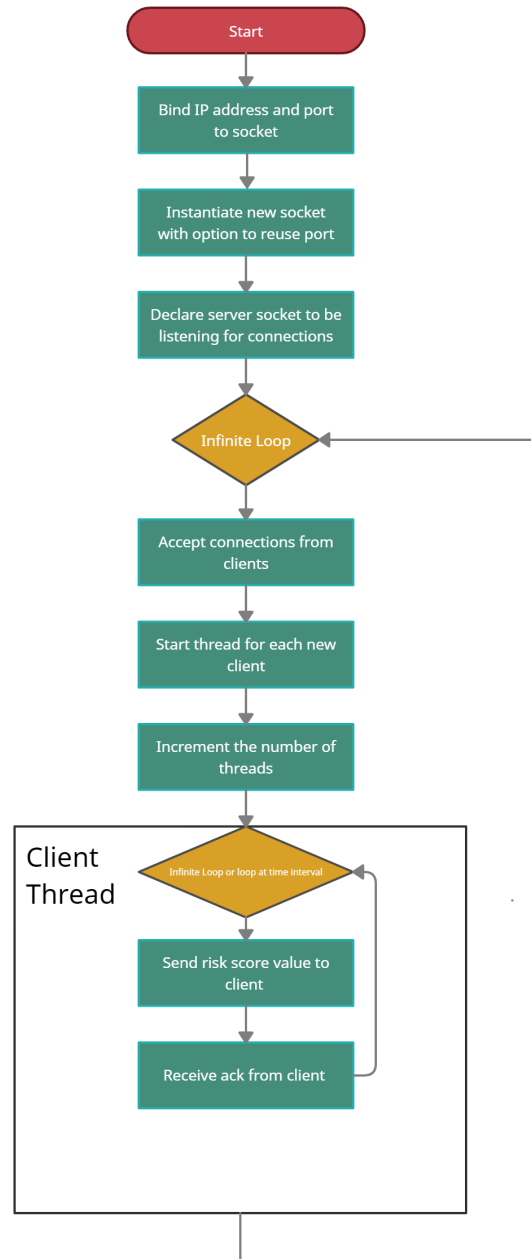
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## 1 Objective

The objective of the UNCC\_WORK team is to complete a backend communication server scheme that functions to deliver messages to a number of clients concurrently; furthermore, the communication between server and client to be fluid to ensure constant transmission by means of error handling. Moreover, the mobile app will be able collect and display data collected from end user devices such as: the heart rate of the individual, alert notifications, and GPS location implemented from the goggles.

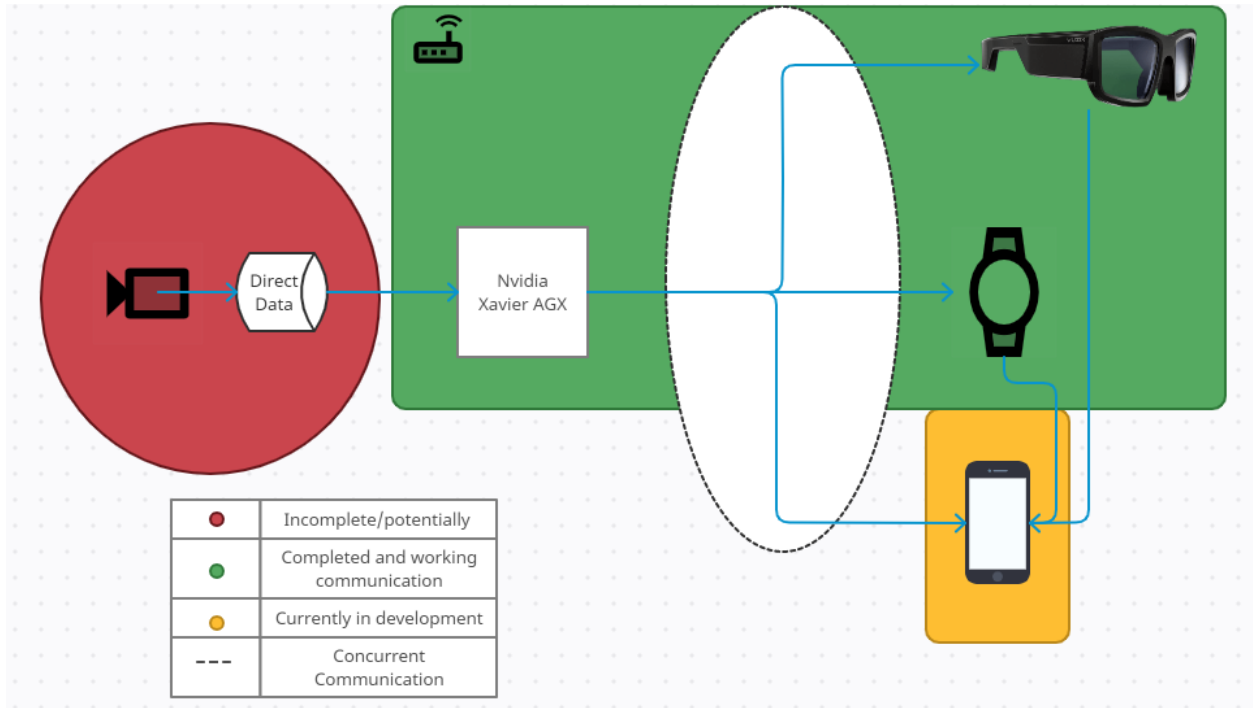
## 2 Work Completed

The team is currently working on implementing a concurrent backend server-client communication scheme that meets the requirement of 10ms latency across devices. The current implemented multithreaded server implementation is below in Figure 1.



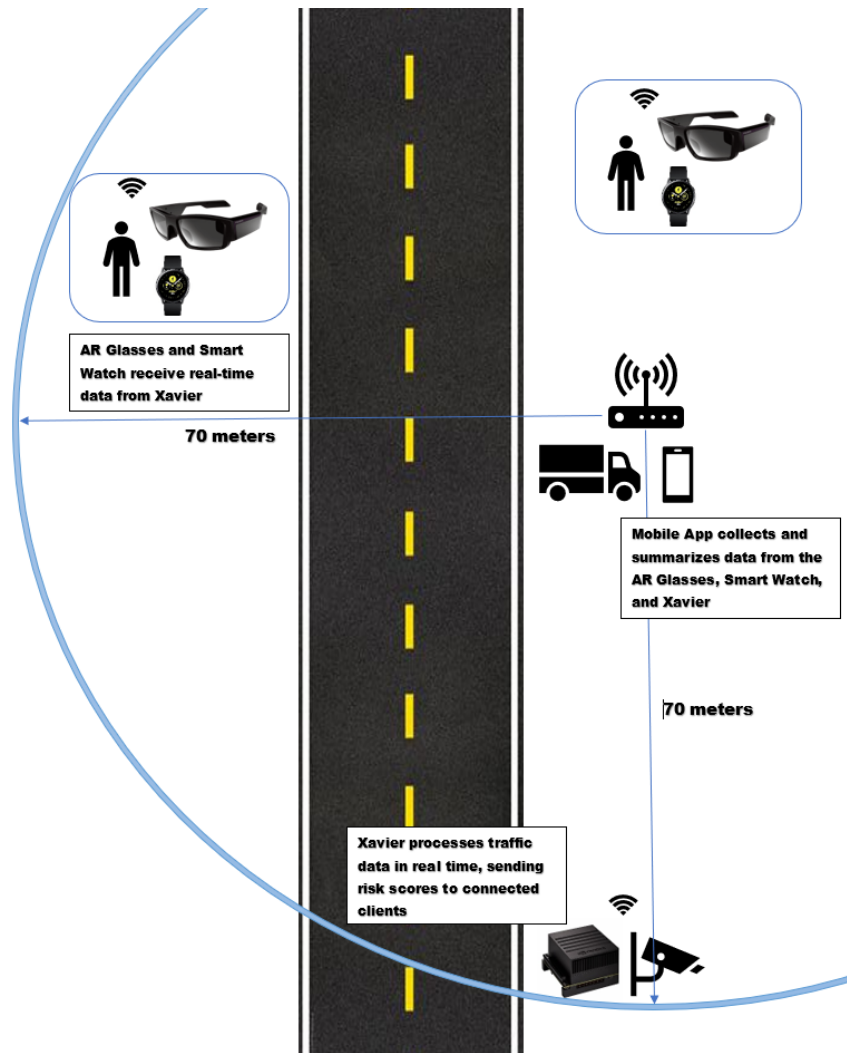
**Figure 1: Multi-threaded Server Scheme Option 1**

The team implemented a primitive version of Figure 1 with success; however, this implementation requires further research to ensure scalability as error handling of data transmission may not be possible. The general server communication scheme is as in Figure 2 below.



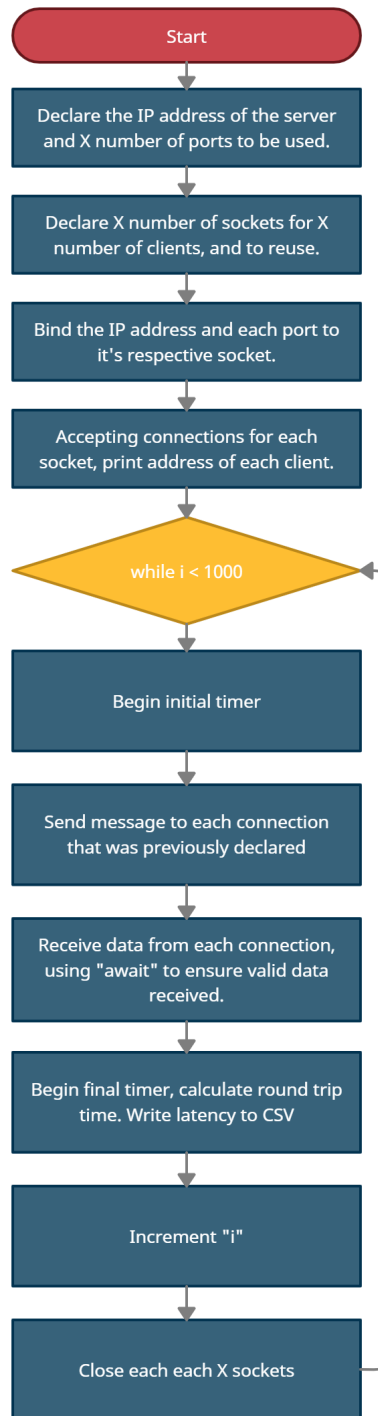
**Figure 2: Server Communication Scheme**

The figure above is largely an abstracted representation of the communication that will be occurring internally within the system. Figure 3 below shows a concrete definition of the potential system layout in a work zone.



**Figure 3: System Overhead**

As of now, the team has implemented a single-thread, multi-socket, multi-port server to measure latency between every possible device that is currently available. The flowchart for this server implementation is below. [Figure 4]



**Figure 4: Single-Thread Server Latency Testing Scheme**

This represents a one-scale system including: Vuzix Blade goggles, Samsung Galaxy Watch Active 1 watch, and an Android tablet. The communication for the mobile application is currently in development with a generic-frontend UI completed and design of the backend client scheme to communicate with the system is in progress, but will be included in the entire system upon completion.

### 3 Issues that Need Immediate Assistance

Currently, the UNCC\_WORK team has no issues that require interference.

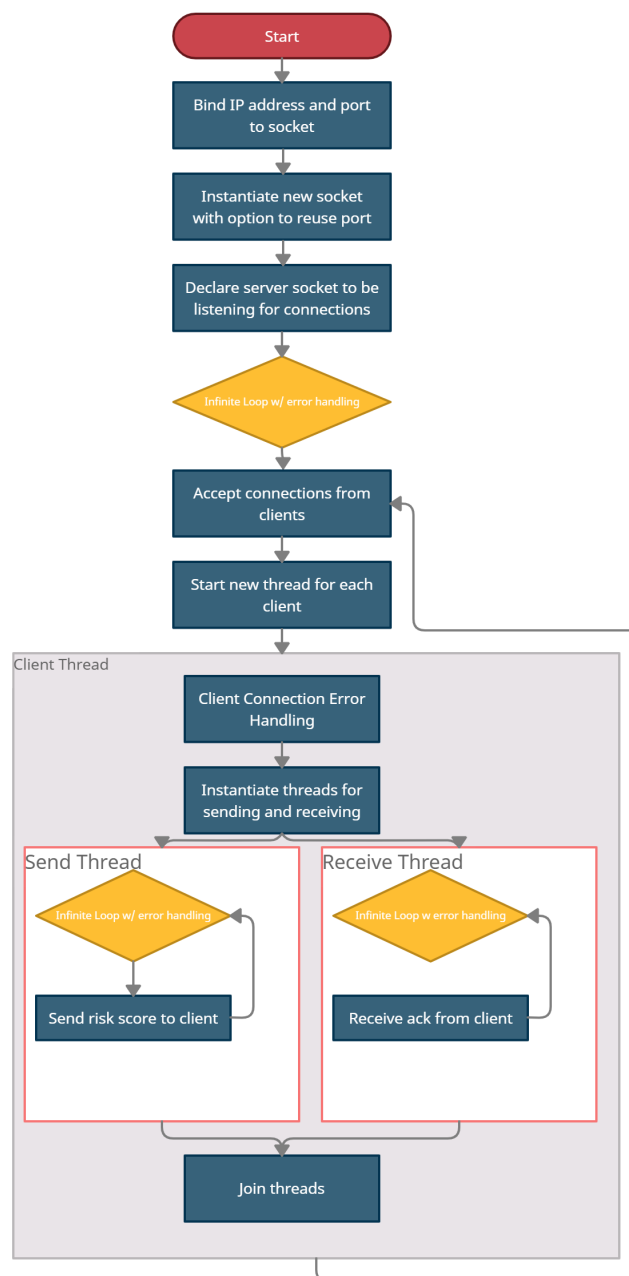
### 4 Plans for the Remainder of Semester

The following remainder of the semester will include further app development, completing a server scheme, and having a scalable, functioning, complete system. The app development will include evolving the user interface of the app. This will include the alert system, heart-rate monitor, and the GPS location linked from the goggles. The mobile application in development will be acting as a digital twin for those involved in the workzone; wherein, the app will aggregate data that has been communicated from the server and other clients. Figure 5 below shows an example of the various functionalities and UI involved with the mobile application.



Figure 5: Application Example

The server scheme will be implemented varying from the single-thread approach that the team has used to measure latency, to a multithreaded, or potentially nested multithreading approach to ensure concurrent message transmission to clients. The multithreading approach should lend greater feasibility to implement connection, data relay, and other error handling for any potential miscommunication within the server. With implementation of said error handling, the server can deliver messages to clients fluidly. Figure 6 is a theorized implementation of a multithreaded server with a send and receive thread nested within the client thread. Ideally, this implementation will lend itself to more sophisticated, inclusive error handling and will be an implementation the team seeks to complete to reach the objective of the project.



**Figure 6: Theorized Multithreaded Server Scheme Option 2**

## **5 Communication with Faculty Mentor and Supporter**

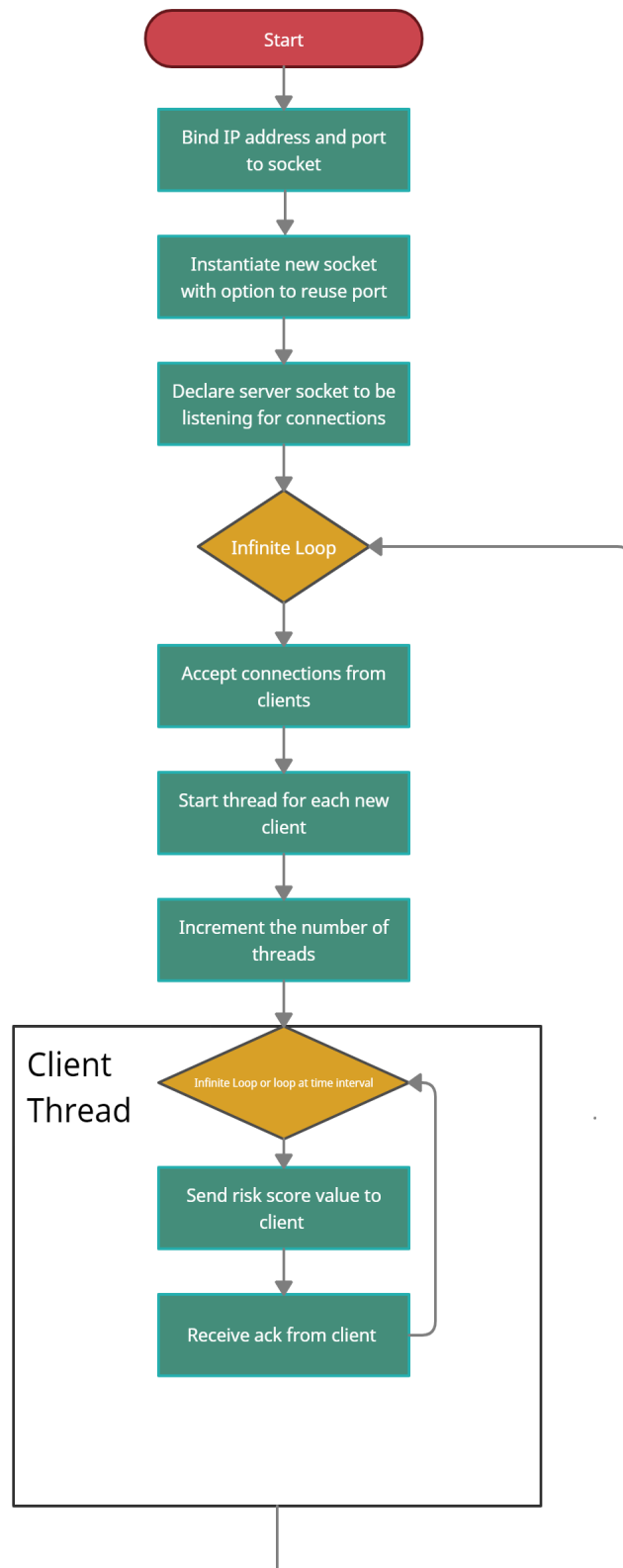
The team is in biweekly communication with the faculty mentor, Dr. Tabkhi, by means of Google Meet. Similarly, the team is meeting with Sepehr Sabeti on a weekly basis at minimum to discuss progress. The team works both independently and collaboratively daily to ensure proper progression to deliverable goals of the project.

## **6 References**

1. Jennings, Nathan. "Socket Programming in Python (Guide)." Real Python. Real Python, September 21, 2020. <https://realpython.com/python-sockets/>.
2. Nicholas, Jennifer. Sending and Receiving Data with Sockets in android, April 16, 2019. <https://www.tutorialspoint.com/sending-and-receiving-data-with-sockets-in-android/>.



## 7 Appendices



**Figure 1: Multi-threaded Server Scheme Option 1**

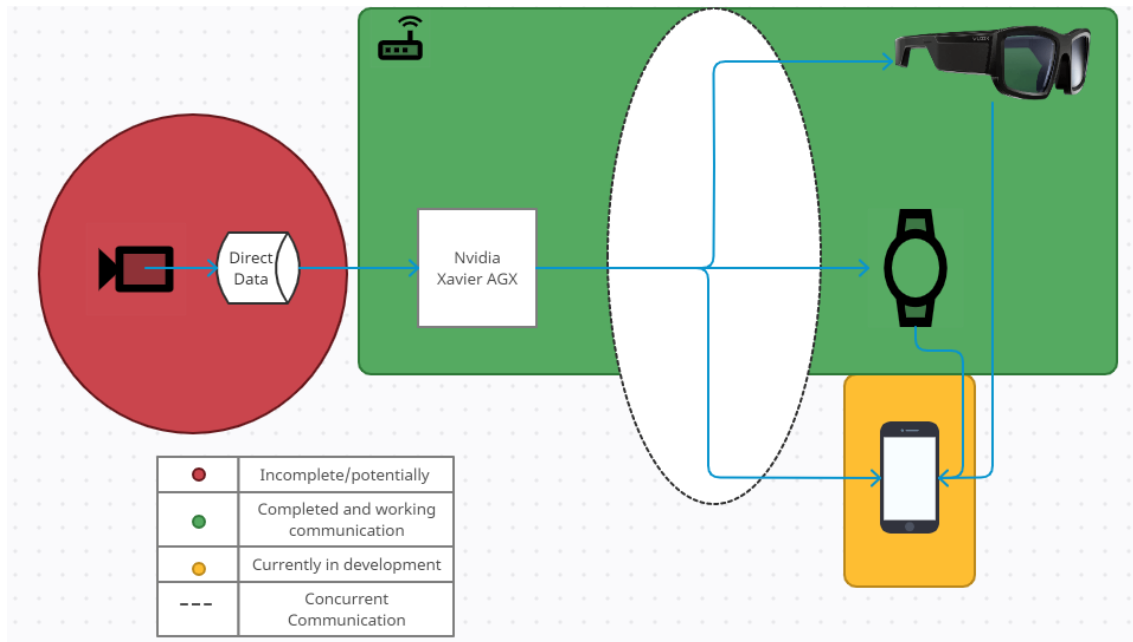


Figure 2: Server Communication Scheme 1

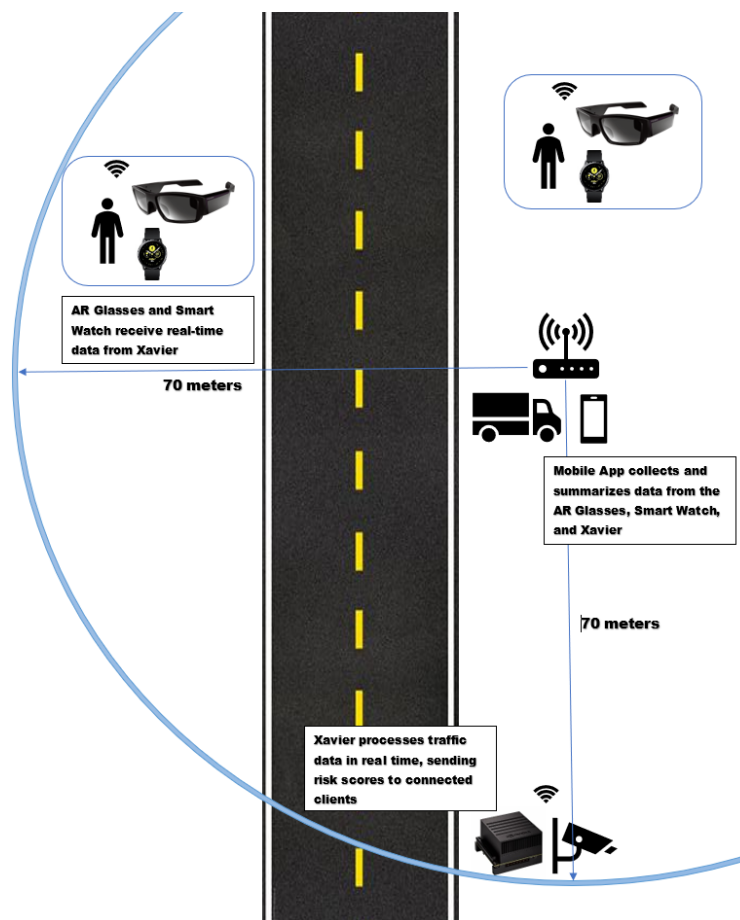
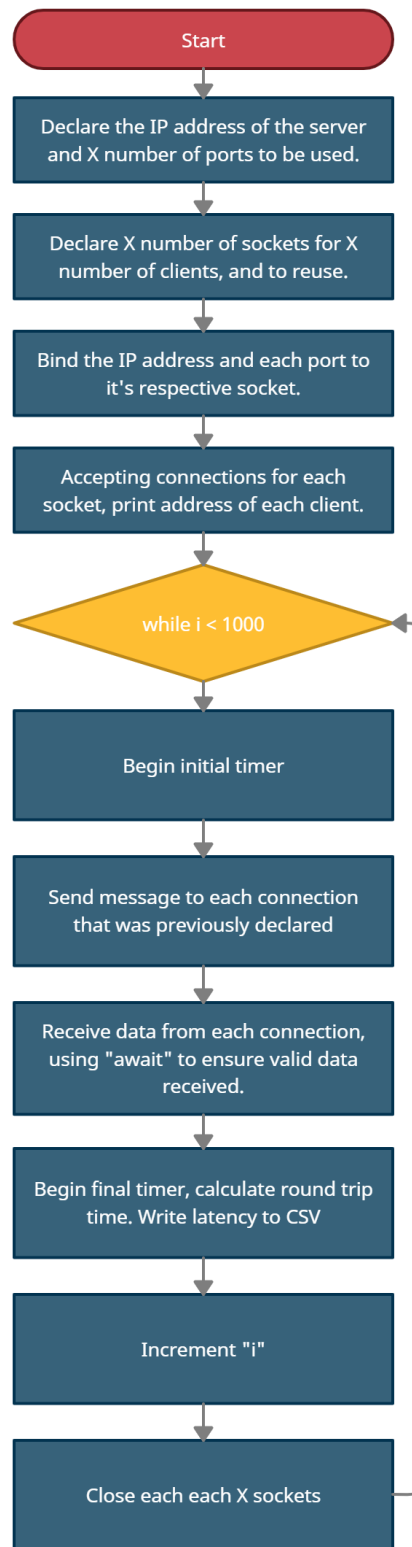


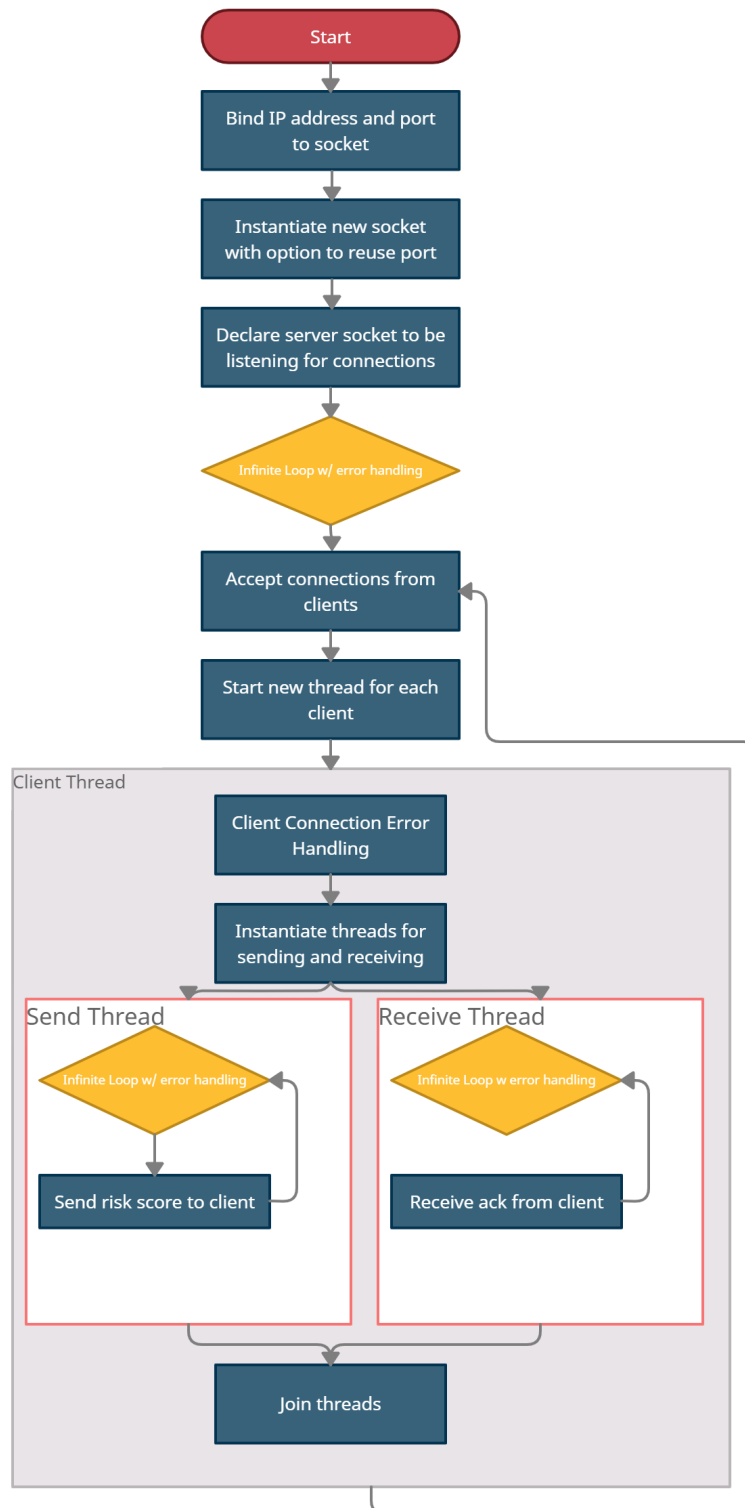
Figure 3: System Overhead



**Figure 4: Single-Thread Server Latency Testing Scheme**



**Figure 5: Application Example**



**Figure 6: Theorized Multithreaded Server Scheme Option 2**

Project UNCC_WORK SD2	85.33 days	Wed 1/20/21	Fri 5/7/21			2	70 hrs	239
Project Management	85.33 days	Wed 1/20/21	Fri 5/7/21			2.1	10 hrs	241
Revised Final Design Package	0.13 days?	Mon 2/1/21	Mon 2/1/21		Damian Hupka,Duncan Tennant,Nathan Pecoraro, William Clampett, Zach Zaleski	DOCUMENT - ADMIN	2 hrs	248
Project Plan	85.33 days	Wed 1/20/21	Fri 5/7/21			PLAN	4 hrs	242
Initial Project Plan Updating	0.33 days?	Wed 1/20/21	Wed 1/20/21		Damian Hupka	PLAN	1 hr	240
Updating Project Plan	0.33 days?	Mon 2/8/21	Mon 2/8/21		Damian Hupka	PLAN	1 hr	263
Updating Project Plan	0.33 days?	Thu 2/25/21	Thu 2/25/21		Damian Hupka	PLAN	1 hr	283
Updating Project Plan	0.33 days?	Mon 3/1/21	Mon 3/1/21		Damian Hupka	PLAN	1 hr	284
Timesheets	85.33 days	Wed 1/20/21	Fri 5/7/21			2.1.3	2 hrs	243
Timesheet #1	0.07 days?	Mon 2/8/21	Mon 2/8/21		Damian Hupka,Duncan Tennant,Nathan Pecoraro, William Clampett,Zach Zaleski	DOCUMENT - ADMIN	1 hr	244
Timesheet #2	0.07 days?	Mon 3/1/21	Mon 3/1/21		Damian Hupka,Duncan Tennant,Nathan Pecoraro, William Clampett,Zach Zaleski	DOCUMENT - ADMIN	1 hr	282
Progress Reports	85.33 days	Wed 1/20/21	Fri 5/7/21			2.1.4	2 hrs	245
Progress Report #1	0.13 days?	Mon 3/1/21	Mon 3/1/21		Damian Hupka,Duncan Tennant,Nathan Pecoraro, William Clampett,Zach Zaleski	DOCUMENT - ADMIN	2 hrs	246

Figure 7: Project Plan Gantt Chart

Project Status Review Presentation (PSR)	40.33 days	Wed 1/20/21	Fri 3/5/21			DESIGN	9 hrs	249
PSR Presentation Preparation	0.27 days?	Thu 2/25/21	Thu 2/25/21		Damian Hupka,Duncan Tennant,Nathan Pecoraro, William Clampett, Zach Zaleski	DESIGN	4 hrs	250
Initial PSR Meeting	0.2 days?	Fri 2/26/21	Fri 2/26/21		Damian Hupka[33%],Duncan Tennant[33%], Nathan Pecoraro[33%], William Clampett[33%],Zach	DESIGN	1 hr	285
Various Schematic Design	0.2 days?	Mon 3/1/21	Mon 3/1/21		Damian Hupka,Duncan Tennant,Nathan Pecoraro, William Clampett, Zach Zaleski	DESIGN	3 hrs	287
Re-do PSR meeting	0.07 days?	Fri 3/5/21	Fri 3/5/21		Damian Hupka,Duncan Tennant,Nathan Pecoraro, William Clampett,Zach Zaleski	DESIGN	1 hr	286

Figure 8: Project Plan Gantt Chart Continued

4 Lab Meetings, Design, and Prototyping	85.33 days	Wed 1/20/21	Fri 5/7/21			2.5	46 hrs	257
Establishing Github Repository and Flashing New Desktop	0.33 days?	Mon 2/8/21	Mon 2/8/21		Damian Hupka,Nathan Pecoraro	DESIGN	2 hrs	258
Application Development Research	0.5 days?	Tue 2/2/21	Tue 2/2/21		Duncan Tennant[67%],William Clampett[67%]	DESIGN	2 hrs	266
Application "Stories" trimming	0.2 days?	Mon 2/1/21	Mon 2/1/21		Damian Hupka[67%],Duncan Tennant[67%],Nathan Pecoraro[67%],William Clampett[67%],Zach Zaleski[67%]	DESIGN	2 hrs	264
Multithreading Implementation Research	1 day?	Tue 2/9/21	Tue 2/9/21		Zach Zaleski[83%]	RESEARCH	2.5 hrs	267
Multi-socket code configuration	0.33 days?	Wed 2/10/21	Wed 2/10/21		Damian Hupka,Duncan Tennant,Nathan Pecoraro,Zach Zaleski	DESIGN	4 hrs	273
End-User Application Development	1 day?	Wed 1/20/21	Wed 1/20/21		William Clampett	DESIGN	3 hrs	274
End-User Application Homepage	1 day?	Wed 2/10/21	Wed 2/10/21		Duncan Tennant	DESIGN	3 hrs	269
End-User Application Development	1 day?	Thu 2/11/21	Thu 2/11/21		William Clampett	DESIGN	3 hrs	272
Tizen Development and End-User Application Development	0.28 days?	Thu 2/11/21	Thu 2/11/21		Damian Hupka,Nathan Pecoraro,Zach Zaleski	DESIGN	2.5 hrs	271
2 Socket Server, tizen Development and End-User Application Development	0.61 days?	Fri 2/12/21	Fri 2/12/21		Damian Hupka,Nathan Pecoraro,Zach Zaleski	DESIGN	5.5 hrs	268

**Figure 9: Project Plan Gantt Chart Continued**

Outdoor Latency Testing (2 socket)	0.33 days?	Wed 2/17/21	Wed 2/17/21		Damian Hupka,Nathan Pecoraro,Zach Zaleski	DESIGN	3 hrs	279
Threaded Server Testing	0.33 days?	Sat 2/20/21	Sat 2/20/21		Damian Hupka,Nathan Pecoraro,Zach Zaleski	DESIGN	3 hrs	278
Testing watch latency and more clients	0.33 days?	Wed 2/24/21	Wed 2/24/21		Damian Hupka,Nathan Pecoraro,Zach Zaleski	DESIGN	3 hrs	277
Multi-Client Latency Testing	0.44 days?	Thu 2/25/21	Thu 2/25/21		Damian Hupka,Nathan Pecoraro,William Clampett	DESIGN	4 hrs	276
App Redesign	0.83 days?	Sun 2/28/21	Sun 2/28/21		Duncan Tennant	DESIGN	2.5 hrs	289
App. Dev. Discussion with graduate mentor	0.33 days?	Mon 3/1/21	Mon 3/1/21		Duncan Tennant	DESIGN	1 hr	288
<b>4 Weekly Meetings</b>	<b>84.33 days</b>	<b>Thu 1/21/21</b>	<b>Fri 5/7/21</b>			<b>DESIGN</b>	<b>5 hrs</b>	<b>259</b>
Weekly Meeting with Supporter/Grad Mentor	0.2 days?	Thu 1/21/21	Thu 1/21/21		Damian Hupka[33%], Duncan Tennant[33%], Nathan Pecoraro[33%], William Clampett[33%], Zach Zaleski[33%]	DESIGN	1 hr	260
Weekly Meeting with Supporter/Grad Mentor	0.2 days?	Fri 1/29/21	Fri 1/29/21		Damian Hupka[33%], Duncan Tennant[33%], Nathan Pecoraro[33%], William Clampett[33%], Zach Zaleski[33%]	DESIGN	1 hr	261
Weekly Meeting with Supporter/Grad Mentor	0.2 days?	Fri 2/5/21	Fri 2/5/21		Damian Hupka[33%], Duncan Tennant[33%], Nathan Pecoraro[33%], William Clampett[33%], Zach Zaleski[33%]	DESIGN	1 hr	262
Weekly Meeting with Supporter/Grad Mentor	0.2 days?	Fri 2/12/21	Fri 2/12/21		Damian Hupka[33%], Duncan Tennant[33%], Nathan Pecoraro[33%], William Clampett[33%], Zach Zaleski[33%]	DESIGN	1 hr	280
Weekly Meeting with Supporter/Grad Mentor	0.07 days?	Fri 2/19/21	Fri 2/19/21		Damian Hupka,Duncan Tennant,Nathan Pecoraro, William Clampett, Zach Zaleski	DESIGN	1 hr	281

**Figure 9: Project Plan Gantt Chart Continued**