EE/CprE/SE 491 WEEKLY REPORT 3

2/5 – 2/12

Group number: 12

Project title: Application Exploration of 5G-and-Beyond Wireless Systems and Rural Broadband

Client &/Advisor: Hongwei Zhang

Team Members/Role:

Caleb Kitzelman - Undefined
Cristofer Espinoza - Undefined
Andrew French - Undefined
Jake Roskopf - Undefined
Samuel Rettig - Undefined
Vibhu Dhavala – Undefined

Weekly Summary

This week the team had their bi-weekly meeting with Dr. Hongwei on Monday February 13th in Durham 91. We also had a follow-up meeting and a check-in meeting as a team via Discord on February 15th and February 19th. In our meeting with Dr. Hongwei, we came prepared with questions that were collectively determined in a meeting from the week prior when we had tried to solidify what our application for 5G would be. During this meeting we also discussed potential projects that we had thought of as well as lingering questions regarding the research documents he had provided to catch up on mobile networks. It was determined that our project would need to utilize the ARA network to have an educational benefit to the undergraduate and high school community or contribute to agricultural and rural communities. The main applications Dr. Hongwei wanted us to focus on revolved around extended reality (XR), automation, and/or drones. Using this information, we researched such applications for our meeting on the 15th. It was at this meeting that the team then decided that it would be best to first research current issues in agricultural and rural communities first instead of trying to create something and then look for what it can solve.

Past Week Accomplishments

Samuel Rettig: I continued my research on the documents provided by Dr. Hongwei. In order to reinforce my understanding of the ideas and technologies underpinning 5G, I decided to re-read the book *5G Mobile Networks: A Systems Approach*. In addition to this, I have begun to dig into the internal resources provided to us. All this research has taken parallel to looking up agricultural problems that have no current solution, as well as ones that could be improved with the utilization of 5G.

Cristofer Espinoza: I continued research on the documents Dr Hongwei had provided, starting *Computer Networks: A Systems Approach*. As I had learned in *5G Mobile Networks: A Systems Approach*, if not the UE-to-BS interaction, the system is very much software oriented with techniques like network splicing, UE-transfers BS-to-BS and communication from the RAN to Mobile Core then the internet. This new text goes deeper into the concepts such as protocols and packet forwarding that take place within this software-oriented system. I also researched possible applications for 5G that would be able to utilize the ARA network and impact agricultural communities like using ML for weed or insect identification and 5G livestock collars. Since our last meeting, we have shifted to researching issues within the communities of focus. Therefore, I had started to glance over concepts highlighted in *Crop Production and Global Environmental Issues*.

Jake Roskopf: This week I spent a lot of time diving into the more agriculturally focused applications of 5G. Although there are many applications we can work on, finding one that is actually desired by farmers has been a more difficult task. Some ideas that were found were using XR to remotely check on and interreact with greenhouses to take care of crops, remote tractor control, and some drone applications.

Vibhu Dhavala: This week I looked further into the 5G projects we narrowed our selection down to. Specifically, I read about robotics and the ways 5G could be used to provide automation to robotics in rural communities. Along with automation of machines I researched the software behind automating data collection and processing using sensors, either attached to a drone or individually

Caleb Kitzelman: I researched into potential problems in agriculture or rural communities that can be solved via 5G applications. Also looking into current applications and procedures that could be improved or modified by the use of 5G. Kept a focus of ways to improve or better things by utilizing 5G technology.

Andrew: I researched potential project ideas that are agriculturally based and looked into their feasibility. Specifically, I investigated how drones might be used to increase farm efficiency and diagnose areas on the farm that need attention.

Team Research Links:
Potential Projects
- https://iowastate.sharepoint.com/:w:/r/sites/ECpESeniorDesign491/_layouts/15/Doc.aspx?sourcedoc=%7B32085F2A-CF08-4133-99DC-1EEC5FA6905E%7D&file=Potential%20Projects.docx&action=default&mobileredirect=truen

Issues in Agriculture and Rural Communities

- https://iowastate.sharepoint.com/:w:/r/sites/ECpESeniorDesign491/_layouts/15/Doc.aspx?sourcedoc=%7B952712A4-918E-4ED7-9B57-A94EF0FC7186%7D&file=Issues%20in%20Agricultural%20and%20Rural%20Communities.docx&action=default&mobileredirect=true

References (Do Not Distribute)

- https://iowastate.sharepoint.com/:w:/r/sites/ECpESeniorDesign491/_layouts/15/Doc.aspx?sourcedoc=%7B5E1C9F4E-09A1-4FAB-B24C-500095F6D677%7D&file=References.docx&action=default&mobileredirect=true

Individual Contributions

NAME	Individual Contributions	Hours this week	HOURS cumulative
Jake	Reading and research	4	10
Samuel	Research	4	11
Cristofer	Continued research on computer & mobile networks, potential ideas, and issues within ag communities.	5	11
Caleb	Looked into current problems and techniques in the ag and rural communities	3	10
Andrew	Researched potential ideas and their feasibility.	3	17
Vibhu			

Plans For the Upcoming Week

Samuel Rettig: Continuing to read and research potential avenues for our project, as well as reinforce my current understanding of 5G.

Cristofer Espinoza: I plan to continue reading *Computer Networks: A Systems Approach* as well as research issues highlighted in *Crop Production and Global Environmental Issues*. The direction for research on issues is subject to change after our meeting where we will discuss issues that all of us have researched in the community of focus.

Jake Roskopf: I plan on getting some project idea proposals ready as well as continuing researching basic 5G system and networking applications.

Vibhu Dhavala: I plan to continue researching and brainstorming ideas for improving rural communities with 5G. I also plan to focus more on the software required to make 5G work with these aplications.

Caleb Kitzelman: Continue reading given resources in free time. Find more applications in the rural and ag communities that could be improved using 5G technology. I also plan to investigate network connectivity.

Andrew French: I plan to look more into the feasibility of our potential projects, the resources that are available to us, and what we would be able to create ourselves.