Monthly Report for ECE FYP/FYT

Project Code:	MR02a-22	Supervisor(s):	Prof. Ross Murch
Project Title:	**IoT-based Radio Tomographic Imaging System**		
Group Member(s):	1) Lee Kwun Yin 2) Pranav Gupta		
Reporting Period:	Report #1 ✔Oct (Fall) Report #2 ☐ Nov (Fall) Report #3 ☐ Feb (Spring) (please attach Reports #1-2 to the Progress Report to be submitted in Jan) (please attach Reports #3 to the Final Report to be submitted in Apr)		
Progress Report: • List the work completed in this reporting period. • Identify the major difficulties encountered. • Comment on the overall progress.	For the hardware setup part, we have finished some coding to measure the received signal strength (RSSI) of the surrounding WiFi Access Points (AP). We have also implemented a simple server and client model for communications between two ESP32 development boards. However, the connection between the two boards is not stable. After discussing with Prof. Murch and our TAs, we believe that this may be due to the difference in manufacturers of the two boards. There are several potential causes, such as the possible instability in power supply (the micro-USB port is delicate), the past use of the boards (they may wear out over time and use), and the difference in WiFi modules. We have already ordered 10 new Sparkfun boards from Digikey and hope that this issue will not persist with the new boards. For the image reconstruction part, the code for solving the inverse problem ($x = W^{-1}y$) has already been completed. This model simply uses the signal strength (RSSI) to represent only the voxels in the line of sight between two wireless transceivers - scattering is ignored in this iteration. However, as an ill-posed problem, we need to include some regularization (e.g. Tikhonov Regularization) to limit the possible number of solutions to every pixel in the image and ultimately, produce an accurate image. This is a great opportunity to not only learn how this regularization method works, but also to experiment with various others methods to improve the image quality. Our current progress is satisfactory as we took our time to properly understand the problem statement and ideate on how we can achieve our proposed goals. We aim to speed up the progress in the next month to compensate for the study time required for our final exams in December. Moreover, our goal is to successfully generate RT images by the next report so that we can explore various novel methods to improve the imaging accuracy and imaging time.		
Future Plan: • Write down the working plan for the next reporting period.	The general plan for November is as follows: Week 1: • Implement the H1 Regularization • Testing the setup with the New Boards (if shipped in time) Week 2: • Test image reconstruction with previous sets of data • Experiment with other Regularization methods • Develop the code for extracting the RSSI on the terminal computer for the image reconstruction data Week 3: • Optimize program to minimize execution time for generating images • Start research on additional methods (such as Channel State Information (CSI)) to provide more data for image reconstruction		

	Week 4: • Create a dataset of RSSI values with known obstacle location. This will be used when using machine learning methods to improve imaging accuracy. • Continue research on CSI and other hardware methods to improve imaging While it is possible that we may have to shuffle these weekly goals according to our schedules, ultimately, we aim to have a functioning imaging system ready by November.
Group Representative's Signature:	[redacted] (Pranav)

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