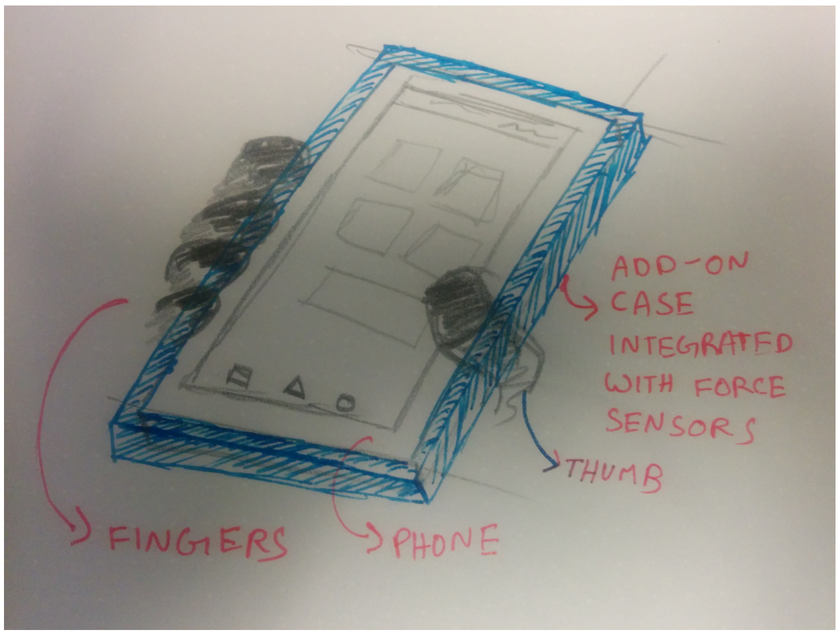
Reach: Enabling Single-Handed Operation on Large Screen Mobile Devices

There is an unprecedented rise in popularity of large screen mobile phones with scree sizes greater than 5 inches. The benefits of larger screens and a larger battery life being the primary drivers of user adoption. However, these larger devices are difficult-if not impossible-to use with one hand and pose usability issues for demographics with smaller hands (especially women). The existing solutions to this include on screen functions that the user can activate to bring the screen content closer to the user's thumb. These methods however, introduce extra steps in the users interaction with the device and can be cumbersome. Here, we propose "*Project Reach*".



By placing force sensors all around the rim of the phone, we can sense how the user is holding the phone and when they are straining their thumb to reach a corner. Using this information we can shift the UI closer to the operating finger. The force sensors can also be used to interact with the phone in other scenarios, for example, swiping on the sides of the phone could scroll pages, or increase/decrees volume etc. In this project, we intend to build the hardware, formulate UI design changes, and do some basic user testing to validate our ideas.

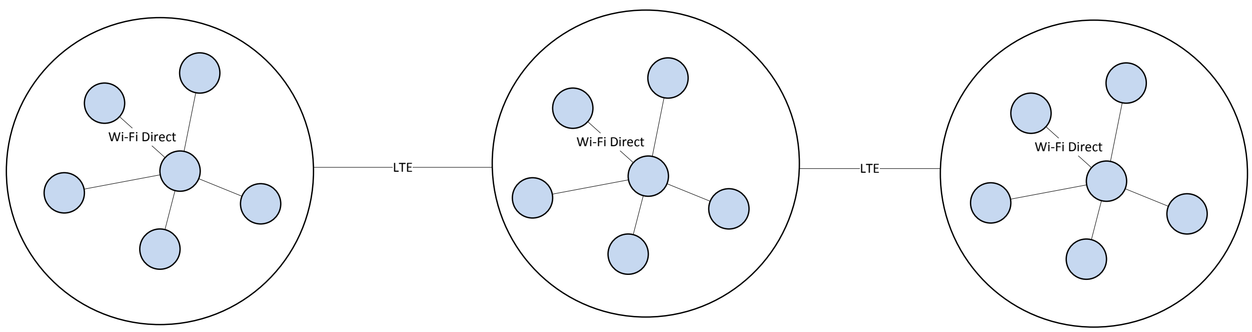
We have evaluated the work required to finish this project and are confident that we can finish it in the duration of the course.

References.

1. Taylor, Brandon T., and V. Michael Bove. "The bar of soap: a grasp recognition system implemented in a multi-functional handheld device." CHI'08 Extended Abstracts on Human Factors in Computing Systems. ACM, 2008.
2. Kim, Kee-Eung, et al. "Hand grip pattern recognition for mobile user interfaces."Proceedings of the National Conference on Artificial Intelligence. Vol. 21. No. 2. Menlo Park, CA; Cambridge, MA; London; AAAI Press; MIT Press; 1999, 2006.

Project Proposal: Proximity aware mesh networks

Mobile devices today usually have at least two wireless communication chips (LTE and Wi-Fi). Wi-Fi Direct, which enables devices to direct connect to each other, has emerged as a widely embraced standard. It is found in smartphones as well as many internet connected devices. This project proposes implementing and studying a system that supports communication between nodes [1] that are located within close proximity to each other, along with clusters of nodes that are located far away from each other so that they cannot connect via Wi-Fi direct.



An example where this might be desirable is to track a convoy of vehicles. You might want a set of vehicles to stay close to each other (so connect via Wi-Fi Direct), while maintaining separate convoys to stay apart from each other. The benefit is that critical information can be quickly passed from one convoy to the other, and then disseminated within each convoy on an ad-hoc basis, thereby reducing overhead of the central controller.

This can also be extended to the internet of things or wireless sensors [2], where each device can stay in a low power mode and batch all of its updates until the user walks into the proximity zone. At that point, information could be quickly sent to the user's device, which can then decide whether the information needs to be uploaded to the cloud for further processing, or if it can take an action right away.

References.

1. Jung, Ahn and Ko, "Designing Content-Centric Multi-hop Networking over Wi-Fi Direct on Smartphones", Wireless Communications and Networking Conference.
2. Abbasi, Ameer Ahmed, and Mohamed Younis. "A survey on clustering algorithms for wireless sensor networks." Computer communications 30.14 (2007): 2826-2841.

Dynamic Graph Analytics

Motivation. Graphs have become increasingly important to represent highly connected and unstructured data with applications in social networks, the Web, biology, and business processes. The ever growing scale of such graph data has driven the development of many large-scale systems specialized for graph analytics [1] (*e.g.,* Pregel, GraphLab, and GraphX). Unlike general large-scale data analysis systems, these new systems execute iterative graph algorithms more efficiently by limiting the types of computation and by introducing new techniques to partition and distribute the graph over clusters. However, these systems mostly concern about applying graph analytics to static graphs whereas in real world, graphs are subject to discrete changes by sequence of updates either by insertion or deletion of vertices and edges. This evolving nature of real graphs makes the traditional graph analytics, which assumes that the graph is fixed upon running an algorithm, is unsufficient. In this work, we explore the possibility of pushing dynamic analytics into these systems by making them aware of changes in the graph.

References.

1. Khan, Arijit, and Sameh Elnikety. "Systems for Big-Graphs." Proceedings of the VLDB 2014.
2. Demetrescu, Camil, et al. "Dynamic graph algorithms." Algorithms and theory of computation handbook 2010.