**Together**

A wearable technology for group management

**Project Synopsis**

Motivation

* Network issues with mobiles restricts communication
* Current offline systems can track location using static gateways that need to be manually placed and configured for every location
* Online systems use a combination of GPS chips, along with some push-pull protocol(eg. MQTT) to centralize the data gathered from all objects of interest to make a decision.
* Ease of use
* Our goal is to design a standalone system that is not reliant on internet connectivity to check relative distance between objects of interest.

Problem Statement

Designing a band that will enable a coordinator(master band) to track members in their group.

Assumptions

* Packages required to implement a Bluetooth mesh framework will be available, or it will be possible to implement it on our own.
* Power consumption of device will be low, even while broadcasting information.
* Device and hardware used can eventually be miniaturized into a band

Constraints

* Environmental factors- for example, rain- could weaken signal strength
* While trying to lower costs by using low-end devices, there is a compromise on the memory available on the device.

Method

* Identification of hardware devices to be used by comparing WiFi and Bluetooth based on the battery consumption and range offered.
* Building a prototype using the ESP32 along with LEDs on a breadboard, to test simple transmission and receiving of signals.
* Building a basic master-slave system with broadcast communication mechanism.
* Devising a pairing mechanism to monitor other bands.
* Dynamic environment variable calculation- to calculate the distance between the master band and other devices
* Integrating a display to show results, using either a basic seven-segment display or OLED
* Testing the various modes the devices can be operated as in the mesh framework, as well as the functioning of the mesh network.
* Combining both mesh and broadcast methods of communication.
* Devising a method to set the maximum distance in which tracking should be enabled dynamically.
* Devising a method by which other bands can ping a band that has gone out of the master band’s range, using the mesh framework.
* For future scope, we may also implement leader election algorithms like bully algorithm or ring algorithm as a fail-safe for the master band.

Expected Results

Cost-effective, durable bands that should be able to communicate with the designated master band, while also keeping power consumption as low as possible to ensure longer battery life.

Related Work

Chen et al.[1] built a mobile application called LocBLE to enable users to estimate the location of nearby Bluetooth low energy(BLE) beacons.

Lee et al.[2] proposed a new localization algorithm that enhances the accuracy of RSSI value, using the Gaussian filter. Experiments conducted indoors showed that this algorithm was more effective than the commonly used Kalman Filter algorithm.

Hoshi et al.[3] proposed dynamic and optimal beacon selection methods to minimize the affectations of wireless signal shielding by static and movable objects in an indoor environment.

References

[1] Dongyao Chen, Kang G Shin, Yurong Jiang, Kyu-Han Kim. Location and Tracking BLE Beacons with Smartphones. In *CoNEXT ‘17 Proceedings of the 13th International Conference on emerging Networking EXperiments and Technologies.*

[2] Jea-Gu Lee, Byung-Kwan Kim, Sung-Bong Jang, Seung-Ho Yeon and Young Woong Ko. Accuracy Enhancement of RSSI-based Distance Estimation by Applying Gaussian Filter. In *Indian Journal of Science and Technology, Vol. 9(20)*

[3] Hisashi Hoshi, Hiroki Ishizuka, Arei Kobayashi, Atsunori Minamikawa. An indoor location estimation using BLE beacons considering movable obstructions. In *2017 Tenth International Conference on Mobile Computing and Ubiquitous Network(ICMU)*