



# Frisbee Tracking System

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## BACKGROUND

### What is Disc Golf?

Frisbee golf is a newly growing hobby amongst many people especially college students. One reason to its exponential growth recently is the simplicity of the game. <sup>1</sup> Like golf, your goal is to get your disc to the hole (Figure 1) in the fewest number of throws. It is rather easy to jump into the hobby as the “clubs” are inexpensive, there isn’t much technique to learn, it promote social interaction, and most fields require no green fees. One idea comes to mind, how do we make this even better?



Credit: OutsidePursuits.com

### The Premise of the Project

One aspect of the game that people can’t seem to get enough of (not by choice) is losing their disc. For those who encounter this problem quite frequently can agree that the game starts to lose its appeal if you are spending more time searching than participating in the game.

Figure 2



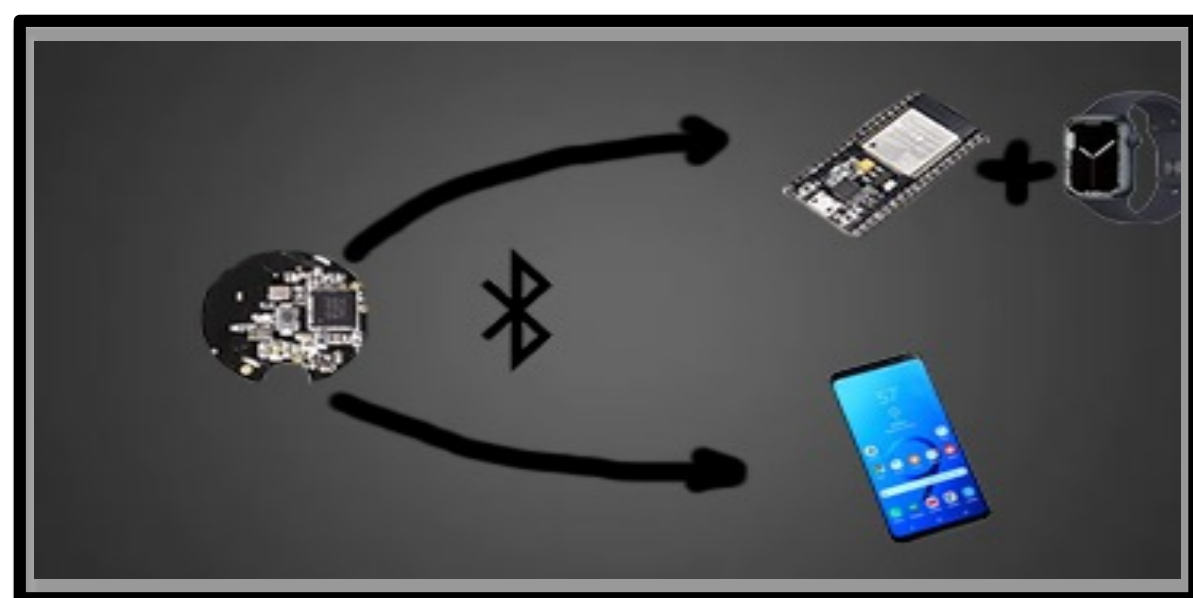
Credit: Innovadiscs.com

Hence, we wanted to shorten this barrier of walking around aimlessly and get players back in the zone. With this idea, we also don’t want to introduce anymore hinderances and end up causing more harm than good.

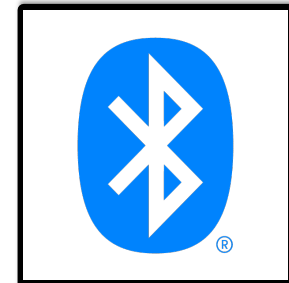
## PROPOSED SOLUTION

Thus, our proposed solution is to attach an aerodynamic, lightweight Bluetooth beacon to a frisbee and having the produced signal being ran through an ESP32 microcontroller-based watch and phone application (Figure 3). Both of the receiving systems will take in the signal, derive a distance variable from the unit, and display an input to the user indicating how far he/she is away from the frisbee. The display used follows a “hot and cold” type concept as well as directly shows the distance (in meters) away. Further demonstration of this idea is shown in the QR Code.

Figure 3



## SYSTEM DESIGN



**BLE 4.0 transmission**  
Bluetooth Low Energy 4.0 (BLE) provides an energy efficient data transfer.

Credit: Bluetooth.com

### PLA Plastic Housing



Credit: Ty's Phone

Both the watch and tracking module come equipped with a PLA plastic casing to provide protection from impacts, and mild weather-proofing. The tracking module housing attaches the module to a disc.

### Adjustable Strap

The watch has an adjustable fabric strap secured with a pin.

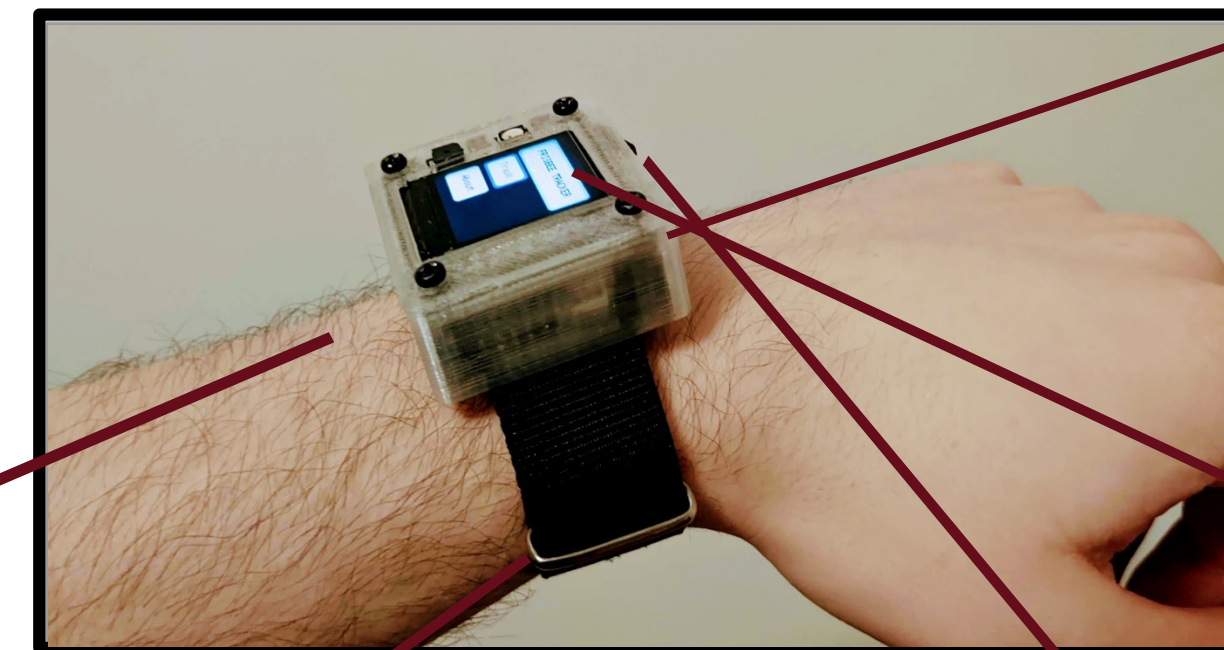
### Loading Screen

This is the first thing the user sees upon opening the smartphone application, and shows the application theme

### Main Menu

The main menu gives the user several options upon loading completion. First, the option to use the locate function,, then a Bluetooth management page, a settings page to change from metric to imperial units, and an about page.

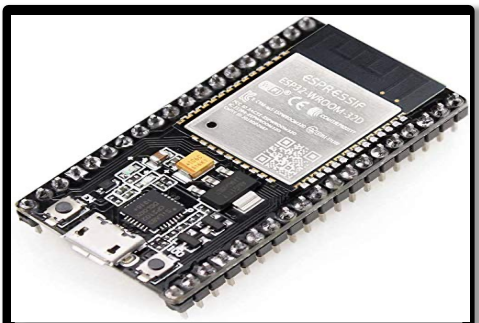
Figure 4



Smartwatch

### ESP32 Microcontroller

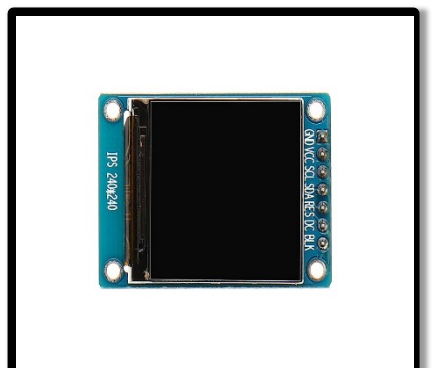
The ESP32 provides a flexible, powerful, and efficient platform for watch configuration. It allows seamless Bluetooth communication between the tracking module and smart-watch.



Credit: Amazon.com

### TFT Display

The watch comes equipped with a 1.54” TFT Color display that allows the user to navigate through menus, and to view the data being received by the watch. The display protocol is shown in Figure 4.



Credit: Makerfabs.com

### Scroll Wheel + Button

The addition of a scroll wheel with an integrated button allows the user to interact with menu options. The power button allows the user to easily shut off the device when no longer in use.

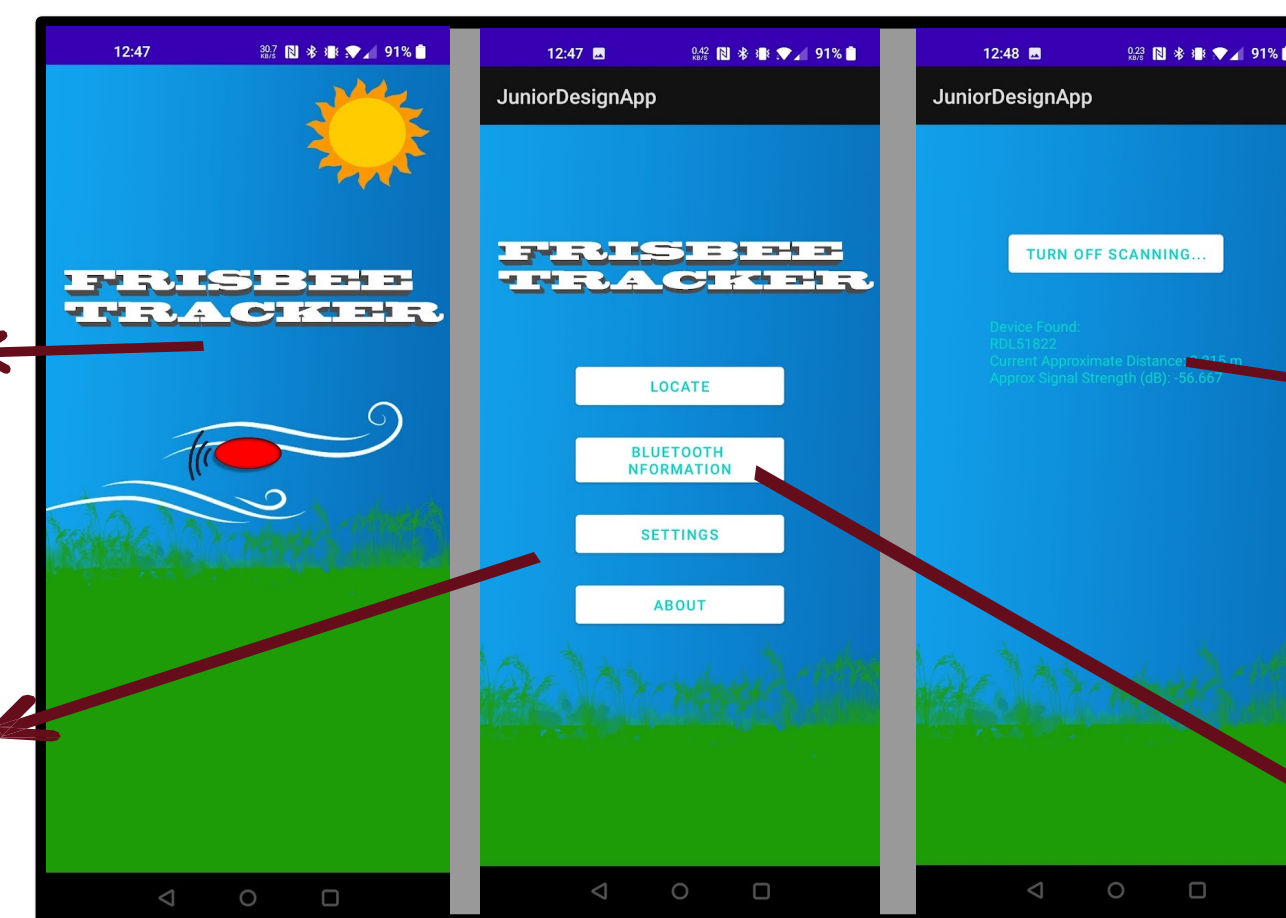
### Locate Page

This page contains the essential functionality of the application. It allows the user to track whichever beacon is within range, and displays an approximate distance, and signal strength.

### Bluetooth Management Page

This page allows the user to configure their Bluetooth options. It gives the opportunity to toggle the Bluetooth radio on/off, pair a new device, and to show a list of paired devices with their corresponding MAC addresses. <sup>2</sup>

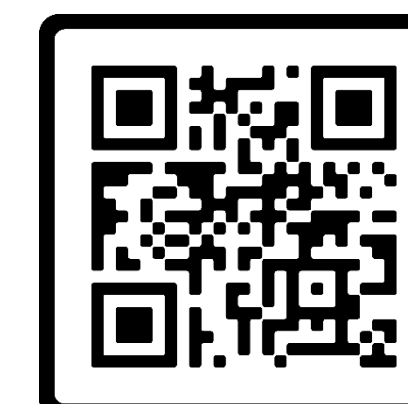
Figure 5



Smartphone Application

## FUTURE DIRECTION

- Combine both tracking environments into a single system (an Apple Watch application)
- Design our own set of iBeacons with simplified distinguishable traits
- Implement a removability future to the PLA beacon housing for easier battery removal.
- Reduce delay in signal processing portion of program (faster updates)



## REFERENCES

- <sup>1</sup> R. Flanagan. “Why the popularity of disc golf is on the rise”. 2021.  
<sup>2</sup> D. Chen, K. Shin, Y. Jiang, K. Kim. “Locating and tracking BLE beacons with smart phones”. 2017.

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## CONTACT INFORMATION

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