Needs and Requirements Specification for Bluetooth Locator Sticker

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Need Assessment:

There is a need for a way to easily locate a frisbee golf disc. Frisbee golf courses are often contructed in locations with many natural obstacles, such as in forests. Even though the obstructions make the game more challenging, they also provide many hiding places for poorly thrown discs. A disc could be in a tree or hidden under leaves, making the search for the disc tedious and time consuming. Even if one knows the general location of a disc, the leaves and trees greatly increase the search time required to recover it. Consequently, a lot of time can be wasted searching for frisbee discs, rather than playing the sport. It is also possible for a search to be unsuccessful, resulting in the loss of a disc. Taking into consideration the multitude of possible hiding places for a disc, there is a need not only to know the general location of a disc, but also able to pinpoint it when in its vicinity. Disc golf can be played in all weather conditions, so the mechanism used to track the disc needs to be able to operate in different temperatures, as well as be water-resistant. Considering the importance of a disc's weight and dimensions, the tracking apparatus needs to be lightweight and produce minimal interference with the aerodynamics of the disc. The problem of losing discs most often affects the beginner or intermediate disc golf player. With the recent boom in the popularity of disc golf, there is now an abundance of inexperienced players, all of whom would benefit from an easy way to locate discs.

Requirements:

Definitions:

- **Device** – The package containing the Bluetooth transmitter, battery, and speaker, which is able to be attached via an adhesive pad.
- **Target** – Object the user wishes to locate using the device (intended target would be a Frisbee Golf Disc).
- **Application** – Software interface on the user's smartphone to facilitate the registration and location of devices attached to targets.

1. Device
    1.1. Physical Design
        1.1.1. Package Body
            1.1.1.1. Made of plastic or other lightweight material.
            1.1.1.2. Body must cause as little signal attenuation as possible.
            1.1.1.3. Body should be water resistant and protect device from the elements.
            1.1.1.4. Ideal package weight is 1-3 grams.
            1.1.1.5. Package should not interfere with normal usage of target when properly attached.
                1.1.1.5.1. Aerodynamics of disc (intended target) must be minimally affected.
        1.1.2. Package Interface
            1.1.2.1. Access port which enables the user to charge the device's battery.
            1.1.2.2. Button

1.1.2.2.1. Preferably conductive pad to minimize risk accidental triggering from environment.

1.1.2.2.2. Allows user to turn the device on and off.

1.1.2.2.3. Can facilitate registration of device with the application if needed via alternate press method (double-press, long-press, etc.).

1.1.2.3. Status LED

1.1.2.3.1. Capable of relaying the following device state information to the user.

1.1.2.3.1.1. Device is powered off.

1.1.2.3.1.2. Device is powered on.

1.1.2.3.1.3. Device is low on battery power.

1.1.2.3.1.4. Device has some internal error.

1.1.2.3.1.5. Device is communicating with application.

1.1.2.3.1.6. Device has successfully registered with the application.

1.1.3. Adhesive Pad

1.1.3.1. Double-sided pad attached to both device and target.

1.1.3.2. Must be easily removable from both device and target.

1.1.3.3. Minimal residue left on device and target after removal of pad.

1.1.3.4. Pad should be made of disposable materials.

1.1.3.5. Several pads should be packaged with each device and/or made available separately.

1.2. Software Specifications

1.2.1. Modes of Operation

1.2.1.1. While in range of user and communicating with application

1.2.1.1.1. Should remain powered on and active, responding as necessary to input from the application.

1.2.1.1.2. Should indicate that it is in this mode on the status LED defined in (1.1.2.3.1.5).

1.2.1.1.3. Should periodically broadcast its MAC address to allow the application to register it.

1.2.1.1.4. Should trigger the speaker if the application requests it.

1.2.1.2. While out of range of user, or while not recieving input from the application

1.2.1.2.1. Should periodically wake from low power mode to perform the following actions

1.2.1.2.1.1. Broadcast a ping containing its MAC address which the application will listen for

1.2.1.2.1.2. Listen for responses to its ping from the application to transition from the current state to the one described in (1.2.1.1).

1.2.2. State monitoring

1.2.2.1. Device should be able to estimate its total remaining battery live, and reduce frequency of wake cycles while in the mode described in (1.2.1.2.1) to compensate for lack of power.

1.3. Hardware Specifications

1.3.1. Bluetooth Module

1.3.1.1. Should be self contained and easily programmable.

1.3.1.2. Should not require a separate antenna.

1.3.1.3. Should have an effective range of at least 50 metres in environments with minimal interference.

1.3.1.4. Should be able to sleep and wake periodically as described in (1.2.1.2.1).

1.3.2. Speaker

1.3.2.1. Should generate a tone which is clearly audible from around 10 metres away.

1.3.2.2. Should be controlled by the Bluetooth module's processor.

1.3.3. Battery

1.3.3.1. Should be rechargable.

1.3.3.2. Should power the device for several hours while operating in the active state described in (1.2.1.1).

1.3.3.3. Should be charged via the port described in (1.1.2.1).

1.4. Tolerances

1.4.1. Device should operate within any environment typical of a temperate or moderate climate.

1.4.2. Device should be water-resistant if not waterproof.

1.4.3. Device adhesive should remain effective in typical environments when attached to smooth, firm surfaces.

1.4.4. Device should be resilient to physical shock and impact.

2. Application

2.1. User Interface

2.1.1. Device Registration View

2.1.1.1. Should show a list of all devices registered with the application.

2.1.1.2. Devices should have a user-customizable identifier.

2.1.1.3. Should show devices which are unregistered but within communications range of the device upon which the application is running.

2.1.1.4. Should allow the user to add unregistered devices to the registered list.

2.1.2. Device Location View

2.1.2.1. Should be associated with a specific device.

2.1.2.2. Should show that device's identifier somewhere on the screen.

2.1.2.3. Should use a meter to visualise the detected signal strength of the device currently in focus.

2.1.2.4. Once within communications range, a button should appear within the view to allow the user to toggle the speaker on the device which is currently in focus.

2.2. Device Communications

2.2.1. Two-way communications range

2.2.1.1. Application should send a confirmation signal to the device once it has been successfully registered.

2.2.1.2. Application should periodically ping the device to discern if it is still within range.

2.2.1.3. Application should send a toggle signal whenever the user presses the speaker toggle button.

2.2.2. One-way communications range

2.2.2.1. Application should periodically ping the device to see if it has come into range.

2.2.2.2. Application should listen for the device's pings to discern location based on strength

2.2.3. Out of range

2.2.3.1. After a timeout period has elapsed, the application should mark a registered device as “out of range”.

2.2.3.2. If a ping is recieved from a registered device marked “out of range,” it should be marked as “in range,” and its signal strength should be made available to the user to view.

2.3. Platform Compatablility

2.3.1. Should be available for any Bluetooth-enabled Android device through the Google Play store.

2.3.2. Should be available for any Bluetooth-enabled iOS device through the App Store.