Friend Finder: A Wearable Device For Reuniting People

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ABSTRACT

The problem of losing friends on a night out is a common occurrence. Phones often run out of battery, or are unable to find a signal within the nightclub. Even if they are working, friends are reliant on each other to respond saying where they are. In this paper, we present Friend Finder, a wearable device for relocating friends on nights out, designed to be low-power and easy to use. Indoor localisation is a currently unsolved problem, and so we have taken the approach of designing an interface that we believe can form the standard for devices when the technological barriers are removed. Friend Finder serves as a prototype for this interface, to allow us to obtain user feedback and evaluate it in a proper context.

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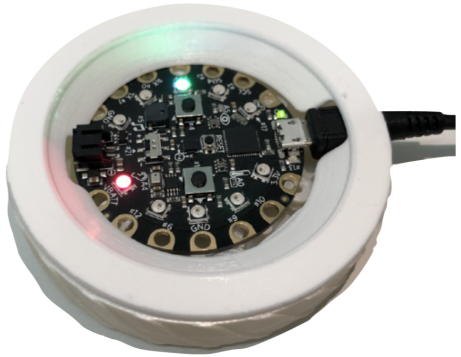

Figure 1: A prototype Friend Finder Device.

CCS CONCEPTS

• **Human-centered computing** → **Interface design prototyping**; **User interface design**; *User centered design*;

KEYWORDS

Localisation; Wearable; Safety

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INTRODUCTION

Nights out at large venues can be a daunting prospect to anyone alone, lost and without phone signal. In a loud, dark and crowded space the reality of finding your friends is often nothing more than blind optimism. We present the interactions for Friend Finder, shown in Figure 1, a small form-factor wearable wrist device that uses indoor localisation to guide you back to your friendship group. At the start of a night out, sync multiple devices and the coloured LED ring will direct you back to your friends whenever you need. The device has two distinct modes, group and person specific. In group mode, the LED ring will display each synced devices as a single, uniquely coloured LED in the direction of their location. In person specific mode, the LED ring will illuminate a varying number of LED's in the direction of a single friend, depending on how far they are from you. As the friend gets closer, more lights are illuminated until the ring is fully lit. In a survey of university students, 75% said it was of high importance to be able to find your friends quickly if alone and 92% said they would use technology to solve this recurring problem. Friend Finder offers a novel solution that no longer requires a two way interaction, simply follow your interactive device back to safety and the comfort of your friends.

WALKTHROUGH

Friend finder enables friends to locate each other on nights out without the need for two way interaction. In order for each device to communicate with each other, at the beginning of the night, all friends sync their devices by bringing them together and holding the sync button. An array of white LEDs will spin during syncing. Once complete, each device will be assigned a unique colour, which will be illuminated fully by the LED ring for 1 second, as shown in Figure 2. If not done so already, the device should then be securely attached to the user's wrist using the straps provided. In the event that a user loses their friends during the night, they should raise their wrist so the device is level and the LED ring is clearly visible in front of them. By default the device is in group mode, with

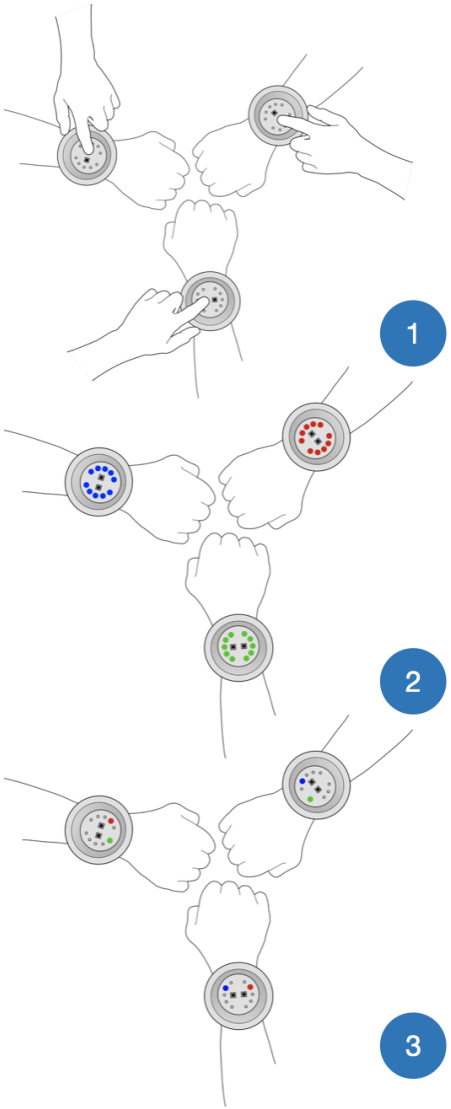

Figure 2: A mockup demonstrating a walk-through of the syncing process for three devices.

a single LED light illuminating for each friend in the direction of their location. These LEDs will guide the user back to their friends. If all of the user's friends are in a group together, a single LED will be illuminated in their direction and will change colour, cycling through the colours of all friends in that direction. The device also offers the ability to find a specific friend. This is achieved by pressing the mode button to cycle through person specific mode until the friend's device's colour is reached. In this mode, the entire LED ring is used to display the direction and distance to that specific friend. As the user moves closer to the friend, more LEDs are illuminated, indicating the distance between devices is decreasing. This process can be repeated throughout the night, at any time and without worry - even if all users have lost each other. If at any point during the night, a user decides they wish to go home, they simply turn off the device. This will automatically trigger a broadcast to all other connected devices, vibrating them and notifying the user's friends that they are leaving.

RELATED WORK

The problem of indoor localisation is a highly researched topic, with many organisations taking a keen interest. Lee, et al. proposed a wearable antenna integrated into a military beret, as military headquarters need to know exact positions of soldiers to quickly and effectively control them in case of emergency [2]. They demonstrated how 915MHz RFID is both viable for use indoors and safe for use in close contact with humans. This is important to the viability of our project, however this proposal does not show how the localisation would actually be performed, and would likely rely on adding receivers into the environment.

Zheng, et al. show how an alternative method for tracking users indoors, using sensors present inside a standard Android smartphone to track movement and extrapolate location from this [4]. They manage to reduce the accuracy error down to 1.5% in a short walk through a controlled environment. This method does not rely on adding receivers to the environment, showing the potential for alternative methods being used in combination with the previously discussed RFID method.

From these works we can see that the technology to perform accurate user localisation is nearly viable, and the large body of research suggests it will be possible soon. The approach to visualising this information to the end user has not been discussed in great detail, however the paper by Lumsden, et al. discusses the need for a paradigm shift in the methods of interaction for wearable and mobile devices [3]. This paper presents strong justification and explanation for the need for research into mobile and wearable interactions, and then experimental data supporting two examples of interaction techniques' improvement over existing options. Our project proposes a novel interaction technique, and this paper validates our use of a simplified user interface for situations where the user cannot devote all of their attention to the device.

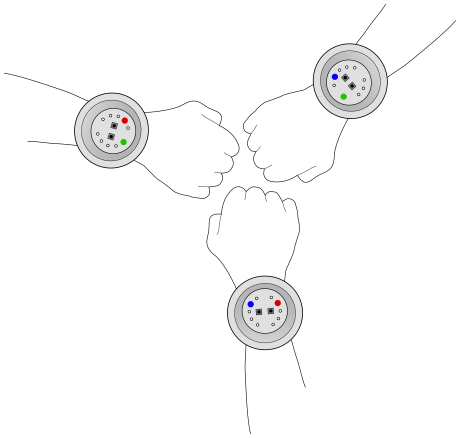

Figure 3: A mockup of three Friend Finders in use. The LEDs pointing towards each person are lit up with the corresponding colour on each device.

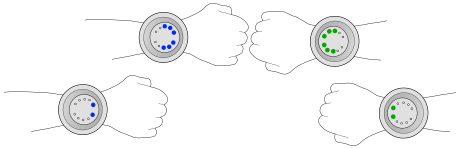

Figure 4: Friend Finder distance mode in use. Top image shows more LEDs lit as devices are close together. Bottom image has reduced LEDs to indicate further distance.

DESIGN

The design choices we made with this product were driven by consultations with potential users, as well as a survey conducted to gauge wider user preferences. From this survey, a strong majority of people said that finding their friends when separated on nights out was both important to them and often difficult to do. The predominant reasons for friends struggling to find each other during a night out were issues with phone signal and battery, as well as their friends not responding to communication attempts. This formed the kernel of our design as a low-power device that allowed one-way communication. What this means is that users are able to reliably find their friends even if they are out for a long time, and without relying on responses from their friends.

Our concept device is a wearable device with a simple display of lights to output information. Using an Arduino RGB LED ring for the display and two control buttons, our device offers a much better battery life than a smartphone, as well as an easy to use interface that will be interpretable to someone on a night out. As the technological problem of indoor localisation that our device is based on is as of yet unsolved, we really focused on the interaction between the device and the users. Several iterations of the LED display were developed through feedback discussions with potential users, and we believe that when the technological barriers are removed, Friend Finder will have laid the groundwork for the UI and input that such devices will use.

ETHICAL CONSIDERATIONS

The nature of our device meant that ethical considerations had to be at the forefront of everything we did. To begin with, the problem we were trying to solve with Friend Finder was fundamentally one of safety and reassurance. This meant it had to be carefully designed to ensure it fulfilled this mission without having any untoward side effects. For example, although a device that can locate your friends is useful to you, it does introduce the potential to be misused by a third party who can either see the device or even acquire it. This in part drove the design choice to make the device wearable, as it was important to ensure that it is only used by those it is meant to be used by.

To guide our design choices with ethics in mind, we made use of the inclusive panda concept. This is a map that helps keep track of the different potential users of a product, both intended and non-intended[1]. In the previous example, third parties who misused another person's Friend Finder come under the inclusive panda's *unwanted* group of users. Another important group of people we took into consideration as a result of the inclusive panda are those who may find accessing regular technology and devices difficult. This includes those who are colour blind, as well as people for whom complex controls present difficulty. While our prototype design does not account for colour blind people, the use of LEDs allows for this to be implemented if the product is taken forward. Having the LEDs flicker at different speeds to distinguish between people, or different light intensities, are

easily implementable changes to benefit colour blind or otherwise visually impaired users. The simple controls of one button to switch between controls makes Friend Finder very accessible. This is not only important for people who find complex controls inherently challenging, but also to account for the fact that our target users are likely to be using it after drinking alcohol. Keeping the safety goals of our product in mind, it is crucial that people are able to find their friends when in a vulnerable state, where controls need to be as simple as possible.

EVALUATION

Having adopted a user-centred approach to the design of our interface, with constant feedback throughout the process, we needed to evaluate the final prototype in similar fashion. A user study was conducted while we demonstrated the device we made, in order to gauge the quality of our interface.

User Study

For the user study, we had two prototypes of Friend Finder on display, each of which was pre-programmed with a series of demos showing the different interactions users would potentially have with the device. Users were guided through the initial operation of the device in the first two demos. After this, we kept explanations of the device to a minimum, encouraging users to work out for themselves what the different displays were showing. By doing this, we were able to get a better impression of how intuitive the interactions were, and how easily users were able to understand the output and controls.

After being shown the demos, users filled out a survey to see how well they responded to the design of the interface. The survey was written in such a way as to minimise the potential bias in the questions, which tied in with the self-guided nature of the later demos to ensure as accurate results as possible. The results of the user study were overwhelmingly positive. When asked what each of the different displays was indicating, all users responded with the intended answer. The clarity of the different modes was supported by users, with no one responding that they found any part of it unclear.

FUTURE WORK

Inherent to this project was the idea of future work being done to carry the outcome forward. We based our approach on the idea that the problem of localisation will be solved in the near-future. When this happens, we believe Friend Finder will provide a standard for the interface that is integrated into such devices.

In the context of the interface itself, we envisage a lot more testing, specifically in realistic circumstances. This could involve setting up prototypes to be remotely operated, allowing testing in a nightclub where a participant uses the device as its output is controlled by another individual to

simulate a real situation. While we focused on use cases on nights out and in nightclubs, going forward the possibility was left open for further applications such as music festivals, or parents keeping an eye on children in parks. This would require more testing, and the acquisition of feedback from specific users who would inevitably have different needs from the device.

Ethical considerations were at the heart of our design choices, and so a large amount of future work would be dedicated to this. We kept the design simple to account for people who may be visually impaired or struggle with complex controls. This is an area that requires more work, as options for colour blind users should be fully developed and integrated, as well as testing the controls with such users.

CONCLUSION

In this paper, we have presented Friend Finder, a wearable device for locating friends on a night out. The concept behind Friend Finder is to propose a well-researched, empirically supported interaction for localisation devices. As the technology improves and such a device becomes feasible to implement, we believe that the user interface and control concepts we have researched and designed for this project will represent the ideal standard. We adopted a user-centred design approach, led by discussions with potential users and constant feedback on each design iteration. This allowed us to demonstrate a prototype of our proposed interface, which was well received in a comprehensive user study.

CONTRIBUTION WEIGHTS

Gareth Carless = 20%, Vansh Dassani = 20%, Goce Dimitrov = 20%, Bradley Miles = 20%, Louis Wyborn = 20%

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