
GotYourBack: An Internet of Toilets for the Trans* Community

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Abstract

Transgender individuals frequently report negative experiences when attempting to access gender segregated areas, such as toilets. This includes physical and verbal harassment and being denied access to facilities. The existing applications used to locate gender-neutral toilets are limited by the few facilities available. Our research shows that many transgender individuals feel more comfortable using gendered toilets in the presence of people who support gender diversity. In this paper we present GotYourBack, a mobile application, which utilizes this support network and works with an Internet of Toilets ecosystem to improve safe access to gendered toilets. GotYourBack works by utilizing motion sensors and Bluetooth beacons to provide real-time data on toilet capacity and presence of supporters.

Author Keywords

Mobile Technology; Contextual Technology; Internet of Things; Transgender

ACM Classification Keywords

H.5.2. User Interfaces (e.g., HCI): (D.2.2, H.1.2, 1.3.6): User-centered design. H.5.m. Information interfaces and presentation (e.g. HCI): Miscellaneous

Figure 1. Quotes from interviews

"I feel embarrassed when I use a single gendered toilet. I might get attacked in a male toilet." – trans user (USA)*

"If I can't find a gender neutral toilet, I can't pee. I know lots of people fear sharing a bathroom with men, which is why some people are against this, but those are fears trans people have to face all the time." – trans user (UK)*

"Situations where I absolutely have to, I will use gendered toilets. I've already given myself stomach aches that caused me to call an ambulance from holding in." – trans user (UK)*

"I remember once I went into a male toilet and a guy told me that I was in a wrong bathroom." – trans user (China)*

Introduction

As little as 1% of the population identify as transgender or gender non-binary [13]. Their minority status makes them vulnerable to collective discrimination and is related to long-term social and health problems.

Even the simple act of accessing public facilities, such as toilets and changing rooms, becomes difficult. These areas are plagued by gender segregation and prejudice and it is reported that 70% of transgender individuals report significant challenges when accessing public toilets [2][5]. Challenges include being stared at, harassed, and denied access to facilities [8][9]. Given that the average person uses the toilet between six to ten times a day [1], such obstacles can make completing the otherwise routine task unbearable. Indeed, many transgender individuals report urinary tract infections due to avoidance of public toilets [11] and what is more, their denial of access to bathrooms has been linked to psychological distress and suicidality [8].

There are already many existing applications, which enable users to locate gender-neutral toilets. Even though these solutions are valuable, they are limited by the few existing facilities available. Our motivation for this project was to level the playing field by increasing access to both gender-neutral and gendered public toilets. Our user group expressed that safety and privacy were key concerns when accessing gendered toilets.

GotYourBack expands access to gendered facilities, integrates the role of supporters, and utilizes inconspicuous design to ensure that users can make informed decisions and feel assured accessing public facilities.

Initial Research

To develop an understanding of some of the challenges trans* individuals face we conducted an initial

questionnaire. It consisted of multiple choice, Likert scale, and free text responses. The questionnaire was posted on specialist forums and received eight responses from trans* individuals. Findings highlighted five major areas where our user group face challenges. These were; access to healthcare, employment, education, safety, and public toilets. We conducted semi-structured interviews with two trans* individuals to gain a better understanding of these five areas.

The most salient themes that emerged from the questionnaires and interviews were access to adequate medical care and public toilets (Figure 2). This motivated us to focus on safe access to public toilets, as it was a challenge clearly and regularly experienced by our informants.

Establishing Requirements

Our initial investigations motivated us to carry out more precisely targeted research regarding the subtleties of access to public toilets for trans* individuals. We carried out an auto ethnography, conducted interviews, talked to specialists in transgender identity, and administered questionnaires.

We conducted semi-structured interviews in which the participants were asked open-ended questions about their experiences accessing public toilets. The participants spoke about safety issues and described problems such as urinary tract infections and being restricted to gender-neutral toilets (Figure 1). Interestingly, one participant we interviewed who had undergone her transition in Japan said that accessing toilets was less of an issue there because of the cosplay culture.

Informal interviews with specialists added a deeper understanding of concepts of gender policing in public toilets whereby other users enforce normative gender division [7]. They also highlighted concerns surrounding the public debate regarding trans* access

Figure 2. Affinity diagram used to identify key themes

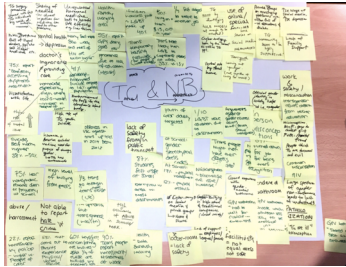


Figure 3. Feasibility and impact scale used to assess potential solutions

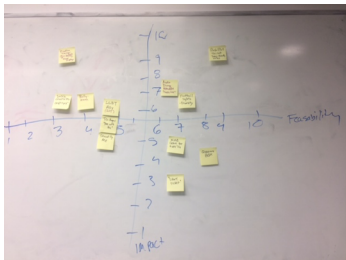


Figure 4. Persona sketch



to public toilets. Consequently, we sought to ensure that design solutions did not further alienate trans* users by drawing attention to the debate.

Our questionnaire revealed that 76.5% of 34 respondents felt uneasy using gendered toilets. An auto ethnography was conducted over a three-day period and encompassed any situation where gender identity was considered or enforced. In combination with the data from the interviews, these methods enabled us to develop a more comprehensive understanding of the breadth and depth of the problem.

Through triangulation, we identified a set of user requirements that called for a design that would enable users to locate gender-neutral toilets, increase safe access to gendered toilets, and be inconspicuous for the user and the audience.

Initial Design

Research shows that support for the trans* community has increased over recent years. Studies have shown a significant rise in the number of Americans who personally know or work with a trans* individual and a corresponding increase in support for them [3][14]. The case is the same in the U.K, whereby the increasing number of referrals of trans* individuals to health services is indicative of wider acceptance and understanding [4]. Business [10] [6], policy [12], and individual action have contributed to this. We sought to capitalize on this support network and find out if we could utilize it to improve access to gendered toilets.

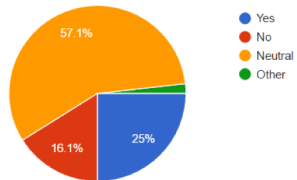
We conducted a questionnaire consisting of multiple choice and free text responses, and identified that 57.1% of 28 trans* respondents would feel more comfortable using a gendered toilet in the presence of someone who supports gender diversity (a supporter). Alongside the questionnaire, and using the information we had gathered, we conducted an in depth task



Figure 5. In depth task analysis to investigate how trans* individuals currently identify appropriate facilities

Figure 7. Feedback from augmented reality section of Storyboard Survey

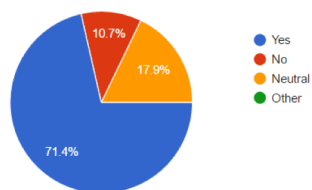
Do you want to see these types of supportive messages? (56 responses)



"I would be concerned that such boards would be taken over with hateful or threatening messages"

Figure 8. Feedback from rating section of Storyboard Survey

Do you want to know how other users have rated the nearby toilet? (56 responses)



analysis to investigate how trans* individuals currently identify appropriate facilities (Figure 5). We ideated using 10x10 sketch techniques and narrowed our focus by conducting a group assessment of the feasibility and impact of each of the potential solutions (Figure 3). We refined the device requirements using personas (Figure 4) and stakeholder analysis.

IoT - Internet of Toilets

Our aim for this project was to expand access beyond gender-neutral toilets by enabling users to feel safer in gendered toilets. This is important given that gender-neutral facilities are still relatively uncommon. Our initial concept was an app designed to utilize the role of supporters to make gendered toilets feel safer.

In order to monitor the presence of supporters, we used low-cost beacons and motion sensors installed at participating toilets. In this instance, supporters are people who have actively installed the application on their phones. Using the app, trans* users are able to locate toilets, see the capacity of toilets and identify the presence of supporters. Our objective was to make the interface rich in detail but glanceable.

Iterations

In order to elicit feedback on our initial concept, we conducted a storyboard survey (Figure 6) which we posted on specialist forums and received 56 responses. We also showed it to trans* individuals who had contributed to our initial research. The Storyboard Survey sought to break the app down to potential functionalities, enabling us to get targeted feedback and therefore prioritize features that would have the greatest impact on our user group.

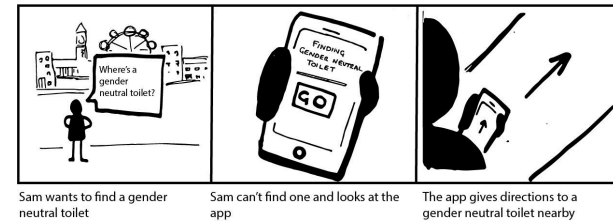


Figure 6. Illustration to show segment of storyboard survey

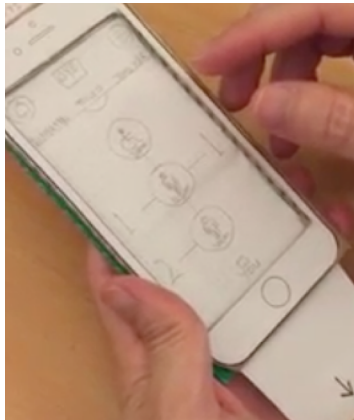
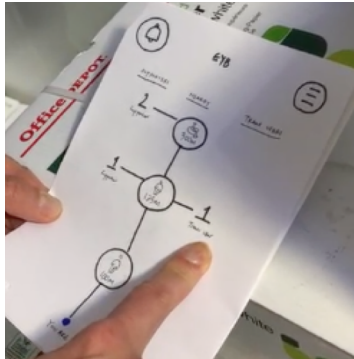
Using our Storyboard Survey, we tested the idea of an Augmented Reality (AR) message board, however this was met with negative feedback (Figure 7). Users were concerned that the feature might be misused to spread hate speech or facilitate casual sexual encounters.

We also tested the concept of a user rating system for toilets, which focused on a user's subjective experience of how safe they felt. 71.4% of users indicated that the ratings would be a valuable way of assessing safety and we sought to include this in our final design (Figure 8).

In the free text section, respondents expressed concern regarding the explicit display of the number of trans* users in the toilet. They expressed this was a safety issue because it could make users targets of hate crime (Figure 7). We mitigated this concern by combining the supporter and trans* user count to show as "supporters". We retained the footfall monitoring function so that trans* users could gauge how full the toilet is before entering.

Personas and stakeholder analysis motivated us to conduct an additional survey in order to explore the engagement required from supporters. The survey demonstrated that supporters are more motivated to keep using the app if they know that their support is having an impact (58.3% of 14 responses). Therefore, we dedicated more of the design to incentivizing the community supporter role. We developed the "Ticket

Figure 9. Paper prototypes used in usability and Wizard of Oz evaluation



System", whereby the app sends a heart ticket to a supporter to thank them for their support if a match between trans* user and supporter is detected. The tickets notify supporters that they have contributed to a system that enables trans* individuals to feel safer in gendered toilets.

We conducted nine formal low-fidelity interface evaluations using paper prototypes and wizard of Oz (Figure 9). Significant changes included an embedded map where there was previously a linked address to allow users to navigate within the app itself. In addition, we added a feature where the user could toggle between two display orientations allowing for a more personalized experience.

The Final Design: GotYourBack

We refined our final design (Figure 11) to include the feedback and findings we gathered. The application expands access beyond gender-neutral toilets through these features:

- **Toilet locator** - the app recommends a list of nearby toilets.
- **Real-time usage information** - shows supporter count, total number of users and capacity percentage (Figure 10).
- **Crowdsourced ratings** - app leverages the crowd for subjective toilet safety ratings.

Additionally, supporters are motivated by the awareness of the positive impact their support is having on the trans* community. The application automatically detects a match between supporter and trans user and sends a heart ticket to the supporter to thank him for his support. There is a time lag to prevent users' from being able to immediately identify trans* people.

The hardware is used to monitor capacity of the toilet and presence of supporters in participating toilets (Figure 10). For toilets without the hardware, their

locations can be suggested and rated using the app so that they show up together with participating toilets. Therefore, trans* users are still able to use the crowdsourced safety ratings to make an informed choice. To prevent abuse, the app would detect malicious users by temporarily banning them from the system (with repeat offenders to be permanently removed), if predatory behavior was exhibited e.g. if the hardware detected a user to have overstayed.

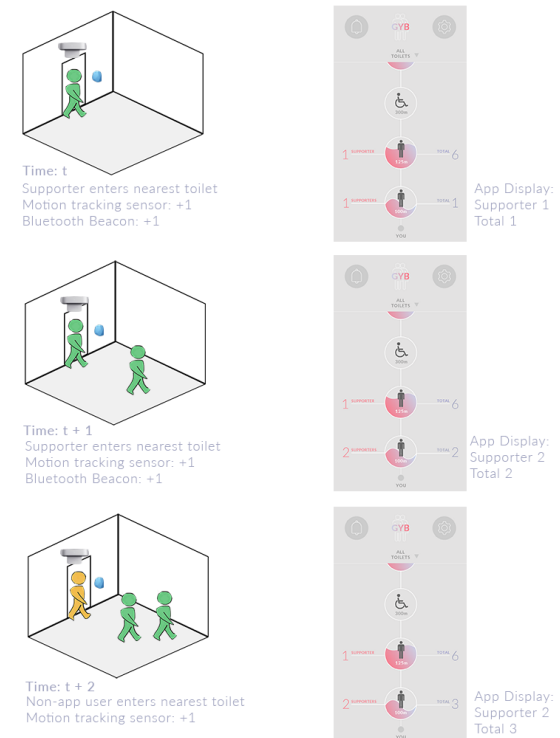
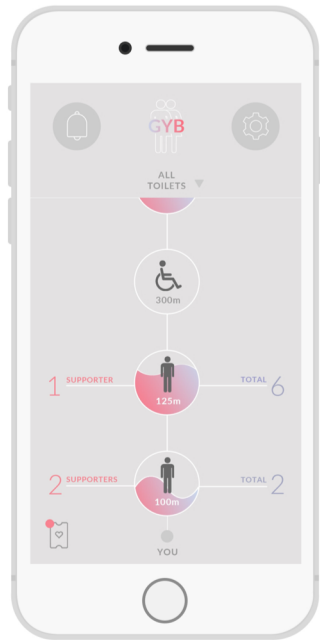


Figure 10. Illustration to show how the hardware and application work together

Figure 11. High fidelity mockup of final design



Responses to product

"This is amazing, beyond my imagination"

"Good job!"

Discussion

To conclude, there is a clear need for safer access to toilets within the transgender community. The GotYourBack app aims to expand on previous toilet finding apps by allowing users to see whether there are supporters in single-gender toilets and granting access to crowdsourced safety ratings.

GotYourBack benefits from the strength of the design process. A range of user centered design techniques were used throughout requirement gathering and usability evaluation and we had individuals from our target user group provide feedback throughout the design process. This is important as it helped us avoid designing for an "elastic user" [2]. Furthermore, we were able to refine the interfaces using paper prototypes, Wizard of Oz evaluation and a high fidelity mock up. As a result, our final design is a product that integrates into daily life and is of high value to our user group.

Limitations

Our greatest challenge was gathering a thorough understanding of requirements whilst having limited access to our user group. However, this prompted us to form stronger relationships with our interviewees and enabled us to establish a more comprehensive understanding of the relevant topics. Additionally, we gathered feedback from questionnaires. Questionnaires lack some validity as the depth of answers respondents can provide tend to be more limited and it relies on a self-selecting sample who might be more motivated and have stronger opinions. However, used in combination with our qualitative findings we were able to obtain rich insight about feelings and challenges our respondents felt.

Future Considerations

Although the feedback on GotYourBack has largely been positive, there are a number of factors, which could be considered in future work. We could further

explore ways to motivate individual and corporate participation to make the product more scalable. Additionally, we could refine the crowdsourced rating system. One possibility, which came out in an interview with a specialist would be to integrate specific metrics such as safety, lighting and privacy. For the current design, we settled on a simple star metric in order to incorporate the diversity of user perspectives and minimize the burden on the user.

A further area to explore would be the display of supporters and whether it would be more effective to display cumulative or real-time number of supporters. It would be beneficial to evaluate how the different displays would impact perception of safety, actual safety, and scalability. Finally, in order to conduct a more comprehensive usability evaluation we would seek to investigate optimum frequency of alerts and enhance memorability of interface.

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