Demo: Tacita – A Privacy Preserving Public Display Personalisation Service

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UbiComp/ISWC'18 Adjunct, October 8?12, 2018, Singapore, Singapore.

ACM ISBN 978-1-4503-5966-5/18/10.
https://doi.org/10.1145/3267305.3267627

Abstract
In this demonstration, we present a full implementation of Tacita, a display personalisation system designed to address viewer privacy concerns whilst still capable of providing relevant content to viewers and therefore increasing the value of displays.

ACM Classification Keywords
H.5.m [Information interfaces and presentation (e.g., HCI)]: Miscellaneous.

Introduction
Recent years have witnessed an increase in the deployment of pervasive displays into our everyday environments. For example, displays can be found at railway stations, airports and throughout urban settings and are utilised for advertising, hospitality and way-finding. Market predictions indicate that by 2019 over 63 million public displays will be deployed [5].

Previous research has identified "display blindness" as a major concern: passers-by tend to ignore displays if the content shown is perceived to be of little relevance [4]. Since the early nineties, researchers have attempted to address display blindness by enabling content to be *tailored* to viewers in close proximity [2]. A popular example has been to use mobile phones for detecting

user's proximity to a screen, e.g., using Bluetooth [3] and to tailor the screen's content according to the individuals in front of them. Some commercial systems have emerged that attempt to use video analytics and viewer demographics to tailor content to individual passers-by [1]. However, such systems raise major concerns regarding viewer privacy and consent. In this demonstration, we present the Tacita display personalisation system which has been designed to address user's privacy concerns whilst ensuring relevant content can be delivered.

Display Personalisation System

Tacita provides an architectural model that enables the delivery of personalised content through public displays to individuals without violating their privacy [1]. To safeguard viewers' privacy, Tacita is designed to specifically provide viewers with the ability to first initiate a trust relationship with a cloud-based content provider (e.g., the BBC) which has access to sensitive information about the viewer.

Tacita relies on a proximity detection technology that is capable of detecting the user's presence near a particular display that supports display personalisation (Figure 1). When viewer presence is detected, e.g., using Bluetooth proximity ranging, the user's current location is sent to the "trusted content provider", i.e. the entity with which the user has initiated the trust relationship. On behalf of the user, the trusted content provider may then choose to conduct a subsequent request to the public display infrastructure to request their content to be shown on the display nearby the user. In this approach, sensitive information about the viewers including their content preferences and location information are only collected and stored within the trusted entity (i.e., content provider) and not shared beyond the boundary of the trusted entity. Subsequent requests to the display infrastructure do not include any user identifiable information and therefore prevent display infrastructure entities from identifying and tracking individuals making requests for personalised content and computing, for example, personalised mobility patterns based on the requests.

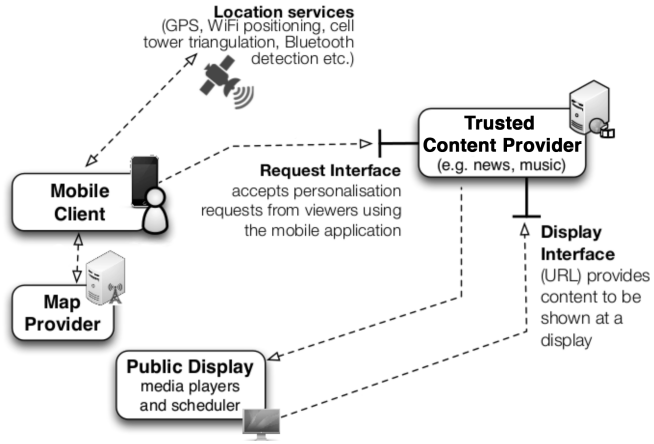

Figure 1: Tacita architecture diagram initially published by Davies et al. [1].

User Interactions

The typical interaction pattern from the perspective of an end-user is as follows: Users can install the Tacita mobile phone client from the Apple App Store. Upon opening the Tacita client (Figure 2), viewers are first presented with an overview of all supported personalisable content applications. such as Bus Departures, Weather Forecasts and News. Viewers can choose to activate available applications and provide further configuration parameters for each of the available apps (e.g. location for personal weather forecasts or bus departure times). After activating, the mobile phone client monitors the proximity

to displays using iBeacon technology. Once a display is detected, the client performs a request to the activated application (as the trusted entity).

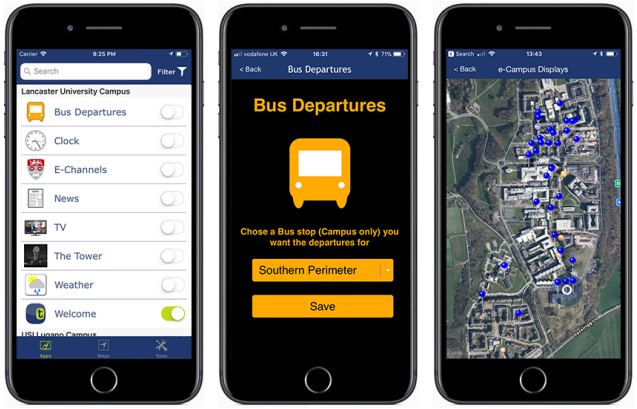

Figure 2: Tacita mobile phone client: list of personalisable applications (left), example configuration page for a personalisable application (middle), and a map of supported displays (right).

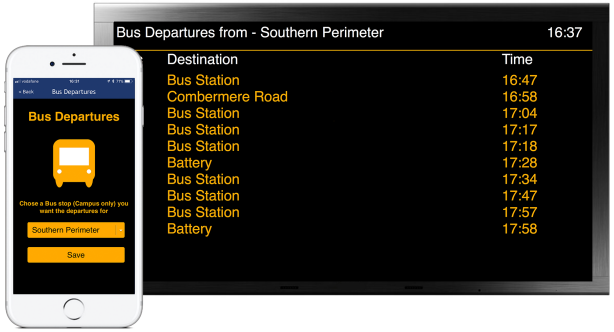

Figure 3: Example application: Users can request real-time departure times for a bus stop of their choice.

Figure 4: Example application: Users can request weather forecasts for a customisable location.

The personalised application performs subsequent back-end interface calls to the display infrastructure requesting the content to be changed based on the viewer's location. In the case of personalised bus departure times, the display nearby will show real-time information for the requested bus stop (Figure 3). The Weather application will show the weather forecast for the specified location in addition to the location of the display and a randomly selected place – to increase viewer privacy and prevent bystanders from identifying the viewer's preferences (Figure 4).

Demo Description

We propose to demonstrate an end-to-end implementation of the Tacita personalisation system. Our Tacita demo will consist of three main components:

1. a dedicated mobile phone application enabling viewers to express their preferences and used to track their proximity to displays,

2. a back-end component for the content provider, and
3. a public display client equipped with an iBeacon to allow the mobile phone client detect viewer proximity and to visualise personalised content.

The demonstration consists of two displays as a representation for a typical ubiquitous display environment (e.g., Figure 5) and a mobile device with the Tacita client. Both displays will be equipped with iBeacons for viewer proximity detection. As part of the demo, we will provide an initial set of personalisable applications including Weather and Travel. Visitors will have the option to either interact with the demonstration using the mobile phone provided, or to download Tacita onto their own device from the Apple App Store. A video of interactions with Tacita is available at https://goo.gl/q7g4La.

Figure 5: Pervasive display deployed at Lancaster University.

We envision the demonstration to provide valuable insights into future, ubiquitous display environments that are highly personalised.

Acknowledgements

This research is partially funded by the UK EPSRC under grant numbers EP/N028228/1 (PACTMAN) and EP/N023234/1 (PETRAS IoT Research Hub – Cybersecurity of the Internet of Things).

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