Bazaar: A Situated Crowdsourcing Market

Jorge Goncalves
Community Imaging Group
University of Oulu, Finland
jorge.goncalves@ee.oulu.fi

Simo Hosio
Community Imaging Group
University of Oulu, Finland
simo.hosio@ee.oulu.fi

Denzil Ferreira
Community Imaging Group
University of Oulu, Finland
denzil.ferreira@ee.oulu.fi

Theodoros Anagnostopoulos
Community Imaging Group
University of Oulu, Finland
tanagnos@ee.oulu.fi

Vassilis Kostakos
Community Imaging Group
University of Oulu, Finland
vassilis@ee.oulu.fi

UbiComp/ISWC '15 Adjunct, September 07–11, 2015, Osaka, Japan.

ACM 978-1-4503-3575-1/15/09…$15.00.
DOI: http://dx.doi.org/10.1145/2800835.2800974

Abstract
In this paper we present a situated crowdsourcing market named Bazaar. Our platform enables researchers to deploy crowdsourcing tasks on simple crowdsourcing kiosks, which can then be placed in different locations. We describe the different components that compose Bazaar, discuss a successful deployment using the platform and reflect on possible future work using Bazaar.

Author Keywords
Crowdsourcing; situated technologies; market; tasks; kiosks; tablets.

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

Introduction
In recent years crowdsourcing has been growing in popularity both in academia and industry. The emergence of online crowdsourcing platforms (such as Amazon's Mechanical Turk, CrowdFlower and oDesk) makes it convenient to pay for workers willing to solve a range of different tasks. Many of these tasks are difficult to solve by computers, like for example, audio transcribing and recognizing objects in images [15]. The most common motivator for these workers to

conduct such crowdsourcing tasks is payment. However, there are examples in which workers contributed altruistically [4,6] or contributed without even being aware (e.g. reCAPTCHA [17]).

While the majority of research on crowdsourcing has been conducted on online and mobile platforms, like the ones mentioned above, there has been a growing interest in using situated technologies for crowdsourcing. Situated crowdsourcing consists of embedding input mechanisms (e.g., public displays, tablets) into a physical space, to leverage users' serendipitous availability [14] or idle time ("cognitive surplus" [16]). It allows for a geofenced and more contextually controlled crowdsourcing environment, thus enabling targeting certain individuals [4], leveraging people's local knowledge [5] or simply reaching an untapped source of potential workers [9].

In this paper we present a platform, named Bazaar, designed to facilitate such situated crowdsourcing deployments. Next, we describe some of the work conducted within the situated crowdsourcing domain. We then describe our platform in more detail.

Related Work

There has been little research conducted using situated technologies for crowdsourcing. In one of the few examples, Heimerl *et al.* reported *Umati* [8], which used a vending machine with a touch display for locally relevant tasks. Workers could earn credits performing these tasks and exchange them for physical rewards directly on the vending machine (snacks). In another paper, Huang explored if micro-volunteering can be leveraged by a situated crowdsourcing platform to enable problem-solving efforts with high-quality results [12]. In a position paper, Marshall *et al.* [13] outline a project, where its goals were to reduce staff stress levels and increase restorative opportunities through situated crowdsourcing.

Recently, researchers have studied the use of public displays as a viable crowdsourcing medium. For instance, crowdsourcing on these devices has been used to gauge fluctuations on a community's diurnal collective emotion [7], generate a repository of keywords that are relevant to a location [5] or polling public opinion [10]. Bazaar is designed for tablets mounted on stands, that together form a type of crowdsourcing kiosk, and enables the deployment of a number of simultaneous tasks, contrary to the previously mentioned single-purpose situated crowdsourcing applications.

Bazaar

Bazaar consists of three main components: a grid of client devices (kiosks), a server and a researcher/administrator hub. We explain each of these components in more detail next.

Client Device (kiosks)

Each kiosk contains an Android tablet with a 10.1" touch-screen, a charger, and uses WiFi to connect to the server (Figure 1). Our client software for the tablets is set to "kiosk mode" to ensure that it was always visible on screen. It also recovers from crashes, and disables unwanted OS functionality (notification bars, etc.). The physical buttons of the tablet are hidden by the kiosk's enclosure. The tablets host the crowdsourcing application that allows workers to access the tasks. Bazaar continuously accesses the server side database, so a reliable Internet connection is required.

Figure 1: One of the kiosks that contain an Android tablet with a 10.1” touch-screen.

The welcome screen of the kiosks contains a brief description of the system, and prompts users to create an account or login (Figure 2). Registration requires only a username and password because a lengthy process would reduce participation when using situated technologies [1].

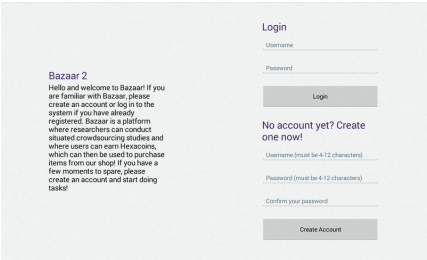

Figure 2: Welcome screen.

Subsequently, workers are shown a main screen (Figure 3). At all times the upper bar of the application displays the HexaCoin balance of the worker, the virtual currency awarded for completing tasks. In the main screen, workers can see how many of their completed tasks have been approved, rejected or still pending moderation. In addition, workers can also see a list of the most recent news set by the system administrators.

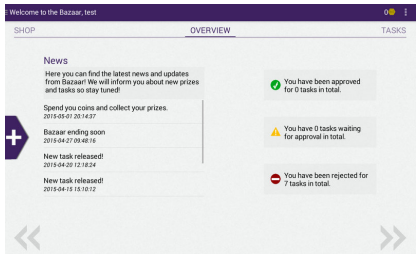

Figure 3: Main screen.

By swiping right workers can access the list of tasks and the leaderboard with the nickname of workers with the most earnings to date (Figure 4). The tasks include a brief description, a thumbnail and the reward assigned to it. Upon selecting a task, an embedded Internet browser (webview) is opened within the Android application, where workers can then complete the tasks to earn HexaCoins, the virtual currency of Bazaar.

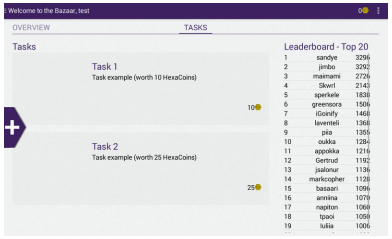

Figure 4: Task list and leaderboard.

By swiping left workers can access the shop (Figure 5). Here, workers can get money or goods in exchange for their HexaCoins. Workers can then pickup their rewards from a physical shop we setup in our laboratory premises. When visiting our lab, workers have to verify their identity by logging into Bazaar on a dedicated computer.

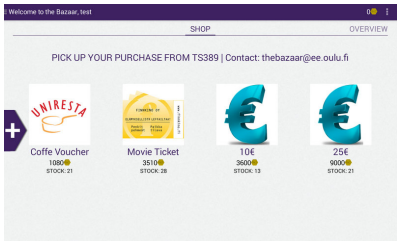

Figure 5: Shop screen.

Server
All communication between the Android application and the MySQL database happens via a REST-like API. The API was based on the Slim micro framework [3]. Slim is a lightweight PHP framework for writing web applications and APIs. From Bazaar's point-of-view, it provides two key features: an URL router and HTTP request/response abstractions. Slim router allowed us to map resource URLs to call back functions for specific HTTP request methods while request/response abstractions allowed easy access to request/response bodies and headers. Slim also provides a route middleware that makes authentication of API requests easy and straightforward.

All the interaction with the database is made via a separate dbHandler class. This class provides all the necessary functions to connect and perform operations on the database. Other middleware functionalities include request authentication, defining HTTP methods and endpoints with associated call back functions.

All the resources accept only GET or POST (or both) HTTP methods. All data exchanges are made via the API using JSON-arrays. When calling a POST method, the client appends a Capsule in the request body containing all the required parameters in JSON format to successfully perform the POST request. If authorization is required (with GET or POST method), the client adds a specific authentication key (i.e. session key) to the HTTP request Authorization header. Authentication of the request allows the API to restrict or limit the access to its resources. The user is identified by a user key or session key. After an API request has been processed, a HTTP response is sent back to the client. The response includes a corresponding HTTP status code and a body with response data in JSON format.

Researcher/Administrator Hub
The researcher/administrator hub allows researchers to upload their tasks and administrate them. Also system administrators can oversee the whole system through the hub. The hub is built using common Web technologies and languages like HTML, CSS, JavaScript and PHP. It allows researchers and administrators to easily see different database tables and manipulate them. For this purpose we used a jQuery plugin called DataTables [3]. It enables users to easily poll the data from the database and display it in simple yet flexible tables. Furthermore, PHP scripts were implemented to fetch the data from the database and the front end.

The two tabs of the researcher panel are depicted in Figure 6. In the first one, researchers can upload tasks by setting the name, description, reward, url and thumbnail. They can also see an overview on their current tasks and contact the administrators. In the second tab, researchers can explore all answers by the workers, which they can either approve/reject individually or in batches.

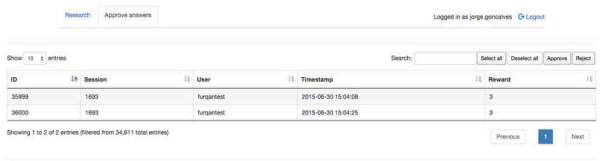

Figure 6: Researcher panel (approve answers tab).

Similarly, Figure 7 shows the administrator panel. Here, the platform administrator can perform a number of actions including: 1) approve/reject/delete tasks uploaded by the researchers, 2) update task rewards, 3) manage user/researcher accounts, 4) manage the shop (add items, edit price, update stock), 5) manage the purchases, 6) add/delete/update news items to appear on the client's main screen, and 7) manage the information snippet that can be shown to users upon logging in as a dialog box.

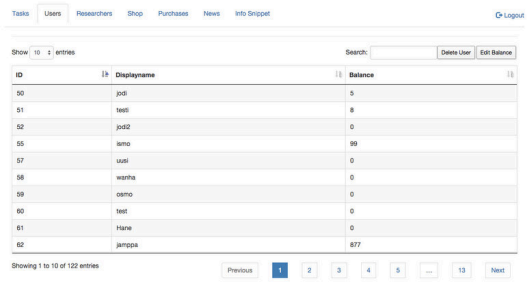

Figure 2: Administrator panel (users tab).

Conclusion & Future Work

An earlier version of the platform presented in this paper was used successfully to investigate the role of price-setting in a situated crowdsourcing market to control labour supply with a number of different tasks [11]. The results showed that a situated crowdsourcing market can attract a populous workforce with comparable quality of contributions to its online and mobile counterparts while maintaining higher task uptake.

In the future we will continue to improve the different components of Bazaar, as well as deploy several different crowdsourcing application that can benefit from a situated setting. We also would like to extend an invitation to other researchers that might want to collaborate and make use of our platform and/or infrastructure.

Acknowledgements

This work is partially funded by the Academy of Finland (Grants 276786, 285062, 286386), and the European Commission (Grants PCIG11-GA-2012-322138 and 645706-GRAGE). We also thank Nemanja Vukota, Teemu Partanen, Miika Keisu and Joonas Nikula for their technical contributions.

References

1. Harry Brignull and Yvonne Rogers. 2003. Enticing people to interact with large public displays in public spaces. In *Proceedings of the 2003 IFIP TC.13 International Conference on Human-Computer Interaction* (INTERACT '03), 17-24.
2. DataTables. 2015. Table plugin for jQuery. Retrieved 15 June, 2015 from https://www.datatables.net/
3. Slim Framework. 2015. A micro framework for PHP. Retrieved 15 June, 2015 from http://www.slimframework.com/
4. Jorge Goncalves, Denzil Ferreira, Simo Hosio, Yong Liu, Jakob Rogstadius, Hannu Kukka and Vassilis Kostakos. 2013. Crowdsourcing on the spot: altruistic use of public displays, feasibility, performance, and behaviours. In *Proceedings of the 2013 ACM International Joint Conference on Pervasive and Ubiquitous Computing* (UbiComp '13), 753-762. http://dx.doi.org/10.1145/2493432.2493481
5. Jorge Goncalves, Simo Hosio, Denzil Ferreira and Vassilis Kostakos. 2014. Game of Words: Tagging places through crowdsourcing on public displays. In *Proceedings of the 2014 Conference on Designing*

Interactive Systems (DIS '14), 705-714. http://dx.doi.org/10.1145/2598510.2598514

6. Jorge Goncalves, Vassilis Kostakos, Simo Hosio, Evangelos Karapanos, and Olga Lyra. 2013. IncluCity: Using contextual cues to raise awareness on environmental accessibility. In *Proceedings of the 15th ACM International Conference on Computers and Accessibility* (ASSETS '13), 17-24. http://dx.doi.org/10.1145/2513383.2517030
7. Jorge Goncalves, Pratyush Pandab, Denzil Ferreira, Mohammad Ghahramani, Guoying Zhao and Vassilis Kostakos. 2014. Projective testing of diurnal collective emotion. In *Proceedings of the 2014 ACM International Joint Conference on Pervasive and Ubiquitous Computing* (UbiComp '14), 487-497. http://dx.doi.org/10.1145/2632048.2636067
8. Kurtis Heimerl, Brian Gawalt, Kuang Chen, Tapan Parikh and Björn Hartmann. 2012. CommunitySourcing: engaging local crowds to perform expert work via physical kiosks. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '12), 1539-1548. http://dx.doi.org/10.1145/2207676.2208619
9. Simo Hosio, Jorge Goncalves, Vassilis Kostakos and Jukka Riekki. 2014. Exploring civic engagement on public displays. In *User-Centric Technology Design for Nonprofit and Civic Engagements,* Springer International Publishing, 91-111. http://dx.doi.org/10.1007/978-3-319-05963-1_7
10. Simo Hosio, Jorge Goncalves, Vassilis Kostakos, Jukka Riekki, 2015. Crowdsourcing public opinion using urban pervasive technologies: Lessons from real-life experiments in Oulu. *Policy & Internet* 7, 2, 203-222. http://dx.doi.org/10.1145/2783446.2783577
11. Simo Hosio, Jorge Goncalves, Vili Lehdonvirta, Denzil Ferreira and Vassilis Kostakos. 2014. Situated crowdsourcing using a market model. In *Proceedings of the 27th Annual ACM Symposium on User Interface Software and Technology* (UIST '14), 55-64. http://dx.doi.org/10.1145/2642918.2647362
12. Yi-Ching Huang. 2015. Designing a micro-volunteering platform for situated crowdsourcing. In *Proceedings of the 18th ACM Conference Computer Supported Cooperative Work & Social Computing* (CSCW '15 Companion), 73-76. http://dx.doi.org/10.1145/2685553.2699324
13. Paul Marshall, Rebecca Cain and Sarah Payne. 2011. Situated crowdsourcing: a pragmatic approach to encouraging participation in healthcare design. In *Proceedings of Pervasive Computing Technologies for Healthcare* (PervasiveHealth '11), 555-558.
14. Jörg Müller, Florian Alt, Daniel Michelis and Albrecht Schmidt. 2010. Requirements and design space for interactive public displays. In *Proceedings of the International Conference on Multimedia* (MM '10), 1285-1294. http://dx.doi.org/10.1145/1873951.1874203.
15. Jakob Rogstadius, Vassilis Kostakos, Aniket Kittur, Boris Smus, Jim Laredo, Maja Vukovic. 2011. An Assessment of Intrinsic and Extrinsic Motivation on Task Performance in Crowdsourcing Markets. In *Proceedings of the 5th International AAAI Conference on Weblogs and Social Media* (ICWSM '11), 321-328.
16. Clay Shirky. 2010. *Cognitive surplus: How technology makes consumers into collaborators.* Penguin.
17. Luis von Ahn, Benjamin Maurer, Colin McMillen, David Abraham and Manuel Blum. 2008. reCAPTCHA: Human-based character recognition via web security measures. *Science* 321, 5895, 1465-1468. http://dx.doi.org/10.1126/science.1160379