Towards a Crowdsourcing Approach for Crime Prevention

Irena Pletikosa Cvijikj

ETH Zurich

Weinbergstrasse 56-58

8006 Zurich, Switzerland

ipletikosa@ethz.ch

Cristina Kadar

ETH Zurich

Weinbergstrasse 56-58

8006 Zurich, Switzerland

ckadar@ethz.ch

Bogdan Ivan

ETH Zurich

Weinbergstrasse 56-58

8006 Zurich, Switzerland

bogdan.mircea.ivan@gmail.com

Yiea-Funk Te

ETH Zurich

Weinbergstrasse 56-58

8006 Zurich, Switzerland

fte@ethz.ch

Abstract

With the rising level of criminal activities, crime is becoming one of the main problems of modern society. To address this issue, we implement a mobile application for crime prevention. We focus on the usage intention and motivations for content creation and consumption. Our results indicate that people are willing to use the app for acquiring and sharing crime-related information, but not on a daily basis. In addition, participation on the platform was found to be driven by affective and rational motivations, to contribute to the neighborhood safety and in return receive help for maintaining personal safety.

Author Keywords

Crime prevention; crime mapping; crowdsourcing; mobile app; participation; motivations; public good.

ACM Classification Keywords

H.4.m. Information systems applications: Miscellaneous.

Introduction

Initially seen as "a business practice that means literally to outsource an activity to the crowd" [9], crowdsourcing has soon shown potential for other applications outside of business context. Today, apart from Wikipedia, as one of the greatest success stories,

there are many other applications of crowdsourcing for public good. For example, Ning.com enabled sharing of ideas for rebuilding after the Hurricane Katrina, OpenStreetMap and Ushahidi collected information on damage and survivors after the earthquake in Haiti and the Fukushima nuclear disaster, while Google Maps and Twitter were used during the Santa Barbara wildfires and the 2011 Egyptian revolution. These examples illustrate the great potential of crowdsourcing for addressing critical natural and societal problems.

The rising level of criminal activities across the world, and in particular of property crimes, made crime one of the main problems of modern society [1]. Apart from the financial losses, the presence of crime also imposes anxiety upon individuals, leading towards negative consequences for individuals and society, manifested as significant decrease in the quality of life [6]. One approach to address this problem is sharing of crime-related information from official sources on a map, referred to as crime mapping. In addition, crowdsourcing principles were applied to facilitate reporting of personal crime experiences, with examples including CrimePush.com, and SpotCrime.com.

Despite the growing popularity of crowdsourcing applications for crime prevention, research in this field is still in a relatively early stage with many open questions to be investigated [10]. To address this issue, in this paper we present and evaluate CityWatch – a crime prevention mobile app, which builds upon the principles of crime mapping and crowdsourcing. We place our focus on the following questions: (1) What is the intention for usage of the proposed solution, and (2) What are the motivations for participation.

This paper is structured as follows. First, we provide an overview of the related work. We then explain the concept of CityWatch. Consequently, we present the results of the evaluation and discuss our findings. This paper concludes with a summary and an outlook.

Related Work

Applications for Crime Prevention

With the proliferation of various crime prevention applications, researchers have turned their attention to understanding the potentials and the underlying principles of these platforms by analyzing the existing solutions, and designing and evaluating new solutions. For example, a mobile application that allows individuals to tag and share areas of the city on a map where they feel unsafe was proposed [2]. Similarly, Fearsquare serves contextualized crime risk information, cross-referenced with geo-located check-ins on Foursquare [8]. These examples utilize a combination of crime mapping and crowdsourcing to address the challenge of crime prevention.

Research in the direction of perception of crime mapping applications is also very limited with only three conducted studies [10]. Generally, people were found to have a positive perception of crime maps - they find them informative and credible [17]. In addition, an investigation of the perception of location privacy revealed that data aggregation is of a high importance [10]. Still, to understand fully the effect these platforms might have over individuals and society further academic research would be needed.

Motivations for Participation

The most prominent theory used to explain motivation is Self-Determination Theory (SDT) [5]. SDT
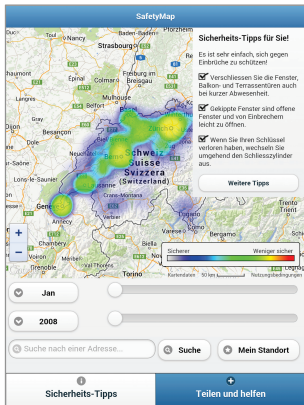
Figure 1. Main view of the app with the crime map, time range selector and prevention tips.
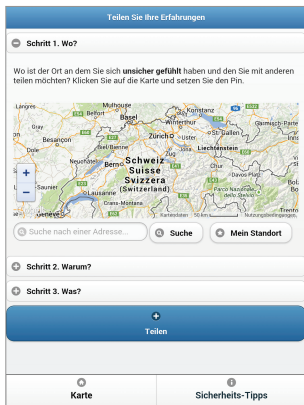

Figure 2. Crime reporting view of the app with three simple questions: what happened, where and why?

distinguishes between two types of motivation, intrinsic - acting simply because something is interesting or enjoyable, and extrinsic - acting to gain some reward, either tangible or psychological. Alternatively, motivations can be rational, norm-based, and affective, where rational motives build upon utility maximization, norm-based motives refer to conforming to norms, and affective motives reflect emotional responses [11].

In the context of crowdsourcing, previous research revealed great diversity of motivations for participation. These motivators are obtaining financial reward, advancing one's career, recognition by peers, meeting new people and socializing, contributing to collaborative effort, having fun, gaining new skills and knowledge, as well as challenging and expressing oneself [3]. In particular, ideology [15], altruism [16] and social norms [7] were identified as key drivers of voluntary content generation, while the motivation to know can be seen as driver for content consumption [14]. Yet, to the best of our knowledge, no previous work was done to confirm these assumptions in the context of crime prevention crowdsourcing platforms.

In order to address the recognized research gaps, we implement and evaluate a mobile application for crime prevention. We focus on the usage intentions and motivations for content creation and consumption in order to understand how to drive sustainable user engagement on these platforms, which could potentially lead to crime prevention. In addition, with this study we contribute to the motivational typologies for crowdsourcing for public good.

Concept and Implementation

In order to support individuals in increasing their safety we implemented CityWatch with a goal of promoting preventive behavior by raising the awareness regarding the current and future levels of crime. CityWatch supports three main concepts. First, it provides crime-related information on a map, shown to be effective for promotion of preventive behavior [18]. Second, it supports sharing of information among individuals, shown to be crucial for building social ties and undertaking collective actions [13]. Finally, it provides prevention tips, intended for counterbalancing of the dissemination of crime-related information to avoid the potential negative effect on people's fear and perception of crime [4]. In addition, notifications are delivered each time a new incident is reported in user's proximity, with a goal of keeping the users engaged on the platform [4]. Figures 1 and 2 illustrate the pilot implementation.

In order to avoid the problem of unsustainable content generation and consumption cycle typical for new crowdsourcing applications [12], an initial dataset was obtained from a large Swiss insurance company containing property claims data. Thus, the crime-related information originates from two separate sources: (1) a "trustworthy" one, which contains incidents reported by insurance customers, and (2) an "unassured" source, which contains crowdsourced data. Each dataset is visualized in a separate map layer, a decision made to address the concerns regarding a potential platform misuse and provision of untruthful contributions. In both cases, data is shown for twelve months in the past and the future.

I would consult the app …
CO1: … before renting or buying a new place to live.
CO2: … to check the safety of the neighborhood where my family members live.
CO3: … to check the safety of an area when going out.
CO4: … to check for safe areas when I go jogging.
CO5: … to check for safe areas to park my car.
CO6: … to check for safe areas to leave my bicycle.
CO7: … to check for safe areas when I visit a foreign city.
CO8: … to receive safety and prevention tips.
I would contribute because …
CR1: … I am concerned about the safety of my neighborhood.
CR2: I feel responsible for sharing my own experiences to help others.
CR3: … the app has helped me.
CR4: … family or close friends would also contribute.

Table 1. Motivation statements used in the survey.

The pilot was implemented as a mobile web application to (1) support provision of contextual information and on-the-spot incident reporting, and (2) to speed up the deployment process and enable rapid prototyping.

Evaluation

Methodology

In order to provide answers to our questions we conducted a quantitative study in December 2013. The participants were presented with a pilot implementation of the app, and were then asked to fill out a survey. The survey consisted of questions regarding the demographics, usage intentions and motivations. From the demographic characteristics, of interest were age, gender, nationality and family situation. In addition, victimization history for property crime was gathered. Measurement of the usage intentions was based on three statements: "*I would consult the safety map*" (UI1), "*I would contribute to the safety map by sharing my personal experience*" (UI2), and "*I would find the safety map useful in my daily life*" (UI3), on a five-point Likert scale, from 1 - "very unlikely" to 5 - "very likely". Finally, motivation for content consumption was measured over eight statements reflecting possible use cases, while the motivation for content creation was measured over four statements, both on a five-point Likert scale, from 1 - "not at all accurate" to 5 - "extremely accurate". A full listing of the used statements is given in Table 1.

Results

A total of 101 participants have filled out the survey. Of those, 69.3% were male and 30.7% female. The smallest age group included participants above 55 years (9.9%), 44.6% fell within the range between 41 and 55 years, 34.7% between 27 and 40 years, and

10.9% were younger than 27. Majority of participants were of Swiss nationality (92.1%), and lived in families with (36.6%) or without children (39.6%), with small portion living alone (17.8%) or in shared apartments (5.9%). Finally, 84.2% reported previous victimization for themselves or their close family members.

In order to provide answers to our research questions, we first looked into the mean values of the obtained answers and compared them to the neutral value of three (3). The results of the t-test showed that the intention to consult the system ($M=3.36$, $SD=1.39$) and to share personal experiences ($M=3.46$, $SD=1.27$) are significantly larger than the neutral value ($p<0.05$). However, the system was not perceived as a tool that would be used on a daily basis ($M=2.72$, $SD=1.19$).

The overall motivation to use the provided information from the system for the envisioned use cases was found to be relatively small, with most of the values being significantly smaller that the neutral value ($p<0.05$). In particular, obtaining information before going out ($M=2.21$, $SD=1.19$) or jogging ($M=2.28$, $SD=1.31$) were found to be the least relevant use cases. These were preceded by checking for safe areas to park the car ($M=2.58$, $SD=1.34$) or bicycle ($M=2.61$, $SD=1.31$). Finally, checking for safe areas in foreign cites was slightly but not significantly smaller than the neutral value ($M=2.91$, $SD=1.35$). In turn, obtaining information before relocating ($M=3.72$, $SD=1.05$), receiving tips ($M=3.63$, $SD=1.26$) and checking the safety of area where one's family members live ($M=3.19$, $SD=1.32$) were the preferred use cases, with the first two being significantly larger than the neutral value. In terms of content creation, contributing because the app has helped them in the past ($M=3.46$,
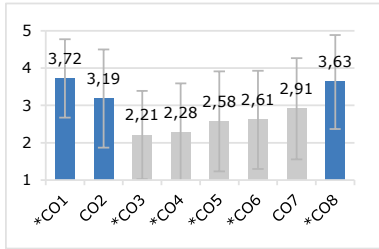
Figure 3. Mean values of the motivations for content consumption (* denotes significant difference to the neutral value, $p<0.05$).
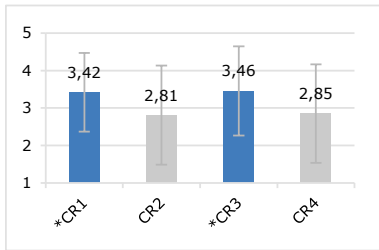

Figure 4. Mean values of the motivations for content creation (* denotes significant difference to the neutral value, $p<0.05$).

$SD=1.22$) and due to being concerned about the neighborhood safety ($M=3.42$, $SD=1.20$) were found to be the main motivators. The remaining two were found to be slightly smaller than the neutral value, i.e. sharing because social peers would also contribute ($M=2.85$, $SD=1.20$) and due to feeling responsibility to share experiences with others ($M=2.81$, $SD=1.28$). Figures 3 and 4 illustrate the obtained results.

To understand how usage intentions and motivations differ across demographic factors, we conducted Kruskal–Wallis test for one-way analysis of variance, and the matching Mann-Whitney test with Bonferroni correction for post-hoc analysis, suitable for not normally distributed data. Surprisingly, previous victimization was found to have a small significant effect only for UI3 with non-victims being more in favor of using the app on a daily basis ($U=442.50$, $p=0.023$, $Z=-2.27$, $r=-0.23$). Similarly, small effect of gender occurred only for CO6 ($U=770.00$, $p=0.017$, $Z=-2.38$, $r=-0.24$) where women were more in favor of this use case. Finally, family situation was found to be a significant factor for CO4 ($H(3)=9.88$, $p=0.02$), CO7 ($H(3)=9.56$, $p=0.023$) and CR4 ($H(3)=10.18$, $p=0.017$) with people living in shared apartments reporting higher values compared to the remaining groups. Table 2 provides the details.

Discussion and Conclusions
Overall, the proposed system was perceived as useful for obtaining crime related information. In addition, intention for sharing personal experiences was expressed. Still, the app was not perceived as a service that would be used on a daily basis. These results comply with those obtained over the motivations for content consumption, i.e. everyday use cases such as

checking the safety before going out received low rankings, while usage before relocating was seen as the most likely scenario. One possible explanation for the results could be that the pilot implementation focused only on household burglary, thus making the provided crime information irrelevant for certain use cases. Of motivations for content creation, contributing due to being concerned for the neighborhood safety and receiving help in return were found to be the main drivers for participation on the platform. These motivations can respectively be seen as affective/intrinsic, and rational/extrinsic. Surprisingly, norm-based motivations did not receive high ranking. Finally, demographic factors were shown to have no or small effect over the usage intentions and motivations.

In summary, the obtained result indicate that the proposed system holds potential to be used for crime prevention. Still, further analysis is needed to address the question of achieving sustainable user engagement.

Summary and Future Work
In this paper, we evaluated the potential of crowdsourcing in the area of crime prevention. The proposed system was perceived as useful for obtaining and sharing crime-related information, but not on a daily basis, while the contribution to the platform is driven by affective and rational motivations.

The results presented in this paper are based on self-reporting. In order to evaluate the actual usage, we plan to deploy CityWatch and conduct a field study. In addition, we would like to dive deeper into questions regarding the quality and trustworthiness of the crowdsourced data, as well as duplicates detection in order to be able to apply accurate crime prediction.

	Family Status	Z r
CO4	Family with children	-3.29 *-0.33***
CO7	Alone	-2.87 -0.29*
	Family w/o children	-2.87 -0.29*
CR4	Alone	-2.83 -0.28*
	Family w/o children	-2.96 -0.29*
	Family with children	-2.93 -0.29*

(Rows CO4, CO7, CR4 are grouped under "Shared apartment")

Table 2. Results of the post-hoc analysis for the effect of demographic factors over usage intention and motivations (italic letters indicate medium effect size; *p*<0.05, **p<0.01).

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