GETTING HELP IN A CROWD
A Social Emergency Alert Service

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Abstract: This paper presents the conceptual design of an emergency alert service which addresses the problem of getting help in a crowd. The design is based on the results of more than 30 years of research in social psychology on the bystander effect and it addresses the obstacles for helping by directing an alert directly to the members of the victim's social group who happen to be near the location of the emergency event. The proposed emergency recommender design combines the general availability of geo-location services with social clusters available either from the analysis of social web-sites or from communication analysis. For this purpose, two recently developed innovative clustering methods are used. The feasibility of the design is evaluated by simulating emergency events on the MIT reality mining data set.

1 INTRODUCTION

On Saturday, the 12th of September 2009, 50-year old Dominik Brunner was brutally murdered in a Munich S-Bahn station (Spiegel Online, 2009b). The attack on Dominik Brunner was observed by 15 passengers (Spiegel Online, 2009c) and transmitted and recorded by his mobile-phone on the open police emergency channel (Spiegel Online, 2009a).

This tragic incident reminds social psychologists of the murder of Kitty Genovese on March 13th, 3:20, 1964 in Queens, New York. Kitty Genovese was stalked, stabbed, and sexually assaulted near her own apartment building. During the attack on her she screamed and broke free twice. 38 of her neighbors witnessed the attack, but no one intervened. After 45 minutes one man called the police, but at this point in time Kitty Genovese was dead.

This incident motivated the study of social processes in emergency situations by Darley and Latané (Latané and Darley, 1970) and it points to the shortcomings and problems of real emergency response organizations and their management which very recently have become the object of scientific research e.g. (Yuan and Detlor, 2005), (Faraj and Xiao, 2006), (Chen et al., 2008), and (Comfort et al., 2009). The mobile phone of the victim transmitting and recording to the end confirms Palen and Liu's thesis of the increasing availability of ICT and its use in an emergency by citizens and also their observation, that the traditional hierarchical command-and-control reporting system of emergency response organizations may not be adequate and "does not include built-in considerations for the important roles that members of the public play as participants" (Palen and Liu, 2007, p. 729). Public participation in emergencies and disasters is active and altruistic. First responders are often not the trained professionals of an emergency response organization who are sent to the incident, but the people from the local and surrounding communities. They provide first-aid, transport victims to the hospital, and begin search and rescue (Palen and Liu, 2007, pp. 728-729). In the case of Dominik Brunner we may speculate whether a fast activation of his social community parallel to the emergency call could have saved his life.

The paper starts with a short review of the social processes which Darley and Latené have identified as obstacles for helping in emergencies in section 2. These obstacles have become known as the bystander effect: The more bystanders, the less likely the victim will receive help. We address the bystander effect by a social emergency alert service and discuss how social emergency alert services may help in improving these processes in emergency settings by activating the nearby members of the victim's social network.

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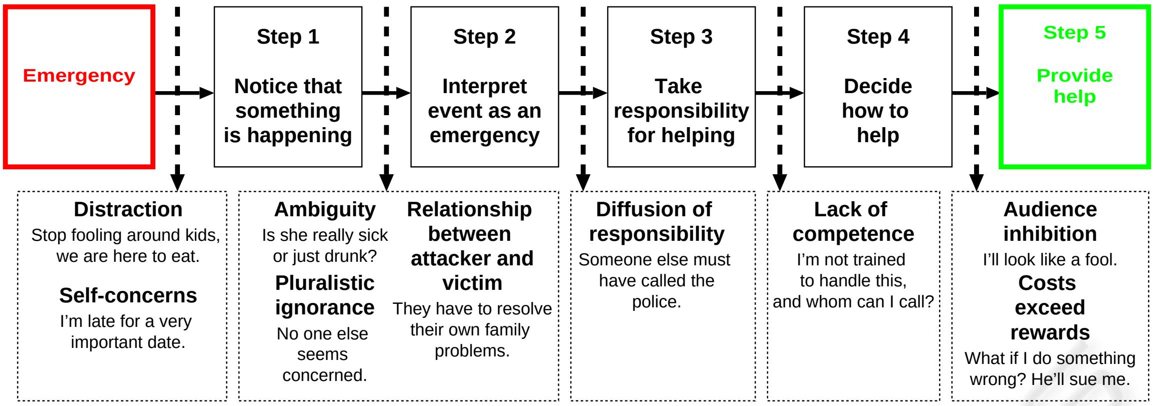

Figure 1: The social help process: 5 steps leading to assistance.

For the process of giving and receiving help, we propose to monitor social interactions and to identify the social clusters of the victims and to locate the nearest members of the social cluster of the victim in an emergency for notification purposes. In section 3 we present details on the social emergency alert service for getting help in a crowd and in section 4 we discuss implementation variants of realizations of such services based on readily available technology by the telecommunication and Internet industry.

The architecture for the prototype of the service which is currently implemented is presented in section 5.

For social cluster identification, recently developed fast algorithms for graph clustering are presented in section 6.

Section 7 of this paper aims at assessing the chances that the social emergency alert service presented has in reality. For this purpose, a first attempt is made to answer three questions which play a crucial role for the success of a social emergency alert service:

1. Has the victim in an emergency a chance to transmit a request for help?
2. Is someone of his social network nearby?
3. Will this person really help?

2 THE UNHELPFUL CROWD: FIVE STEPS TO HELPING IN AN EMERGENCY

The murder of Kitty Genovese in 1964 in Queens, New York, in front of 38 witnesses who did not interfere led Darley and Latané to start investigating the social psychological processes at work in this incident. Their research revealed that the more bystanders, the less likely the victim will be helped. This is the *bystander effect*: The presence of others inhibits helping. One of the reasons for this is the diffusion of responsibility (Darley and Latané, 1968). Darley and Latané (Latané and Darley, 1970) provided a careful analysis of the process of emergency intervention shown in figure 1. Unfortunately, many obstacles to helping must be overcome. At each step, however, psychological factors are at work which explain why people fail to help:

1. **Noticing.** The presence of others distracts attention from the victim. People who live in big cities may filter out people lying on sidewalks or screams (stimulus overload (Milgram, 1970)).

2. **Interpreting.** People must interpret the meaning of what they perceive. Their perception may be ambiguous: Cries of pain may be taken for laughter, hypoglycemia may be taken for drunkenness (e.g. (Clark and Word, 1972), (Piliavin et al., 1975)). A perceived relationship between attacker and victim may lead the observers to think that everything is OK (Shotland and Straw, 1976). If an emergency happens, the most powerful information available is often what other people do. However, if everybody looks on everybody else to get clues on what to do, the whole group is suffering from pluralistic ignorance and everybody concludes that help is not needed (e.g. (Miller and McFarland, 1987), (Monin and Norton, 2003)).

3. **Take Responsibility.** When help is needed, who is responsible for providing it? The diffusion of responsibility means that people belief that others will or should help. The effect usually is strengthened by anonymity and considerably reduced by a reduction in psychological distance. Groups with members who know each other are more helpful than strangers. See e.g. (Garcia et al., 2002), (Rutkowski et al., 1983), (Baumeister et al., 1995).

4. **Decide how to Help.** Bystanders are more likely to offer direct help if they feel competent to perform the actions required (e.g. (Shotland and Heinold, 1985), (Cramer et al., 1988)).
5. **Provide Help.** Some people may feel too embarrassed to provide help in a public setting (audience inhibition). However, when people think they will be scorned by others for failing to provide help, the presence of an audience will increase their helpful actions. See (Schwartz and Gottlieb, 1980).

In addition, a series of other variables have a high influence on helping behavior as experiments in social psychology have shown: Time pressure reduces the tendency to help (e.g. (Darley and Batson, 1973), (Batson et al., 1978)). Group membership and empathy and attractiveness interact: empathy is a positive predictor for help for in-group members, whereas attractiveness works for out-group members (Stürmer et al., 2005). Group membership positively influences help for in-group members, and the group boundaries can be shifted by proper priming (Levine et al., 2005). Group status and group identification influence the willingness of receiving help (Nadler and Halabi, 2006).

But what can you do to receive help in a crowd? Try to counteract the ambiguity of the situation by making it clear that you need help, and try to reduce the diffusion of responsibility by addressing a specific individual for help, keep eye contact, point or direct requests (e.g. (Moriarty, 1975), (Shotland and Stebbins, 1980)). Consistent with this is a recent study of P. Markey (Markey, 2000) of people in Internet chat rooms: If the number of individuals is large in a chat room, individuals react slower to a plea for help. However, addressing a specific individual by his name leads to considerably faster help and eliminates this effect.

Research on the bystander effect in social psychology showed that even weak social links matter and increase the chance of a victim to receive help considerably. This fact is the main motivation to send alerts to the geographically close members of the victim's social group.

The asymmetric perception of social links (e.g. (Hoser and Geyer-Schulz, 2005)), the role of weak ties, and the cultural norms of the community play a major role in the formation of the social group of the victim. The asymmetric perception of social links implies that a person may not be really aware of possible helpers in his loose social contacts. Taken together with cultural norms, even professional acquaintances are potential helpers. The role of weak ties for networks has been studied by M. Granovetter ((Granovetter, 1973) and (Granovetter, 1982)). In the context of information diffusion on open jobs Granovetter observed that "it is remarkable that people receive crucial information from individuals whose very existence they have forgotten" (Granovetter, 1973, p. 14). This is an indication that an explicit list of emergency contacts provided by the subscriber of such an emergency service will considerably limit the effectiveness of such a service, because of these social phenomena.

3 GETTING HELP IN A CROWD - A SOCIAL EMERGENCY ALERT SERVICE

Getting help in a crowd is a social emergency alert service selecting nearby members of the social group of the victim and notifying them about the victim's need for help and the victim's location. With this service we aim to activate the locally available social network of the victim and to eliminate the bystander effect.

The UML sequence diagram depicted in figure 2 shows the generic process in an emergency incident. It is designed on a high-level, abstract way allowing a variety of industrial implementations. We will address this issue in section 4.

An emergency notification is submitted by the victim by starting an application on his mobile device (`LaunchEmergenyApplication` in figure 2) e.g. by pressing the help-button shown in figure 5. The application retrieves the current geo-position. Both, the ID of the emergency caller and his geo-location are then transmitted to the emergency alert service (`EmergencyAlert` in figure figure 2).

For discovering the most likely person to help in the victim's social network, his social network has to be known and possible helpers identified (`GetHelperCluster` in figure 2). The network is either built from social interaction data from e-mail, sms, phone, and mobiles where the number of interactions is taken as an indication of social nearness or from social web sites as for example Facebook or Xing. However, the number of social interactions may be ambiguous as a recent incident (Rungg, 2010) of a woman threatened by her former husband with Googles Buzz has shown: So the possibility to check for such unwanted relations must be provided for the participants of the emergency alert service (`FilterCandidates` in figure 2). Usually social networks tend to be very large. As emergencies are often time-critical, it might take too long to calculate such a network on-the-fly. The network is pre-built and up-

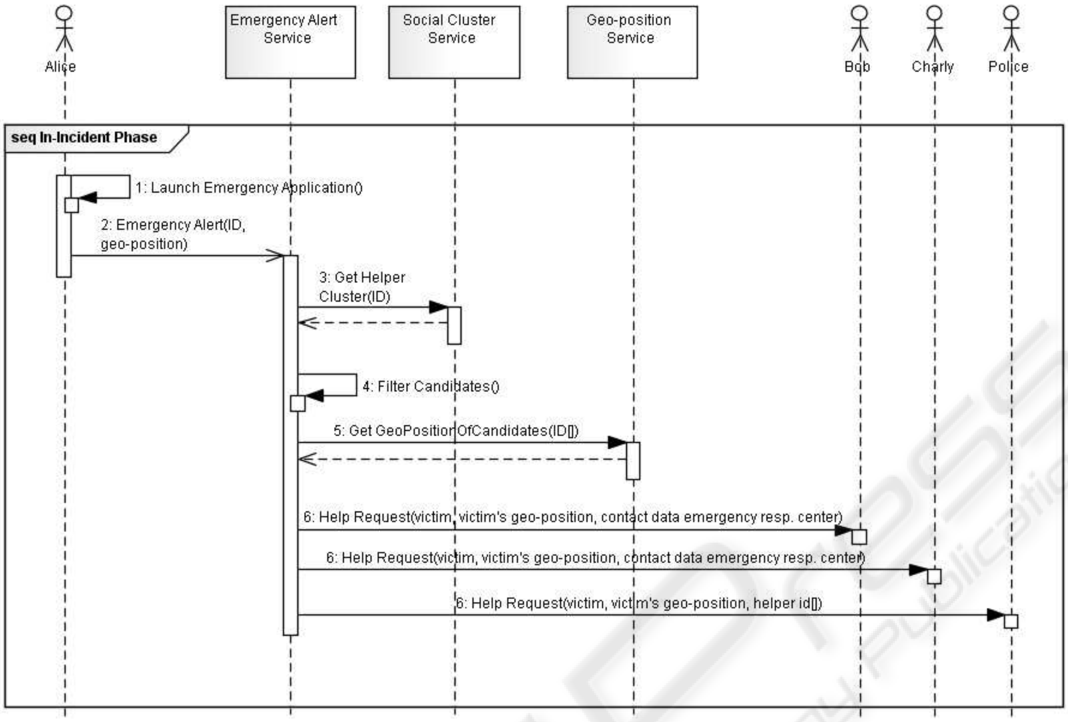

Figure 2: Sequence Diagram of a Generic Social Emergency Alert Service (in-incident).

dated regularly for all service subscribers. To find out which persons in the social network are likely to help, a clustering of the network is performed. Details for this clustering are addressed in section 6.

Next, the current geo-position of the candidates is retrieved from a geo-position service (`GetGeoPositionofCandidates` in figure 2). The alert service uses the geo-data as a filter on the victim's social cluster to find out, who of the possible helpers is locally close enough. Section 7 deals with details of having at least one member of the victim's social cluster in range.

The possible helpers in range and the emergency response center are informed about the emergency situation of the victim (several invocations of `HelpRequest` in figure 2). All possible helpers in range are informed simultaneously. The victim's name, his geo-location and the shortest route as well as the contact data for the emergency response center are provided.

Finally, possible helpers and the emergency response experts at the police's emergency response center may communicate, because of the information forwarded by the emergency alert service (not shown in figure 2). This facility has the potential of providing expert guidance to the socially close first responders on the scene. However, it also reveals the identity of potential helpers to the emergency response center. The privacy impact of this must be addressed for such a service.

In section 2 obstacles to the five steps leading to assistance have been described. The emergency alert service presented addresses these obstacles directly:

1. The *distraction* obstacles can be avoided by noticing, that an emergency incident takes place: Clear signal words are part of the personal message to the helpers. This makes it obvious, an emergency case is happening and this is made clear to the helper.
2. *Self concerns* are also addressed by the service: Since the potential helper is directly addressed and others know this from the incident protocol, social norms lead to pressure to help.
3. *Ambiguity* is by-passed by the clear and unmistakable help request sent to the helpers.
4. As this message is personal, *pluralistic ignorance* is eliminated. Experimental evidence for these effects in internet chat rooms is provided by P. Markey (Markey, 2000).
5. The *relationship between attacker and victim* can not lead the helper to overlook the emergency event, because of the unambiguous emergency message.
6. *Diffusion of responsibility* is also reduced, since the emergency alert message is directly and per-

sonally addressed to the helper. Because of this, he is responsible and because of the incident protocol, others will know this and hold him responsible.

7. *Lack of competence* may be addressed by providing fast expert backup for helpers from the police emergency response center.
8. Expert guidance of how to help also addresses the problems of *audience inhibition* and *costs exceed rewards*.

4 IMPLEMENTATION VARIANTS

In this section we present implementation examples how the *Social Emergency Alert Service* can be implemented in an industrial environment.

4.1 Emergency Alerting

To be able to use the service, the user has to possess a mobile device (e.g. a mobile phone). He can then subscribe to the service. In case of an emergency, he starts an application on his mobile device. Of course, the start of the application must be made simple and fast, as we do not expect it likely that the victim is able to deal with complex applications in an emergency situation. For the implementation third-party platforms like Android can be used. Android (Android, 2010) is a mostly free and open-source OS platform developed and driven by the Open Handset Alliance (Open Handset Alliance, 2010). Further platforms like Apples iPhone may be supported as well. Special mobile devices combined with body-sensors, e.g. for elderly people, linking the start of the application to a hardwired button can be offered.

4.2 Geo-position Service

Geo-positions of both the victim and all possible helpers of the victim's social network need to be calculated. Many of todays mobile phones are able to calculate their geo-position by GPS (Global Positioning System). The service Google Latitude is an example for a service that users can publish their current geo-position and share it with friends. If a mobile device does not include such a feature, several alternative techniques have been described and implemented. Even speed vectors can be calculated (for example (Kikiras and Drakoulis, 2004; Borkowski and Lempiainen, 2006)). By this, the expected geo-position of somebody moving in a train can be found out.

4.3 Building Social Networks and Identifying Possible Helpers

For discovering the most likely person to help in an emergency case the social network has to be known. We present three possible realizations.

The social network can be built by monitoring outgoing and incoming calls on the mobile device of the subscriber. The emergency alert application running on the mobile device collects this call data, pools it and regularly (e.g. once a week) transmits it via HTTP to the social cluster service (see figure 2). There the call logs of all service subscribers are combined and the network is calculated: Telephone numbers are represented as nodes, the calls are weighted ties. Each call strengthens a tie. The advantage of this solution is, that the network is independent from the telephone provider. It works depending just on the emergency alert application. The disadvantage is, that the calculated social network consists only of subscribers and their direct connections. Ties between non-subscribers can not be observed technically.

Alternatively not the mobile devices monitor the calls, but connection records from telephone providers are used. Connection records are stored for billing purposes. In the European Union an directive forces the provider to save call logs from six month up to two years (EU, 2006). These connection data can be used to calculate the social networks. Every connection is represented by a tie between the calling parties (more concrete, their telephone numbers) as nodes. Of course, the resulting network will be huge. In section 7 we will show that feasible cluster algorithms for such huge data sets exist. The advantage of this solution is, that much more network data can be collected so that the problem of missing links is smaller. On the other hand this alternative can only be realized if the calling logs are available to the emergency alert provider. As we do not expect network providers to give such information away, the most likely approach for this alternative is, if the network provider is identical with the emergency alert service provider. The provider can then use the service as an additional opt-in feature. Another disadvantage is, that one network provider will probably not exchange network or call log data with other providers. By this the social network is limited to the customers of the provider plus their direct links.

As an additional feature for both alternatives address books in the customers' devices can be used to group telephone numbers. Different telephone numbers of one person can be combined and fused to one node in the social network.

A third approach to build the social network is to cooperate with existing social network platforms. Data from Facebook, Xing, Myspace can be used. The advantage of this solution is, that no subscriber or network provider boundaries exist. The disadvantage is, that people tend to accept more ’friends’ in social platforms than they would accept offline. Additionally most of these platforms do not weight their ties, which makes it difficult to apply cluster algorithms.

In practice all three alternatives used to build a social network as discussed above can be complemented with a list of emergency contacts provided by each subscriber and, if available, with a list of dedicated helpers for an event or for a community. In a German small rural community, the community’s voluntary fire-fighters are an example of such a community. We expect, that people in the same social group are likely to help each other.

5 ARCHITECTURE OF THE PROTOTYPE

In figure 3 we present the architecture of a prototype of the service. The mobile application (*Emergency Alert Widget*, *GPS-Push Service*, *Communication Capture Service* in figure 3) is implemented on a Motorola Milestone smart phone using Android as OS. The *Service Provider* is realized in Java using Apache Service Mix as OSGi [1] provider.

Figure 4 depicts the sequence diagram of the prototype. Each subscriber is identified by his unique telephone number (ID). In the *Pre-Incidence Phase* each subscriber submits his geo-location data to the *GPS Cache* (step 1). We use a *GPS Push Service* running as background service on the Android smart phone to transmit the GPS coordinates via REST to the *GPS Cache*. The transmission is done on a regular basis, e.g. every 10 minutes and if the position changed by more than 10 meters. The *GPS Cache* stores the latest transmitted geo-position of each subscriber in a database. The *Communication Capture Service* runs on the mobile device. It monitors all ingoing and outgoing calls and messages. This communication data is collected in a local cache. Once a day the smart phone submits the cached communication data via SOAP to the *Communication Collector* (step 2). The *Social Cluster Calculator* pulls new data from the *Communication Collector* on a daily basis. It builds a communication network, clusters the groups and stores the results in the *Social Group Provider’s* database (step 3 and 4). OSGi is used as the internal Service Provider’s protocol.

In the *In-Incident Phase* the user in need (in our example this is Alice) starts a widget on her smart phone (see figure 5). A emergency alert is transmitted via REST to the *Emergency Alert Service* (step A). The service pulls the helpers candidate list from the *Social Group Provider* for Alice via OSGi (step B). For each candidate the *GPS Cache* is searched for the latest geo-position data of the candidate (step C). If close enough, a MMS is sent out to the helper with information about the victim and the victims geo-position (depicted on a map).

Note, that Figure 4 is restricted to a proper emergency alert. False alerts can be revoked by a similar process (not shown in Figure 4) which is password protected. However, pragmatically a set of passwords is provided which act as silent signals. A small solution consists of three passwords, the first signaling a false alarm, the second signaling that the victim is forced to revoke the alarm, and the third that there is danger for the helpers.

6 IDENTIFYING SOCIAL GROUPS BY CLUSTERING SOCIAL NETWORKS

Calling persons willing to help is crucial for the proposed system but their identification is not trivial. Communication networks or ’friend’ networks of online social network sites usually contain many links that do not result from close personal relations. Links may connect business partners or co-workers. On social network sites people ’friend’ others they rarely know. Therefore, identifying social groups is an approach to separate close personal contacts from other distant contacts that are less willing to help in a case of emergency.

The appropriate cluster algorithms depend on the network that needs to be analyzed. All algorithms need to be highly efficient as the mentioned networks are very huge (several million vertices). From communication data weighted networks could be created where an edge connects caller and the callee respectively sender and receiver of a text message. The edges can be weighted by the number of calls or messages. Walk context clustering is a suitable method for this kind of network. It generates overlapping clusters and can reflect that people might have several groups of close contacts (family, friends, neighbors) that are almost not connected with each other.

Cluster algorithms based on optimizing the mod-

[1] The Open Services Gateway initiative is a module system and service platform for Java. For details see http://www.osgi.org

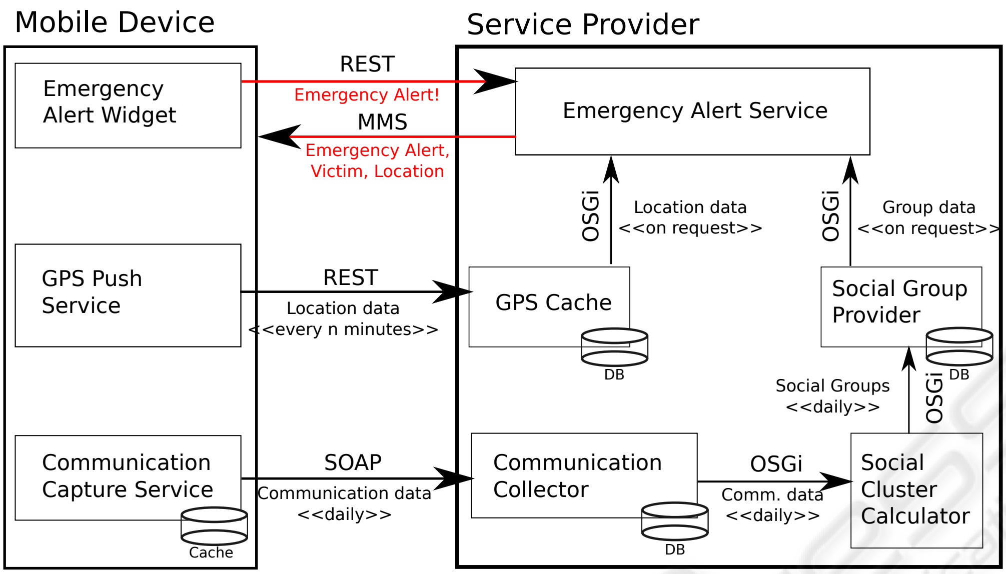

Figure 3: Architecture of the Prototype.

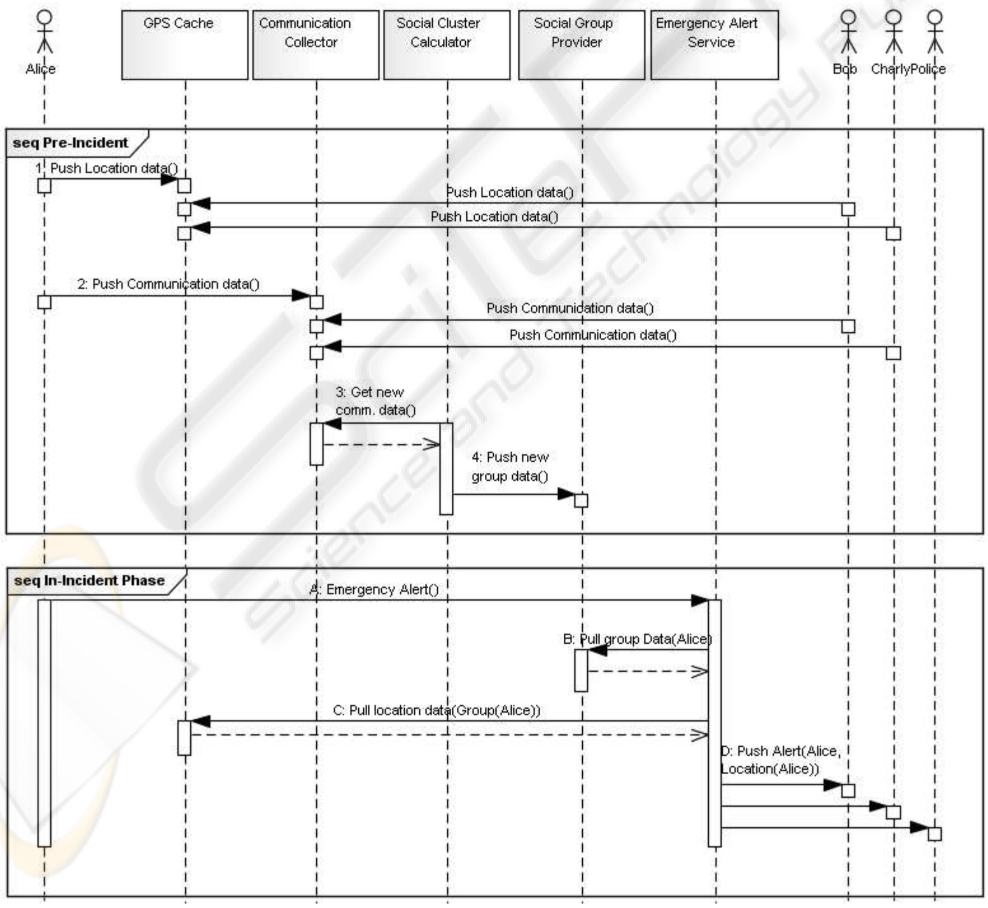

Figure 4: Sequence Diagram of the Prototype.

ularity measure can not reflect the multitude of social groups one person is integrated in. However, they are able to deal with unweighted networks like the friendship networks of social network sites.

Figure 5: Alert Widget on Phone.

6.1 Walk Context Clustering

Walk context clustering consists of two stages (see algorithm 1). In the walk stage, a set of restricted random walks is generated by starting a number of walks at each vertex and repeatedly choosing the following vertices randomly among those vertices that are linked by an edge which has a higher weight than the previously taken one (see figure 6).

In the cluster construction stage, clusters get generated from the walks. Walk context clustering assigns a vertex to the cluster of another vertex if both are part of the same walk. A level parameter l specifies the fraction of vertices at the beginning of a walk that are disregarded. The later a pair of vertices appears in a walk the stronger is their connection. The interesting feature of walk-context clustering is that the closeness of two persons can be measured by the maximal level that assigns one person to the cluster of the other one.

A recently developed database-backed update algorithm for the walk stage maintains asymptotically optimal clusters in near real-time (< 0.2 sec for a single update on graphs with approximately 500000 nodes and 20 million edges) (Franke and Geyer-Schulz, 2009).

Algorithm 1: Walk context clustering.

Data: undirected, weighted graph $G = (V,E)$, constant p

▼ **Walk generation**

$walkSet \leftarrow \emptyset$ **forall** $v \in V$ **do**
  for $counter \leftarrow 1$ to p **do**
    $walk \leftarrow (i)$; $last \leftarrow 0$; $i \leftarrow v$ **while** $N = \{x|\omega_{ix} > last\} \neq \emptyset$ **do**
      $j \leftarrow$ random element of N $last \leftarrow \omega_{ij}$ append j to walk w $i \leftarrow j$
    $walkSet \leftarrow walklist \cup walk$

Data: walkSet ws, vertex v, level l

▼ **Cluster Construction**

$cluster \leftarrow \emptyset$ **forall** $w \in ws | v \in w \wedge pos(v,w) > l$ **do**
  forall $x \in w | pos(x,w) > l$ **do**
    $cluster \leftarrow cluster \cup x$

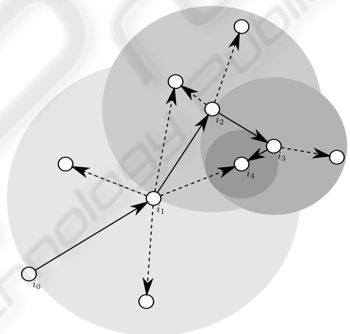

Figure 6: Narrowing search space for successive vertices of the restricted random walk algorithm. The walks terminates when no neighbor is within the search space. Solid arrows symbolize used transitions. Dashed arrows symbolize links to possible successors that have not been chosen by the random process.

6.2 Modularity Clustering

Newman and Girvan (Newman and Girvan, 2004) proposed a quality function for graph clusterings. The modularity Q of a clustering $C = C_1, \ldots, C_z$ $(\forall i,j : C_i \cap C_j = \emptyset$ and $\cup_i C_i = V)$ of a graph $G = (V,E)$ is

$$Q = \sum_i (e_{ii} - a_i^2) \tag{1}$$

with $e_{ij} = \frac{|\{\{v_a,v_b\} \in E | v_a \in C_i \wedge v_b \in C_j\}|}{2|E|}$ and $a_i = \sum_j e_{ij}$.

The randomized greedy modularity clustering algorithm (Ovelgönne and Geyer-Schulz, 2009) (see algorithm 2) is a fast agglomerative hierarchical clustering algorithm. It places each vertex in a separate cluster and builds the complete dendrogram by repeatedly merging clusters. In each step it randomly selects k clusters and searches among the clusters and their neighbors for the pair that yields in the highest increase in modularity. The ΔQ of the merge of two clusters i and j is $\Delta Q(i,j) = e_{ij} + e_{ji} - 2a_i a_j = 2(e_{ij} - a_i a_j)$. This algorithm is able to process even very large networks in reasonable time. A graph with about 300.000 vertices and 1 million edges is clustered in roughly 10 seconds.

Algorithm 2: Randomized greedy modularity clustering.

Data: undirected, connected graph $G = (V,E)$, constant k
▼ **Initialize**
  forall $v \in V$ **do**
    forall *neighbours n of v* **do**
      $e[v,n] \leftarrow 1/(2 * edgecount)$
    $a[v] \leftarrow rowsum(e[v])$

▼ **Build Dendrogram (Randomized Greedy)**
  for *i = 1 to rank(e)-1* **do**
    maxDeltaQ $\leftarrow -\infty$ **for** *j = 1 to k* **do** search among k communities for best join
      $c1 \leftarrow$ random community **for** *all communities c2 connected to c1* **do**
        $deltaQ \leftarrow 2(e[c1,c2] - (a[c1] * a[c2]))$ **if** $deltaQ > maxDeltaQ$ **then**
          $maxDeltaQ \leftarrow deltaQ$ $next\,join \leftarrow (c1,c2)$
    join(nextjoin)

7 ASSESSMENT OF BENEFITS

7.1 Ability to Transmit Request for Help

Emergency situations can result of various incidents, e.g. crime, accidents, medical emergencies. By their nature, accidents happen unexpected and sudden. Some medical emergencies as heart attacks do as well. The ability to make an emergency call in these cases will depend on the physical condition of the person in need.

For victims of violent crime their ability to send an emergency signal depends on the progress of crime. In 25%, respectively 22%, of the robberies analyzed by Smith (Smith, 2003) instant violence or attempts to snatch property don't give the opportunity to call for help. However, in 37% of the robberies the offender approached the victim and demanded money or valuables without immediate violence. In many cases later victims were also aware of an upcoming threat. In those cases it would be possible to send an emergency message.

7.2 Chance for Nearby Help

The helpfulness of the proposed system depends on the availability of close social contacts in the proximity of the site of the emergency. The actual number of persons in ones proximity in general and the number of close contacts with a particular motivation to help will surely depend on several factors, e.g. place and time.

To gain insight into the availability of potential help the MIT reality mining experiment (Eagle and Pentland, 2005) provides an interesting data set. For this experiment a group of 100 persons (75 students or faculty of the MIT Media Laboratory and 25 students of the MIT Sloan Business School) has been equipped with smart phones with special software applications preinstalled. These applications recorded phone numbers of incoming and outgoing calls, text messages, and the id of the cellular tower the phones were connected to during one academic year.

The phone call and text message data from the reality mining data set can be used to construct a communication network. Based on the assumption that the communication intensity of two people reflects the closeness of their relation, social groups can be identified by clustering this weighted network. The availability of nearby help from within the social group of a person in need can be estimated by the number of persons from the same social group whose phones are connected to the same cellular tower as the person in need.

For three consecutive months all communication prior to the specific month has been used to build an undirected, weighted communication network. The edge weights are the number of communication events (calls, text messages). This network has been clustered by the walk context cluster algorithm with the level parameter set to 0.8. The generated clusters had an average size of about 5.

The MIT reality mining data set contains a history of time-stamped connection records of the participating persons. For each month 1000 connection records have been randomly selected. Then, for each persons in a connection record the number of persons of his social cluster who have been connected to the same cellular tower at the same time have been counted. This simulation showed that on average more than one close fellow student was available for help at any time (see table 1). E.g. for September 2004 the probability of having at least one person from one's social group in the proximity was 78% - independent of time of the day.

This is just a basic assessment for a particular group of people that has several shortcomings. Due to the lack of more detailed data it was not possible to as-

Table 1: Average number of other persons of same social group connected to same cellular tower for 1000 randomly selected persons and points of time.

	Day (6am-6pm)		Evening (6pm-11pm)		Night (11pm-6am)	
	Group	Others	Group	Others	Group	Others
09/2004	1.16	3.74	1.17	2.73	0.95	1.51
10/2004	1.33	3.12	1.29	3.4	1.14	1.82
11/2004	2.2	3.18	1.53	2.16	1.76	1.03

sess if other social contacts than fellow students were available for help. Proximity could just be estimated by radio cells which have a radius of a few hundred meters in urban areas and a radius up to about 35 km in rural areas. But it is fair to regard the results as an indication that people living in urban areas will usually have at least one of their social contacts in their proximity.

7.3 Chance to Actually Receive Help

Once a request for help has been transmitted to a potential helper in the proximity of the site of the emergency the chance to actually receive help depends on the willingness and the ability of the informed persons to get to that place. The ability to get to a specific site can be supported in various ways. For example a map and route directions could be displayed together with the emergency message. The research of Markey (Markey, 2000) showed that also in computer-mediated communication settings help requests that were directed to specific persons had a high probability to receive fast response and the bystander effect was virtually eliminated.

8 CONCLUSIONS

In this paper a novel emergency alert service has been introduced which addresses all obstacles to providing help identified in the social emergency intervention process discussed in section 2. The service is designed to reduce psychological barriers that result in a bystander effect and inhibit effective help for persons in need. The analysis of emergency situations and whereabouts of persons in relation to their respective social group suggest that the described service can actually provide a benefit in practice. A first prototype of this service is currently under development.

The main emphasis of this paper is on the reduction of the bystander effect. However, the following challenges which are beyond the scope of this paper are examples of what must be addressed thoroughly for concrete industrial service offerings:

1. Legal issues: The service raises e.g. the problem that potential helpers become liable to help and failure to do so may be prosecuted.
2. Privacy: The service should be designed in order to minimize the intrusion of privacy of service-subscribers.
3. Emergency dialog: The emergency dialog could be further automated e.g. by providing an automatic classification of the incident type.
4. Geo-positioning problems: Geo-positioning is still problematic in large buildings, tunnels, subterranean areas (e.g. subway). Enhancements could be based e.g. by embedding geo-position senders in such structures or by image recognition techniques which exploit public geo-coded images of such spaces.

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