ISSN : 2347 - 8446 (Online)
ISSN : 2347 - 9817 (Print)

# Enforcing Security for Smartphone user by Crowdsourcing Model Using Internet of Things

[I]Pallavi A R, [II]Annapurna V K
[I]PG Student, Dept. of IS&E, The National Institute of Engineering, Mysore, India
[II]Associate Professor, Dept. of CS&E, The National Institute of Engineering, Mysore, India

**Abstract**
*With the powerful sensing capability of mobile smart devices, users can easily obtained the crowd sensing services with smart devices in the Internet of Things (IoT).With the surging of smart phone sensing, wireless networking, and mobile social networking techniques, Mobile Crowd Sensing (MCS) has become a promising paradigm for cross-space and large scale sensing. MCS extends the vision of participatory sensing by leveraging both participatory sensory data from mobile devices (offline) and user-contributed data from mobile social networking services (online). However, credible interaction issues between mobile users are still the hard problems in the past. In this paper, we focus on how to assign the crowd sourcing sensing tasks based on the credible interaction between users. First, a novel credible crowd sourcing assignment model is proposed based on social relationship cognition and community detection.*

**Keywords**
*Internet of things (IoT), mobile crowd sensing (MCS), analytic hierarchy process (AHP), mobile sensing service, credible interaction.*

## I. Introduction

Many technical communities are vigorously pursuing research topics that contribute to the Internet of Things (IoT). Today, as sensing, actuation, communication, and control become ever more sophisticated and ubiquitous, there is significant overlap in these communities, sometimes from slightly different perspectives. IoT is a new revolution of the Internet. The spectrum of research required to achieve IoT at the scale envisioned above requires significant research along many directions. Objects make themselves recognizable and they obtain intelligence by making or enabling context related decisions thanks to the fact that they can communicate information about themselves. They can access information that has been aggregated by other things, or they can be components of complex services. This transformation is concomitant with the emergence of cloud computing capabilities and the transition of the Internet towards IPv6 with an almost unlimited addressing capacity.

**Mobile Crowd Sensing (MCS)** presents a new sensing paradigm based on the power of mobile devices. The sheer number of user-companioned devices, including mobile phones, wearable devices, and smart vehicles, and their inherent mobility enables a new and fast-growing sensing paradigm: the ability to acquire local knowledge through sensor-enhanced mobile devices – e.g., location, personal and surrounding context, noise level, traffic conditions, and in the future more specialized information such as pollution – and the possibility to share this knowledge within the social sphere, healthcare providers, and utility providers. The information collected on the ground combined with the support of the cloud where data fusion takes place, make MCS a versatile platform that can often replace static sensing infrastructures, and enabling a broad range of applications including urban dynamics mining, public safety, traffic planning, environment monitoring, just to name a few.

A formal definition of MCS is: a new sensing paradigm that empowers ordinary citizens to contribute data sensed or generated from their mobile devices, aggregates and fuses the data in the cloud for crowd intelligence extraction and people-centric service delivery. Similar to participatory sensing , MCS has sensed data from mobile devices as inputs. Nevertheless, it additionally "reuses" the user-contributed data from mobile Internet services (mostly mobile social network services), which is often termed as the participatory media . In other words, the user-contributed data are used for a second purpose. MCS further explores the integration and fusion of the data from heterogeneous, cross-space data sources. We use the following example to showcase its characters.

Mobile phones or smart phones are rapidly becoming the central computer and communication device in people's lives. Application delivery channels such as the Apple App Store are transforming mobile phones into App Phones, capable of downloading a myriad of applications in an instant. Importantly, today's smart phones are programmable and come with a growing set of cheap powerful embedded sensors, such as an accelerometer, digital compass, gyroscope, GPS, microphone, and camera, which are enabling the emergence of personal, group, and community scale sensing applications. We believe that sensor equipped mobile phones will revolutionize many sectors of our economy, including business, healthcare, social networks, environmental monitoring, and transportation.

## II. Related Work

The **Internet of Things (IoT)** is the network of physical objects—devices, vehicles, buildings and other items which are embedded with electronics, software, sensors, and network connectivity, which enables these objects to collect and exchange data. The Internet of Things allows objects to be sensed and controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit; when IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart grids, smart homes, intelligent transportation and smart cities. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure. The IoT provides solutions based on the integration of information technology, which refers to hardware and software used to store,

retrieve, and process data and communications technology which includes electronic systems used for communication between individuals or groups. IoT continues to affirm its important position in the context of Information and Communication Technologies and the development of society.
socioscope model for social network and human-behavior analysis based on mobile-phone call-detail records. The "socioscope" consists of several components, including zoom, scale, and analysis tools, which are used for analysing network structures, for discovering social groups and events, for quantifying relationships, and so on. It is extensible; new tools can be added as needed. By zoom-in, we may use multiple scales to analyse social-group member behaviour up to the one-to-one relationship. By zoom-out, we may analyse general social-network structures and properties. One technique cannot detect all the different features of human social behaviors. Thus, we used multiple probability and statistical methods, including affinity, wavelet denoising, sequential detection, inhomogeneous Poisson and inhomogeneous exponential model, and Bayesian inference for quantifying social groups, relationships, and communication patterns and for detecting human-behavior changes. As a result Reciprocity index to measure the level of reciprocity between users and their communication partners. Socioscope model is useful for homeland security and for detecting unwanted calls, e.g., spam, telecommunication presence, and marketing.
EMC3 shares the same objective of reducing the energy consumption under the coverage constraint and this work is different from other existing work in the following aspects: 1) Unlike all abovementioned works which focus on reducing overall energy consumption in sensing, we mainly focus on reducing the overall energy consumption in data transfer. However, the techniques in reducing sensing energy consumption can be also applied in our framework. 2) The optimization problems considered in those related works are mathematically different from the problems considered here, due to different objectives and assumptions. For example, we have a different coverage definition from the related works, and we request to return a fixed number of returned results with minimal number of task assignments under full coverage.
Mobile crowd sensing (MCS) uses mobile terminals such as smart phones to collect and analyse the information of people and surrounding environments, analyses service characteristics and activity patterns of mobile users based on the mass of information, and subsequently mines such data to reveal hidden information about user behaviour, community structure, and service-related attributes, ultimately providing useful information, and services to end users. MCS provides a new method of perceiving the world, by involving anyone in the process of sensing, to greatly extend the services of IOT and build a new generation of intelligent networks that interconnect things–things, things–people, and people–people.

## III. Crowdsourcing Model

In our crowdsourcing scenario, the completion of the sensing task in the target area is no longer achieved depending on a single fixed node. In a sparse network, a trusted route from the service requester (SR) to the service provider (SP) is built based on the mobility and sociality of users to achieve efficient distribution and reliable delivery of crowdsourcing requests. Fig. 1 illustrates a use case of our study scenarios and the architecture of the crowdsourcing model we propose.

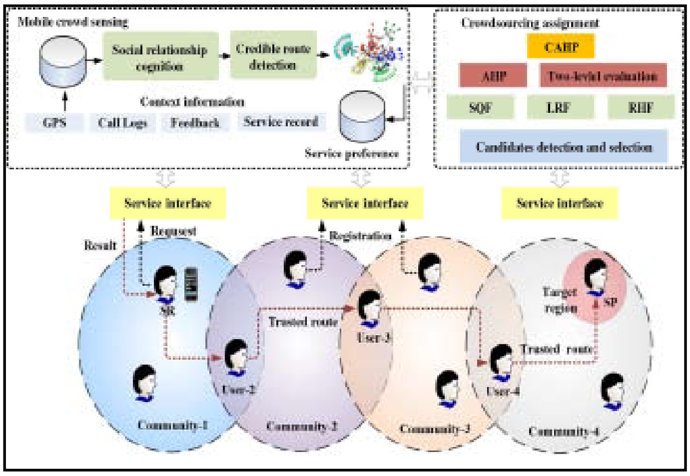


Fig.1: Framework of the crowd sourcing model

### 1. MCS Module

The MCS module is the basis of our model. It gathers realtime ctivity and interaction data (such as the global positioning system (GPS) trail and external environment data) from mobile devices that a user carries. Users can also register and publish service information and service capacity by interacting with the mobile service interface, which is provided by the mobile devices. The MCS module analyzes the social characteristics and network structure of peers by applying machine learning and data mining methods to the raw data gathered. This information could be used to provide a basis for decisionmaking for a subsequent process of a credible crowdsourcing route.

### 2. Mobile Service Interface

The mobile service interface consists of two parts, service registration, and context registration. Service registration allows the SP to register the services it provides. Registration information may include service ID, service location, and service type. Context registration further details the services of users, e.g., service capacity, GPS, user preferences, and social relationship. Mobile service interface can be described as the service request of the SR when the request is initialized and, further, to find and match the right candidate crowdsourcing service nodes to the SR.

### 3. Data Center Module

As the name suggests, this module serves as the storage center in our model. Social attributes, activity patterns, and community relationships of users are stored in the data center. Effective assignment of sensing tasks from SR to SP is achieved by mining the trust relationship between users and their service preferences.

### 4. Crowdsourcing Module

The crowdsourcing module is the core of our model; focus was on how to achieve credible interaction between SR and SP. This is only the first step to achieve the crowdsourcing sensing task. However, in reality, the final completion of the crowdsourcing service not only depends on the service route but also on the context environment, such as the route reliability, the location information of target area, and user preference. In this paper, the crowdsourcing decision factors including SQF, LRF, and RHF are defined, and we use the AHP to calculate different weights.

ISSN : 2347 - 8446 (Online)
ISSN : 2347 - 9817 (Print)

## IV. Crowdsourcing Decision Making Procedures

The mobility and sociality of mobile nodes will bring new challenges to crowdsourcing service. The success of crowdsourcing service not only depends on the service capacity of a provider but also on the service environment, such as the route reliability and the location information of the target area. This section focuses on how to realize the trusted crowdsourcing, which leverages the usage of social relationships, activity patterns, and coherent subgroups of users. As Fig. 1 illustrates, the assignment of crowdsourcing is decided by SQF, LRF, and RHF. The decision-making procedure can be ummarized as follows.

1) Detection of crowdsourcing service candidates: This step detects candidates in the target area and can provide mobile aware service based on information provided by crowd computing, such as the social relationship, community structure, and activities track.
2) Computation of crowdsourcing decision-making factors: Based on the records in the data center module, we can further define and calculate factors such as SQF, LRF, and RHF. Among them, SQF is determined by the user satisfaction ratio, service rate of success, and service delay. LRF is determined by link stability, attenuation factor, and the number of forwarding users. RHF is determined by the region visit frequency and duration.
3) Assignment of crowdsourcing sensing task: The crowdsourcing algorithm based on AHP (CAHP) is proposed by using SQF, LRF, and RHF. In this method, AHP theory is implemented to provide quantized result and to achieve the goal of crowdsourcing assignment.

## V. Crowdsourcing Algorithm Based on AHP (CAHP) Mechanism

### 1. Detection of Crowdsourcing Candidates

To realize a crowdsourcing sensing task in a given area, the set of users that can provide services needs to be discovered. Actual service users should be chosen from this set. If the target region does not contain any candidates, the users who are most likely to arrive at the target region should be considered based on their movement patterns. Trails of movement directly reflect user activities. Collecting and analysing trail information should provide a guideline for the detection of crowdsourcing service candidate users.

### 2. Service Quality Factor

Assume Mi is a user in a mobile-aware network, where i  N, and N is a set of users. Lk denotes different awareness areas, where k  U , and U is an awareness area set. The purpose of our study is to discover and select the crowdsourcing service users set and corresponding forwarding users set, when a service request is issued toward Lk at time t.

### 3. Link Reliability Factor

The mobility and complexity of mobile users should bring a revolution to crowdsourcing service patterns. The success of crowdsourcing assignment will not only be decided by a provider's service capabilities but is also related with service route. The reliable service route will be more helpful to the ultimate success of the mobile-aware service. Therefore, in addition to the provider's capacity, link reliability should be taken into consideration when selecting crowdsourcing service providers. Link reliability has a direct impact on the rate of successful services.

### 4. Region Heat Factor

In a mobile-aware service scene, the space is partitioned into different aware regions. The completion of crowdsourcing assignment and the mobile-aware service are based on different target regions. The RHF represents the amount of traffic in a specific region at a given time. RHF is decided by the number of arrivals of users and their duration at the specific region.

## VI. Conclusion

Various types of microsensors in smart communication devices can measure a significant amount of potentially useful information, but exploiting this information to provide services to users is rare. In this paper, a novel crowdsourcing service model for mobile-aware service is proposed based on crowd computing according to the mobility, sociality, and complexity of users. Subsequently, the decision-making factors, including SQF, LRF, and RHF, are defined and calculated for user preferences. Finally, a hierarchy crowdsourcing assignment algorithm based on AHP is designed. Crowdsourcing model has better performance with credible interactions between Smartphone users.

## References

[1] Ed Burnette, *"Hello, Android Introducing Google's Mobile Development Platform", Shroff Publishers, 2011*
[2] J. A. Stankovic, *"Research directions for the Internet of Things," IEEE Internet Things J., vol. 1, no. 1, pp. 3–9, Feb. 2014.*
[3] N. D. Lane et al., *"A survey of mobile phone sensing," IEEE. Commun. Mag., vol. 48, no. 8, pp. 140–151, Sep. 2010.*
[4] C. Boldrini and M. Conti, *"Context-and social-aware middleware for opportunistic networks," J. Netw. Comput. Appl., vol. 33, no. 5, pp. 525– 541, May 2010.*
[5] Speckmann, Benjamin, *"The Android mobile platform". Michigan: Eastern Michigan University, 2008.*
[6] H. Y. Xiong et al., *"EMC3: Energy-efficient data transfer in mobile crowdsensing under full coverage constraint," IEEE Trans. Mobile Comput., vol. 14, no. 1, 2015, to be published.*
[7] B. Guo et al., *"From participatory sensing to mobile crowd sensing," in Proc. 12th IEEE Int. Conf. Pervasive Comput. Commun. Workshops (PerCom'14), Budapest, Hungary, Mar. 2014, pp. 593–598.*
[8] Bin Guo et al., *"Mobile Crowd Sensing and Computing: The Review of an Emerging Human-Powered Sensing Paradigm, ACM Computing Surveys, Vol. V, May 2015.*
[9] J. Howe, *"The rise of crowdsourcing," Wired Mag., vol. 14, no. 6, pp. 1–4, Jun. 2006.*
[10] Bin Guo, Chao Chen, Daqing Zhang, Zhiwen Yu and Alvin Chin, *"Mobile Crowd Sensing and Computing: When Participatory Sensing Meets Participatory Social Media", IEEE Communication Magazines 54(2). Jun 2015, page 01-15.*