Trustworthy Sensing for Public Safety in Cloud Centric Things of Internet with Wi-Fi Sensing System

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***Abstract*—The Things of Internet (TOI) are paradigm stands for virtually interconnected objects that we can identify the objects through its different devices and services with Wi-Fi sensing system, computing, and communications system. All of the implementations, applications and there services are implemented over the TOI architecture system. It can use the concept to get benefit over the cloud computing services. Sensing Service (SS) is cloud-inspired service model which used to enables access the TOI. We present a framework where TOI can enhance public safety through crowd management system, and also provide sensing services with different types of sensors device are available. In order to ensure trustworthiness in the presented framework, where users can support from there reviews with the incentive supported of network, we can also check the trustworthiness of data, for more trustfulness. We have design for mobile services application to demonstrate how users our can connect to Wi-Fi hotspots and how the networks work in crowd sourced Wi-Fi sensing system. We propose a SS scheme namely, Sensing for Crowd Management (SCM) for front-end access to the TOI. To collect and share user experience through Wi-Fi hotspots in an urban and rural area. We incorporate the network into the system. SCM is used to sensing data on cloud model and a procedure which used to selects mobile devices for specific tasks and identifies the payments by users through mobile devices which provide data. The performance of SCM shows that the impact of more users in the crowd sourced data can be degraded by 70% while trustworthiness of a malicious user converges to a value below 30% following few auctions. Moreover, we show that SCM can enhance the utility of the public safety authority up to 80%.**

***Index Terms* — Things of internet, Sensing service, crowd management, crowd sensing.**

I. INTRODUCTION

To understanding of human behavior or habits in crowds is very important day to day life. This is required for human to giving proper support for preparation during a crowd event for crowd managers. During the past years many proposals have been put forward to understand the habits of crowd behavior. This can be achieved by implementing models, ranging from formal (e.g. Computational model) or implicit knowledge (e.g. mental model of experts). Some of the models have been used for assistance by crowd management thus portraying a substantial gap between crowd research and crowd management practices. And this work concept of crowd sources to design a Wi-Fi sensing system for a smart city, where users use smart phones to contribute the network quality and detailed locations of the connected Wi-Fi hotspots so as to help other people in crowd to connect to the better Wi- Fi hotspots. However, trust issue is a critical challenge in such a crowd sourced Wi-Fi Sensing system is a sense that the system must be able to evaluate the trustworthiness of data publishers. To achieve this goal, we incorporate or support network to all the users in the system or crowd, So that users can submit not only reviews of Wi-Fi hotspots but also the opinions on data publishers. Specifically our system allows users to support others users who submit trustworthy reviews of Wi-Fi hotspots and thus form an endorsement network. Moreover, we further quantify the trustworthiness of users based on the number of reviews submitted by users and the number of support earned by them. Our system has the following two unique features. Firstly, our system form into one whole an endorsement network together with the crowd sourced Wi-Fi sensing system to make the system more trustful. Secondly, our system will be able to launch satisfy based on campaigns to collect the user experience through Wi- Fi hotspots. In this work, we have implemented the crowd sourced Wi-Fi sensing system in mobile devices (e.g., Smartphone and tablets) to collect information from crowd sourced Wi-Fi data and to built directional endorsement links between users or mobile devices. We will demonstrate how our system guides users to connect Wi-Fi hotspots and how the user support network works with the crowd sourced Wi-Fi sensing system. We will demonstrate how our system guides people to connect to.

II. CROWD MANAGEMENT AND SENSING

Crowd management is the systematic planning technique and provides the guidance in order to achieve a safe and proper execution of the events in crowd. It considers all the events like crowd size, characteristics of the landscape, crowd control as well as planning, organizing, directing and evaluating the crowd. The current methodologies of crowd management include two phases namely.

1. Event preparation phase

2. Event execution phase.

The event preparation phase include majority of the concentration goes into preparing for ongoing events or

expected events. This is achieved by planning on the event i.e. forestalling the event and preparing accordingly. The event execution phase focuses mostly on crowd monitoring and computing. This is achieved by different ways such as employing stewards and officers to for common monitoring as well as the use of surveillance cameras whose footage is continuously monitored by human agents. The authors have implemented a system called "In-Crowd" for helping in the process of crowd management.

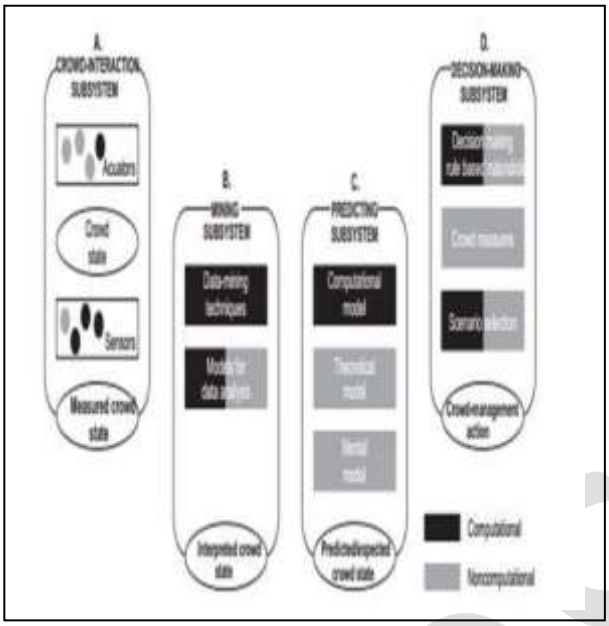

Fig. 1. In-Crowd

A. InCrowd

The system "In-Crowd" consisted of four components:

1) Crowd- Interaction Subsystem

The crowd – interaction subsystem acts as an interface between the real time system and the crowd. This can be achieve by using the help of sensors such as smart phones, cameras and microphones can be used to sense the state of the crowd and actuators such as mobile barriers, traffic lights and displays can be used to guide the crowd.

2) Mining Subsystem

The mining subsystem is accountable for apprehending the state of the crowd by holding the raw data gathered by the crowd – interaction subsystem. This can be achieve by arranging various data mining techniques, various methods for crowd analytics and interpretation of data gathered are provided by human experts.

3) Predicting Subsystem

The predicting subsystem is accountable for predicting the state of the crowd. This is achieved by referring predictive simulation models present in the system and also models that generate synthetic data sets that are successively fed into the mining subsystem for further analysis.

4) Decision – Making Subsystem

The decision making subsystem is used for generating regarding crowd interaction by selecting solutions from past models and interacting with the crowd using actuators.

The model combined the use of automation and human interaction to build up a crowd management system. They also have taken into account the computational data i.e. those that can be executed in an automated and mechanized manner e.g. simple data collected by sensors or humans that can be fed as input to a computer and non – computational data i.e. those that do not act automatically e.g. purposefully designed questionnaires or observation by humans visual and hearing.

The In-Crowd system implemented crowd management using automated as well as human interaction but how can we say that the data provided is valid? If it turns out to be false then the analysis would be false as well. In [3p] the authors of this paper have proposed a method for providing this validation.

B. Ttrustworthy Sensing For Crowd Management

SCM is used for front end access of Internet of Things (IOT). SCM collects sensing data based on an auction procedure and a cloud model which selects devices for a particular task and determines the payment of the user providing sensed data.

SCM consists of four layers

1) Crowd Management Authority

The work of Crowd Management Authority is to provide with sensing task request and receive those data once the auction is completed

2) Cloud Computing Platform

Stores user‟s reputation, bids, payments, sensing task and associated events in a user database. It further interacts with social networking services in order to sense candidate user and collect sensing data.

3) Social Networking Services

The Social Networking Services are used for publishing data such as bids, payment and sensing data. The service can also help in inviting people nearby for Sensing as a Service (SS) auction.

4) Smart Phone Users

These are crowd that are in a particular region, which is aimed to be monitored by the public safety authority. There are two types of user, namely users who provide truthful sensing data and bids and those who provide false data and low bids in order to be selected in the auction.

SCM provides a reputation to every user which when provided with truthful bids and sensing data increases and likewise if it‟s provide with a false bid or data decreases.

SCM provides assistance to the public safety authority to select only bids from high reputed people for auction.

Fig. System Design

System Design

In above fig the architecture of our system which is provide the two major parts, the crowd sourcing frontend and the backend management platform. The frontend crowd sourcing platform which provide to collect the currently connected Wi-Fi information including the user rating, the nearby location and address, the uplink and downlink network speeds, and the detailed location information . The backend management platform consists of four components: (1) endorsement network, (2) crowd sourced data manager, (3) endorsement manager, and (4) trust evaluator. Our system allows all the users to support one another and thus form a simple endorsement network in the sense that the directional trust relationships between any two mobile users will be maintained by the system.

III. CONCLUSION

Sensing Service (SS) has been very influential in providing a solution for the problems in TOI and Cloud patterns. Crowd sensing helps in sensing data required for the solution via various methods such as smart phones, social network and sensing devices. Trustworthiness has also been a challenge to implement in the cloud environment and many steps have been taken to solve this issue. Crowd management helps in taking in those sensed data and processing them to provide a proper a direction to the successful execution of the events. This work incorporated with crowd sourcing technologies to support network to design a Wi-Fi sensing system for smart-city, where we addressed the trust issue to quantify the trustworthiness of data publishers in the system.

We implemented tools to design as a mobile application, called Wi-Fi-scout, to collect the reviews of Wi-Fi networks from users and establish to support links among users. We have reviewed in this paper various methods to implement crowd management technique such as In-Crowd where it utilized both machineries as well as human observations on sensed data provided by the users and come up with a proper event management scheme. The data is sensed using various methods such as social network, smart phones and human inputs. SCM provided with the tools to validate data where it took into consideration reputation values for users and only selected those with higher reputation. SCM degraded the impact of malicious users in the system by 75%. The problem to this method was users could fool the implementing bounds on their reputation value i.e. if a malicious user crossed the lower bound of the reputation then it would start providing truthful data to increase its reputation value and if it crossed the upper bound than would start giving false data. Vote based mobile crowd sensing provided a method to validate the truthfulness of the data. It worked similar to SCM but have anchor nodes that have 100% reputation and vote against or for a user to check for the validation of the data. These studies can be combined together to form a smart system providing for the betterment of people and easier life in societies. Smart cities can be built where all the sectors are interconnected via a cloud and data are sensed by the devices and processed by the cloud system.

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