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Wireless Sensor Network: Deployment in Mobile Phones Environment

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Abstract – Wireless sensor networks have been widely deployed to perform sensing constantly at specific locations, but their energy consumption and deployment cost are of great concern [8]. With the popularity and advanced technologies of mobile phones, participatory urban sensing is a rising and promising field which utilizes mobile phones as mobile sensors to collect data, though it is hard to guarantee the sensing quality and availability under the dynamic behaviors and mobility of human beings. Based on the above observations, we suggest that wireless sensors and mobile phones can complement each other to perform collaborative sensing efficiently with satisfactory quality and availability. The deployment becomes a challenge because participatory sensing processes are dynamic and wireless sensor networks are relatively static.

Keywords: Wireless Fidelity (Wi-Fi), Attacks, Security, Information, Technology

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INTRODUCTION

A wireless sensor network (WSN) consists of spatially distributed autonomous sensing devices which cooperatively monitor physical or environmental conditions, such as temperature, sound, vibration, pressure, motion or pollutants at different locations. Traditional sensor networks involve a number of static sensors being deployed carefully at chosen locations. Although individual sensor node is not very expensive, large deployment of sensor nodes in the network could make the total cost considerably high. In the meantime, mobile phones are becoming very popular and more powerful which make participatory sensing possible [1], [2]. Some mobile phones could also be used as sensors to collect data such as sound, motion, temperature, etc. Mobile phone users could collect data at different time and locations when they move around. The phones are regularly charged and no extra deployment cost is involved in participatory sensing. However, the randomness of user movements and behaviors may bring difficulty in guaranteeing satisfactory coverage and sensing quality in the network. The quality of sensing data resulted by human may differ from one to another, which may not always satisfy the requirement of the applications. Compared with the dynamic nature of participatory sensing campaigns, wireless sensor networks are relatively stable. In most applications, after the WSNs are deployed, the topologies remain almost the same and their behaviors are more predictable. Although there are some random or unpredictable factors, such as damage of sensors, running out of energy, and data inaccuracy during transmission, their performance can be analyzed. It is obvious that the different natures and characteristics of static sensors and mobile phones could complement each other to perform collaborative sensing to reduce the deployment cost and provide satisfactory quality of sensing data

REVIEW OF LITERATURE:

Deployment problems in traditional wireless sensor networks have been widely studied. Tian et al. proposed a nodescheduling scheme to reduce system overall energy consumption and increase system lifetime [4]. Their scheme turns off some redundant nodes and guarantees that the original sensing coverage is maintained. Dhillon et al. proposed two greedy algorithms for deployment of wireless sensor network [5]. They built a probability model for wireless sensors based on a grid sensing field. Chakrabarty et al. proposed a deployment strategy to reduce cost for wireless sensor network which has different kind of wireless sensors [6]. They formulated the problem with integer linear programming. Poduri et al. proposed an algorithm based on artificial potential fields for the self-deployment of a mobile sensor network [7]. Their deployment strategy is researched in a network with the constraint that each of the nodes has at least K neighbors. Our work is different from the above as we consider sensor deployment in mobile phone assisted environment. We investigate how sensor deployment can be optimized costeffectively considering the mobility and human behaviors in mobile phone sensing. Our framework enables static sensors and

mobile phone participants complement each other to provide satisfactory sensing services with minimized cost.

Participatory sensing as a dynamic process

The rapid adoption of mobile phones over the last decade and an increasing ability to capture, classify, and transmit a wide variety of data (image, audio, and location) have enabled a new sensing paradigm - participatory urban sensing - where humans carrying mobile phones act as, and contribute to, sensing systems. In participatory sensing, mobile phone-based data gathering is coordinated across a potentially large number of participants over wide spans of space and time[1]. CENS (Center for Embedded Networked Sensing) has put participatory sensing into action in some projects, for example: 1. Dietsense: Participants can upload photos of their daily meals onto the server. In addition to photos, they can also annotate photos with more information, such as voice or text messages. Then dietary specialists will provide further analysis and give some comments. 2. Garbage watch: Students in UCLA campus collect and upload photos of the contents of garbage bins, in order to help UCLA Facilities determine where new recycle bins should be placed, the effectiveness of existing recycling infrastructure, and to learn more about when, where, and what materials get thrown away on campus. 3. Cycle sense: Cyclers use an application which runs on mobile phones to log their routes using GPS and provide geo-tagged annotations, along with other data. The information is used to infer the roughness and traffic density of the road. And it can give suggestions and feedbacks on their routes. Although different participatory sensing campaigns exist, typically they have the following different stages:

(a) Definition: Organizers define a sensing campaign, including its aim, coverage and lifetime, etc.

(b) Recruitment and refinement: Organizers recruit some participants according to some criterions, such as number of campaigns volunteered for, number of campaigns accepted for, number of campaigns participated in, and number of campaigns abandoned [1].

(c) Execution and publishing: Organizers gather uploaded data from participants, then analyze them to get some useful results. The results will be published to the participants or to the public.

Sensing with Sensors and Mobile Phones

The network can be deployed in different places to monitor the environment and human activities. Some potential sensing environments include amusement parks, universities, tourist attractions, etc. We intend to build a network for the administrator to monitor and collect data from the environment considering the unique behaviors and mobility of the mobile phone participants collaborating with wireless sensors. We consider some primary sensing data like the noise level and pictures to be collected by the microphone and the camera of the sensors or mobile phones. Based on the capability of the sensors and phones, other secondary data like temperature, pressure and motion could also be detected with different types of sensing components in the sensors or the mobile phones. We focus on the primary data which could be collected by sensors or mobile phones interchangeably in this work. However, the approach could be extended easily for different kinds of sensing data and application requirements. Sensors could be deployed cost-effectively with the assistance of mobile phones for monitoring the environment.

Wireless sensor network as a static deployment [9]

Compared with the dynamic aspect of participatory sensing campaigns, wireless sensor network is relatively static. In most applications, after the WSNs are deployed, the topologies almost remain the same and their behaviors are more predictable. Although there are some random or unpredictable factors, such as damages of sensors, running out of energy, and data inaccuracy during transition, its performance can be analyzed. For example, the amount of data being gathered can be estimated.

Necessities of combination Participatory sensing campaigns which only rely on humans have some disadvantages:

1. Sometimes the campaign cannot attract enough participants, maybe because of their consideration of privacy. For example, in the Cycle sense, a lot of data is required such as GPS information along the routes, which is considered as personal secrets for many people.

2. If some critical data cannot be gathered, because of participants' factors, the campaign has to be prolonged to get enough data for analysis. That means the cost of campaign will increase, which may exceed the budget.

Even worse, the campaign may fail at last. On the other hand, the drawback of wireless sensor network is also obvious: 1. For some interesting research, the data need to be gathered is far more complex than temperatures or vibrations, such as images and audio.

CONCLUSION:

Wireless sensors and mobile phone participants can perform sensing collaboratively and complement each other. Our framework predicts the sensing

quality of the mobile phone participants considering their mobility and sensing behaviors. Then, it provides wireless sensor deployment minimizing the number of sensors, while guaranteeing satisfactory sensing quality and coverage [8].

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