

An Overview of Motivation Mechanisms in Mobile Crowd Sensing Networks

Qianqian Wu, Hua Su

Abstract— Mobile crowdsensing network is a new way to combine the perceptive data of the Internet of things. This way is efficient and simple. The reason is that everyone carries smart devices, such as mobile phones and watches, with him or her in daily life. And mobile crowdsensing network uses these terminals to obtain data, which saves the cost and does not need to build additional infrastructure. But the process of perceiving data emphasizes the importance of people. With the development and progress of the society, mobile crowdsensing network has also been developed, but also faces many challenges. The number of participants is insufficient, that is, if there are not enough participants to participate in the task, a large amount of data cannot be obtained. Therefore, the incentive problem of participants needs to be solved urgently. Participants' privacy is also in urgent need of protection. The location of participants is easy to be disclosed, and attackers can obtain participants' information through the information perceived by participants. In this way, the accuracy of data cannot be guaranteed. We discussed the motivation of participants from the aspects of participants' privacy protection and energy consumption reduction with participants as the center and platform as the center respectively. Provide valuable reference for relevant personnel.

Index Terms— crowdsensing, incentive, participants, Privacy protection

I. INTRODUCTION

Mobile crowdsensing network is to take the intelligent equipment carried by ordinary users as the perception element, transmit it through the network, and complete the perception task assigned by the platform. user terminal equipment is usually built all kinds of sensors, such as magnetic sensor, the direction of sensors, pressure transducers, temperature sensors, etc., these sensors in the record on the user's behavior, therefore, the mobile crowdsensing network when collecting information no longer need to redeploy equipment, intelligent terminal equipment at the same time also has the ability to calculate and awareness, mobile crowdsensing network has become the current hot research areas. The problem of insufficient number of people participating in perception task [1]and the low quality of data [2][3]provided has seriously affected the development of swarm perception network. Therefore, it is essential to choose

appropriate incentives to encourage participants to actively participate in the task.

The network has the following advantages:

Low cost: The mobile crowdsensing network is the use of smart devices carried by people to collect tasks, without the need for special personnel deployment and maintenance. With the movement of people, personnel with smart devices can reach the target task point and perceive at anytime and anywhere. It saves people and money.

Easy to maintain: The nodes in the mobile crowdsensing network are intelligent devices carried by people, and these intelligent devices are managed and maintained by people themselves. Once the smart device is unavailable, the user can refuse to participate in the task.

Scale: everyone in everyday life with a smart device can participate, and if a lot of data needs to be collected, more people can be recruited. Scale can be expanded anytime, anywhere.

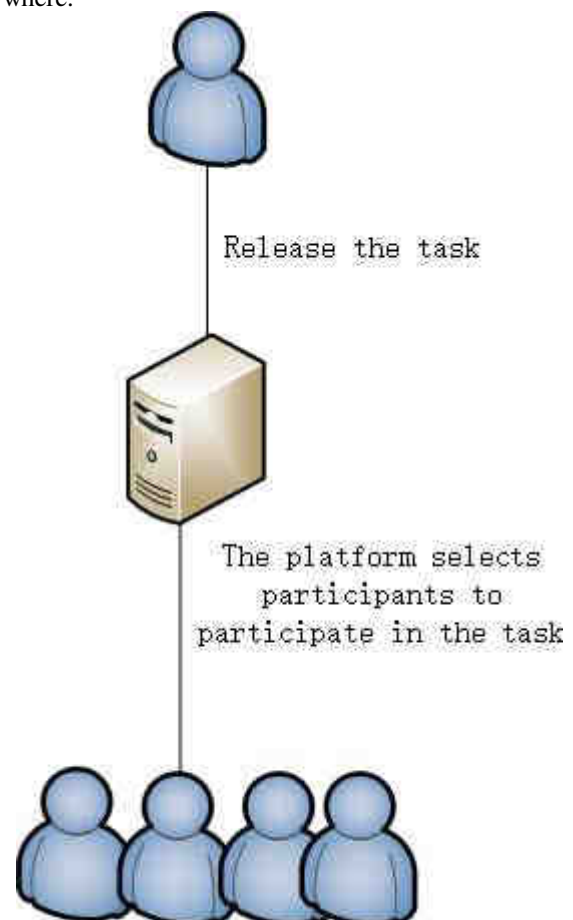


Figure 1. Group perception network schematic diagram

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Qianqian Wu, Department of Computer Science, Tiangong University, Tianjin, China,300387

Hua Su, Department of Computer Science, Tiangong University, Tianjin, China,300387

II. MAIN INCENTIVES

A. Payment incentives

Payment incentives are better than others[4]. The compensation incentive mechanism is mainly carried out by auction, which means that participants provide their own quotation (bidding price) and the platform selects appropriate participants within the acceptable range.

The platform obtains the task to be collected from the publisher and divides the task into sub-tasks. In the first subtask phase, the platform sends the task and specific requirements to the participants, the platform promises that participants with good data quality and completed within the specified time will be paid accordingly. Participants will be aware of the timing of the data, and what they want to be paid -- their own bid -- as well as some other information sent to the platform for bidding, as well as a real estimate. When the bidding platform adopts some algorithm, such as the greedy algorithm, the so-called greedy algorithm is to make the optimal decision in the current stage, that is, the platform chooses the participant with good data quality and relatively low payment as the winner, and then notifies the winner to upload the perceived data. After the data is uploaded, the platform will pay the payment required by the previous participants. For each stage, the platform can choose the best participant to participate in the task. This method is the platform directly according to the user's quotation for payment.

B. Incentives based on user reputation

Incentives based on user reputation[5][6].The incentive mechanism introduces the credit value of users by recruiting participants, judging their behaviors and historical contributions. Credit value mechanism the credibility of the idea is to participants, giving a standard, the initial value is 0, according to the involvement of each participating tasks can give the corresponding credit value, then accumulate to participants Credit value system, this gives the platform a referable level of credibility, and the platform can also combine some previous historical information based on the credit value and select the participants. With the passage of time, the platform gets a minimum credit rating, then platform can be set up every once in a while a standard, eliminate accounts for users who do not reach the lowest credit value, in order to eliminate some users with low credit and no improvement. In the perception task, before starting, the platform sets an identical credit value for each participant, , and the initial Credit value , and then began to sensory data according to the task of platforms. After each participant sends the perceived data to the platform, the platform sends the participant's corresponding collected data to the task publisher. The task publisher evaluates the collected data, and if the data quality meets the requirements, then the participant who collects the data is qualified, otherwise, the credit value of the qualified participant is increased by one, but not greater than . Participants with higher credit scores were paid more. The unqualified participants' credit rating was reduced by one and their compensation was reduced. When a participant Credit value equal to , if the participant's next collection of data is still unqualified, the participant's credit value will be 0, the participant will not be paid to participate in the next task. If the data collected by the participant is still unqualified, the participant will never participate in the perception task. If the

data received by the participant is qualified, his credit value will be increased by 1. The rewards received by participants are related to the size of their credit value, and the use of this method ensures the quality of data perceived by participants, while also motivating more participants to participate in the task and providing reliable data.

C. Through incentives to protect privacy

The mobile crowdsensing network platform is a relatively safe, and task publishers can according to the data provided by the participants to guess the participants' behavior, action, preferences, such as privacy, only the participants' privacy protected, to inspire more participants involved in the task, make participants aware of the group of intelligence network security perception.

The participant privacy protection method of grid division is to divide all the areas that need to collect information into fixed size grids, and calculate the probability of historical perception data of each grid participant in this position. The probability of historical perception data in a certain location may be very high, because this area happens to be the city center, and many participants will reach this area. The probability of historical perception data may be very zero, because this area happens to be the place where the participants cannot reach, such as mountains and rivers. When a participant perceives the data in a fixed area, select (n - 1) surrounding locations with the historical perception data greater than 0 and form a collection of n locations together with the real location. Then randomly selected from the n position one to replace the real location, when participants upload sensed data, will not perceive the true location of the data uploading platform itself, but rather choose the one from the n position location instead of true location to the platform, the platform sends the data to the task publisher, task publisher will not be able to guess the participants' personal privacy according to the data upload.

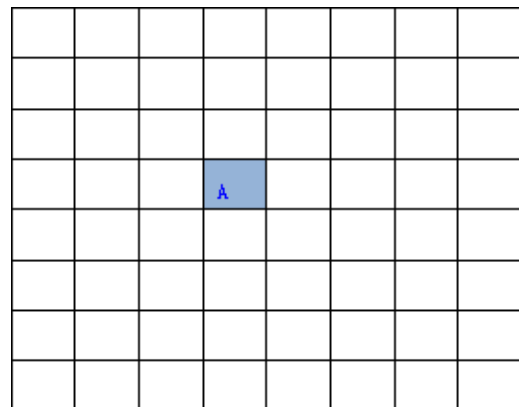


Figure 2. Grid division diagram

Trajectory privacy protection, participants are real life people, so participants will have a fixed action track, such as from home to the company and then back home, then the data perceived by participants must be perceived from the position on this action track. In order to protect participants' privacy, it is necessary to select places where participants do not often go for perceptive data. As a result, participants did not engage in data awareness in their regular activity locations, when participants travel somewhere, or to an area they rarely visit, they send their destination to the platform, the platform will send the task that needs to be perceived in the region, as well

as the information of perception time and requirement to the participants, who will upload the data perceived in the region according to the requirements within the specified time. In this way, when the task publisher receives the data from the platform, it is impossible to determine the action trajectory of participants, because participants do not often arrive in the area, thus protecting the location privacy of participants.

Differential privacy protection, the so-called differential privacy, is two data sets, suppose $A = (1,2,3,4)$, $B = (1,2,3)$, the attacker knows all the data of A and all the data of B, then he can infer the different data of A and B according to the set. In real life, assuming that need to be sick in the hospital information privacy protection, there are 100 participants, illness, if participants showed 1, without ill show 0, assuming that the attacker is very powerful, namely 100 ill information, and know that article 99 of the information, you can according to the reasoning, infer the 100th person is sick or not ill. Then, for differential privacy protection, Laplace mechanism is adopted to add random noise obeying Laplace mechanism in every real data. When random noise is added to the location information of participants in the group perceptive network, the attacker cannot determine the spatial location information of participants, thus privacy protection is carried out.

D. Incentives to reduce costs

For participants, participating in the process of collecting and uploading perceptual tasks needs to consume traffic, storage space, communication resources, etc. Therefore, it is necessary to reduce the consumption of perceptual tasks as much as possible. piggyback sensing[7] is a method of task sensing and uploading that can reduce energy consumption. Because many tasks do not need to upload information in real time, when the user collects the data, they first store it and wait for the device to make a call. When the device is invoked, the data obtained by Participants will be sent to the nearest signal tower in the form of backpack. Participants are unwilling to participate in the perception task, because the perception of data will consume personal resources, battery and storage space of Participants' smart devices, etc. Only when the energy consumption problem is solved can participants be encouraged to participate in the perception task.

III. CONCLUSION AND FORECAST

This paper mainly discusses the incentive mechanism in the mobile group perceptive network, which aims to motivate more participants to participate in the task. We provide an extensive overview of participant-centered incentives, platform-centered incentives, privacy protection, and cost savings for participants during data collection. Mobile crowdsensing network is a current research hotspot, and is widely used in traffic monitoring, environmental monitoring, and personal behavior. With the popularization of mobile terminal equipment, the advantages of mobile crowdsensing network are gradually highlighted, but also facing great challenges. In the future, the privacy protection of participants, maximization of platform utility, minimization of participants' consumption, coverage and other aspects need to be further studied.

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