Mobile Data Management Using Crowdsourcing as a Service

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Abstract

Crowdsourcing is a distributed problem-solving methodology in which an undefined number of people participate in an open call to solve a complex problem. This new problem-solving paradigm has been used in a variety of web-based applications such as voting, fund-raising, micro-works, and crowd-sourcing scenarios. On the other hand, in the post-PC era, the movement of desktop users to mobile platforms, along with the unique multi-sensing capabilities of modern mobile devices, is projected to unlock Crowdsourcing's full potential. Smartphones provide an excellent platform for expanding and broadening web-based crowdsourcing apps to a larger contributing audience, making participation more convenient and accessible. The essential concepts of crowdsourcing and their applications to mobile data management are presented in this advanced session. In the first half of the seminar, we'll take a broad look at the crowdsourced research landscape from a variety of angles, with a focus on the most recent data management trends. We will focus on an in-depth treatment of new mobile crowdsourcing architectures and systems in the second and more extended half of the seminar, using a multi-dimensional taxonomy that will address location, sensing, power, performance, big-data, and privacy, among other topics. We'll also go over a couple of the in-house crowdsourcing prototypes we've built and deployed over the last few years. The lecture finishes with a discussion of the field's challenges, prospects, and new paths.

Keywords: *Crowdsourcing, Mobile, GPS, Privacy.*

I. INTRODUCTION:

This course covers the fundamentals of crowdsourcing and how it can be applied to mobile data management. This is the only lesson that we are aware of that clearly covers this combination, which comes directly from our recent work in [1]–[3]. We plan to cover definitions and existing crowdsourcing platforms in the first part of the seminar before moving on to how crowdsourcing has transformed the research landscape in a range of sectors. We will use numerous examples to demonstrate to the audience how crowdsourcing can provide new computing capacity to humanity. We will concentrate entirely on mobile crowdsourcing solutions in the second and larger section of the seminar. We will show the inherent properties of cellphones as well as a taxonomy for categorising emerging Mobile Crowdsourcing research findings and applications. As a rudimentary type of crowdsourced information, user location will be recognised. This data can be supplemented with the temporal dimension to obtain trajectory-related information, as well as interrelations between location data, such as proximity information, to provide a new dimension to crowdsourcing activities in general. In addition, a set of in-house applications will be presented to aid understanding of crowdsourcing for mobile data: I a neighbourhood crowdsourcing application, in which mobile users contribute to the creation of detailed kNN neighbourhood maps; (ii) an indoor and outdoor localization service using RSS information from WiFi access points; and (iii) a crowdsourced trajectory comparison framework. The lecture comes to a close with a summary of the topic of Crowdsourcing for Mobile Data Management, including characteristics, difficulties, opportunities, directions, and visions.

II. A REFERENCE MODEL FOR CROWDSOURCING SERVICES

The crowd (crowdsourcing providers), crowdsourcing tasks, the platform, and crowdsourcers (i.e., end users of crowdsourced data) are the four main components of a crowdsourcing system. A crowdsourcing system also includes the following platform-based sub-components: I the task manager, ii) evaluation, iii) user ranking, and iv) incentives. Figure 1 depicts the suggested reference model, which includes the four key participants as well as the computational components that are hosted on a cloud platform. It's worth mentioning that crowdsourcing service providers don't have to engage with the platform directly; instead, they can convey their crowdsourced data through a data publisher layer (e.g., social media accounts) [7].

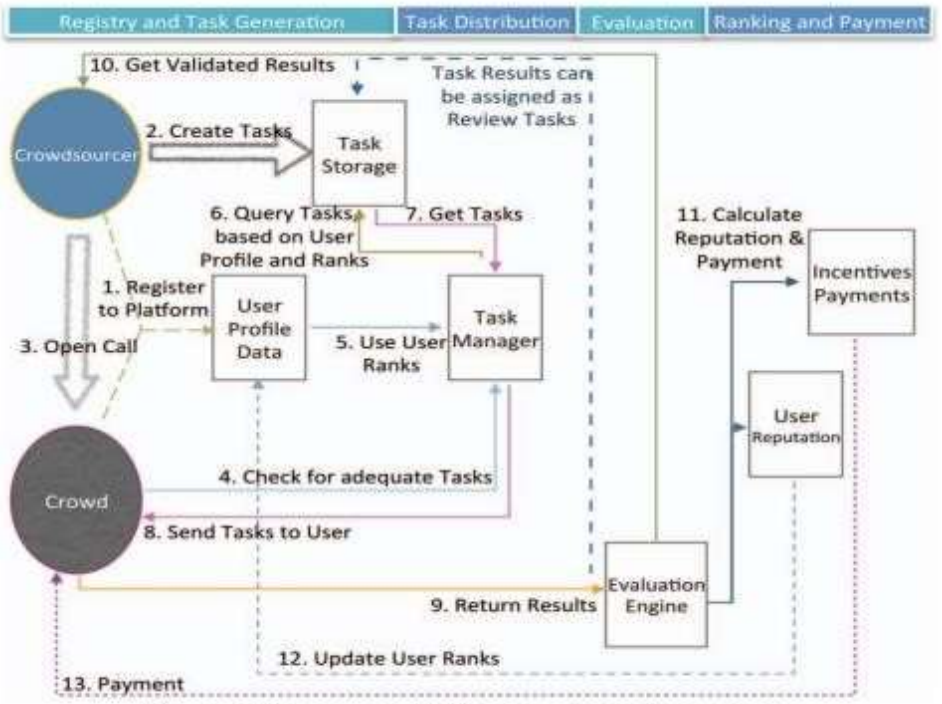

Fig. 1. Reference model for crowdsourcing process

As indicated in the diagram, the crowdsourcing process is divided into four steps:

i). Task creation and management, ii task distribution, iii task evaluation, and iv task rating and payment. In the registration and task generation phases, both crowdsourcing providers and end users are involved. Both suppliers and end users use the cloud platform to acquire crowdsourcing as a service. Anonymity or valid identity (e.g., via social network accounts [8]) can be utilised to register. It's worth noting that people who register anonymously will not be reimbursed for providing crowdsourced data to the site as a service. End users submit their crowdsourcing requests in the form of job submissions to the site. Users are matched to tasks by the cloud platform, which is addressed in the second step. The tasks are saved in the cloud platform's task storage module, and each task has its own task ID, job type, and other parameters.

Registry and task generation phase

The crowdsourcing providers and end users are both involved in the registry and job generation phases. The cloud platform is used by both providers and end users to get crowdsourcing as a service. Valid identity (e.g., via social network accounts [8] or anonymity can be used to register.

It's worth emphasising that anonymously registered users will not be compensated for supplying crowdsourced data to the site as a service. End users submit their crowdsourcing requests to the platform in the form of job submissions. The cloud platform is in charge of matching users to tasks, which is addressed in the second phase. The tasks are stored in the task storage module of the cloud platform, and each task is specified by a unique task ID, task type, and other parameters as described in Section III.

Task distribution Phase

During the task distribution step, the crowdsourcing service providers are matched with tasks. Matching service providers and tasks can be done using a variety of criteria. In [9], crowdsourcing is used to develop a mobile-based participatory sensing application in which service providers are chosen based on their location, repute, and remaining battery capacity. Furthermore, since users are selected based on an auction in which they are guaranteed to be rewarded no less than their sensing costs, users' sensing costs are employed as input parameters of the selection process in [10].

Evaluation Phase

The "value" of the crowdsourced data is assessed during the evaluation phase. Furthermore, when data is being

aggregated, anomalous crowdsourced data about a specific job is eliminated, and the accompanying crowdsourcing service provider is tagged as an outlier whose likelihood of recruitment is potentially degraded in the subsequent task distributions. The user incentives and itrustworthiness iare itightly ilinked iduring ithe iranking iand irewarding iphase. iBecause icrowdsourcing ias ia service necessitates efficient incentives to encourage a large number of users to participate, a rewarding mechanism must be established [11]. Furthermore, in order to assure the end user's trustworthiness of crowdsourced data, crowdsourcing providers should either be ranked or a reputation databaseshould be maintained.

Ranking and rewarding phase:

The user incentives and trustworthiness are tightly linked during the ranking and rewarding phase. Because crowdsourcing as a service necessitates efficient incentives to encourage a large number of users to participate, a rewarding mechanism must be established [11]. Furthermore, in order to assure the end user's trustworthiness of crowdsourced data, crowdsourcing providers should either be ranked or a reputation database should be maintained.

III. THE MODEL'S COMPONENTS AND ATTRACTIONS

An individual, an institution, a non-profit organisation, or a firm that uses the crowd to complete a work is known as a crowdsourcer. The crowdsourcers who join the crowdsourcing platform may come from diverse locations, countries, genders, and intents. Crowdsourcer has its own responsibilities and goals, such as task development, task size construction, content design, and work breakup into microtasks. The crowdsourcer is responsible for creating solvable jobs and defining incentives (money, reputation, etc.). When creating a new task, the crowdsourcer usually selects from a list of established task kinds. Tasks that do not fit into any of the categories, on the other hand, might be filed as "others."

A "huge number of users equipped with mobile smart devices (or sensors themselves) who can be disordered or organised in communities (groups)" is referred to as a "crowd." The crowdsourcer may be unfamiliar to the crowd. Crowdsourcing apps are used for a variety of reasons, including profit, entertainment, and reputation. The majority of crowd users want to execute work correctly and get compensated for the value of the tasks completed. Crowds can be made up of both individual users and communities. Within the same circle, community-based crowdsourcing gives the opportunity to shift work to one another.

Crowd Participation and Incentives: Users must actively participate in the completion of assigned tasks on all crowdsourcing sites. Smartphones and tablets with geo-location and other sensing capabilities are becoming more widely available, opening up new possibilities for opportunistic crowdsourcing frameworks. Quinn and Bederson investigate the crowd's incentives [12], which include altruism, enjoyment, reputation, remuneration, and entertainment. The willingness of users to participate has been considered to be a crucial component in the success of apps [13, 14].

The Crowdsourcer is solely responsible for task design (requester). An innovation model, a data collecting issue, or a fundraising strategy are all examples of crowdsourced tasks. Complicated jobs can be broken down into microtasks to reduce completion time. The task's clarity, modularity, and complexity have a significant impact on performance. Every task has its own unique identification number, which allows it to be tracked across the platform (see Table 1).Tasks include information on the responsible user as well as other required data obtained from the crowdsourcing site. i). Voting,
ii) information sharing, iii) enjoyment, iv) creative designs, v) complicated work, and vi) sensed data sharing are the six types of tasks.

The task manager serves as a portal for tasks to interact with crowd members. The processing unit of crowdsourcing services is the task manager. The following are the responsibilities of a task manager:

a) Depending on the task context and admittance requirements, the crowdsourcer may only hire people from a given profession, area, or gender to complete the assignment. Such controls should be handled by the task manager.

b) Task recommendation in order to accommodate the crowd's needs and boost incentive to finish the assignments.

c) Worker referrals when specialised knowledge is required.

Depending on the number of participants and the amount of data submitted from the crowd, the evaluation process varies. It's easier to evaluate data collected by sensors than it is to evaluate data generated by humans. Because crowd users have varying levels of job processing capabilities, ensuring good quality output is difficult.

The real crowdsourcing work is pooled, processed, analysed, and given to the end user on the platform. The cloud-centric design can be used by all crowdsensing systems. Participants in a crowdsourcing application have duties, just as they do in traditional platforms. The security and privacy of participant data [15] is a significant challenge.

IV. THE PROPOSED MODEL'S APPLICABILITY

Crowdsourcing systems, in general, have resource constraints, such as storage, compute power, platform dependencies, and management. For such systems, cloud-centric design appears to be a promising approach. By offloading compute jobs onto cloud servers, our crowdsourcing approach in a cloud-centric architecture can improve computation capabilities, community involvement, and mobile device energy efficiency. A service-based work paradigm is required for such architecture.

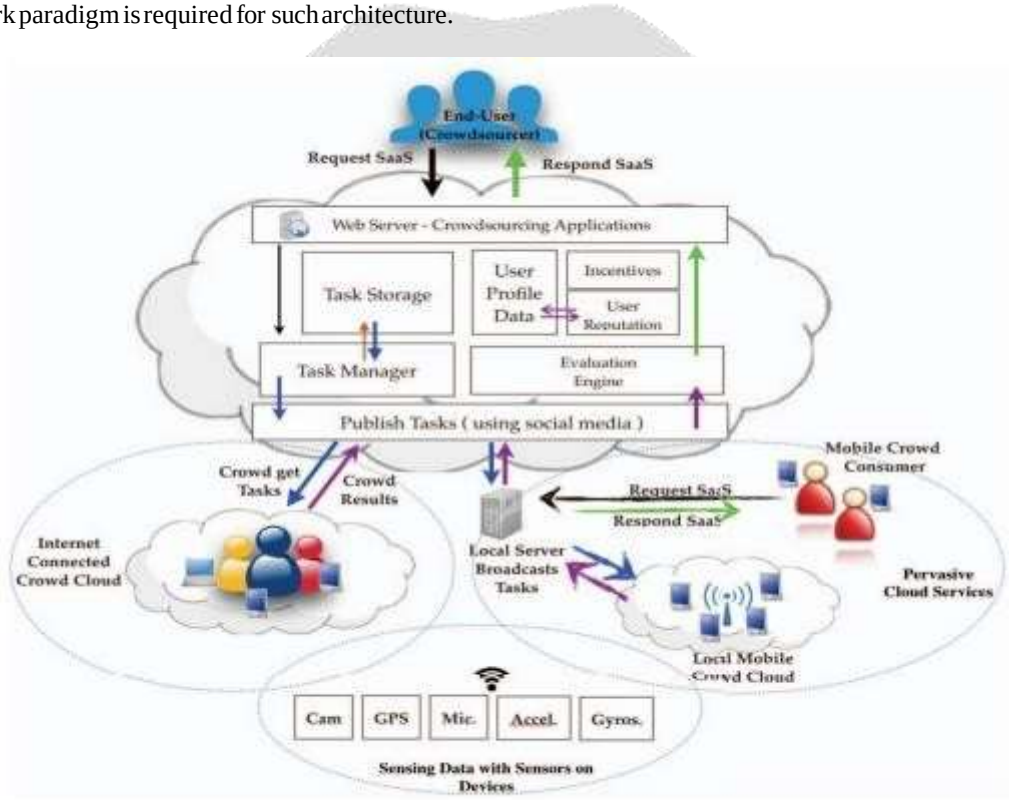

Fig. 2. Crowdsourcing as service over a cloud platform

Crowdsourcing is depicted in Figure 2 as a cloud-based service architecture. Incoming requests for services via the web server are handled by the task manager, which locates and publishes the appropriate task on online social networking applications. Crowds connected to the Internet can work on the same assignment at the same time and submit their results. Furthermore, a significant number of mobile devices communicate with one another via wireless networks, establishing an unprecedentedly powerful mobile cloud capable of providing ubiquitous data collecting, processing, and computing services.

As a result of the introduction of the mobile cloud paradigm, mobile crowdsourcing has gained traction as a viable method for tackling large-scale challenges. Cost-effective and widespread cloud services can be provided by outsourcing jobs to the mobile cloud, allowing a potentially large number of mobile users and devices to collaborate in a distributed manner.

V. CONCLUSION

We have presented a crowdsourced reference model with a cloud-centric architecture in this research. We offer developers of crowdsourcing platforms and applications helpful insights on how to create effective and

cloudified crowdsensing services. We also present and explore the proposed model's application inside the mobile cloud idea.

REFERENCES

1. Crowdsourcing with Smartphones", Georgios Chatzimiloudis, Andreas Konstantinidis, Christos Laoudias, Demetrios Zeinalipour-Yazti, IEEE Internet Computing, Special Issue: Sep/Oct 2012 - Crowdsourcing, May 2012. IEEE Press, Volume 16, Pages: 36-44, 2012.
2. "Crowdsourced Trace Similarity with Smartphones", Demetrios Zeinalipour-Yazti and Christos Laoudias and Costantinos Costa and Michalis Vlachos and Maria I. Andreou and Dimitrios Gunopulos, IEEE Transactions on Knowledge and Data Engineering, IEEE Computer Society, In-press, 2013.
3. "Continuous all k-nearest neighbor querying in smartphone networks", Georgios Chatzimilioudis, Demetrios Zeinalipour-Yazti, Wang-Chien Lee, Marios D. Dikaiakos," Proceedings of the 13th IEEE International Conference on Mobile Data Management" (MDM '12), IEEE Computer Society, Pages: 79–88, Bangalore, India, ISBN: 978-0-7695-4713-8, 2012.
4. "Managing crowdsourced human computation: a tutorial" Panagiotis G. Ipeirotis and Praveen K. Paritosh, In Proceedings of the 20th international conference companion on World wide web (WWW '11). ACM, New York, NY, USA, 287-288, 2011.
5. "Crowdsourcing for information retrieval: principles, methods, and applications" Omar Alonso and Matthew Lease, In Proceedings of the 34th international ACM SIGIR conference on Research and development in Information Retrieval (SIGIR '11). ACM, New York, NY, USA, 1299-1300, 2011.
6. "Crowdsourcing Applications and Platforms: A Data Management Perspective," AnHai Doan, Michael J. Franklin, Donald Kossmann, Tim Kraska, PVLDB 4(12): 1508-1509, 2011.
7. "Participatory Sensing: Crowdsourcing Data from Mobile Smartphones in Urban Spaces," Salil S. Kanhere, Proceedings of the 12th IEEE International Conference on Mobile Data Management (MDM'11), Vol. 2, Pages 3-6, Lulea, Sweden, 2011.
8. B. Kantarci and H. T. Mouftah, "Trustworthy sensing for public safety in cloud-centric Internet of Things," IEEE Internet of Things Journal, vol. 1/4, pp. 360–368, Aug 2014.
9. D. Yang, G. Xue, X. Fang, and J. Tang, "Crowdsourcing to smartphones: Incentive mechanism design for mobile phone sensing" Intl Conf. on Mobile Computing and Networking, Aug. 2012, pp. 173–184.
10. A.E. Al-Fagih, F.M. Al-Turjman, W.M. Alsalih, and H.S. Hassanein, "A priced public sensing framework for heterogeneous IoT architectures," IEEE Trans. on Emerging Topics in Computing, vol. 1/1, pp. 133–147, June 2013.
11. A.J. Quinn and B.B. Bederson, "Human Computation: A Survey and Taxonomy of a Growing Field," Proc. ACM Ann. Conf. Human Factors in Computing Systems, 2011, pp. 1403–1412.
12. S. Jain, Y. Chen, and D. C. Parkes. Designing incentives for online question and answer forums. In Proc. of the 10th ACM conference on Electronic commerce, EC '09, 129–138, New York, NY, USA, 2009.
13. S. Cooper, F. Khatib, I. Makedon, H. L, J. Barbero, D. Baker, J. Fogarty, Z. Popovic, and F. players. Analysis of social gameplay macros in the foldit cookbook. In M. Cavazza, K. Isbister, and C. Rich, editors, FDG, pp. 9–14. ACM, 2011. *15+ M. Vukovic, "Crowdsourcing for enterprises," in 2009 World conference on Services-I, pp. 686-692, June 2009