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A Technology for Sharing Battery Power of Smartphone using P2P Network

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Abstract: ***Users often have a love-hate relationship with their mobiles batteries. From the bricks that last longs to fall one day, the charge of mobile battery drops out in a day. Thereby user always need to keep their devices with as much power as possible, in the fear of losing power during critical task. In the middle of a task when battery drains out even the user may not have the facility of charging devices by tethering them to a cord. In recent days, power sharing technology has been emerged to gather power from the nearby devices. This technology mainly uses only the human carried mobile devices operating on batteries. The limit of power sharing depends on their charging pattern and close proximity. The proposed system shares their power by simply grouping the nearby mobile devices to form a peer to peer network. In this network, when a mobile device request for the power any device in that particular network can share power. To respond to the request, the mobile devices are paired or mapped. This kind of mapping can be done based on Aggregation method and power sharing can be done in less than few minutes. Aggregation technique includes one to many, many to one and one to one mapping.***
Keywords: Power sharing, Mobile devices, P2P, Aggregation, Peer mapping.

I. INTRODUCTION

Smart phones are undoubtedly the most useful devices in 21st century but they are ceaseless to have one foible i.e battery life. As the smart phones evolved, they incorporates great feature in every upgrade but never extend their battery life and it sounds terrible too. Everyone have a nature of forgetting, especially humans forget to charge their mobile devices. Even though there are numerous ways to charge their devices by simply plugging in or by tethering them to a cord or in a coffee shop or by power bank. The trouble over here is, mostly everyone have smart phone with 4G data speeds but batteries aren't. Batteries always take longer time to charge but soon lack their capacity. Hence, the best alternative way to avoid letting the charge drains out is by switching the phone off for later calls.

Network is group of nodes that links the device together. It often uses the client-server model to perform any task. Mobile Social Network (MSN) is a type of Delay Tolerant Network (DTN), an emerging network results in rapid and wide spread use of various personal wireless devices such as mobile phones and GPS devices among user and user's vicinity. From [1] DTN lacks in establishing the end to end communication path and hence peer networking is chosen for secure connection.

Peer- to-Peer (P2P) networking is distributed application architecture which partitions the tasks or workloads between peers. Peers are equally privileged, equipotent participants in the architecture. In this network, nodes acts as both client and server where communication can be made by any peer but in the centralized client-server model, client request a server for resources and server responds. Hence to share power, P2P networking is chosen where every peer has equal responsibility and any mobile device can initiate the request/response for power sharing. Secure power transmission can be done using blow fish algorithm [7].

Figure 1 Wireless power shraing

How interesting, when a mobile device can be charged wirelessly or obtain charge from nearby mobile devices within few minutes. These few minutes can let some few more minutes of using the devices in case of any purposes. The benefit of this technology only shares power to short duration but it could extend its charge to complete the critical task in time. To share power, analysis of charging pattern is to be known and nearby mobile devices must be mapped. This method also focuses on the speed and efficiency of power sharing in mobile devices.

A. Organization of This Paper

The remainder of this paper is organized as follows. In Section II, literature survey followed by the summary. The related work is described in Section III**.** We present our proposed system in Section IV and in Section V conclusion of this paper. Section VI includes further enhancements.

II. LITERATURE SURVEY

In [7] P2P network, it is composed heterogeneous and homogeneous peer which works well in decentralized network. All the mobile devices in this network is both the power sharer and gainer. But the problem over here is free riders, the tendency of mobile device which only gains the power in turn never share the power. Hence reputation management system is used to overcome free riders in the P2P network. It also avoids disconnection among mobile devices. Although it is a time consuming and also helps in choosing the peer partners randomly. Mobile devices can create own trust group by using SORT technique. Trust is calculated based on interaction of the network and this trust information helps to built a secure environment to transfer or share power.
Aggregation or grouping can be done without any normalization technique in absolute trust algorithm.
Device to device communication [D2D] is the key solution for future 5G systems, allows mobile devices to transmit data signals over local P2P links instead of traditional infrastructure. It enables fast content delivery in user activities involved in social network. This paper focuses on content delivery problem related to peer discovery and resource allocation by combining social and physical layer information. It is estimated by Bayesian non parametric model which characterized social impacts on D2D pair formation and sharing power. The proposed algorithm is 3D iterative matching which is used to improve quality of service [QOS] requirement. This algorithm is better than random matching algorithm [6].
From [5], a new collaboration frame work Carrier Mix is proposed in which smart devices are aggregated through various multiple heterogeneous cellular carriers. It allows better transfer and it maximize the energy benefits in mobile devices. This paper focuses on the energy wastage during any transmission, consider when 3G/4G data transfer is occurred there may be a loss of energy and transmission may take longer time. Each user can download and upload data traffic through its 3G/4G carrier wire cellular module when it works on host and can be connected to internet wire P2P module. Carrier mix has group planner and host selector. From this mobile device can determine the group to which it can be joined and host that is a particular mobile device to transfer power. The future work is based on fixed group or static network.
In content messenger selection [4], mobile social network users transfer not only content but also the energy to an intermediate user. It creates end to end connection using Markov decision process is formulated to obtain optimal solution. The mobile power can be shared with others while they move and meet, thus minimizing the insufficient power in mobile devices. This concept [2] is similar to opportunistic MSN in which user share their power during travel. The proposed framework determines stable user matching for the power sharing. This kind of sharing improves QOS. The mobile user matching model deals with both static and dynamic matching.
Author [10] states that smart phones and wearable are equipped with powerful sensors and has led the development in numerous applications using sensor nodes. The data that are sensed are collected from various mobile devices and it provides services in healthcare, entertainment, environmental monitoring and transportation. This kind of application requires continuous sensing and high battery capacity that aren't provided by the recent batteries. Hence this paper presents the Sharesens, an approach for merging the independent applications. Activity monitoring is used in the video based application and in health monitoring systems. This is implemented using android API.
In energy harvesting based D2D network [8], simultaneous wireless information and power transfer(SWIPT) which enables mobile devices to harvest energy from the radio frequency(RF) signals emerging solution to improve energy efficiency(EE) performance. In this paper, joint power control and spectrum resource allocation are addressed. Joint optimization problem is stated as 2D matching between D2D pairs and propose a preference establishment algorithm based on Dinkelbach method and lagrange dual decomposition. Then EE stable matching algorithm is proposed by exploring Gale- Shapley algorithm which is capable of maximizing performance of D2D pairs. The properties like convergence, stability, optimality and complexity of the algorithm is

analyzed. The further work deals with the power control and partner selection to improve performance.

The author studied [1], the problem of finding subset of the nodes in MSN in which power to other devices will be provided only during interactions and states that the mobile devices will not have a need of charging individually. But this kind of charging requires the secondary high capacity battery units which will be used to share power to others. But it is impossible to carry such device often. The consumption of battery and habit of charging is also been studied in various mobile phones. The charging mechanism for mobile social and sensor network have been studied on human carried mobile devices. Multiple devices are equipped with sensing software such as navigation and GPS. Mostly battery powered devices can function only on limited amount of time.

Context aware optimization problem [9] is implemented by matching theory, where D2D user equipment and resource blocks can act as set of domains and interact with each other to obtain optimal matching algorithm that maintains stability with limited number of swap operations. In resource allocation utility function is adopted which captures the priorities and QOS. QOS deals with data rate, packed error rate and delay. The proposed novel algorithm is based on many to one matching with peer effects where D2D pair is affected the decisions of its peer. It is also similar to the Gale-.shapley algorithm, where one to one matching algorithm as well as context unware algorithm. It improves data rate, decreased packet error rate and reduced delay compared to context unaware approach.

The sharing of power between friends in MSN improves data delivery and content disseminator peer to peer. But it focus is only on the pattern of content delivery performance not much on the charging patterns of mobile devices and interactions between mobile devices. The interactions are needed for creating trust network. The power saving is done based on pairing the mobile devices and friend matching algorithm is proposed to determine the best friends to pair. A novel analytical model is developed based on Markov chain approach to analysis energy outage probability for single user and average energy can be transferred between mobile devices [3].

Energy efficient matching [12] is critical for D2D enabled cellular networks due to limited battery capacity and serves co channel interference. The energy efficient problem is addressed by stable matching approach. NP hard joint resource allocation problem is stated as one to one matching as two-sided preferences which varies dynamically. Game theoretic approach is employed along with Gale-Shapley algorithm for addressing scalability. Spectrum efficient resource allocation algorithm have been proposed to address problems such as relay aided transmission, network capacity, wireless video network, software defined multitier cellular network and energy harvesting.

Battery technology does not match with the growing power demands in mobile devices. The average battery life of smart phones is nearly a day with normal usage. Although there are power packs, solar chargers which offer solution to this kind of problems, but even they also make us to carry additional devices for extending shorter span of time. The recent survey shows that the most demanded feature of future mobile devices is longer battery life. The best alternative way is to use the power of other user mobile devices from the user's vicinity. This can be a better remedy in case of emergency since everyone's handy device is mobile phone. To find the devices with maximum power in close proximity is done using Bluetooth or Wi-Fi or by tethering.

Figure 2 Mobile devices power sharing

By [11], power sharing can be achieved from one mobile device to another using the On The Go sharing or by power sharing cable in wired technology. Samsung have made initiatives for sharing the battery power using cable between mobile devices. Spatio-temporal analysis reports that most of users charge their mobile devices based on their time and location but not completely based their remaining battery levels.

A. Summary

From the above literature survey, the mobile devices can share their power to nearby devices using peer to peer network concepts. To form the network the mobile devices should be capable of finding nearby devices. it can be determined using technologies like Bluetooth, Zigbee, Wi-Fi or mobile hotspots and by using phone as modem. This can be done by Gale-shapley or deffered acceptance algorithm which is used to overcome stable matching problem. In this order of preference (priority), set of elements present in the domain list and elements can be matched and finally optimal solution can be obtained from peer to peer networking.

III. RELATED WORK

From the above literature survey, the various algorithms and methodologies are identified and are listed below. The mobile power sharing can be done by power shake in real time which incorporates 12 seconds of power sharing will enable one minute of call and two minutes of power sharing enables four minutes of video watching.

A. Aggregation algorithm [7]
B. Gale-Shapley algorithm[1][4][8][11][12]
C. Blow fish algorithm and SORT [7]
D. Absolute trust algorithm [7]
E. Charging based heuristic algorithm [5]
F. Friend matching algorithm [2][3][9][10]
G. 3D iterative matching algorithm [6]

IV. PROPOSED SYSTEM

To share power or gain power from mobile devices, initially mobile devices needs to create a preference list at end of the each day to whom the power had gained or shared. But there will not be any preferred mobile devices because the mobile devices are mapped to only one device at a time hence only the last assigned mobile devices can be recognized for next share. From this, multiple devices need to be connected at a time and all previously paired devices should be noted for the next share. This information will be useful for assigning the mobile devices based on the battery power, capacity and priority. To create the network stable Gale-shapley algorithm is used along with aggregation algorithm for grouping the mobile devices in peer network. The power sharing is implemented based on the concept of contiguous memory allocation where there will partition such as first fit, best fit and worst fit cases to find the optimal solution like the way battery power should be transferred based on user needs. Hence from this stable network can be maintained and multiple mobile devices can share their power at a time.

V. CONCLUSION

In this paper, the survey has been taken for analyzing the battery power and sharing the mobile phones battery power from one mobile device to another mobile device. The Gale-Shapley aggregation algorithm is the proposed algorithm which overcomes the stable matching problem in peer to peer network. This proposed algorithm can be implemented in truly distributed system where there is no need of any central authority. The stability is maintained through the network as P2P network provides trustworthy environment. Hence free riders are eliminated from the network based on their past interactions and robust against various attacks too based on QOS.

VI. FURTHER ENHANCEMENT

As there is no restrictions for power sharing in the network from one mobile device to another, sometimes the entire power can be drop out in the sharer mobile device a major issue. It should be avoided by using the sensor, when two devices attain the same power or reached its maximum power, automatically power sharing should dropped out and notify the user.

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