IJSEAT International Journal of Science Engineering and Advance Technology

A Mobility Prediction Algorithm To Estimate The Contact Opportunities For Smartphone Users

R Suganya[1], K.T.V Subbarao [2]
Department of Computer Science And Engineering
Akula Sree Ramulu institute of Engineering and Technology, prathipadu, Tadepalligudem, A.P, India
[1] Email- zenithsugan@gmail.com, [2] ogidi@rediffmail.com

Abstract:
The objective is to consent users to issue queries for content stored on other smart phones wherever in the network and to measure the chances of obtaining the information needed. We take for granted that smart phones can carry out searches on their local storage and we find the appropriate results for a given query to make easy searching. In our work we inspect a network of smart phones with the deliberation that Smartphone carriers expend most of their time indoors where GPS cannot be accessed. Previous research shows that GPS signal is available for 4.5 percent only of a typical user's day. Therefore we require designing a system to support location-based services in indoor environments. As well as the methods decrease resource consumption by sufficiently choosing the number of message replicas. However most of the existing prediction-based schemes focus on the prediction of whether two nodes would encounter each other in the prospect and not on when they would encounter each other again. Still the prediction of encounter opportunities based on the encounter history of nodes is not optimal due to missing communication opportunities.

Keywords: Store and forward networks, wireless communication, location dependent and sensitive, pervasive computing.

Introduciton:

We propose discover-predict-deliver (DPD) as a well-organized content sharing scheme for smart phone-based DTNs. DPD assumes that the communications between smart phones happen in a set of locations where smart phone transporters stay for a major duration. It occupies a hidden Markov model and Viterbi algorithm to forecast the future locations of individuals. The proposed scheme is inspired by two observations stated. One is that human trajectories show a high degree of temporal and spatial regularity so each individual has a considerable probability to go back to a few extremely frequented locations that we call meaningful places. The second observation is that in most social environments an individual's route in time is almost deterministic which means an individual has his or her own mobility plan and generally moves between meaningful places according to this schedule subject to a few random deviations. The objective of our work is to discover the solutions to the content sharing problem in smart phone-based DTNs. These solutions are the proficient discovery of contents and their delivery to the correct destinations within a given time.

Related Work:

Opportunity-based routing protocols use encounter opportunities to exchange messages. Zebra Net takes benefit of the history of past encounters and can make rapid forwarding decisions. The Spray-and-Wait solution assigns a duplication number to a message distributes message copies to a number of carrying nodes and stays until a carrying node meets the destination. Chaintreau et al. studied the effect of human mobility on opportunistic forwarding and suggested that the inter contact time between two nodes can be approximated by a power law. Though they did not look at how mobility information can be used for approximation encounter opportunities among users. In prediction-based schemes complicated utility functions are intended using the history of the mobility the encounter times and the encounter rates. Each node upholds a usefulness value for every other node which is updated using the time between contacts.

Existing Method:

Delay-Tolerant Network (DTN) routing protocols manage better performance than traditional mobile ad hoc network (MANET) routing protocols. One way to reduce a user's burden is to depend on an ad hoc method of peer-to-peer content sharing. In this method contents are spontaneously discovered and shared. The efficiency of this sharing method depends on the competence of sharing and the significance of the shared contents.

Disadvantages:

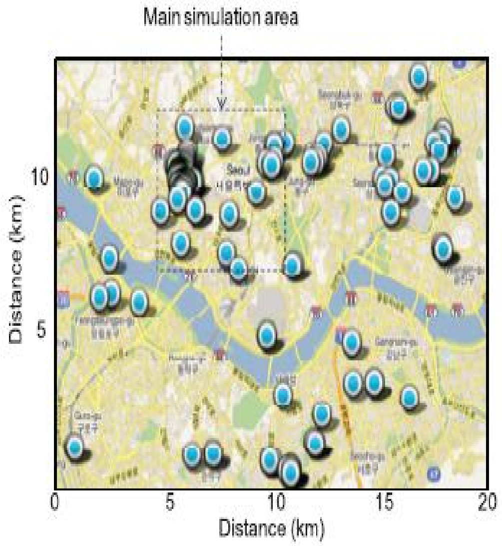
Many routing protocols merely manage the issue of attaining location information indoors. They mostly focused on preventive search query propagation and proposed a number of query processing methods. And not focus on the geographic search query propagation limit.

ISSN 2321-6905

Proposed Method:
The solutions are well-organized discovery of contents and their release to the proper destinations within a given time. Discover-predict-deliver (DPD) is a capable content sharing scheme for Smartphone-based DTNs. DPD sees that the communications between smart phones occur in a set of locations where Smartphone carriers stay for a significant duration.

Advantages:
We confirm the viability of content sharing with DTN by implementing a sample application on commercial smart phones. We increase a practical place mobility learning system for both outdoors and indoors.

Collected Meaningful Places And The Simulation Area:



Dynamic Neighbor Discovery:
Neighbour discovery is a significant task for routing protocols. Particularly in delay-tolerant networking efficient neighbour discovery considerably improves the performance of the routing protocols. Though most protocols authenticated with simulations do not address this issue as these protocols assume that nodes always perceive neighbours with recurrent hello messages. In real implementations frequent hello messages are not adequate due to high energy consumption. In dynamic neighbour discovery each mobile device can be in one of three modes idle (discoverable) mode, search mode or aggressive search mode. When an application does not have any queries or content to forward the device is in discoverable mode and does not broadcast intervallic hello messages. When an application has a query or content to forward and did not programme encounters by prediction the device periodically searches neighbours according to the given query. In case neighbour devices are not discovered the device continuously augments the discovery interval up to 10 times of the initial discovery interval.

Movement Tracking:
In Life Map the Activity Manager checks the stepping up vector of a three-axis accelerometer and detects the motion of the user. The movement detector function of the Activity Manager is essentially a classifier M that has two outputs moving or stationary. When the user is walking, running or moving in a vehicle the motion is classified as moving whereas when the user stays at a certain location the motion is classified as stationary.

Mobility Learning:
In daily life people typically visit a number of places but not all of these are meaningful for learning people's mobility. Indeed DPD requires the detection of locations where content sharing can be performed. Content sharing is productively performed in places where Smartphone users stay long enough as perceiving the existence of other nodes and message swapping requires several minutes depending on the size of the message the bandwidth and the network interface. Hence we are basically interested in discovering places where the user stays longer than certain duration i.e. meaningful places and the context in user movement.

Discovering And Learning Meaningful Places:
Currently obtainable location technologies focus on providing geographical information. This information is inadequate to discover meaningful places because the physical location is not precisely generated at the same place in spite of the fact that a user usually has a comparable life pattern every day. In addition this information cannot differentiate a place that has a similar geocode but different floors. In modern society places are usually located in multiple floor buildings. Thus the logical information of significant places has more advantage to the proposed scheme as content sharing is conducted in indoor environments.

Mobility Prediction:
As DPD uses location information to approximation if a node approaches the destination of the content or deviate from the destination the prediction of nodes' mobility information is necessary.

Algorithm Used:

Algorithm 1. GETRECOMMENDATIONS(p_j)

$\mu_{rt} \Leftarrow \frac{1}{|A_i|}\sum_{p_k \in A_i} rt_{ik}$

$\sigma_{rt} \Leftarrow \frac{1}{|A_i|}\sqrt{\sum_{p_k \in A_i}(rt_{ik} - \mu_{rt})^2}$

$th_{high} \leftarrow 1$

$th_{low} \Leftarrow \mu_{rt} + \sigma_{rt}$

$rset \Leftarrow \emptyset$

while $\mu_{rt} - \sigma_{rt} \leq th_{low}$ **and** $|rset| < \eta_{max}$ **do**

  for all $p_k \in A_i$ **do**

    if $th_{low} \leq rt_{ik} \leq th_{high}$ **then**

      $rec \Leftarrow$ RequestRecommendation(p_k, p_j)

      $rset \Leftarrow rset \cup \{rec\}$

    end if

  end for

  $th_{high} \Leftarrow th_{low}$

  $th_{low} \Leftarrow th_{low} - \sigma_{rt}/2$

end while

return $rset$

Enhancement:

Caching Mechanism:

1) Upon receiving a message M, the node tries to forward to every connection. If a connection is established and M is forwarded via that connection, M's source ID, destination ID is cached as a record (entry) in the cache table.

2) That connection's other end node ID is also stored as next hop in the same record. Additionally, that record's flag is set as NULL as this route is not cross checked by a returning message. Therefore, this caches information is not usable yet.

3) How route information is cached when a message is traversed through this concerning node for the first time. For every message M, the corresponding node also checks whether M's destination ID and any cached record's considered as a returning message. In this case, cached record's next hop is set with M's previous hop ID and record's flag is set as OK.

4) It shows this cache table update process when destination node is sending a returning message to the source node. Typically, such returning message can be an acknowledgment message.

5) Upon receiving every message the corresponding node also looks up the cache table to find a match of M's destination ID and a cached record having same destination ID. If there is a match, this message is considered as a consecutive message

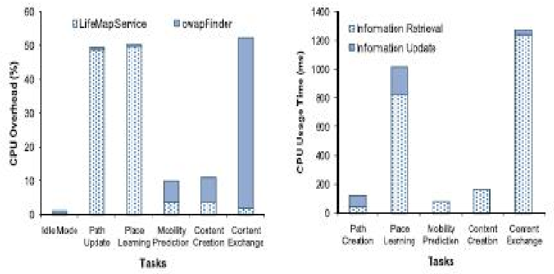
6)If such match is found and corresponding record's flag is marked as OK, messages M's next hop field is set with the corresponding record's next hop ID. This is possible because previous traversal of message is cached in the cache table as mentioned previously.

7)This cache table based forwarding of M .While a message M is forwarded, the node follows routing protocol use limited flooding by fixing initial number of copies of M.

8) Whenever M is forwarded, this number of copies is divided by 2 - receiver gets half and sender keeps half

9) So, numbers of copies are decreased if next node is a mobile node Otherwise, M is forwarded with number of copies value same.

Experimental Results:



a) CPU Overhead b) CPU Usage Time

It exemplifies the CPU overhead and the CPU usage time of a variety of tasks performed by the application. The percentage of CPU usage for each task which is the average of 100 samples is shown. The request runs in inactive mode during most of the day which has only a 2 percent CPU overhead. This overhead is caused by the Life Map activity manager that observes user activity as well as the owapFinder task scheduler. The scheduler arranges upcoming tasks such as mobility prediction, neighbour discovery and content exchange amid others. Path update and place learning are performed within Life Map service which creates about 50 percent CPU overhead.

Conclusion:

Mobility prophecy has been widely studied in and out of the delay-tolerant networking community. Markov-based schemes prepare the problem as a Hidden Markov or semi-Markov model and probabilistically predict human mobility. By contrast neural network based schemes effort to match the observed user behaviour with some before observed behaviour and forecast the future based on the observed patterns. Markov based systems are suitable for resource-constrained devices such as smart phones due to their short calculation overhead and modest storage requirements. Also the time restraint on query distribution decreases transmission cost. Most important the proposed protocol correctly discovers and delivers 87 percent of contents within 2 hours when the contents are available only in 30 percent of nodes in the network.

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ISSN 2321-6905

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Authors:

Mrs. R suganya is a student of Akula Sree Ramulu institute of Engineering & Technology, Tadepalligudem. Presently she is pursuing her M.Tech [Computer Science and Engineering] from this college and she received her MCA from MAILAM Engineering College, affiliated to ANNA University, Chennai, Tamil Nadu in the year 2009. Her area of interest includes Java and Database languages, all current trends and techniques in Computer Science.

Prof. K.T.V Subbarao, well known Author and teacher received M.Tech (CSE) and working as Principal, Akula SreeRamulu institute of Engineering and Technology, He is an active member of ISTE. He has 12 years of teaching experience in various engineering colleges. To his credit couple of publications both national and international conferences/journals. His area of interest includes cryptography and network security, Distributed databases, Operating systems and other advances in computer Applications.