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A novel approach of location awareness and sharing system in disruption tolerant network

Harish Prakash Patil [1,] Prof. Gokul L Patil, [2]

[1, 2] Department of Computer Engineering, Sandip Institute of Technology and Research Centre, Nasik, SPPU, India, Email-

Abstract: In todays advanced and fast moving life services based on location has acquired a significant role in delivery of personalized services. Thus with ever increasing location dependent applications, location awareness and tracking of the mobile becomes important aspects. All recent trends in mobiles and gadgets use location as a key to provide services and position to the users as location gives information which is useful in routing, deployment, location services tracing the target and tracking in rescue operation in a sparse disruption tolerant networks (DTNs) which are not properly addressed. To tackle this, a cooperative decentralized method known as Pulse-counting for localization and probabilistic tracking technique known as Prob-tracking is proposed. Pulse-counting determines the users movement and walking steps with inbuilt accelerometer and electronic compass in the mobile phones by improving estimation accuracy. Distinctive refinement techniques for location estimation consist of adjustment trajectory rely on reference points, and mutual refinement. Prob-tracking method used for tracking user possible movements. This system is implemented in any mobile and provides security to user information at client-side by Advanced Encryption Standard algorithm and server-side by Rivest cipher 6 algorithm then deployed the test in the area of organization.

Keywords: **Positioning, Tracking, Cooperation, Disruption tolerant network (DTN), Advanced Encryption Standard (AES), Rivest cipher 6 (RC6)**

I. INTRODUCTION

DISRUPTION occurs due to sparsity of nodes (mobile), limits of wireless radio range, resources, noise and attacks. The sparse mobile ad hoc networks where nodes connect with each other temporary are disruption tolerant networks [1]. DTNs advantage is that humans can be in contact without network infrastructure, and largely use in vehicular communication, wildlife tracking, positioning, battlefields and tracking [2]. Location details is very essential to authorize context-aware and location-based systems [3].But due to continuous network connection and lack of fixed infrastructure in DTNs, recalling the location of users and tracking their movement flight or route are challenging. DTNs faces problem consist of :

1) the common nodes without GPS module points that is GPS nodes and access point they confront;

2) the infostation requires tracking the flight of the ordinary nodes on the limited information collected by the Aps. Previous positioning system depends on GPS satellites [4] and GSM cell towers [5] where triangulation with physical signals received by deployed-fixed infrastructures. Wi-fi formed localization method gather the radio fingerprints quantified from the Wi-fi signal strengths at multiple APs and physical positions, and find users location by extracting and corresponding the fingerprints [6]. Likewise methods need togather a huge amount of signal samples, that cannot be put in sparse networks. Upcoming research goals on GPS free localization in wireless networks including affixed landmarks and environmental characters, distance estimation logical navigation but this is not suitable structure that is decentralized and DTNs opportunistic communication nature.

A. Motivation

Motivation of this work occur due to positioning and tracking mobiles becomes very important to authorize pervasive and context-aware services. To estimate position depending upon neighbouring node. Also to calculate accurate longitudes and latitudes, to synchronize all the result and update location as per the node mobility.

B. Problem Statement

Sometime the common nodes without GPS included and landmarks in their communication range in Disruption Tolerant Network, making users hard to decide their locations. To solve and answer this questions the system provides the location awareness with cooperative positioning and tracking of the person movements in disruption tolerant networks. Also to find the current location estimation, to reduce estimation error and the most to track user walking movements except global information, provide security to user information and share their location to other persons via SMS alerts.

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II. RELATED WORK

A. Existing System

Most of the previous works concern on the graph which are not for DTN. fundamental problem of data-routing in DTNs. Previous investigation on wireless localization depend on wireless infrastructures deploying approach to lower delivery delay, number of such as cell towers and telecommunication satellites or installing RFIDs or GPS in the nature [4]. In this system, mobiles measure the wireless signals to various infrastructures in the cooperation for data relays in DTNs [13]. known locations and calculate actual location rely on their geometric relationships. Cell tower work triangulation is favoured way for determining the location of a mobile phone [5]. Wi-fi based strategies depends on deploying fixed APs and require Wi-fi signal strengths at many physical location to authorize localization. RADAR [6] developed full radio fingerprints of the Aps and combines empirical measurements with signal propagation modelling to find target location.

In the recent time, few works gives the issues of localization using surroundings and affix landmarks. Surround-Sense [7] spot a person location with the help of camera and sensors on mobiles to collect surrounding information. The specific idea is to fingerprint the location depends on its ambient light, sound, colour, also the layout creates user activity which only obtain a users logical location like in McDonalds or Starbucks, but fails to give geographical coordinates. AAMPL [8] commence location estimation method using accelerometer and compass. It finds rough physical coordinates of mobile phones.

In paper [9], [10] Compacc, uses the same estimation method AAMPL found , and refines the location estimation by equating it against possible path signatures generated from a local map to improve accuracy of location. It gains a location accuracy of less than 11 meters. But, it needs to construct path signatures from electronic maps in advance, which is time consuming and complex. Escort [11] present logical navigation system for social localization. Its aim is to help a person navigate to another in a public place such as a shop and not to find the physical location. Either it needs global information of user route and their confronts to construct the navigationgraph which are not for DTN.

The paper [12] issue, different routing approach to lower delivery delay, number of hops, and energy consumption to achieve data transmission. Few of the works proposed the issues of selfish behavior of nodes to amplify the cooperation for data relays in DTNs [13].Distinct from the existing works, this proposed work concentrated on the case of positioning and tracking mobiles in DTNs, which are not discussed in the past. Various methods [14], collation of different methods for locating and tracking mobiles are studied. Enabling tracking application in java handheld devices and sharing their location to their friends, relatives is developed [15]. The overall discussion and study of papers lead to overcome the drawback of the existing system and to proposed cooperative positioning and tracking system for mobile nodes in disruption tolerant network using communication technique to track its location with the help of partial information.

III. PROPOSED SYSTEM

This work proposes a cooperative decentralized method known as Pulse-counting for DTN localization and a probabilistic method known as Prob-tracking for tracking walking movements using sensors such as accelerometerdata, and the electronic compass which resolves the orientation of eevery step. Measurements thus by collecting the segments of walking steps, it is able to give current location estimation. Pulse-counting gains at refining the location estimation as:

confronting APs and mobiles incorporated with GPS suppose be reference points;

the encountering of two mobiles solve the scope of correlative adjustment for reducing estimation error.

Prob- tracking finds the movement flight obtain by partial location information given by another mobiles. It builds the movement history data and then evaluating the most probable user walking route except the need of location information globally. Implementation of this system in any mobile can be done and provides security to user information at client-side by AES algorithm and server-side by RC6 algorithm,

and to deploy a test in the area of organization for performance evaluation.

IV. SYSTEM ARCHITECTURE

The system architecture of the cooperative positioning and tracking system is described as:

A. Cooperative Positioning and Tracking System

The Fig. 1. shows the architectural diagram of cooperative positioning and tracking system in DTN.

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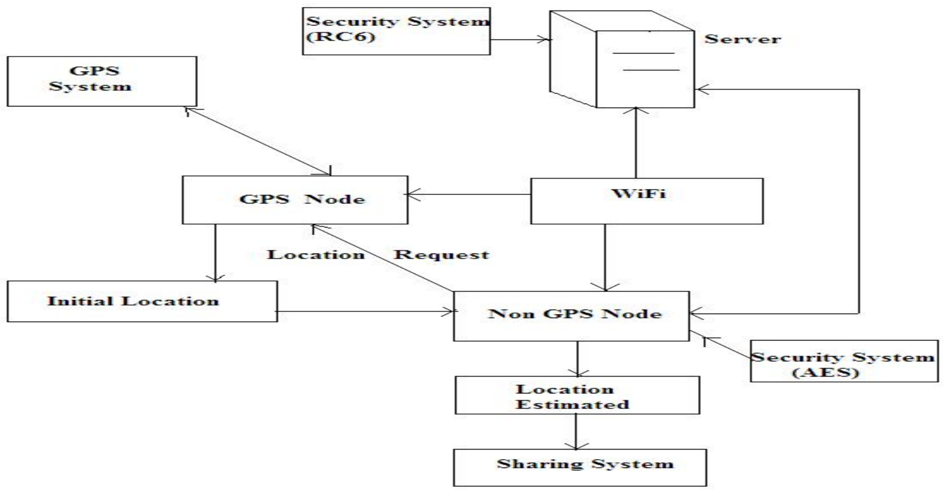


Fig. 1. Architecture Diagram

Discovering the location of mobile users and tracking their activity is not possible due to the absence of constant network connection fixed infrastructure in DTNs. Basically our system will be implemented in various modules, and categorized mobile user depend upon the data availability with respect to the location. A GPS user will access its own location details through GPRS from its GPS server. But Non-GPS user is not able to communicate to the GPS server due to the number of internet connectivity. Hence, it will connect to the neighbouring GPS user through the Wi-Fi medium will send the request for its longitude and latitude as a response to this request. The GPS user will forward its own longitude and latitude values and Non-GPS user will store multiple longitude and latitude values from neighbouring GPS user and we will compute the corrected location for it as own location result. The calculated longitude and latitude will be consider as equivalent or as predicated location for the respective device. The proposed positioning and tracking system will be implemented as server-side web application and client-side that is mobile application to track the movement of users and providing security for user information. This is done using Prob-tracking method in a PC server, where MySQL and JAVA are used for storing user history data and calculate the movement flight. Service of tracking will be deployed in an apache server, and can be accessed from a web browser and sharing location with family members, relatives and friends via SMS alerts and can view them on maps.

V. METHODOLOGY

A. Pulse counting

At times in DTNs the common nodes are with- out GPS and landmarks of their communication range, making user difficult to decide location. The work states the Pulse-counting method for cooperative positioning in DTNs, which include the following six steps :

1) *Bootstrapping*: At very beginning, every node must know its position initially, without it no reference point there for location estimation. In DTNs, assuming a small number of fixed landmarks like wireless APs are deployed in the environment with locations known. And assuming that few GPS nodes are willing to give their locations to other nodes. Thus, the common nodes can obtain a rough initial location when they firstly confront the landmarks or GPS nodes.
2) *Calculate distance between two GPS co-ordinates*

Radian = degrees □ PI / 180
varr r = 6371;
varr dLati = (lati2-lati1).toRad();
varr dLong = (long2-long1).toRad();
varr lati1 = lati1.toRad();
varr lati2 = lati2.toRad();
varr m = Math.sin(dLati/2) □ Math.sin(dLati/2)+ Math.sin(dLong/2) □ Math.sin(dLong/2) □ Math.cos(lati1) □ Math.cos(lati2);
varr p = 2 * Math.atan2(Math.sqrt(a), Math.sqrt(1−a));

varr d = r p;

Initially taking GPS as the reference point. So calculating the GPS coordinates, where r is radius of the earth. Rad() function is used to convert degree in radian. Point m and p are intersection point coordinates which returns distance in meter by mathematical function[15].

3) *Step Counting*: Introducing the technique that utilize the ac- celerometer to measure walking steps [16]. Accelerometer records user steps in 3 dimensions: X that is front and back direction, Y is left and right direction, and Z is up and down direction. To find the distance moving by counting the number of steps. Let m be number of walking steps and L the length of a step are known, the distance can be evaluated by S = m L. As one period means two walking steps, if P periods in the accelerometer measurement are spotted, then m approximately given as m = 2P. The step size L varies from one person to another. In the work, let users walk via a straight road with fixed length for many circles to find their average step lengths L|. General expression for step size of each user is a random variable and assuming it is given as :Gaussian distribution: L N (L|, σ2) (1) where, L| is the mean value and σ2 is the variance.

4) *Direction Mapping*: The other vital facet of movement is direction, which can be evaluated with electronic compass. The mobile phone compass can list the user orientation in the form of an angle with respect to magnetic north [10]. Projecting the compass data to eight distinct directions: North, Northeast, East, Southeast, South,Southwest, West and Northwest numberedfrom 0 to 7. To find its direction mapping, assume is a reading of the compass taking the value from [0, 360] as:

(argmin k | (360/8) k |) mod 8 (2)

where, k is the compass reading used to lowef fluctuation and noise of compass measurement.

5) *Trajectory Generation*: Gathering the outcome from step counting and direction mapping, can explain user movement So calculating the GPS coordinates, where r is flight. A movement flight is given as a series of segments with distance and direction:T (P0→P1) = {h S1, θ1 i ,—, h SM, θM i }(3)where, P0, P1 is departure point and destination point of the flight. Each tuple h Si, θi i (i = 1, 2, − − − , M) shows a segment of the movement. Si is the moving distance of two successive walking steps (one period of the acceleration); θi is the movement direction measured by the angle to the north in the steps obtained by the direction mapping method. M denotes total number of segments.

6) *Location Estimation*: For estimating location of a node at any time we must know initial location. Because of inexactness of step size and orientation measurement, errors get follow during the estimation of each segment. This drawback is overcome by the use of confront opportunity of nodes to enhance the estimation accuracy.

rom Eq.(3), given trajectory let P0 (x0, y0) be coordinate and estimating location coordinate for P1 as :

(x0 + Σ M i=1 Si sin θi, y0 + Σ M i=1 Si cos θi) (4)

Following to the segments, the user moves horizontally in the total displacement Σ M i=1 Si sin θi and moves vertically in the total displacement Σ M i=1 Si cos θi.

7) *Refinement*

As earlier mentioned users step size is a random variable given by :

Gaussian distribution: L N (L|, σ2)

To enhance location estimation using encounter opportunities of mobile phone in sparse DTNs by using different location refinement methods as:

a) Refinement depend on Reference Point: When a common node come across GPS node or a landmark, it can get the location from the encountering node and use it as a reference point to maintain the estimation. The main idea to refine the segments is to reduce the errors. For simplicity adjusting the length of every segment and leaving the close to angle unaltered. Using the Eq. (4) we get the other location coordinate.

b) Mutual Refinement: The originality of mutual refinement isthat the encountering nodes can take one another as a reference point, and thus applying maximum likelihood method to amortize the estimation errors. In DTNs, node can confront many nodes while movement. So proposed refining method allows the node to balance its location estimation on each couple wise contact. Hence encountering opportunities in DTNs benefit to data dissemination, and also to cooperative positioning.

B. Prob tracking

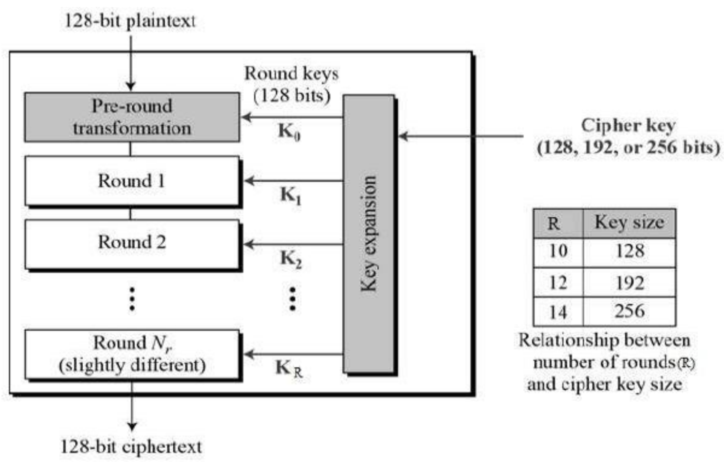
Tracking mobile users in DTNs, Prob tracking method is use for the infostation for tracking user movement in DTNs. Because of DTNs opportunistic communication environment, tracking the users flight without continuous connection is significant. The infostation in DTNs can only reach with the mobile passing by the landmarks. While moving each node keeps logging its flight, as well as the partial flight data obtained from the confronting nodes.

C. Advanced Encryption Standard (AES) algorithm

The AES is a symmetric block cipher used to safeguard sorted data and is executed in hardware and software all over the globe to encrypt delicate data.In system AES is applied for client-side that is in mobile application for securing user references or information [17].1) AES algorithm:

1) Encryption Process : Each round comprise of four sub-processes:

a) Byte Substitution: There are 16 input bytes and result are in the four by four matrix.
b) Shiftrows : Rows of the matrix is left shifted. The entries that fall off are reinserted on the right side
c) 3) Mixcolumn: Replaces original column.
d) Addroundkeys: 16 bytes of matrix are considered as 128 bit and are XORed to the 128 bits of the round key. The output is the ciphertext then this is the last round.
e) Decryption Process : The reverse order of the four processes of encryption is this process of AES cipher text.



D. Rivest Cipher 6 (RC6)

Rivest cipher 6 (RC6) in cryptography is a symmetric key block cipher modified from RC5 to fullfil the requirements of the AES competition. Algorithm RC6 is used to give security to the data of the users personal information, location of the user in latitude and longitude which are store in databases of the server which cannot be get accessed by any intruder and making wrong use of it [18].RC6 Algorithm as follows :

1) RC6 encryption/ decryption - w/r/b
2) Input: Plaintext stored in four w-bit input registers E, F, G, H.
3) j specify number of rounds
4) Let w-bit round keys S [0, ... , 2r + 3]
5) Output: Ciphertext stored in E, F,G,H.
6) Encryption Operation:

F = F + S[0]
H = H + S[1]
for i = 1 to j do
{t = (F *(2F +1)) hhh lg w
u = (H□(2H + 1))<<< lg w
E = ((E □ t) <<< u) + S[2i]
G = ((G □ u) <<< t) + S[2i + 1]
(E, F, G, H) = (F, G, H, E) }

$E = E + S[2j+2]$

$G = G + S[2j+3]$

7) Decryption Operation

$G = G - S[2j + 3]$

$E = E - S[2j + 2]$

for i = j downto 1 do

{(E, F, G, H) = (H, E, F, G)

u = (H*(2H+1)) hhh lg w

t = (F□ (2F + 1)) <<< lg w

$G = ((G - S[2i + 1]) >>> t) \oplus u$

$E = ((E - S[2i]) >>> u) \oplus t$ }

$H = H - S[1]$

$F = F - S[0]$

VI. MATHEMATICAL MODEL

A. *Problem Description*

Let S be a GPS positioning system such that

{L, N, P, A, E, R□ S }

where, L= Locations, N =Nodes,

P =Server, A= SMS alerts,

E = security system (AES) for client side,

R = security system (RC6) for server side.

Input I = {L, N, P, E, R}

Output O = {L, A}

1) L represents set of locations

L = {` 0 , ` 1 , − − − − −, ` n ∅ L };

2) N represents set of nodes.

N = {n 0 , n 1 , − − − − −, n n ∅ N };

3) P represent server.

P = {P 0 □ P };

4) A represent alerts.

A = {a 0 , a 1 , − − −−, a n ∅ A };

5) E represent the security system (AES) for client side.

E = {e 0 , e 1 , − − −−, e n ∅ E };

6) R represent the security system (RC6) for server side.

R = {r 0 , r 1 , − − −−, r n ∅ R }

VII. CONCLUSION AND FUTURE SCOPE

DTNs faces two main problems in localization: the mobile phone may only use sparse reference points to evaluate its location and the tracking server need to find and predict movement flight with partial location data, it will connect to the neighboring GPS user via the Wi-fi medium sending its longitude and latitude as a response to this request. The GPS user will forward its own longitude and latitude values and Non-GPS user will store multiple longitude and latitude values from neighboring GPS user and proposed system will compute the corrected location for it as own location result. The calculated longitude and latitude will be considered as equivalent or as predicated location for the respective device. To overcome these difficulties, thus proposing positioning and tracking in disruptive tolerant network that is which provides the users cur- rent location, security to user information and sharing location with family members, relatives and friends via SMS alerts and views them on maps. The proposed system gains an average deviation lower than 8m in contrast to GPS. Future work will consist of enhancing the prediction accuracy and thus amortizing the errors incurred during tracking.

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