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Adaptive and Optimized Emergency Navigation in Wireless Sensor Networks

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Abstract*-Wireless sensor networks are spatially distributed autonomous sensors to monitor physical or environmental conditions such as temperature, sound, pressure etc.. It is widely used in various domains such as military application and industries .The navigation application is interaction between sensor and user .In previous paper the proper navigation for the users has not been defined. The alternative path will not be shown on the same time. In this project we propose DES algorithm to increase the accuracy and speed is to avoid computational problem. This algorithm is efficient to find navigation. Distributed navigation algorithm is used to find emergency situations. When the sensors detect emergency events, the algorithm quickly separates hazardous areas from safe areas, and the sensors establish escape paths.

1 Introduction

One of the Major applications of Wireless Sensor Network (WSNs) is the navigation service for emergency evacuation. It is widely used in various domains such as military application, industrials and environment. Emergency responders need location and navigation support but few commercial research location systems are design with them in mind. The navigation application was interaction between sensor and user. In this paper presented on the first WSN-assisted emergency navigation algorithm achieving both mild congestion and small stretch, where all operations are in-situ carried out by cyber-physical interactions among people and sensor nodes. The idea of level set method to track the evolution of the exit and the boundary of the hazardous area, so that people nearby the hazardous area achieve a mild congestion at the cost of a slight detour, while people distant from the danger avoid unnecessary detours. CANS does not require location information, and the Algorithm contains level set of methods. The first method to Establishing the Potential map, second method to Building the Hazard level map and final method is Planning a safe path for each user(Potential map and Hazard level map combine Compound level map).

2 Problem Formulation

When emergency occurs existing system only focus on finding the safest path for each person, but they are not considering the congestion during the sensor trigger time. It is one of the major issues in this system. The alternative path will not be shown on the same time while ignoring a roundabout way temporarily replacing part of a route.The problem definition for the Existing system is

1. The proper navigation that for the users has not been defined.
2. The smart way to avoid the hazardous is to calculate congestion has not taken into account.
3. After the emergency triggered, the user don't find the shortest exit path 100% percentage efficiently because of unknown place.

In this Mobile Environment, the users are equipped with PDAs or smart phones that can talk with the Sensors easily.When emergency occurs, the WSN provides necessary information to users, So that guided to move out of a hazardous area through interaction with sensors. Wireless network sensor combined with a navigation algorithm could help safely guide people to a building exit while helping them avoid hazardous area.We propose DES algorithm to increase the accuracy and speed is to avoid computational problem. And distributed navigation algorithm for emergency situations. [6] discussed about a Secure system to Anonymous Blacklisting. The secure system adds a layer of accountability to any publicly known anonymizing network is proposed. Servers can blacklist misbehaving users while maintaining their privacy and this system shows that how these properties can be attained in a way that is practical, efficient, and sensitive to the needs of both users and services.

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When the sensors detect emergency events, the algorithm quickly separates hazardous areas from safe areas, and the sensors establish escape paths. To assist people in escaping from a hazardous (dangerous area) region quickly when an emergency occurs with guaranteed safety, while avoiding excessive congestions and unnecessary detours has been implemented using the environment map navigation.

3 Architecture Diagram

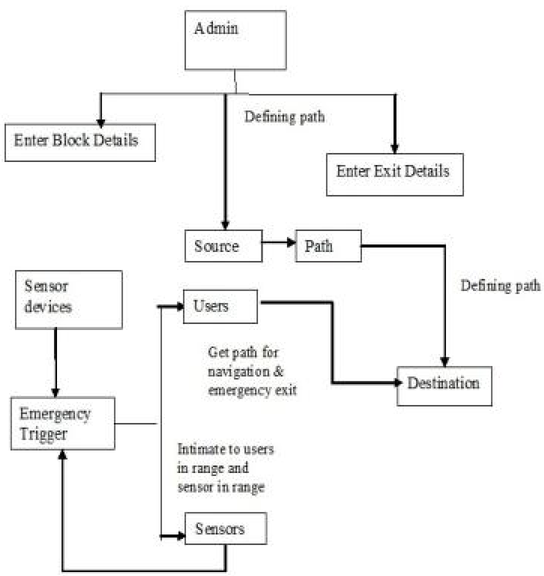

Fig. Architecture of the Emergency navigation

3.1Algorithm

Distributed Navigation algorithm
Input Block detail
Output Map level
1.**if** ((recveLat > minlat && recveLat < maxlat) && (recveLon > minlon && recveLon < maxlon))
2.**else** vobj.set1(Sensor_neighbour_list)
3.**elseif** (action.equals("keyshare")) **then**
4.**else if** (action.equals("mykey")) **then**
5.**else if** (action.equals("blocklist")) **then**
6. **if** (!Block_List.contains(sp[i])
7. result = in.readLine
8. return result

Proof: If the user is in need to get the particular path from the source to the destination. The user request for the path with the destination that user should reach. The centralized server checks with the user's source and destination and find the path for the respective travel. And navigate the user in the map level.

Plain Navigation Algorithm

Input Exit r; Current v≠r

Output Next hop u

1.**for each** v'є ngv(v) **do**

2. **if** f(v')<f(v)**then**

3. u←v';**break**

4. **return** u

Shortest Path Algorithm
This algorithm is nothing but BFS over the communication graph. The graph is flooded with search packets starting from the source. Every packet contains two fields which specify how many hops it has traveled from the source and the last node visited. When a node receives a search packet, it increments the hop count by 1 and forwards the packet to the other neighbors. Every node maintains a distance variable which counts the minimum number of hops to the source and a parent pointer which points to the node via which the minimum hop search packet was received.

If a node receives multiple search packets from the source, only packets with smallest hop counts are forwarded. When BFS terminates, every node knows its distance to the source and its parent pointer points to its parent along the path towards the source. Note that in a shortest path computation by BFS, the number of packets transmitted by each node is exactly 1. The first search packet that arrives at a node is the packet which hastraveled by the least number of hops.

Minimum Exposure Path Algorithm
Algorithm MINIMUM-EXPOSURE
1: **while** TRUE **do**
2: Receive(pkt) from neighbor
3: pkt.exposure ← pkt.exposure + self.potential
4: **if** pkt.exposure < minexposure **then**
5: minexposure ← pkt.exposure
6: parent ← neighbor
7: schedule pkt for forwarding
8: **else**
9: Drop(pkt)
10: **end if**
11: **if** there is a scheduled packet **then**
12: Transmit(pkt)
13: **end if**
14: **end while**

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3.2 Admin Process

The admin should have the prior knowledge about the environment. The admin will preprocess the whole environment for the complete navigation for the users by adding the block details (Peter England, theater, etc…) and the exit, the brief description about the block and exit. And admin navigate the user by preprocessing the path for source to the destination that the user request.

3.3 Network Formation

In Network formation we construct the whole environment, where the environment actors are users, sensors, and the centralized server. Where the sensors are scattered among the environment that sense the environment condition. And the users are with their handheld device that gets connected by the any of the sensor in the environment based on the coverage of the sensor.

3.4 Destination Navigation

If the user is in need to get the particular path from the source to the destination. The user request for the path with the destination that user should reach. The centralized server checks with the user's source and destination and find the path for the respective travel. And navigate the user in the map level

3.5 Emergency Navigation

The sensors sense the environmental conditions continuously, if the sensor senses the abnormal values the sensor intimates to the users that connected with the sensor and intimates with the nearby sensors. And the all sensor does the same. And the emergency passes to the whole environment. And the user handheld device gets the navigation from the server that exit as the destination. And the map level navigation has been given to the user's handheld devices.Whereas the potential map locally provides a sense of direction for users to the exit in a consistent way,it is of much randomness and blindness in the sense that uses might be guided, without location information, to regions quite close to the hazardous areas. To tackle this issue, the hazard level map is thereby put forward.

4 DISCUSSIONS

4.1 Reacting to Emergency Dynamics

In reality, hazardous areas may vary in time, e.g. theymay emerge, expand, shrink or disappear. The impactsof such dynamics on the compound map and further onour navigation algorithm mainly reflect in two aspects.

4.1.1 Dealing with the Local Minima

The construction of the potential map in a static network, according to Lemma, guarantees that every non-exit node in the network has a neighbor whose potential value is smaller than its own, such that the plain navigation proceeds smoothly.It is noted that the local minima may theoretically fall into a plateau region, where all its neighbors have the same potential value. If this situation happens, local discovery by searching the local neighborhood through either a random walk or a local flooding can be performed to reach a nearby non-stationary node, so that the navigation can proceed without being suspended.

4.1.2 Rebuilding the Hazard Level Map

Due to emergency dynamics, the hazard level map may no longer valid, and thus the reconstruction of the hazard level map has to be considered. A trivial but highly time/message costly and inefficient method is to entirely reconstruct the new hazard level map whenever the emergency varies. Instead, the emergency dynamics only induce a local impact on our established hazard level map, as will be proven below, and thus only a local operation on the reconstruction of the hazard level map is required.

4.1.3 Reacting Speed and Relevant Overhead

As discussed before, CANS only needs local information (i.e., each node requires only information from its local neighbors) to react to the emergency dynamics. Therefore, the reacting speed to emergency dynamics and the resulting communication overhead largely depend on the updating frequency of CANS: more frequent updating obviously results faster reacting speed but higher communication overhead.

In addition, the updating frequency is closely related to the emergencies of different spreading speeds. For example, compared to a fire hazard, a chemical gas leakage incident often requires a faster reacting speed. Thus, it is essential to take into consideration such aforementioned factors, so that an appropriate updating frequency can be obtained for the implementation of the algorithm in reality.

4.2 Trade-off Among Path Safety,Congestion and Stretch

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Emergency navigation design with WSNs requires a proper tradeoff among three conflicting factors: path safety, congestion and stretch. Early proposals typically consider the level of danger based on the distance of the node to hazardous areas: the farther, the safer. Accordingly, the media axis based methods such as are proposed to obtain navigation path that maximizes the minimum distance of all possible paths to the hazardous areas. Whereas selecting the path farthest from the hazard area assures pathsafety to the greatest extent, it is more likely to result in pathcongestions and unnecessary detours, as all users are guided to the specific path no matter where the users are. In contrast, CANS provides multiple navigation paths for users to escape, so that the tradeoff among path safety, congestion and stretch can be achieved.

To be more concrete, in CANS we regard the areas outside the SAFE bands are sufficiently safe, such that users therein can tolerate the congestions as they are far away from the hazardous areas. For users within the SAFE bands, they are required to be branched into SAFE bands with different weights to avoid heavy congestions. Particularly, for users within the INTERIM band without the chance turning to the SAFE bands, they will locally follow the direction of a lower criticality. With such design, users outside the SAFE bands reduce needless detours, while users within the SAFE bands avoid heavy congestions. Meanwhile, the safety remains guaranteed as proved in Section . It is worth noting that, another neat part of this design is that, the width and the number of the SAFE bands can be adapt to different applications by tuning the values of parameters k and k, so that the path safety can be enhanced and guaranteed in various scenarios.

4.3 Complexity and Storage Cost

Message complexity, time complexity and storage cost are of great importance for a distributed algorithm relying on mere connectivity information. The message complexity is the traffic cost an algorithm incurs, the time complexity is determined by the number of iterations during the running time of an algorithm, and the storage cost is measured by the number of nodes are stored. All three factors significantly affect the scalability of a distributed algorithm.

4.4 Planning a Safe Path for Each User

Given the constructed compound map (i.e., the combinationof the potential map and the hazard level map), each node in the network has the knowledge of its hop count distanceto the exit; each SAFE node knows its hazard level; eachINTERIM node is aware of its criticality. On this basis, wedesign a navigation scheme to schedule a safe path, alongwhich a user can reach the exit apart from the hazardousareas while avoiding heavy congestions.Denote the user as v0.

As we assume that any user isequipped with communicating devices to interact with thesensors in the network, the navigation path can be interpreted as a sequence of sensor nodes.A group target can be monitored by tracking the contour of acoustic readings above a certain threshold. Contour changes reveal important information, e.g., the formation of a team or gathering, the dispersion of vehicles, or certain animal activities.

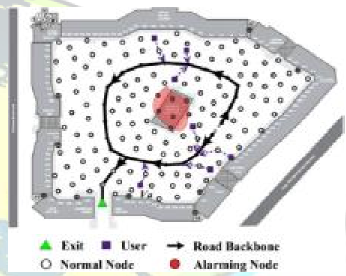

Fig:Illustration of different paths

5 SIMULATION RESULT

6 RELATED WORKS

6.1 Multiple Target Tracking with RF Sensor Networks

RF sensor networks are wireless networks that can localize and track people (or targets) without needing them to carry or wear any electronic device. They use

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the change in the received signal strength (RSS) of the links due to the movements of people to infer their locations. In this paper, we consider real-time multiple target tracking with RF sensor networks. We perform radio tomographic imaging (RTI), which generates images of the change in the propagation field, as if they were frames of a video.

6.2 Distributed Navigation Algorithms for Sensor Networks

We propose efficient distributed algorithms to aid navigation of a user through a geographic area covered by sensors. The sensors sense the level of danger at their locations and we use this information to find a safe path for the user through the sensor field. Traditional distributed navigation algorithms rely upon flooding the whole network with packets to find an optimal safe path.

6.3 Light-weight Contour Tracking in Wireless Sensor Networks

Most physical phenomena represent strong spatial and temporal correlations, since physical measurements are predominantly governed by the law of diffusion. In this paper, we study the problem of tracking contours represented by binary sensors, and we focus on light-weight maintenance of contours that evolve over time. This abstracted problem is motivated by a variety of tracking and monitoring applications. Contour tracking scenarios. Consider an application scenario in which the sensors are used to detect and track chemical pollution. Each sensor measures the chemical intensity in its vicinity. As chemical contamination often comes from some pollution source, and the propagation of contaminants is typically by water current, wind, or diffusion, the pollution map exhibits strong spatial correlation and is often modeled and represented by a smooth signal field. The contaminated regions, having sensor readings above a danger threshold, naturally form a number of (possibly nested) blobs. Over time, the blobs may morph, merge, or split, indicating the pollution movement and/or the effectiveness of pollution treatment. In another example, a group of targets moving in a field may alert the monitoring acoustic sensors nearby. Target movements in nature, such as human, vehicle, animal movements, have a tendency to be clustered.

6.4 Sensor Network Navigation without Locations

We propose a pervasive usage of the sensor network infrastructure as a cyber-physical system for navigating internal users in locations of potential danger. Our proposed application differs from previous work in that they typically treat the sensor network as a media of data acquisition while in our navigation application, in-situ interactions between users and sensors become ubiquitous. In addition, human safety and time factors are critical to the success of our objective. Without any preknowledge of user and sensor locations, the design of an effective and efficient navigation protocol faces nontrivial challenges. We propose to embed a road map system in the sensor network without location information so as to provide users navigating routes with guaranteed safety. We accordingly design efficient road map updating mechanisms to rebuild the road map in the event of changes in dangerous areas. In this navigation system, each user only issues local queries to obtain their navigation route. The system is highly scalable for supporting multiple users simultaneously. We further conduct comprehensive and large-scale simulations to examine the efficiency and scalability of the proposed approach under various environmental dynamics.

6.5 Iso-Contour Queries and Gradient Descent with Guaranteed Delivery in Sensor Networks

We study the problem of data-driven routing and navigation in a distributed sensor network over a continuous scalar field. Specifically, we address the problem of searching for the collection of sensors with readings within a specified range. This is named the iso-contour query problem. We develop a gradient based routing scheme such that from any query node, the query message follows the signal field gradient or derived quantities and successfully discovers all iso-contours of interest. Due to the existence of local maxima and minima, the guaranteed delivery requires preprocessing of the signal field and the construction of a contour tree in a distributed fashion. Our approach has the following properties: (i) the gradient routing uses only local node information and its message complexity is close to optimal, as shown by simulations; (ii) the preprocessing message complexity is linear in the number of nodes and the storage requirement for each node is a small constant. The same preprocessing also facilitates route computation between any pair of nodes where the route lies within any user supplied range of values.

7 CONCLUSION

CANS donot require in advance knowledge of location or distance information, nor the reliance of on any particular communication model. To find a shortest/safest path for each person while ignore the number of people and the path's stretch.

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Enhancement

1. Dynamic short path.
2. Map level implementation for navigation path(from one place to another place).
3. Databases are highly dynamic.

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