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# CANS: Congestion Adaptive Navigation System

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**Abstract:** Wireless Sensor Networks (WSNs) are widely used in navigation service for emergency evacuation. It is also used in various realms 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 applications are usually an interaction between the sensor and the user. In this paper presented on Congestion Adaptive Navigation System is the first WSN-assisted emergency navigation algorithm which attains both mild congestion and small stretch, where all the operations are in-situ, carried out by cyber-physical interactions among people and the sensor nodes. CANS deploys the idea of level set method which is used to find the nearby exit area and the boundary of the hazardous area, so that people nearby the hazardous area achieve a mild congestion at the cost of a slight deviations, while people distant from the danger avoid unnecessary detours. CANS does not require location information. The first method is to establish the Potential map, second method to build 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).

**Key words:** Wireless sensors · Hazards · Level set map · Congestion

## INTRODUCTION

RF sensor networks are those networks which localize and track people (or targets) even without carrying or wearing any electronic device. They make use of the change in the received signal strength (RSS) of the links because of the movements of people infer with their locations. In this paper, we consider real-time multiple targets tracking with RF sensor networks. We use Radio Tomographic Imaging (RTI), which generates images of the change in the propagation field, assuming them to be frames of a video.

Our RTI method uses RSS on multiple frequency channels on each link, combining them with a fade level-based weighted average. We describe methods to adapt machine vision methods and to the peculiarities of RTI to enable all the different real time multiple target tracking. Several tests are performed in an open environment, a single room apartment, and an office environment.

The results demonstrate that the system is capable of accurately tracking in real-time upto 4 targets in indoor environments, even their trajectories intersect multiple times, without under-estimating the number of targets found in the monitored area[5].

Area monitoring is again a very common application of WSNs. In area monitoring, the WSN is deployed in a particular region where some phenomenon must be monitored. A military example is the use of sensors detects enemy intrusion; a civilian example is the geo-fencing of gas or oil pipelines. Wireless sensor networks have been deployed in several cities (Stockholm, London, and Brisbane) to monitor the concentration of dangerous gases for citizen. These can take advantage over the ad hoc wireless links rather than those of wired installations, which also make them more mobile for testing readings in different areas. Wireless sensor networks have been deployed in several cities (Stockholm,London, and Brisbane) to monitor the concentration of dangerous gases for citizen. These can take advantage of the ad hoc wireless links rather than wired installations, which also make them more mobile for testing readings in different areas.

**Literature Review:** In an existing system, when emergency occurs it 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

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be shown on the same time while ignoring a roundabout way temporarily replacing part of a route.Here we study the problem of data-driven routing and navigation present in a distributed sensor network over a continuous scalar field. Specifically, we also address the problem of searching for the collection of sensors which also has readings within a specified range. This is called as the iso-contour query problem. We develop a gradient based routing scheme such that from any query node, the query message follows each of the signal field gradient or derived quantities and successfully discovers all iso-contours of interest.

Due to the existence of both local maxima and minima, the guaranteed delivery also 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 local node information and its message complexity is likely close to optimal, as shown by its simulations; (ii) the preprocessing message complexity is again linear in the number of nodes and the storage requirement for each node is of 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 [19].

We propose efficient distributed algorithms to aid navigation of a user through a geographic area covered by sensors. The sensors also sense the level of danger at their locations and we use all this information to find a safe path for the user through the sensor field. Traditional distributed navigation algorithms rely upon flooding the entire network with packets to find an optimal safe path. To reduce the communication expense, we introduce the concept of a skeleton graph which is again a sparse subset of the true sensor network communication network graph.

Using skeleton graphs we show that it is possible to find approximate safe paths at a very much lower communication cost. We give tight theoretical guarantees about the quality of our approximation and by simulation, shows the effectiveness of our algorithms in realistic sensor network situations respectively[11]. Most of the physical phenomena represent strong spatial and also temporal correlations, since physical measurements are predominantly governed by law of diffusion.

In this paper, we also study about the problem of tracking contours represented by binary sensors, and we focus on light-weight maintenance of contours that evolve over a period of time. This abstracted problem is once again motivated by a variety of tracking and monitoring applications. An example for Contour tracking scenarios is that Consider an application scenario in which the sensors are used to detect and track chemical pollution. Each sensor is used to measures the chemical intensity in its vicinity. As chemical contamination mostly comes from some pollution source, and the propagation of contaminants is typically by water current, wind, the pollution map that exhibits strong spatial correlation and is often modeled and represented by a smooth signal field respectively. The contaminated regions, having sensor readings mostly above a danger threshold, naturally form a number of blobs. Over time, the blobs may morph, merge, or split, indicating that the pollution movement and/or the effectiveness of the pollution treatment. In another example, a group of targets which are moving in a field may alert the monitoring acoustic sensors nearby. Target movements in nature, such as human, vehicle again have a tendency to be clustered. A group target can also be monitored by tracking the entire contour of acoustic readings above a certain threshold. Contour changes reveal important information such as the formation of a team or gathering, the dispersion of vehicles, or certain animal activities [8].

We also propose a pervasive usage of the sensor network infrastructure which is 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 for data acquisition while in our navigation application, in-situ interactions between users and sensors once again become ubiquitous. In addition, human safety and time factors are more critical to the success of our objective. Without any pre knowledge of user and sensor locations, the design of an effective and efficient navigation protocol also 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 also accordingly design efficient road map updating mechanisms to rebuild the entire road map in the event of changes in dangerous areas. In this navigation system, each user can only issues local queries to obtain their own navigation route. The system is also highly scalable for supporting multiple users simultaneously. We implement a prototype system with 36 TelosB motes to again validate the effectiveness of this design. We further conduct large-scale simulations to examine the efficiency and scalability of the proposed approach under various environmental dynamics [23].

**Proposed System:** In this Mobile Environment, the users are equipped with PDAs or smart phones which can interact with the Sensors easily. When emergency occurs, the WSN provides necessary information to users and they are guided to move out of a hazardous area through interaction with sensors. Wireless network sensor combined with a navigation algorithm helps in safe navigation for the people to exit from hazardous area. We propose a plain navigation algorithm for emergency situation. EENA leverages the idea of level set method to track the evolution of the exit and the partition of the hazardous area, so that people who stay nearby the hazardous area achieve a light traffic at the cost of a slight deviation, while people distant from the danger avoid unnecessary diversions. First, the navigation of human beings seeks for a safe-critical path, other than packet loss or energy efficiency which is the first priority as in packet routing. Secondly, human navigation kill time than traditional packet routing process, due to the limited movement speed of people and which are critical for a fast evacuation, as they mainly focus on finding the shortest and/or safest path for each individuals, while other less optimal (yet safe) paths are left unused throughout most of the evacuation process.

There are four modules used in the proposed system,

- Admin Process
- Network Formation
- Destination Navigation
- Emergency Navigation

**Admin Process:** The admin should have the prior knowledge about the surrounding. The admin will preprocess the entire environment for the complete navigation for users by adding the block details (Peter England, theater, etc…). A brief description about the block entry and exit are provided by the admin. The admin navigates the user by preprocessing the path for source to the destination according to the user request.

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

**Destination Navigation:** If the user is in need to get the specific 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 to find the path for the respective travel and navigate the user in the map level.

**Emergency Navigation:** The sensors sense the environmental surroundings continuously, if the sensor senses the abnormal values the sensor intimates to the users that is connected with the sensor and intimates with the nearby sensors. All sensors do the same and the emergency senses are passed to the whole environment. The user handheld device gets the navigation from the server that leaves the destination and the map level navigation has been given to the user's handheld devices.

**Implementation:** Admin login is the one which allows the user to access the application.Without logging in the admin will not be allowed to use the application.

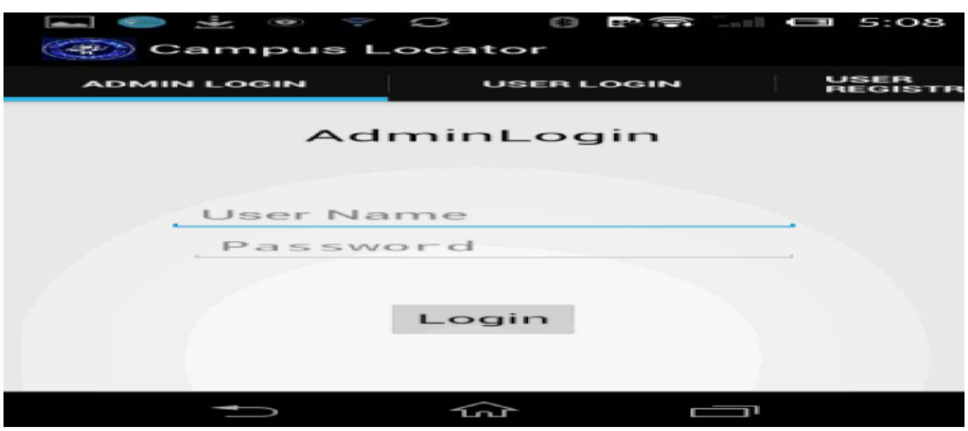


Fig. 1: Admin login

Similar to that of the admin login we also have an user login which allows the user to establish access to the application.For this the user should first register with all the necessary information.

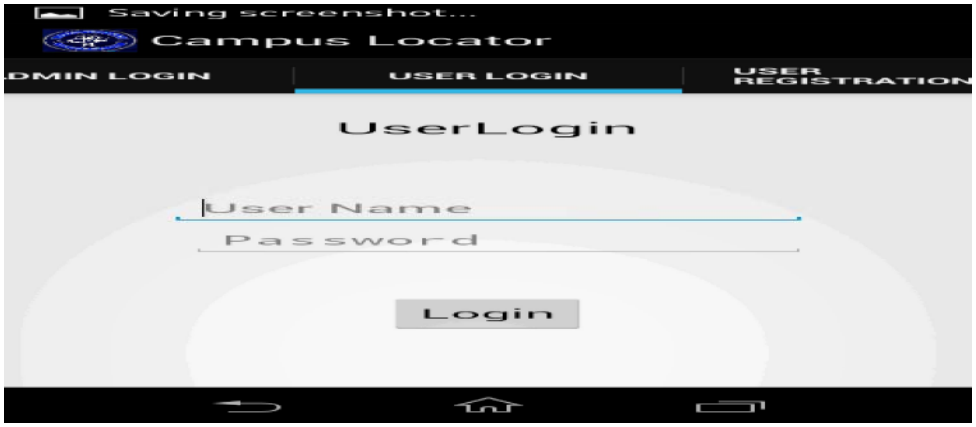


Fig. 2: User login

The User Registration window again enables the user to register with the application.An user cannot simply use the application with registering.


Fig. 3: User registration

Add block is where the user can add all the various blocks present in the map.Here the user will have to add as well as name each block uniquely inorder to avoid confusion.

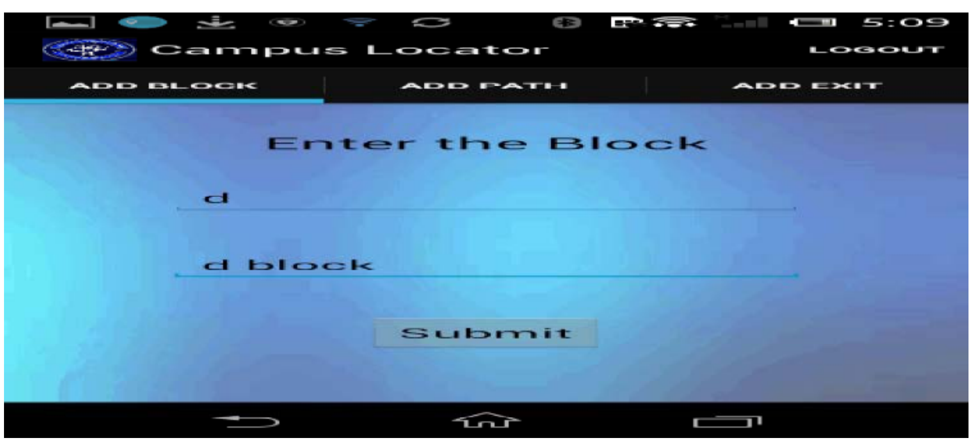


Fig. 4: Add Block

The below figure shows the various blocks which can be set by the admin

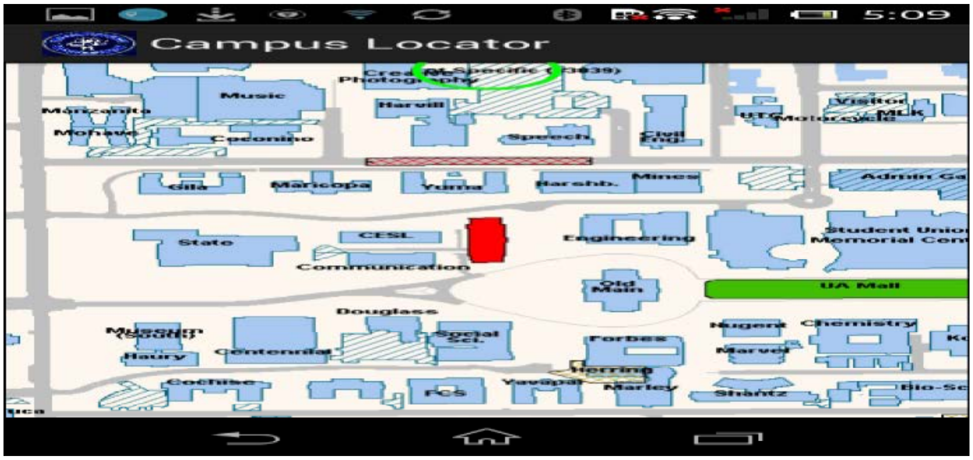


Fig. 5: Various blocks in campus locator

Here the admin will have to enter the various exits that are available so that later the paths can be assigned easily.

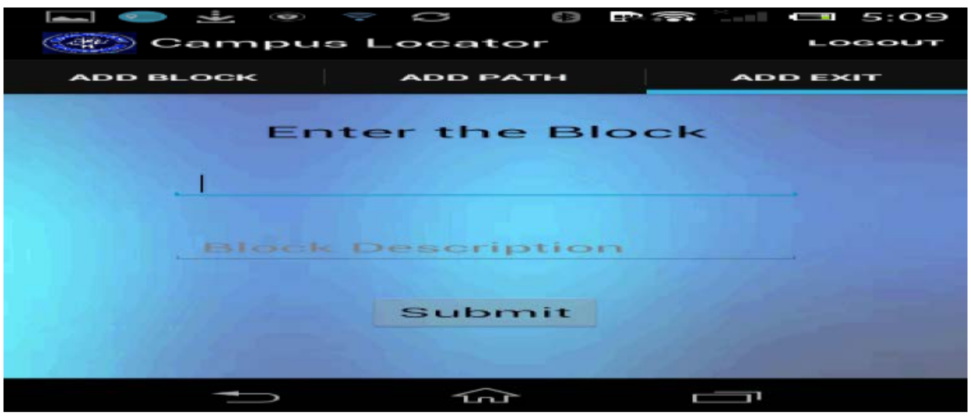


Fig 6: Add exit

Here the admin will have to set the path from block to the exit and also in addition to it also sets the path between different paths


Fig 7: Add path

Here we can see the path that is being set by the admin from one block to the other and also to the exit

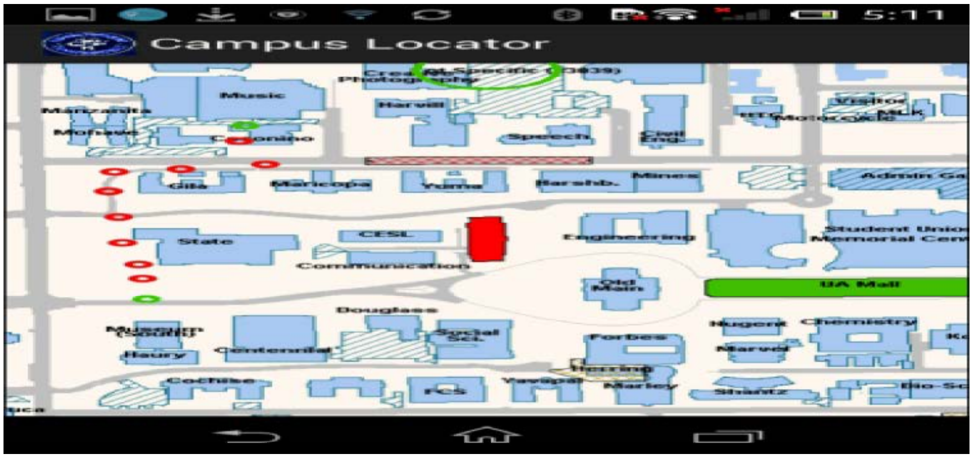


Fig. 8: Path set by the admin

Now this is how the path will be visible to the users.

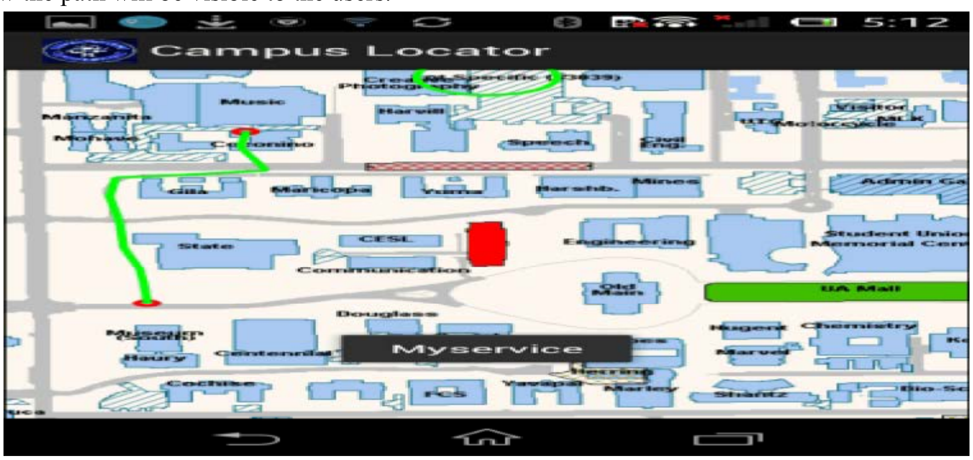


Fig. 9: Path visible to the user

**Applications**

**Area Monitoring:** Area monitoring is a common application of WSNs. In area monitoring, the WSN is deployed over a region where some phenomenon is to be monitored. A military example is the use of sensors detect enemy intrusion; a civilian example is the geo fencing of gas or oil pipelines.

**Health Care Monitoring:** The medical applications can be of two types: wearable and implanted. Wearable devices are used on the body surface of a human or just at close proximity of the user. The implantable medical devices are those that are inserted inside human body. There are many other applications too e.g. body position measurement and location of the person, overall monitoring of ill patients in hospitals and at homes. Body-area networks can collect information about an individual's health, fitness, and energy expenditure.

**Environmental/Earth Sensing:** There are many applications in monitoring environmental parameters, examples of which are given below. They share the extra challenges of harsh environments and reduced power supply.

**Air Pollution Monitoring:** Wireless sensor networks have been deployed in several citiesto monitor the concentration of dangerous gases for citizens. These can take advantage of the ad hoc wireless links rather than wired installations, which also make them more mobile for testing readings in different areas.

**Forest Fire Detection:** A network of Sensor Nodes can be installed in a forest to detect when a fire has started. The nodes can be equipped with sensors to measure temperature, humidity and gases which are produced by fire in the trees or vegetation. The early detection is crucial for a successful action of the firefighters; thanks to Wireless Sensor Networks, the fire brigade will be able to know when a fire is started and how it is spreading.

**Landslide Detection:** A landslide detection system makes use of a wireless sensor network to detect the slight movements of soil and changes in various parameters that may occur before or during a landslide. Through the data gathered it may be possible to know the impending occurrence of landslides long before it actually happens.

**Water Quality Monitoring:** Water quality monitoring involves analyzing water properties in dams, rivers, lakes and oceans, as well as underground water reserves. The use of many wireless distributed sensors enables the creation of a more accurate map of the water status, and allows the permanent deployment of monitoring stations in locations of difficult access, without the need of manual data retrieval.

**Natural Disaster Prevention:** Wireless sensor networks can effectively act to prevent the consequences of natural disasters, like floods. Wireless nodes have successfully been deployed in rivers where changes of the water levels have to be monitored in real time.

**Machine Health Monitoring:** Wireless sensor networks have been developed for machinery condition-based maintenance (CBM) as they offer significant cost savings and enable new functionality.Wireless sensors can be placed in locations difficult or impossible to reach with a wired system, such as rotating machinery and untethered vehicles.

**Data Center Monitoring:** Due to the high density of servers racks in a data center, often cabling and IP addresses are an issue. To overcome that problem more and more racks are fitted out with wireless temperature sensors to monitor the intake and outtake temperatures of racks. As ASHRAE recommends up to 6 temperature sensors per rack, meshed wireless temperature technology gives an advantage compared to traditional cabled sensors.

**Future Enhancements:** CANS cannot be used for path prediction for places that falls under the same latitude and longitude.This is because it makes the navigation system more complicated.This can be made as a future enhancement were it can be implemented for a building that has more than one floor.

## CONCLUSION

EENA does not require in advance knowledge of location or distance information, nor the reliance on any particular communication model. It can easily establish a connection with the mobile device and provides easy navigation for the users. It can also be used efficiently for both public as well as private properties. It is extensively used 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.

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