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Robust Ranging Quality in Woodland and Localization of Wireless Sensor Networks

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Abstract: Localization is an important area that attracted by the research peoples in wireless sensor network. Localization is one of the arduous and recent technologies. In real fact when we actually implement it then different disturbing properties of nature are present. Now a day's wireless sensor network are commonly implemented to control on various area like military, environment, woodland. With the help of broadcasting of signals we can communicate with different nodes without any disturbance and we can extend our ranging distance is called localization. In this we will learn, Combined and Differentiated Localization idea for localization. Which elaborate the range-free approaches and range-based approaches? By using received signal strength indicator (RSSI) we will get it. After study we had seen that accuracy of estimation is decreases with increase in range. To overcome this CDL method is used. It provides more accurate and consistent performance.

Keywords: Wireless sensor networks; Localization; AOA; RSSI; CDL.

I. INTRODUCTION

A wireless sensor network is a group of specialized transducers with a communications infrastructure that uses radio to monitor and record physical or environmental conditions. It used for monitoring and recording conditions of places. Basic Commonly monitored parameters are chemical concentrations, temperature, humidity, pressure, wind and speed, illumination intensity, vibration intensity, sound intensity, power-line voltage, pollutant levels and vital body functions.[2] Sensor network consists of many small, lightweight and portable detection stations called sensor nodes. Each sensor node consist of transducer, microcomputer, transceiver and power battery.[12] In this electrical signals generates by transducer based on sensed physical effect. Microcomputer processes and stores the output of it. Transceiver receives commands from computer and transmits data. Power to the sensor is given by battery. The technology Sensor node positioning is one of the most popular technologies for wsn. The estimation of position of nodes is crucial when we track or monitor on the target. As per the climate the accurate distance or angle is measured between the nodes by using distance measurement techniques.[11] The typical distance measurement techniques includes the use of RSSI, TOA or TDOA ranging and AOA ranging. The accuracy of this method is not high. RSSI-based ranging method is still widely used. In this paper CDL method is used which is a mixer of two localization methods. Localization is achieved with the help of any one of following methods (i) range-based localization and (ii) range-free localization. A range-free method no need of any additional hardware. With the help of properties of the WSN and algorithms to obtain location information. In this Range-free localization requires no distance or angle measurements.

This method divided into two categories:

- Pattern Matching.
- Hop-counting techniques.

A range-based method positions the sensor nodes using additional devices etc. Timers, RSSI, Antennas Range-based localization relies on the availability of point-to-point distance or angle information.[7] These two parameters are obtained by following things. Time of arrival (ToA), Time difference of arrival (TDoA), Received signal strength indicator (RSSI), Angle of arrival (AoA).CDL is combination of some properties of range based and range free methods. CDL gives us robust ranging quality. Due to this CDL accuracy percentage is more than the range free and range based methods. So the error percentage is less than the old methods.[4] This method is more effective and less limited for wider area range. CDL the advantages of both range-free and range-based methods.Then to get good ranging quality, this method CDL. This technology gives output robustly and accurately. This technique overcomes different drawbacks of the ranging or disturbance, discontinued communication due to natural disturbance to the nodes.[6]

II. FUNCTIONS AND RELATED WORKS

This work is based on the need for accurate location information in woodland, a large-scale sensor network system deployed in a forest. The most important element in woodland applications is the sensor nodes positions. Localization achieved by two types which is range based and range free.[15] In this range based technology is accurate but costly. In range free technology it is not accurate and it is cheap as compared to the range based. In this CDL, a Combined and Differentiated Localization method for localization that combines the properties of range-free approaches and range-based approaches using received signal strength indicator (RSSI).[16] CDL technology affects the accuracy of localization and this will use the virtual hop localization technique. CDL inherits the advantages of both range-free and range-based methods.[20] Normally localization algorithm for sensor network share main two terms distance, position estimation, localization.[8] As per the name in distance estimation it will find out the actual distance between two nodes in woodland.

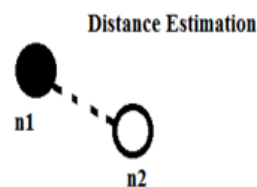


Fig.1 Distance Computation

For the Position computation it first calculates the coordinates of the unknown node with respect to the known other neighbouring nodes by applying algorithm.

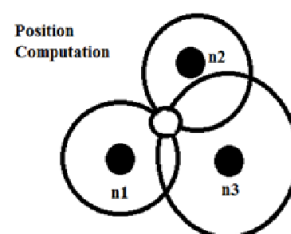


Fig.2 Position Computation

The localization algorithm evaluates the distances and positions, most or all of the nodes of a WSN to estimate their position. This algorithm will reduce the errors and refine the node positions.

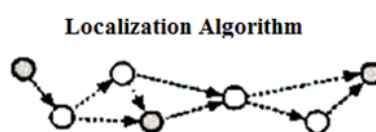


Fig.3 Localization algorithm

The localization is totally based on RSSI measurement is studied in this paper. Sometimes natural disturbance affects to the radio frequency signals and RSSI.[14] This causes that the exact distance cannot be calculated by the RSSI. The basic parameters are calculated by anchor nodes and correct the data. In this multipath propagation occurs so errors are less as

compared to other techniques. There are four methods for measuring in distance technique in range based application Angle Of Arrival (AoA), Time Of Arrival (ToA), Time Different Of Arrival (TdoA). It's a method that allows each sensor to evaluate the relative angles between received radio signals. Costly and needs extensive signal processing.

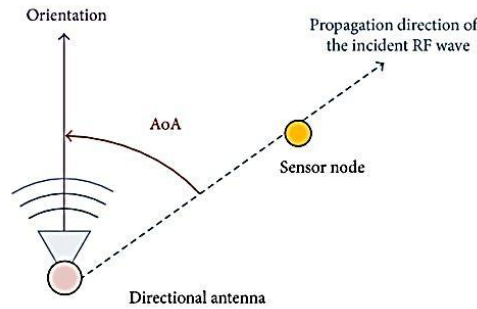


Fig. 4 Angle Of Arrival

In TdoA method determining the distance between a mobile station and a nearby Synchronized base station. It is costly.

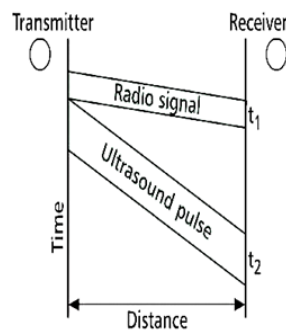


Fig. 5 Time distance of Arrival

All the techniques are reliable and accurate to evaluate distance and gives error free information of nodes.

III. VARIABLES FOR LOCALIZATION

In this there are some variables which are important for good ranging quality in localization.[5]

Cost: It is one of the most important variables in localization because if cost is high then accuracy is high and if cost is low then accuracy is low.

Accuracy: For good ranging quality and long distance communication accuracy of the distance estimation and position computation is mandatory.

Nodes: In this there are two types of nodes static and mobile nodes. Static nodes are identical which needs power also identical. In mobile nodes are connected with GPS so it will require power more than the static nodes.

Power: For robustness in wireless sensor network power is the most important variable.

IV. CURRENT ASPECT IN LOCALIZATION

Environmental obstacles: When we deploy the sensors in the woodland. There we communicate from one node to another again from that node to next node like this till the destination.[2] So there is one type of chain communication will be there but due to any disturbance any one of them node destroyed from that then further communication stops. This disturbance is of natural, environmental etc.[3] To overcome this there is CDL technique means when one node is damaged then find out nears other node from that node and go through that node towards the destination node.[18]

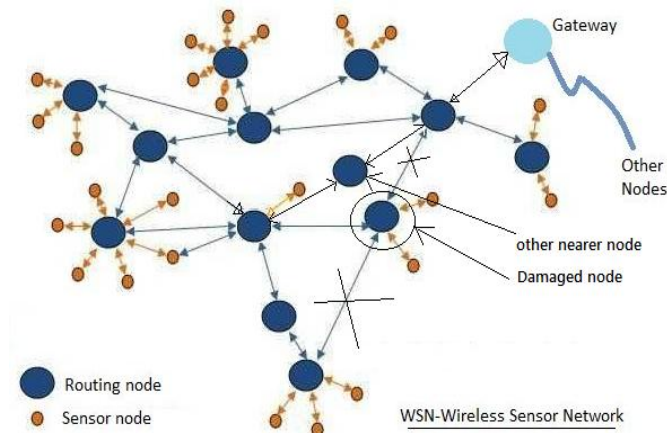


Fig.6 Localization of WSN

Security: In WSN beacon node or routing node which sends the information to other sensor nodes then if this routing node virus affected then it will affect to other sensor nodes. Due to this an error will occur which is harmful for our computation.

V. LOCALIZATION ISSUE

In localization the most common error is distance estimation and position estimation accurately.

- Range-based technique utilizes various ranging techniques. In this hardware are used so this is costly.
- Range-free technique performs only on hop count and measurement. So it is easily affect to node density.
- If the deployment of sensor nodes is not done properly then it could affect ranging quality.

In this complexity of the communication is more and obstacles in the forest.

VI. SENSOR NETWORK APPLICATION

Area monitoring

Area monitoring is a common application of WSNs. WSN is deployed over a region where some phenomenon is to be monitored.[19] In military they 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. The implantable medical devices are those that are inserted inside human body and Wearable devices are used on the body surface of a human or just at close proximity of the user.[12] Some different many other applications are there body position measurement and location of the patient, monitoring of patients in hospitals.[9]

Environmental/Earth sensing

There are many applications in monitoring environmental parameters.

Air pollution monitoring

Wireless sensor networks have been deployed in several cities to monitor the concentration of dangerous gases for citizens. This will give advantage of the ad hoc wireless links this make more mobile for testing readings in different places.[4]

Forest fire detection

In forest we can install WSN to detect the fire. This sensors are capable to identify the fire with related properties like temperature, humidity and gases which are produced by fire in the woodland.[20]

Landslide detection

WSN we can implant in soil to detect its movement and prevent the landslide. Through the data gathered it may be possible to know the occurrence of landslides long before it actually happens.[14]

Water quality monitoring

The use of many wireless distributed sensors enables the creation of a more accurate map of the water status. Water quality monitoring involves analyzing water properties in dams, rivers, lakes & oceans, as well as underground water reserves.[18]

Natural disaster prevention

Wireless nodes have successfully been deployed in rivers where changes of the water levels have to be monitored in real time. Prevent the consequences of natural disasters, like floods.

VII. CONCLUSION

This paper describes overview of robust and good ranging quality in localization WSN, functions and related work variables used in localization, current aspects in localization, localization issues, its applications.

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