

A
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On
Distributed Localization in Wireless Sensor Networks Using Bat Algorithm

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by
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CERTIFICATE

This is to certify that the project report entitled “**Distributed Localization in Wireless Sensor Networks using Bat Algorithm**” is a bonafide record of work carried out by **Priyanka Balhara (2K13/CSE/18)** under my guidance and supervision, during the academic session 2013-2015 in partial fulfillment of the requirement for the degree of Master of Technology in Computer Science & Engineering from Delhi Technological University, Delhi.

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ABSTRACT

With the rapid development of Wireless Sensor Networks (WSNs), location information becomes critically essential and indispensable since WSNs are intended to provide spatial-temporal information about the characteristics of the physical world. Hence, it becomes important to associate sensed data with location information, thus, making data geographically meaningful. So, one of the fundamental challenges in WSNs is the localization of nodes. Localization means assigning geographical coordinates to each device with unknown position in the deployment region. It is required in WSN to report the origin of events, routing, assisting group querying of sensors and to answer questions on the network coverage.

In WSN, there will be sensor nodes densely deployed at positions which may or may not be predetermined. Global Positioning System (GPS) is not practical to be used in every sensor node because it will be costly. Moreover, there are energy constraints due to nodes being battery powered. Also, GPS is not accessible in some environments (like dense forests, under-ground) due to non-availability of signals in confined environment. Therefore, only some nodes are equipped with GPS known as anchor nodes. The other nodes known as target nodes, try to localize themselves using the location information obtained from anchor nodes within their range.

In this dissertation, we developed a distributed localization technique which uses Bat algorithm to find the optimum locations of target nodes. It incorporates solutions to the problem of flip ambiguity which frequently occurs in localization. Flip ambiguity occurs when the number of anchors are less and are collinear. We have shown that our approach removes flip ambiguity problem and performs better than the approaches which do not include any measures to deal with it. We have compared our approach with the Bat algorithm approach without any measures to deal with flip ambiguity problem and shown the improvement in localization error. We have also compared our approach with the localization using Particle Swarm algorithm.

Keywords- *WSNs, Localization, Flip ambiguity, Global Positioning System, PSO, Bat algorithm, Anchor nodes, Target Nodes.*

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List of Abbreviations

WSNs	Wireless Sensor Networks
BS	Base Station
MMP	Mobile Management Plane
PMP	Power Management Plane
TMP	Task Management Plane
RSS	Received Signal Strength
ACO	Ant Colony Optimization
PSO	Particle Swarm Optimization
RSSI	Received Signal Strength Indicator
AoA	Angle of Arrival
TDoA	Time Difference of Arrival
APIT	Approximate Point in Triangle test
MDS	Multidimensional scaling
SVD	Singular Vector Decomposition