

Energy Efficient 2D and 3D Localization in Wireless Sensor Networks using Single Anchor Node

*A Thesis Submitted in Partial Fulfillment of the
Requirements for the Degree of*

*Doctor of Philosophy
in
(Electronics and Communication Engineering)*

by

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Undertaking

I declare that the work presented in this thesis titled “*Energy Efficient 2D and 3D Localization in Wireless Sensor Networks using Single Anchor Node*”, submitted to the Department of Electronics and Communication Engineering, **Motilal Nehru National Institute of Technology Allahabad, Prayagraj, India 211004**, for the award of the **Doctor of Philosophy** degree in **Department of Electronics and Communication Engineering**, is my original work. I neither have plagiarized any part of the thesis nor submitted the same work for the award of any other degree anywhere. In case this undertaking is found incorrect, the degree shall be withdrawn unconditionally.

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Prateek Raj Gautam

(2016REL01)

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Certificate

This is to certify that the thesis entitled “**Energy Efficient 2D and 3D Localization in Wireless Sensor Networks using Single Anchor Node**” being submitted by **Prateek Raj Gautam** (registration number: 2016REL01) in the Electronics and Communication Engineering Department, Motilal Nehru National Institute of Technology Allahabad, Prayagraj, India 211004, in fulfillment of the requirement for the award of the Doctor of Philosophy, is a record of bonafide work carried out by him, under my supervision. This work has not been submitted in parts or in full to any other university or institute for the award of any degree or diploma or for any other purpose.

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Sign

Prateek Raj Gautam



Abstract

Wireless Sensor Networks (WSNs) is a sub-class of wireless Ad-hoc networks where sensor nodes are randomly deployed to gather some specific type of information about physical phenomena such as temperature, pressure, humidity, rainfall, etc. The nodes in an ad-hoc network are small battery-operated devices with limited computational capabilities and transceivers to communicate with nearby nodes and the base station (BS) or a gateway to another network. However, in WSNs, these nodes also have additional sensor/transducer modules to measure some desired physical phenomena, hence, called sensor nodes or sensors. The lifetime of a WSN can be defined as the functional duration of nodes in WSNs. The lifetime of the network (or nodes in the network) depends on the initially installed battery and power consumption of the nodes. To prolong the lifetime of network operation like routing, sensing, communications protocols are planned differently.

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List of abbreviations

abbreviation Abb.

rss received signal strength indicator.

WSN Wireless sensor network.



List of symbols

P_t Power transmit.



Chapter 1

How To Use thesisMNNIT class

1.1 REMOVE After Finalizing

to remove this chapter remove comment \printHelp from the template file

1.2 how to compile

It uses biber (insted of bibtex) for bibliography compilation.

It is a six step process and the sequence is

1. pdflatex
2. biber
3. makeindex
4. makeglossaries
5. pdflatex
6. pdflatex

1.2.1 customize texworks

go to texworks edit preferences typesetting processing tools

add makeglossaries to compiler

go to texworks edit preferences typesetting processing tools

click + to add new name makeglossaries browse to texlive bin directory where makeglossaries is located in the parameters add \$basename and save

create custom after analyzing other scripts

Use this script to compile on linux or bash shell. similar sequence of commands can be used on windows.

1. pdflatex \$1 \$2 \$3
2. biber \$2
3. makeindex -s \$2
4. makeglossaries \$2
5. pdflatex \$1 \$2 \$3
6. pdflatex \$1 \$2 \$3

here \$1 \$2 \$3 requires in arguments \$filename, \$basename and \$synctexoptions

1.3 \documentclass [Final or Draft]{ thesisMNNIT }

You can use Draft option to compile chapter and bib only, Final option will compile all front matter and backmatter

1.4 to print author

`\printAuthorWithSign`

`\printAuthorSign`

`\theauthor`

1.5 Figure and figure ref



Figure 1.1: mnnitlogo

1.6 Cite and footcite

The Figure 1.1 default [1], [2]¹ margins produced by small TEXT normalize TEXT

1.7 make Index list as

`\index{Prateek} \index{Raj} \index{Refresh}`

1.8 Define glossary and abbreviations

Define abbreviations as below and list will be generated Define definition

¹2.

`\abbDef{WSN}{Wireless Sensor Network}`

Define short form

`\abb{Definition}{Short form, ABB, ot term}`

Define short form for glosary but do not print

`\abbNoPrint{ P_t }{Power transmit}`

`\abbDef{rssi}{received signal strength indicator}`

`\abb{Wireless Sensor Network}{WSN}`

`\abb{ABB}{abbreviation}`

`\abb{ P_t }{Power transmit}`

results as received signal strength indicator (rssi)

Wireless Sensor Network (WSN)

ABB (abbreviation)

Separate list of symbols with `\sym`

`\sym{Power transmit}{ P_t }{pt} Power transmit (P_t)`

To print use above defined terms use code as glossary package

`\gls{WSN}`

`\glspl{ABB}`

results appear as WSN rssi

List of publications

Journals

- 1) **P. R. Gautam et al.**, “Energy-efficient localization of sensor nodes in WSNs using beacons from rotating directional antenna”, *IEEE Transactions on Industrial Informatics*, vol. 15, no. 11, pp. 5827–5836, 2019
DOI: 10.1109/TII.2019.2908437, **Impact Factor:** 9.112
- 2) **P. R. Gautam et al.**, “Energy-efficient localization of sensor nodes in WSNs using single beacon node”, *IET Communications*, vol. 14, no. 9, pp. 1459–1466, 2020
DOI: 10.1049/iet-com.2019.1298, **Impact Factor:** 2.1
- 3) **P. R. Gautam et al.**, “Energy-efficient three dimensional localization in WSNs using directional beacons from single anchor node”, *IEEE Wireless Communications*, 2021 **Under review**
- 4) **P. R. Gautam et al.**, “Industrial inventory monitoring with 3D localization of sensors in wireless sensor nodes”, *IEEE Sensor Journal*, 2021 **Under review**
- 5) **P. R. Gautam et al.**, “Directional antenna design for experimentation in internet of things and wireless sensor networks”, *IEEE Antenna and Wireless Propagation Letter*, 2021 **Under review**

Conferences and Book chapters

- 1) **P. R. Gautam et al.**, “Localization of Sensor Nodes in WSNs using Three Dimensional Angle of Arrival detection at BS”, in *2019 International Conference on Electrical, Electronics and Computer Engineering (UPCON)*, IEEE, Nov. 2019, pp. 1–4
DOI: 10.1109/UPCON47278.2019.8980262
- 2) **P. R. Gautam et al.**, “Localization of sensor nodes in WSN using area between a node and two beacons”, in *Advances in VLSI, Communication, and Signal Processing*, ser. Lecture Notes in Electrical Engineering, Springer, 2020, pp. 221–228
DOI: 10.1007/978-981-32-9775-3_22
- 3) **P. R. Gautam et al.**, “Sensor localization in WSNs using rotating directional - antenna at the base station”, in *Advances in VLSI, Communication, and Signal Processing*, ser. Lecture Notes in Electrical Engineering, vol. 683, Springer, 2021, pp. 705–718
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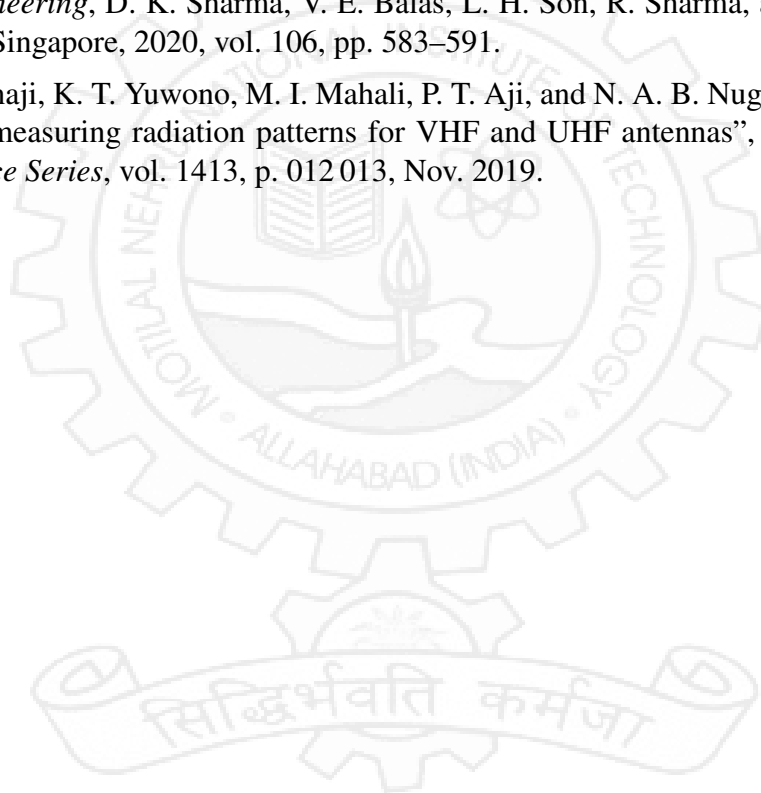
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