

Research Methods in computer science

Spring 2025

Lecture 9

Omprakash Gnawali

February 17, 2025

Agenda

CS Experiments

HW5

Experiments

What experiments are useful?

Critical for the main arguments of the paper

What experiments are not useful?

Pointless experiments that generate pointless numbers, graphs, and tables

Types of Experiments

From the “context” perspective

Controlled

Uncontrolled

There are other perspectives to be covered in future lectures

Group Activity

Experiment Design

Metric Selection

Group 1

A new algorithm that translates English text to Spanish.

Group 2

A new wireless networking technology.

Group 3

Impact of doing court proceedings in metaverse.

<https://www.reuters.com/world/americas/colombia-court-moves-metaverse-host-hearing-2023-02-24/>

Anatomy of a Science Paper

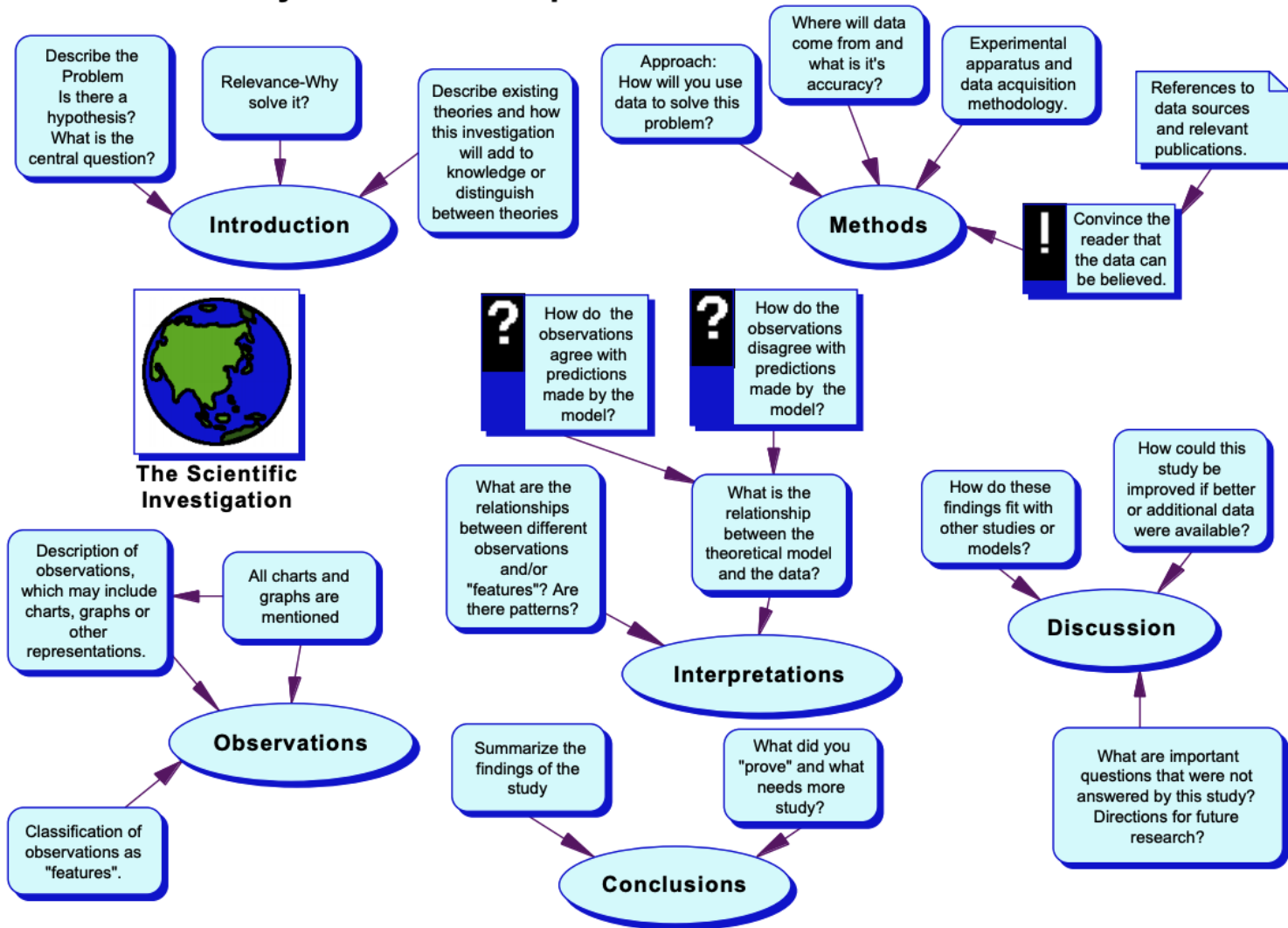


Figure 3.1. This diagram shows the headings that must be used for this science paper. Please pay careful attention to the boxes with arrows pointing at each elliptical heading box. These boxes are reminders of the content that belongs with each heading.

Types of Papers (mechanical)

Technical Reports

Project description

Research paper

Conference

Journal

Magazine

Find out what type your group
and community writes.

Which papers are more important?

Conference

Journal

Magazine

Impact factor

CORE ranking

DBLP

What makes a paper more important than others?

Types of Papers (purpose)

Research Paper

Survey Paper

Tutorial

Technical Report

- E.g., NIST, Other Orgs

White Paper

Vision Paper

Challenge Paper

Publications – Looking Ahead

Blogs?

Facebook?

Twitter?

LinkedIn?

GitHub?

YouTube?

arXiv?

.....

Citation and References

Clean! Clean! Clean!

(esp. for websites, links, datasheets)

Consistency! Consistency! Consistency!

Examples

^ 6th

- ALIZAI, M. H., WIRTZ, H., KIRCHEN, B., VAEGS, T., GNAWALI, O., AND WEHRLE, K. 2011. TinyWifi: Making Network Protocol Evaluation Portable Across Multiple Phy-Link Layers. In *WINTECH '11: Proceedings of the Sixth ACM International Workshop on Wireless Network Testbeds, Experimental Evaluation and Characterization*.
- BHATTI, S., CARLSON, J., DAI, H., DENG, J., ROSE, J., SHETH, A., SHUCKER, B., GRUENWALD, C., TORGERSON, A., AND HAN, R. 2005. MANTIS OS: An Embedded Multithreaded Operating System for Wireless Micro Sensor Platforms. *Mobile Networks and Applications* 10, 4 (Aug.), 563–579.
- BROUWERS, N., LANGENDOEN, K., AND CORKE, P. 2009. Darjeeling, a Feature-rich VM for the Resource Poor. In *SenSys '09: Proceedings of the 7th ACM Conference on Embedded Networked Sensor Systems*. ACM, New York, NY, USA, 169–182.
- BURRI, N., VON RICKENBACH, F., AND WATTENHOFER, R. 2007. Dozer: ultra-low power data gathering in sensor networks. In *IPSN '07: Proceedings of the 6th international conference on Information processing in sensor networks (2007-05-06)*. ACM, 450–459.
- CHALLEN, G. W., WATERMAN, J., AND WELSH, M. 2010. IDEA: Integrated Distributed Energy Awareness for Wireless Sensor Networks. In *MobiSys '10: Proceedings of the 8th international conference on Mobile systems, applications, and services*. ACM, New York, NY, USA, 35–48.
- CHEN, Y., GNAWALI, O., KAZANDJEVA, M., LEVIS, P., AND REGEHR, J. 2009. Surviving Sensor Network Software Faults. In *SOSP '09: Proceedings of 22nd ACM Symposium on Operating Systems Principles*.
- CHIPARA, O., LU, C., BAILEY, T. C., AND ROMAN, G.-C. 2010. Reliable Clinical Monitoring Using Wireless Sensor Networks: Experiences in a Step-down Hospital Unit. In *SenSys '10: Proceedings of the 8th ACM Conference on Embedded Networked Sensor Systems*. ACM, New York, NY, USA, 155–168.
- CONTIKI COLLECT. 2010. Contiki Collect Memo. <http://77comments.gmane.org/gmane.os.contiki.devel/5790>.

References

Can take a long time to format references.

Is it worth it?

Citations – Google Scholar

Scholar About 6,880 results (0.07 sec)

YEAR ▾ ☰

Language independent analysis and classification of discussion threads in Coursera MOOC forums

LA Rossi, O Gnawali - ... Reuse and Integration (IRI), 2014 IEEE ..., 2014 - ieeexplore.ieee.org

... Aside from students and instructors, other categories of **Coursera forum** users: are Course Staff (teach-655 Page 3 ... 4.1. Different usages of posts and comments As we mentioned in Sec. ... a discussion thread on a **Coursera forum** is composed of posts and possibly comments ...

☆  Cited by 38 Related articles All 7 versions 

[PDF] ieee.org

Find This Item @ UH

×

Cite

- MLA Rossi, Lorenzo A., and Omprakash Gnawali. "Language independent analysis and classification of discussion threads in Coursera MOOC forums." *Information Reuse and Integration (IRI), 2014 IEEE 15th International Conference on*. IEEE, 2014.
- APA Rossi, L. A., & Gnawali, O. (2014, August). Language independent analysis and classification of discussion threads in Coursera MOOC forums. In *Information Reuse and Integration (IRI), 2014 IEEE 15th International Conference on* (pp. 654-661). IEEE.
- Chicago Rossi, Lorenzo A., and Omprakash Gnawali. "Language independent analysis and classification of discussion threads in Coursera MOOC forums." In *Information Reuse and Integration (IRI), 2014 IEEE 15th International Conference on*, pp. 654-661. IEEE, 2014.
- Harvard Rossi, L.A. and Gnawali, O., 2014, August. Language independent analysis and classification of discussion threads in Coursera MOOC forums. In *Information Reuse and Integration (IRI), 2014 IEEE 15th International Conference on* (pp. 654-661). IEEE.
- Vancouver Rossi LA, Gnawali O. Language independent analysis and classification of discussion threads in Coursera MOOC forums. In *Information Reuse and Integration (IRI), 2014 IEEE 15th International Conference on* 2014 Aug 13 (pp. 654-661). IEEE.

BibTeX EndNote RefMan RefWorks

Citations – ACM DL

DL Check out a preview of the [next ACM DL](#)

Room occupancy estimation through wifi, UWB, and light sensors mounted on doorways

Full Text: PDF Get this Article

Authors: [Hessam Mohammadmoradi](#) [University of Houston](#)
[Shengrong Yin](#) [University of Houston](#)
[Omprakash Gnawali](#) [University of Houston](#)



2017 Article

Published in:



· Proceeding
[ICSDSDE '17](#) Proceedings of the 2017 International Conference on Smart Digital Environment
Pages 27-34

Rabat, Morocco — July 21 - 23, 2017
ACM New York, NY, USA ©2017
[table of contents](#) ISBN: 978-1-4503-5281-9
doi>[10.1145/3128128.3128133](https://doi.org/10.1145/3128128.3128133)

Bibliometrics

Citation Count: 0
Downloads (cumulative): 116
Downloads (12 Months): 66
Downloads (6 Weeks): 1

Tools and Resources

- Buy this Article
- Recommend the ACM DL to your organization
- Request Permissions
- TOC Service:
[Email](#) [RSS](#)
- Save to Binder
[View My Binders](#)
- Export Formats:
[BibTeX](#) [EndNote](#) [ACM Ref](#)
- Upcoming Conference:
LAK '19
- Share:
[f](#) [t](#) [g+](#) [r](#) [+](#)

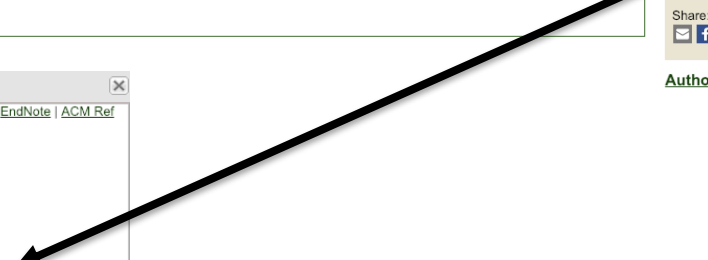
Author Tags ▼

Export Formats

BibTeX | EndNote | ACM Ref

```
@inproceedings{Mohammadmoradi:2017:ROE:3128128.3128133,  
author = {Mohammadmoradi, Hessam and Yin, Shengrong and Gnawali, Omprakash},  
title = {Room Occupancy Estimation Through Wifi, UWB, and Light Sensors Mounted on Doorways},  
booktitle = {Proceedings of the 2017 International Conference on Smart Digital Environment},  
series = {ICSDSDE '17},  
year = {2017},  
isbn = {978-1-4503-5281-9},  
location = {Rabat, Morocco},  
pages = {27--34},  
numpages = {8},  
url = {http://doi.acm.org/10.1145/3128128.3128133},  
doi = {10.1145/3128128.3128133},  
acmid = {3128133},  
publisher = {ACM},  
address = {New York, NY, USA},  
keywords = {channel state information, people counting, wireless sensing},  
}
```

[\[download\]](#)



Citations - IEEE

Towards Embedded Visible Light Communication Robust to Dynamic Ambient Light

2 Author(s) Shengrong Yin ; Omprakash Gnawali [View All Authors](#)

1 Paper Citation

169 Full Text Views



Abstract

Document Sections

- I. Introduction
- II. Related Work
- III. System Overview
- IV. Evaluation
- V. Conclusions

Authors

Figures

References

Citations

Keywords

Abstract:

The presence of ambient light is a key challenge for reliable and robust low cost embedded visible light communication system. The photodetector used by these systems can perform poorly when subjected to bright ambient light or fluctuating ambient light. To solve this problem, we present an ambient light cancellation mechanism for low cost embedded LED to photodiode communication systems that utilizes a digital potentiometer to adaptively nullify the ambient light to provide an always ZERO output no matter what the ambient light intensity is. The proposed technique allows the receiver to correctly receive the light transmitted by the transmitter without any interference from the ambient light. We provide a detailed description of the modulation and demodulation schemes as well as ambient light cancellation mechanism, and their evaluations. The results show our proposed system can provide a reliable and robust visible light communication with extremely low symbol error rate (almost 0) and an acceptable data rate up to 3kbps given an operating distance of 50 centimeters.

Published in: [2016 IEEE Global Communications Conference \(GLOBECOM\)](#)

Date of Conference: 4-8 Dec. 2016

INSPEC Accession Number: 16655135

Date Added to IEEE *Xplore*: 06 February 2017

DOI: [10.1109/GLOCOM.2016.7842344](#)

► ISBN Information:

Publisher: IEEE

Conference Location: Washington, DC, USA

```
@INPROCEEDINGS{7842344,
  author={S. Yin and O. Gnawali},
  booktitle={2016 IEEE Global Communications Conference (GLOBECOM)},
  title={Towards Embedded Visible Light Communication Robust to Dynamic Ambient Light},
  year={2016},
  volume={},
  number={},
  pages={1-6},
  keywords={demodulation;free-space optical communication;interference suppression;light emitting diodes;optical modulation;photodetectors;photodiodes;dynamic ambient light fluctuation;robust low-cost embedded visible light communication system reliability;photodetector;photodiode communication system;low-cost embedded LED;digital potentiometer;modulation scheme;demodulation scheme;ambient light cancellation mechanism;distance 50 cm;Receivers;Photodiodes;Robustness;Modulation;Prototypes},
  doi={10.1109/GLOCOM.2016.7842344},
  ISSN={},
  month={Dec},}
```

References - 1

- [36] D. Chen, X. Cao, F. Wen, and J. Sun, “Blessing of dimensionality: High-dimensional feature and its efficient compression for face verification,” in *Proc. IEEE Conf. CVPR*, Jun. 2013, pp. 3025–3032.
- [37] Z. Cui, W. Li, D. Xu, S. Shan, and X. Chen, “Fusing robust face region descriptors via multiple metric learning for face recognition in the wild,” in *Proc. IEEE CVPR*, Jun. 2013, pp. 3554–3561.
- [38] H. Larochelle, D. Erhan, A. Courville, J. Bergstra, and Y. Bengio, “An empirical evaluation of deep architectures on problems with many factors of variation,” in *Proc. 24th ICML*, 2007, pp. 473–480.
- [39] M. Varma and A. Zisserman, “A statistical approach to material classification using image patch exemplars,” *IEEE Trans. Pattern Anal. Mach. Intell.*, vol. 31, no. 11, pp. 2032–2047, Nov. 2009.
- [40] A. Krizhevsky, “Learning multiple layers of features from tiny images,” 2009.
- [41] R.-E. Fan, K.-W. Chang, C.-J. Hsieh, X.-R. Wang, and C.-J. Lin, “LIBLINEAR: A library for large linear classification,” *J. Mach. Learn. Res.*, vol. 9, pp. 1871–1874, Jul. 2008.
- [42] D. Ciresan, U. Meier, and J. Schmidhuber, “Multi-column deep neural networks for image classification,” in *Proc. IEEE Conf. CVPR*, Jun. 2012, pp. 3642–3649.
- [43] K. Sohn, G. Zhou, C. Lee, and H. Lee, “Learning and selecting features jointly with point-wise gated Boltzmann machines,” in *Proc. 30th ICML*, 2013, pp. 217–225.
- [44] K. Yu, Y. Lin, and J. Lafferty, “Learning image representations from the pixel level via hierarchical sparse coding,” in *Proc. IEEE Conf. CVPR*, Jun. 2011, pp. 1713–1720.
- [45] S. Belongie, J. Malik, and J. Puzicha, “Shape matching and object recognition using shape contexts,” *IEEE Trans. Pattern Anal. Mach. Intell.*, vol. 24, no. 4, pp. 509–522, Apr. 2002.

References - 2

- [1] N. H. Motlagh, M. Bagaa, and T. Taleb, "UAV-based IOT platform: A crowd surveillance use case," *IEEE Communications Magazine*, vol. 55, no. 2, pp. 128–134, 2017.
- [2] L. Gupta, R. Jain, and G. Vaszkun, "Survey of important issues in UAV communication networks," *IEEE Communications Surveys & Tutorials*, vol. 18, no. 2, pp. 1123–1152, 2016.
- [3] (2017, April) Homeland security in united states. [Online]. Available: https://en.wikipedia.org/wiki/Homeland_security
- [4] C. C. Haddad and J. Gertler, "Homeland security: Unmanned aerial vehicles and border surveillance." DTIC Document, 2010.
- [5] Y. Zou, J. Zhu, X. Wang, and L. Hanzo, "A survey on wireless security: Technical challenges, recent advances, and future trends," *Proceedings of the IEEE*, vol. 104, no. 9, pp. 1727–1765, 2016.
- [6] R. K. Sharma and D. B. Rawat, "Advances on security threats and countermeasures for cognitive radio networks: A survey," *IEEE Communications Surveys & Tutorials*, vol. 17, no. 2, pp. 1023–1043, 2015.
- [7] A. Mukherjee, S. A. A. Fakoorian, J. Huang, and A. L. Swindlehurst, "Principles of physical layer security in multiuser wireless networks: A survey," *IEEE Communications Surveys & Tutorials*, vol. 16, no. 3, pp. 1550–1573, 2014.
- [8] J. Xu, K. Li, L. Duan, and R. Zhang, "Proactive eavesdropping via jamming over HARQ-based communications," in *IEEE Global Communications Conference (GLOBECOM)*, 2017.
- [9] M. Bloch, J. Barros, M. R. Rodrigues, and S. W. McLaughlin, "Wireless information-theoretic security," *IEEE Transactions on Information Theory*, vol. 54, no. 6, pp. 2515–2534, 2008.

Citations

- Systems and artifacts
 - Generally immediately after the names
AnguLoc [5] is better than SideLoc[6].
- Narrative
 - Generally at the end of the sentence

Researchers have made a lot of progress in this field
in the last five years [6]

This solution is scalable as the number of transmitting anchors can be small and can be scheduled in different time slots. With the usage of inter-anchor concurrency, solutions like AnguLoc [1] managed to make it more efficient. However, this architecture is not cost-effective as described earlier.

In addition to that, new light-emitting technologies, such as LEDs, become more popular and accessible, enabling new perspectives for optical wireless communication [7], [8]. Finally, the increasing interest and exploration of the

Bad form:

[1] presents a new technique.

Citation Format

Number: [n]

Author / year: [Gnawali et al. 2020]

In text without [] or (), e.g., Gnawali et al. proposed a new technique.

Consult the instruction for your conference or journal. Number [n] format common in our fields.

HW5 – Metrics

List of metrics from the related papers.

Define the metrics.

Observations about common and uncommon metrics.