

FLORIDA POLYTECHNIC UNIVERSITY

MASTER'S THESIS

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# Security, Control, and Visualization of a Cognitive Radio Mesh Network

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*A thesis submitted in fulfillment of the requirements  
for the degree of Masters of Engineering*

*in the*

College of Engineering

January 24, 2016



## Declaration of Authorship

I, John MCCORMACK, declare that this thesis titled, “Security, Control, and Visualization of a Cognitive Radio Mesh Network” and the work presented in it are my own. I confirm that:

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- Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated.
- Where I have consulted the published work of others, this is always clearly attributed.
- Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work.
- I have acknowledged all main sources of help.
- Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself.

Signed:

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Date:

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*"Thanks to my solid academic training, today I can write hundreds of words on virtually any topic without possessing a shred of information, which is how I got a good job in journalism."*

Dave Barry



FLORIDA POLYTECHNIC UNIVERSITY

*Abstract*

Dr. Ryan Integlia  
College of Engineering

Masters of Engineering

**Security, Control, and Visualization of a Cognitive Radio Mesh Network**

by John MCCORMACK

The system presented is that of a cognitive radio mesh network testbed. The testbed is made up of Ettus Research USRP Software Defined Radios. The mesh network is created using the batman-adv mesh network protocol. The system is capable of running tests on various cognitive radio functions including frequency hopping. Also presented is a visualization and control system implemented in Unity3D. This tool allows for unique visualization of the network in addition to providing means for human in the loop cyber physical systems. Finally, a novel security scheme is presented that serves as a first step towards cryptographic wireless transmission protocols over the cognitive radio mesh network.





## *Acknowledgements*

I would like to thank Dr. Ryan Integlia for all of his support throughout this process. I would also like to acknowledge Joseph Prine, Bradley Trowbridge, and R. Cody Maden for all of their hardwork.



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# List of Abbreviations

**LAH** List Abbreviations Here  
**WSF** What (it) Stands For



# Physical Constants

Speed of Light  $c_0 = 2.997\,924\,58 \times 10^8 \text{ m s}^{-1}$  (exact)



# List of Symbols

$a$	distance	m
$P$	power	W (J s <sup>-1</sup> )
$\omega$	angular frequency	rad





*To my parents, Joe and Kathy McCormack for supporting  
me in all my endeavors.*



# **Chapter 1**

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- 1.1 SDN In Unity as a Mesh Network with Actuation and Feedback**
- 1.2 Human Machine Interaction**
- 1.3 Trends Towards Software Defined Environment**
- 1.4 Encryption in SDR and Mesh Environments**





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**6.4 Future Work**



## **Appendix A**

# **Appendix Title Here**

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