

# Joanna C. S. Santos

ASSISTANT PROFESSOR  
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING  
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## RESEARCH INTERESTS

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I work at the intersection of **Security** and **Software Engineering**. My work draws on *program analysis*, *empirical research*, *software verification*, and *machine learning* to solve software engineering and security problems, such as the detection of software vulnerabilities and architectural weaknesses, reasoning and formal modeling of security properties, and software architecture reverse engineering.

## PROFESSIONAL EXPERIENCE

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<b>Assistant Professor</b> <i>University of Notre Dame (ND)</i>	Aug. 2021 – Present Notre Dame, IN. USA
<b>Systems Analyst</b> <i>ACONE - Assessoria e Consultoria Empresarial LTDA</i>	Jan. 2014 – Aug. 2014 Aracaju, SE. Brazil



## EDUCATION

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<b>Ph.D. in Computing and Information Sciences</b> <i>Rochester Institute of Technology (RIT)</i> Dissertation: <i>Understanding and Identifying Vulnerabilities Related to Architectural Security Tactics</i> Advisor: <i>Dr. Mehdi Mirakhorli</i> GPA: 4.0	Aug. 2016 – June 2021 Rochester, NY. USA
<b>M.Sc. in Software Engineering</b> <i>Rochester Institute of Technology (RIT)</i> Thesis: <i>Toward Establishing a Catalog of Security Architecture Weaknesses</i> Advisor: <i>Dr. Mehdi Mirakhorli</i> GPA: 4.0	Aug. 2014 – May 2016 Rochester, NY. USA
<b>B.Sc. in Computer Engineering</b> <i>Federal University of Sergipe (UFS)</i> Undergraduate Thesis: <i>JOnline: An Online Judge for Teaching Programming</i> Advisor: <i>Dr. Admilson R. L. Ribeiro</i> GPA: 8.9/10 (equivalent to 3.61 in USA)	Jan. 2009 – Oct. 2013 São Cristóvão, SE. Brazil

## HONORS & AWARDS

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 <b>Research Pitch Competition at JOBS Workshop 2020</b> Won Research Pitch competition at JOBS Workshop (co-located with 53rd IEEE/ACM International Symposium on Microarchitecture - MICRO 2020).
 <b>Best Paper Award at ICSA 2017</b> Award to the paper “ <i>Understanding Software Vulnerabilities Related to Architectural Security Tactics: An Empirical Investigation of Chromium, PHP and Thunderbird</i> ”

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### Science Without Borders Scholarship (CAPES/IIE/Fullbright)

Scholarship granted by CAPES (Coordination for the Improvement of Higher Education Personnel) in coordination with IIE and Fullbright to pursue a masters degree at RIT (2014-2016).

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### Published paper ranked at 3rd place in WTICGBASE - XIII ERBASE, 2013

Paper: *A Location Service using the HTML5 Geolocation API*

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## PUBLICATIONS (CHRONOLOGICAL ORDER)

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### REFEREED JOURNAL ARTICLES

- JSS 2019 **J. C. S. Santos**, K. Tarrit, A. Sejfia, M. Mirakhorli, and M. Galster. “An empirical study of tactical vulnerabilities”. *Journal of Systems and Software*. Vol. 149, pp. 263–284. (Received Oct. 2017, Revised Sep. 2018, Accepted Oct. 2018, Available online Oct. 2018.)
- JSS 2016 I. J. Mujhid, **J. C. S. Santos**, R. Gopalakrishnan, and M. Mirakhorli. “A search engine for finding and reusing architecturally significant code”. *Journal of Systems and Software (JSS)*. Vol. 130, pp. 81–93. (Received Feb. 2016, Revised Aug. 2016, Accepted Nov. 2016, Available online Nov. 2016).
- EMSE 2016 W. Zogaan, I. J. Mujhid, **J. C. S. Santos**, D. Gonzalez, and M. Mirakhorli. “Automated training-set creation for software architecture traceability problem”. *Empirical Software Engineering (EMSE)*. Vol. 22, Issue 3. pp. 1028–1062. (Received Nov. 2015, Accepted Oct. 2016, Available online Nov. 2016)

### REFEREED CONFERENCE PAPERS (RESEARCH TRACK)


- ICSA 2021 A. Shokri, **J. C. S. Santos**, and M. Mirakhorli. “ArCode: Facilitating the use of application frameworks to implement tactics and patterns”. In: *IEEE International Conference on Software Architecture (ICSA 2021)*. {To appear}
- SCAM 2020 S. Moshtari, **J. C. S. Santos**, M. Mirakhorli and A. Okutan. “Looking for software defects? First find the nonconformists”. In: *2020 IEEE 20th International Working Conference on Source Code Analysis and Manipulation (SCAM 2020)*, Virtual (due to COVID-19), pp. 75–86.
- ESEC/FSE 2019 **J. C. S. Santos**, A. Sejfia, T. Corrello, S. Gadenkanahalli, and M. Mirakhorli. “Achilles’ heel of plug-and-Play software architectures: a grounded theory based approach”. In: *27th ACM Joint Meeting on European Software Engineering Conference and Symposium on the Foundations of Software Engineering (ESEC/FSE 2019)*, Tallinn, Estonia, pp. 671-682.
-  ICSA 2017 **J. C. S. Santos**, A. Peruma, M. Mirakhorli, M. Galster, J. V. Vidal and A. Sejfia, “Understanding software vulnerabilities related to architectural security tactics: An empirical investigation of chromium, php and thunderbird”. In: *2017 IEEE International Conference on Software Architecture (ICSA 2017)*, Gothenburg, Sweden, pp. 69–78. **Best Paper Award**
- MSR 2017 D. Gonzalez, **J. C. S. Santos**, A. Popovich, M. Mirakhorli and M. Nagappan, “A large-scale study on the usage of testing patterns that address maintainability attributes: Patterns for ease of modification, diagnoses, and comprehension”. In: *2017 IEEE/ACM 14th International Conference on Mining Software Repositories (MSR 2017)*, Buenos Aires, Argentina, pp. 391–401.
- ITNG 2016 F. M. Ribeiro, T. Rocha, **J. C. S. Santos**, and E. D. Moreno. “A model-driven solution for automatic software deployment in the cloud”. In *Information Technology: New Generations (ITNG 2016)*, Las Vegas, USA, pp. 591–601.

- EATIS 2012 A. R. Ribeiro, M. T. Chella, L. M. M. Santos, **J. C. S. Santos**, and W. R. Melo. “ERLab: a middleware for remote access electronic laboratories”. In *Proceedings of the 6th Euro American Conference on Telematics and Information Systems (EATIS 2012)*, Valencia, Spain, pp. 199–205.

## REFEREED SHORT CONFERENCE PAPERS & WORKSHOP PAPERS

- FTfJP 2020 **J. C. S. Santos**, R. A. Jones, and M. Mirakhorli. “Salsa: Static analysis of serialization features”. In: *Proceedings of the 22nd ACM SIGPLAN International Workshop on Formal Techniques for Java-Like Programs (FTfJP 2020)*, Virtual (due to COVID-19), pp.18–25.
- EnCyCriS 2020 **J. C. S. Santos**, S. Suloglu, J. Ye, and M. Mirakhorli. “Towards an automated approach for detecting architectural weaknesses in critical systems”. In: *Proceedings of the IEEE/ACM 42nd International Conference on Software Engineering Workshops – 1st International Workshop on Engineering and Cybersecurity of Critical Systems (EnCyCriS 2020)*, Virtual (due to COVID-19), pp. 250–253.
- ICSA 2020 **J. C. S. Santos**, S. Moshtari and M. Mirakhorli. “An Automated Approach to Recover the Use-case View of an Architecture”. In: *2020 IEEE International Conference on Software Architecture Companion (ICSA-C 2020)*, Virtual (due to COVID-19), pp. 63–66. ICSA 2020 NEMI Track.
- WoSoCer 2020 **J. C. S. Santos**, A. Shokri, and M. Mirakhorli. “Towards Automated Evidence Generation for Rapid and Continuous Software Certification”. In: *Proceedings of the 2020 IEEE International Symposium on Software Reliability Engineering Workshops (ISSREW) – 10th IEEE International Workshop on Software Certification (WoSoCer 2020)*, Virtual (due to COVID-19), pp. 287–294.
- ICSAW 2017 **J. C. S. Santos**, K. Tarrit and M. Mirakhorli. “A Catalog of Security Architecture Weaknesses”. In: *Proceedings of the 2017 IEEE International Conference on Software Architecture Workshops (ICSAW 2017)*. Gothenburg, Sweden, pp. 220–223. (ICSA 2017 - Early Career Track).
- WICSA 2016 **J. C. S. Santos**, M. Mirakhorli, I. Mujhid, and W. Zogaan. “BUDGET: a Tool for Supporting Software Architecture Traceability Research”. In: *Proceedings of the 13th Working IEEE/IFIP Conference on Software Architecture (WICSA 2016)*, Venice, Italy, pp. 303–306. Tool Demo.

## PUBLICATIONS IN BRAZILIAN VENUES

-  ERBASE 2013 **J. C. S. Santos**, S. C. P. Hoentsch, R. A. Nascimento, and A. R. L. Ribeiro. “A Location Service using the HTML5 Geolocation API”. In: *13th Regional School of Computing of the States of Bahia, Alagoas and Sergipe - Scientific Initiation and Undergraduate Works Workshop (XIII Escola Regional de Computação dos Estados da Bahia, Alagoas e Sergipe - Workshop de Trabalhos de IC e de Graduação - ERBASE 2013 - WTICG)*. Aracaju, Brazil. pp. 60–69. **Paper ranked in 3rd place.**
- ERBASE 2012 S. C. P. Hoentsch, A. R. L. Ribeiro, **J. C. S. Santos**, L. L. B. Menezes. “A Mobile Social Network Approach for Research and Education.”. In: *12th Regional School of Computing of the States of Bahia, Alagoas and Sergipe - 10th Workshop on Education and Informatics Bahia-Alagoas-Sergipe (XII Escola Regional de Computação dos Estados da Bahia, Alagoas e Sergipe - X Workshop de Educação e Informática Bahia-Alagoas-Sergipe - ERBASE 2012 - X WEIBASE)*. Juazeiro, Brazil. pp. 26–33.
- SBIE 2011 **J. C. S. Santos** and A. R. L. Ribeiro. “JOnline: a preliminary approach of an online judge for teaching computer programming”. In: *22nd Brazilian Symposium on Computers in Education (Simpósio Brasileiro de Informática na Educação-SBIE)*. Aracaju, Brazil. pp. 964–967.
- ENINED 2011 **J. C. S. Santos** and A. R. L. Ribeiro (2011). “An online judge approach for teaching computer programming”. In *2nd National Meeting on Informatics and Education (II Encontro Nacional de Informática e Educação - ENINED)*. Cascavel, Brazil. pp. 332–341.

ENINED 2011 A. R. Ribeiro, M. T. Chella, L. M. M. Santos, **J. C. S. Santos**, and W. R. Melo. “LEW: Web Engineering Laboratory for teaching, research and extension”. *2nd National Meeting on Informatics and Education (II Encontro Nacional de Informática e Educação - ENINED)*. Cascavel, Brazil. pp. 359–368.

ENINED 2011 S. C. P. Hoentsch, A. R. L. Ribeiro, **J. C. S. Santos**. “SocialNetLab - A Social Networking Site for Education”. In: *2nd National Meeting on Informatics and Education (II Encontro Nacional de Informática e Educação - ENINED)*. Cascavel, Brazil. pp. 77–84.

## TEACHING EXPERIENCE

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**Course Instructor** Aug. 2021 – Present  
ND - University of Notre Dame Notre Dame, IN. USA

**Courses:**

*CSE30332: Programming Paradigms* (Fall 2021)

**Course Instructor** Session 1: May 2012 – Aug. 2012, Session 2: Nov. 2012 – Apr. 2013  
Softteam - Empresa Júnior de Informática da UFS São Cristóvão, SE. Brazil

**Course:** *An Introduction to Java* (**Total Duration:** 48hrs)

- › Designed the course materials (syllabus, class slides, lecture notes, weekly assignments, and projects), graded assignments, and projects and taught a class of approximately 20 students the main concepts of software development using Java: classes, objects, inheritance, interfaces, data structures, exception handling, packages, database access, file handling, and Java Swing.

**Course Instructor** Oct. 2011 – Dec. 2011  
CAFIS - Centro Acadêmico de Física da UFS São Cristóvão, SE. Brazil

**Course:** *An Introduction to C++* (**Total Duration:** 20hrs)

- › Designed the course materials (syllabus, class slides, lecture notes, weekly assignments, and projects), graded assignments, and projects. Taught a class of 25 students the main concepts of software development using C++: data types and operators, pointers and references, control flow structures, interfaces, classes, objects, inheritance, polymorphism, exception handling, and UI development using QtCreator.

**Teaching Assistant** Jan. 2010 – Dec. 2011  
UFS - Federal University of Sergipe São Cristóvão, SE. Brazil

**Courses:**

*COMP0197: Imperative programming* (Spring 2010, Spring 2011)

*COMP0198: Object-oriented programming* (Fall 2010, Fall 2011)

- › Designed the weekly assignments, graded assignments, and projects. Answered questions and provided assistance for students during office hours or via e-mail. Ran programming labs once a week in class and helped students during these sessions.

## GUEST LECTURES AT RIT

### SWEN-440: Software System Requirements and Architecture Engineering

- › **Lectures:** Introduction to Requirements and Architecture Engineering. Architecturally Significant Requirements. Security Architecture Design. Threat Modeling. Security Patterns. Usecase Modeling.

### SWEN-610: Introduction to Software Engineering

- › **Lectures:** Research in Software Engineering.

### SWEN-755: Software Architecture and Product Lines

- › **Lectures:** Requirements Specification. Google Chromium Architecture. Failure Detection and Recovery. Secure by Design.

## RESEARCH EXPERIENCE

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### Graduate Research Assistant

*Rochester Institute of Technology (RIT)*  
*Laboratory of Software Design and Productivity*

Aug 2016 – Present

*Rochester, NY. USA*

**PI:** *Dr. Mehdi Mirakhorli*

- › Working on using program analysis techniques, empirical research methods, and machine learning to develop automated approaches for detecting security weaknesses in architectural models and source code.

### Graduate Research Assistant

*Rochester Institute of Technology (RIT)*  
*Laboratory of Software Design and Productivity*

Jan. 2015 – May 2016

*Rochester, NY. USA*

**PI:** *Dr. Mehdi Mirakhorli*

- › Worked on multiple research projects related with software architecture and security, such as identification of vulnerabilities rooted in the architecture of a software, retrieving architecturally-relevant code snippets and automated software traceability.

### Undergraduate Research Assistant

*Federal University of Sergipe (UFS)*  
*Research Group on Networks and Distributed Computing*

Nov. 2012 – Sep. 2013

*São Cristóvão, SE. Brazil*

**Leads:** *Dr. R. Salgueiro and Dr. E. D. Moreno*

- › Worked on the research & development project “Infrastructure for Interoperability of Social Networking Sites” (**PI:** *Dr. Admilson R. L. Ribeiro*) to create an academic social network using semantic Web technologies.

### Undergraduate Research Assistant

*Federal University of Sergipe (UFS)*  
*Research Group on Networks and Distributed Computing*

Aug. 2010 – Jul. 2012

*São Cristóvão, SE. Brazil*

**Leads:** *Dr. R. Salgueiro and Dr. E. D. Moreno*

- › Worked on the research project “ERLAB: a middleware model for remote access laboratories” (**PI:** *Dr. Admilson R. L. Ribeiro*) to develop a service-oriented middleware using Java to support the remote control of electronic devices through the Web

## INTERNSHIP EXPERIENCE

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### Intern Software Developer

*ACONE - Assessoria e Consultoria Empresarial LTDA*

Apr. 2013 – Oct. 2013

*Aracaju, SE. Brazil*

- › Created an Android app using Java & its backend Web service using C for reporting data about families within a community. Gathered the requirements for developing the software module used by a patient for requesting medical procedures.

### Intern in Informatics

*MPF/SE - Office of Federal Prosecution in Sergipe*

May 2012 – Apr. 2013

*Aracaju, SE. Brazil*

- › Developed and deployed its new internal Web site using Python and Plone. Maintained legacy internal systems written in PHP.

## STUDENTS

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### Latif Siddiq Sunny

*PhD Student*

Jan. 2022 – Present

*University of Notre Dame (ND)*

### Joshua Agron

*Undergraduate Research Assistant*

Aug. 2021 – Present

*University of Notre Dame (ND)*

### Megan Campbell

*Undergraduate Research Assistant*

Aug. 2021 – Present

*University of Notre Dame (ND)*

## MENTORSHIP EXPERIENCE (PRIOR JOINING ND)

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All mentees supervised in conjunction with Dr. Mehdi Mirakhorli (RIT).

\* Mentorship as part of the REU site at RIT (“Cultivating Next Generation Software Engineering Researchers”).

<b>Chinomso Ashiogwu *</b> <i>Undergraduate Research Assistant</i>	May 2020 – May 2021 <i>University of Maryland - Baltimore County (UMBC)</i>
<b>Reese A. Jones</b> <i>Undergraduate Research Assistant</i>	Dec. 2018 – Jul. 2019 // Jan. – Oct. 2020 // Jan. 2021 – May 2021 <i>Rochester Institute of Technology (RIT)</i>
<b>Joanna Ye *</b> <i>Undergraduate Research Assistant</i>	Jun. 2019 – Oct. 2019 <i>Rochester Institute of Technology (RIT)</i>
<b>Jasmin Gomez Heredia *</b> <i>Undergraduate Research Assistant</i>	Jun. 2019 – Aug. 2019 <i>California State University - Sacramento (CSUS)</i>
<b>Omar Dajani *</b> <i>Undergraduate Research Assistant</i>	Jun. 2018 – Mar. 2019 <i>Rochester Institute of Technology (RIT)</i>
<b>Wendy Hsia *</b> <i>Undergraduate Research Assistant</i>	Jun. 2018 – Oct. 2018 <i>Seattle University (SU)</i>
<b>Smruthi Gadenkanahalli</b> <i>Graduate Research Assistant</i>	Nov. 2017 – May. 2018 <i>Rochester Institute of Technology (RIT)</i>
<b>Taylor Corrello</b> <i>Graduate Research Assistant</i>	Dec. 2017 – May. 2018 <i>Rochester Institute of Technology (RIT)</i>
<b>Jairo Pavel Veloz Vidal</b> <i>Graduate Research Assistant</i>	Jan. 2016 – Jan. 2017 <i>Rochester Institute of Technology (RIT)</i>

## SERVICES

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### PROGRAM COMMITTEE (PC) MEMBER

- › PC Member (Engineering Track) *21st IEEE Int’l Working Conf. on Source Code Analysis and Manipulation (SCAM 2021)*
- › PC member (Workshop & Tutorials Track) *15th European Conference on Software Architecture (ECSA 2021)*
- › Shadow PC Member *Mining Software Repositories (MSR 2021)*
- › PC member *3rd International Workshop on Software Security from Design to Deployment (SEAD 2020)*
- › PC member *2nd International Workshop on Software Security from Design to Deployment (SEAD 2019)*

### REVIEWER

- › External Reviewer *6th IEEE European Symposium on Security and Privacy (Euro S&P 2021)*
- › Reviewer *IEEE Software (Special Issue: Diversity Crisis in Software Development - 2020)*
- › Sub-reviewer *36th International Conference on Software Maintenance and Evolution (ICSME 2020)*
- › Sub-reviewer *14th European Conference on Software Architecture (ECSA 2020)*

### STUDENT VOLUNTEER

- › Student volunteer *36th International Conference on Software Maintenance and Evolution (ICSME 2020)*
- › Student volunteer *20th IEEE Int’l. Working Conference on Source Code Analysis and Manipulation (SCAM 2020)*
- › Student volunteer *International Conference on Software Engineering (ICSE 2019)*
- › Student volunteer *Brazilian Symposium on Computers in Education (SBIE 2011)*

### OTHER

- › Panelist *2019 REU Graduate Study and Research Symposium*
- › Panelist *2018 REU Graduate Study and Research Symposium*
- › Member of the Computer Engineering Collegiate Board (2012-2013) *Federal University of Sergipe (UFS)*