Kaushal Kafle

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I am a PhD student in the Department of Computer Science at the College of William and Mary, being advised by Prof. Adwait Nadkarni. My research interests lie in analyzing the security practices employed in modern operating systems as well as designing practical security frameworks for such systems. I work at the Secure Platforms Lab (SPL) at William & Mary, where currently, I am actively involved in identifying and analyzing security problems in smart home platforms and devices, especially concerning home automation.

EDUCATION

College of William and Mary **PhD in Computer Science** **August 2017 - Present**
Advisor: Dr. Adwait Nadkarni
Relevant Courses:
Computer and Network Security, Cybersecurity Research Analysis, Systems Security, Advanced Software Engineering, Practice of Machine Learning, Analysis of Algorithms

Pulchowk Campus, Tribhuwan University **Bachelor's in Computer Engineering** **Nov 2011- Nov 2015**

PUBLICATIONS

Journal Papers

Kaushal Kafle, Kevin Moran, Sunil Manandhar, Adwait Nadkarni, and Denys Poshyvanyk. Security in Centralized Data Store-based Home Automation Platforms- A Systematic Analysis of Nest and Hue. In *ACM Transactions on Cyber-Physical Systems (TCPS)*. To appear. [Preprint]

Conference Papers

Sunil Manandhar, Kevin Moran, **Kaushal Kafle**, Ruhao Tang, Denys Poshyvanyk, and Adwait Nadkarni. Towards a Natural Perspective of Smart Homes for Practical Security and Safety Analyses. *To Appear in the Proceedings of the 41st IEEE Symposium on Security and Privacy (S&P)*, San Francisco, CA, USA, May 2020. [PDF]

Kaushal Kafle, Kevin Moran, Sunil Manandhar, Adwait Nadkarni, and Denys Poshyvanyk. A Study of Data Store-based Home Automation. In *Proceedings of the 9th ACM Conference on Data and Application Security and Privacy (CODASPY)*. Dallas, TX, USA, March 2019. ***Best Paper Award*** [PDF] [press coverage]

Richard Bonett, **Kaushal Kafle**, Kevin Moran, Adwait Nadkarni, and Denys Poshyvanyk. Discovering Flaws in Security-Focused Static Analysis Tools for Android using Systematic Mutation. In Proceedings of the 27th USENIX Security Symposium. Baltimore, MD, USA, August 2018. [Source code] [PDF]

Undergraduate Work

Kaushal Kafle, Diwas Sharma, Aayush Subedi, and Arun Kumar Timalsina. Improving Nepali Document Classification by Neural Network. In Proceedings of IOE Graduate Conference (pp. 317–322), Pulchowk, Kathmandu, Nepal, 2016. [PDF]

WORK EXPERIENCE

Research Assistant, Department of Computer Science, William & Mary *Jan 2018 – Present*

Over the course of my research, I have worked in analyzing and discovering flaws in different smart home systems (e.g., Google Nest, Philips Hue, SmartThings), security tools (e.g., Flowdroid, Amandroid) as well as third-party apps developed for smart homes or Android. I have also helped build security frameworks that aim to protect from those flaws. Details of my work are as follows:

Ongoing Research Project

- **Towards integrity of shared platform resources (Project Lead)**
  - A supplementary security framework for smarthome platforms to protect the integrity of their shared resources such as states shared with 3rd party apps

Completed Research Projects*:*

- **Security of Data-Store Based Home Automation (Project Lead):**
  - Analyzed the security of various components of smart home platforms that facilitate routines
  - Analysis of two major platforms: *Google Nest* and *Philips Hue*
  - Analyzed components included the Cloud backend, smart-apps review process, SSL enforcement in third-party smart-apps of the platforms.
  - A journal version was recently accepted to *ACM TCPS'20*.
  - Won the **Best Paper Award** in *ACM CODASPY '19*
  - Press coverage

- **MUSE (MUtation-based Soundness Evaluation)**:
  - Designed a framework for analyzing *soundness claims* of Android static analysis tools leveraging concepts from mutation testing
  - Discovered undisclosed flaws in multiple prominent Android static analysis security tools
  - *USENIX '18*

- **Helion (Home automation security EvaLuatION)**:
  - Conducted a user study to collect and understand smart home routines from real users.
  - Designed representation of user-driven routines gathered from user-study to be used for natural language processing
  - Created safety policies by analyzing automation sequences generated from a user's automation preferences
  - *IEEE S&P '20*

Teaching Assistant, Department of Computer Science, William & Mary *Aug 2017 – May 2019*

Taught labs and graded assignments for the following classes:

- Computational Problem Solving (CSCI 141), Fall 2017 *– 133 Students*
- Programming for Data Science (CSCI 140), Spring 2019 *– 93 Students*

Graded assignments for the following classes:

- Mobile App Security (CSCI 520), Spring 2018 *– 20 Students*
- Mobile App Security (CSCI 520), Fall 2018 *– 12 Students*

IT Manager, Lionize Travel and Tours, Patan, Nepal *Nov 2015 – May 2017*

CONFERENCE PRESENTATIONS & INVITED TALKS

- **Journal Club** - William & Mary, Williamsburg, VA *Sep 26th, 2019*
  - "The Security of Smart Home Platforms"
- **9th ACM CODASPY** – Dallas, TX *Mar 25th, 2019*
  - "A Study of Data-store Based Home Automation"
- **18th Graduate Research Symposium** – William & Mary, Williamsburg, VA *Mar 15th, 2019*
  - "A Study of Data-store Based Home Automation"
- **USENIX'18** – Baltimore, MD *Aug 17th, 2018*
  - "Discovering Flaws in Security-Focused Static Analysis Tools for Android using Systematic Mutation"

AWARDS & HONORS

- **Best Paper Award**, ACM CODASPY, Dallas, TX, USA, March 2019
- USENIX **Travel Award** (USENIX Security Symposium 2018).

PROFESSIONAL SERVICE

- **Sub-reviewer for Conferences**
  - ISOC Network and Distributed System Security Symposium (NDSS), 2020
  - USENIX Security Symposium (USENIX), 2019
  - The International Conference on Information Systems Security (ICISS), 2019

OTHER ACTIVITIES

- One of the founding members of Secure Platforms Lab at William & Mary (Lab website)
- Volunteer, IOE Graduate Conference, Pulchowk, Lalitpur, Nepal 2015
- Volunteer, Latex Workshop at IOE Graduate Conference, Pulchowk, Lalitpur, Nepal 2015
- Organizer, Hackathon, Locus 2015
- Organizer, Yomari Codecamp, Locus 2015