



**COLLEGE OF ENGINEERING  
AND COMPUTER SCIENCE**  
FLORIDA ATLANTIC UNIVERSITY

Announces the Ph.D. Dissertation Defense of

## **Bijayita Thapa**

for the degree of Doctor of Philosophy (Ph.D.)

### **“An Entity Solution Frame (ESF) for Autonomous Cars”**

**October 17, 2024, 4:00 p.m.**

**Building: Engineering East, Room # 405**

**777 Glades Road**

**Boca Raton, FL**

**DEPARTMENT:**

Computer & Electrical Engineering and Computer Science

**ADVISOR:**

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**ABSTRACT OF DISSERTATION**

Dissertation Title: An Entity Solution Frame (ESF) for Autonomous Cars

Abstract: The Cyber-Physical Systems (CPSs) and Internet of Things (IoT) have become emerging and essential technologies of the past few decades that connect various heterogeneous systems and devices. Sensors and actuators are fundamental units in most CPS and IoT systems, they are used extensively in vehicle systems, smart health care systems, smart buildings and cities, and many other types of applications. The extensive use of sensors and actuators, coupled with their increasing connectivity, exposes them to a wide range of threats. Given their integration into various systems and the use of multiple technologies, it is very useful to characterize their functions abstractly. For concreteness, we study them here in the context of autonomous cars. Security is a fundamental objective for autonomous cars because their safe operation can be affected by security attacks. In addition, the CPS and IoT systems are integrated in autonomous cars making designing for security very difficult. Designing a secure system requires a systematic and holistic global view of the system. We use abstraction in the form of software patterns, which allow us to address the complexity and heterogeneity of a system. Also, we use patterns because they can be used as a guideline for design and describe a component of a system at a high level of abstraction without containing any implementation details. These patterns are grouped together to build an Entity Solution Frame (ESF) for autonomous driving, which provide us better insight to analyze security issues in autonomous systems. This is the first work we know of where Abstract Entity Patterns (AEPs), Abstract Security Patterns (ASPs), and concrete patterns are used to build the ESF and analyze security issues in autonomous system.

**BIOGRAPHICAL SKETCH**

Born in Nepal

B.S., Palm Beach State College, Lake Worth, Florida, 2013

M.S., Florida Atlantic University, Boca Raton, Florida, 2017

Ph.D., Florida Atlantic University, Boca Raton, Florida, 2024

**CONCERNING PERIOD OF PREPARATION  
& QUALIFYING EXAMINATION**

**Time in Preparation:** 2018-2024

**Qualifying Examination Passed:** Fall 2024

**Published Papers:**

1. Thapa, B.; Fernandez, E.B.; Cardei, I.; Larrondo-Petrie, M.M. Abstract Entity Patterns for Sensors and Actuators. Computers 2023, 12, 93. <https://doi.org/10.3390/computers12050093>
2. Thapa, B. and Fernandez, E. B., Secure Abstract and Radar Sensor Patterns. Procs. of the 28<sup>th</sup> Conf. on Pattern Lang. of Prog.s (Plop'21), October 2021.
3. Thapa, B. and Fernandez, E. B. 2020. A Survey of Reference Architectures for Autonomous Cars. Proc. of 27thConf. on Pattern Lang. of Progs.'20 (October 2020).
4. Saemaldahr R., Thapa B., Maikoo K., and Fernandez E. B. 2020. Reference Architectures for the IoT: A survey. 5th International Conference of Reliable Information and Communication Technology 2020 (IRICT 2020).