BIOGRAPHICAL SKETCH

Mohamed Baza is currently a PhD Candidate at the Department of Electrical & Computer Engineering, Tennessee Tech. University. He received the B.S. and M.S. degrees in Electrical & Computer Engineering from Benha University, Egypt in 2012 and 2017, respectively. His research interests include blockchains, machine learning, and security and privacy in emergent technologies such as smart grids and VANETs. He has one best paper award in IEEE SmartNets 2019.

EDUCATION

Ph.D. Engineering
Tennessee Tech University, August 2020 *(expected)*
Cookeville, Tennessee

M.S. Electrical Engineering – Communication
Benha University, June 2017
Egypt

B.S. Electrical Engineering Electronics & Telecommunications
Benha University, June 2012

College of Engineering

TENNESSEE TECH

The Department of

Electrical and Computer Engineering

Announces the Dissertation Defense of

Mohamed I. Baza

In Partial

Fulfillment of the Requirements

For the degree of

Doctor of Philosophy in Engineering

July 29, 2020

3:30 p.m.

Tennessee Tech University

Zoom Link: https://tntech.zoom.us/j/93795210466

FIELD OF STUDY

Blockchain applications for smart connected vehicles

DISSERTATION TOPIC

BLOCKCHAIN-BASED SECURE AND PRIVACY-PRESERVING SCHEMES FOR CONNECTED VEHICLES

EXAMINING COMMITTEE

Dr. Mohamed Mahmoud, Committee Chair
Associate Professor, Electrical & Computer Engineering

Dr. Douglas Talbert
Associate Chair & Professor, Computer Science

Dr. Ambareen Siraj
Professor, Computer Science

Dr. Syed Rafay Hasan
Associate Professor, Electrical & Computer Engineering

Dr. Ghadir Radman
Professor, Electrical & Computer Engineering

ABSTRACT

Nowadays, blockchain and smart contract technology is gaining massive attention due to the security features it brings. In this dissertation, we leverage this technology to design secure and privacy-preserving schemes for connected vehicles applications.

We first propose a decentralized firmware update dissemination scheme for the autonomous vehicles (AVs). The scheme enables AVs, namely distributors, to participate in the distribution process to guarantee high availability and fast delivery of the updates. To incentivize AVs to distribute the updates, a reward system is developed to maintain a credit reputation for each distributor AV. A zero-knowledge proof protocol is used to enable AVs to exchange a firmware update in return for a proof of distribution that is used to update the AV reputation.

Then, we propose a decentralized privacy-preserving ride-sharing organization scheme using public blockchain. Since anonymous users may submit multiple ride requests or offers, while not committing to any of them, we develop a time-locked deposit protocol where drivers and riders lock a deposit to a smart contract. Later, a driver has to prove to the blockchain that he/she arrived the pick-up location on time to get the deposit, otherwise the rider obtains it. In addition, we introduce a reputation model to rate drivers based on their past behavior.

Then, we design a decentralized charging coordination mechanism for Energy storage Units (ESUs). The idea is that ESUs send anonymous charging requests to a smart contract. Then, the contract runs a charging coordination mechanism such that ESUs with the highest priority indices are charged in the present time slot while charging requests of lower-priority ESUs are deferred to future time slots.

Finally, we propose a blockchain-based privacy-preserving schemes for the energy trading of Electric Vehicles (EVs). Launching Sybil attacks, e.g., to submit a large number of messages and pretending that they are submitted from different EVs to launch DoS attacks, are thwarted by our schemes to ensure that the energy trading system is reliable and the service is available. To preserve the privacy of EV owners, an efficient anonymous payment system is developed to allow EVs to pay their charging fees with untraceable digital coins.