Optimizing Energy in Heterogeneous Perpetual IoT Platforms

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Introduction

Emerging IoT technologies hold significant promises to improve quality of life; however, several challenges and resource restrictions arise in operating IoT deployments in a scalable, and resilient manner over time.

Challenges include:

- Energy Constraints
- Failures
- Heterogeneity
- Variability
- Privacy
- Security

Objectives

- ✓ In our research, we aim to handle challenges caused by perpetual operations in different IoT platforms, such as mission-critical and assisted living deployments.
- ✓ Mission-critical systems are expected to operate 24/7 to monitor and detect critical events (health emergencies, gas leaks, fire etc.)
- ✓ Operational failures impact service availability and quality of service delivered by these solutions.

Progress to Date

Studied Problem:

- Energy efficiency for perpetual IoT platforms in an assisted living context.

Unique characteristics to leverage:

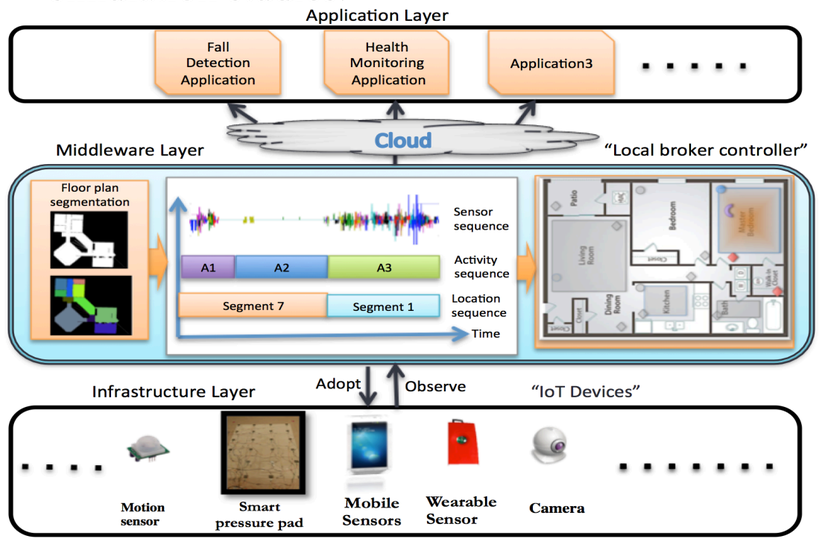
- IoT devices have heterogeneous power sources.
- IoT devices can be configured under multiple energy settings.
- Real time semantic knowledge of applications (Activities of daily living) can be derived.

→Aim: Create an energy-efficient perpetual IoT system without loss of service quality.

Nailah Alhassoun, Md Yusuf Sarwar Uddin, and Nalini Venkatasubramanian. "SAFER: An IoT-Based Perpetual Safe Community Awareness and Alerting Network," *in 8th International Green and Sustainable Computing Conference (IGSC)*, Orlando, 2017.

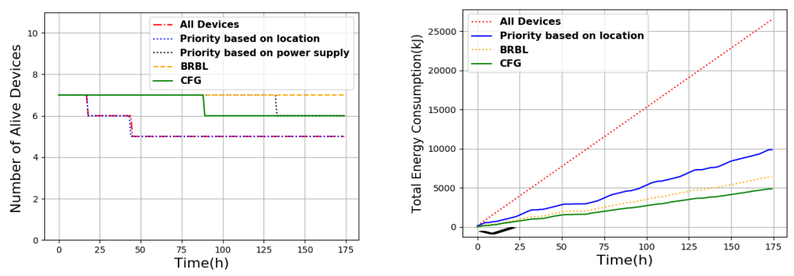
Methodology

- Develop systems and applications to instantiate real world use cases to conduct measurement studies and gain insight into application needs, and system limitations.
- Use measurements to drive larger scale simulation studies.



SAFER: an elderly multi-sensor fall detection system, which provides us with a real-world implementation of smart assisted living IoT systems for algorithm implementations, energy and accuracy measurements.

Experimental results



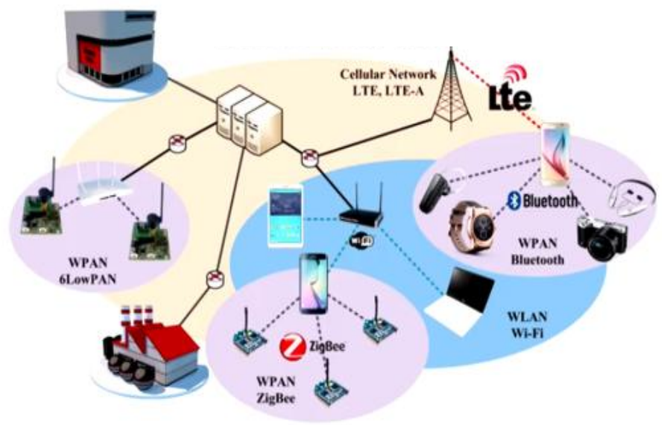
Experimental studies with real world trace datasets indicated that our proposed algorithms were able to achieve more than 80% reductions in energy consumption, doubling the system-lifetime.

Future Work

We plan to develop techniques to integrate multiple functional and non-functional needs to operate perpetual IoT – focusing on interoperability, reliability and energy efficiency. This will require an in-depth understanding of how these requirements interact; we will design an intelligent middleware layer for heterogeneous device resource management in IoT deployments.

Multinetworking and Perpetual IoT:

- Addressing IoT energy efficiency challenges by leveraging IoT multiple network technologies, such as WiFi, Bluetooth, ZigBee and 2G/3G/4G cellular, .. etc.
- Depending on the application factors, such as range, data requirements, security, power demands and battery life will dictate the choice of one or some form of technology combination.



Handling Failures in Perpetual IoT Deployments:

- Determining IoT failures and how can we predict failure in IoT deployments.
- Develop techniques to track and monitor devices remotely. Use IoT device logs with sensor inputs, devices response, and detailed status updates back to a centralized controller with a data repository for analysis.

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