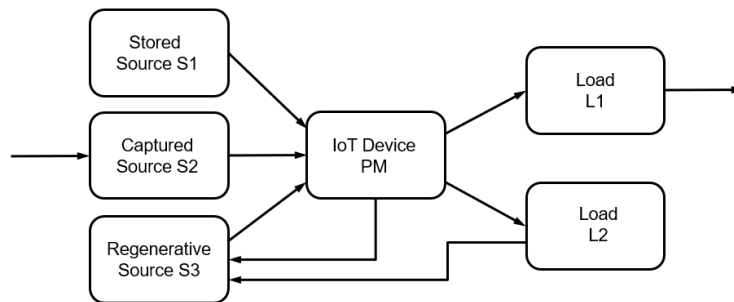


HIGHOMY - Power and Energy Management of IoT Devices for High Autonomy

This project addresses the theme of **ICT networks and distributed systems**. This project investigates **what** techniques need to be developed to maximise long-term power supply autonomy of an assortment of Internet of Things (IoT) devices. A framework is proposed for the analysis of energy flow within, and through, the IoT device. Energy to supply the IoT device is proposed to come from three types of sources: 1) stored or connected, 2) captured from the environment, and 3) reused from regenerative techniques from the activity of the device. The IoT device is also proposed to have two types of loads when functioning: 1) a load which is dissipative as it undergoes its function and the energy is lost and 2) a load which is regenerative which is able to capture some of the energy once the function is completed. This is illustrated in the figure “Block Diagram of Approach”.



Block Diagram of Approach

The smart toaster is an example of an IoT device which has a connected power supply and a dissipative load. All the energy used to toast bread is used and cannot be reclaimed. However, the heating element and geometry of the structures will permit some lost energy which could be captured for supplying its electronics. The remote vibration sensor is an example of an IoT device which uses regenerative techniques from the vibration action for supplying its electronics and communications. Here the function is to monitor/sensor the vibrational load.

Idea Aim: To develop a suite of techniques for Energy & Power Management to reclaim the maximum energy that is available to an IoT device for high autonomy

Why is this idea speculative and high-risk? Two of the key challenges faced by IoT devices is (1) energy efficiency and (2) security of distributed sensor networks (DSN). This project is speculative and high risk as it looks at making IoT devices robust against power supply failure and cyber-attack.

Potential Reward and why is this exciting?

This project is exciting as it not only addresses the key issues of energy management and reliability, but proposes solutions to maintaining integrity and reliability of DSN which has the great potential to be employed in various industries. In particular, development of a reliable communications infrastructure and transforming community health and care.

- Research Objective 1:** Ambitiously classifying and analysis of different types of IoT device to determine power/energy budget over time.
- Research Objective 2:** What is the theoretically available energy available for different type of regenerative energy capture techniques which can be deployed in IoT devices?
- Research Objective 3:** What is the minimum residual energy that can be captured?
- Research Objective 4:** Exploring solutions with high security and integrity of DSN.