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Intelligence Partitioning for IoT

Communication and Processing Inter-Effects for Smart Camera Implementation

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Abstract

The Internet of Things (IoT) is becoming a tangible reality, with a variety of sensors, devices and data centres interconnected to support scenarios such as Smart City with information about traffic, city administration, health-care services and entertainment. Decomposing these systems into smaller components, results in a variety of requirements for processing and communication resources for each subsystem. Wireless Vision Sensor Network (WVSN) is one of the subsystems, relying on visual sensors that produce several megabytes of data every second, unlike temperature or pressure sensors producing several bytes of data every hour. In addition, to facilitate the deployment of the nodes for different environments, we consider them as battery-operated devices. The high data rates from the imaging sensor have extensive computational and communication requirements, which in the meantime should meet the constraints regarding the energy efficiency of the device, to ensure a satisfactory battery lifetime.

In this thesis we analyse the energy efficiency of the smart camera, including the smart camera architecture, the distribution of the image processing tasks between several processing elements, and the inter-effects of processing and communication. Sensor selection and algorithmic implementation of the image processing tasks affects the processing energy consumption of the node, alongside to the hardware and software implementation of the tasks.

Furthermore, considerations of different intelligence partitioning configurations are included in the analysis of communication related elements, such as communication delays and channel utilisation. The inter-effects resulting from the variety of configurations in image processing allocation and communication technologies with different characteristics provide an insight into the overall variations of the smart camera node energy consumption. The aim of thesis is to facilitate the design of energy efficient smart cameras, while providing an understanding of energy consumption variations related to processing and communication configurations.

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