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A high performance, low power computational platform for complex sensing operations in smart cities

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Abstract

This paper presents a new wireless platform designed for an integrated traffic/flash flood monitoring system. The sensor platform is built around a 32-bit `ARM Cortex M4` microcontroller and a 2.4GHz 802.15.4 ISM compliant radio module. It can be interfaced with fixed traffic sensors, or receive data from vehicle transponders. This platform is specifically designed for solar-powered, low bandwidth, high computational performance wireless sensor network applications. A self-recovering unit is designed to increase reliability and allow periodic hard resets, an essential requirement for sensor networks. A radio monitoring circuitry is proposed to monitor incoming and outgoing transmissions, simplifying software debugging. We illustrate the performance of this wireless sensor platform on complex problems arising in smart cities, such as traffic flow monitoring, machine-learning-based flash flood monitoring or Kalman-filter based vehicle trajectory estimation. All design files have been uploaded and shared in an open science framework, and can be accessed from [1]. The hardware design is under CERN Open Hardware License v1.2.

Keywords: `Wireless sensor network, Embedded system, Artificial Neural Networks`

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