Poster: Exploring the Raspberry Pi for Data Summarization in Wireless Sensor Networks

Extended Abstract

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CCS CONCEPTS

• **Networks** → *Sensor networks*; • **Computer systems organization** → *Sensor networks*; • **Hardware** → *Wireless integrated network sensors*;

KEYWORDS

Raspberry Pi, Sensor Node, Data Summarization, Wireless Sensor Network

Single board computers (SBCs) are a class of devices where the entirety of the computer is printed on a single circuit board. The Raspberry Pi is perhaps the most popular SBC on the market today. The Raspberry Pi version 3 (1.2 Ghz A53 CPU, 2 GB of RAM), and the Raspberry Pi Zero W (1.0 Ghz ARM11 CPU, 512 MB RAM), cost $35.00 and $10.00 respectively, and both include integrated wireless and Bluetooth. Unlike microcontrollers, SBCs are fully functioning computers with more memory and processing power than the typical sensor. Their powerful System-on-a-Chip (SoC) processors make SBCs good candidates for at-node data summarization tasks in a wireless sensor network [1]. Reducing data transfer in a wireless sensor network is critical for energy efficiency and improved latency [2]. In this poster, we explore the viability of a wireless sensor network composed of Raspberry Pis for video and audio summarization tasks. Our contributions include a i.) novel sensor and gateway node design and ii.) a user interface implemented as an Android App.

Network Description: The network is comprised of a single central gateway node, and several sensor nodes that collect data. An overview of our sensor node design is given in Figure 1. Each sensor node consists of a Raspberry Pi Zero W, two lithium-ion 22, 000 mAh batteries, a GPIO-based real-time clock, a Raspberry Pi camera, and a compatible microphone. The batteries provide each node up to 10 days of continuous power. The real-time clock provides each node with a synchronized clock signal that allows WiFI communication utilizing WPA2 encryption. The camera and microphone connect to the Raspberry Pi's camera serial interface (CSI) port and microUSB port, respectively. Although a camera and microphone are used in Figure 1, virtually any sensor can replace the two pictured. Data is stored locally on a 64 GB microSD card.

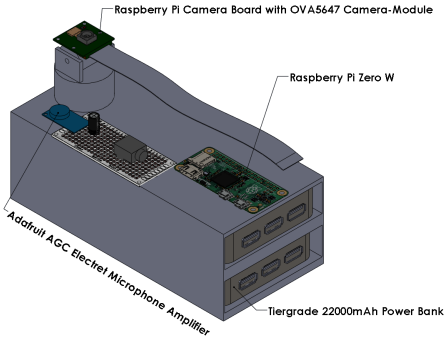

Figure 1: A concept rendering of a sensor node.

Each sensor node pre-processes data before sending it to the central or "gateway" node, which includes the more powerful Raspberry Pi 3. The gateway node communicates with both the sensor nodes and the Android user interface. The gateway node also acts as a DHCP server, distributing IP addresses to the sensor nodes. Preprocessed data collected from the sensor nodes undergoes a final summarization step at the gateway node before being transmitted to the user interface. The user interface enables the user to control which nodes are attached, what sensors are active among each node, what triggers are associated with each sensor (i.e. motion, light, sound, timer), view collected data, and monitor status of the nodes.

ACKNOWLEDGMENTS

Funding is provided by the U.S. Army Armament Research, Development and Engineering Center (ARDEC). The opinions in this work are solely of the authors and do not necessarily reflect those of the U.S. Military Academy, the U.S. Army, or the Department of Defense.

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HoTSoS '18, April 10–11, 2018, Raleigh, NC, USA
ACM ISBN 978-1-4503-6455-3/18/04.
https://doi.org/10.1145/3190619.3191679