

An Open-Source Power Monitoring Framework for Real-Time Energy-Aware GPU Scheduling Research

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Introduction

Power consumption of GPUs is concerning in real-time systems with stringent power constraints such as automobiles and battery-powered devices.

Analytical study of real-time systems with power consumption constraint on GPUs requires comprehensive knowledge about GPU architecture which are usually closed source in current COTS GPUs.

Although many of today's GPUs have onboard sensors to report their power consumption, they are usually slow and imprecise to be used for real-time GPU research, especially when observing the power consumption behavior of GPUs and developing scheduling techniques in dynamic workload scenarios.

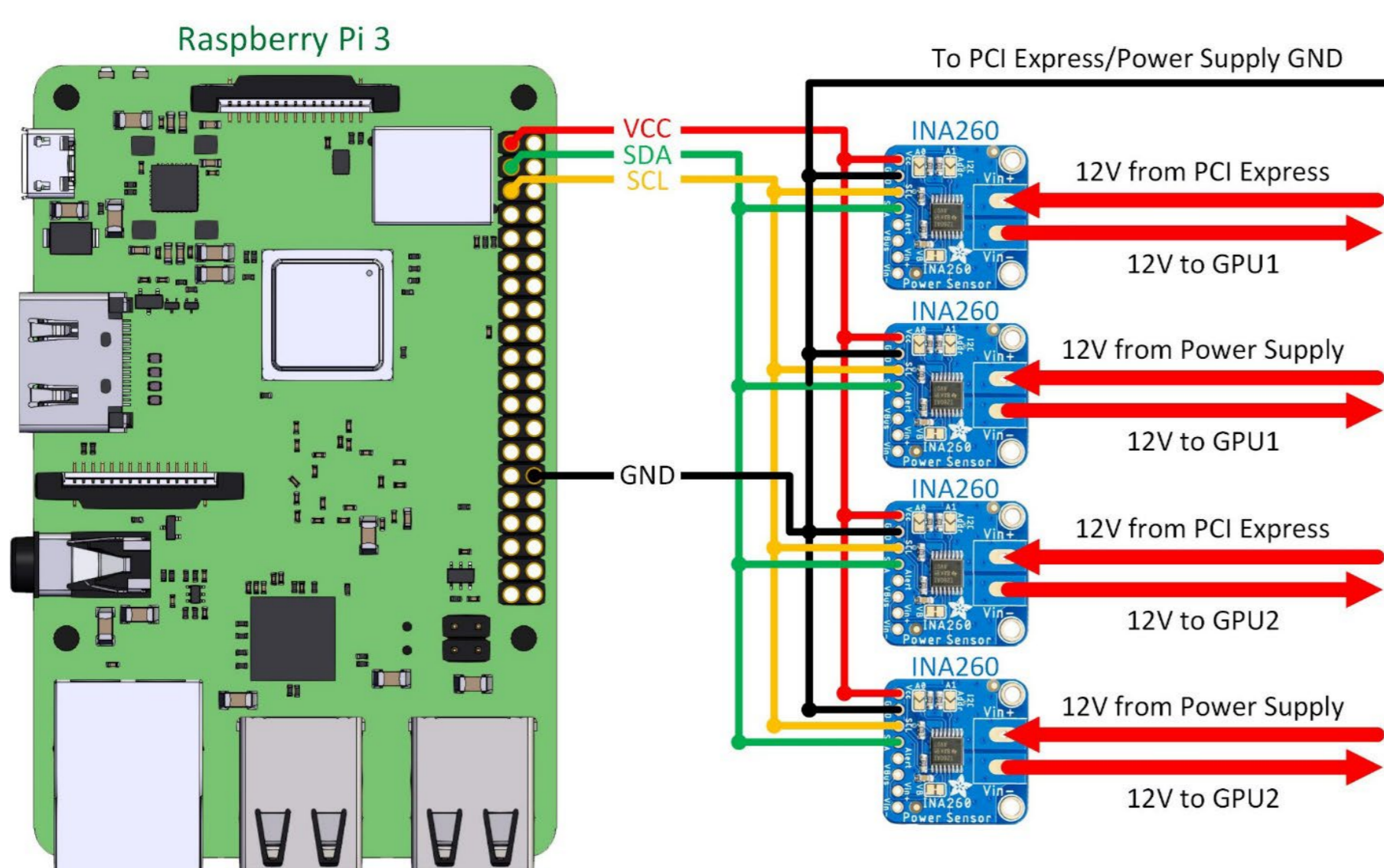
Various abnormal events can affect the stability and reachability of networks. In this work, our main focus is on indirect anomalies caused by worms in the network.

Proposed Method

High-end GPUs usually receive power from PCI Express (PCI-E) as well as directly from the power supply unit (PSU). To measure the entire power consumption of each GPU, both of these powers should be measured when the GPU is operating.

The proposed setup consists of:

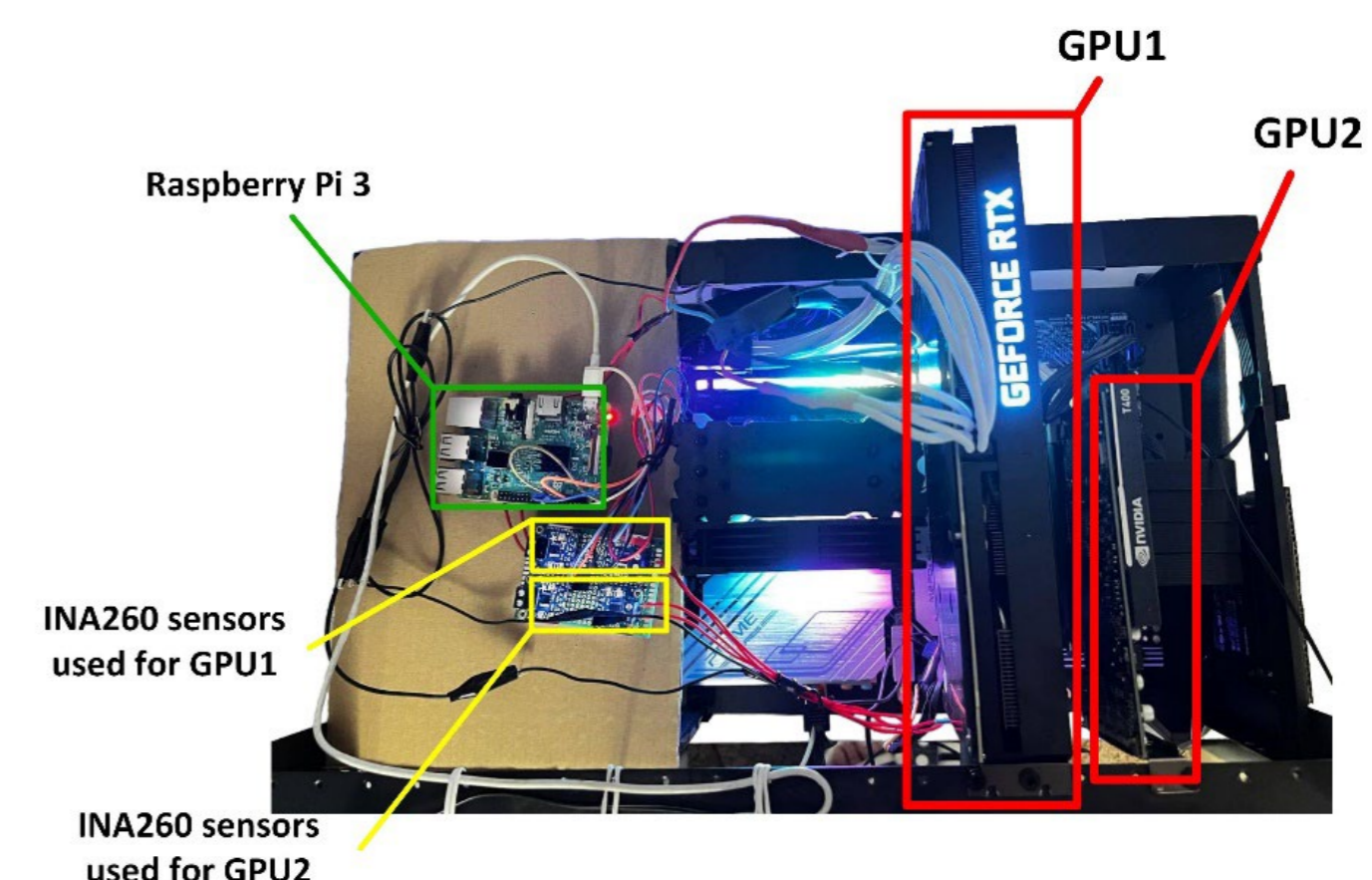
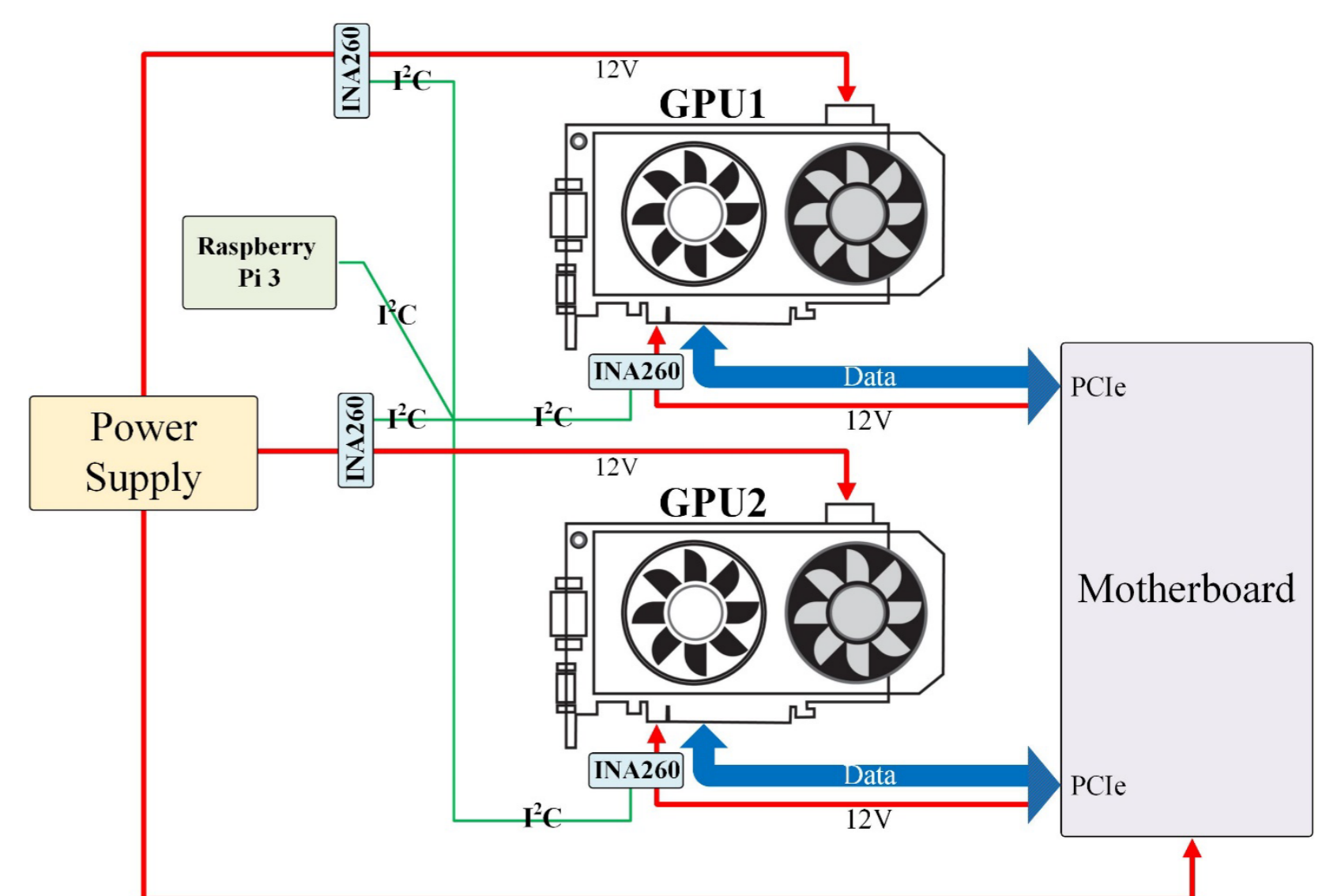
- INA260 sensors to measure voltage and current
 - 140us sampling rate
 - 1.5 mA resolution
- Raspberry Pi to collect and send data
 - Each voltage and current data is stored with time stamp (in microsecond resolution)
 - The data is sent over WiFi
- Developed open-source library for high-speed sensor data collection



https://github.com/rtenlab/gpu_power_monitoring

Implementation

- Two GPUs
 - NVIDIA RTX 3070
 - NVIDIA T400
- Linux OS
 - Real-time priority is given to the task to reduce the delay caused by other tasks running on OS
 - Unnecessary services such as GUI are disabled



Results

- 1 Million samples are collected
- More than 5KHz sampling rate
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 - Minimum measurement time: 168 μ s
 - Average measurement time: 177 μ s
 - Maximum measurement time: 224 μ s
 - 99th percentile: 181 μ s

