MAF UPS remote monitoring system

Poster Abstract

Mission Aviation Fellowship (MAF) is an organization that provides aviation and communication services to humanitarian agencies, as well as to missionaries and indigenous villagers in remote areas. Effectively coordinating the organization's various operations, though, require technological communication equipment and ground-control nodes throughout the areas they are servicing. Many of these locations, however, are within regions with less-than ideal power grids, specifically parts in Indonesia and Africa. MAF has rectified issues with these intermittent power grids by employing Uninterruptible Power Systems (UPS). The UPS devices themselves, however, require battery supplies; during a 'down' period, the battery powers the UPS and thus powers the device to which it is connected. MAF was thus looking to implement a system that could remotely monitor said battery supplies, such that they could anticipate a battery beginning to default. Without a remote monitoring system in place, MAF would observe functionality problems with a certain node's UPS battery supply, and then would take the necessary steps to fix / replace the battery. However, it would typically be a minimum of 3 days before the battery could be replaced. As such, anticipating a battery's failure before it fully defaults would allow MAF to significantly mitigate the time a UPS and, by proxy, the equipment the UPS supplied backup power to was not operating. Traditionally, IoT (Internet of Things) integrated power monitoring systems are implemented utilizing commercially available products. However, these systems are generally costly and therefore not conducive to non-profit organizations and their associated efforts. Accordingly, MAF reached to California Baptist University with a project they were looking to have developed, namely a low-cost remote battery monitoring solution. Three students from the university's senior electrical and computer engineering cohort thus took up the project, and after speaking with MAF personnel decided to develop the system using a Raspberry Pi, a Hall-effect current sensor, and an analog-to-digital converter. These devices would be used to gather data from the UPS' battery, and then send said data to the remote monitoring software Paessler Router Traffic Grapher (PRTG). The Raspberry Pi would continually (every sixty-seconds) execute a local Python script that created and uploaded JSON strings (data collected from the battery) to the PRTG server. From here, MAF personnel could remotely monitor the batteries by looking at different variables such as Time-to-Go, Current, Voltage, Power, and State-of-Charge. As such, the poster will demonstrate the feasibility and cost-effectiveness of a UPS remote monitoring system using an ACS712 current sensor, the ADS1115 analog-digital converter, a Raspberry Pi, and PRTG.

Author Names:

Timothy Gage

Electrical and Computer Engineering California Baptist University Riverside, CA, USA
TimothyDean.Gage@calbaptist.edu

Seth Truitt

Electrical and Computer Engineering California Baptist University Riverside, CA, USA
Seth.Truitt@calbaptist.edu

Benjamin Vincent

Electrical and Computer Engineering California Baptist University Riverside, CA, USA
BenjaminEric.Vincent@calbaptist.edu

Seunghyun Chun Ph.D

Electrical and Computer Engineering California Baptist University Riverside, CA, USA
schun@calbaptist.edu