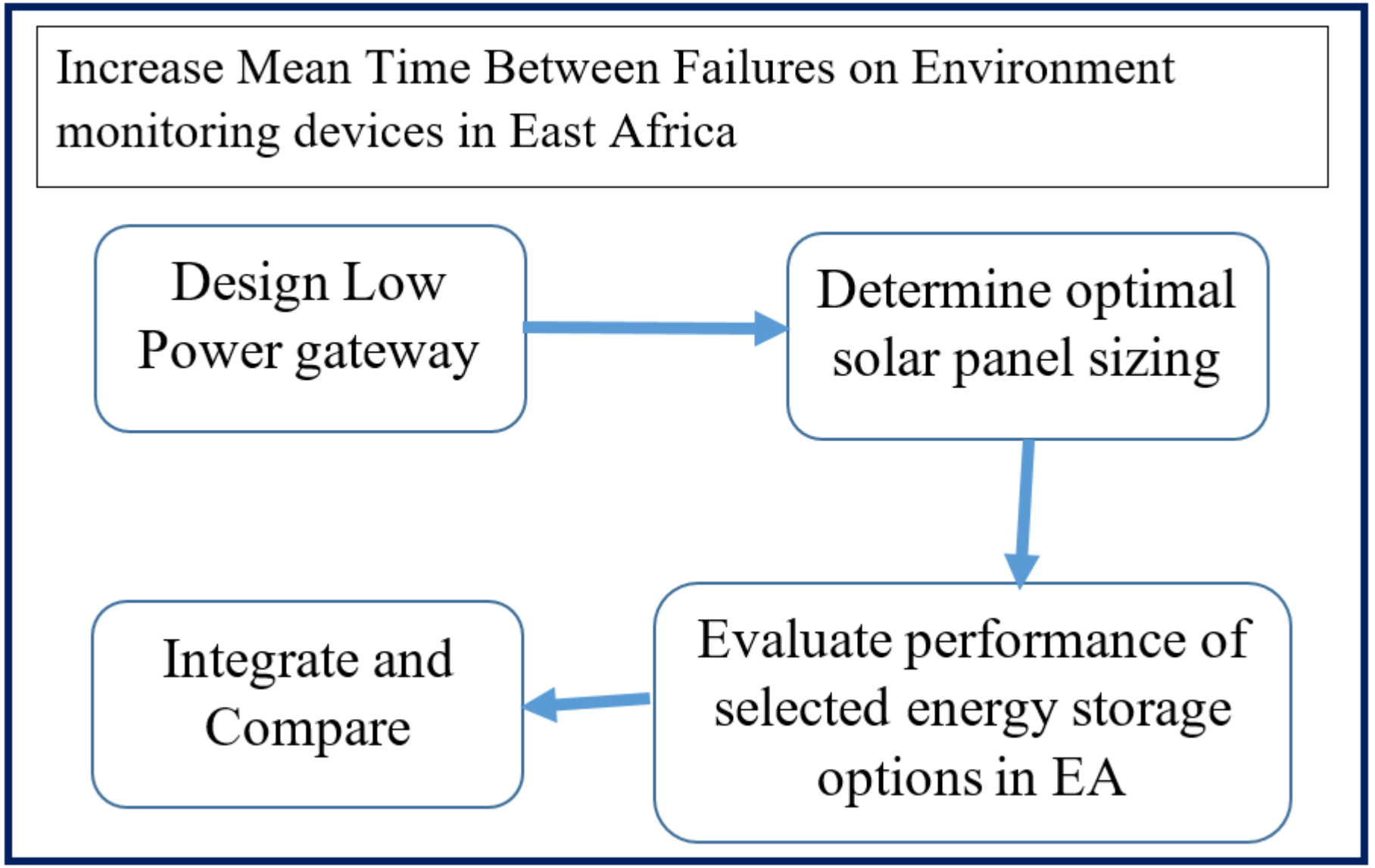
Energy Harvesting, Storage and Management for Automated Environment Monitoring in the East African Region

PROGRESS REPORT – APRIL

Maximus Byamukama

Illustration of Research



April Plans as per last presentation

❑Finish Paper - *Practical Design Guidelines for Ultra-low Power Gateways in Environment Monitoring Wireless Sensor Networks* **- Submitted to IEEE AFRICON 2017**	
Finish Contiki-based sink-node	
Finish proposal and present to HDRC	
Get the RC3 student matriculated into the project	
Test bed and start experiment for Objective 3	

Practical Design Guidelines for Ultra-low Power Gateways in Environment Monitoring Wireless Sensor Networks

Abstract—**We explore the techniques that can be used to reduce the power consumption of gateways considerably in wireless sensor networks deployed in environment monitoring applications, such as Automatic Weather Stations (AWS). The problem being addressed is that the deployment of these networks, especially in developing countries, is done in locations that are very far from the reach of a consistent power source, such as a national grid. As such, the stations must be battery-powered and power consumption must be minimized as much as possible.**

We present test scenarios for illustrating the impact of the suggested techniques. We explore hardware and software based methods of power reduction and assess the impact of each, and, if any, the constraints to be expected and how to overcome them.

We further provide a reference implementation of a gateway in which we integrate these techniques, and show that power consumption can be reduced by 55-85% when comparing best and worst case scenarios. The reference implementation we provide consumes about 30mW.

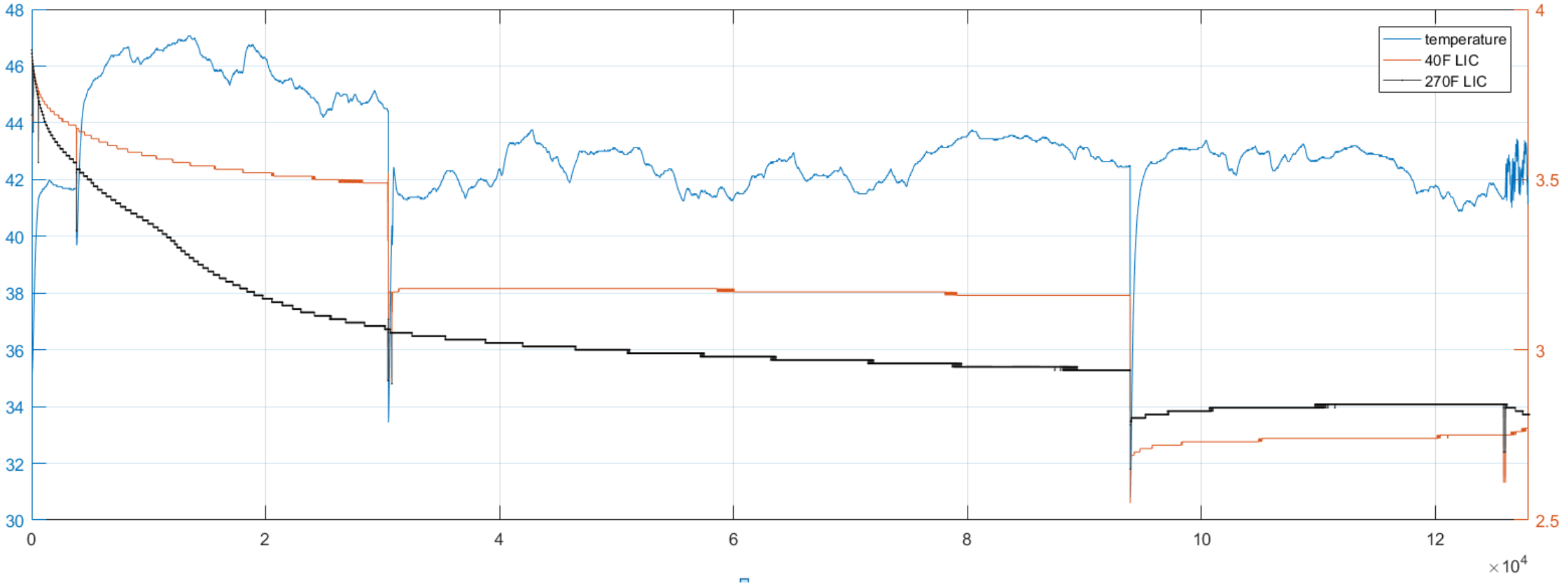
Keywords— Low Power; Wireless Sensor Networks; Gateway; Contiki; Automatic Weather Station; Environment Monitoring; Internet of Things

received by another node called the sink node. The sink node may be equipped with persistent storage, such as an SD card, or may buffer the received data in memory and at predefined intervals, transmit the data over a local network or the internet to a central repository. This transmission is made possible by an uplink device, which offers network connectivity such as a cellular modem or an Ethernet controller. The combined set-up of the sink node and uplink device is called the gateway.

For transmitter sensor nodes, low power design is easy to implement. It consists of an RF-enabled microprocessor that wakes up from sleep, takes a reading, sends out the data and resumes the sleep state. There has been a great deal of progress in sleep current reduction over the years by many manufactures, and some devices now consume as little as 0.2µA during this state. Because of this, and the fact that in environment monitoring applications the frequency of capturing weather data is often very low, ranging from once every 15 minutes for synoptic stations to once an hour for other stations, it is possible to design ultra-low power transmitter nodes that will last days, months or even years on a single battery.

The challenging design is that of the sink node and the uplink

First result set – objective 3



May Plans

- Finish editing proposal and submit for HDRC
- Design uplink and get data on server
- Repeat experiments for objective 3, including control experiment