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

PROGRESS REPORT – JULY
MAXIMUS BYAMUKUKAMA
June in brief

• Submitted LIC Self Discharge Paper to PLOS ONE – under review

• Prepared paper on “Powering Environment Monitoring WSNs: Lessons from Eastern Africa” for journal EAI Transactions on IoT in Developing countries – Accepted with minor comments. Published by EUDL.

• Completed testing of 2 new models on Solar panel sizing (Obj 3)


Transfer function estimation Model

\[ r = 0.934 \]

\[ \text{RMSE} = 1.695 \]
Discrete Calculus Model - Theory

\[ E_e = \eta E = P \Delta t + \Delta C \]
Discrete Calculus Model - results

The graph shows the imparted change in state of charge $\Delta C$ plotted against the accumulated energy from a PV panel ($\Delta t=15$ mins). The correlation coefficient $r$ is 0.605.
Discrete Calculus Model - results

- Actual
- Predicted
- Pred. opt

$r = 0.844 \quad \text{rmse} = 11.86$
$r_m = 0.844 \quad \text{rmse}_m = 9.20$
Sizing
August Plans

• Submit objective 3 paper to MDPI sensors
• Hand in Draft Thesis – ETA=August 7
• Submit Notice of Intention to Submit
• Put project work into 2\textsuperscript{nd} gear
• Minor change in objectives
Suggested objectives

1. to review the design and operational challenges of wireless sensor networks in the region
2. design a low-power gateway for environment monitoring WSNs
3. propose optimal electrochemical energy storage technologies for different deployment scenarios of WSNs
4. investigate alternative techniques of sizing solar energy harvesting units for WSNs
5. evaluate the cost effectiveness of using these approaches for subsequent adoption by local stakeholders