

MAKERERE



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NORHED

5th Jan 2026

The Coordinator,

NORHED II

Prof. Buyinza Mukadasi

Makerere University

Through:

The PI,

AdEMNEA Project

Dr. Mary Nsabagwa

Subject: Accountability for UGX 1,388,500 used for prototyping materials of AWS

I requested for One million three hundred eighty eight thousand and five hundred Uganda shillings (Ugx 1,388,500) for purchasing materials for prototyping of the Automatic Weather Station (AWS). The activity commenced on 7th December 2025 and was meant to guide the fine-tuning of the PCB boards that I have been designing for AdEMNEA Project.

This is therefore to account for the funds.

Attached;

- A. Summary of Expenditure
- B. Report For the prototyping process
- C. Receipts

I remain committed to ensuring the successful implementation of the project objectives under Task 2.4. This is to handle timely achievement of deliverable D2.4.1. Thank you for your kind consideration.

Sincerely,

Lt Tobias Newman Muhanguzi

MSc Student – Task 2.4, AdEMNEA Project

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A. Summary of Expenditure

GATE WAY BOARD					
Component name	Descripton	Quantity	Unit price (UGX)	Total price (UGX)	Country
ESP32 WROOM	micro controller	1	60,000	60,000	uganda
ESP32 DevKitC	ESP32 DevKitC WIFI+Bluetooth Development Board WROOM & WIFI Module with 2.4G Antenna Optional ESP32-WROOM-32U Development Board	2	120,000	240,000	uganda
SM7000E	GSM	1	195,000	195,000	uganda
Ai-Thinker RA-08H	LORA	1	40,000	40,000	uganda
MEM2067	Micro SD	1	10,000	10,000	uganda
MAX 485 MODULE	RS485	2	10,000	20,000	uganda
RESISTOR PACK	resistors	1	30,000	30,000	uganda
CAPACITOR PACK	capacitors	1	150,000	150,000	uganda
JST XH 2.54 4 Pin	4 pin connector	5	3,500	17,500	uganda
JST PH 2.54 2 Pin	2 pin connecctor	5	1,500	7,500	uganda
JST XH 2.54 3	3 pin connector	5	2,500	12,500	uganda
push buttons	push buttons	10	500	5,000	uganda
2N2222A –NPN	npn transistor	10	500	5,000	uganda
GL5506	ldr light sensor	5	1000	5,000	uganda
A3144	hall effect sensor	2	4,500	9,000	uganda
REED swtch	reed switch	1	6,000	6,000	uganda
LED PACK	LEDs	1	35,000	35,000	uganda
diodes	rectifier diodes	10	500	5,000	uganda
screw terminal		10	1,500	15,000	uganda
SUB-TOTAL				867,500	

POWER BOARD						
Component name	Descripton	Quantity	Unit price (UGX)	Total price (UGX)	Country	
BQ24650RVAR	solar mppt	2	59,000	118,000	uganda	
XL4015 5A	5a buck converter	2	20,000	40,000	uganda	
LM1117T	3.3V regulator 0.8A	4	4,000	16,000	uganda	
T73 JQC-3FF-S-Z	power mux relay	4	5,000	20,000	uganda	
3S 40A CMB	3S bms	1	40,000	40,000	uganda	
4S 40A 18650	4S BMS	1	40,000	40,000	uganda	
LM393	voltage comparator	5	1,500	7,500	uganda	
screw terminal		2	1,500	3,000	uganda	
3 Pin ON/OFF Slide	slide switch	5	2,000	10,000	uganda	
LIR2032 Rechargeable Button Battery 3.6V	coin cell	2	5,000	10,000	uganda	
18650 Rechargeable Lithium Ion Battery		10	5,000	50,000	uganda	
jumper wires		3	10,000	30,000	uganda	
bread board		2	10,000	20,000	uganda	
perf board	solder board	4	6,000	24,000	uganda	
Single Core Tinned Copper Wrap Wire 30 AWG 8	wire	1	27,000	27,000	uganda	
solder cleaner		1	20,000	20,000	uganda	
lithium battery holder	3s holder	3	6,000	18,000	uganda	
pc817c	optocoupler	5	1,000	5,000	uganda	
solder wick		1	10,000	10,000	uganda	
power switch	switch	5	2,500	12,500	uganda	
SUB-TOTAL				521,000		

GRAND TOTAL

1,388,500

B. Progress Report

Project Name: AWS PROJECT

Prepared By: TOBIAS NEWMAN MUHANGUZI

Date: January 05th, 2026

1. Executive Summary This report is about power system prototyping and gateway system design of the prototype, firmware development, and full system integration testing. Major efforts were directed towards designing and validating the Power Board, implementing power monitoring firmware on the STM32F401, and resolving communication as well as boot-related challenges on the ESP32 Gateway Board. Additionally, version control practices were established through a shared GitHub repository, and PCB designs were revisited to reflect all validated prototype changes. Overall, the month marked a transition from isolated prototyping to a more cohesive and integrated system design to improve the PCBs.

2. Key Accomplishments

● Power Board Prototyping & Testing:

Designed and prototyped the Power Board on a perforated board. A buck converter was used in place of an MPPT controller to function as a solar charger for the battery cells. The converter was configured at a higher output voltage to ensure effective charging, and the setup was successfully tested using a solar panel.

● Design Validation & PCB Creation:

Validated the Power Board design through testing and proceeded to create the corresponding PCB layout based on the confirmed prototype behavior.

● Firmware Development (STM32F401):

Wrote firmware for the STM32F401 microcontroller to perform power monitoring. The firmware enables voltage level sensing and transmits the measured data to the ESP32 via I²C communication.

● System Integration Testing:

Tested the complete system with the Power Board supplying power to the Gateway Board, validating stable operation across both boards under real conditions.

● ESP32 UART Configuration:

Implemented a custom UART configuration for the LoRa module on the ESP32. This was done to address challenges encountered while multiplexing LoRa and GSM modules, both of which have long setup and initialization times.

● ESP32 Boot Issue Resolution:

Identified boot failures caused by the use of strapping pins for peripheral connections. This issue was resolved by selecting logic-high strapping pins to avoid logic-level conflicts during ESP32 boot and reset cycles.

- **Version Control Setup:**

Created a GitHub repository for the project and added all relevant personnel. This significantly improved version control, collaboration, and traceability of firmware and hardware design changes.

- **PCB Design Review:**

Revisited all PCB designs to ensure they accurately reflected the modifications and improvements identified during the prototyping and testing phase.

3. Challenges & Technical Constraints

- **Unvalidated Sensors:**

Some required sensors have not yet been tested. As a result, the current design cannot be fully verified for compatibility with these components until physical testing is completed. This introduces a risk that minor design changes may still be required before final PCB printing.

- **Limited ESP32 Pin Availability:**

The use of remaining strapping pins introduced boot instability, which required careful pin selection and logic-level considerations to resolve

4. Plan for the Upcoming Month (This January)

- **Sensor Testing:**

Test and validate the remaining sensors to confirm compatibility with the current hardware design.

- **Enclosure Design:**

Begin designing the mechanical casing for both the Power Board and the Gateway Board to support deployment and protection of the system

All project progress and reviews are available at (<https://github.com/marydovika/AWSProject>)