FIG WORKING WEEK 2023
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Protecting Our World, Conquering New Frontiers

Adoption of Low-Cost GNSS Unit and Raspberry Pi 4 for CORS Network in Africa: Alternative Solution for Reliable and Accurate Positioning

Presented by:
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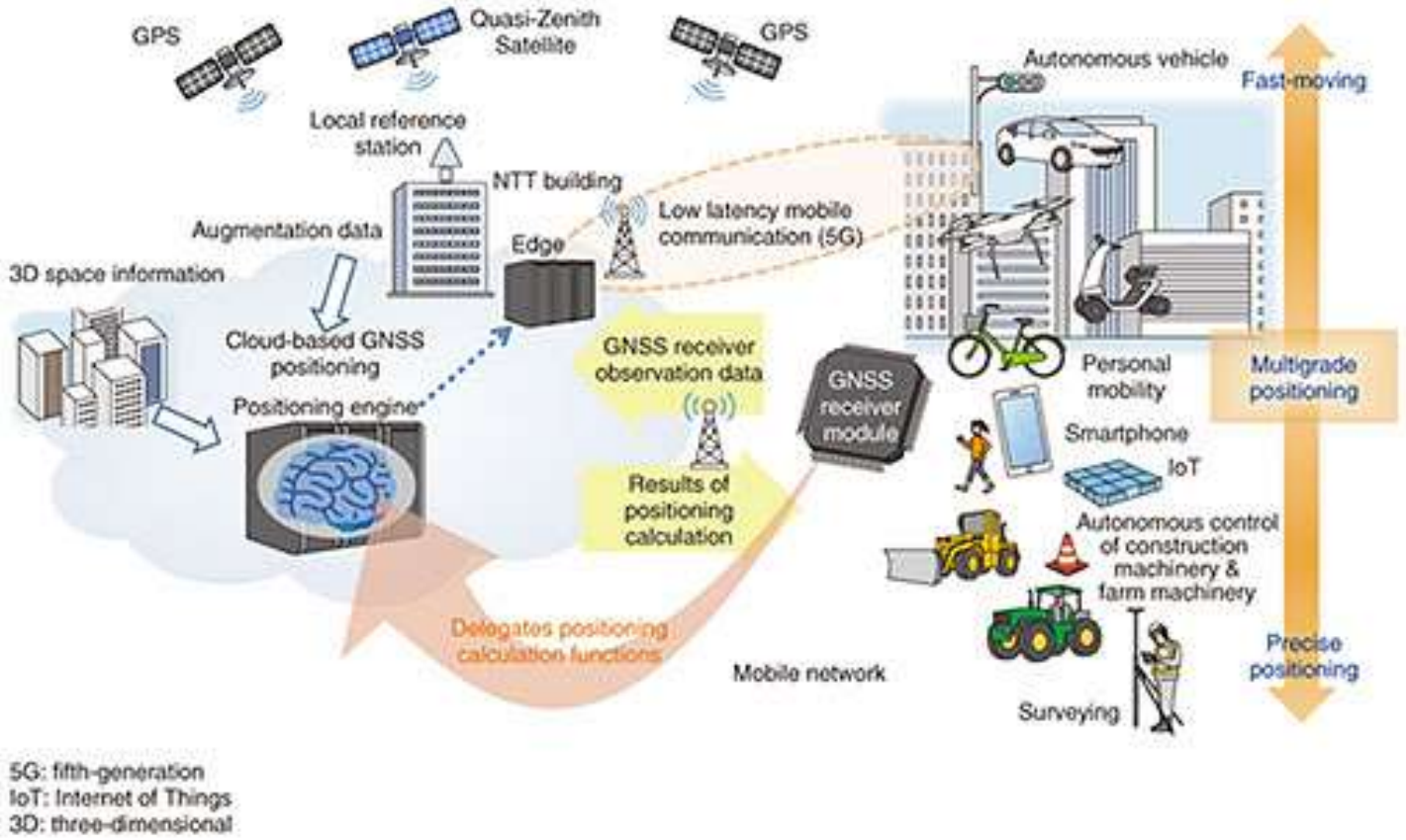
Introduction

- Importance of Global Navigation Satellite System (GNSS) in precise positioning for surveying, mapping, and transportation application.

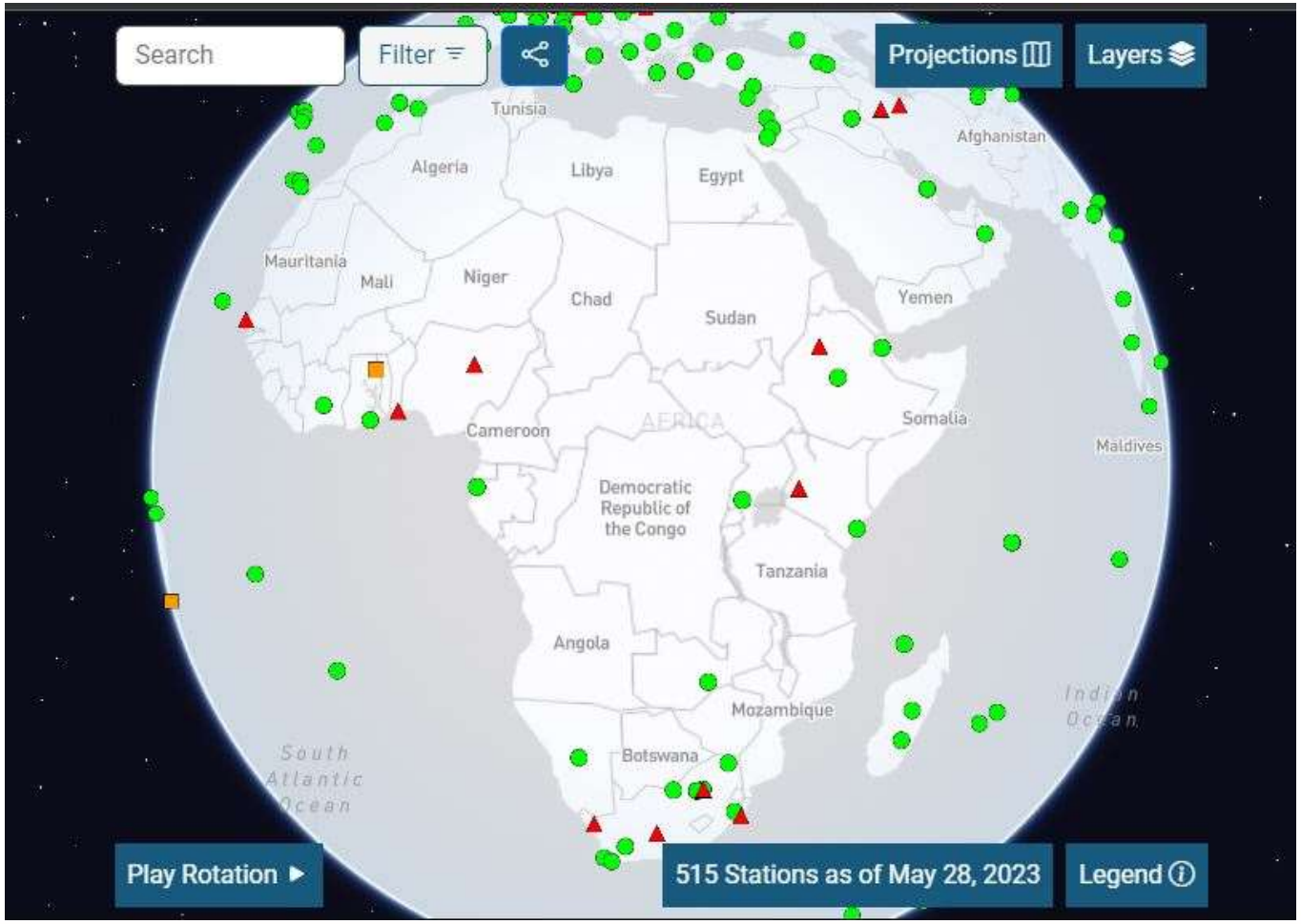


5G: fifth-generation
IoT: Internet of Things
3D: three-dimensional

Challenges faced in Africa

1.Limited Infrastructure
2.GNSS Receiver Availability and Cost
3.Data Accessibility
4.Maintenance and Calibration
5.Power Supply and Connectivity
6.Lack of Local Expertise
7.Policy and Regulatory Framework:

Limited Infrastructure



GNSS Receiver Availability and Cost

Low cost GNSSS

<$400
Low Power consumption
Cheap additional components
Low security risk
Skeleton setup with SBCs(Raspberry Pi or Banana)

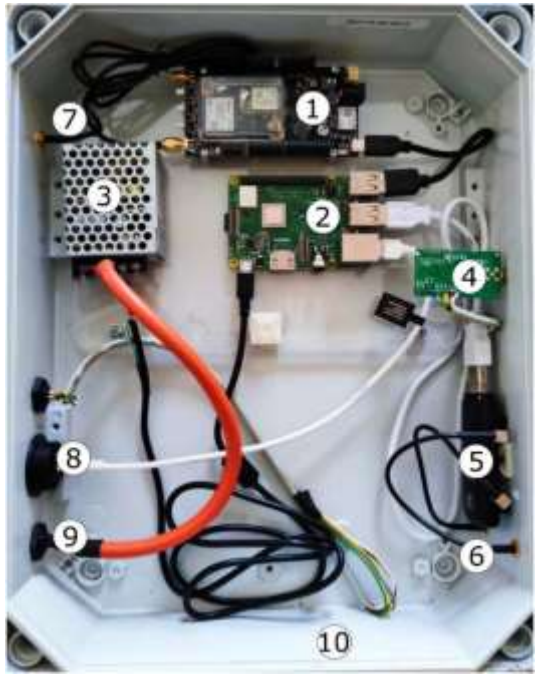
High Cost GNSS

$2,000- $30,000
High-security risk
Advanced configuration and integration.
Multi-peripherals
Front end- and back end Interfaces

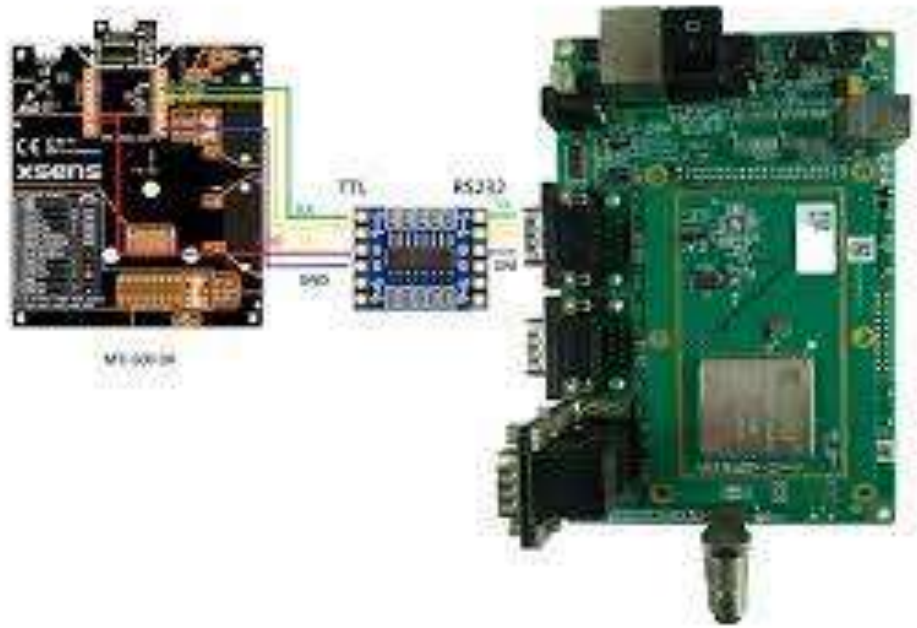
Study's approach and components used:

1. Raspberry Pi 4: powerful single-board computer for additional computing capabilities
2. ComNav technology K803 GNSS unit: low-cost multi-frequency unit for CORS setup.
3. Optimized version of RTKLIB from ALA-Engineering on GitHub(
4. Utilization of a local internet router for internet connectivity to the CORS station.

Low Cost GNSS Receiver and SBC

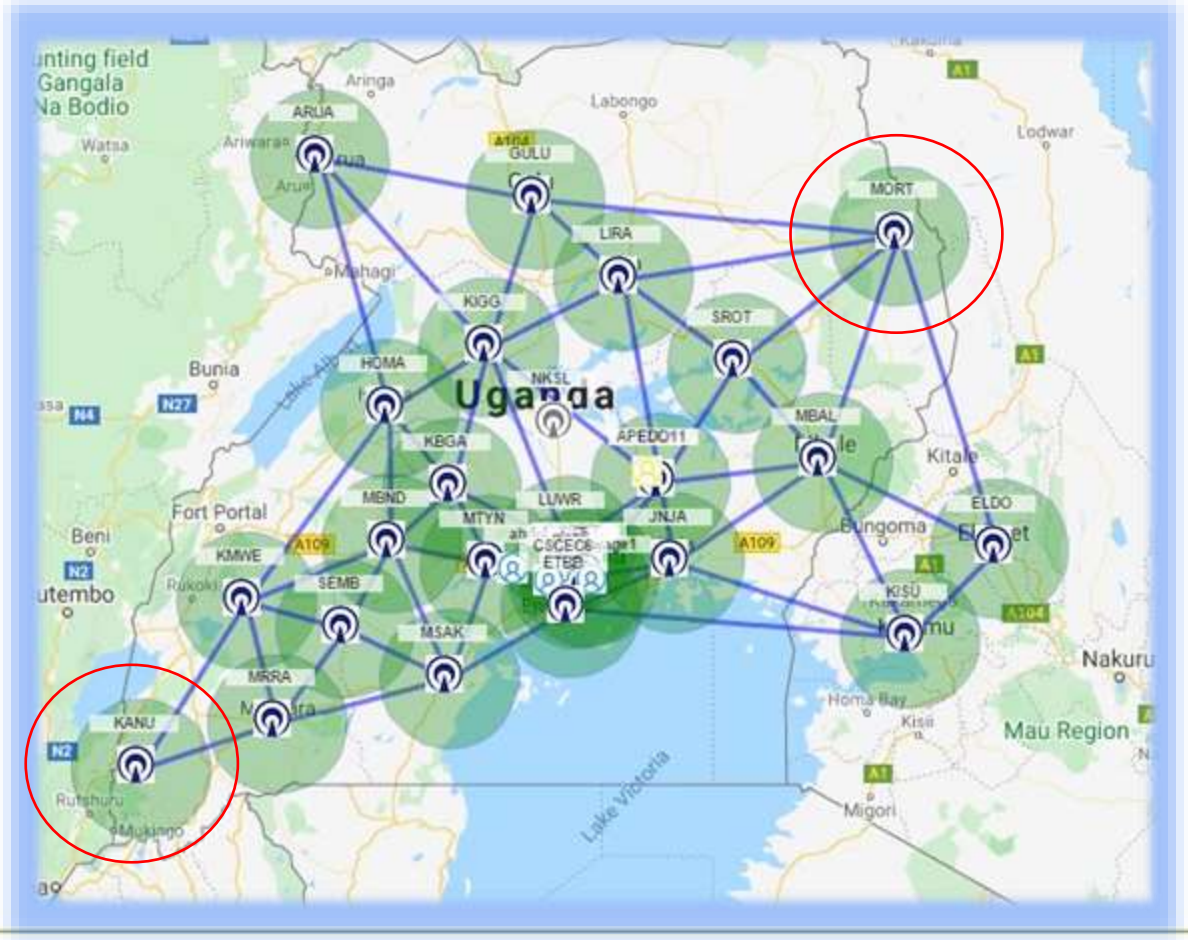


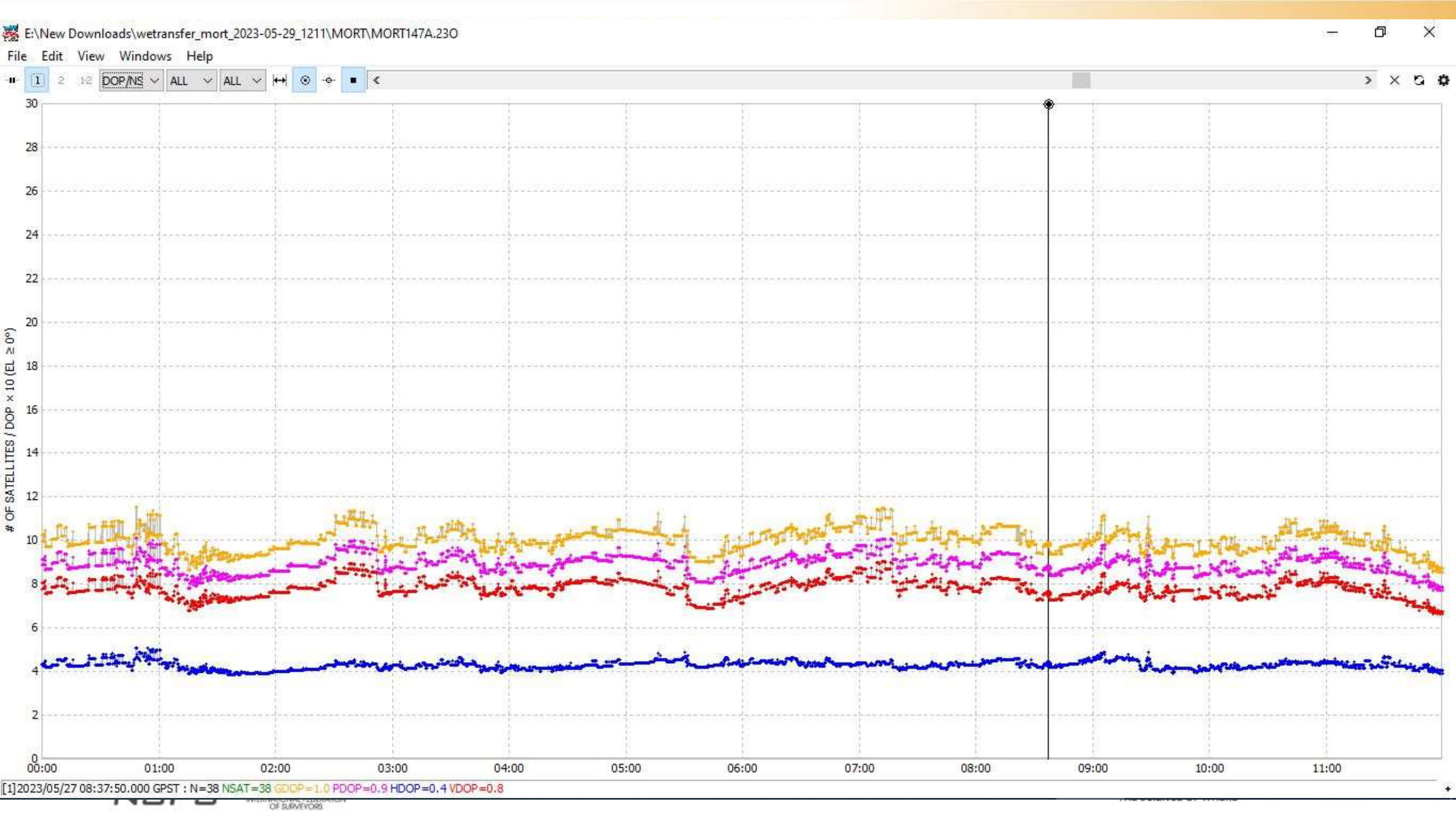
Continuation- K803 Board



-Raspberry Pi ported with Ubuntu desktop version
-Run the headless option of Pi3
- Configuration to build and stream data to Ntrip caster(not simple)

Tests and deployment

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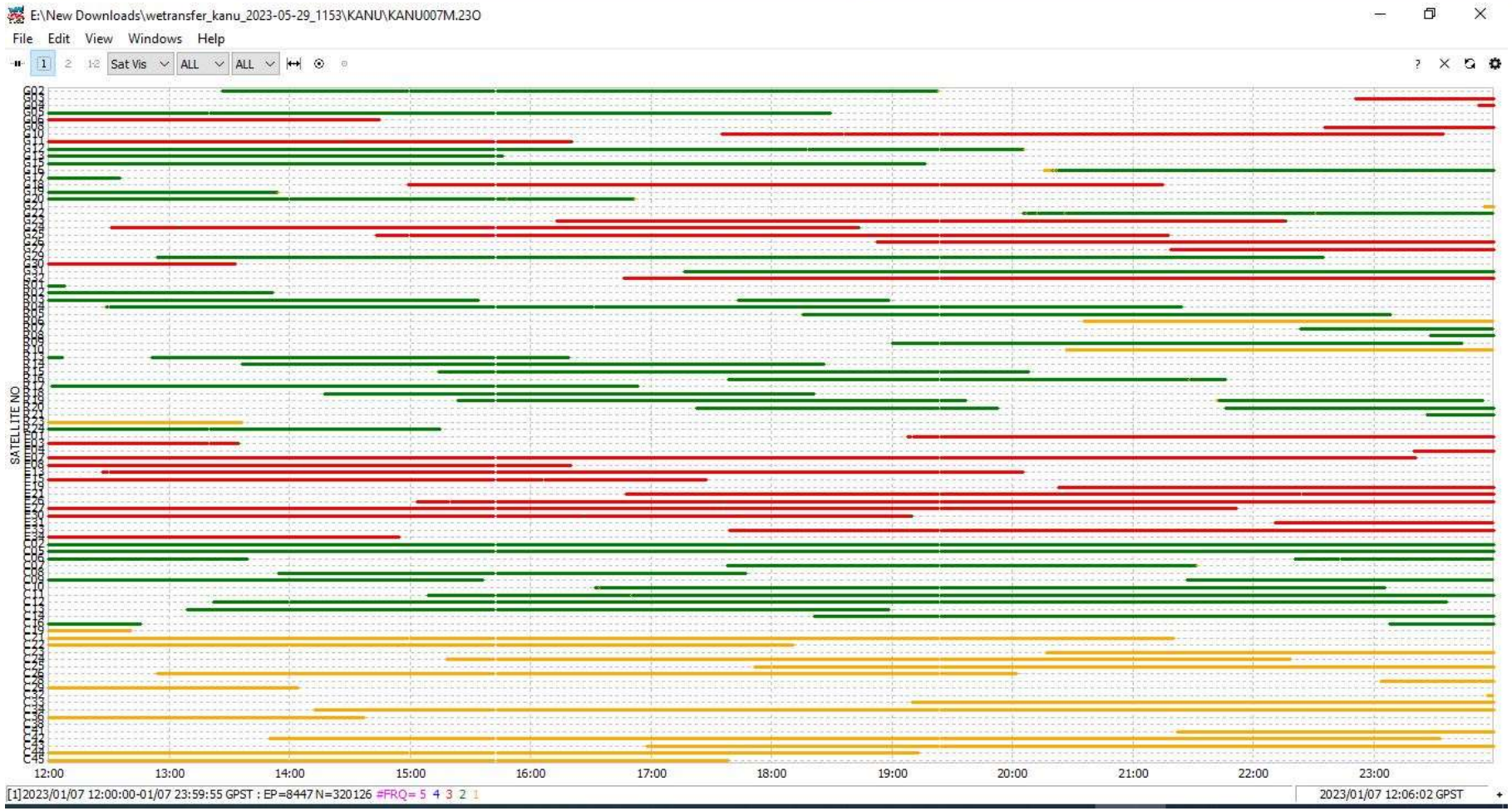
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Results and Discussion

- Performance Evaluation of the Low-Cost GNSS Unit and Raspberry Pi 4
- Reliability and Accuracy of Positioning Data
- Comparison with Traditional High-Cost GNSS Equipment
- Feasibility of the Low-Cost Solution for CORS Networks in Africa

- The study results demonstrated that the low-cost GNSS unit, the ComNav K803 OEM board, and Raspberry Pi 4 combination provided reliable and accurate positioning data, with an accuracy of up to 2.5 cm.
- The collected data was compared with data collected using a high-end M300pro GNSS receiver, and the results showed that the data collected using the low-cost solution was comparable in accuracy and reliability to the data collected using the high-end GNSS receiver.
- This comparison demonstrated the effectiveness of the low-cost solution in providing precise positioning data for CORS applications in Uganda.

Results

Parameter	ComNav K803 OEM Board	M300pro GNSS Receiver
Horizontal Accuracy (cm)	2.3	2.1
Vertical Accuracy (cm)	2.5	2.4
Time to First Fix (seconds)	35	30
Power Consumption (W)	1.0	1.5

- This study has shown that the combination of the ComNav 803 OEM board, a low-cost GNSS unit, and Raspberry Pi 4, a powerful single-board computer(SBC), offers a practical and effective solution for CORS applications in Africa.
- The results demonstrate that this low-cost solution can provide reliable and accurate positioning data, with an accuracy of up to 2.5 cm, making it a viable option for applications such as surveying, mapping, and transportation.

Implications and Applications

- Enhancing Accessibility to Precise Positioning Services in Africa
- Supporting Surveying and Mapping Applications
- Facilitating Transportation Systems
- Potential Economic and Social Impacts

- ComNav 803 OEM board and Raspberry Pi 4 combination offer an efficient and low-power consumption solution, with the added benefit of low risk in terms of security, and flexible adaptability in configuration by local operators or surveyors.
- These benefits make this low-cost solution an attractive option for organizations and individuals who cannot afford expensive GNSS equipment and require precise positioning services in remote areas with limited infrastructure.

- The adoption of this low-cost solution has the potential to expand access to precise positioning services in Africa, promoting economic development and enhancing the quality of life for the region's inhabitants.
- This low-cost solution can be deployed on a larger scale, making it possible to establish CORS networks in areas where traditional GNSS equipment is not feasible.

Future is in Cost effective solutions

Resources

1.-https://learn.sparkfun.com/tutorials/how-to-build-a-diy-gnss-reference-station/all
2.-https://github.com/ALA-Engineering/RTKLIB
3.-https://learn.sparkfun.com/tutorials/how-to-build-a-diy-gnss-reference-station/all#esp32-setup-option-2
4.-https://rtklibexplorer.wordpress.com/2020/02/05/rtklib-tips-for-using-a-cors-station-as-base/

Thank you

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