

AFRETEC NETWORK IDT RESEARCH FUNDING PERIODIC NARRATIVE REPORT

Report Submitted By

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INSTRUCTIONS

Partner: Please refer to the original Inclusive Digital Transformation Africa Research Proposal when answering these questions, as relevant. Upon completion, please email this report to CMU-Africa at afretec@andrew.cmu.edu.

GENERAL INFORMATION

Organization Name:

Reporting Period: 2026

☒ January- June

☐ July- December

1. REPORTING PERIOD SUMMARY

1.1 Activity Achievements

Outline your key achievements that occurred during this reporting period. What factors do you think contributed to these achievements? Please consider and include achievements that touch on inclusion.

Achievements:

Continual maintenance of the project website www.cssr4africa.org and [wiki](#), including periodically updated [News](#), [Deliverables](#), and [Publications](#) pages.

Continual update of a comprehensive 96-page [work plan](#) (see the document history at the end of the report to view the updates in version 3.7 made in the current reporting period).

Completion, revision, and curation of [deliverables](#) in this reporting period

Revision of main CSSR4Africa deliverables

- D3.1 [System Architecture, version 1](#) (v2.7)
- D3.5 [System Integration and Quality Assurance](#) (v1.4)
- D4.3.2 [Speech Event](#) (v1.4)
- D5.4.1 [Cultural Knowledge Ontology & Culture Knowledge Base](#) (v2.2)
- D5.4.2 [Robot Mission Language](#) (v1.8)
- D5.4.3 [Robot Mission Interpreter](#) (v1.9)
- D5.5.1.1 [Gesture Execution](#) (v1.3)
- D5.5.2.4 [Integrated Text to Speech Conversion](#) (v1.3)
- D6.1 [Use Case Implementation](#) (V1.3)
- D6.2 [Use Case Evaluation](#) (v1.3)

Additional work is being done as a spin-off project that forked to implement in ROS2 to give tours of the Digital Experience Center of the [Upanzi Network](#) at CMU-Africa. The work plan was continually maintained (in this reporting period, versions 1.2–1.6). The [overview](#) shows the motivation for this spin-off project.

Completion of Pepper4DEC deliverables

- D1.0 [DEC Tour Guide Initial ROS1 Prototype](#) (v1.0)
- D2.2 [Robot Behaviour Specification](#) (v1.0)
- D2.3 [Visitor Behaviour Specification](#) (v1.0)
- D3.1 [System Architecture, version 2.0](#) (v2.0)
- D3.2 [Software Engineering Standards Manual, ROS2 version](#) (v1.3)
- D4.1 [Robot Sensing Migration](#) (v1.4)
- D4.3 [Conversation Manager](#) (v1.2)
- D5.1 [Robot Actuator Migration](#) (v1.6)

Publications

The following paper was published by A. Akinade, D. Barros, E. Birhan, M. Danso, Y. Haile, I. Jimoh et al., “Culturally Sensitive Social Robotics for Africa”, Cultural Robotics: Diversified Sustainable Practices, accepted for publication, April 05, 2026; available [here](#).

Birhanu Shimelis Girma, Ibrahim Jimoh, Yohannes Haile, Assane Gueye, Moise Busogi, and David Vernon, “CSSR-Nav: Culturally Sensitive Social Robot Navigation Using Open-Source Vision-Language Model and Empirical Cultural Knowledge”, International Conference of Social Robotics, 2026, [here](#).

The full list of publications related to this project can be found in the publication section on the website [here](#).

Factors of Success:

- Preparation and continual update of a detailed [work plan](#) with which all members of the team are thoroughly familiar.
- Having complete, detailed, up-to-date [system architecture](#) with which all members of the team are thoroughly familiar.
- The involvement of full-time research associates at CMU-Africa: Birhanu Shimelis Girma, Mohammed Danso, Richard Muhirwa, Clifford Osano, Tsegazeab Taye Tefferi and Yohannes Haile, all of whom received intensive training.
- Hands-on project management, with adjustment of the work plan, when appropriate.
- Weekly project [team meetings and meeting notes](#).
- Weekly task progress reports.
- Embracing the complexity of systems engineering and focusing on periodic demonstrations.

1.2 Activity Learnings

What key lessons did you learn during this reporting period (e.g., through the process of design and implementation of Activities)? Include learnings that touch on inclusion. Outline 3 key lessons that emerged during this reporting period. *Add rows as needed.*

Lesson 1: A detailed, comprehensive, up-to-date work plan is essential.

Lesson 2: An agile approach is critical for success so that changes in circumstances can be quickly accommodated (e.g., the need for CMU-Africa to step in and work on Task 5.4.1 Cultural Knowledge Ontology & Culture Knowledge Base, Task 5.4.2 Robot Mission Language, Task 5.4.3 Robot Mission Interpreter, Task 5.5.2.1 English Text to Speech Conversion, Task 5.5.4.2 Integrated Text to Speech Conversion, Task 6.1 Use Case Implementation, and Task 6.2 Use Case Evaluation in lieu of Wits).

Lesson 3: Weekly project group meetings are essential, with a prepared agenda circulated in advance of the meetings, and formal minutes circulated after the meeting. The minutes must include a list of action items assigned to members of the team. Progress on these action items is reviewed at the next meeting.

Lesson 4: To help Pepper work well in the larger space of the Upanzi Digital Experience Center, we've purchased a Unitree L2 LiDAR sensor. This device helps the robot 'see' and understand its surroundings, allowing it to move around and operate accurately within the bigger area.

Lesson 5: Hands-on project management, with the team members taking on the responsibility of project manager for periods of two months at a time.

Lesson 6: Sharing weekly task progress updates within the team at the end of each working week on Fridays, keeping overall system progress transparent across the whole team.

Lesson 7: Having formal software engineering standards, an associated quality assurance process, and a dedicated RA to check compliance with the standards is invaluable.

1.3 Progress & Impact

Use the tables below to report numerical targets, results, and relevant explanations or comments. If any internal or external factors may influence progress, please explain. All quantitative indicators should be disaggregated by gender, and where possible and relevant, by age groups, disability status, rural/urban, degree program, etc.

1.3.1: Progress Reporting (Outputs): Progress reporting shows the outputs of the Activity. In the table below, please provide updates on your progress on funded Activities. Examples of progress indicators include the gender representation of students/learners/faculty receiving support, the number of Afretec and non-network universities partnered with, or the share of participants who completed training or education relative to the total target. *Add rows as needed.*

Progress Reporting	Indicators (quantitative or qualitative)	Target	Results to date (include gender & other disaggregation as relevant)	Comments on progress (any insights, opportunities to adapt, etc.)
Software	Submission to project GitHub repository	12 ROS Nodes 1 Pepper Interfaces Test ROS node 1 cultural knowledge dashboard. ROS2 migrated nodes under pepper4dec.	12 ROS nodes 1 Pepper interface tests ROS node 1 cultural knowledge dashboard	All software that was part of the CSSR4Africa and Pepper4Dec work plan has been submitted and integrated into the official CSSR4Africa GitHub repository. The conversational system software has been demonstrated and shown to functionally work; It is now incorporated as part of the spin-off project Pepper4Dec. The deliverable for this work can be found here . Additional hardware such as L2 LiDAR was purchased to improve the performance of the Pepper Robot. A full interactive demonstration, together with the conversational system, has been achieved.
Deliverables	Submission to the website	33 deliverables (Main CSSR4Africa Deliverables) Additional 8 Deliverables Delivered under Pepper4Dec.	42 delivered	All deliverable reports are currently maintained, and the eight additional deliverables submitted under Pepper4DEC meet the software compliance requirements of the CSSR4Africa Software Engineering Standards. These have been accepted and included in the CSSR4Africa software repository on GitHub. Note that to achieve this, CMU-Africa needed to take responsibility for seven tasks originally assigned to Wits due to unforeseen circumstances:



				Task 5.4.1 Cultural Knowledge Ontology & Culture Knowledge Base, Task 5.4.2 Robot Mission Language, Task 5.4.3 Robot Mission Interpreter, Task 5.5.2.1 English Text to Speech Conversion, Task 5.5.4.2 Integrated Text-to-Speech Conversion, Task 6.1 Use Case Implementation, and Task 6.2 Use Case Evaluation
Diversity	Balance of female/male research assistants	Equal balance	Three female RA/Interns were involved during the duration of the Project.	Female research associates at CMU-Africa have successfully transitioned from the project, with many continuing to PhD programs or securing positions in the workforce.
Collaboration	Meetings	Weekly	Approx. 70% of weekly meetings are held	The Co-PI from Wits represented the project at the Principal Investigator Meeting in Kigali in June.
Leadership	Ability to coordinate multiple tasks and manage projects	Rotational project manager role	5 Research Associates have served as project managers	The project manager position is rotated among the RAs after a period of two months to ensure that every RA acquires tangible leadership skills.

Please describe any of the above-mentioned qualitative indicators that show progress. Examples of qualitative progress indicators are the development of a training curriculum, the signing of an agreement, etc.

1.3.2: Impact Reporting (Outcomes): Impact monitoring shows the changes or outcomes that occur partly or fully due to the Afretec collaboration and program investment. In the table below, please provide updates on outcomes and/or emerging outcomes. Examples of outcomes include the level of student preparedness for and interest in pursuing graduate education in ICT, assessment of faculty engagement in professional development that enhances their teaching, or evidence of increased collaboration with universities or industry locally and regionally. *Add rows as needed.*

Outcomes should relate specifically to the Afretec Network Principles [**Network-Based, Leveraged, Collaborative, Diverse & Inclusive, Transformative and Evidence-Based**] (see the principles section of the Afretec Action Plan). Include in Comments to which Principle the outcome is related.

Main changes or outcomes (indicate the level the activity is focusing on– learner, student, faculty, institution, industry, country or region)	Indicators (quantitative or qualitative)	Target	Results to date/contribution to impact (include gender & other disaggregation as relevant)	Comments on impact (any insights, opportunities to transform)
Professionalism	Research assistant productivity	5 RAs/Interns trained	To date, a cumulative total of 16 RAs/Interns have been trained across all reporting periods.	Comprehensive training material and a period of induction are essential. This material has been made available to other groups and research projects.
Technical knowledge & skills	Ability to acquire new technical skills and overcome unforeseen technical problems	Independent learning	Clear evidence of independent learning, varying from good to outstanding,	It is essential to assign individual responsibilities to encourage the acquisition of new knowledge and skills, and to make it transparently obvious when these skills have been acquired, and the degree to which they have been acquired.

			depending on the research assistant	
Diversity	Ability to work with people from different cultural and professional backgrounds	100% cohesion in the team	Most RAs work well together	Diversity adds value as it exposes RAs to different standards and expectations regarding both professionalism and technical competence.
Leadership	Ability to coordinate multiple tasks and manage projects	Rotational project manager role	4 RAs have served as project managers	The project manager position is rotated among the RAs after a period of two months to ensure that every RA acquires tangible leadership skills.

Describe any emerging effects or changes that are not captured quantitatively. Include both positive or negative changes that were either intended or unintended.

1.3.3. Ripples of Impact: Your intervention may have ripple effects beyond the level identified above. For example, a program targeting young women or men to pursue education or entrepreneurship opportunities may have an impact on their households or communities. A program targeting university- industry relationships may have an impact on recent graduate job placement. Multi-university knowledge creation projects may impact the visibility of African research collaborations to global funding organizations.

We hope to capture the full range of potential ripples of impact and broader changes of Afretec programs, so we may potentially follow up with impact assessments. Please note if any programs that targeted one level (e.g., learner, student, faculty, institution, industry, country or region) are showing ripple effects on other levels:

The [Upanzi Network](#) at CMU-Africa has forked the CSSR4Africa repository and is porting it to ROS 2 for use in giving a tour of the Digital Experience Centre at CMU-Africa. The results of CSSR4Africa will therefore continue to be felt even after the conclusion of the research, creating robotics interest in incoming CMU-Africa students who will continue to see the results of the project at the Digital Experience Centre.

1.3.4: Additional data collection: Please describe any additional quantitative and qualitative data collection efforts utilized (e.g., key interviews and focus group discussions, pre- and post-program knowledge assessments, attitudes and practices (faculty or collaboration partner surveys, etc.). This may help identify opportunities to deepen how we capture the impact of this partnership. These efforts could include data collection described in your proposals or any other relevant data collection.

No data was collected in the current period. However, in April 2024, a wide-ranging survey in both English and Kinyarwanda was conducted to acquire cultural knowledge about how to interact respectfully with people in Rwanda.

2. PARTNERSHIP UPDATES

2.1 Partnership Changes

Have there been any key changes (changes with significant impact on partnership or activity success) to any of the following items? ☐ Yes ☒ No

Items: context, outputs/deliverables; key activities; inputs/resources; monitoring, evaluation, research and learning plan; communications approach; team structure (including staffing), etc.

If yes, please describe:

The CMU-Africa team has updated its staffing, resulting in changes to how the team operates to fulfill its mandate. Prof. Assane Gueye, the previous PI, has transitioned out of CMU-Africa, and Prof. Moise Busogi has taken over as the new project PI. The spinoff project, Pepper for Digital Experience Center (Pepper4DEC), also falls under the new PI's leadership.

2.2 Collaboration Update

Please provide an update of your engagement and collaboration with partnership stakeholders (e.g., academic institutions, private sector organizations, government organizations, community groups, civil society organizations, etc.) during this reporting period.

There has also been collaboration with the Upanzi Network at CMU-Africa, with two of their research associates working in close collaboration with the CSSR4Africa CMU-Africa team, and the Upanzi Network lab manager and project manager also helping in managing the CSSR4Africa project.

3. COMMUNICATIONS UPDATE

3.1 Communications Activities Update

Please describe the marketing and communications outreach that occurred during this reporting period, as well as any relevant media links.

The project was featured in Nature Africa: "Can robots learn African culture?" (March 2026). It can be found [here](#).

Journal papers, conference papers, workshop papers, abstracts, posters, and talks & presentations on the project are available on the CSSR4Africa website [here](#).

4. RISK UPDATE

4.1 Risk Update

Please provide an update on the risks, whether new or previously identified, in the Proposal or the previous Periodic Reporting Template. Consider partnership and activity-level (e.g., capability, capacity), and organizational-level (e.g., affecting management, governance, personnel essential to the functioning of the organization).

Risk	Likelihood	Risk Impact	Risk Mitigation Plan
Inadequate funding for research assistants	Low	High	Alternative funds (e.g., Research Professorship Start-up Fund) were used to fund Year 3, and two RAs were hired under the Upanzi Network at CMU-Africa to work on the spin-off project.
African cultural knowledge is not effective in use cases	Low	High	D6.2 Use Case Evaluation documents the required changes to be implemented based on the initial evaluation done.
Implementation of the system architecture for use cases is insufficient	Low	High	Improved support for synchronized execution of parallel ROS nodes by leveraging ROS Action nodes, as reflected in D3.1 System Architecture, version 1 , D4.3.2 Speech Event , D5.4.2 Robot Mission Language , D5.4.3 Robot Mission Interpreter , D5.5.1.1 Gesture Execution , and D5.5.2.4 Integrated Text to Speech Conversion . Additional improvement in the architecture was made specifically for the Pepper4DEC spin-off project by utilizing ROS2 (Humble). In addition, improvements on some of the nodes have been implemented by utilizing LiDAR-Inertial Odometry (LIO). Document D3.1 System Architecture version 2
Robot sensing and analysis do not perform adequately	Low	High	A 3D LiDAR sensor was added to the Pepper robot to help it better understand its surroundings, move more accurately, and navigate more reliably. Document D4.1 Robot Sensing Migration report the changes.
Robot behaviors do not perform adequately	Low	High	D6.2 Use Case Evaluation documents the required changes to be implemented.
T6.4 Use case evaluation does not achieve sufficiently high user ratings in the evaluation	Moderate	Moderate	D6.2 Use Case Evaluation documents the required changes to be implemented based on the initial evaluation done.

5. NEXT REPORTING PERIOD

5.1 Plans for Next Reporting Period

Based on the Afretec Action Plan and progress updates thus far, please outline your key activities for the next reporting period.

This is the final report for this project, marking the completion of Year 3. All previous reports are also available on the [Deliverables](#) page. A final summary of the project is included in Section 6 (Additional Information).

6. ADDITIONAL INFORMATION

6.1 Additional Information

Please describe any additional information that the Director of the Afretec Network should be aware of.

This is a CMU-Africa periodic narrative report. It does not cover the progress made by the University of the Witwatersrand over the current period. All deliverables for which CMU-Africa is responsible under the work plan, including those for which CMU-Africa assumed responsibility in place of Wits, have been completed and uploaded to the CSSR4Africa website (see [Deliverables](#)). Fifteen of these deliverables include software elements in the form of ROS nodes, fourteen of which have been integrated, demonstrating compliance with the [CSSR4Africa System Integration and Quality Assurance](#) process.

Eight additional deliverables for the spin-off project (Upanzi Network-funded) have been submitted under Pepper4DEC, as stipulated in the [work plan](#). The website will continue to be maintained and will be updated should any further deliverables become available.

The following team members participated in the CSSR4Africa Project, including RAs/interns, PIs, and staff involved in the project:

Adedayo Akinade	Kleber Kabanda
Assane Gueye (PI)	Lenah Chacha (Upanzi Network Staff)
Birhanu Shimelis Girma	Mihiretab Taye Hordofa
Clifford Osano	Moise Busogi (PI)
Daniel Barros	Muhammed Danso
David Vernon (PI)	Muhirwa Richard
Deogratias Amani	Natasha Mutangana
Deogratius Kiggude (Upanzi Network Staff)	Pamely Zantou
Eyerusalem Birhan	Tsegazeab Taye Tefferi
Heran Equbay	Yohannes Haile
Ibrahim Jimoh	

As a final note, it is important to acknowledge that the effort expended on this project far exceeded what was originally planned or funded by Afretec. Over the past three years, sixteen interns and RAs, most working full-time, have contributed to the project. The flexibility afforded by Carnegie Mellon University Africa in allowing David Vernon to use his Research Professorship Startup Fund to support this work has been instrumental to its success. In addition, the Upanzi Network's funding of two RAs for the spin-off project, Pepper4DEC, has been essential in sustaining this work.

On the hardware side, three Pepper robots have been used over the course of the project. The first robot was gifted by CMU but is no longer operational. CSSR4Africa funded the purchase of a second robot, and CMU-Africa funded a third; both are currently housed in the Robotics Lab.

Furthermore, following the departure of the project's original PI at CMU-Africa, David Vernon, in June 2025, the continued efforts of Assane Gueye, Deogratius Kiggude, Lenah Chacha, and Moise Busogi from the Upanzi Network have been instrumental in sustaining the project. In addition, David Vernon continued to contribute significant effort for 11 months following his departure.

NOTE: THE FOLLOWING SECTION IS FOR INTERNAL USE AT CMU-AFRICA ONLY.

Associate Director of Impact to complete this section following submission of the Periodic Narrative Report by the Afretec Partner.

7. REVIEW

7.1 Associate Director of Impact Comments

Please describe any key issues and/or follow-up items and provide a summary of discussions that occurred with partners during this reporting period.