PYRNEXAT

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SPACE FOR SANITATION
ESA Contract No. 4000132950

Introduction

The PYRNEXAT platform will provide smart sanitation management data and deliver applications and services which can be used to manage the next-generation sanitation infrastructure.

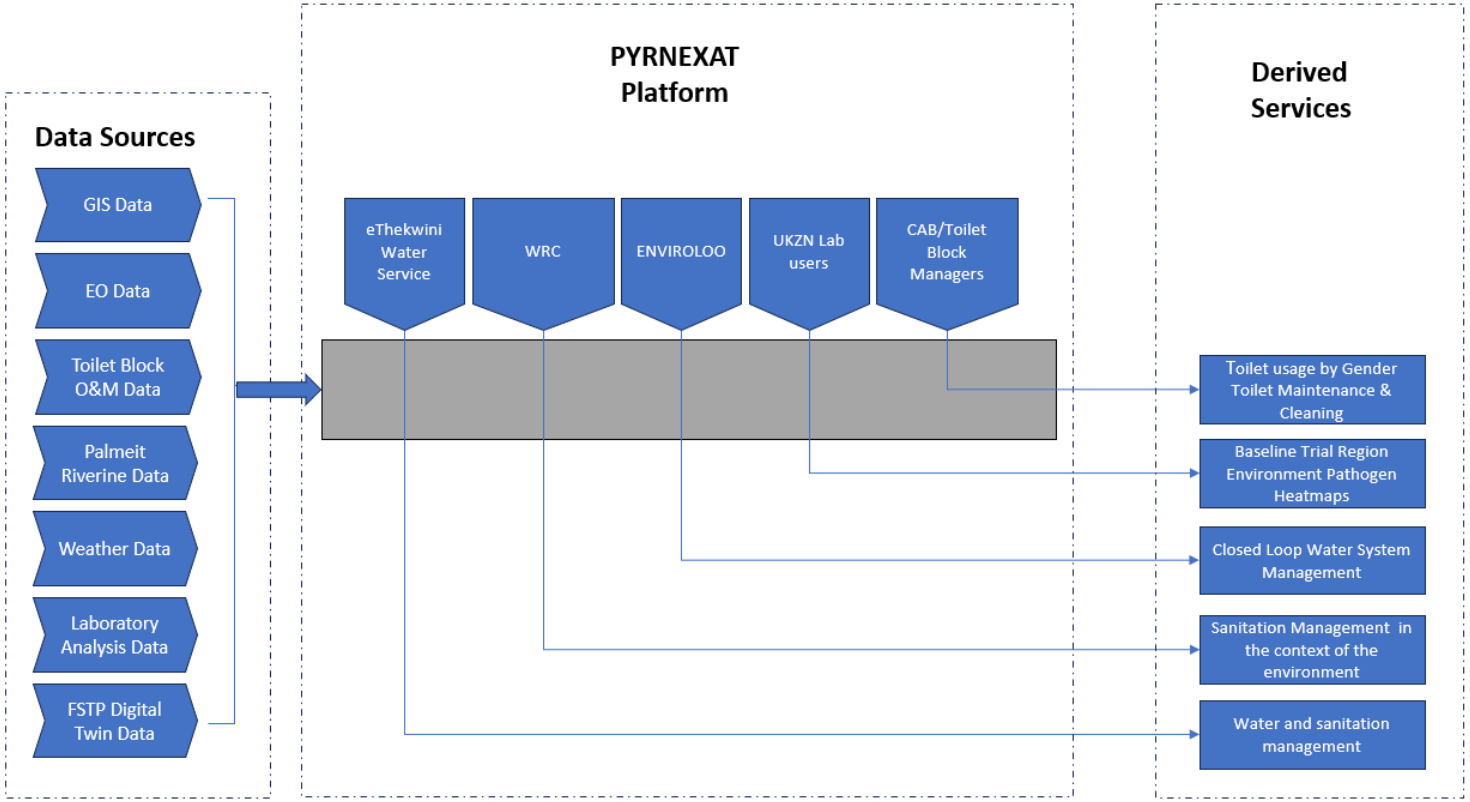
- The demonstration project will provide basic AI-based predictive analytics to measure pathogen concentrations in a monitored environment and verify if fluctuating concentrations can be linked to weather events and toilet usage.

- The project will also assess if sewage treatment using pyrolysis might contribute to lower pathogen concentrations in the environment. The latter is based on developing a “virtual” faecal sludge treatment plant (FSTP) to emulate the treatment of 10 tons of waste per day.

- The project was scheduled to have completed a demonstration stage by 2024 but due to the sudden death of the project leader and pyrolysis system designer the project stopped. The project recommenced in June of 2024 with a revised completion date in October 2025.

- We require access to Sentinel data to complete the project

Overview



The PYRNEXAT platform will collect and collate data from multiple sources and present these in web-based applications. The data from all of these applications can be linked to provide actionable insights on the use and efficacy of the sanitation system and how sewage contamination is affecting people living in the local environments. The users are as follows,

- eThekwini Water Services – The local authority sanitation and water entity in the Durban region of South Africa
- The WRC – Water Research Commission – A branch of the South African Government responsible for providing water an sanitation nationally
- ENVIROLOO – The South African suppliers of closed look water flushing systems supported by the South African Sanitation Technology Demonstration Programme (SASTEP) and the Bill & Melinda Gates foundation
- University of Kwa Zulu Natal (UKZN) Wash R&D center - Water, Sanitation & Hygiene Research & Development Centre
- Mandosi Mixed School – A test site where toiler blocks will be monitored and managed to assess toilet usage by gender and factor this in terms of water usage and hoe environmental factors can affect usage

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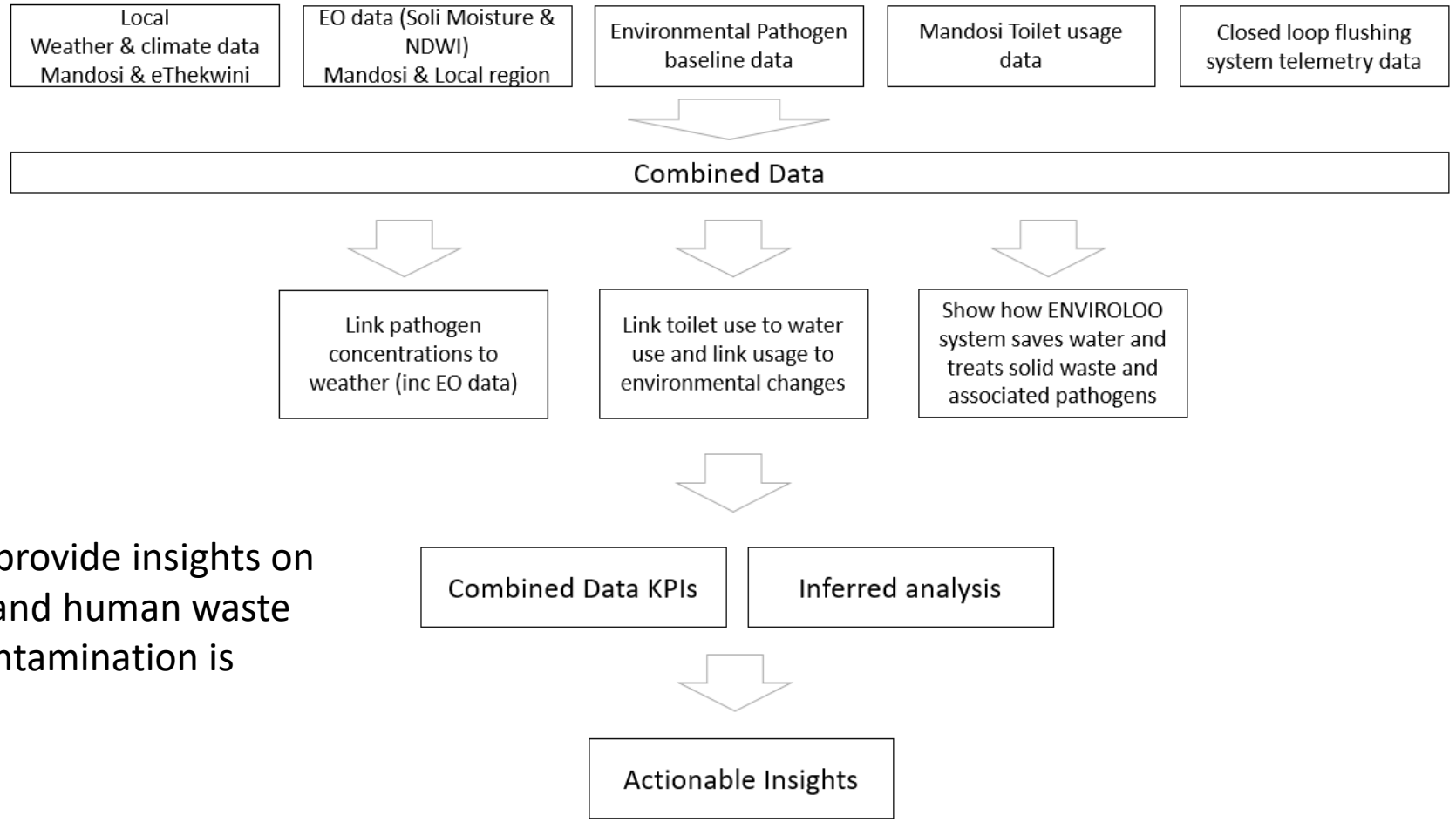
Project Objectives



The project will collate data to provide insights on the performance of sanitation and human waste treatment systems and how contamination is affecting the environment

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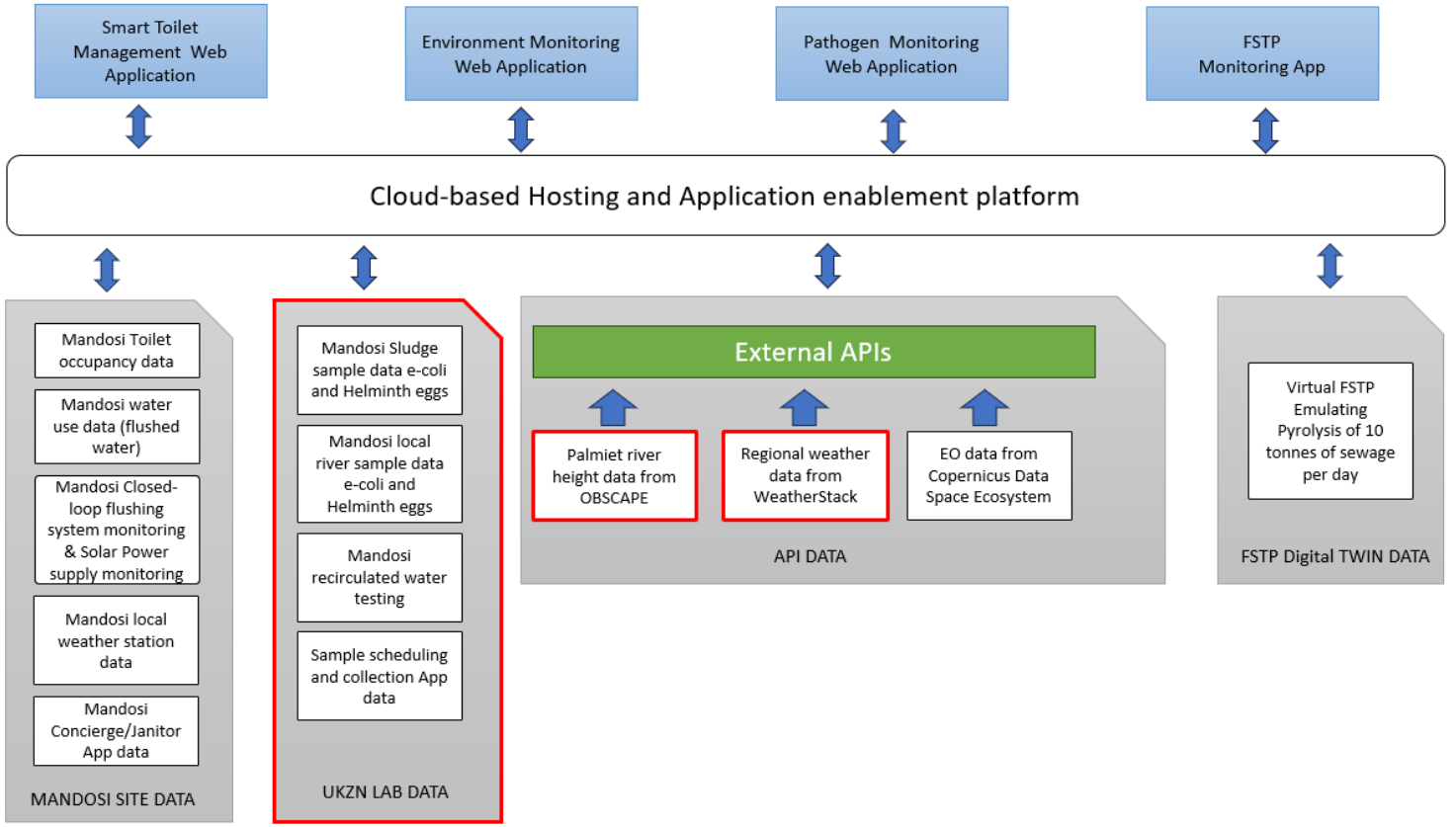
Current Update

The toilet sensor hardware, weather station and user Apps will be deployed in South Africa at the end of November 2024. The cloud based platform will be released to the users/stakeholders in South Africa.

There are 4 web-based applications

- Smart Toilet Management App
- Environment Monitoring App
- Pathogen Monitoring App
- FSTP Monitoring App

The Features outline in RED will be added once the system has been installed and commissioned (December 2024 to May 2025)



Use of Sentinel Data in the context of the project

- **NDWI** is calculated using Sentinel-2 imagery (green and NIR bands)
- **Soil moisture** can be derived from Sentinel-1
- Locating pathogen concentrations on maps linked to the EO data swathes.

In the South Africa over 50,000 litres of untreated sewage is released into the environment evert second. In the Durban region outbreaks of illness related to sewage contamination in the area is increased when there has been an increase in rainfall. Where the soil is wet this can accentuate the level of harmful pathogens in the environment.

We are sampling the environment to collect data on the concentration of E-Coli bacteria and Intestinal parasite Helminth eggs. We are comparing the concentration to rainfall and soil moisture and want to assess if we can develop predictive analysis tools to show where improved waste management might mitigate the risks associated with poor sanitation.