## CLIMATE SMART RURAL WASH DEVELOPMENT PROJECT

## MINISTRY OF FISHERIES WATER RESOURCES AND NAMS

# DEVELOPMENT OF A WASH MAP AND ESTABLISHMENT OF A FUNCTIONAL WEB-BASED M&E SYSTEM

## WASH MAP SYSTEM DESCRIPTION

MARCH 2022

WASHMAP
The Gambia Water, Sanitation and Hygiene Project
Monitoring and Information Portal

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# 1 INTRODUCTION

## 1.1 PROJECT BACKGROUND

On paper, the people of The Gambia shouldn't suffer from lack of reliable and safe sources of water. The small African nation has adequate water resources to supply its population of 2.45 million people. In rural, urban, and peri-urban areas, potable water demand is met by groundwater supplied by NAWEC (in the capital, parts of the Kombos, and large towns), private wells, and village wells.

Rural Gambians are particularly affected by issues of water access. In 2020, WHO & UNICEF found that only 7.62% of rural Gambians have access to a safely managed water point. Only 61.7 percent of the rural population has access to a basic water service, which is defined as water that is supplied through an improved water source and can be collected within a 30-minute timeframe. In rural Gambia, 16.5% of people have limited access to an improved water source, which is one that requires more than 30 minutes to collect water. Of rural Gambians, 14.24% must turn to "unimproved" water sources, including unprotected hand-dug wells, springs, or surface water. In our preliminary survey, we found that 63 percent of Gambia's rural water wells were unsafe and/or non-functional.

Even in NAWEC territories, problems with the water supply have led to households having to resort to their own sources of water for drinking and other household chores. Families with more resources dig boreholes in their compounds and others resort to shallow wells.

We understand that the republic of the Gambia has received grants from the African Development Bank to finance the Climate Smart Rural WASH Development Project to improve the socio-economic and environmental conditions of the rural and peri-urban population through improved access to sustainable WASH infrastructure and services in the Gambia. The project is being implemented over a period of over 60 months, since October 2018.

The Ministry of Fisheries and Water Resources is the Executing Agency, through its Department of Water Resources (DWR) as Implementing Agency, supported by a Project Steering Committee (PSC), chaired by the Permanent Secretary of the Ministry to provide policy direction and operational oversight. The direct implementation and management of the project is undertaken by a Project Coordinating Unit (PCU) supported by the Project Implementation Partners (PIPs).

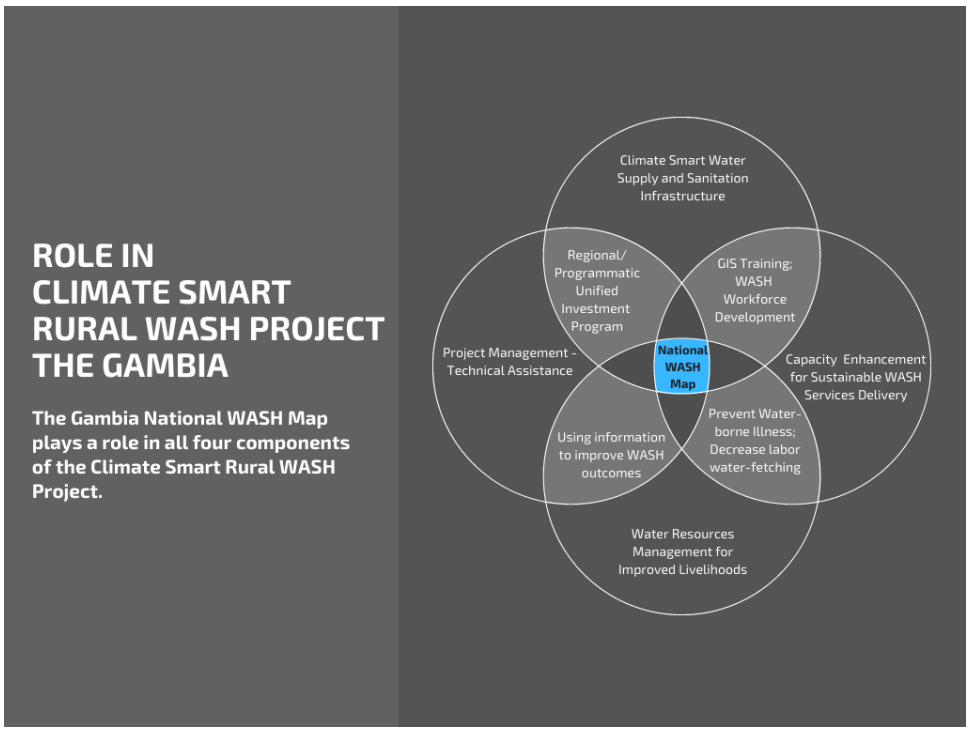
The principal objectives of this project are to: 1.) Increase sustainable access to safe water by 17% and access to safely managed sanitation by 2%; 2.) Enhance services delivery capacity in the sector; and 3.) Improve livelihoods through nurturing safe water and sanitation services related opportunities for women and youth employment.

The DWR and country's main utility company NAWEC implemented numerous water supply projects in the rural and urban areas respectively. Similarly, various donors have installed water supply systems and sanitation facilities primarily in the rural areas. However, the status of these systems for both the rural and the urban areas are currently unknown.

In this framework, the "Development of a WASH Map and Establishment of a Functional Web-based M&E System" Project covers all four components of the Climate Smart Rural WASH Development Project: Component 1: Climate Smart Water Supply and Sanitation Infrastructure; Component 2:

Capacity Enhancement for Sustainable WASH Services Delivery; Component 3: Water Resources Management for Improved Livelihoods; Component 4: Project Management – Technical Assistance.

A WASH MAP and Functional Web-based M&E System, along with a National WASH Plan, will allow for possible sector harmonization, moving from the implementation of individual donor projects in water supply, sanitation, and hygiene toward a programmatic approach, which foresees a move to regional and district-level plans. These efforts seek to move from a landscape where donors make separate reporting activities for their mapping of WASH interventions toward a more collaborative and programmatic approach—a more unified WASH program.




*Project role within CSRWASHDEP project*

An integrated online (web-enabled) Integrated Performance Management Information System (IPMIS) for the Climate Smart Rural Water Supply and Sanitation Development Project (CRSWASHDEP) will enable effective decision-making – at all levels within The Gambia – through the use of continuous, reliable and relevant data and indicators that can be analyzed and used to inform decisions. National WASH M&E has the potential to inform intervention tracking, corrective actions, planning and resource allocation, to increase accountability of service providers and authorities toward citizens, and to inform regulation of services and service providers. Ultimately, an IPMIS can and should result in improvements to, and the sustainability of, WASH service delivery.

## 1.2 PROJECT SCOPE

The objective of the project is to develop a WASH map for the Gambia and a functional web-based WASH data Management Information System, allowing users to access and manage the information collected.

The Project is divided into two main tasks (and related subtasks), as follows:

- Task 1 – Wash Mapping:
  - Task 1.1 - Consultation With Stakeholders;
  - Task 1.2 –Training, outreach, surveying water points & sanitation facilities;
  - Task 1.3 –Wash mapping;
  - Task 1.4 - Data analysis;
- Task 2 - Integrated Performance Management Information System (IPMIS):
  - Task 2.1 - System requirements study;
  - Task 2.2 - Centralized storage information system design;
  - Task 2.3 –IPMIS system development and software testing;
  - Task 2.4 – IPMIS system website development and publication;
  - Task 2.5 – Training on IPMIS.

IPMIS System IT infrastructure is here briefly described; the system was rebranded under the WASHMAP name, which is the name available also on the project website (https://gamwashmap.gm/), where main outcomes and analysis are published.

WASHMAP
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*WASHMAP Logo*

# 2 WASHMAP SYSTEM DESCRIPTION

## 2.1 SYSTEM INFRASTRUCTURE

The Client requires an online system with project monitoring, data analysis, reporting, "web-GIS" mapping functionality, data sharing. Access to data as well as being able to perform advanced analysis and mapping over the internet is becoming more common and of relatively straightforward implementation.

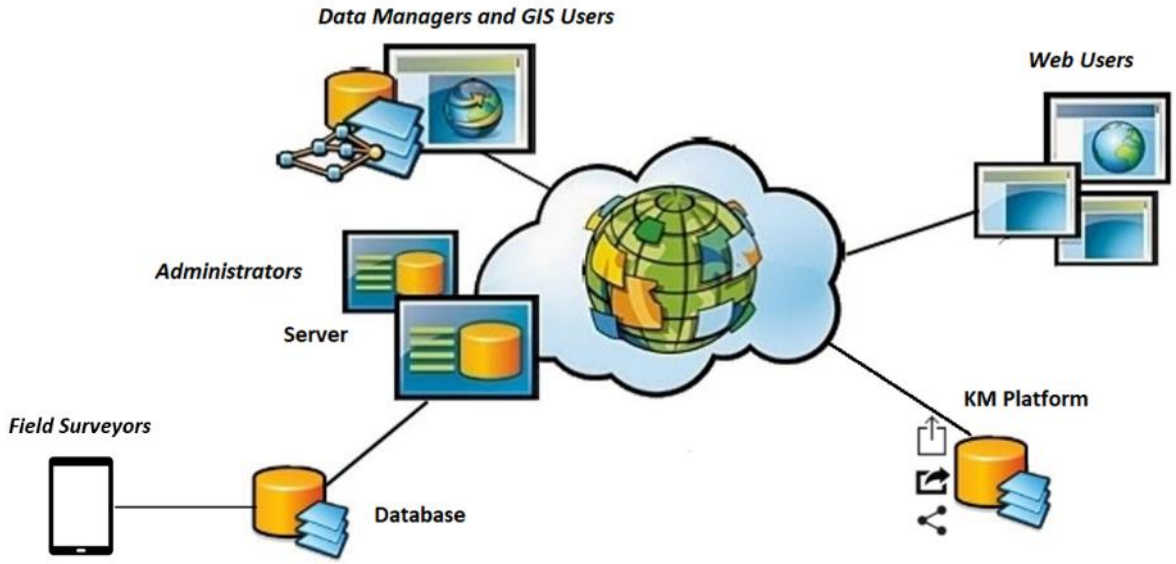
The main components of such a system include:

- A server granting the database services and the web-GIS services; the server might be hosted externally or in-house;
- The Database, or GeoDatabase, is where the non geographical and geographical information is stored and managed in a unified and consistent framework;
- The web-GIS services allow the users of the system to connect to the web to consult and interact with maps and collected data on the field;
- The Knowledge Management platform.

Users of the IPMIS system might include:

- Web users. They can simply access data and reports, browse maps on the web;
- Data managers and GIS Users. They can modify/update data depending on the level settings of the system; they can modify the data locally, and synchronize it on the server, through a geographic user interface;
- Administrators. They can manage access to the system and users permissions.
- Field surveyors. They can download an offline copy of the data, edit and add points, and synchronize the changes to the server. Once they have completed the survey, data collected will be analyzed, vetted and elaborated to obtain specific indicators.

The figure below shows the overall proposed infrastructure of the system.




*IPMIS system design concept*

As part of the development of the IPMIS system, the Consultant is currently in the beta testing stage of system development. The current focus is on the development of a tool for field data surveying that will be utilized to collect and enter data from the field during the WASH survey of this project. Other components of the IPMIS system, such as database, front end user interface (UI) and web-GIS tool, are still under design phase of development. This section provides an overview of the current status of development of the IPMIS system.

At this preliminary stage, the following software is envisioned to be utilized, although choices might be changed during the design and implementation phase of the project:

- Server: Debian 11 Linux Operating System[1];
- Database System: PostgreSQL with the PostGIS geographic extension[2];
- Maps will be created and managed as standard OGC services (WMS and WFS) through QGIS Server[3], when necessary integrated with the web front end Lizmap[4];
- Field survey is going to be performed through mobile devices pre-installed with Input[5] app, built on top of the above mentioned QGIS open source project, allowing users to setup maps and forms in QGIS on their workstation, and deploy those in the field through Input;

[1] https://www.linux.com/what-is-linux/

[2] https://postgis.net/

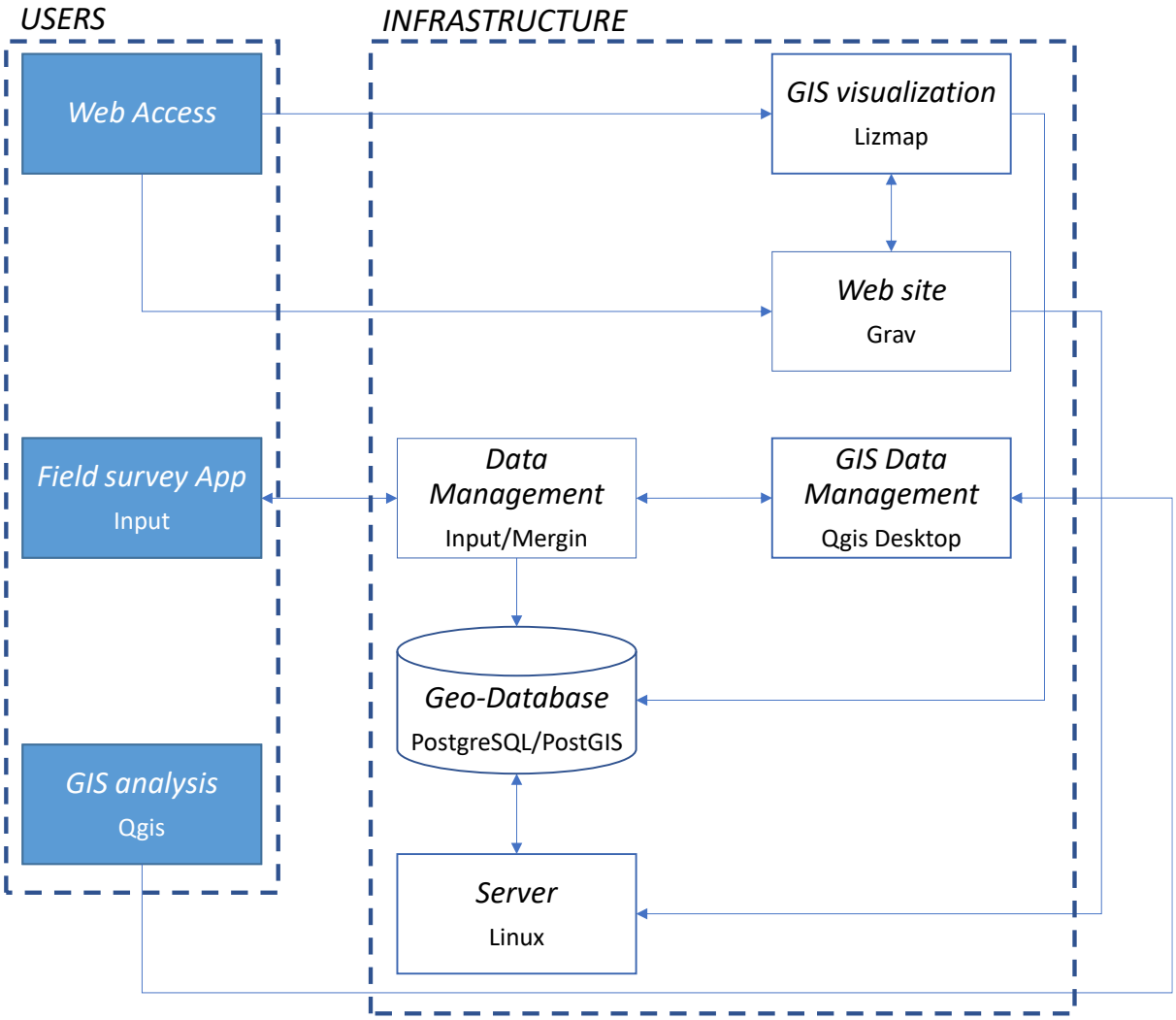
[3]https://docs.qgis.org/3.16/en/docs/user_manual/working_with_ogc/server/index.html

[4]https://www.3liz.com/en/lizmap.html

[5] https://inputapp.io/

- The synchronization between the mobile devices and the database is performed by the Mergin[6] service;
- Grav CMS[7] is used to create the website infrastructure. Being a CMS it allows to add users with different rights (only access, edit/add new pages, load external documents).

All of the software and applications used are entirely open source, ensuring confidentiality of the data and service continuity.



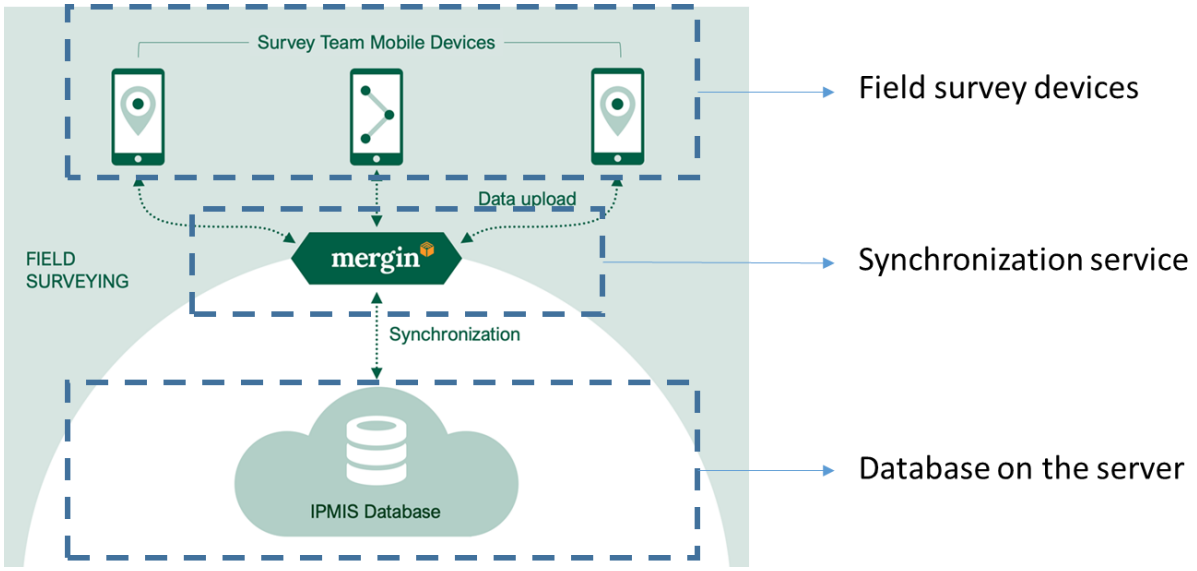

*IPMIS data management scheme*

The Input tool sends and uploads data collected in the field directly onto the IPMIS Database. Data is handled through a synchronization component called *Mergin*, which sends data from the Input app on

[6] https://public.cloudmergin.com/#

[7] https://getgrav.org/

the mobile device to the IPMIS database server. The figure below illustrates how the Input tool handles data upload and synchronization from the field.



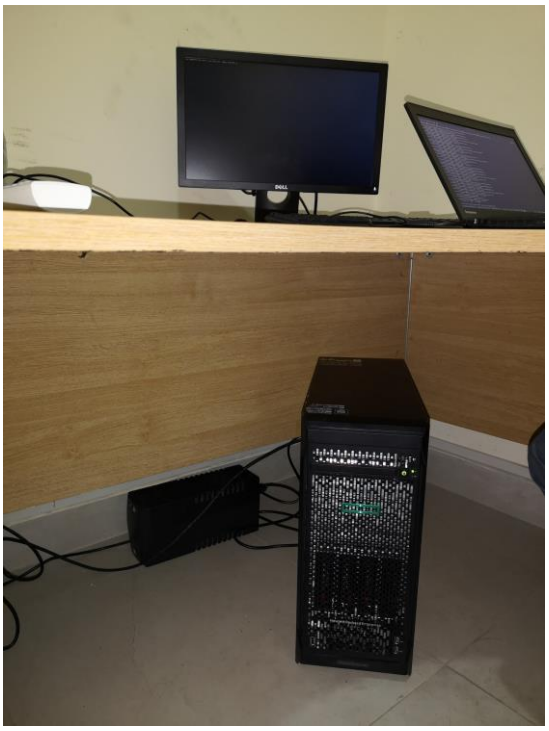

*Data collection flow and synchronization with the Database*

The Input tool sends and uploads data collected in the field directly onto the IPMIS Database. Section below describes this data handling in more detail.

## 2.2 SERVER PROCUREMENT AND INSTALLATION

The international IT specialists delivered the server to the MoFWR premises in Banjul in November 2021. The server room was inspected and internet connection was checked. The installation activities were conducted along with on the job training for the IT Ministry team. The server system includes the following hardware:

- 1 Server HPE ProLiant ML110 Gen10 Performance - tower -Xeon Bronze 3204 1.9 GHz - 32GB, 3x1TB hard drive;
- 1 Monitor Dell;
- 1 keyboard;
- 1 mouse;
- UPS.



*Server installed at MoFWR office in Banjul*

The server was installed in the server room with a 40/10 megabits connection, and an UPS to prevent electrical shocks and short-term power losses.

A temporary dynamic DNS service was enabled to make the server reachable while the fixed IP address and the domain name is finalized.

The Debian 11 operating system was installed, along with the following software, containerized and managed with Docker and Docker-compose:

- Grav for the website;
- Mergin for the data management and synchronization;
- Dash as the mapviewer;
- PostgreSQL database with PostGIS extension;
- Nginx as the main webserver;
- Certbot as the SSL certificates manager, with autorenewal;
- Duckdns as the dynamic DNS manager and IP updater;
- Redis for the caching of Mergin data;

A manual backup procedure of the complete dataset was established. Remote access was enabled. All the appropriate security measures, including restricting the access with a password and requiring a public-private keypair, were enabled.

## 2.3 FIELD SURVEY APPLICATION DEVELOPMENT

To aid in collecting and entering data from the field for the WASH survey, a practical user-friendly tool has been developed, called the *Input Mobile App* (or simply referred to as "Input"). Input is the tool through which WASH data is collected for the survey and uploaded and entered into the IPMIS database. After the App was developed in beta version, tailored to the project, and went through the process of testing it in the field, the tool resulted ready for rollout by end of September 2021.

Survey activities began in October and project surveyors were trained on how to operate and use the Input App to perform the duties of the survey. A user manual was developed for the purpose of training and for future reference and is provided in Annex to this Report.

### About Input


Input is an application used on a mobile device (tablet or mobile smart phone) that allows the WASH surveyors in this project to easily capture survey information from the field. Input allows the user to download and view the survey map and connect to the IPMIS database directly through the mobile device. Users can complete survey questionnaires and enter location-specific data into the Input. Input uploads and synchronizes the field data collected by the surveyors directly to the IPMIS database.

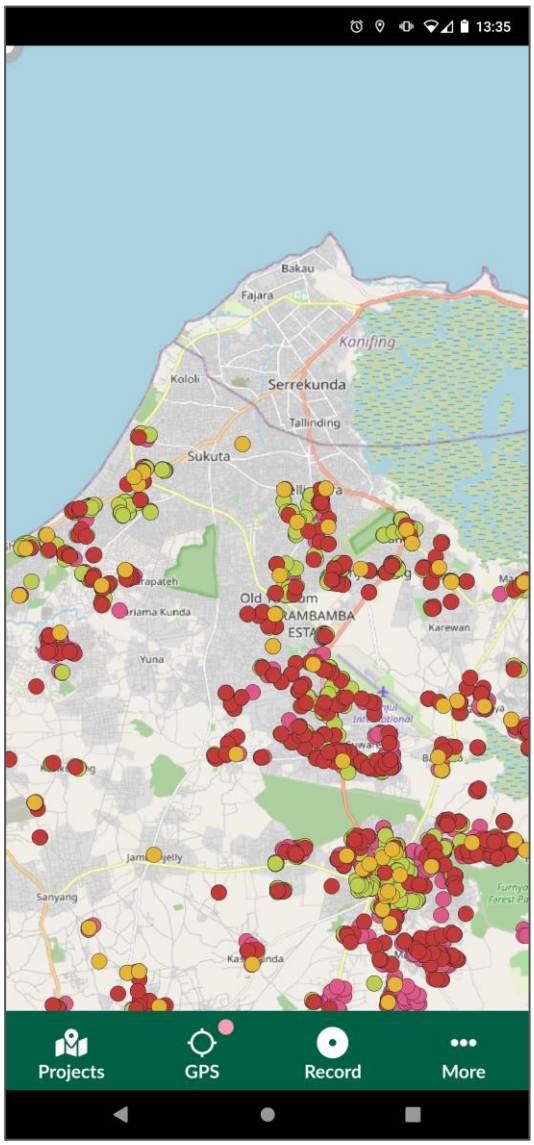
### Main features of the Input tool

- Operates on a mobile device in the field, tracking specific location through GPS network.
- Capture survey data as a point on the map.
- View survey data and location on the map.
- Take geotagged photos.
- Effortlessly upload field data to the IPMIS database
- Works offline
- Keeps the survey data consolidated in one database
- Data administrators can retrieve previous versions of data and view historical changes.
- Surveyors can synchronize the geo-data with all devices and people in the Survey Team.

### How it works

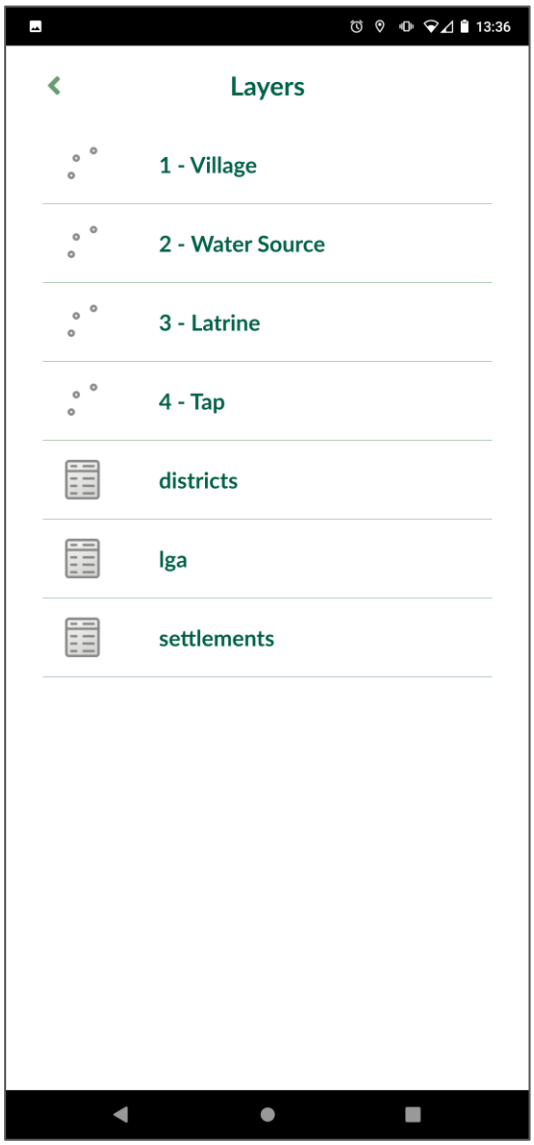
The Input app is installed and runs directly on a mobile device (smart phone, tablet) and uses the cellular and GPS location services of the mobile device to track location and store and send data. A few

examples of the Input tool are provided in figures below to demonstrate the user experience as designed for this project.

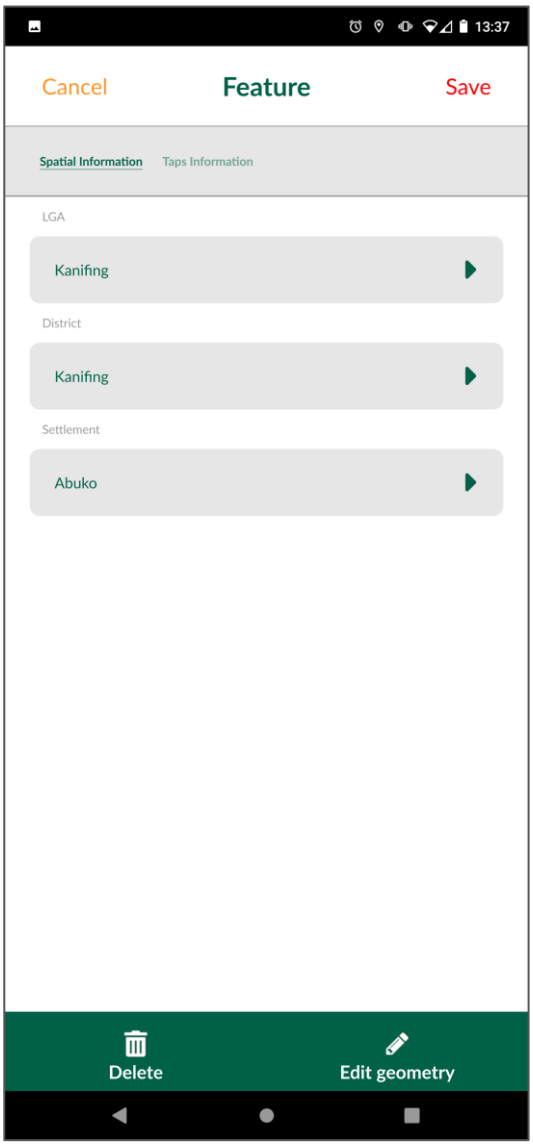



*Main user interface showing the map view with WASH survey points and primary menu.*


*Adding a new WASH survey datapoint in the east of the Gambia.*



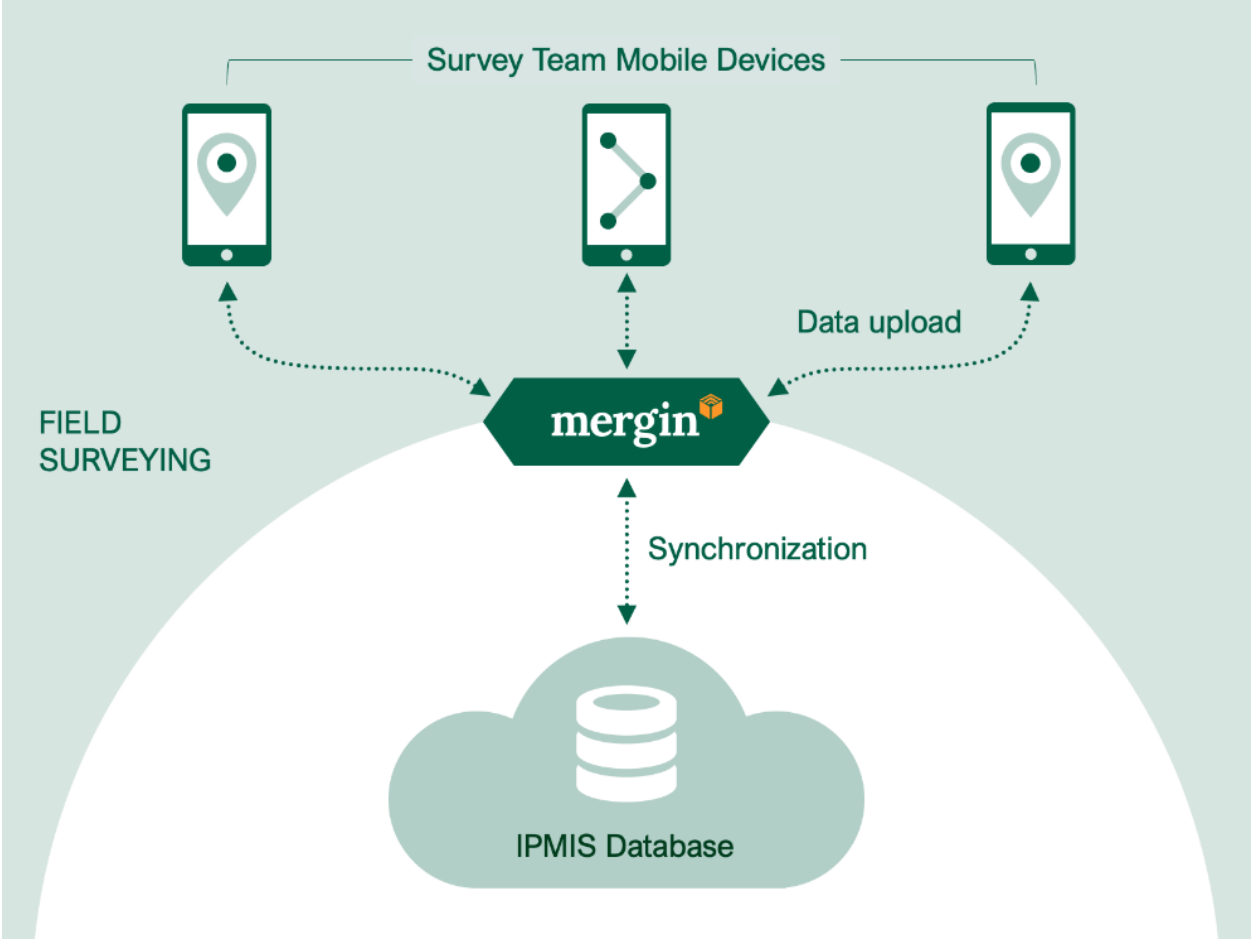

*Adding a new WASH survey datapoint, showing different layer options to select from.*




*Adding a new WASH survey data on taps in a school area in the Gambia*

## Data handling

The Input tool sends and uploads data collected in the field directly onto the IPMIS Database. Data is handled through a synchronization component called *Mergin*, which sends data from the Input app on the mobile device to the IPMIS database server. The figure below illustrates how the Input tool handles data upload and synchronization from the field.




*Input Tool data handling with the IPMIS database*