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Apps for Monitoring Of Hydrological Parameters in the Alexandra Jukskei Catchment in South Africa

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Extended Abstract

It has been noted that technical programming for handling groundwater resources is not accessible. The lack these systems hinder groundwater management processes necessary for decision making through monitoring and evaluation regarding the Jukskei River of the Crocodile River (West) basin. In Johannesburg South Africa. Several challenges have been identified in South Africa's Jukskei Catchment concerning groundwater management. Some of those challenges will include the following: Gaps in data records; there is need for training and equipping of monitoring staff; formal accreditation of monitoring capacities and equipment; there is no access to regulation terms (e.g., meters). Taking into consideration necessities and human requirements as per typical densities in various regions of South Africa, there is a need to construct several groundwater level monitoring stations in a particular segment; the available raw data on groundwater level should be converted into consumable products for example short reports on delicate areas (e.g., Dolomite compartments, wetlands, aquifers, and sole source) and considering the increasing civil unrest there has been vandalism and theft of groundwater monitoring infrastructure. An app and GIS was employed at the catchment level to plot the relationship between those identified groundwater parameters on the catchment area and the identified borehole. GIS-based maps were designed for groundwater monitoring to be pretested on one borehole in the Jukskei catchment. This data will be used to establish changes in the borehole compared to changes in the catchment area according to identified parameters.

It has been stated that technical programming for managing groundwater resources is not available due to the current industrial revolution [1]. These technologies' accessibility will make groundwater management easier and give monitoring and assessment staff access to data [2]. This article provides an overview of the creation of a framework for groundwater management in South Africa's Jukskei River basin. The purpose of this essay is to convey recent findings on modelling methodology, data security, and software compatibility with the groundwater area. Applications, GIS, and Smart phones serve as a paradigm for groundwater modelling of water resources.

To assist engineers and workers recovering water resources with the goal of establishing a sustainable future and a true circular economy, mathematical modelling is a vital tool [3]. Although mechanistic models have been successfully applied in the water sector, they exhibit several significant flaws and do not completely benefit from the growing digitalization of systems and processes [4]. The potential of the Fourth Industrial Revolution can be harnessed thanks to recent developments in data-driven methodologies; however, these methods are frequently constrained by a lack of interpretability and extrapolation abilities [5]. These two modelling paradigms are combined in hybrid modelling (HM), which strives to take advantage of both the steadily rising data quantities and the ongoing quest for deeper process comprehension [6]. The use of hybrid models is still unclear despite the promise they have in a field that is going through a considerable digital and cultural transition [7].

The Jukskei catchment was surveyed to ascertain the groundwater management status in order to address the aforementioned difficulties. The survey was conducted by looking at the readily accessible groundwater records and the rationally written papers of the many research conducted in the area. Groundwater infrastructure was used to identify and track crucial indicators, such as groundwater level, and establish groundwater patterns. A technology/App based on blockchain, and artificial intelligence is being developed for groundwater monitoring and will be pretested on one borehole in the Jukskei watershed.

The mobile app's high-level implementation design, which distinguishes between "general public" and "professionals" users, is shown in Figure 1. These two user categories differ primarily in their capacity for precise borehole measurement, analysis, and interpretation. All the accessible data collecting fields are visible to users. All fields will be accessible to users who have registered as professionals, however ordinary public users will only be able to submit data by selecting options from a list that has to be filled in.

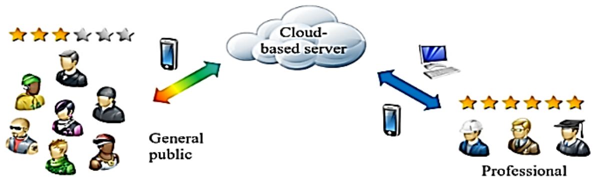
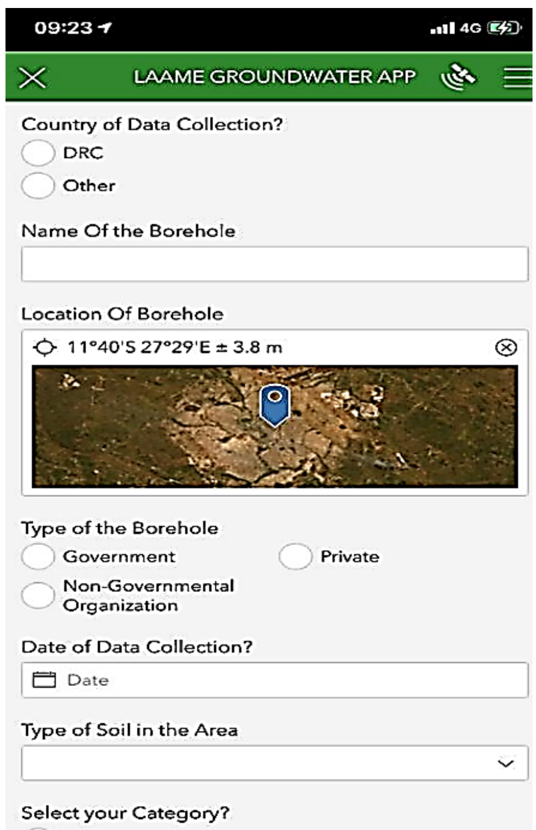
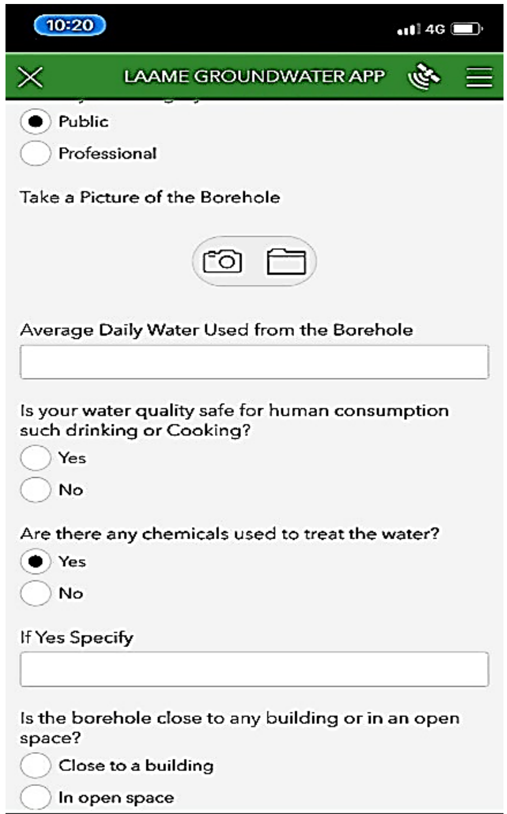


Figure 1: App Implementation. (Source: Authors).

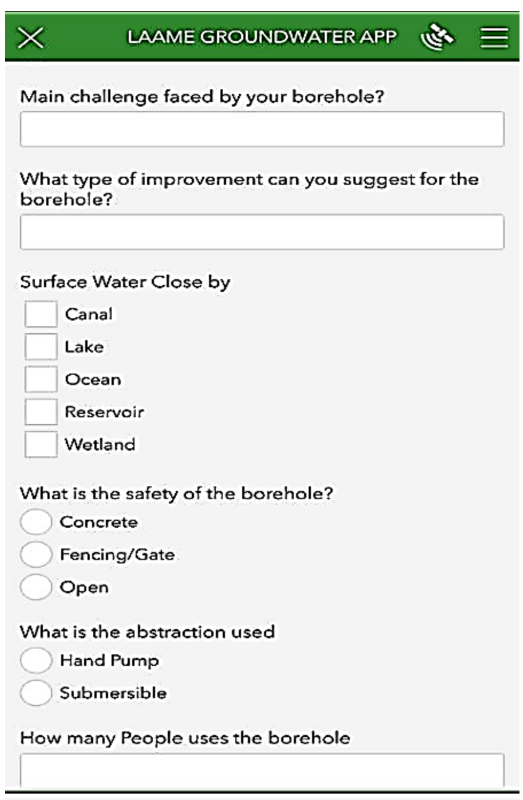
In terms of the app's user interface features, Figure 2 below depicts how the app operates.



(a)


10:20
4G
LAAME GROUNDWATER APP
Public
Professional
Take a Picture of the Borehole
Average Daily Water Used from the Borehole
Is your water quality safe for human consumption such drinking or Cooking?
Yes
No
Are there any chemicals used to treat the water?
Yes
No
If Yes Specify
Is the borehole close to any building or in an open space?
Close to a building
In open space

(b)


LAAME GROUNDWATER APP
Main challenge faced by your borehole?
What type of improvement can you suggest for the borehole?
Surface Water Close by
Canal
Lake
Ocean
Reservoir
Wetland
What is the safety of the borehole?
Concrete
Fencing/Gate
Open
What is the abstraction used
Hand Pump
Submersible
How many People uses the borehole

(c)

(d)

Figure 2 (a,b,c,d): Running procedure of the developed app on the Smart phone. (Source: Authors).

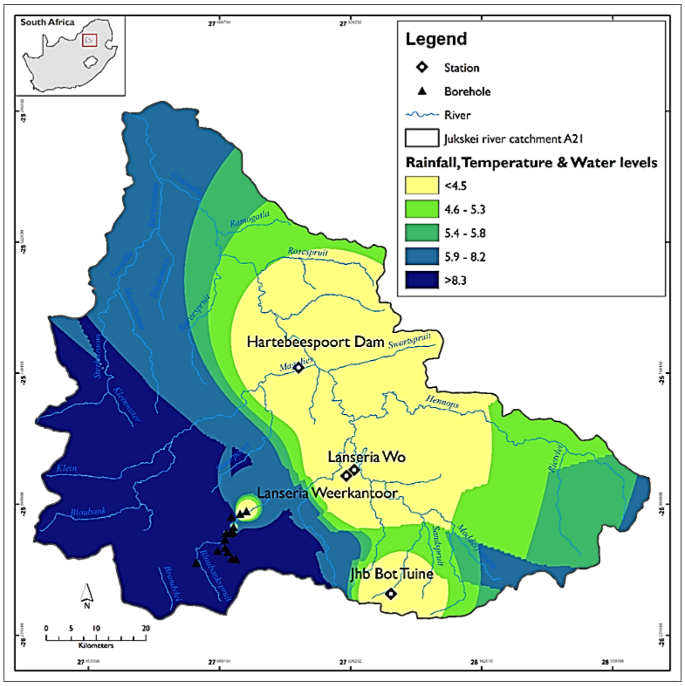


Figure 3: Map output. (Source: Authors).

Jukskei accessible borehole data, which totalled 39, will be used to further test the mobile app. Analysis will be done, and a map displaying the locations of each well will be constructed. On the other side, professionals can export the submitted data in a format of their choosing, including CSV, Excel, KML, shapefile, and file Geodatabase, among others. The laptop's exported data can be processed to perform additional analysis and save for upcoming studies and investigations.

Statistical tools like bar chat, pie charts, and summaries of the data gathering process, including information on which countries most recently used the app and the most frequently answered questions, are also included in the professional interface. Users of the app can cross-check each other's information using a function included in the app. Each user receives a user rating and a one-star rating upon registration. Numerous verifications result in an increase in a user's star rating.

This poster provides an overview of resource recovery modelling for water and provides details on the creation of a framework for groundwater management in South Africa's Jukskei River basin. The article disseminates current software compatibility research. The creation of maps showing the Land Use/Land Cover of the Jukskei River watershed and a description of the Jukskei area using the GIS tool and a java-capable phone will help in the development of a conceptual hydrological model which is the next step of this study.

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