This project has received funding from the European Union's Horizon2020 Research and Innovation Programme. Grant Agreement 851816

Development of geofluid knowledgebase system (KBS) to optimize geothermal energy production

Mollika Pervin[1], A.K.M. Asaduzzaman[1], Ashadul Hoque[1], Miah Raihan Mahmud Arman[1], Md. Mashiyat Nawal[1], Fahim Chowdhury[1], M Azizur Rahman[1]

Technovative Solutions Ltd., Manchester Science Park, M15 6JJ, United Kingdom

Corresponding author: mollika@technovativesolutions.co.uk

Introduction

The possibility of optimizing existing geothermal plant operations efficiently, economically, and minimally disrupts the environment depends on all components of the plant system, i.e., reservoir, wellhead, energy generation components, and reinjection. The equation of states (density, enthalpy, specific heat capacity, entropy, etc.) depends on the geofluid's temperature, pressure, and chemical composition (TPX). These thermodynamic properties and reaction kinetics indicates how much energy is achievable from the reservoir, and what types of challenges (scaling, corrosion, erosion, gas effects, etc.) need to be mitigated for geothermal power production.

Understanding and characterizing geofluid properties is one of the important research areas and several ongoing studies are in progress. But the research data are sparse, and one cannot use them readily due to a lack of enough background information and accessibility. Uploading research data directly to a repository is not enough because data may be of low quality, may have errors, or some part is missing. Another problem is that not enough metadata is available. Metadata is descriptive information on data that other researchers can use. All these problems restrict the power of the data. We have developed an open Knowledgebase system (KBS) to overcome these issues. The KBS separates the query interface from the data storage and opens and connects the underlying metadata to other metadata sources. This allows much greater freedom, and users are no longer restricted to querying one set of metadata. In addition, the KBS is flexible about the type of data it can incorporate, and GEOPRO consortium members can include their data anytime that suits them.

This poster has been developed under the scope of the Horizon 2020 project GEOPRO project– 'Accurate Geofluid Properties as key to Geothermal Process Optimisation'. GEOPRO project deals with geofluid properties or processes used to determine the overall geothermal energy production potentiality. During the GEOPRO project period, industrial and academic partners will conduct a range of experiments. These experiments will generate datasets for equations of states, reaction kinetics, reservoir modeling, and flow assurance simulation. The KBS will be used to facilitate the co-organize partners to organize data and make it available in an adequate format to their peers. All these data and relevant open-source models will be made available, accessible, and usable by everyone so that advances in scientific understanding happen faster. After the project period, external users can also contribute to the KBS.

In this paper, we will report on the following: an overview of the KBS and its key features, a description of the development process of the KBS using open-source tools and technologies, a description of the data publishing plan, and finally we provide a summary.

Figure 1 - Data Portal homepage of Open Knowledge Base System.

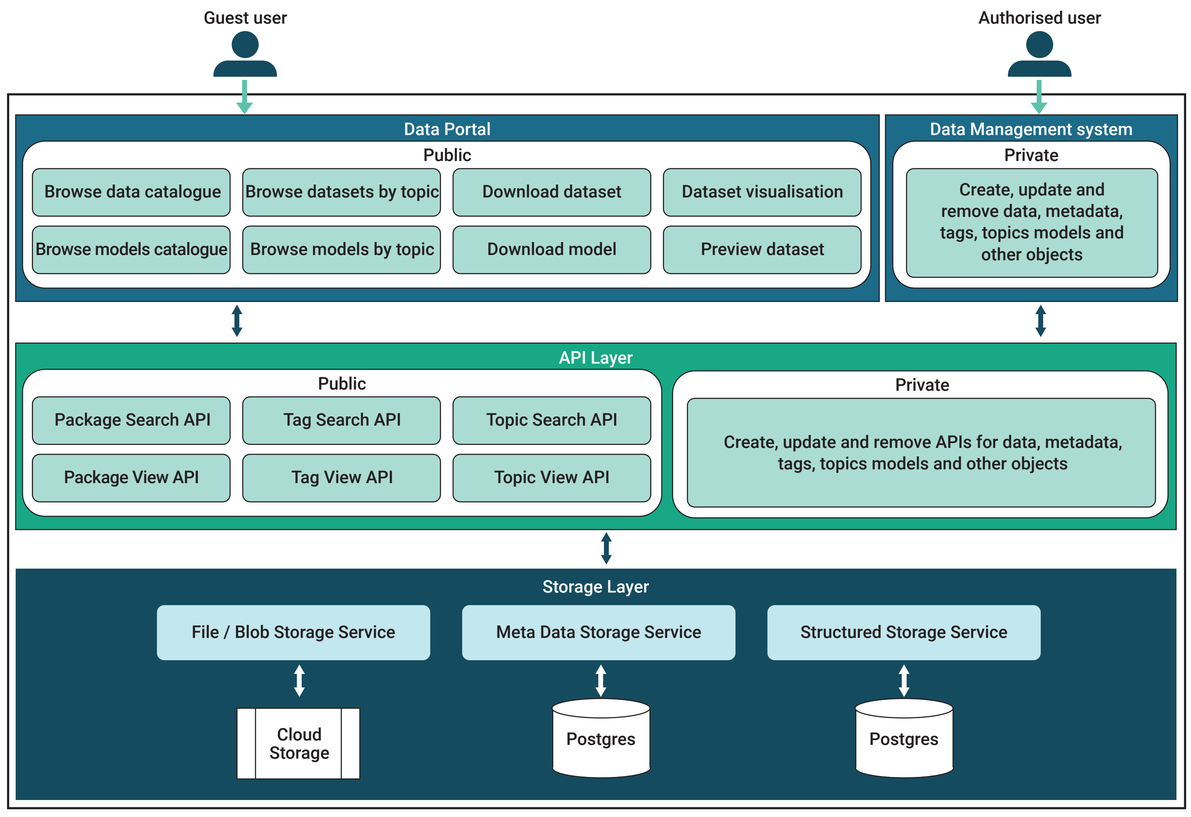
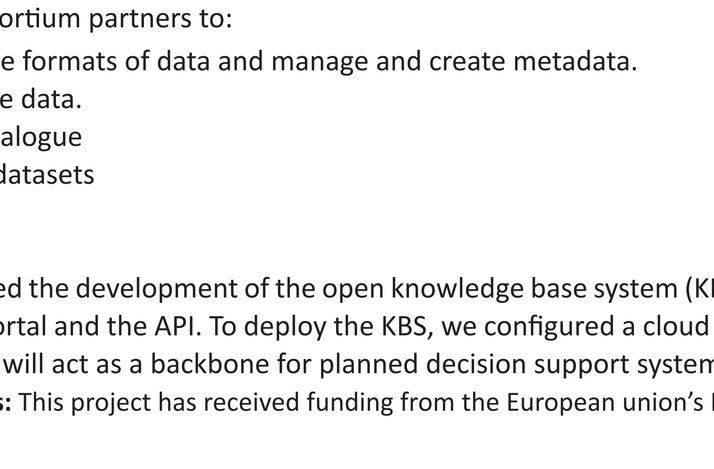


Figure 2 - Open Knowledge Base System Architecture.

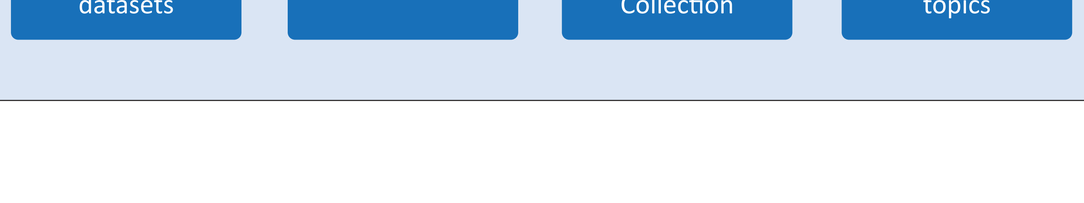
Publishing Data & Data Life Policy

Publishing data is a continuous process, and GEOPRO consortium partners will continuously provide their data until the project's end. While publishing data, GEOPRO consortium partners will follow the data life cycle policy recommended in Open Data Goldbook .Publishing open data in the KBS consists of various sub-process: Data Collection, Data Preparation, Data Publishing and Data Maintenance. The upcoming sections will explain key concepts of these sub-processes that consortium members will follow while publishing data in the KBS.



Any user wants to publish their data in the KBS will follow the data collection process which includes the following steps:

- Map the currently available dataset.
- Prioritise the available datasets.
- Audit the data collection process.
- Choose and publish topics.



Data Management System

The KBS has a data management system (DMS)

which allows consortium partners to:

- Manage multiple formats of data and manage and create metadata.
- Import and store data.
- Search Data Catalogue
- Tag and Group datasets

The DMS also has admin UI which allows administrators to:

- Monitor: who is doing what, audit log, etc.
- Use analytics: e.g., number of views, number of downloads, recent activity.
- Revision data and metadata.

Comment

This study described the development of the open knowledge base system (KBS) carried out under the scope of GEOPRO project. The KBS has three sub-modules: the database management system (DMS), the data portal and the API. To deploy the KBS, we configured a cloud IT infrastructure with deployment automation techniques. A data life-cycle policy has also been placed for consortium partners. This KBS will act as a backbone for planned decision support system (DSS).

Acknowledgements: This project has received funding from the European union's Horizon 2020 research and innovation and program under grant agreement number 851816.