Senior Design Project

WaterVision

Project Specification Report

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1 Introduction

WaterVision is a web application that aims to detect groundwater using satellite imaging. It will not only the highlight the areas consisting of groundwater but will also show the level of water present. It will act as a groundwater detecting and monitoring tool.
This report describes the use cases of WaterVision, its constraints and the professional and ethical issues involving the project. It also analyses the functional and nonfunctional requirements.

1.1 Description

Water is one of the most crucial natural resources present as it sustains life itself. Water sustainability – especially in the wake of climate change, global warming, water depletion – is at the core of a sustainable environment. [1]
Similarly, groundwater supplies drinking water for over half the population in almost every country [2]. It is used to grow food and sustain irrigation for growing crops. Groundwater is also one of the integral components in many industrial processes. Likewise, for regions prone to floods, groundwater detection can play a key role in flood management. In addition, diseases that spring from water such as dengue – which is carried by mosquito larvae dwelling in still groundwater – can be controlled by effective groundwater detection and moderation [3]. Thus, groundwater detection carries a plethora of applications.
WaterVision will bring this to life by detecting groundwater using satellite imaging of various regions. Along with detection of groundwater, it will also report the level of water present. For regions where satellite imaging is difficult to obtain, there will be machine learning algorithms to predict the presence of groundwater. After detection, the application will showcase a variety of layers with various use cases. Such as, a layer for drinking water supply will distinguish it from the rest of groundwater. Areas which are prone to floods and heavy rainfall will be highlighted in the flood dashboard for effective flood management. Similarly, water irrigation layer will be also be present which separates water being used in agriculture. If time allows, we will also add a layer highlighting water regions which are prone to water borne diseases such as dengue [3].

1.2 Constraints

1.2.1 Development Constraints

- Since this project requires satellite imaging, we will make us of NASA's satellite image library [4].
- To implement the front end of our project, we will use VueJs [5].
- The backend will be developed using Django Framework [6] in Python since it has useful machine learning libraries.
- We will use ElasticSearch [7] for an efficient indexing of the data present.
- Google's Map API [8] will be used for reference and checking of the data.
- Visual Paradigm software will be used to design UML diagrams.
- GitHib will be used as our version control and source code management.
- We will also use Microsoft Teams to communicate between the group.

1.2.2 Cost Constraints

- For monitoring groundwater, we would require updated satellite images which would be costly.

1.2.3 Reliability Constraints

- The application will be tested for multiple regions and in a plethora of environments to ensure that the methods we have implied are robust.

1.2.4 Time Constraints

- The project and its reports will be completed in the time due.

1.3 Professional and Ethical Issues

To keep the project professional, the source code of the project will be kept private in a private repository on GitHub. We will also divide the workload equally and take into account all the group member's opinions.
In order to address ethical issues, the application will be implemented in accordance with the GDPR – the code of ethics [9].

2 Requirements

2.1 Functional Requirements

WaterVision will consist of the following functionalities:

2.1.1 Groundwater Detection

The most important and obvious functionality is groundwater detection. WaterVision will detect groundwater and present it to the user as a layer on its already existent map.

2.1.2 Water-level Measurement

After identifying the water, the user will be able to see the level of water present. Where level 0 would imply surface water, level 1 would imply a greater depth, level 2 would consist of a depth higher than 1 and so on.

2.1.3 Groundwater Prediction

For regions where accessing satellite imaging is difficult, WaterVision will consist of machine learning algorithms and will be able to predict groundwater present along with its level.

2.1.4 Drinking Water Supply

Once water detection is complete, WaterVision will present various layers, each appropriate for a specific userbase. One of those layers will consist of drinking water supply where the application will distinguish between the rest of the water and the water allocated for drinking.

2.1.5 Flood Management

In areas prone to floods and heavy rainfalls, the flood management section of the application will highlight water areas with high water levels thus posing a high risk of floods. This can then be used for flood management dashboards.

2.1.6 Water for Irrigation

Another layer on the application will consist of irrigation. This will distinguish the water reserved for or being used in agriculture from the rest of the groundwater.

2.1.7 Others – Water Borne Disease Identification

If time allows, we will work on adding more layers to our application. One of those will consist of recognizing groundwater which poses a risk for water borne diseases. One of those diseases, dengue, which is currently seeing an alarming rise of cases persists in areas prone to high rainfall and the presence of still groundwater. This allows mosquitos larvae to multiply in numbers. WaterVision will recognize these water regions which can then be used to control the spread of these diseases.

2.2 Nonfunctional Requirements

2.2.1 Security

The application will provide a secure platform for the user with login credentials.

2.2.2 Reliability

The application will focus on accuracy and reliability.

2.2.3 Scalability

Although we will initially focus on a limited region such as Ankara, Turkey. The application will be built in a way that it is scalable and can also be extended to other regions.

2.2.4 Usability

The application will provide an easy-to-use interface with distinguishable map layers.

2.2.5 Performance

The application will have a fast performance and a minimum loading time depending on the server being used.

3 References

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