

MEDEAS Web Database Management System

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INTRODUCTION

A web database management system that allows users to store, retrieve and manage data was designed, implemented and installed in the framework of MEDEAS project (Modelling the Energy Transition under Environmental and Socioeconomic constraints). MEDEAS is a project that uses advanced modelling techniques to produce a flexible tool that will help decision makers steer the European economy towards a low carbon future under different policy, technology, resource availability and consumption scenarios. Within the project, data are collected, elaborated and imported into the tool, whereas additional data are generated by the tool to quantitatively describe different scenarios. To support model users and analysts in managing this large number of data either for using the MEDEAS tool or for conducting policy analyses it was important to develop a user-friendly database management system.

The developed management system consists of a database which holds the data and a web application that allows users to view and manage the data.

The database was designed using the “entity – attribute – value” model and is hosted on a MariaDb server.

The web application was developed using Java technologies and has two main functionalities. Firstly, public users can view and download data, performing queries to the database. Moreover, administrator users can update or insert new data.

DATABASE APPLICATION DESCRIPTION

The developed database application consists of three parts, as described below.

Layer 1 – Database Description

The design and development of the database was based on the “entity - attribute – value” model. Within this context, the entity is one among "Global", "EU", “Austria” or “Bulgaria” referring to the different geographical levels of the MEDEAS modelling tool and the attribute is the specific variable. In this model, the variables are organized in a tree, whereas provisions were made, so that the history of changes for each variable is stored and readily available. Moreover, for each variable the relevant metadata are stored.

The DBMS selected to develop this application is MariaDB.

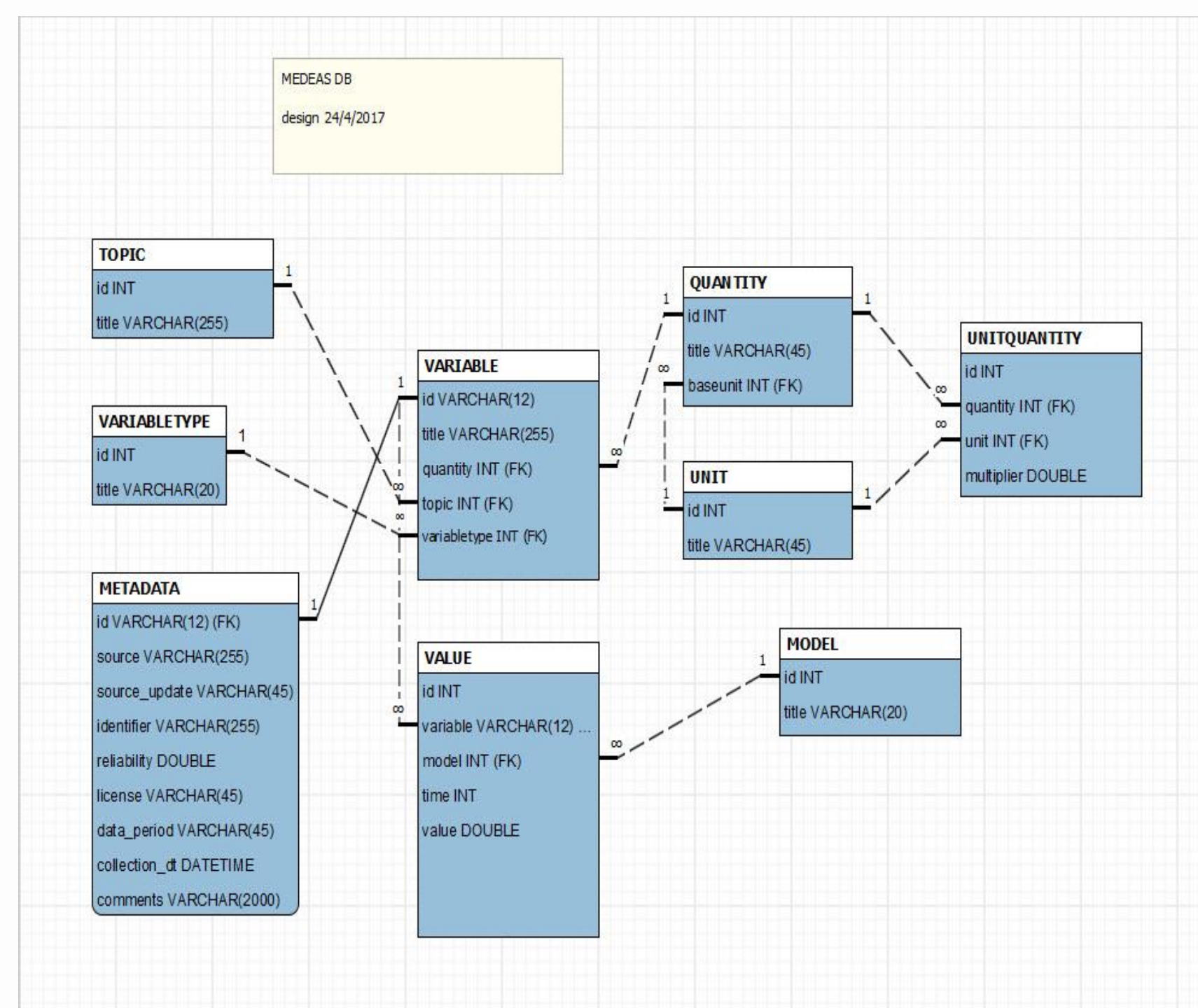


Figure 1 Database Structure

Figure 1 shows the schema of the database structure, which was designed based on a set of initial sample data and following some requirements addressed by the MEDEAS model developers.

As seen in Figure 1, the database consists of two main entities: Variable and Value. The Variable entity holds the basic characteristics of the variables of the MEDEAS project (ID code, variable title, etc.). It is connected with the Metadata entity, which holds additional characteristics of the variables. The Value entity holds the data collected, elaborated and generated within the MEDEAS project.

Layer 2 – Middle Layer Description

In terms of functionality, a J2EE library (.jar files) has been designed and developed that provides the following functionality, in the form of JSF post-backs:

- Store the value of a specific variable.
- Retrieve the value of a specific variable.
- Create a new variable.
- Retrieve the data needed for report generation. For this purpose, a Java API has been designed and implemented, that, given one or more variables and one or more entities retrieves the relevant data.

Two main types of users are able to use the web application: public users and administrators.

Public Functionality

Public users are able to retrieve data from the MEDEAS database in two different ways:

- All data contained in the database can be retrieved at once.
- A certain part of the database can be viewed or downloaded by selecting one or more variables (either by clicking on certain variables or through search criteria)

Administrator Functionality

Administrators can additionally to the above:

- See a list of the data for all entities of the database.
- Edit the data for all entities of the database.
- Create new records for all entities of the database.

Layer 3 – Front End Description

A web application that exposes the ‘layer 2’ functionality to the web user has been designed and developed. Emphasis has been given in the simplicity and robustness of the application. A user authentication system is also provided at specific application sections, with the initial passwords sent to application users by a separate, secure medium.

Public Section

The public section of the web application will be open to any user that registers in the MEDEAS website and consists of one page that is called View Data. Here, the user can retrieve data from the database and view them in different forms.

There are two tabs in this page, representing the two different ways to search for variables:

1. Select Variables from Tree (Figure 3)
2. Select Variables with Criteria (Figure 4)

In the first option, data can be displayed either in tabular form or in a chart, whereas in both options metadata can be retrieved and displayed.

All tabular views of data and metadata allow the user to download the data currently displayed in three different forms: XLSX, XML and CSV, by clicking on the corresponding icons.

VIEW DATA

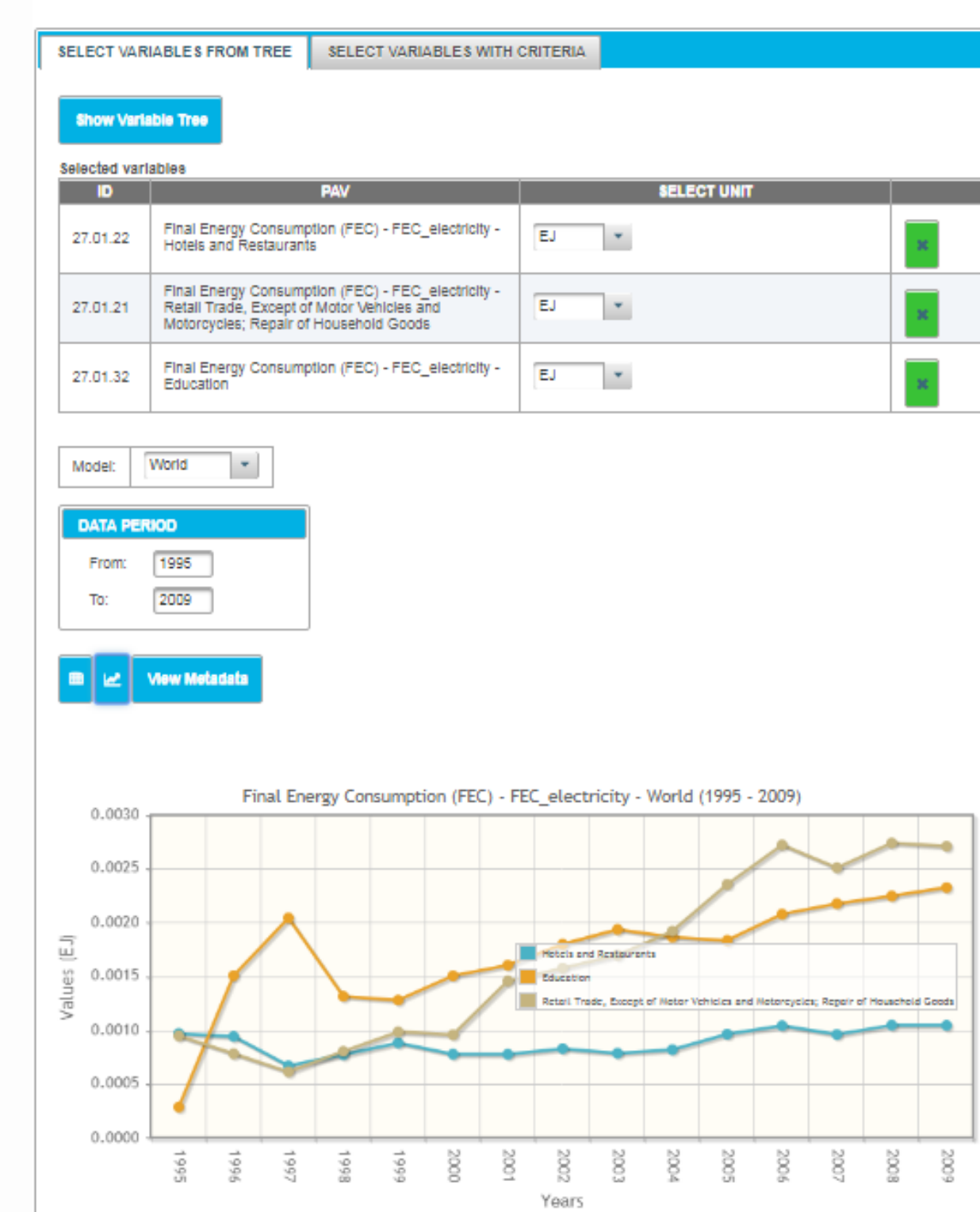


Figure 3 Select Variables from Tree tab

VIEW DATA

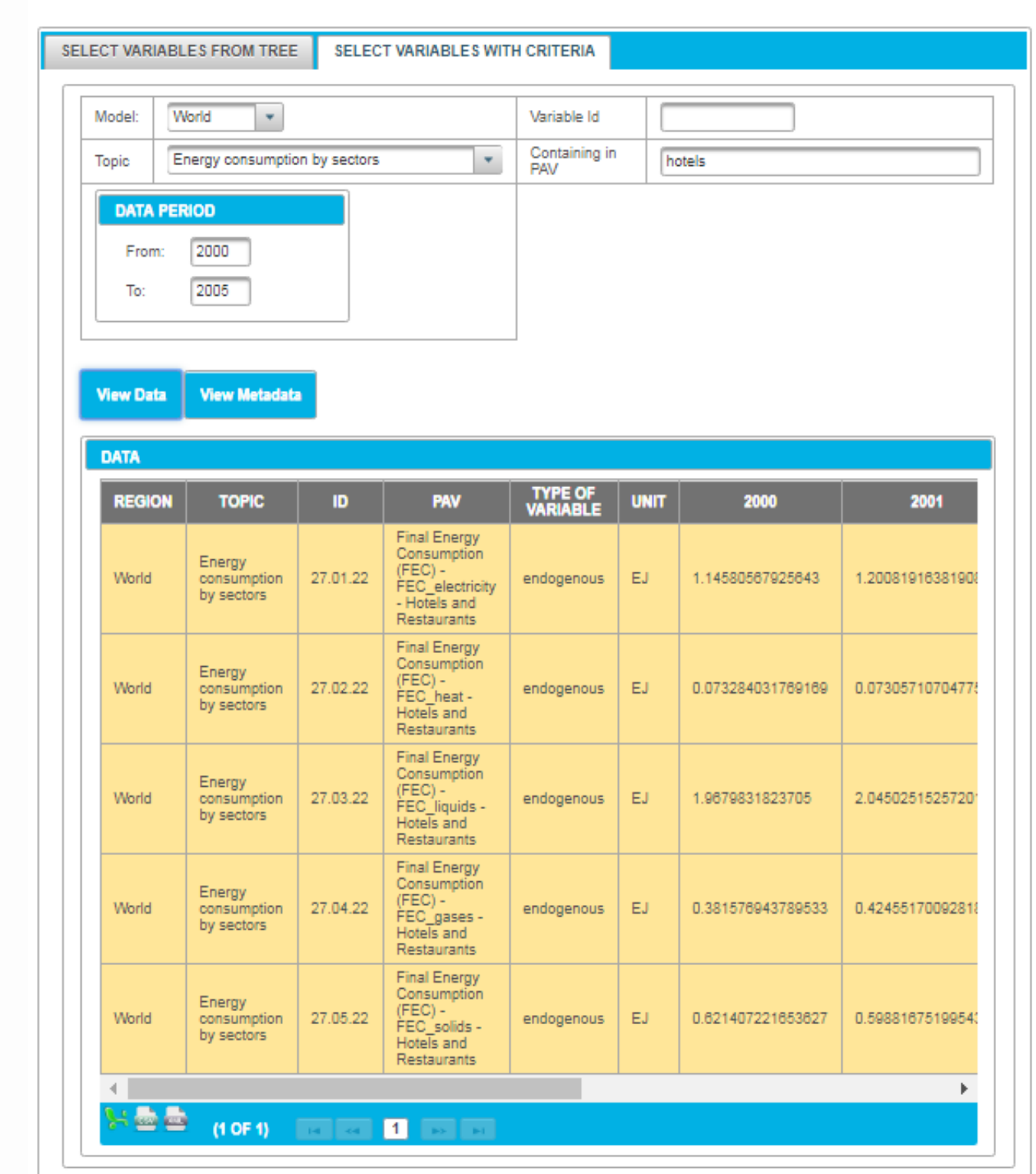


Figure 4 Select Variables with Criteria tab

Administrator Section

The administrator section of the web application consists of a main page and several other pages, as well as a menu (Figure 5).

Inserting data (i.e. values for certain variables) in the database is done in two ways:

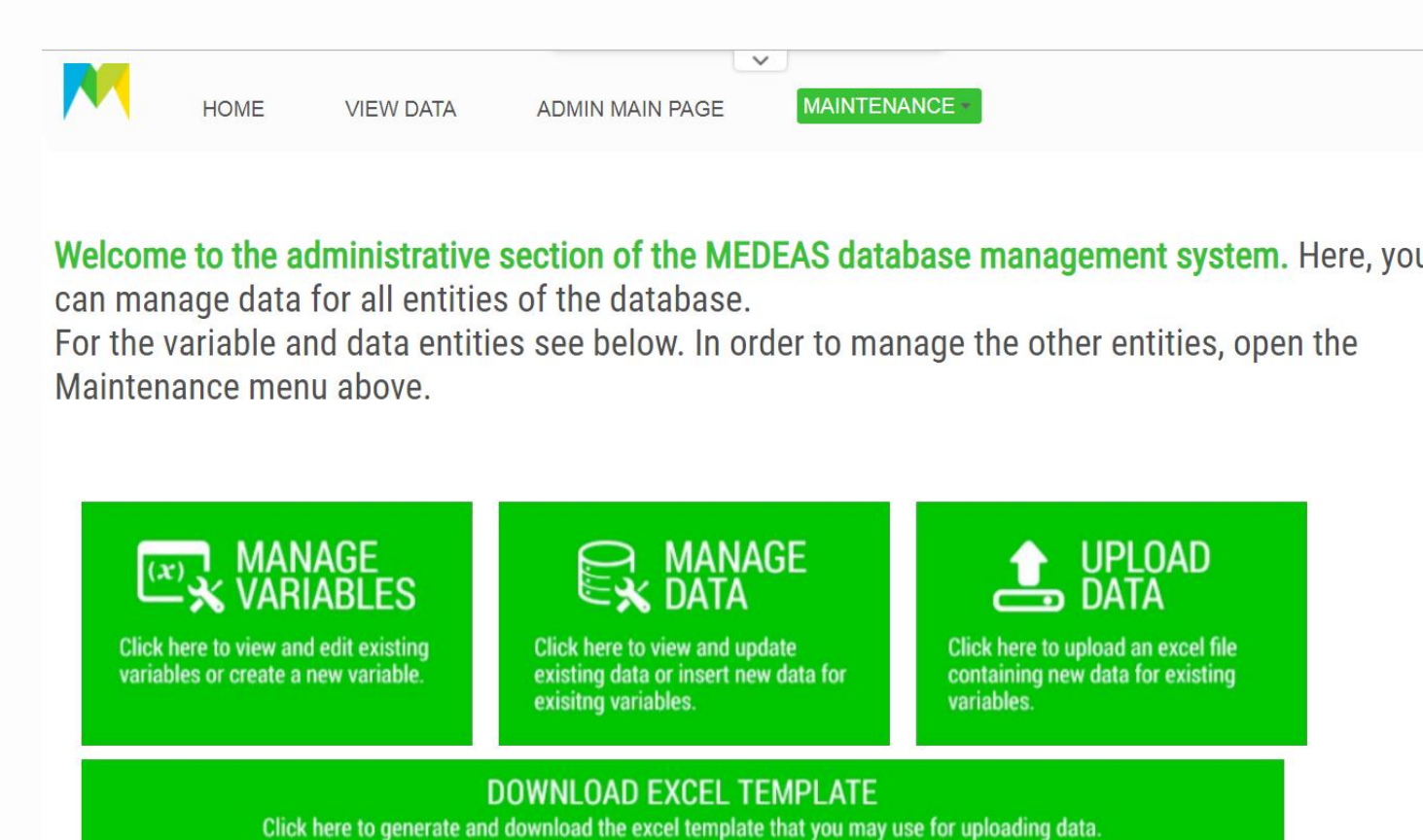


Figure 5 Administrator main page

A. When clicking the “Download Excel Template” button, the application reads the database and exports data in an excel file with a certain structure, called the Excel Template. All information stored in the database the moment the user downloads this template is copied to its worksheets. This template is used to upload data and store them in the database through the “Upload data” link of the main admin page.

B. Manually data is inserted through the “Manage data” link. The application

opens a list of all values (i.e. all data) stored in the database. In this page, data can be viewed using proper filters and values can be created and edited (i.e. insert or update data).

Similarly to data, a user can also manage variables.

Contact

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