### MANAGEMENT OF MULTIPLE VACCINATION CENTRE

This webapp was designed and realised as an examination project for 'WEB ARCHITECTURE AND SYSTEMS DESIGN (code 13581)', a subject of the university course of study 'COMPUTER ENGINEERING (code 2035)', taught by Professor Marco La Cascia, professor at the University of Palermo, with an exam score of 30/30 cum laude.

**Introduction and description of web-app functionality**

The web app includes four protected areas, and one publicly accessible area.

The protected areas are respectively:

* area utente
* area medico
* area operatore Asp
* area accettazione.

These areas are accessible by registered users with the corresponding role.

The non-protected area, apart from the welcome page and the login and registration pages, which for obvious reasons can be accessed publicly, is the . “Sala d’aspetto” page.

Protected areas:

**Area utente:**

In this area it is possible to:

* Booking a vaccination
* Access the data of a pending reservation
* Access the history of bookings made
* Access your vaccination data
* Display the QR-Code of the green pass for the last vaccination carried out

***Reservation of vaccine:***

This functionality allows you to book a vaccine at an available vaccination centre in the selected area.

A form allows you to select in order, the region, the province and possibly the municipality in which you wish to search for an available vaccination centre.

If only the province is selected it will search for vaccine centres, entered in the appropriate table of the DB, by an ASP operator, for the whole province, while if the municipality is specified the search will be more specific.

If the search returns one or more vaccination centres, it is possible to select one of them in order to see the days on which it is possible to book the vaccine.

Each vaccination centre has a number of available places, which vary depending on the day .

Realistically, many similar vaccine-booking systems provide for direct interaction by an operator, who is in charge of defining the days when the public is open and on which it is possible to make a reservation.

In addition to entering the days open for booking, the possibility of specifying by the ASP operator the number of places available per day has been provided for. This information was deliberately linked to the individual opening day to allow greater flexibility on the number of places, which varies not only on the basis of the vaccination centre but also in relation to the opening day.

The checks carried out during the booking phase include a check for any pending bookings (status associated with a booking that has a date greater than or equal to today's date, taken as 00:00, and which is not completed) or if the maximum number of permissible administrations has been reached.

Once the booking has been made, the booking will be displayed with the relevant information directly on the same page.

***Access to booking data:***

It is possible to have one 'valid' pending booking at a time, where valid means a booking that is in reference to today's or future date and that has not been confirmed, i.e. has not already been administered and thus confirmed by the doctor.

It is therefore possible to access the booking information, including the vaccination centre and date, for both a pending and past booking.

In the case of a pending booking, the relevant booking code will be visible, which can be used to trace the booking if necessary.

The created code is defined by means of the hash function of java on the user's data, such as first name, surname and social security number, with a few adjustments to ensure that a code is defined in an easily readable format.

***Access to data administration:***

If there is at least one administration, the data for this or these will be displayed. Then there will be a summary of the data of the vaccine administered, entered by the doctor who carried out the procedure, the data of the vaccination centre where the vaccine was administered and the code of the doctor who carried out the administration.

The QR-Code for the last administration carried out will be visible in large size.

The Qr-Code is generated using a specific jQuery library from the user's personal information, such as name, surname, tax code and booking code, which can be retrieved by scanning the latter.

**Area medico:**

In this area it is possible to:

* Request user authorisation
* Search for a user by booking code
* Search a list of users by vaccination centre
* View user information
* Fill in the form for entering the data of the vaccine administered
* Confirm administration

***Request user authorisation:***

In order to access the functions of the protected area, after registering, the first time you log in you will be asked to select the vaccination centre where the service will be carried out and to which the account will be linked by means of a special table.

Once the vaccination centre has been confirmed, the doctor's user name will be confirmed by an authorised ASP operator. Once the necessary internal checks have been carried out, the operator will be able to proceed with the confirmation and therefore with the enabling of the doctor's user account.

***Cercare un utente per codice di prenotazione***

With this functionality, it is possible to search for a user by means of the booking code provided by the user.

In this way, the doctor can search for the user if the code is valid.

The booking code is validated if:

* existing
* concerning a reservation in the vaccination centre where the doctor is working
* whether with reference to today's date
* whether he/she has followed the procedure for shift entry after acknowledgement in reception

If it is valid, the doctor can view the user's personal data and proceed with the administration.

***Search a list of users by vaccination centre:***

Similar procedure to the one described above, with the difference that the doctor can search for the patient in the list of users who have been entered in turn by the receptionist in the vaccination centre where the doctor works.

***Fill in the form to enter the data of the vaccine administered and confirm the administration:***

Once the user's data has been retrieved, it is possible to proceed with filling in the form for the vaccine being administered.

Confirming the data confirms the administration of the vaccine to the selected user.

Once confirmed, the user can access his private area to view the administration data and the Qr-Code generated, which will act as a green pass.

**Area Accettazione:**

In this area it is possible to:

* Request user enablement
* Place a user in turn
* Put an unbooked user on shift
* Display the shift in the room

***Requesting user authorisation:***

As with the doctor, before the functionality can be used, the operator's user must be approved in reception by an authorised ASP operator.

***Putting a user in turn:***

L’operatore può mettere a turno un utente che si presente in accettazione.

Può quindi cercare tramite codice di prenotazione l’utente abilitato.

Il concetto di abilitato è uguale a quello descritto per la ricerca dell’utente nell’area medico, considerando che la prenotazione dovrà essere relativa a quella del centro vaccinale nella quale lavora l’operatore dell’accettazione.

Una volta trovata la prenotazione è verificata quindi la validità l’utente viene inserito a turno.

**Enter an unbooked user:**

If a user who is not booked but has an active user shows up, the check-in operator can enter a new booking for today's date after checking the validity of the user.

***Display the shift in the hall:***

The current shift number, confirmed and available room seats for the reception operator's vaccination centre are shown.

The operator can then use this view by clicking on the appropriate icon, which will open a sub-page showing the data on the screen. In this way, the users in the room can see the shift number and get useful information.

**Area ASP:**

In this area it is possible to::

* Request user authorisation
* Approve employee authorisation requests per vaccination centre
* Enter new vaccination centre
* Enter opening dates per vaccination centre

***Requesting authorisation of the user:***

Come per il medico e l’operatore in accettazione prima di poter utilizzare le funzionalità deve essere approvata l’utente dell’operatore da un altro operatore ASP abilitato.

***Cercare una lista di utenti per centro vaccinale:***

The ASP operator can search for any requests to enable employees from a specific vaccination centre, or by province.

Once the request has been found, the operator can access the personal data of the employee who is applying for authorisation, and once the necessary checks have been made on the user, he or she can enable the request.

***Enter a new vaccination centre:***

The Asp operator may enter a new vaccination centre, specifying the region, province, municipality, name and address where it is located.

No two vaccination centres can have the same combination of information.

***Enter the opening dates per vaccination centre and number of places available::***

The Asp operator can search for a vaccination centre and enter its opening dates.

In addition, for each opening day entered he can specify the number of places available on that date.

Unprotected areas:

**“Turno Sala” area:**

L’area turno sala visualizza le informazioni del tabellone della sala d’attesa, per uno specifico centro vaccinale selezionato, con aggiornamento della pagina ogni 10 secondi.

**Utility area of the web app:**

It includes the welcome page, log-in/log-out and registration.

### SYSTEM ARCHITECTURE

Technologies used:

1. Java servlet classes, for the acceptance of http requests, for the construction of the corresponding response web pages and for the validation and processing of the data entered by the client
2. JSP for the main views, home and category views, and for building JSON files used for AJAX calls
3. REALMS for defining personal areas for doctor, user, asp, acceptance roles
4. HTML, CSS and JavaScript, JQuery, for user interface management
5. JQuery library jquery.qrcode.min.js, popular library for generating Qr\_Codes
6. Bootstrap and fontawesome for the layout
7. Apache Tomcat, as middleware for web application deployment
8. MySQL was used as relational database
9. The MVC approach was used, for AJAX requests, login, registration and the main functionalities of the web app, especially the functionalities on the main pages of the various protected areas
10. JSON for AJAX calls as Controller response in view of the MVC approach
11. DAO (Data Access Object) pattern for defining the database access architecture and for loading SQL queries from a properties file. We proceeded by defining the DBManager class for opening the connection to the DB, loading the properties file containing the queries and retrieving them. We defined an abstract class called QueryAbstract, which takes care of requesting the connection to the DB via DBManager, defining the preparedStatement, 'unpacking' the DB result by creating a list of a generic type, and also defining an abstract method which will be implemented by all the classes implementing QueryAbstract.

Finally, the above-mentioned classes were created to define the interaction between the DB and the controller servlet, using the corresponding Bean according to the MVC model as information transport.

1. Utility class for managing the date and time, such as the conversion of the timestamp format from string and vice versa, and others, and class for 'centralised' management of exceptions, with logging in the console by means of the appropriate java Logger class.
2. XML for the vaccination data file for the ASP operator.

### DATA MODEL

DB logic diagram.

