Clinic appointments and treatment administration system.

User requirements.

The system should allow the clinic staff to book appointments for patients' examinations and procedures. A staff user first must be able to check the available timeslots for a required type of appointment and then to select a timeslot suitable for a patient. The appointment may include assigning doctors and/or nurses, room, required medicine and equipment for procedures.

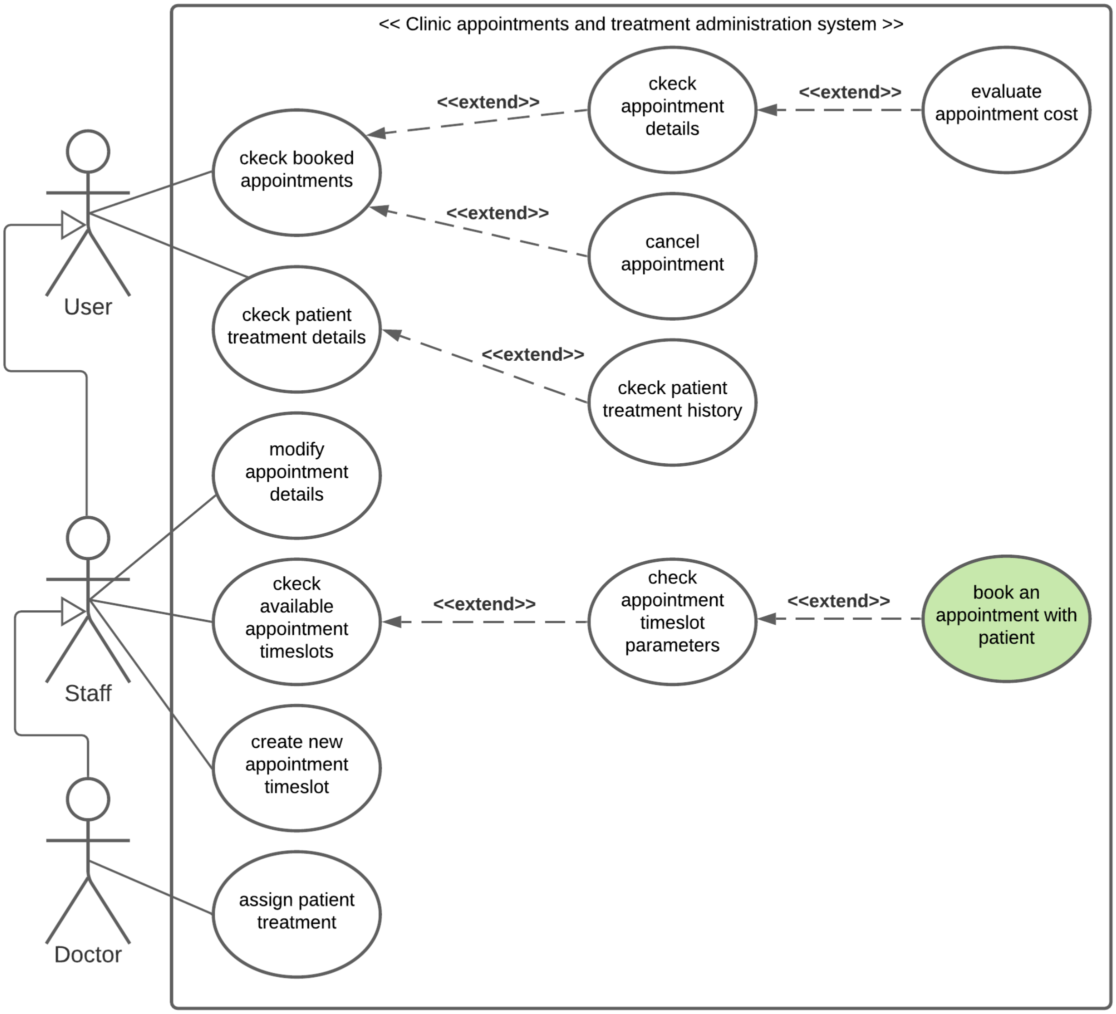
Patients should be able to enter the system using their patient accounts to check details about their appointments or cancel their appointments. Patients should also be able to check their treatments details and history.

Doctors and Nurses should also be able to check appointments details, book, cancel or create new appointments, access patients' treatment details and history.

Doctors should be able to assign patients treatment.

It should also be possible to evaluate an appointment cost based on involved staff rates, used medicine and equipment.

Figure 1. Use case diagram.



<< Clinic appointments and treatment administration system >>
User
Staff
Doctor
ckeck booked appointments
ckeck appointment details
evaluate appointment cost
cancel appointment
ckeck patient treatment details
ckeck patient treatment history
modify appointment details
ckeck available appointment timeslots
check appointment timeslot parameters
book an appointment with patient
create new appointment timeslot
assign patient treatment
<<extend>>
<<extend>>
<<extend>>
<<extend>>
<<extend>>
<<extend>>

Use case scenario: "Book an appointment with patient".

The process starts with a Staff worker (who is authorised for appointments administration) clicking the button "Appointment booking" in the "Booked appointments" screen. This opens the "Appointments time slots search" screen (*use case: Check available appointments timeslots*).

To check available timeslots, the user first needs to select an appointment type. Optionally other parameters like the name of a doctor or time range can be entered. Then the "Search" button can be clicked. Available appointments timeslots for given parameters will be displayed on the "Available appointment time slots" screen.

Now the user can click a preferred timeslot to proceed to its booking. This will open the "Appointment booking" screen (*use case: Check appointment timeslot parameters*). To book an appointment with patient (*use case: Book an appointment with patient)* the user must select a patient for the "Patient" parameter. After all the details are set up the user can press the "Submit" button. The user will be returned to the Booked appointments" screen.

Figure 2. Class diagram – analytical.

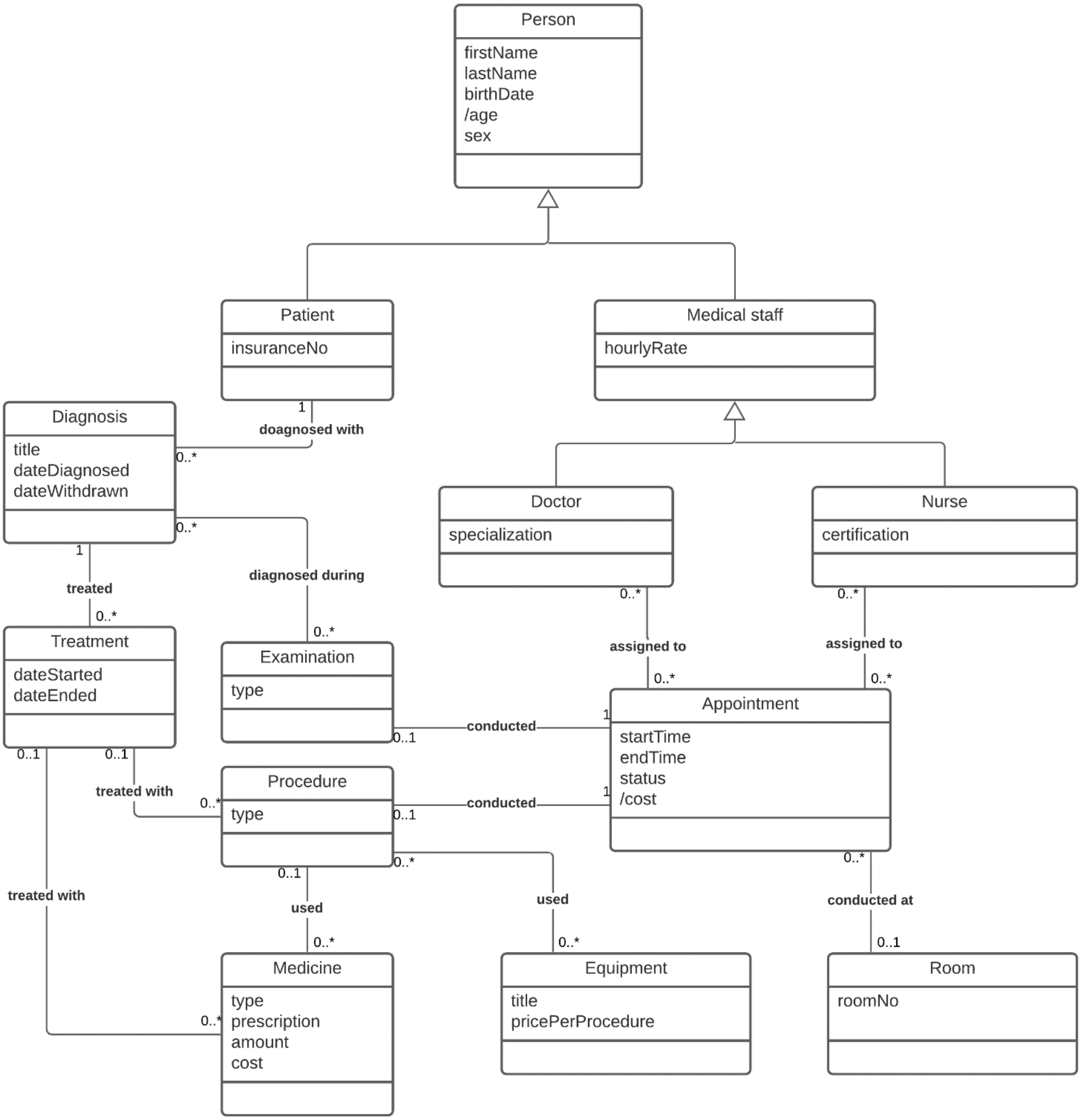


Figure 3. Class diagram – design.

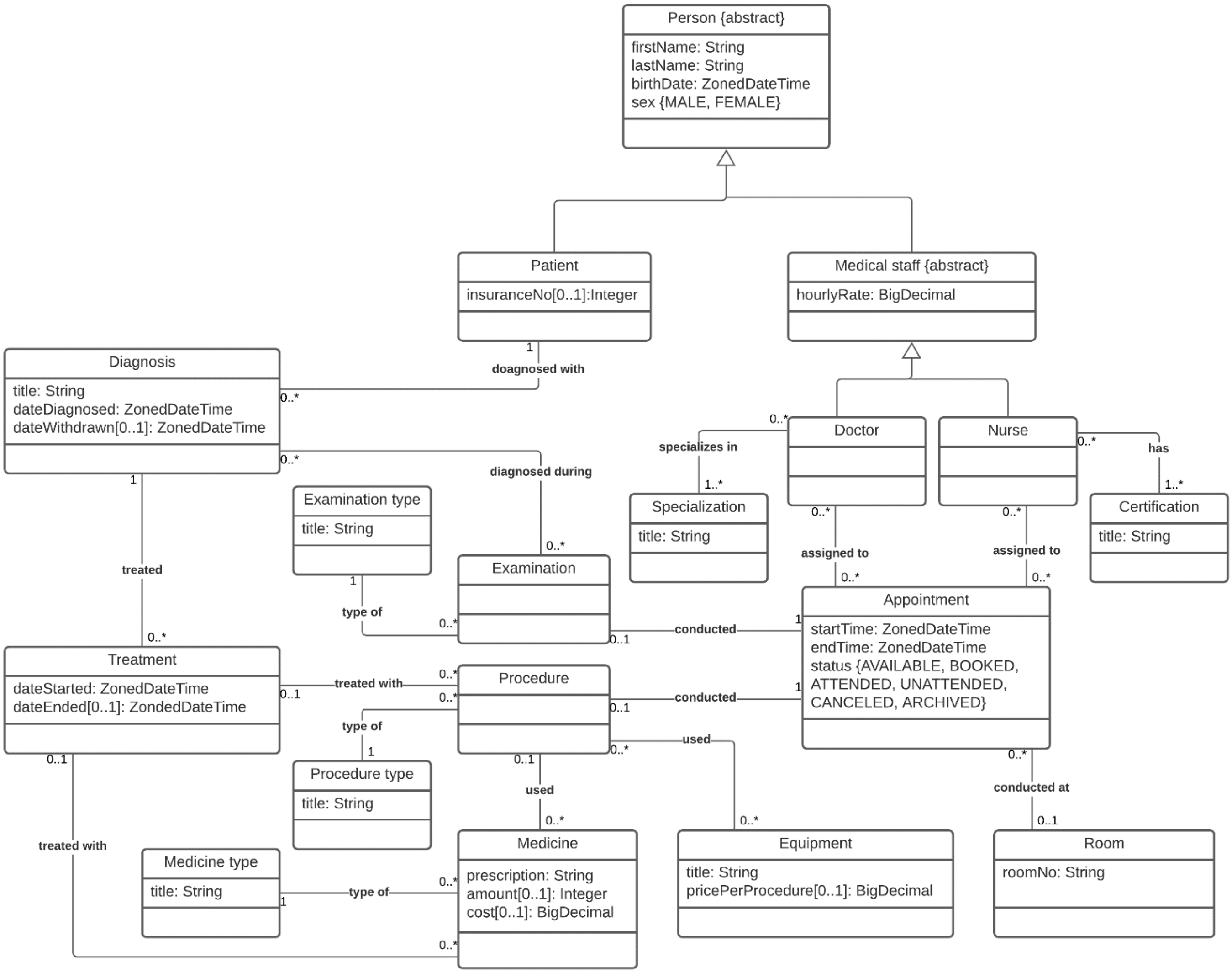


Figure 4. Interaction (sequence) diagram. *("Book an appointment with patient" use case)*

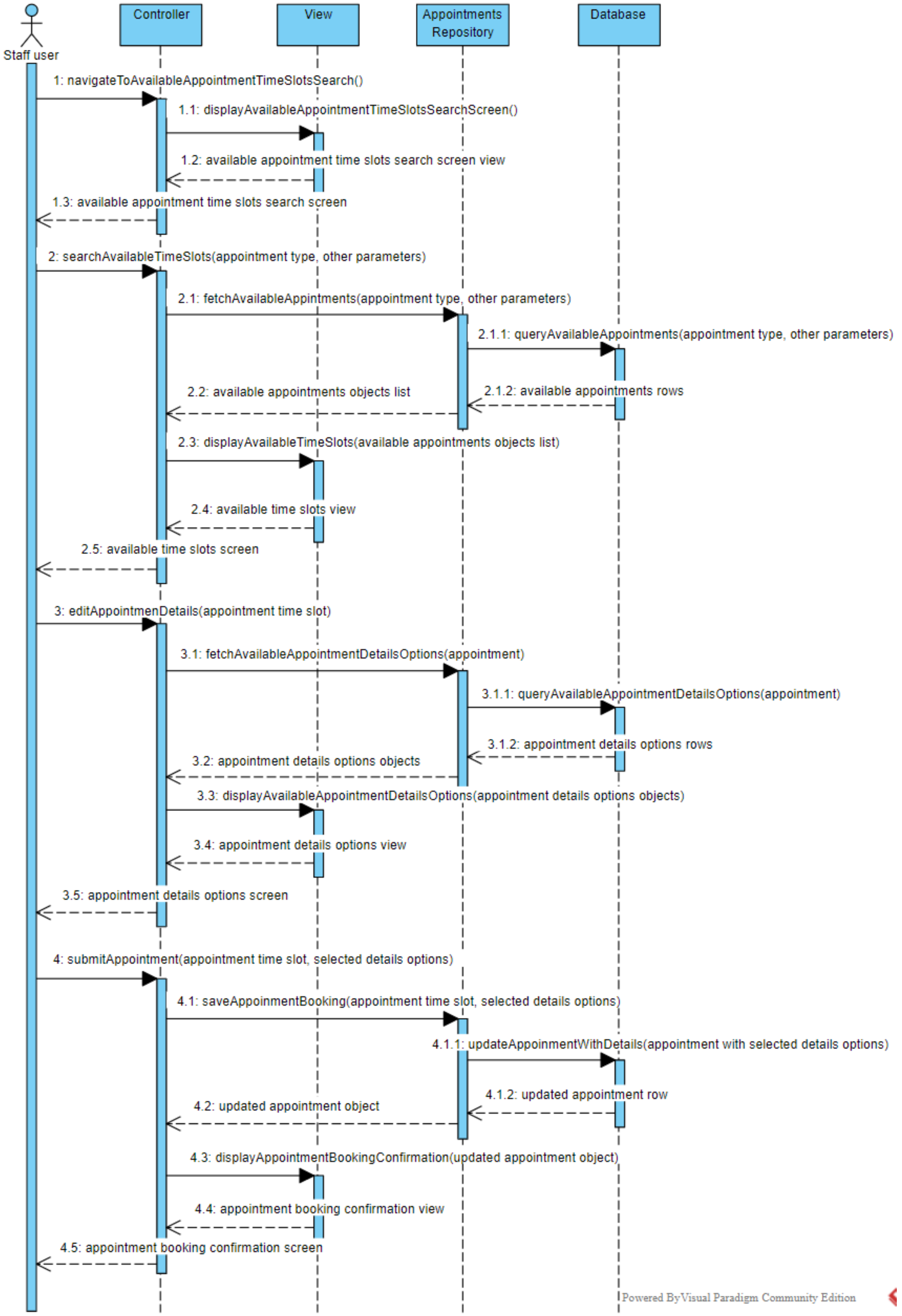

Staff user
Controller
View
Appointments Repository
Database
1: navigateToAvailableAppointmentTimeSlotsSearch()
1.1: displayAvailableAppointmentTimeSlotsSearchScreen()
1.2: available appointment time slots search screen view
1.3: available appointment time slots search screen
2: searchAvailableTimeSlots(appointment type, other parameters)
2.1: fetchAvailableAppintments(appointment type, other parameters)
2.1.1: queryAvailableAppointments(appointment type, other parameters)
2.1.2: available appointments rows
2.2: available appointments objects list
2.3: displayAvailableTimeSlots(available appointments objects list)
2.4: available time slots view
2.5: available time slots screen
3: editAppointmenDetails(appointment time slot)
3.1: fetchAvailableAppointmentDetailsOptions(appointment)
3.1.1: queryAvailableAppointmentDetailsOptions(appointment)
3.1.2: appointment details options rows
3.2: appointment details options objects
3.3: displayAvailableAppointmentDetailsOptions(appointment details options objects)
3.4: appointment details options view
3.5: appointment details options screen
4: submitAppointment(appointment time slot, selected details options)
4.1: saveAppoinmentBooking(appointment time slot, selected details options)
4.1.1: updateAppoinmentWithDetails(appointment with selected details options)
4.1.2: updated appointment row
4.2: updated appointment object
4.3: displayAppointmentBookingConfirmation(updated appointment object)
4.4: appointment booking confirmation view
4.5: appointment booking confirmation screen
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Figure 5. Activity diagram. *("Book an appointment with patient" use case)*

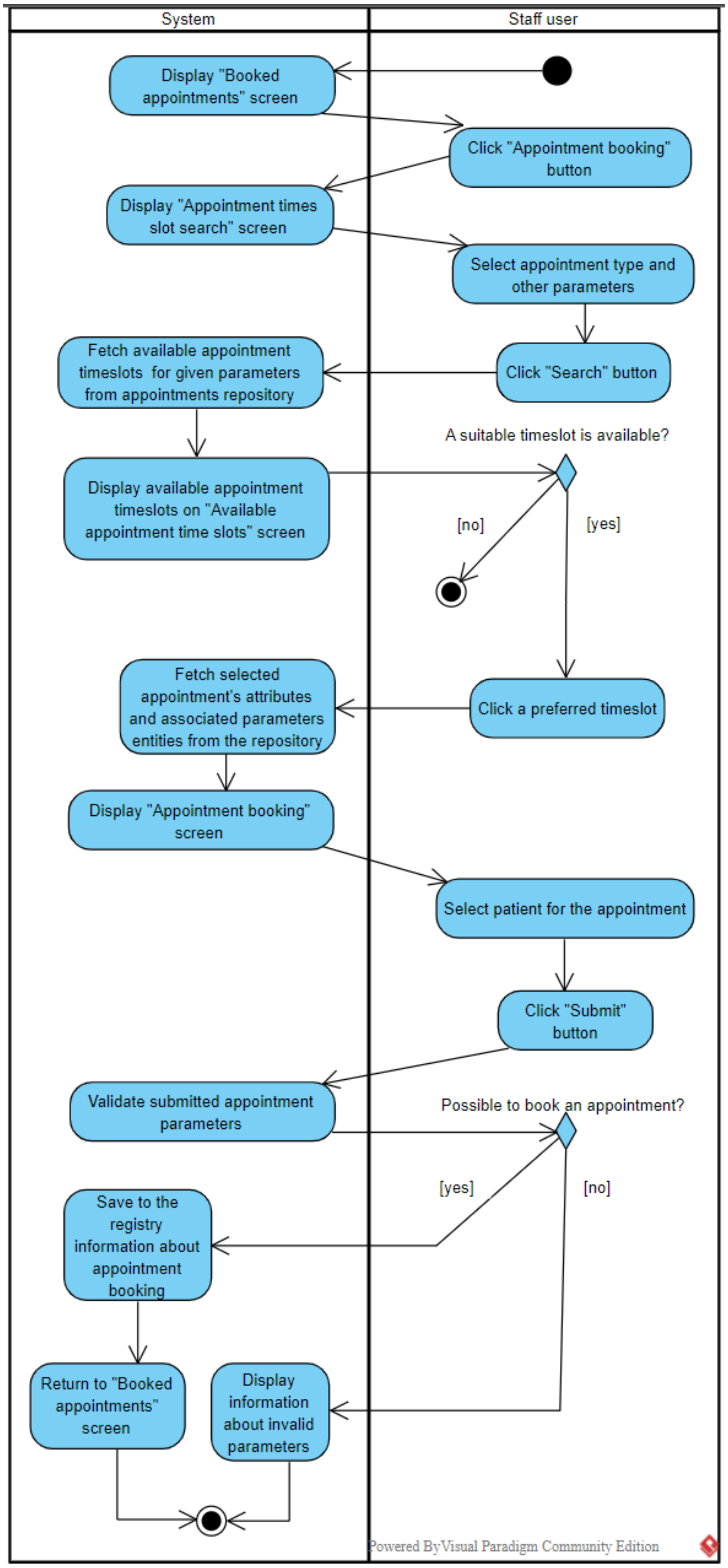
System
Staff user
Display "Booked appointments" screen
Click "Appointment booking" button
Display "Appointment times slot search" screen
Select appointment type and other parameters
Click "Search" button
Fetch available appointment timeslots for given parameters from appointments repository
Display available appointment timeslots on "Available appointment time slots" screen
A suitable timeslot is available?
[no]
[yes]
Click a preferred timeslot
Fetch selected appointment's attributes and associated parameters entities from the repository
Display "Appointment booking" screen
Select patient for the appointment
Click "Submit" button
Validate submitted appointment parameters
Possible to book an appointment?
[yes]
[no]
Save to the registry information about appointment booking
Return to "Booked appointments" screen
Display information about invalid parameters
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Figure 6. State diagram of Appointment entity lifecycle.

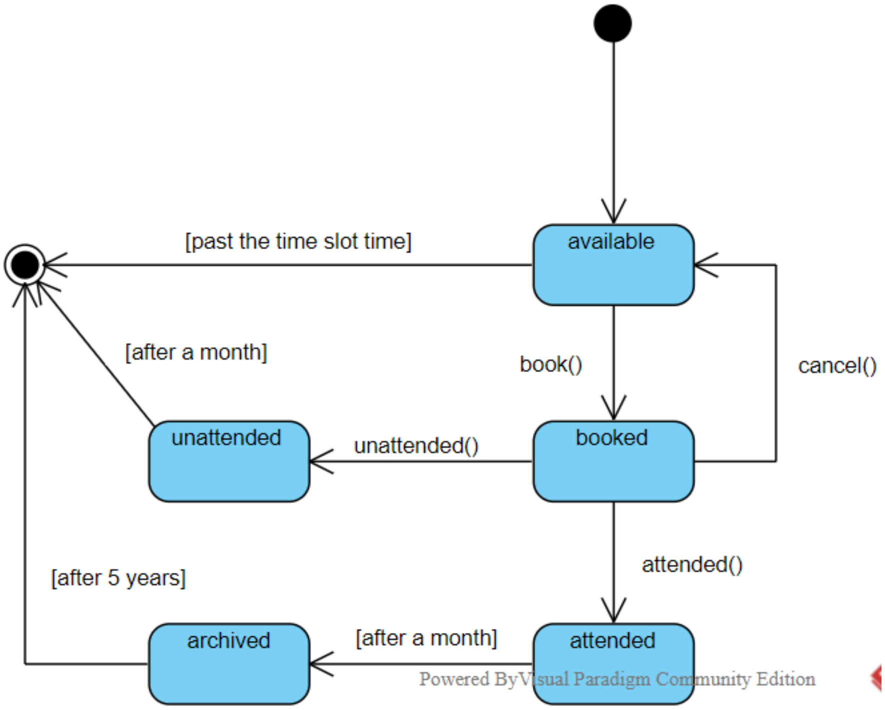
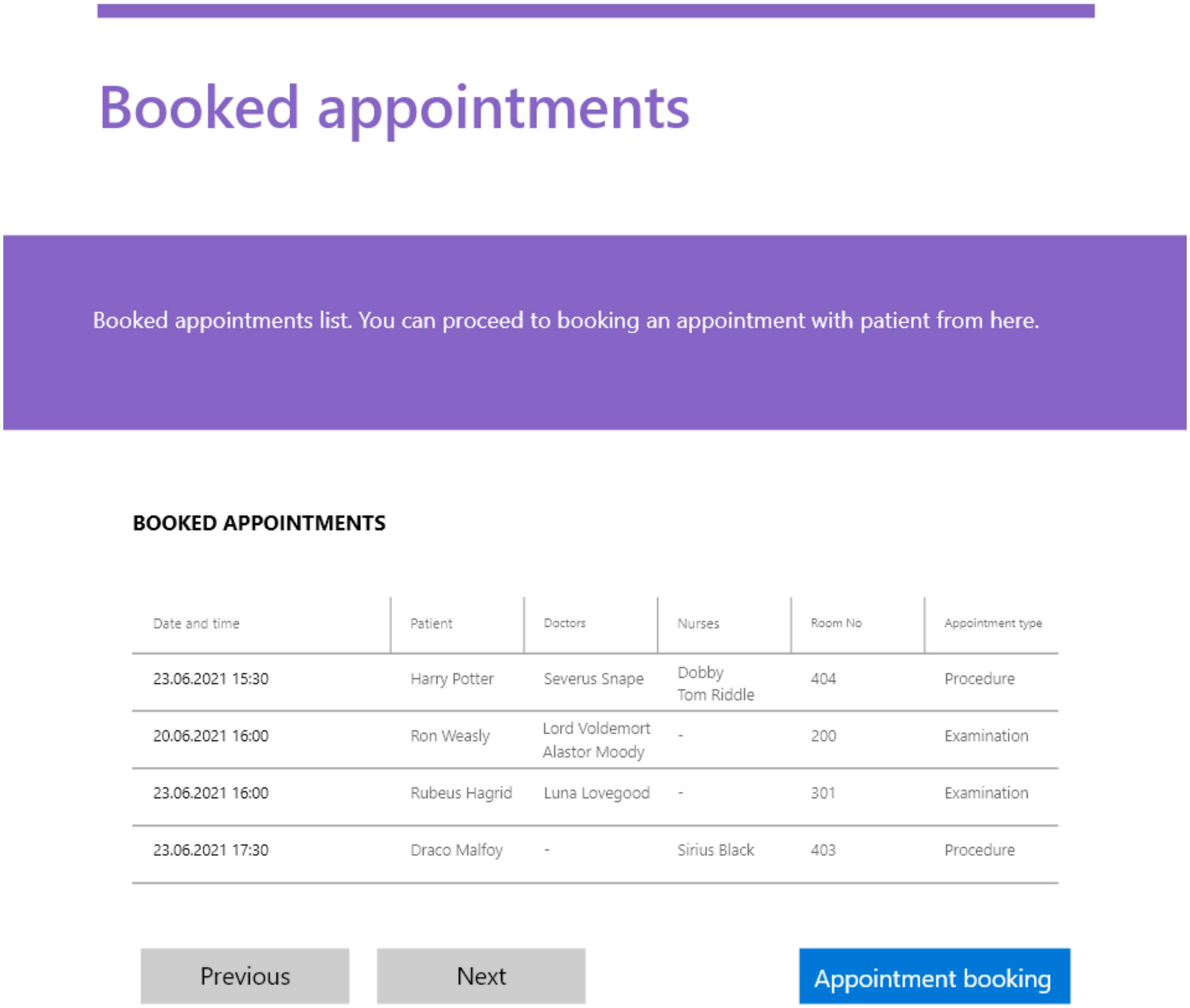


Figure 7. GUI design for “Book an appointment with patient” use case flow:

“Booked appointments” screen with "Appointment booking" button.



Booked appointments

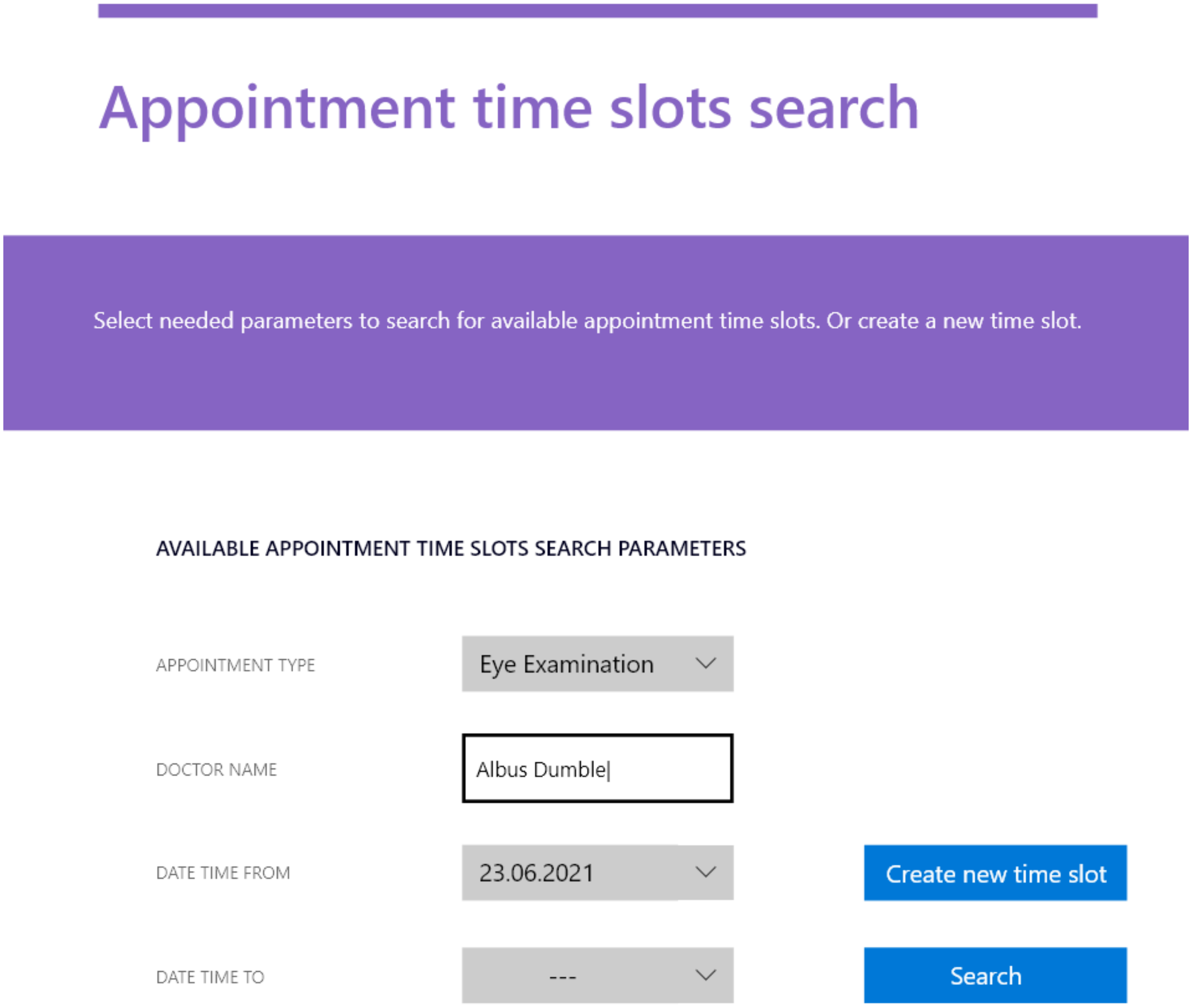
Booked appointments list. You can proceed to booking an appointment with patient from here.

BOOKED APPOINTMENTS

Date and time	Patient	Doctors	Nurses	Room No	Appointment type
23.06.2021 15:30	Harry Potter	Severus Snape	Dobby Tom Riddle	404	Procedure
20.06.2021 16:00	Ron Weasly	Lord Voldemort Alastor Moody	-	200	Examination
23.06.2021 16:00	Rubeus Hagrid	Luna Lovegood	-	301	Examination
23.06.2021 17:30	Draco Malfoy	-	Sirius Black	403	Procedure

Figure 8. GUI design for “Book an appointment with patient” use case flow:

“Appointment time slots search” screen with search parameters and “Search” button.



Appointment time slots search

Select needed parameters to search for available appointment time slots. Or create a new time slot.

AVAILABLE APPOINTMENT TIME SLOTS SEARCH PARAMETERS

APPOINTMENT TYPE: Eye Examination

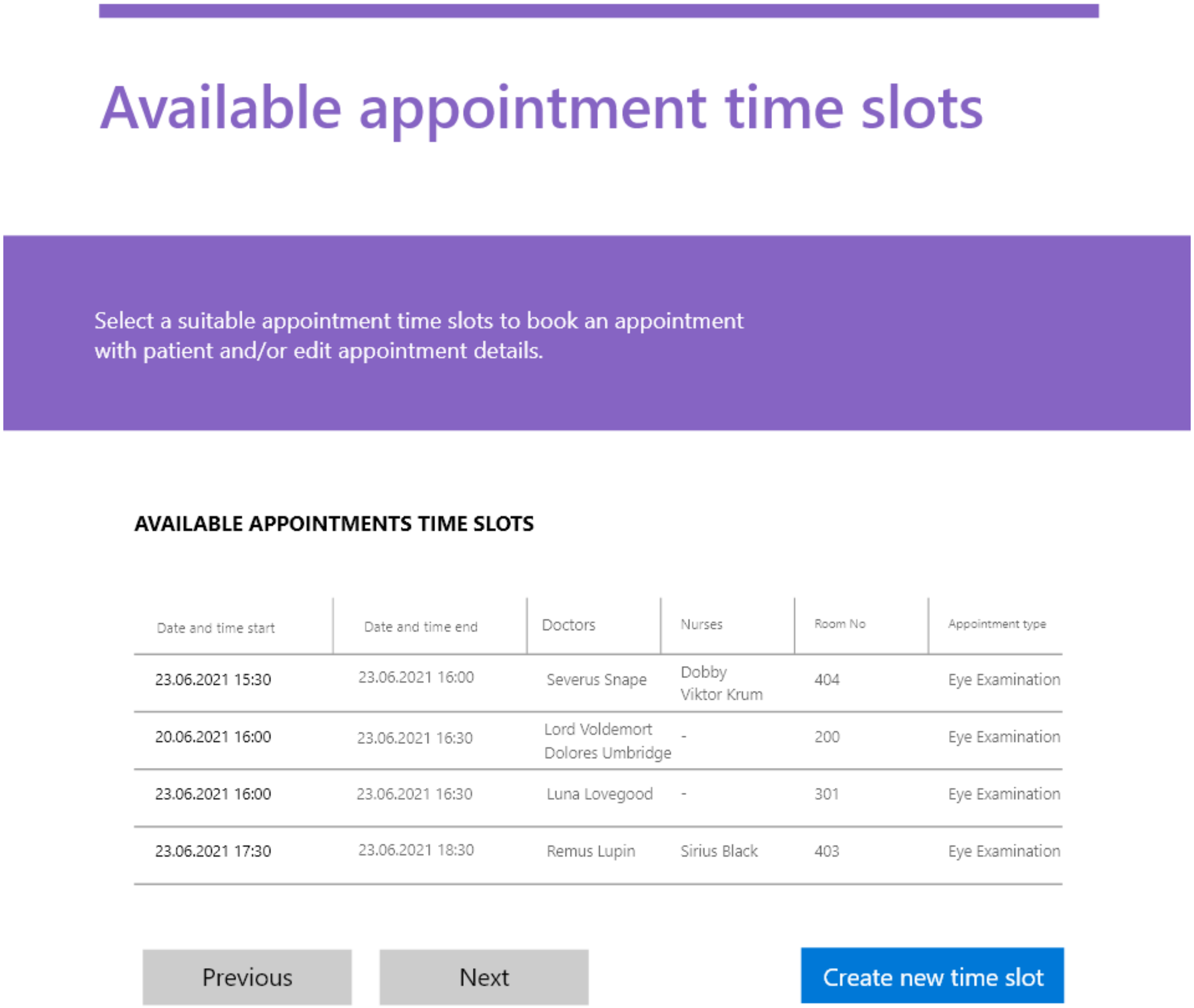
DOCTOR NAME: Albus Dumble|

DATE TIME FROM: 23.06.2021

DATE TIME TO: ---

Figure 9. GUI design for “Book an appointment with patient” use case flow:

“Available appointment time slots” screen with available time slots list (clickable time slot items) and “Create new time slot” button.



Available appointment time slots

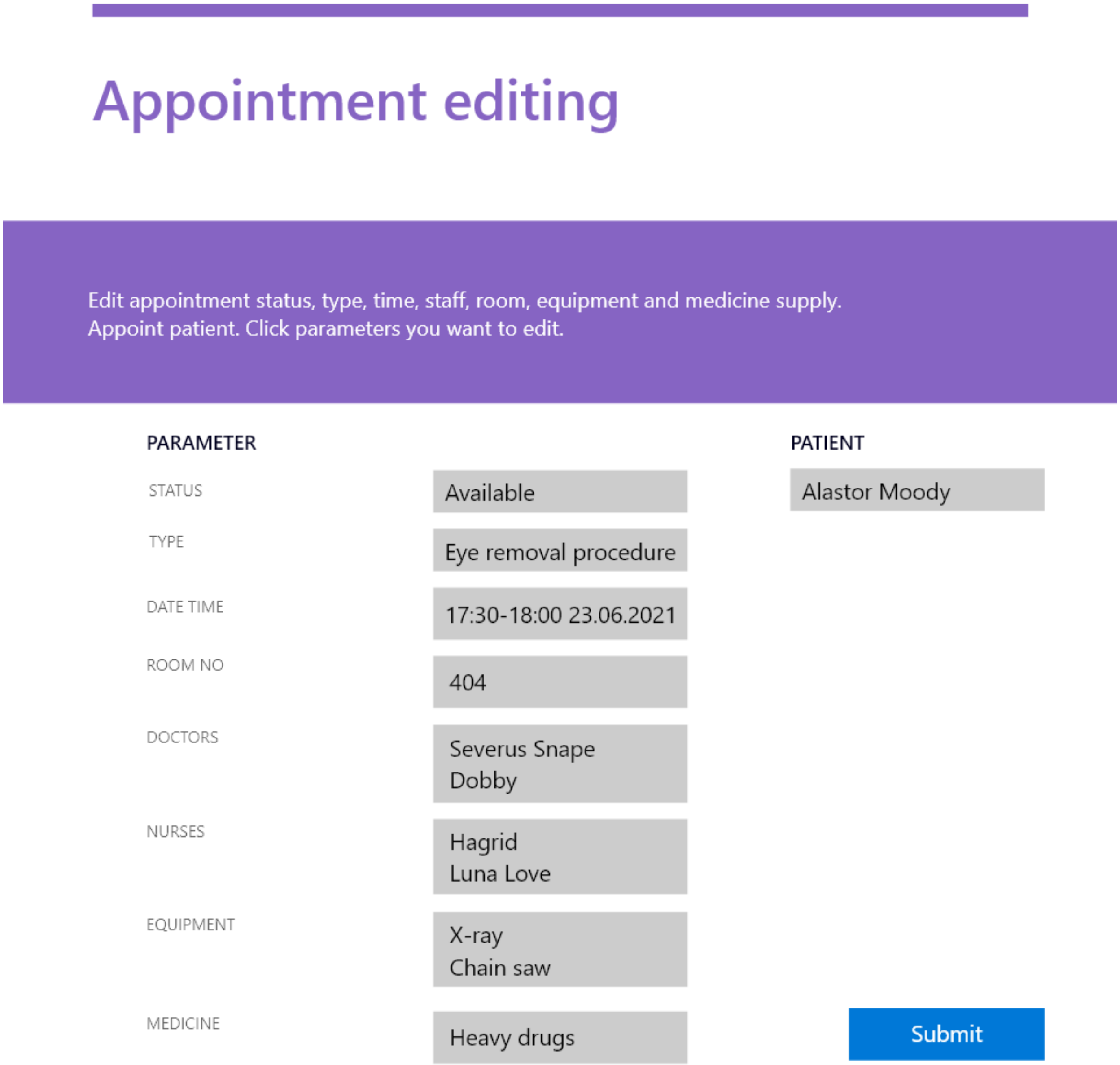
Select a suitable appointment time slots to book an appointment with patient and/or edit appointment details.

AVAILABLE APPOINTMENTS TIME SLOTS

Date and time start	Date and time end	Doctors	Nurses	Room No	Appointment type
23.06.2021 15:30	23.06.2021 16:00	Severus Snape	Dobby Viktor Krum	404	Eye Examination
20.06.2021 16:00	23.06.2021 16:30	Lord Voldemort Dolores Umbridge	-	200	Eye Examination
23.06.2021 16:00	23.06.2021 16:30	Luna Lovegood	-	301	Eye Examination
23.06.2021 17:30	23.06.2021 18:30	Remus Lupin	Sirius Black	403	Eye Examination

Figure 10. GUI design for “Book an appointment with patient” use case flow:

“Appointment editing” (renamed to “Appointment booking”) screen with appointment details parameters and “Submit” button.



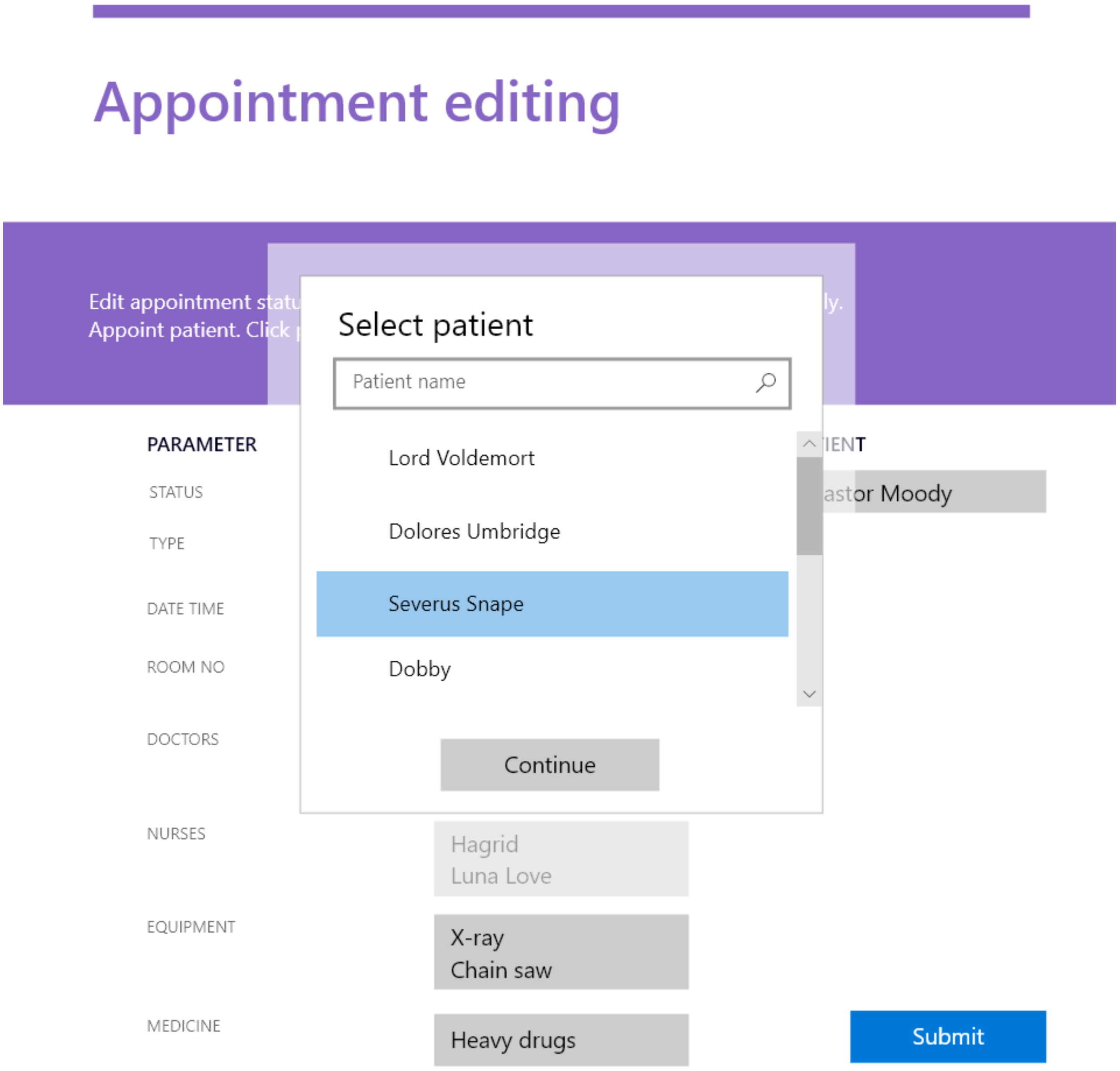
Appointment editing

Edit appointment status, type, time, staff, room, equipment and medicine supply.
Appoint patient. Click parameters you want to edit.

PARAMETER		PATIENT
STATUS	Available	Alastor Moody
TYPE	Eye removal procedure	
DATE TIME	17:30-18:00 23.06.2021	
ROOM NO	404	
DOCTORS	Severus Snape Dobby	
NURSES	Hagrid Luna Love	
EQUIPMENT	X-ray Chain saw	
MEDICINE	Heavy drugs	

Figure 11. GUI design for “Book an appointment with patient” use case flow:

“Appointment editing” (renamed to “Appointment booking”) screen with “Select patient” box, which allows to appoint a patient.



Appointment editing

Edit appointment statu ly.
Appoint patient. Click

Select patient

Patient name

Lord Voldemort

Dolores Umbridge

Severus Snape

Dobby

PARAMETER

STATUS

TYPE

DATE TIME

ROOM NO

DOCTORS

NURSES

EQUIPMENT

MEDICINE

IENT

astor Moody

Hagrid
Luna Love

X-ray
Chain saw

Heavy drugs

Discussion of the design decisions.

The Class Diagram is designed for the implementation using an ORM framework – Hibernate in particular. All the classed are designed as models for ORM entities, they are all just POJOs. The Class Diagram purposefully describes only the data types and associations structure, it does not include any logic utilization classes (Services/Controllers etc.) with functions.

As the classes will be used as Hibernate entities, they all need an “id” field. As this attribute would be the same for all classes, it is purposefully omitted in the diagram to make it less loaded.

The same applies to private fields annotation, as all the fields in all classes would be private with public getters and setters.

As all the logic would be placed in some Service classes (which are not part of the entities class diagram) the derived attributes are removed from the design class diagram as their values will be calculated in some of the logic (Service) classes methods.

The Examination, Procedure and Medicine types are made to be stored in separate entities with association to Examination, Procedure and Medicine entities. This way the types can be reused in multiple associated entities. And querying all the available types is more effective.

In class Doctor attribute “specialization” and in class Nurse attribute “certification” also moved to separate classes Specialization and Certification. This has the benefits of reusability and more effective querying of all available entity variants.

Medicine class attributes “amount” and “cost” are optional as they are needed only when a medicine is used during procedure, otherwise it is just a prescription for a patient treatment (patient buys medicine outside the clinic).

Equipment class “pricePerProcedure” attribute is optional because some of the equipment may be used without including it in patient’s appointment cost.

Diagnosis can be associated with 0 examinations because a diagnosis information can be entered as a part gathering new patient’s medical history and not diagnosed during examination.

“RoomNo” attribute in Room class has type String in case a room number would also include some letters, e.g., rooms with numbers “101A” and “101B”.

Important for 4.2.4 requirement:

Appointments time slots in the “Book an appointment with patient” use case are not necessarily created during the use case scenario, and the UI design prototype does not display the extents of Appointment's parameters, but it displays the existing associations of the Appointment. Booking is not equal to creating a new Appointment entity, but it is rather modifying an existing Appointment's associations.

In the “Available appointment time slots” screen there is a list of time slots, each time slot (Appointment) has multiple associations, some of those associations are “Many” associations (lists).