CMMS Report

Team members

Name	Seat number	Section	Bench number
Ahmed Khaled Mohammed	53004	1	4
Bassam Mustafa Mahmoud	53022	1	22
Shaden Ahmed Abd EL Baky	53044	1	44
Tarek Allam Ibrahim	53047	2	2

Introduction:

This project is Computerized maintenance management system (CMMS), it is a database system that organizes maintenance and other device-related operations.

This systems aims to make management and maintenance operations more effective for all parts involved, also allows better allocation of resources.

The database involved in the system can also be analyzed later to better recognize patterns of different scenarios that happen frequently in the hospital.

Background data:

Three hospital departments where chosen for this project, and the project can be further extended to include more departments in future versions.

The departments and their hierarchy are as shown in Figure 1.

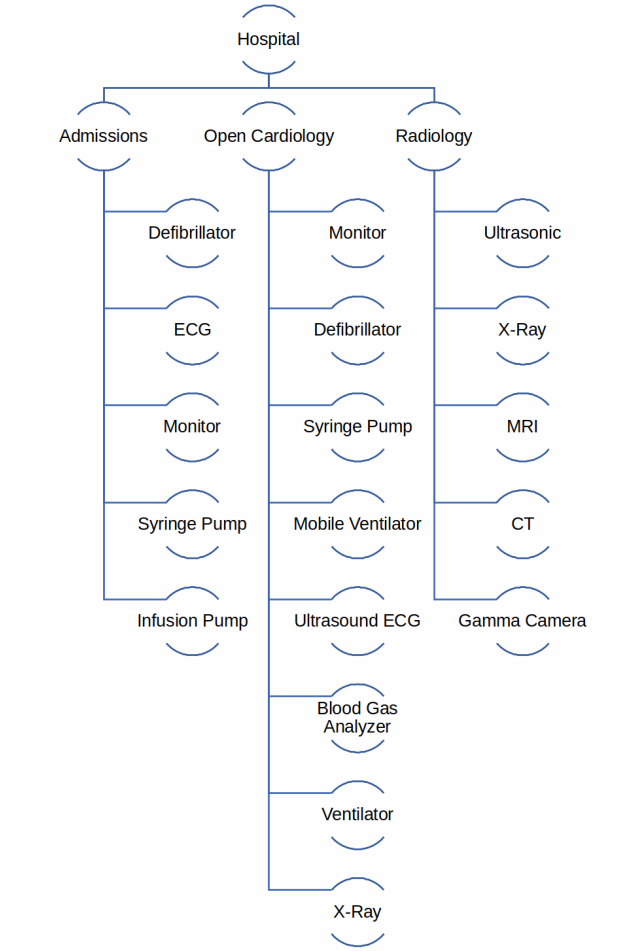


Figure 1: Hospital hierarchy

Other background data is gathered from miscellaneous sources, including standards, textbooks, web articles, and device manuals.

Most of the background date is gathered in “background_data” folder.

Programming background:

For the project we need some sort of database server, a programming language of choice, connector to connect the programming language to database, and a deployment method.

In details the programming components are:

Database server: MySQL server v 8.0

Programming language: Python 3

Connector: PyMySQL

Deployment method: Server application (Using flask v 1.1)

Aitional component: SQLAlchemy

The server application deployment method is favored because it can be accessed anywhere from any device with internet connection, this gives great flexibility as opposed to other deployment methods that force workers to certain devices.

The aitional component “SQLAlchemy” is used to generate SQL queries on demand more efficiently, this allows the programmers to focus more on programming logic and less on SQL queries’ syntax.

The project handles four different CMMS components, namely:

1- Preventive maintenance.

2- Purchasing

3- Scraping

4- Movement

These components are tracked and a short or detailed report is given out by the system when requested.

Programming details:

Initialization “init.py”:

This file is run only once on every server to initialize the database, and its tables.

The tables are managers-specific, technicians-specific, operation-specific and device-specific where every device has its very own PPM (planned preventive maintenance).

Tables with a lot of columns (attributes) are divided into two or three tables connected by reference of primary key; this is because database servers read all columns for a given row even if a column selector is applied in query (it then deletes unwanted columns from memory buffer), thus making two or three tables with columns sorted according to read frequency gives a much better execution time.

The “init.py” file should be used only once to initialize database, but running the script multiple times won’t do any harm as this case is handled in program.

Note: country codes used in the tables are gathered from “ISO 3166 – country codes”

Helper functions “helpers.py”:

Helper function includes an error handling function “apology”, and four (4) security functions (two of which are disabled for ease of configuration and testing by supervisors).

The main program “application.py”:

The program first check the tables if they were initialized correctly or not, set website configuration (most importantly disable cache and make cookies temporary; to avoid any unauthorized access), then handle routes.

The program uses very few cookies to make data handling more efficient, however the cookies are temporary, as soon as the session is closed the cookies are deleted.

Registration uses tokens to handle cookies, the tokens are generated randomly to each user to prevent any mischievous user to predict the token and use it to get unauthorized access, also the passwords are not saved in the database as they are; they are hashed by “sha256, 50000 iteration” method to prevent if someone took access of the database itself to know the users

password, when the user logs in, the entered password is hashed using the same method and both hashes are compared to each other to validate login.

Also the tokens of cookies are validated on each page request to be certain no cookie-based attack could happen.

All the remove methods in the system do NOT delete the entry from the database; it only assigns a flag that denotes as if the entry is removed; i.e when a manager is removed he is not deleted from the database, his status field changes from “hired” to “fired” or “resigned”.

For every operation in the system there is a set of exception handlers and sanity checks to minimize errors and ease the use of system.

The flow of the program is:

- The system engineer defines the HRs of the hospital
- The HRs are the people who register and remove managers and technicians.
- The managers a, remove, and move the devices
- The managers also assign maintenance orders to technicians.
- The technicians review their due orders and submit them accordingly.

The routes defined in the program include:

- “index” (home route), this route displays contents differently according to the type of user (not logged in, manager, HR, or technician logged in)
- “login”, handles login of users.
- “logout”, logs the user out by clearing cookies.

HR-specific:

- “register”, handles registers.
- “remove”, removes manager or technician.

Manager-specific:

- “a device”, a a device to database, the device’s department is automatically assigned to the department of the manager who aed the device, also as the device to “installing report” table.

- “remove device”, removes device, also as the removed device to “scrap report” database (the device must be of the same department as the manager).

- “move device”, moves a device from one department to another, also as the moved device to “moved report” database (the device must be of the same department as the manager).

- “review device” gives a table of the devices and their attributes.

- “near dates” gives a table of the devices sorted according to the maintenance dates of devices.

- “assign order” gives a maintenance check order to a technician of choice.

- “review orders” a table of assigned orders and their attributes.

- “short PPM report” a short PPM report that can be exported to a PDF file.

- “detailed PPM report” a detailed PPM report that can be exported to a PDF file.

- “installing report” a purchasing report, can be exported to a PDF file.

- “moving report” a moving report, can be exported to a PDF file.

- “scraping report” a scraping report, can be exported to a PDF file.

Technician-specific:

- “due orders” a table of assigned order for the logged technician.

- “submit order” submits a due order.

Screenshots of system:

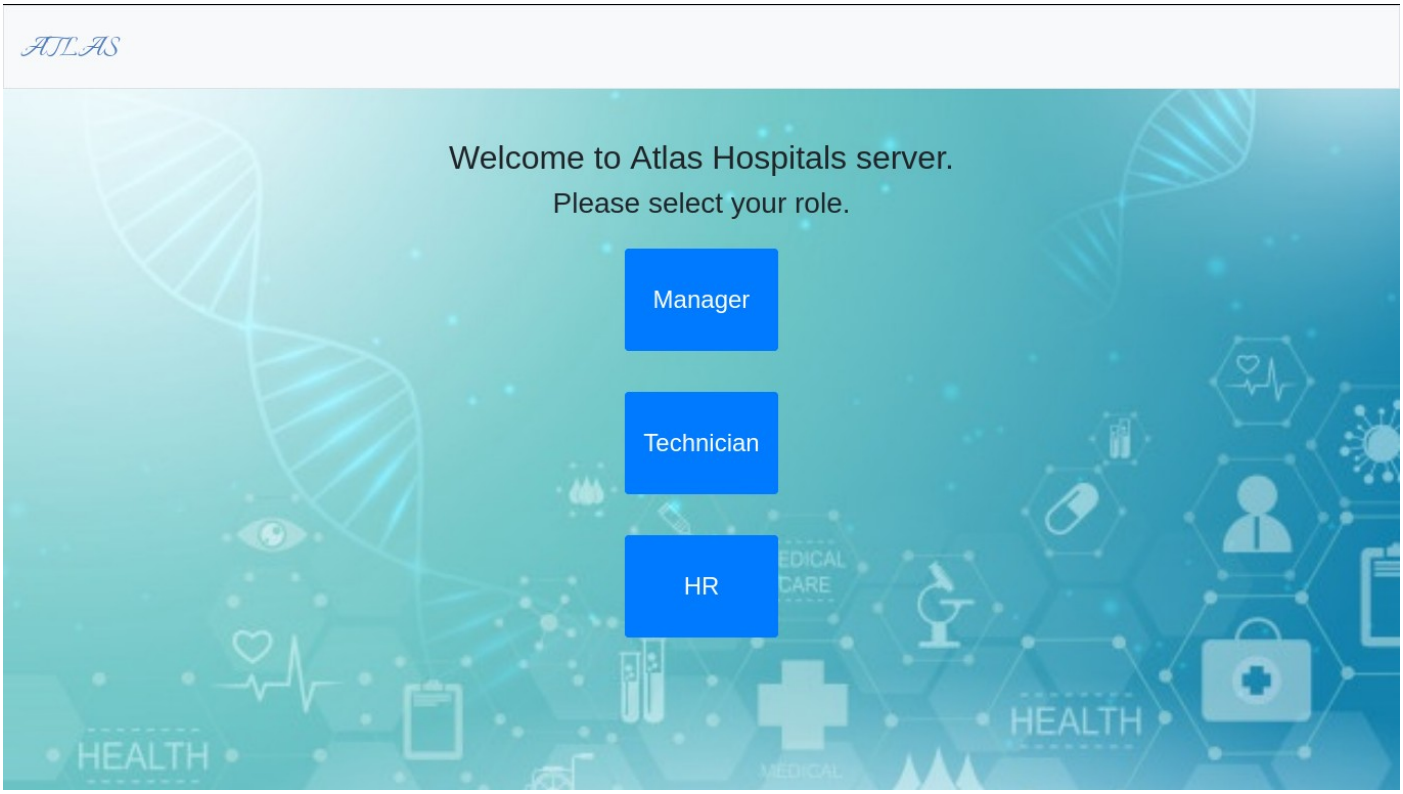


Figure 2: Homepage (not logged in)

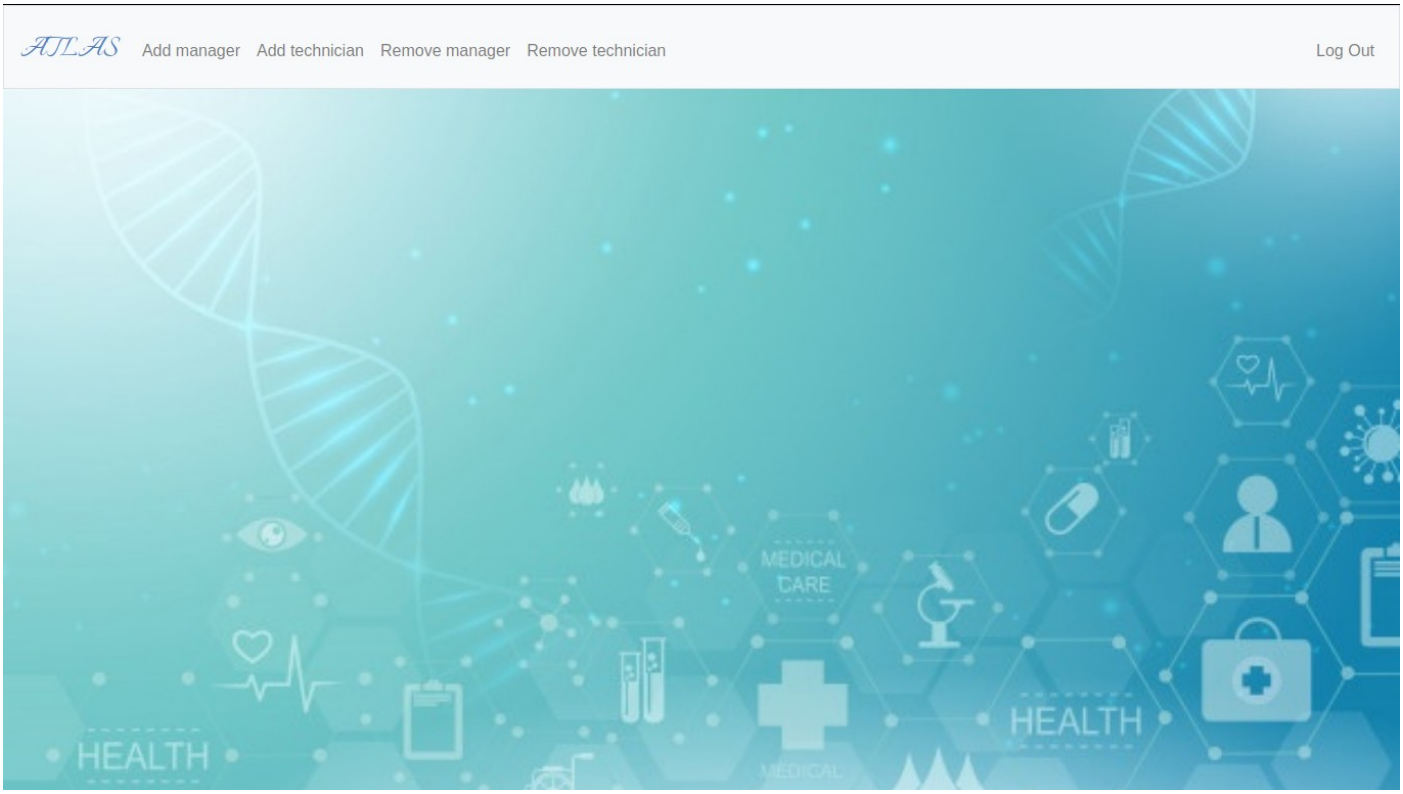


Figure 3: HR homepage

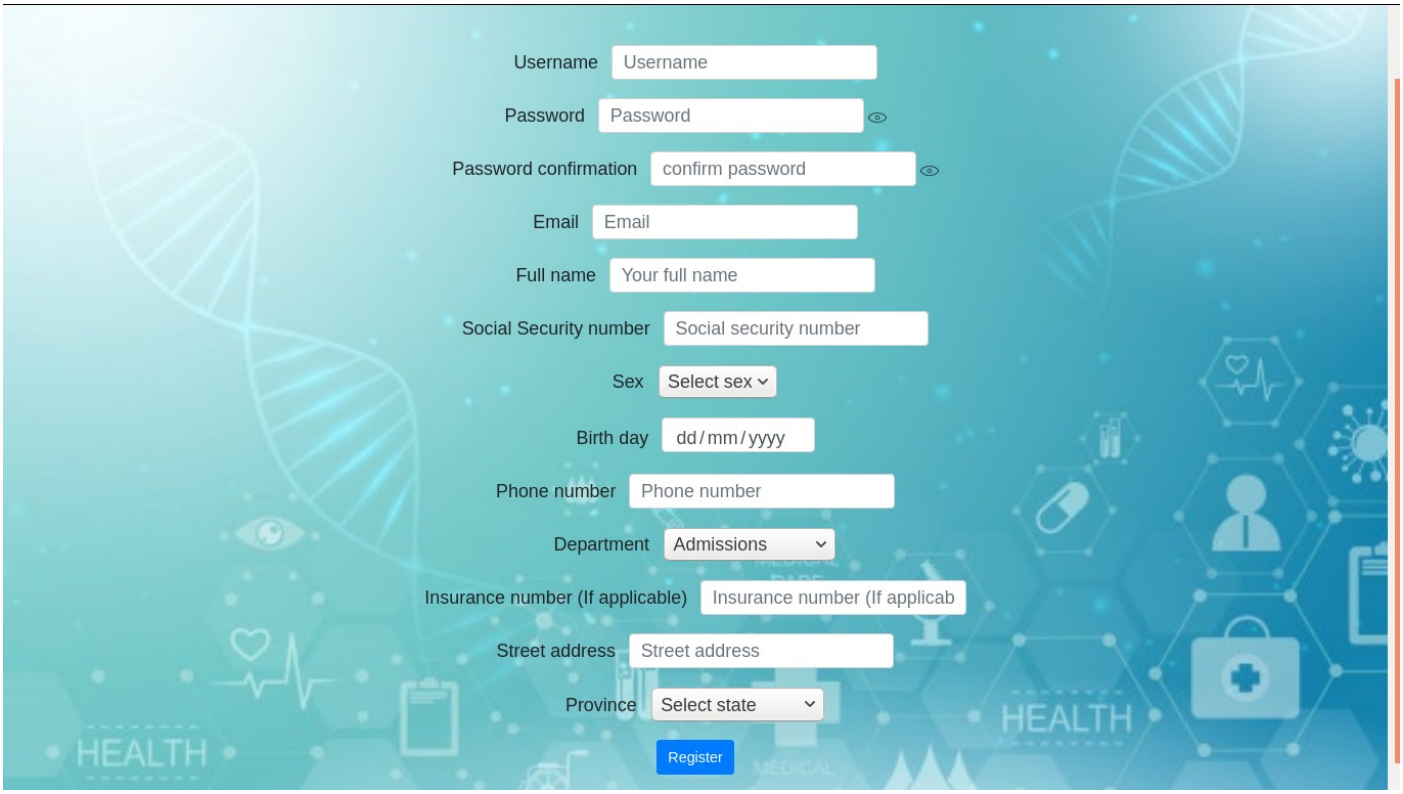
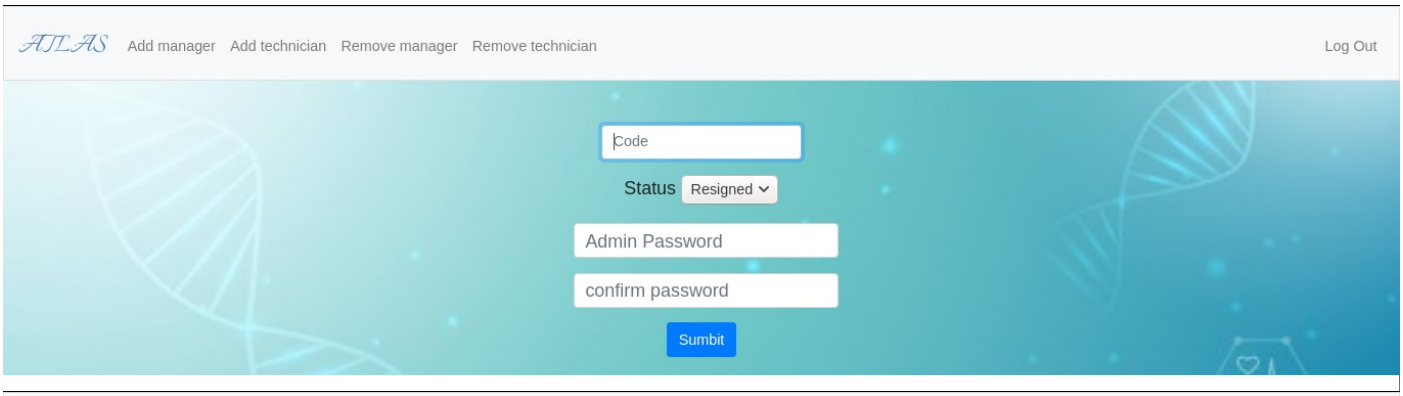


Figure 4: A manager/technician



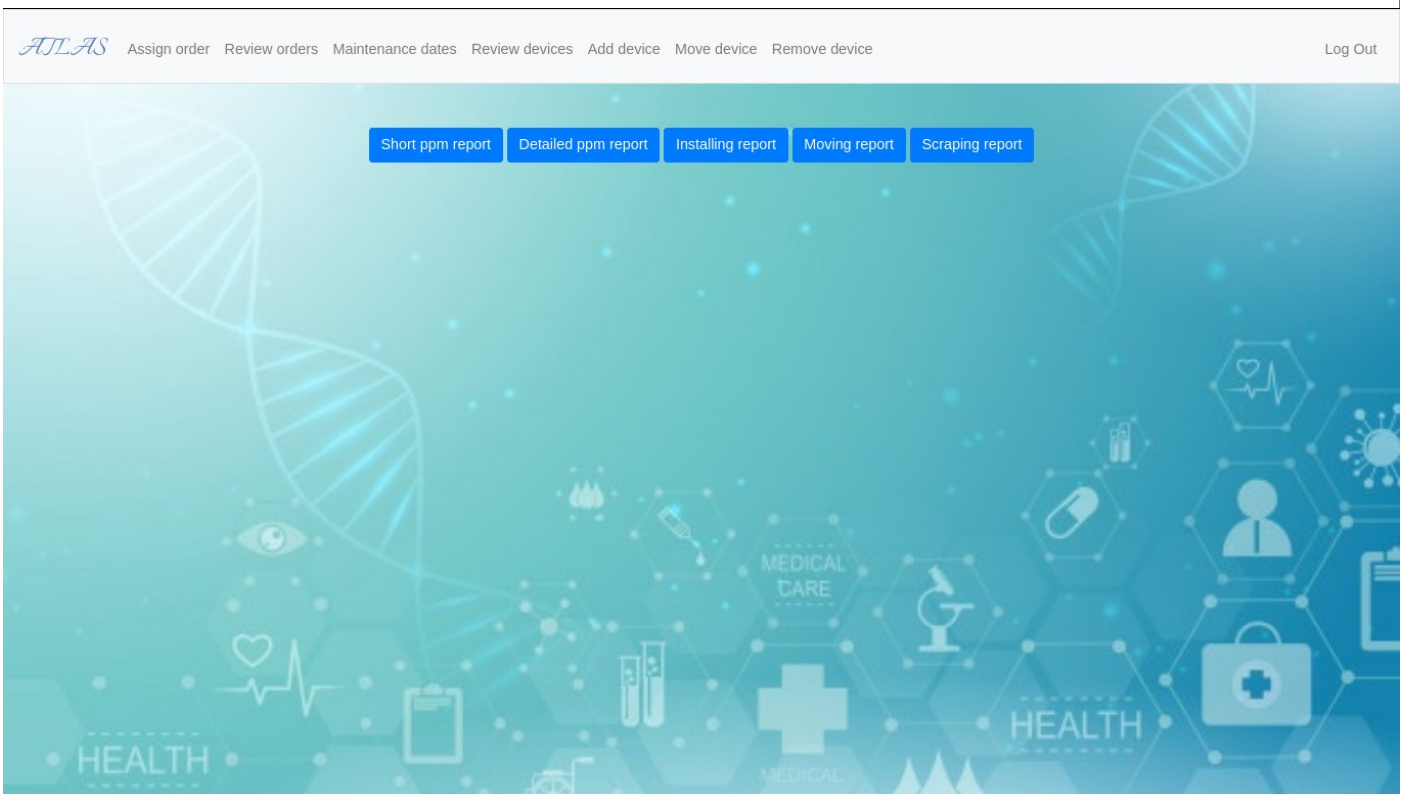


Figure 6: Manager homepage

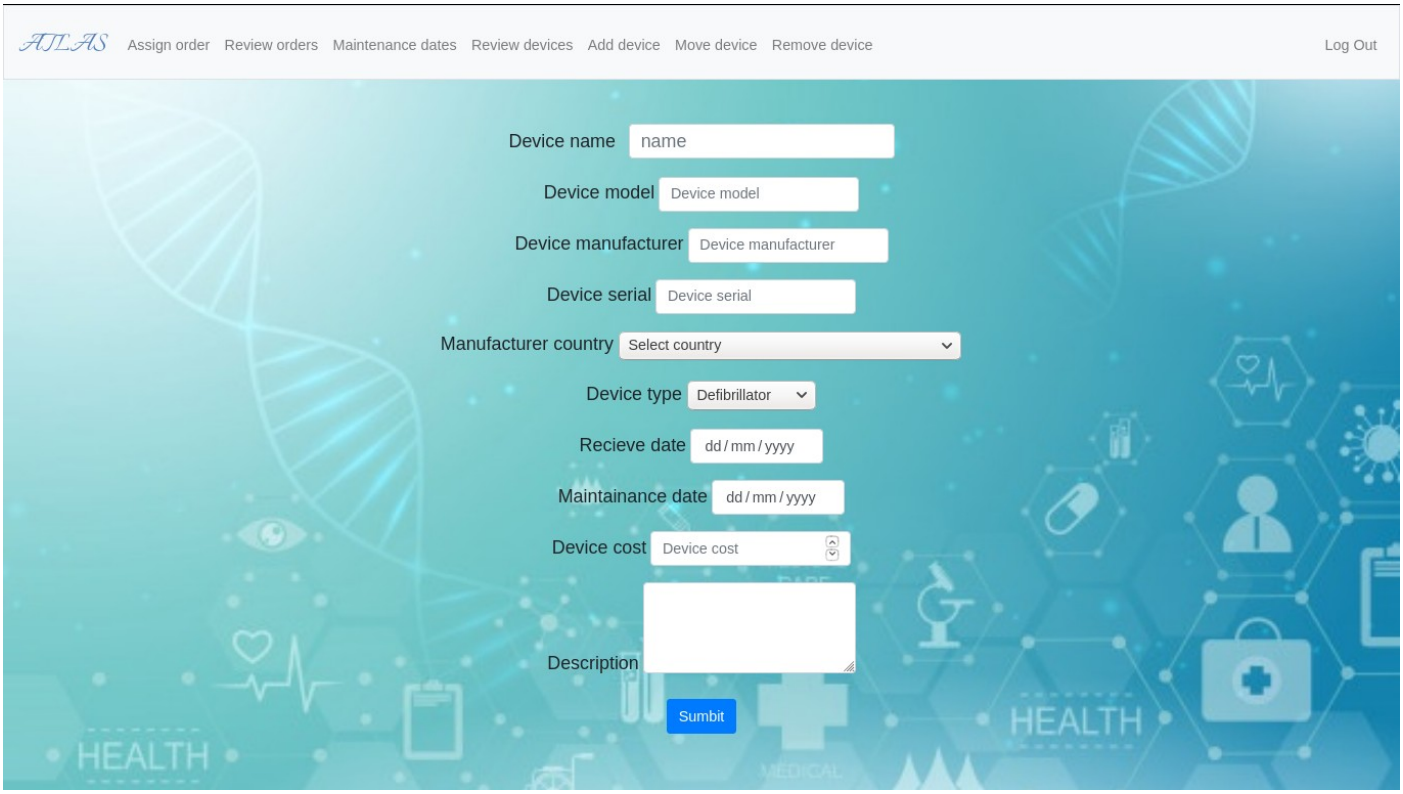
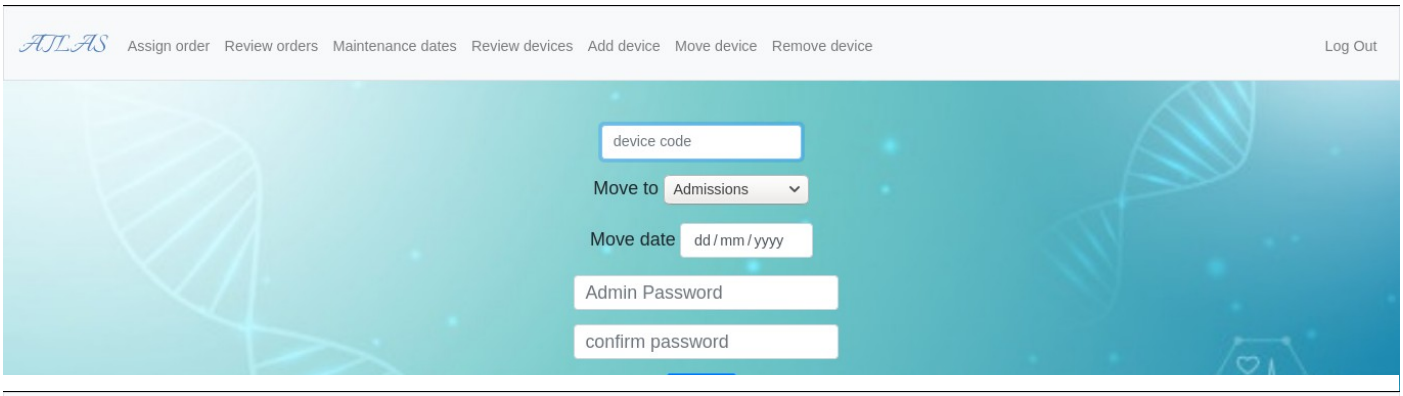


Figure 7: A device



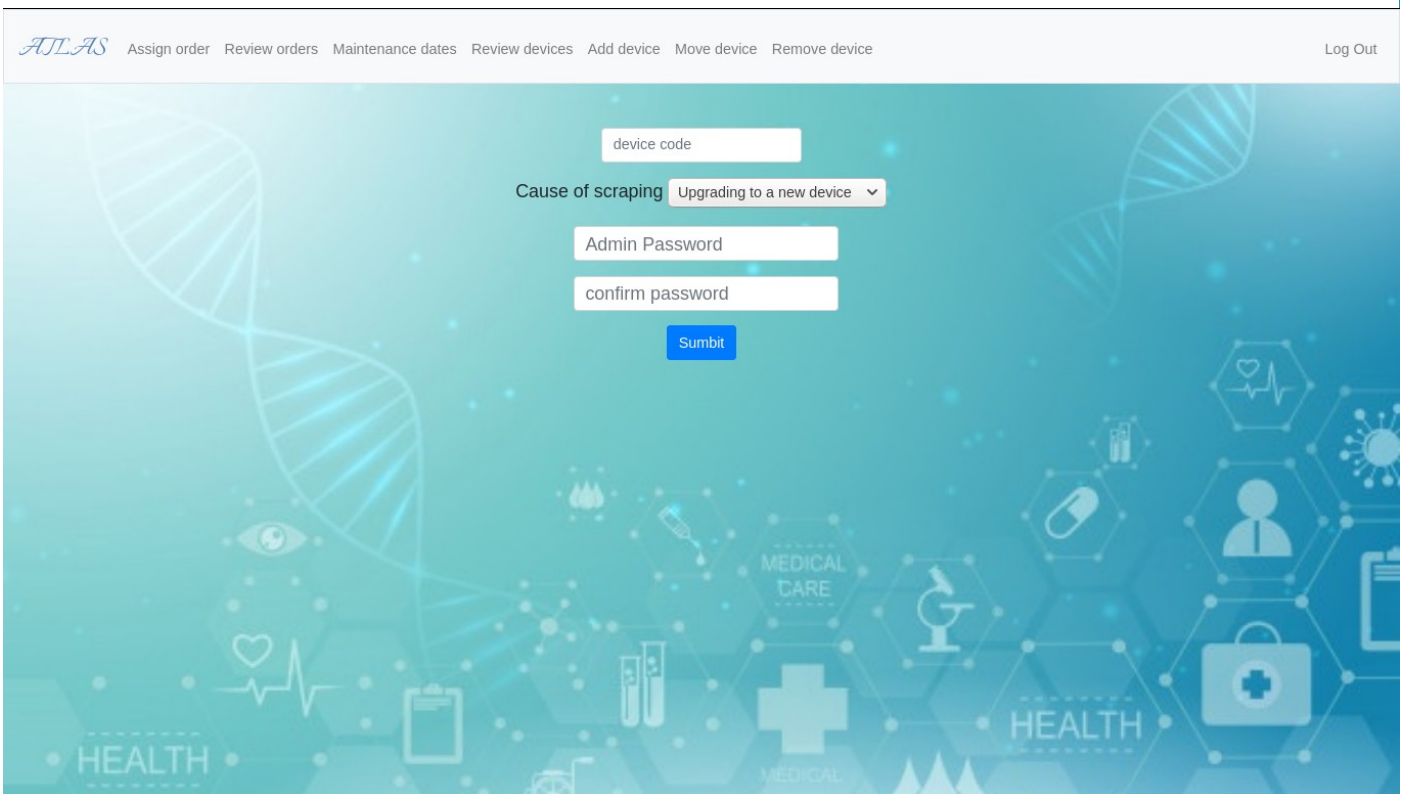
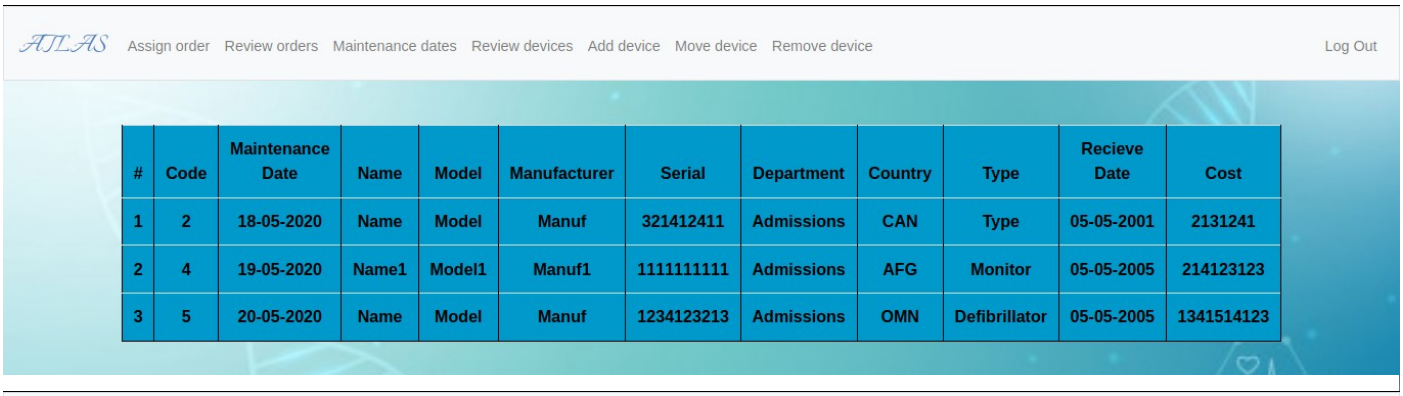


Figure 9: Remove device

#	Code	Name	Model	Manufacturer	Serial	Department	Country	Type	Recieve Date	Maintenance Date	Cost	Remove Date	Status
1	2	Name	Model	Manuf	321412411	Admissions	CAN	Type	05-05-2001	18-05-2020	2131241	2020-05-09	Operational
2	4	Name1	Model1	Manuf1	1111111111	Admissions	AFG	Monitor	05-05-2005	19-05-2020	214123123	2020-05-09	Operational
3	5	Name	Model	Manuf	1234123213	Admissions	OMN	Defibrillator	05-05-2005	20-05-2020	1341514123	2020-05-12	Operational

Figure 10: Review devices



#	Code	Maintenance Date	Name	Model	Manufacturer	Serial	Department	Country	Type	Recieve Date	Cost
1	2	18-05-2020	Name	Model	Manuf	321412411	Admissions	CAN	Type	05-05-2001	2131241
2	4	19-05-2020	Name1	Model1	Manuf1	1111111111	Admissions	AFG	Monitor	05-05-2005	214123123
3	5	20-05-2020	Name	Model	Manuf	1234123213	Admissions	OMN	Defibrillator	05-05-2005	1341514123

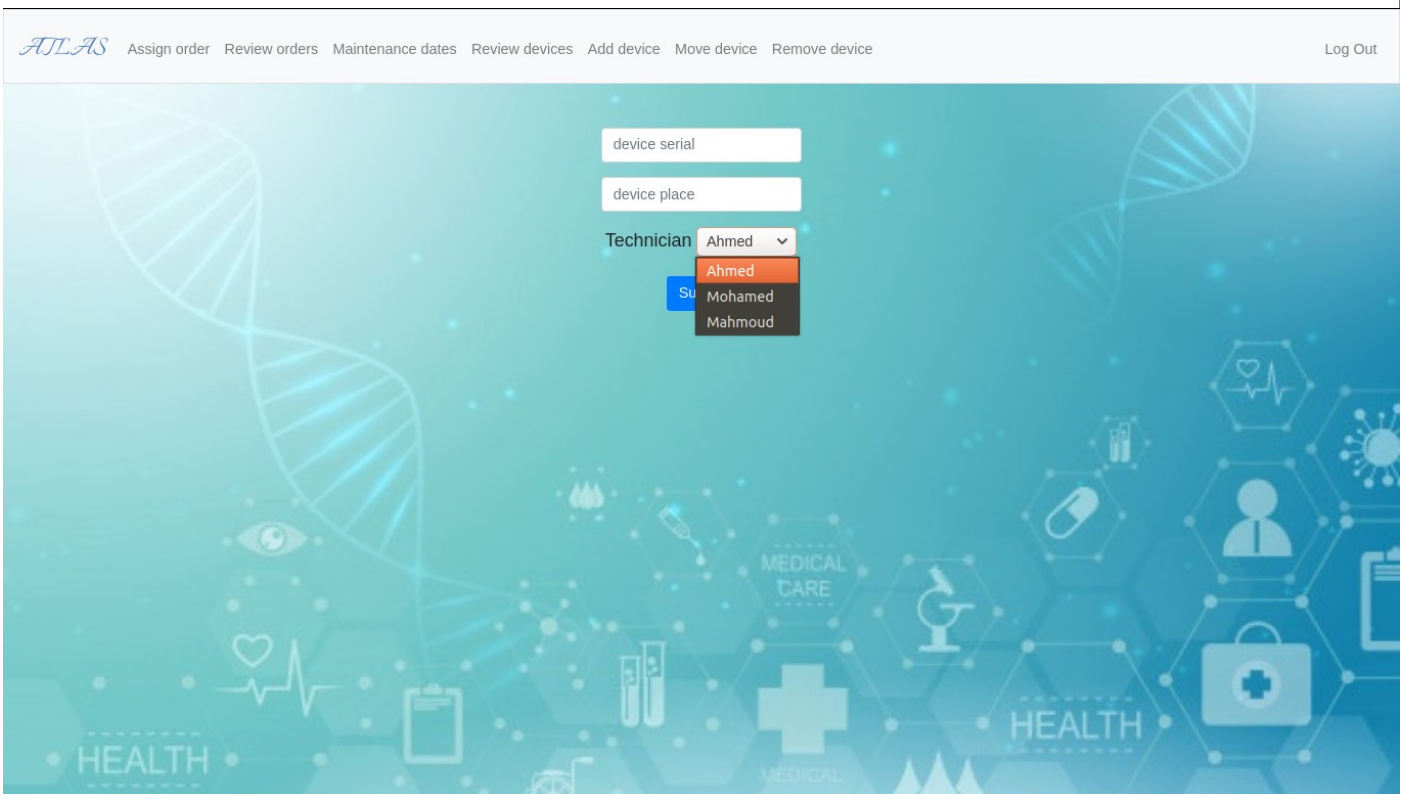
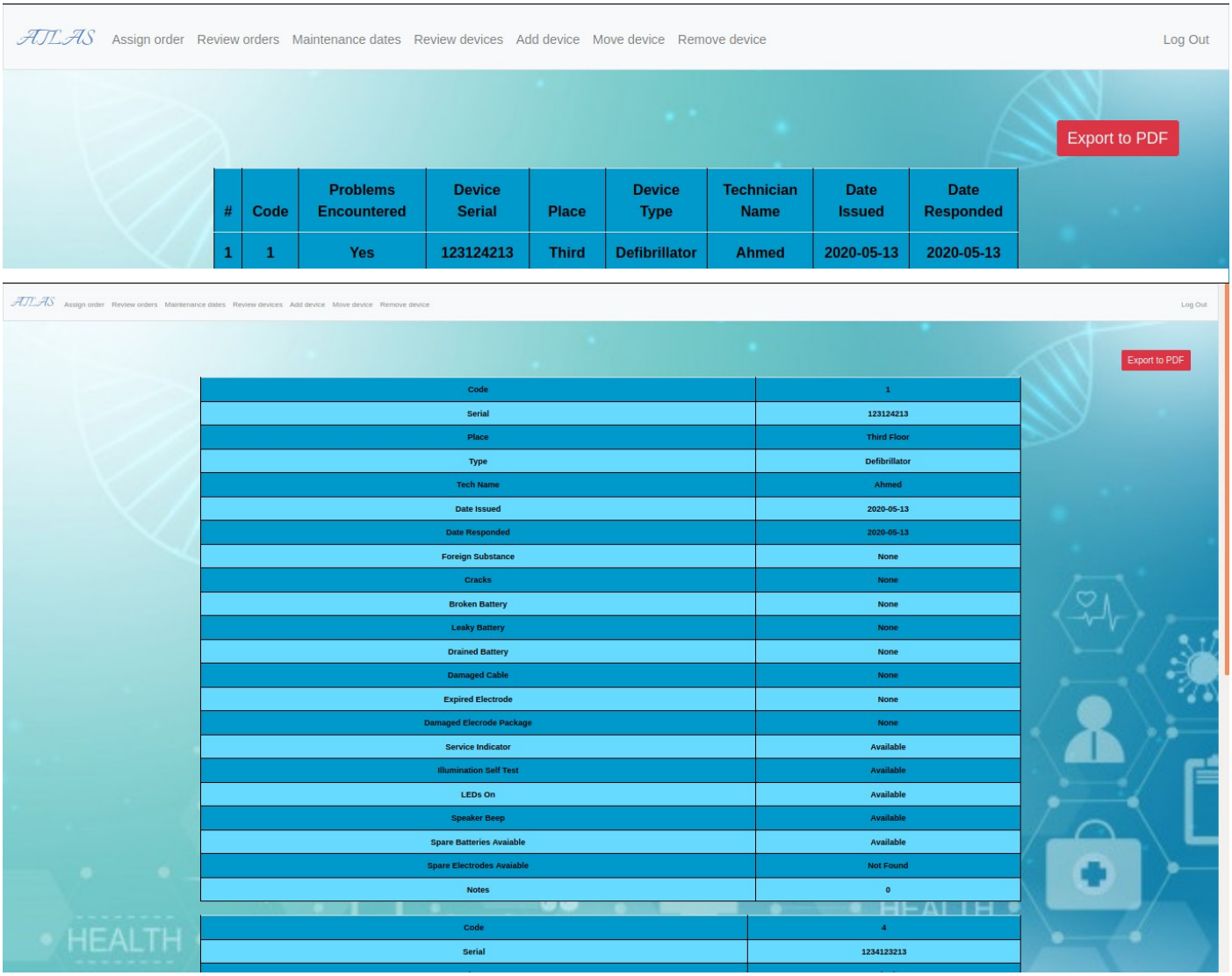


Figure 12: Assign order

#	Completed	Order Code	Device Serial	Place	Type	Department	Technician Name	Issue Date	Response Date
1	Yes	1	123124213	Third Floor	Defibrillator	Admissions	Ahmed	13-05-2020	13-05-2020
2	No	3	1111111111	Third Floor	Monitor	Admissions	Ahmed	13-05-2020	None
3	Yes	4	1234123213	Fourth Floor	Defibrillator	Admissions	Mahmoud	13-05-2020	13-05-2020

Figure 13: Review orders



#	Code	Problems Encountered	Device Serial	Place	Device Type	Technician Name	Date Issued	Date Responded
1	1	Yes	123124213	Third	Defibrillator	Ahmed	2020-05-13	2020-05-13

Code	1
Serial	123124213
Place	Third Floor
Type	Defibrillator
Tech Name	Ahmed
Date Issued	2020-05-13
Date Responded	2020-05-13
Foreign Substance	None
Cracks	None
Broken Battery	None
Leaky Battery	None
Drained Battery	None
Damaged Cable	None
Expired Electrode	None
Damaged Elecrode Package	None
Service Indicator	Available
Illumination Self Test	Available
LEDs On	Available
Speaker Beep	Available
Spare Batteries Avaiable	Available
Spare Electrodes Avaiable	Not Found
Notes	0

Code	4
Serial	1234123213

Figure 15: Detailed PPM report (zoomed out)

Figure 16: Installing report

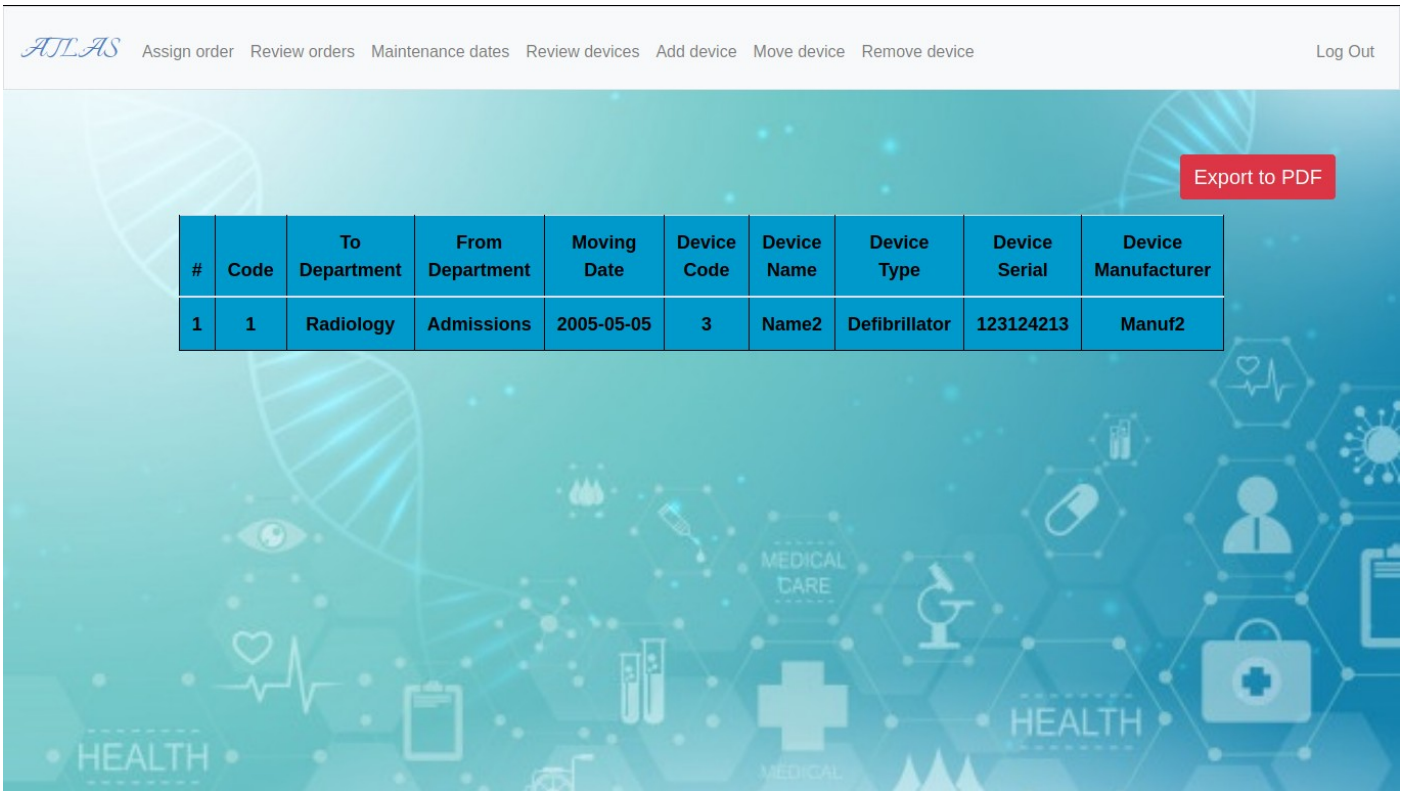


Figure 17: Moving report

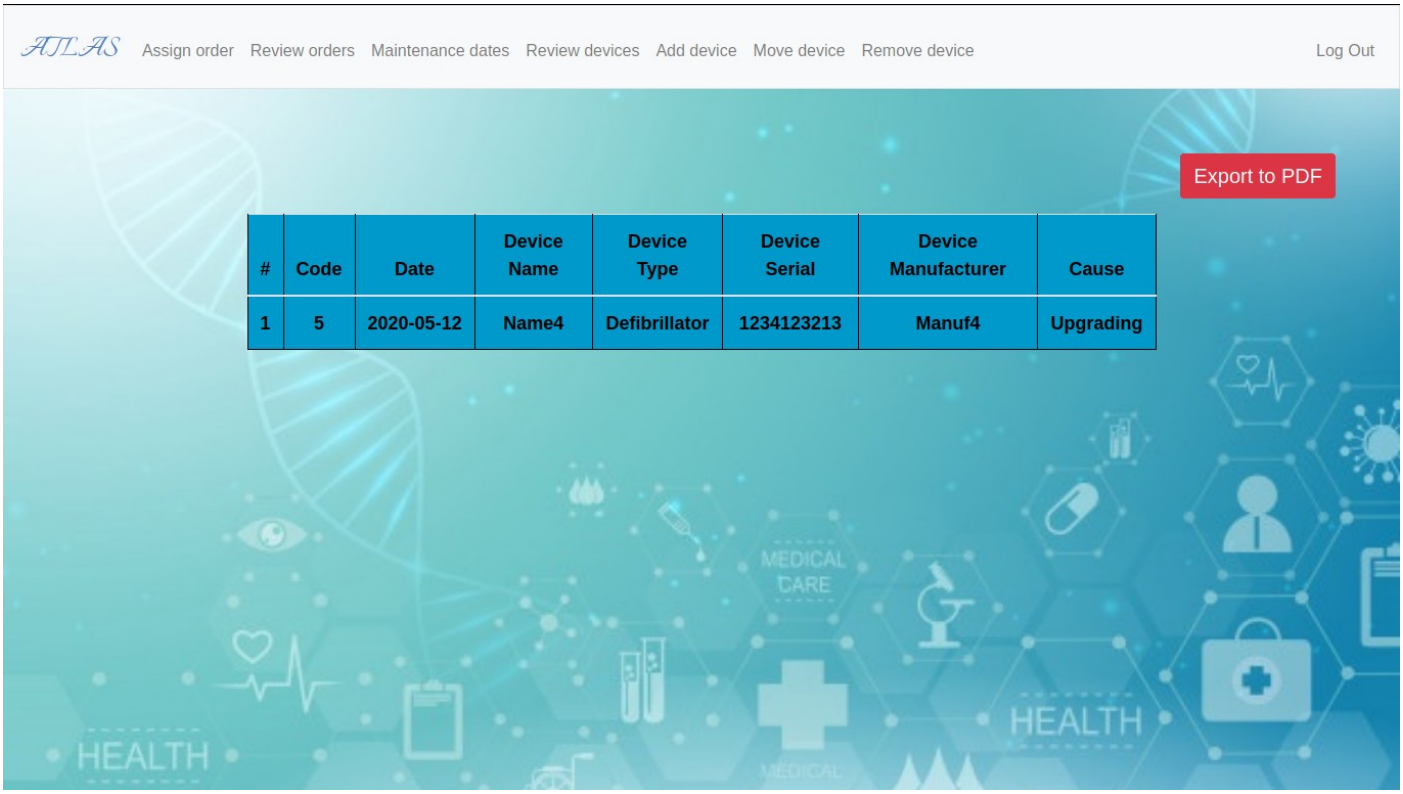


Figure 18: Removing report

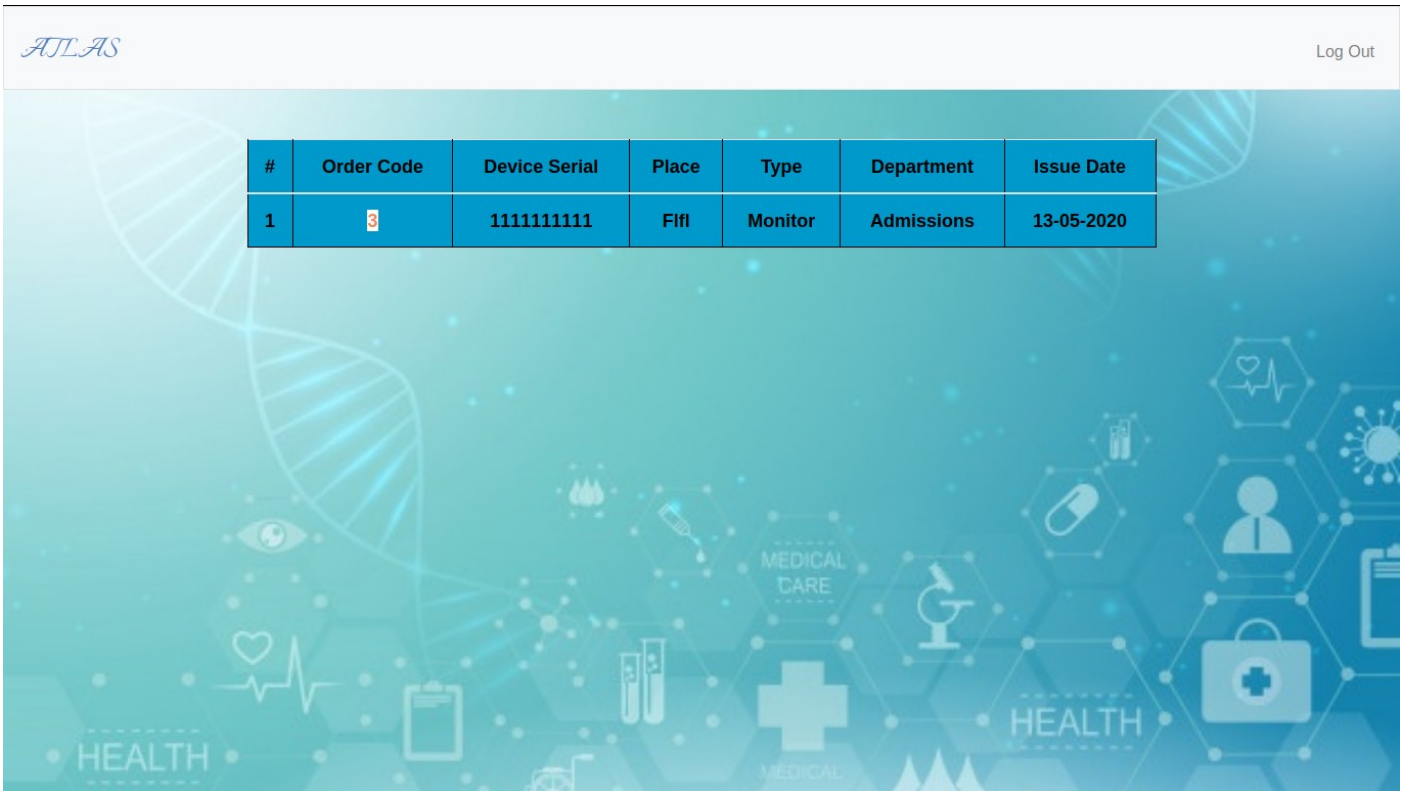


Figure 19: Technician homepage

Figure 20: Submit order (of a monitor)(zoomed out)