

# XRay System Requirements

## Inf 43 – Homework 1

October 10, 2023

Youhao Liu  
ID# 76932113

## **Introduction**

The MobileMedDev Xray application is designed to be an essential tool for field medics, enabling them to conduct Xray scans on injured individuals' body parts. The mobile dev Xray application will allow a user to enter a patient's name and perform an x-ray on a specific body part. The Xray app can save image and medical notes and send to the attending hospital for analysis. All patient information will remain confidential. The application also monitors the radioactive sensors for any radiation leaks. The application will link to the x-ray device via Bluetooth or USB-C cable. The application will be able to run on android devices.

## **Overview / Executive Summary**

The MobileMedDev Xray application is a sub-app for the mobile application software. The application is an Android app and designed for injured people in the field or ambulance. The app allows user to scan the ID card of the EMT to log in. The QR code on the ID card of the EMT will be scan by app and user is log in to the app successfully, or user can use ID and password to log in as well. After log in to the app, user will be able to take X-ray scans on body parts. User needs to enter their first, middle(optional), and last names, then consent to take the x-ray scans to enable "take x-ray" feature. After taking the x-ray, the photo file of the x-ray will be formed. The file name contains patient's name, date/time, and body part name. Each Xray will be approximately 200MB, and it will be saved on the device hard drive. The app will save the information in a database on the device. The app also allows the user to upload data and files. The data can only be sent over 4G/5G networks, data must be encrypted. No public Wi-Fi should ever be used. Only hospital, secured Wi-Fi.

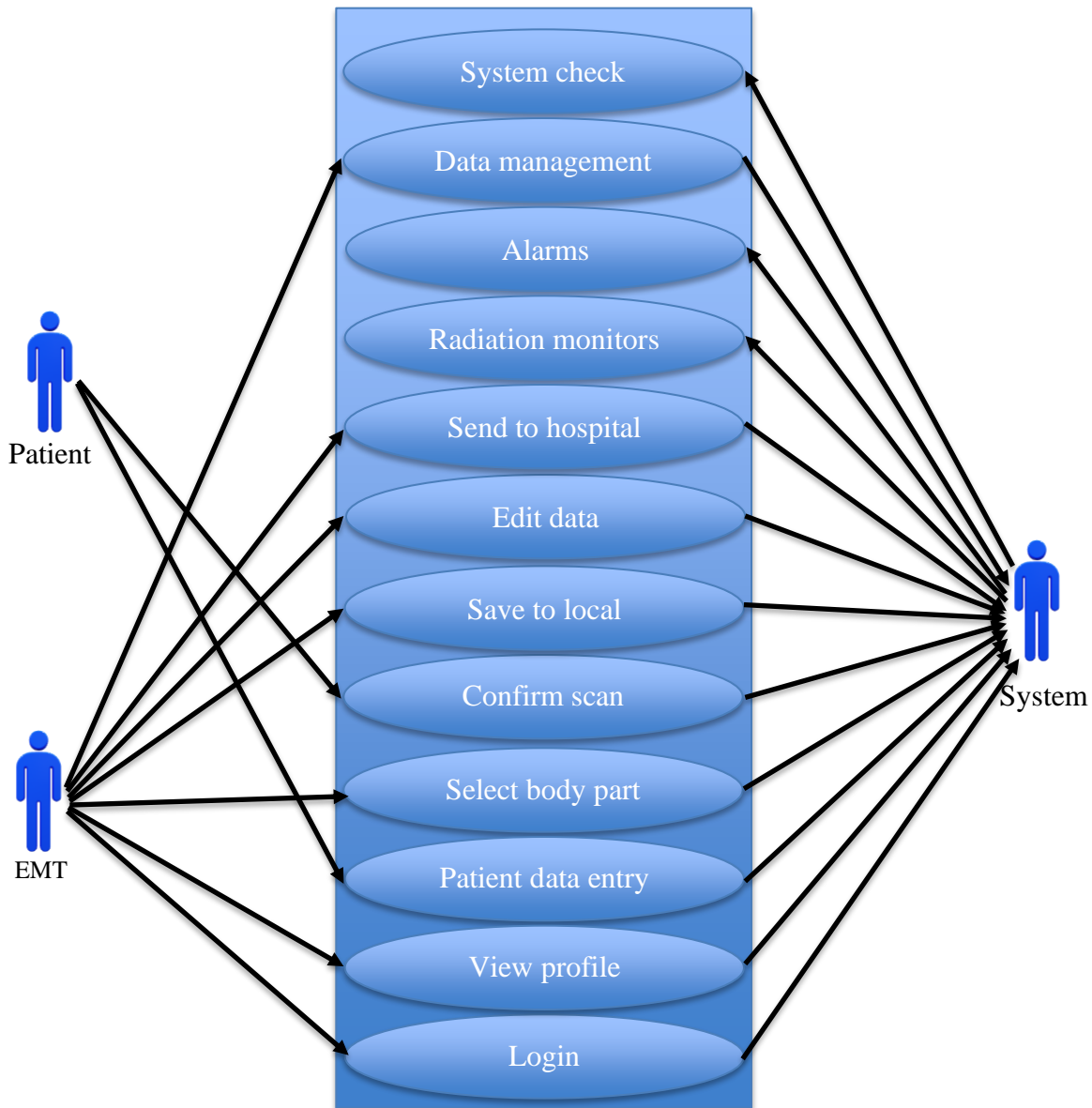
## **Application Context / Environmental Constraints**

The MobileMedDev Xray application is an Android app that can run on any Android version 10 or above. The app allows users to update and track all their activities. The app is linked to each EMT's account. All information will be synced and accessible on any android devices with internet accessibility without fear of lost data. The app scans EMTs' ID card to log in, EMT has authority to access all the patients' x-ray pictures files. When the patient needs to take x-ray, EMT will let the patient enter their first, middle, and last name, and also click the confirm button to consent to take x-ray. After taking the x-ray, the system will form the photo file. EMT has to decide to save, delete, rename, download, or upload files. By default, the app will name the photo file by patient's name and body parts. The date and time of the x-ray operation will also appear on the app following the corresponding photo files. Hardware constraints include a 1TB hard drive and integration with an X-ray device. The user interface should be intuitive and user-friendly. The application interacts with the hospital's system for image and data transfer.

## **Functional Requirements**

Diagram 1 displays the use case diagram of the Xray application. There are three actors within Diagram 1; the EMT User, the Patient User, and the System. The EMT User has all of the functionality of the Patient User except sign to confirm taking x-ray. The

Patient User has limited functionality, they can only access their own corresponding files. The System taking care all the actions that EMT user and Patient user makes on the app. Below are the textual descriptions of the function requirements and goals of the Xray app through use cases organized and detailed by actor.



**Diagram 1: Use Case Diagram of Xray**

#### **EMT User:**

- Login:  
Open the app, the user will choose login method (scanning ID card or user ID and password) to login their account. If either way works perfectly, the UI will display the user's basic information such as user's name and user's pictures. If the ID card cannot be verified or the user ID and password are not entered correctly, the error message will be displayed, and prompt user to redo the actions. There will

also be a selection if user forget their password, the password reset technique will be provided via email address that bounded to the account.

- View Profile:  
Users can view their profile in the app. User can edit their profile in the profile page, it offers changing profile pictures, changing account email address or phone numbers, and changing privacy settings.
- Select body part:  
User will select the body parts that patient needs to take an x-ray of. The selection will be saved for the image file name after taking x-ray. User must make a selection to continue x-ray scanning operation.
- Save to local:  
After taking x-ray scanning, the x-ray image file will be formed and will have the default name corresponding to the patient's name and body part selected. Xray images will have a watermark in the upper left corner displaying patient name and timestamp. The placement of this watermark can be adjusted in the application settings. If the body part in the image file doesn't meet the selection before the x-ray scanning. User will be noticed, and system will provide a change of the selection technique. The file will be automatically saved to local hardware. If the hardware does not have enough memory space for the file, the error message will display, and prompt user to release hardware memory. After releasing the memory, the file will be saved to local.
- Edit data:  
User will be able to edit files. User can rename a file, sort files, and delete the file. User can also edit files properties such as sizes.
- Send data to hospital:  
User choose to send the saved x-ray data to hospital. The system encrypts the data and sends it over a 4G/5G network or hospital secured WIFI.
- Data management:  
Saved data will remain in the database. The system will not delete any data.

#### **Patient User:**

- Patient data entry:  
User will be prompted to enter their names, age, and gender. System will save the information for the data collection.
- Confirm scan:  
User needs to confirm taking x-ray scan to continue the process. Only patient user can confirm the scan.

#### **System:**

- Radiation monitors:  
Radiation sensor continuously sends radiation levels to the system. If the system detects the radiation leak, the System displays the leak threat level (High, Med, Low). The notification message will also display. System fetches instructions from the hospital-provided XML file and displays step-by-step resolution to the EMT.
- Alarms:

System will have the alarms when there is a radiation leak. Also, when there is a disconnection occur or low battery, the alarm will also ring to aware users. Radiation leak, radiation sensor disconnected, sensor not found, low tablet battery will cause the alarm in the system to go off.

- System check:

The application shall monitor user activity, ensuring automatic logout after 3 minutes of inactivity to maintain security. The application shall constantly monitor the status and connectivity of radiation sensors. Notifications shall be provided if a radiation sensor disconnects or is not found.

## **Software Qualities and Non-functional Requirements**

Reliability	The system should be working properly all the time, especially during emergencies. The application should constantly monitor the radiation sensors and detect any radiation leaks. The system needs to be able to keep all its information safe and backed up online in case of unforeseen failure.
Usability	The app interface should be user-friendly and easy for field medics to understand and navigate. The app has a QR code scanner and the thumbprint reader for EMT to login quickly. A setting should be provided for users to adjust the watermark's position on the X-ray image.
Security	All patients' personal information and x-ray photo files transferred should be encrypted. App will make sure only EMTs are authorized to access that information. The app should restrict data transfer to only secure networks, 4G/5G and secured hospital WIFI. Users should be automatically logged out after 3 minutes of inactivity to ensure the app is secured.
Accuracy	The x-ray photo file names should have precise timestamping to avoid potential mix-ups. The app should make sure that patient's information such as name, body parts scanned, and timestamp associate with the x-ray images. The system should also accurately determine the radiation level and report correctly.
Portability	The app should be able to run on any Android version 10 and above devices. The app should support various connectivity such as Bluetooth and USB-C, allow app to connect the X-ray device smoothly. The app should be scalable so that it can expand to mobile MRI devices in the future.
Efficiency	The data should be transferred efficiently over 4G/5G, or hospital secured WIFI without significant delays. Each x-ray photo file sizes 200MB in the average, the app should ensure the efficient storage usage on the 1TB device hard drive. The system should immediately alert the user in case of disconnection, radiation leaks, and low battery.

## **Other Requirements**

Application performance:

The app should be optimized for quick startup and smooth performance.

Application backup:

The app should have automatic back up features in case of the any failure and crash. The app will ensure that there is no data lost. The process can be resumed from the last states.

#### Glossary of Terms:

EMT	A trained professional who provides medical care in emergency situation.
App	Application, software system that has a specific function or purpose.
X-ray	a type of radiation called electromagnetic waves. X-ray imaging creates pictures of the inside of your body.

## Assumptions / Risks

The app will be developed for Android version 10 or above. It is assumed that users won't use older Android version devices.

It is also assumed that there is no failure with the alarm that to remind EMT the Bluetooth, connection, and low battery.

It is assumed that Radiation sensors are always in proper working condition.

There is a potential risk of radiation leaks. If the radiation sensor not working properly, it might not detect the radiation leaks. It will cause an explosion of radiation and effect the patient and EMT's health.

There is a risk about security. If EMT connects to an unsecured network, it might cause exposure to the patients' data. It might have a potential security problem.

## Priorities / Implementation Phases

#### Must Have:

- Clean and usable interface.
- Inactivity logout.
- Radiation Monitoring.
- Data storage and transfer
- Safety Alerts

#### Should have:

- Easy access control.
- User profiles
- Watermark

#### Nice to have:

- Customization settings
- Advanced security features

## **Future Directions and Expected Changes**

It is potential for the MobileMedDev application to expand its capabilities to MRI scans. The future new version of the app might be able to run on the IOS devices. The app may develop compression techniques to handles large x-ray photo files. While the software is currently designed to wipe data locally, one potential direction could be to develop cloud storage options that enable hospitals to access and archive X-ray images and related data. This can be used both as a backup and as a long-term storage solution, reducing the burden of local storage.