Joe Durko (jsd94@drexel.edu), *Kaushik Mukherjee* (km3762@drexel.edu), *Taiwo,Owolabi* (ot22@drexel.edu), *Wendy Prayer* (wp86@drexel.edu)

Assignment 2

Mission

Develop a comprehensive secure electronic medical record system with a user-friendly interface for doctors, nurses and clerical staff at JKTW medical center.

Problem

Patient records are not properly secured in the current Electronic Medical Record (EMR) system - every member of staff in the existing system has access to the same patient information and can edit them willingly. Due to the loose restrictions on patient record entry, the hospital staff consistently has to correct record errors associated with manual client data entry. Furthermore, searching for records based off patient information requires an unreasonable amount of searching through scanned PDF files. Simple tasks such as finding the phone number of a patient who needs a follow-up consultation can take sometimes hours. There's also an issue where reporting and auditing takes whole weeks to find the correct scanned forms for certain patients.

Users

The users of this system are broken down into two groups:

- Hospital Administrator - The person who manages the EMS system including user logins and permissions.
- Medical Staff - JKTW employees who interact with patient records (also referred to as "hospital employees")

The medical staff can be broken down further into:

- Doctors
- Nurses
- Clerical Staff

Link to GitHub:

https://github.com/dream-team-se577/jktw_emr/blob/master/README.md

Features

User	Feature Name	Description
Hospital Admin	Create Account(s)	As a hospital administrator, I would like to create accounts for doctors, nurses and clerical staff.
Hospital Admin	Delete Account(s)	As a hospital administrator, I would like to delete accounts for doctors, nurses and clerical staff.
Hospital Admin	Edit Account(s)	As a hospital administrator, I would like to edit account information for doctors, nurses and clerical staff such as name, contact information, role, permissions, password resets
Hospital Admin	Retrieve Account(s)	As a hospital administrator, i would like to retrieve accounts for doctors, nurses and clerical staff currently in the system
Medical Staff	Login Portal	As a hospital employee, I would like to be able to log into the EMS Dashboard
Medical Staff	Dashboard	As a member of the medical staff, I would like to navigate the dashboard and search for patient(s)
Clerical Staff	Dashboard	As a member of clerical staff, I would like to navigate the dashboard Register patient, retrieve patient create appointments and schedule follow-up
Clerical Staff	Register Patient	As a member of clerical staff, I would like to register a patient into the system when they visit for the first time including their demographic, medical history and contact information.

Medical Staff	Medical Record Retrieval	As a hospital employee, I would like to use a patient's social security number to retrieve their information such as lab/diagnostic records, referrals, personal health record, and visit summary.
Clerical Staff	Update Contact Information	As a member of clerical staff, I would like the ability to update existing contact information and demographic information on a patient.
Doctors/Nurses	Update Medical Information	As a doctor/nurse, I would like to update the medical information of a patient including their prescriptions, diagnoses, and recommendation for lab tests.
Clerical Staff	Attach Document Feature	As a member of clerical staff, I would like to attach scanned paper-based documents to a patient's file.
Medical Staff	Search Medical Record	As a hospital employee, I would like to search for medical records of employees based off contact information and previous visits.

These features will remedy the problems plaguing the current system(s) utilized by JKTW staff. In addition, being able to create accounts via a hospital administrator will assure that only the employees of JKTW have encrypted logins that facilitate viewing and updating patient records. Furthermore, the system supports roles and permissions, with roles such as "doctor", "nurse" and "clerical staff" so that only specific roles have permissions to edit, read and access certain patient information. The search functions will allow for easy recall on patients who have visited previously so that medical staff can view health and contact information. Finally, allowing scanned documents to appear on patient records will also provide a paper trail for auditing and quality control.

Use Cases

Name:	Create doctor, nurse or clerical staff in system
Description:	Hospital administrator needs to create a new account for a new doctor, nurse or clerical staff
Primary actors:	Hospital administrator
Secondary actors:	Doctors, nurses, clerical staff
Flow of events:	The use case starts when a new doctor, nurse or clerical staff joins the hospital. The new doctor, nurse or clerical staff fills in new employee paperwork, which gets routed to the hospital administrator. The hospital administrator utilizes information in new staff paperwork to create an account for new staff in the system
Exceptional flow of events:	N/A

Name:	Delete doctor, nurse or clerical staff in system
Description:	Hospital administrator needs to delete existing account for a doctor, nurse or clerical staff
Primary actors:	Hospital administrator
Secondary actors:	Doctors, nurses, clerical staff
Flow of events:	The use case starts when an existing doctor, nurse or clerical staff leaves the hospital. The doctor, nurse or clerical staff signs termination in employee paperwork, which gets routed to the hospital administrator. The hospital administrator utilizes the information to delete the correct account.
Exceptional flow of events:	N/A

Name:	Edit doctor, nurse or clerical staff in system
Description:	Hospital administrator needs to edit an account for an existing doctor, nurse or clerical staff
Primary actors:	Hospital administrator
Secondary actors:	Doctors, nurses, clerical staff
Flow of events:	The use case starts when an existing doctor, nurse or clerical staff has account properties that need to be updated such as a name change in the event of marriage. The doctor, nurse or clerical staff fills out paperwork to confirm the change which gets sent to the hospital administrator to update the system.
Exceptional flow of events:	N/A

Name:	Retrieve doctor, nurse or clerical staff in system
Description:	Hospital administrator needs to retrieve account information for an existing doctor, nurse or clerical staff
Primary actors:	Hospital administrator
Secondary actors:	Doctors, nurses, clerical staff
Flow of events:	The use case starts when the hospital administrator needs to perform some action on the record for an existing doctor, nurse or clerical staff.
Exceptional flow of events:	N/A

Name:	Login to System
Description:	Doctor, nurse, clerical staff need to log into the system to access EMR dashboard and features
Primary actors:	Doctors, nurses, clerical staff
Secondary actors:	None
Flow of events:	The use case starts when a doctor, nurse, clerical staff needs to log into the system dashboard.
Exceptional flow of events:	The user is unable to login to the after 3 attempts at which time the user account is locked out till an administrator resets the password

Name:	Utilize Dashboard Search for Patient
Description:	Doctor, nurse, clerical staff have successfully logged into the dashboard and searches for a patient
Primary actors:	Doctors, nurses, clerical staff
Secondary actors:	None
Flow of events:	The use case starts when a doctor, nurse, clerical staff needs to locate a patient within the system and want to search by first name, last name, social security or a combination of all 3. All matches will be returned based on all available matches to search
Exceptional flow of events:	The user is not located within the system at which time the system defaults to the create new patient screen

Name:	Utilize Dashboard (Schedule or Retrieve appointment)
Description:	Clerical staff have successfully logged into the dashboard and need to schedule an appointment or retrieve an existing appointment to edit it.
Primary actors:	Clerical staff
Secondary actors:	Patients
Flow of events:	The use case starts when a clerk needs to create a new patient or uses an existing patient's SSN. The clerk uses the dashboard to create or access an existing appointment and then fills in the date, time and the patient's SSN.
Exceptional flow of events:	N/A

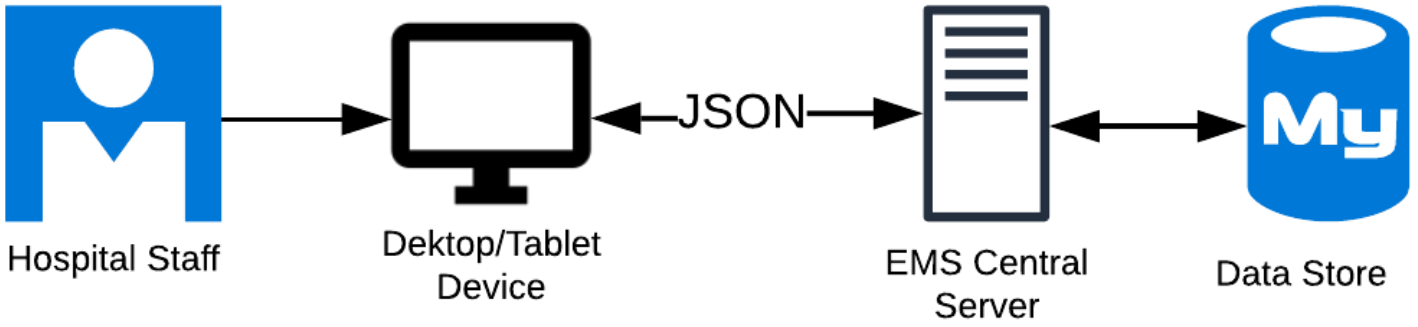
Name:	Register Patient
Description:	Clerical staff have successfully logged into the dashboard and proceeds to register new patient
Primary actors:	Clerical staff
Secondary actors:	Patients
Flow of events:	The use case starts when a clerk needs to create a new patient and has the relevant information received from the patient. The clerk will use the dashboard to register the patient's information to be retrieved for later.
Exceptional flow of events:	The required fields are not filled out that constitutes the patient as fully registered. In this case, the patient is not saved into the system and a warning message appears for the clerk.

Name:	Medical Record Retrieval
Description:	Doctor, nurse or Clerical staff have successfully logged into the dashboard and proceeds to search for a medical record by searching for the relative patient
Primary actors:	Doctors, nurses, clerical staff
Secondary actors:	None
Flow of events:	The use case starts when a doctor, nurse, clerical staff needs to locate a patient within the system and know the exact social security number. Using the dashboard, they find the exact medical record of the patient.
Exceptional flow of events:	The user is not located within the system at which time the system defaults to the create new patient screen

Name:	Update Contact Information, Update Medical Information
Description:	Doctor, nurse or clerical staff have successfully logged into the dashboard and proceeds to make update to patient information (Clerical role only) or update medical information (Doctor and nurse role only)
Primary actors:	Doctors, nurses, clerical staff
Secondary actors:	Patients
Flow of events:	The use case starts when a doctor, nurse, clerical staff needs to update a patient record, or a doctor or nurse needs to update a medical record. After retrieving the correct information, they can update a patient's contact information (clerical) or add medical information (doctors and nurses).
Exceptional flow of events:	N/A

Name:	Attach Document Feature
Description:	Clerical staff needs to attach a document to the record of the patient such as a copy of a signed patient registration sheet used by the hospital.
Primary actors:	Clerical staff
Secondary actors:	Patients
Flow of events:	The use case starts when clerical staff receives a new form of signed paperwork about a patient - this can be the registration paperwork when the patient visits for the first time, releases, bills, etc.
Exceptional flow of events:	N/A

High-Level Software Architecture



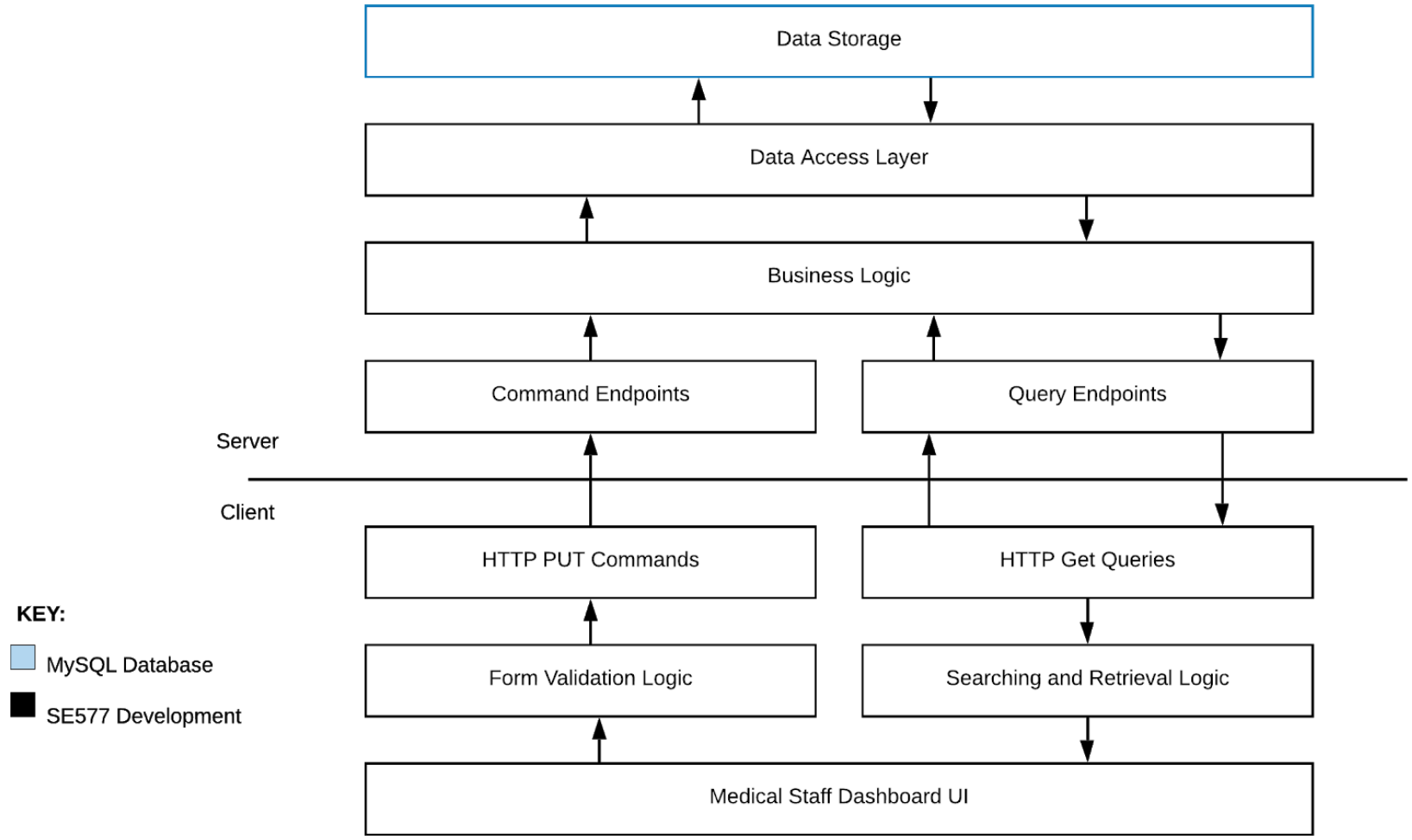
KEY:

SE577 Developed

The JKTW Hospital EMS will be developed in a Client-Server Pattern. Hospital computers and tablets will have the client software installed which will provide the correct forms for creating medical patient records and options to retrieve/search for patient records. Clients will use GET or POST methods in JSON to communicate with a central Electronic Medical System (EMS) server that is located on a central server machine. This machine will provide information using a data store on the same machine.

The client library will perform form validation to make sure a record has sufficient information before posting to the server thus preventing invalid entries from being accepted to foolproof record creation. Requests can be filled out via the Dashboard feature which will combine patient searching and record retrieval.

Detailed Layer/Tier Architecture

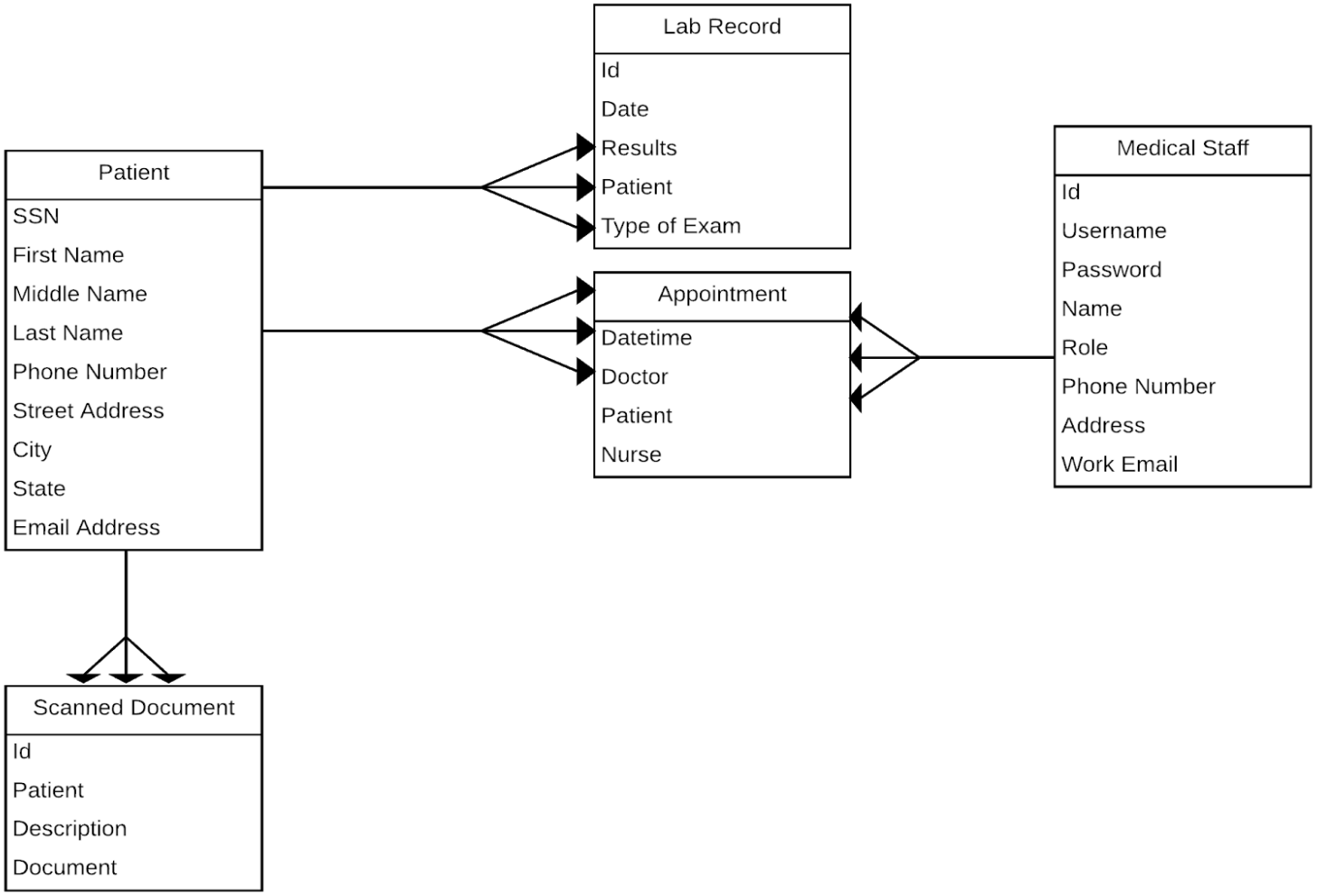


Detailed Layer/Tier Architecture Description

The EMS will consist of a series of layers on the client and server side (tiered between the client machines and a central server machine). A user will interact with the user interface to either view or edit a patient's record. Therefore, to edit a patient record, the UI will consult the client API for which parts of the form are editable. Furthermore, when the user decides to send the edits of the record to the server, a form validation layer will first make sure all the necessary fields are sufficiently filled out. Next, an HTTP PUT call will be performed on a command endpoint in the server library's RESTAPI. The request will then enter a business logic layer that will validate server concerns such as ensuring a record with the same social security number as an existing one is denied. Finally, a Data Access Layer will interact with a MySQL database that will store the raw information.

Similarly, searching and retrieval will access query endpoints in the RESTAPI. The Business Logic layer will query the Data Access Layer for the specific information and filter out unnecessary or classified information on the patient.

Database Design



Database Design Description

The database is designed in such a way that allows for medical staff to retrieve relevant information from patient records. A patient is an entity that has its own information but also has a one to many mapping to a few different entities:

- Scanned Documents are patient-specific PDF's that are stored for auditing and quality control
- Lab Records are created upon any appointment for an X-Ray, MRI, etc.
- Appointments are created for when a patient checks-in for a schedule check-up

Medical Staff is an entity that represents the logins for the medical staff and contains their username and password for validation purposes. There is also a "Role" attribute that will be used for permission and authorization purposes. The rest of the Medical staff fields are for the hospital administrator to retrieve the medical staff's contact information.

Design Pattern

Abstract factory will be the design pattern utilized within the object classes supporting the major actors and the objects against which they take action. The abstract factory (staff class) will have abstract method definitions for methods encompassing the entire project. These methods will be given definition within the 3 classes that define the 3 major types of staff members (doctor class, nurse class, clerical staff).

Classes will also be created to define other objects such as patient, prescription, labs, medical procedures, etc. Most of these objects will support the ability to CRUD (create, retrieve, update and delete) per these objects and aligned against the appropriate staff that should be able to perform that specific action in relation to that object

Below is a diagram of the envisioned class hierarchy

Abstract Factory Design