MIS 6308.501 – System Analysis and Project Management

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Group 10

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PROJECT PRESENATATION LINK

https://www.youtube.com/watch?v=LcJDjIU1ssE

CURRENT SITUATION

In the modern world, hospitals have more than 120 rooms, and we have a well-developed healthcare system with significant infrastructure. A fifth of patients on an intravenous drip develop complications because they are given the wrong levels of fluid, according to a review of guidance in England and Wales. Taking care of such a large number of people can be challenging, particularly the current pandemic What Covid19 has shown us, Official estimates of deaths attributable to COVID-19 indicate that over 1 million Americans have lost their lives to COVID-19 since the first COVID-19 death was reported in the United States in March 2020.If there are patients in every room in such a large hospital, it is a problem. To remember every drip or IV the patient receives is challenging for nurses.

EXECUTIVE SUMMARY

The development of this project throughout the semester gave us a deep understanding of the software development life cycle and different methodologies for project management along with object-oriented analysis and design. We as a team could apply all the knowledge acquired in the class to a real-world problem through this project.

This project aims to develop a drip/IV management system that will improve patient care and security. Managing drips and IVs manually now takes time, is error-prone, and can lead to serious consequences including infections or medication blunders. Ingenious technologies, including sensors and alarms, will be used by the system to accurately track and manage the flow of medications and fluids to patients. Healthcare practitioners will find it easy to enter patient data, manage fluid and medication orders, and monitor patient progress thanks to the user-friendly interface. To support healthcare professionals in making informed decisions about patient care, the system will also contain functionality for data analysis and report generation.

To ensure patient safety and health, the project's scope calls for improved precision, and more efficient patient data recording, reporting, and analysis. The project's success will depend on its capacity to increase patient safety, reduce medication errors, and increase the effectiveness of administering IV fluids and drugs. However, the project's exclusions include areas such as medical condition diagnosis or treatment, vital sign monitoring, patient safety outside of treatment, power supply, heart and respiratory monitoring, and diagnostic imaging.

STATEMENT OF PURPOSE

The purpose of this project is to create a drip/IV management system that can be used in clinics, hospitals, and other healthcare settings to enhance patient treatment and safety. The manual methods currently used to manage drips and IVs are time-consuming, prone to mistakes, and can result in severe complications like infections or medication errors.

In order to precisely track and control the flow of medications and fluids to patients, our system will make use of innovative technology. Sensors and alarms will be built into the system to notify medical professionals of any deviations from the recommended doses or rates and to identify any foreseeable problems, such as air bubbles or occlusions in the IV lines.

Additionally, the user-friendly interface of our system will make it simple for healthcare professionals to enter patient data, handle fluid and medication orders, and keep track of patient progress. In order to aid healthcare professionals in making wise choices about patient care, the system will also include features for data analysis and report generation.

Our overall objective is to develop a secure and dependable drip/IV management system that will ease clinical workflows and enhance patient safety. We intend to increase patient safety and raise the standard of care given by medical institutions by lowering the risks connected with manually managing drips and IVs.

PROJECT OBJECTIVES

The objective of this project is:

- Enhanced precision: By integrating latest optical technology, which is primarily used for keeping a track on drip speed, level, and completion.
- To streamline the process of recording, reporting, and analysing patient's data.
- To monitor IV drip parameters to maintain safety and health.
- Remote patient monitoring would enable medical professionals to keep an eye on patients while they are receiving care, allowing for shorter response times in case of difficulties.

PROJECT SCOPE

Scope for this project is described as below:

- By monitoring the drip speed and real-time drip completion progress, the project aims to have immediate care to the patient improving patient safety and at the same time make life of hospital staff easy.

- The system will be integrated with the hospital's electronic health record (EHR) system, enabling medical personnel to access patient history and drug consumption.
- Analytics and reporting features will allow tracking of dosage administration and monitoring of IV status.
- With the use of mobile alerts, the system will be able to alert medical professionals via their mobile devices if there are any problems with the administration of medication, such as leakage detection or an empty IV bag.

The project's success will be decided by the system's capacity to improve patient safety, eliminate medication mistakes, and boost efficiency in giving IV medications and fluids.

OUT OF SCOPES

- **Diagnosis or treatment of medical conditions**: This smart drip monitoring systems are designed to provide accurate and real-time data on the flow rate and volume of fluids being infused into a patient's bloodstream. They are not intended (made) to diagnose or treat any other medical conditions.
- While this Smart Drip Monitoring System can help ensure that the correct dosage of medication is being delivered, they are not responsible for Medication administration (the direct application of a prescribed medication—whether by injection, inhalation, ingestion, or other means—to the body of the individual by an individual legally authorized to do so themselves.)
- **Monitoring of vital signs**: Although smart drip monitoring systems can provide useful information about a patient's hydration status, they are not designed to monitor other vital signs such as blood pressure, heart rate, or oxygen saturation.
- **Patient safety outside of treatment**: While smart drip monitoring systems are essential for monitoring the safety and efficacy of the treatment, they are not responsible for the safety of the patient outside of treatment or after treatment results.
- **Patient positioning**: The accuracy of the readings from the monitoring system may be compromised because the system is not intended to monitor or regulate the patient's position during infusion.
- **Power supply**: the system might not take care of the power supply requirements or backup systems, In the event of a power loss or outage.
- **Heart monitoring**: Although keeping track of the patient's heart rate may be important in some medical situations, it is usually not covered by a smart drip monitoring device.
- **Respiratory monitoring**: Similarly, monitoring of the patient's oxygen saturation or breathing rate would also be outside the reach of an injectable smart drip monitoring device.
- **Diagnostic imaging**: A smart drip monitoring system would not normally include the utilization of medical imaging technology, such as X-rays or MRI scans.

REQUIREMENTS

The requirements for this project are described below:

Optical technology: The system should use optical technology to monitor the drip speed, level, and completeness in order to ensure real-time patient care and improve patient safety.

Integration with EHR system: The system should be integrated with the hospital's electronic health record (EHR) system to allow medical staff access to patient history and drug usage.

Analytics and reporting abilities: The system should offer analytics and reporting abilities to monitor dose administration and IV status.

Mobile alerts: The system should be able to alert medical professionals via their mobile devices in the event of any problems with medication administration, such as the discovery of a leak or an empty IV bag.

User-friendly interface: The system needs to have a user-friendly interface to make it easy for hospital staff to utilize.

Compliance with regulations: The system must adhere to all laws, regulations, and guidelines that are relevant to medical devices, user privacy, and data security.

System dependability: The system must function as intended without experiencing any technical issues that might cause malfunctions, downtime, or system failures that might have an impact on patient care.

Training: Hospital staff members need to receive instructions on how to use the system.

Patient safety: The system should improve patient safety by eliminating pharmaceutical errors and guaranteeing effective drug delivery.

Efficiency: The system should be more effective at giving IV medications to reduce the strain of hospital staff and hasten reaction times in the event of issues.

SYSTEM CAPABILITIES

Some potential project capabilities for creating an improved IV monitoring system may be as follows, depending on the objectives specified:

Integration of optical sensors: To allow the system to track fluid level, drip speed, and completeness.

Creating **a user-friendly interface** would make it easier for nurses and other medical professionals to use and comprehend the system.

Creating a system that can **gather information** on IV drip parameters including flow rate, dose, and duration and evaluate that information to guarantee patient safety and health.

Alert system: Creating a system that will send out a message to medical personnel if there are any irregularities or problems with the IV drip, including blockages or low fluid levels.

Possibilities for remote patient monitoring: Creating a system that will allow doctors to keep an eye on patients while they are undergoing treatment, maybe through a web-based or mobile app.

Data security: Ensuring that patient data is sent and maintained securely to respect patient privacy and adhere to legal obligations.

Integration with current hospital information systems, such as **electronic health records**, is being done to create a system that can offer a more complete picture of patient care.

Training and support: To guarantee effective use and interpretation of the data, training and support should be provided for nurses and other medical professionals who will be utilizing the system.

PROJECT APPROACH

We are going to follow the iterative (Agile) approach for this project development. As this project methodology should, in general, be iterative, with regular reviews and input from stakeholders. Patient safety should be the project team's top priority, and they should make sure that the Smart Drip Management System achieves its goals and benefits both patients and hospital staff.

Initiation: The project team should review the project's problem statement and objectives during the initiation phase. These include creating an improved precision system that makes it easier to record, report, and analyse patient data, to keep IV drip parameters under control for safety and health, and to enable remote patient monitoring. The project's scope, stakeholders, and restrictions should all be identified by the team. The project's goals, objectives, timetables, and available resources should be listed in a project charter.

Planning: The project team should create a thorough project plan during the planning phase that includes a task breakdown structure, timetable, budget, and resource allocation. Along with identifying risks, the team should create a risk management strategy. The team should focus especially on regulatory compliance and compatibility with the hospital's EHR system as part of this. The group should decide on the essential hardware and software components as well as the technical and functional requirements for the Smart Drip Management System. The project team should also specify the metrics and indicators used to gauge the effectiveness of the system, such as increased effectiveness, decreased medication errors, and patient safety.

Design: The electronic health record (EHR) system and other components of the hospital's current infrastructure will be compatible with the Smart Drip Management System. To ensure prompt patient care and enhance patient safety, the system will use optical technology to monitor the drip speed and real-time drip completion progress. To check dosage delivery and keep track of IV status, the system will also provide analytics and reporting tools.

The system will use mobile notifications to alert healthcare providers via their mobile devices so that they may react swiftly in the event of any issues with medication administration. The system will be created to abide with pertinent laws, rules, and regulations regarding medical devices, user privacy, and data security.

The system will be created with a user-friendly interface and medical employees will receive training on how to utilize it efficiently to ensure ease of usage. The system's performance will be determined by its capacity to raise IV fluid and drug efficiency, reduce medication errors, and safeguard patient safety.

Execution: The project team should create the Smart Drip Management System and incorporate it with the hospital's EHR system during the execution phase. The group shall develop the hardware and software parts, including the optical technology for measuring the rate, level, and completion of the drip. Along with developing analytics and reporting tools that enable tracking of dosage delivery and IV status monitoring, the team should also test and validate the system. The system's compliance with rules and norms should be checked by the project team, and the team should also instruct the hospital personnel on how to utilize the system. The team should set up mobile alerts so that medical personnel can receive notifications on their mobile devices if there are any problems with medicine administration.

Monitoring and Control: The project team should make sure that the Smart Drip Management System is operating as intended during the monitoring and control phase. The group should keep an eye on the system's functioning, spot problems, and take corrective action. To guarantee that the project is completed within the set timelines and budget, the team should also manage the project's scope, schedule, and budget.

Finalization: The project team should assess the project's progress in the finalization phase using the metrics and indicators set forth in the planning phase. The team must record the lessons learned and support the hospital staff after implementation. The project team should provide the hospital personnel with access to the system so they may use it to enhance patient safety, get rid of medication errors, and boost efficiency in giving IV medications and fluids.

ASSUMPTIONS

Project completion is subjected to below assumptions:

- Regulatory compliance: We assume that the Smart Drip Management System will comply with relevant regulations and guidelines for medical devices, data and user privacy, and security.
- Availability of hospital infrastructure: We assume that the hospital infrastructure is already in place, including sufficient power supply, internet connectivity, and hardware equipment required for the Smart Drip Management System apart from the built especially for the product.

- Compatibility with hospital EHR system: We assume that the Smart Drip Management System can be integrated successfully with the hospital's electronic health record (EHR) system without any significant technical difficulties or adjustments in the existing system.
- No major technical issues: We assume that the Smart Drip Management System will function as intended, without any technical issues that can cause system failures, malfunctions, or downtime that can impact patient care.
- Availability of trained medical staff: We assume that the hospital has trained medical staff who are knowledgeable about intravenous drug administration and can effectively use the Smart Drip Management System to monitor with fewer efforts on training.
- Accurate patient history and dosage information: We assume that the patient history and dosage information in the hospital's EHR system is accurate and that there are no errors or discrepancies that can compromise patient safety and generated reports' data.
- Patient cooperation: We assume that patients will cooperate with medical staff and follow instructions regarding intravenous drug administration, and there will be no resistance or non-compliance that can affect the accuracy and safety of the system.

OVERALL GOAL

The overall goal of the smart drip management system is to improve patient safety by providing medical staff with precise and secure tools and dashboard to monitor intravenous drugs and fluids consumption effectively while reducing the risk of errors.

PROJECT COMPLETION CRITERIA

Completion requirements for a smart monitoring IV/drip system are as follows:

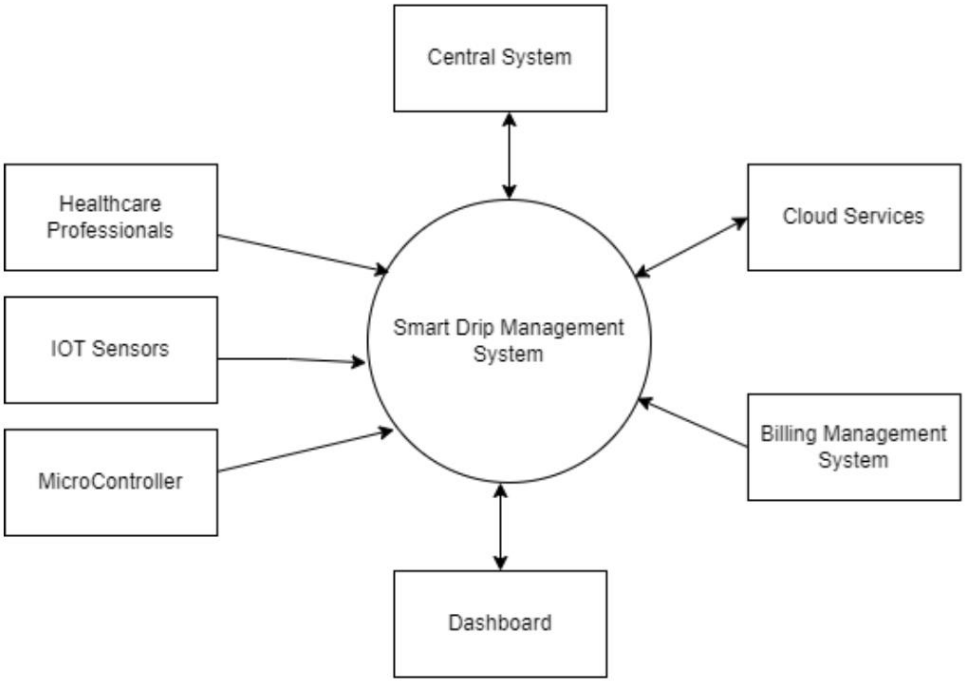
- Accuracy of the system: The system should monitor and control the drip rate and amount of medicine administered to the patient with precision. This should be validated and tested against established standards.
- User interface: The system should feature an easy-to-use interface that allows healthcare practitioners to monitor and alter settings as required. The interface should be built with input from healthcare experts and usability assessed.
- Alarm system: The system should have an alarm system to warn healthcare practitioners if any parameters are deviated from, such as changes in the drip rate or volume of medicine. For accuracy and dependability, the alarm system should be verified.
- Data collection and analysis: The system should gather and store data on the drip rate, medication quantity, patient vitals, and any alarms that have been triggered. The data should be freely available and displayed in such a way that healthcare practitioners can track the patient's development and alter therapy as needed.
- Wireless data transmission: The system should be able to wirelessly transfer data to a centralized monitoring station or electronic health record system. Healthcare

practitioners will be able to obtain real-time data and intervene immediately if necessary.

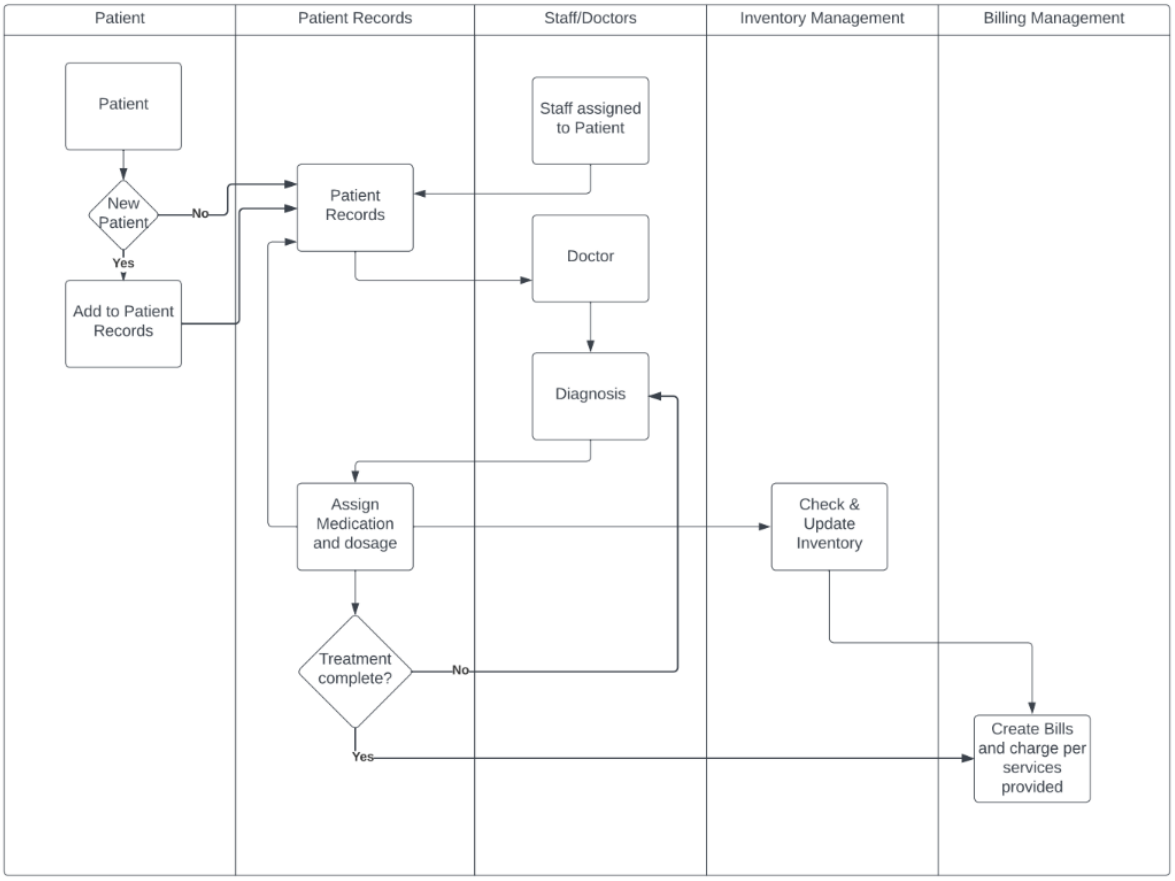
- Regulatory compliance: The system should meet all applicable regulatory requirements, such as safety standards and data privacy laws.
- Training and support: For healthcare practitioners, the system should provide extensive training and support resources. This should include user guides, training videos, and a helpline to address any issues or concerns that arise during use.

If the smart monitoring IV/drip system meets these project completion requirements, it will offer healthcare personnel with a dependable and user-friendly instrument for giving IV fluids and medicines to patients.

SYSTEM CONTEXT DIAGRAM

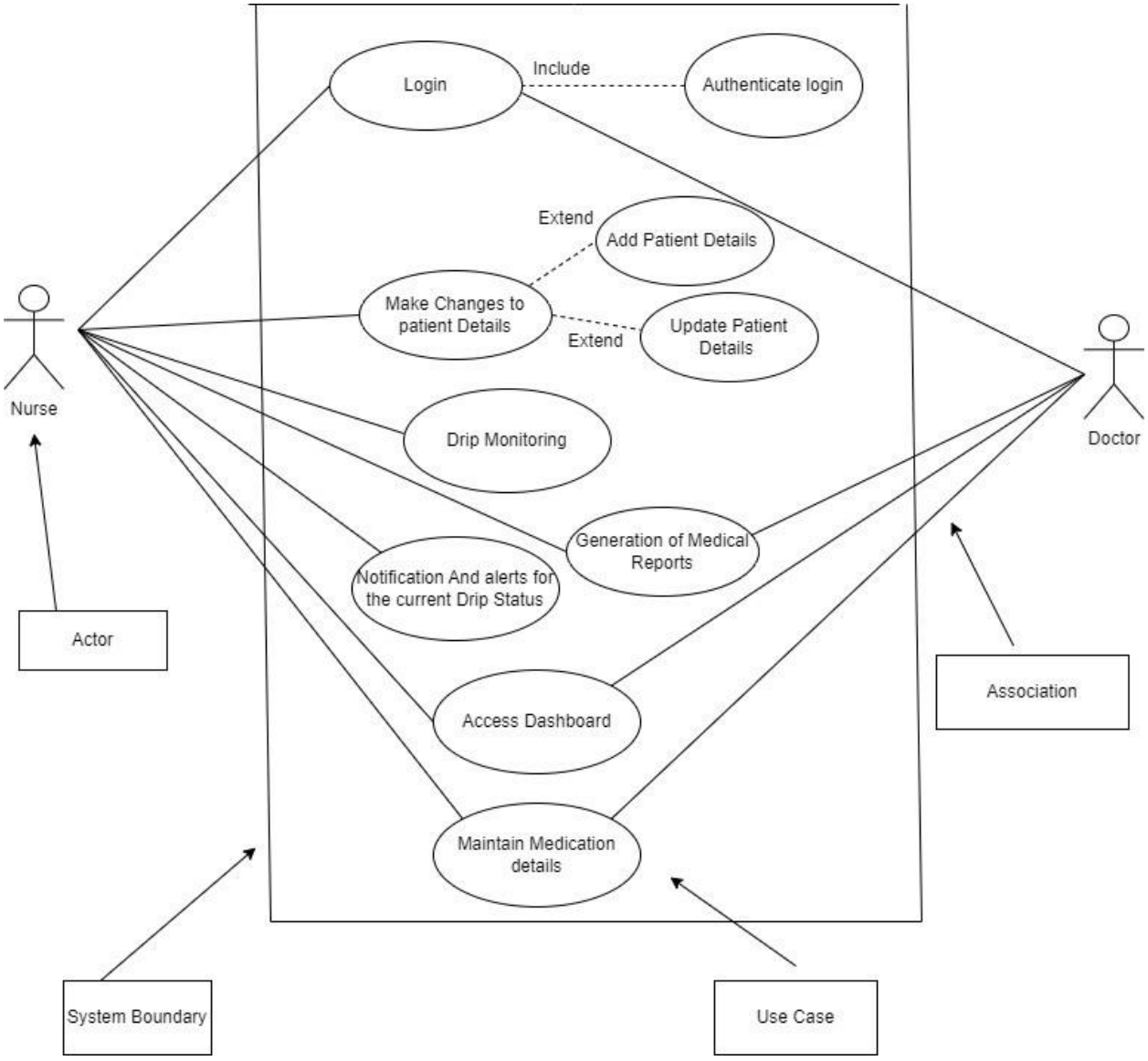


BUSINESS PROCESS MODELING DIAGRAM

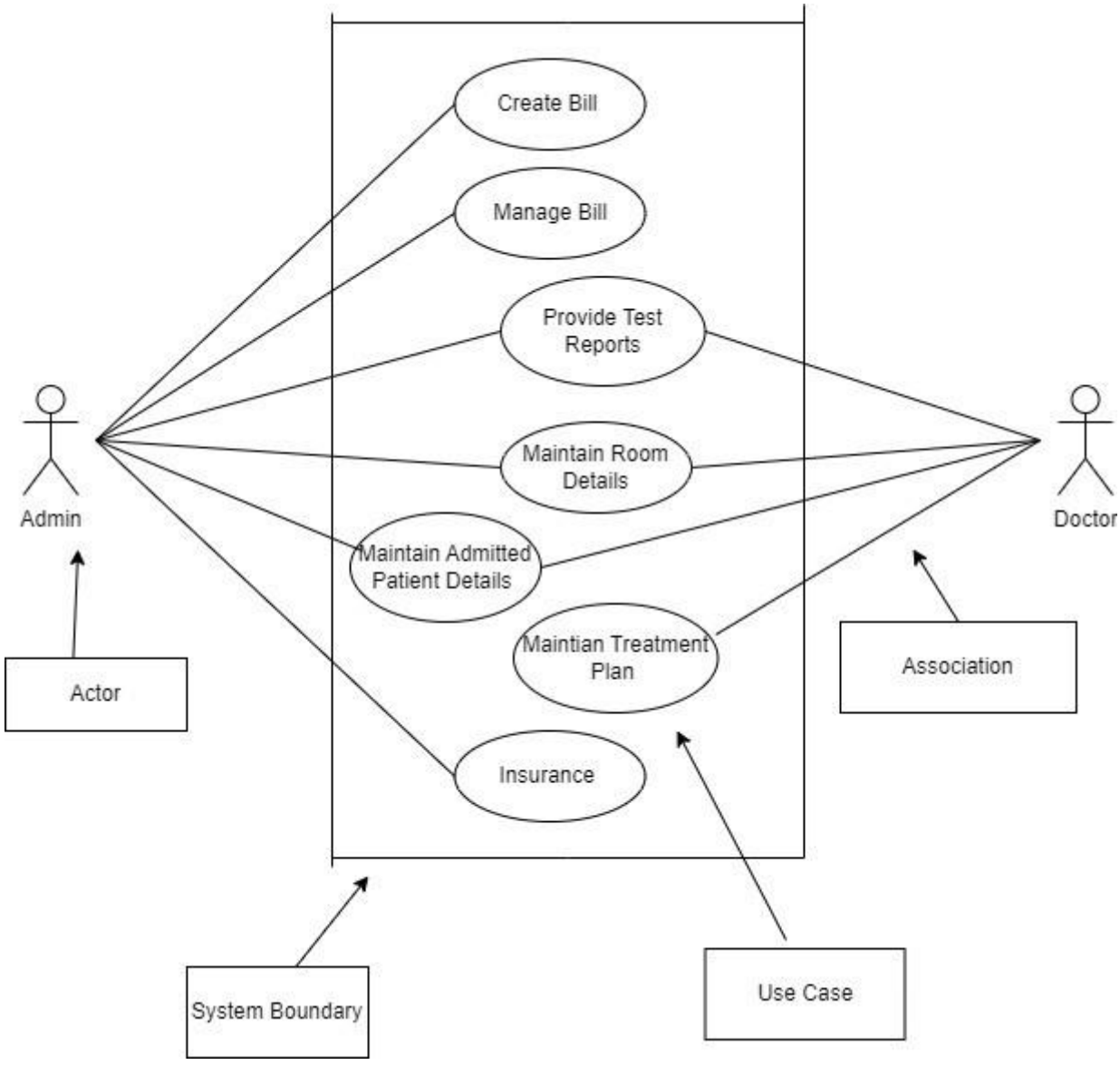


USE CASE DIAGRAMS

Patient/Drip Management:



Administration:



USE CASE DESCRIPTIONS

Use Case Description 1:

Use Case Name: Make changes to patient details
Primary Actor: Nurse
Stakeholder: Smart Drip Management System
Brief Description: This use case allows the Nurse to make changes to the patient's details, including personal information, medical history, and medication allergies.
Trigger: The trigger for this use case is the need to update the patient's details due to changes in their medical condition or personal information
Normal flow of Events: 1. The nurse logs into the system and selects the patient whose details need to be updated. 2. The system displays the patient's details, including personal information, medical history, and medication allergies. 3. The nurse selects the section of the patient's details they want to change. 4. The system allows the nurse to make changes to the selected section. 5. The Nurse saves the changes. 6. The system updates the patient's details with the changes made. 7. The system displays a confirmation message indicating that the changes have been saved successfully.

Use Case Description 2:

Use Case Name: Generation of medical reports
Primary Actor: Nurse, Doctor
Stakeholder: Smart Drip Management System
Brief Description: This use case allows the nurse and doctor to generate medical reports for a patient, including information about the patient's medical history, diagnosis, medications, and other relevant information.
Trigger: The trigger for this use case is the need to generate a medical report for a patient, typically after a consultation or treatment session.
Normal flow of Events: 1. The healthcare provider logs into the system and selects the patient for whom they want to generate a medical report. 2. The system displays the patient's details, including personal information, medical history, and medication allergies. 3. The healthcare provider selects the option to generate a medical report for the patient.

Use Case Description 3:

Use Case Name: Maintain medication Details
Primary Actor: Nurse, Doctor
Stakeholder: Smart Drip Management System
Brief Description: This use case allows the Nurse to make changes to the patient's details, including personal information, medical history, and medication allergies.
Trigger: This use case allows the healthcare provider to maintain medication details, including the list of medications available, the dosage, the frequency, and the duration of medication.
Normal flow of Events: 1. The healthcare provider logs into the system and selects the medication details option. 2. The system displays the list of available medications and their details, including the dosage, frequency, and duration of medication. 3. The healthcare provider selects the medication they want to update or maintain. 4. The system displays the medication details, including the dosage, frequency, and duration of medication. 5. The healthcare provider updates the medication details if necessary. 6. The healthcare provider saves the changes. 7. The system updates the medication details in the system.

Use Case Description 4:

Use Case Name	**Drip/IV Monitoring**
Primary Actor	Nurse
Stakeholders	Smart Drip Management System
Brief Description	The nurse or healthcare provider monitors the patient's drip/IV system to ensure that the correct amount of fluid is being administered to the patient.
Trigger	The patient's drip/IV system has been initiated or there is a change in the patient's condition.
Normal Flow of Events	1. The nurse checks the patient's drip/IV system to ensure that it is functioning properly. 2. The nurse checks the drip/IV percent of completion, and takes necessary steps as needed. 3. The nurse monitors the patient's vital signs to ensure that they are stable. 5. The nurse documents the monitoring activities in the patient's medical record. 6. If there are any concerns or issues, the nurse alerts the doctor.

Use Case Description 5:

Use Case Name	**Notifying nurses about drip progress**
Primary Actor	Smart drip/IV system, Nurse
Stakeholders	Smart Drip Management System
Brief Description	Notifies the nurses about the progress of the drip treatment, including the volume of the drip administered and the remaining for the drip to complete.
Trigger	Need to notify nurses about the progress of the drip treatment at regular intervals or when there is a change in the drip status.
Normal flow of events	1. The smart drip/IV system monitors the progress of the drip treatment. 2. The system generates a notification when a predefined event occurs. 3. The system sends the notification to the nurses assigned to the patient. 4. The nurses receive the notification and review the details of the drip progress. 5. The nurses take appropriate action based on the drip progress.

Use Case Description 6:

Use Case Name	**Access Dashboard**
Primary Actor	Nurse, Doctor
Stakeholders	Smart Drip Management System
Brief Description	The healthcare provider accesses the system dashboard to view patient information and manage system settings.
Trigger	The healthcare provider needs to access the dashboard.
Normal Flow of Events	1. The healthcare provider or administrator logs into the system. 2. The system authenticates the user's credentials. 3. The system displays the dashboard, which includes patient information, system settings, and other relevant data. 4. The healthcare provider or administrator navigates the dashboard to view patient information or manage system settings.

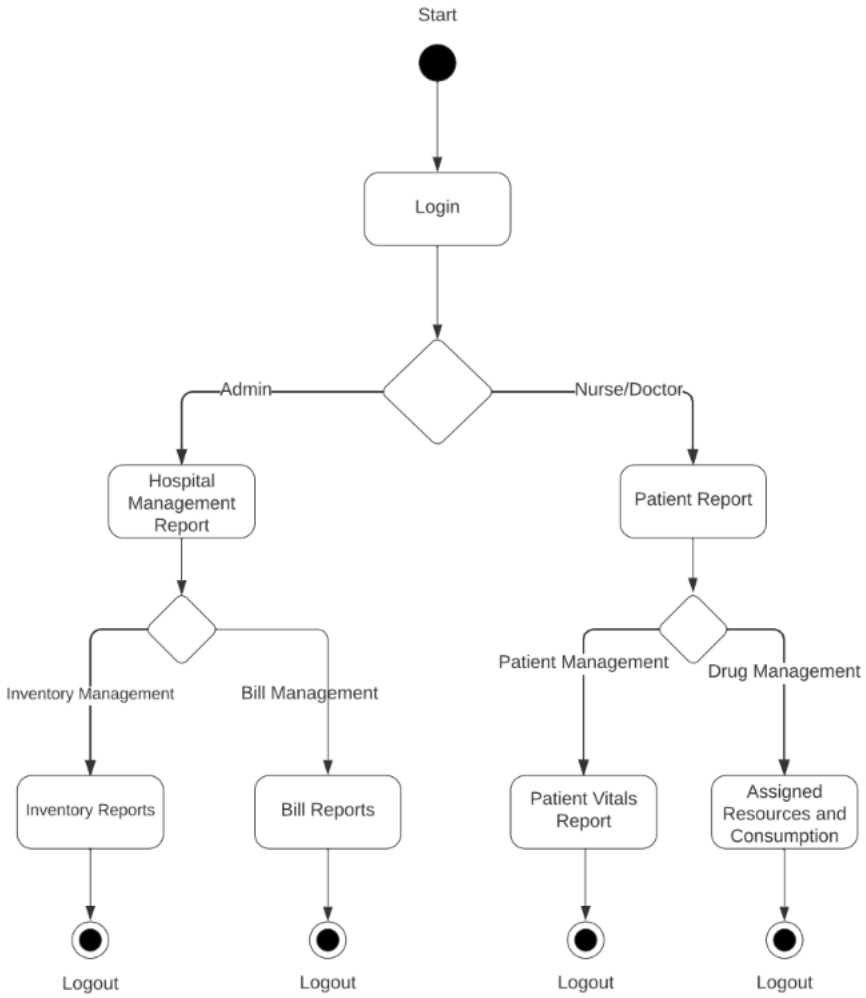
Use Case Description 7:

Use Case Name	**Administration Activities**
Primary Actor	Administrator
Stakeholders	Smart Drip Management System
Brief Description	The administrator or healthcare provider with administrative privileges performs various administrative activities related to the system.
Trigger	The administrator or healthcare provider with administrative privileges needs to perform an administrative task related to the system.
Normal Flow of Events	1. The administrator or healthcare provider with administrative privileges logs into the system with appropriate credentials. 2. The administrator or healthcare provider navigates to the appropriate page or section of the system to perform the desired administrative task. 3. The administrator or healthcare provider performs the administrative task, such as creating a new bill, update current bill.

ACTIVITY DIAGRAM

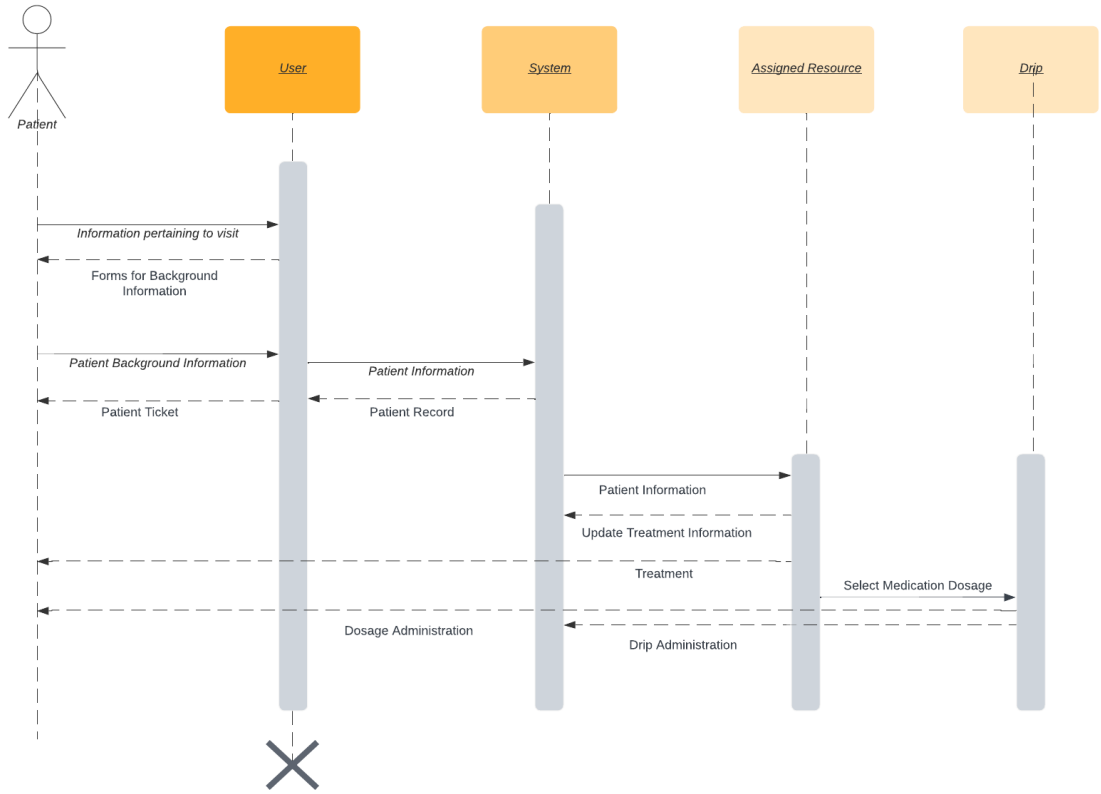
Drip Administration:

Dashboard Administration:

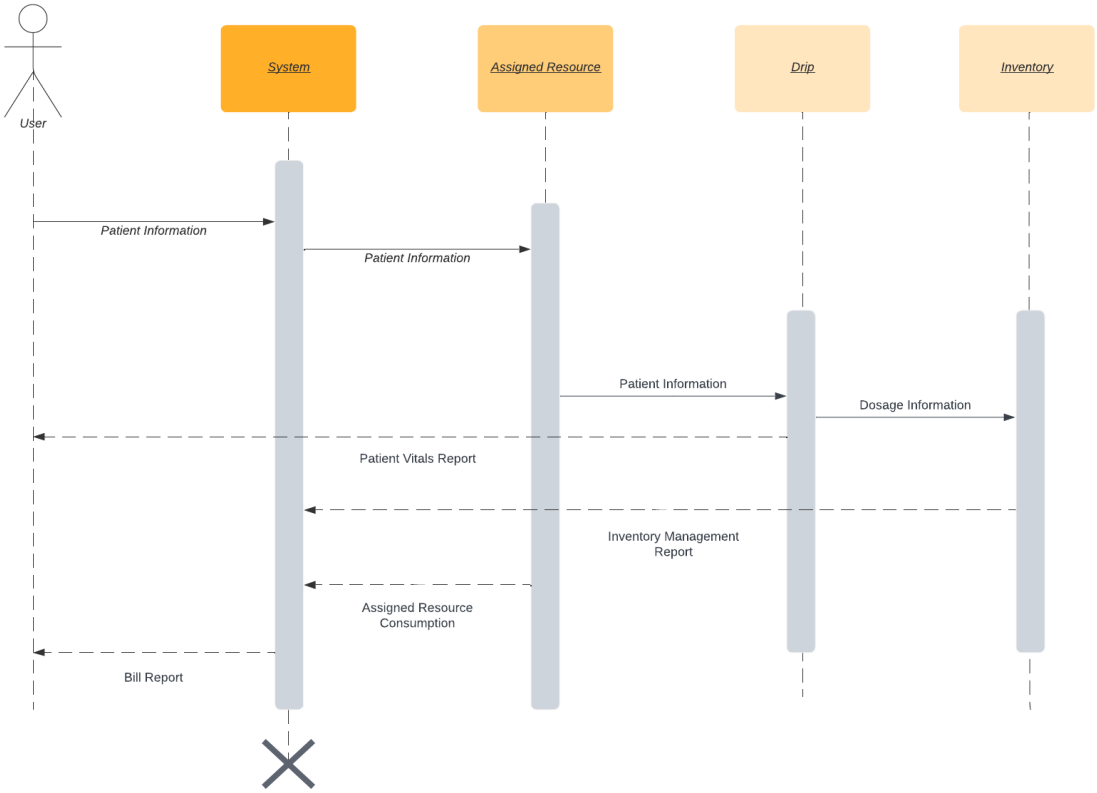


SEQUENCE DIAGRAM

Drip/Patient Administration:



Report Administration:



DATA DICTIONARY

Medical Service = Patient Details + Hospital Staff + Insurance ID + Smart Drip Management

Patient Details = Patient ID + Patient First Name + Patient Last Name + Patient Age + Patient Address + Patient Insurance ID + Patient Gender + Patient Contact Details

Patient Address = Patient Address Line 1 + Patient Address Line 2 + Patient City + Patient State + Patient Country + Patient Zip Code

Patient Contact Details = Patient Home Number + Patient Cell Number + Patient Email Address + Patient Emergency Contact Name + Patient Emergency Contact Number

Gender = [Male, Female, Other]

Hospital Staff = Employee ID + Employee Details + Employee Department

Employee Details = Employee First Name + Employee Last Name + Employee Pager ID

Department = [Emergency department, Intensive care unit (ICU), Operating room (OR), Post-anaesthesia care unit (PACU), Oncology department, Cardiology department, Hematology department, Nephrology department, Gastroenterology department, Infectious disease department]

Smart Drip Management = Medicine ID + Drip Rate + Patient Report + Inventory Report

Medicine ID = Medicine Manufacturer Name + Medicine Name + Medicine Dosage + Medicine Expiry + Medicine Price

Patient Report = Patient Vitals + Hospitalization Details + Medicine ID

Patient Vitals = Patient Pulse Rate + Patient Blood Pressure + Patient Respiration Rate + Patient Oxygen Saturation + Patient Temperature

Hospitalization Details = Hospital Staff + Hospital Room ID

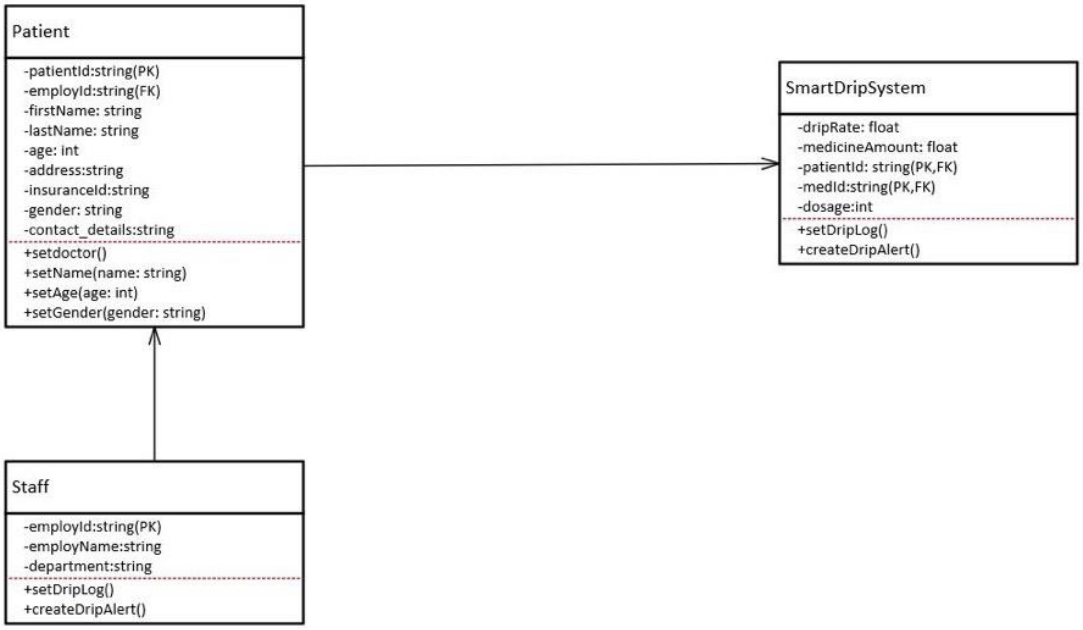
Hospital Room ID = Hospital Room Type + Hospital Room Price

Inventory Report = Medicine ID + Quantity

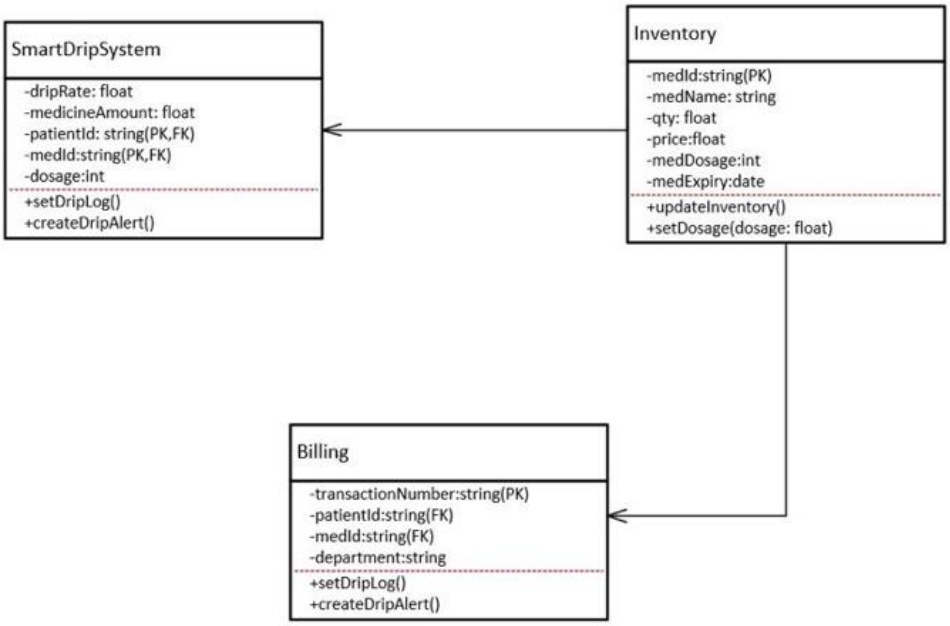
Bill Report = Smart Drip Management

CLASS DIAGRAM

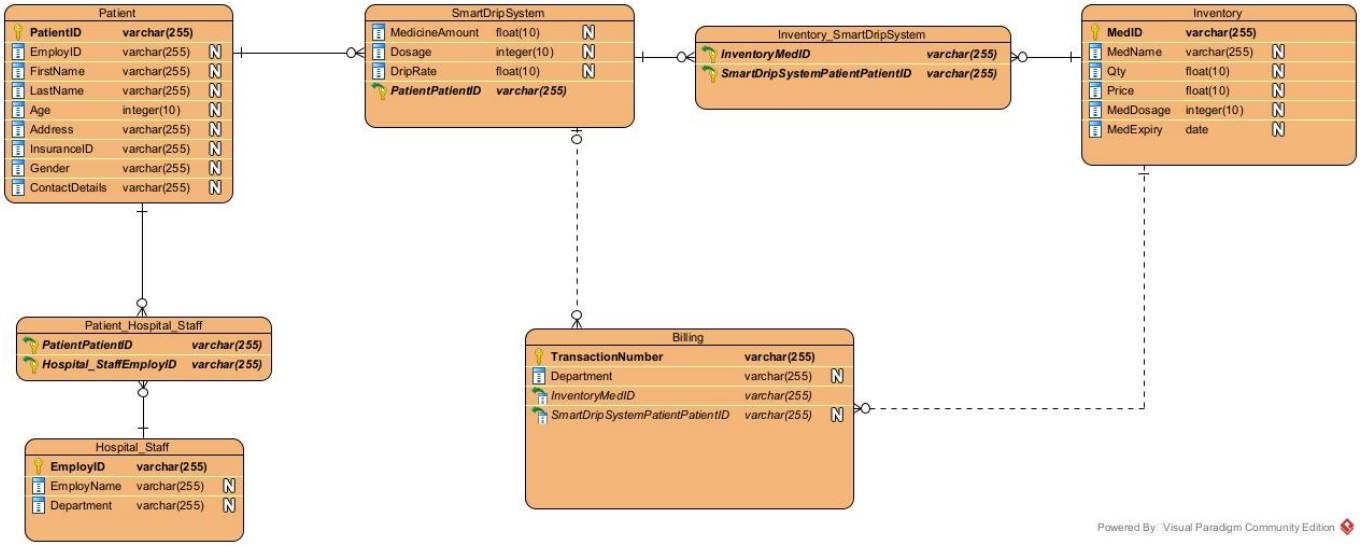
Resource Assignment Class Diagram



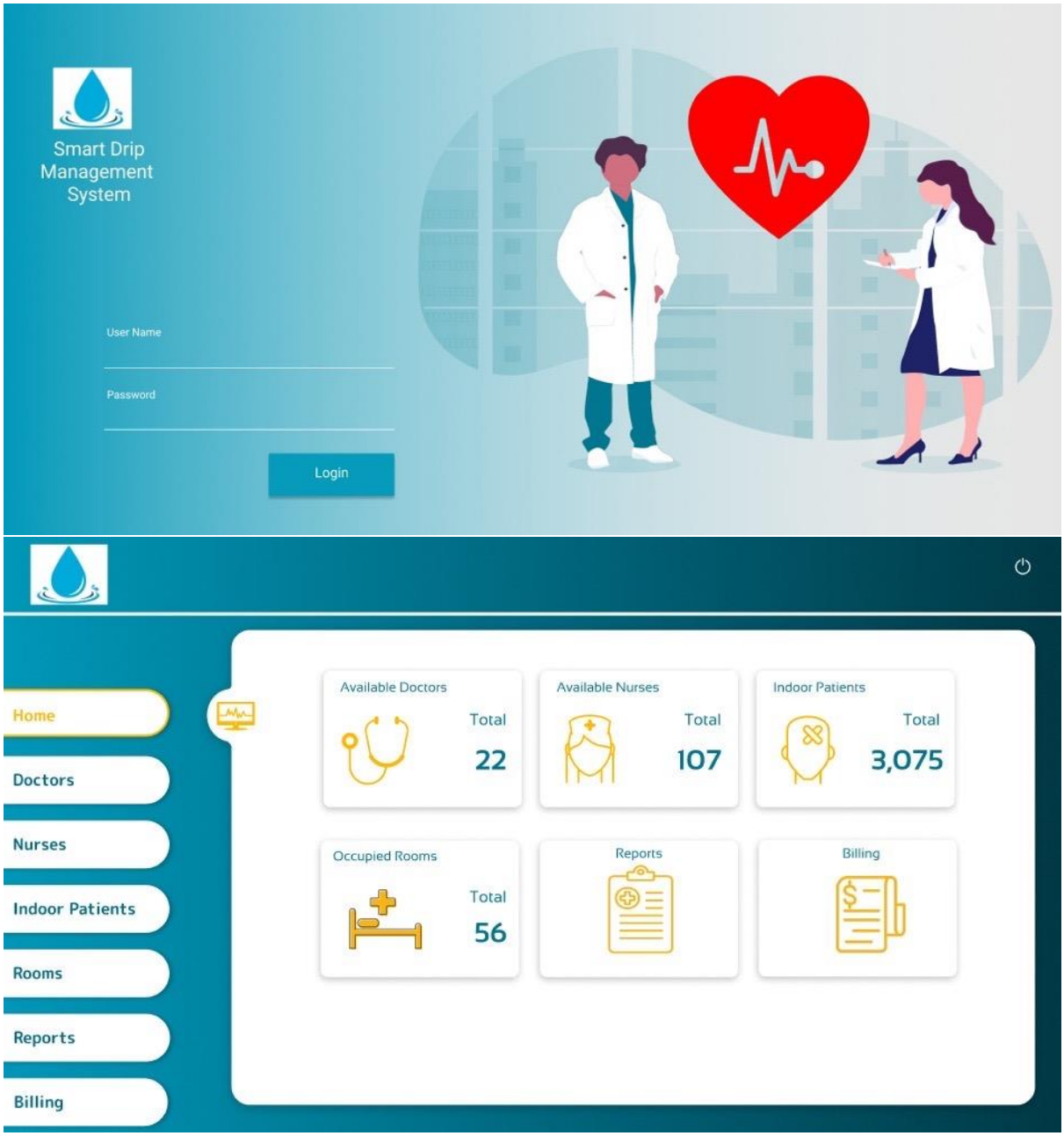
Billing Class Diagram



DATA MODEL


Patient
PatientID varchar(255)
EmployID varchar(255) N
FirstName varchar(255) N
LastName varchar(255) N
Age integer(10) N
Address varchar(255) N
InsuranceID varchar(255) N
Gender varchar(255) N
ContactDetails varchar(255) N
SmartDripSystem
MedicineAmount float(10) N
Dosage integer(10) N
DripRate float(10) N
PatientPatientID varchar(255)
Inventory_SmartDripSystem
InventoryMedID varchar(255)
SmartDripSystemPatientPatientID varchar(255)
Inventory
MedID varchar(255)
MedName varchar(255) N
Qty float(10) N
Price float(10) N
MedDosage integer(10) N
MedExpiry date N
Patient_Hospital_Staff
PatientPatientID varchar(255)
Hospital_StaffEmployID varchar(255)
Billing
TransactionNumber varchar(255)
Department varchar(255) N
InventoryMedID varchar(255)
SmartDripSystemPatientPatientID varchar(255) N
Hospital_Staff
EmployID varchar(255)
EmployName varchar(255) N
Department varchar(255) N
Powered By Visual Paradigm Community Edition

USER INTERFACE DESIGN



Occupied Rooms 56
Home
Doctors
Nurses
Indoor Patients
Rooms
Reports
Billing
Room No.
Patient Id
Patient Name
Doctor Name
Dose Name
Drip IV Status
101
1235693
Akshay Ochani
Dr. John Daniel
Ibuprofen
56 %
Reports
Home
Doctors
Nurses
Indoor Patients
Rooms
Reports
Billing
Room No.
Patient Id
Patient Name
Doctor Name
Test Conducted
101
1235693
Akshay Ochani
Dr. John Daniel
Blood Test CBC
Generate Report

CONCLUSION

In conclusion, the project's goal is to create a drip/IV management system that will enhance patient security and care, lower medication errors, and boost the efficiency of IV fluid and medication administration. The current manual procedures used in healthcare settings are prone to errors and can result in serious complications, necessitating the creation of an original and dependable system. In order to accurately track and manage the flow of medications and fluids to patients, the system will use sensors and alarms. It will also give medical professionals access to real-time information. Healthcare professionals will find it simple to enter patient data, manage fluid and medication orders, and track patient progress thanks to the system's user-friendly interface. To help healthcare professionals make wise decisions about patient care, the system will also have data analysis and report generation capabilities. The project's success will depend on its capacity to improve hospital care standards, decrease medication errors, and safeguard patients.