

PROJECT DESIGN DRAFT
FOR
ELECTRONIC MEDICAL INFORMATION SYSTEM

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1 Executive Summary

The purpose of this document is to do an analysis of an Electronic Medical Information System (EMIS) for a local clinic and provide a system design using UML methodologies. The system has been designed in accordance to requirements mentioned in the term project description document and assumed clarifications provided by the client through interviewing during the requirement elicitation phase.

The next sections of this document contain an introduction of the system to be designed followed by system analysis, which includes the problem statement and functional and system requirements. Later sections of this report consists of findings of the requirement-gathering phase and the system design- use case diagrams for the assumed cases including Appointment scheduling subsystem, Clinical Visit subsystem and Payment subsystem. It also contains the use case descriptions and activity diagrams for Appointment Scheduling subsystem and Patient's CoPayment. The following sections contains the system domain class diagram, sequence diagrams for Appointment Scheduling subsystem and Patient's CoPayment along with the updated class diagram. Finally, state diagrams for the Payment class is included which provides states of Patient's Co-payment and Insurance Payment.

2 Introduction

A comprehensive UML model of the EMIS will be created for a clinic. With the help of this system, the clinic will be able to transform old paper-based patient records and automate the handling of medical information. In addition to the above, it will also be able to send and receive notifications to the users and simplify everyday operations such as doctor-patient appointments and payment records. This system is expected to be used by clinic staff which includes receptionist, nurse, doctor whose goals and responsibilities have been described in next section and the design document will reflect how they will interact with the system.

3 System Analysis

3.1 Problem Statement

The overall goal of the system is to enable the Doctors, Nurses and staff (the Receptionist and administration staff) to create and modify patient records on the computers. The EMIS will help to improve the communication between the clinic and patient by sending automated email or text messages. Additionally, it will help the clinic to keep detailed patient records for a longer period of time.

Patient can schedule an appointment with a doctor through a call or online messaging system. The system also sends a confirmation and reminder to the patient for the scheduled appointment.

The clinic employees (staff, nurse, receptionist and doctor) can update patient's records in the system for easy reference later. Lab reports can also be saved in the system, which provides an additional benefit to a doctor while referring to a patient's record.

3.2 Requirements Elicitation

During system analysis the team had a lot of queries about the system. To get clarity we created a list of interview questions to be asked from the client. The table below lists all the questions along with the assumed answers taken as assumptions for this system.

Interview Questions Asked	Assumptions Obtained
Can a patient have multiple insurances?	Yes
Does clinic accept walk in patients?	Yes
How does the system send reminder to patient (Online application/ phone call / email/ a text message on phone)?	A text message on phone or an email according to the patient's preference
Does the system send an appointment confirmation message to the patient?	Yes
When does the system send the confirmation message?	As soon as the appointment is scheduled
How does the system send the confirmation message?	A text message on phone or an email according to the patient's preference
When will the system send a reminder if patient schedules an appointment in less than 24 hours?	A reminder message is sent as soon as appointment is scheduled
Who does the patient request for the lab report (Doctor / lab)?	The Doctor
Who makes the patient's copy of the lab report?	Lab
Who sends the copy of the lab report to the patient?	The Doctor
How is the lab report sent to the doctor?	Via mail
Who updates the test's result in the patient's medical record?	The Doctor

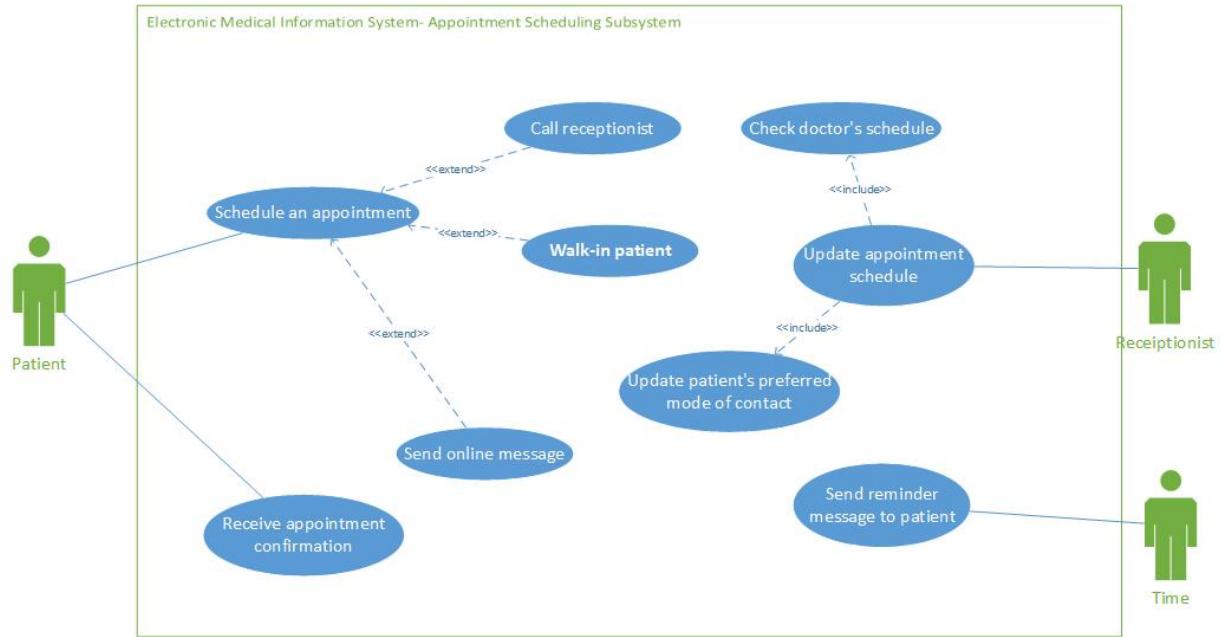
Will there be a follow up appointment for review after receiving test report?	Follow up appointment is required only when test results are not normal
Is a follow up appointment considered a new visit?	Yes
How does the patient receive an itemized bill?	Staff hand over the bill, which is generated by the system, on the day of visit.
Is the patient charged for the lab tests?	Yes
Who charges the patient for the lab tests?	Lab
Are the lab charges included in the scope of the EMIS?	No
How do staff send bill to insurance agencies?	Via EMIS which interacts with Insurance Agencies' systems
How do the insurance agencies make payment to the clinic?	Via check per patient bill
Does patient receive receipt if pays by check?	No, patient will receive receipt later when the check is authorized by bank.
How does patient receive receipt if pays by check?	Patient can choose mailing to registered address or email to registered email address.
If a bank check from patient/ insurance agency is invalid, who needs to make payment and how?	In both the cases, patient is asked to make cash payment within 2 days.
How is the insurance agency informed once the check provided by them has been en-cashed?	A payment receipt is sent to the insurance agency via email.

4 System Design

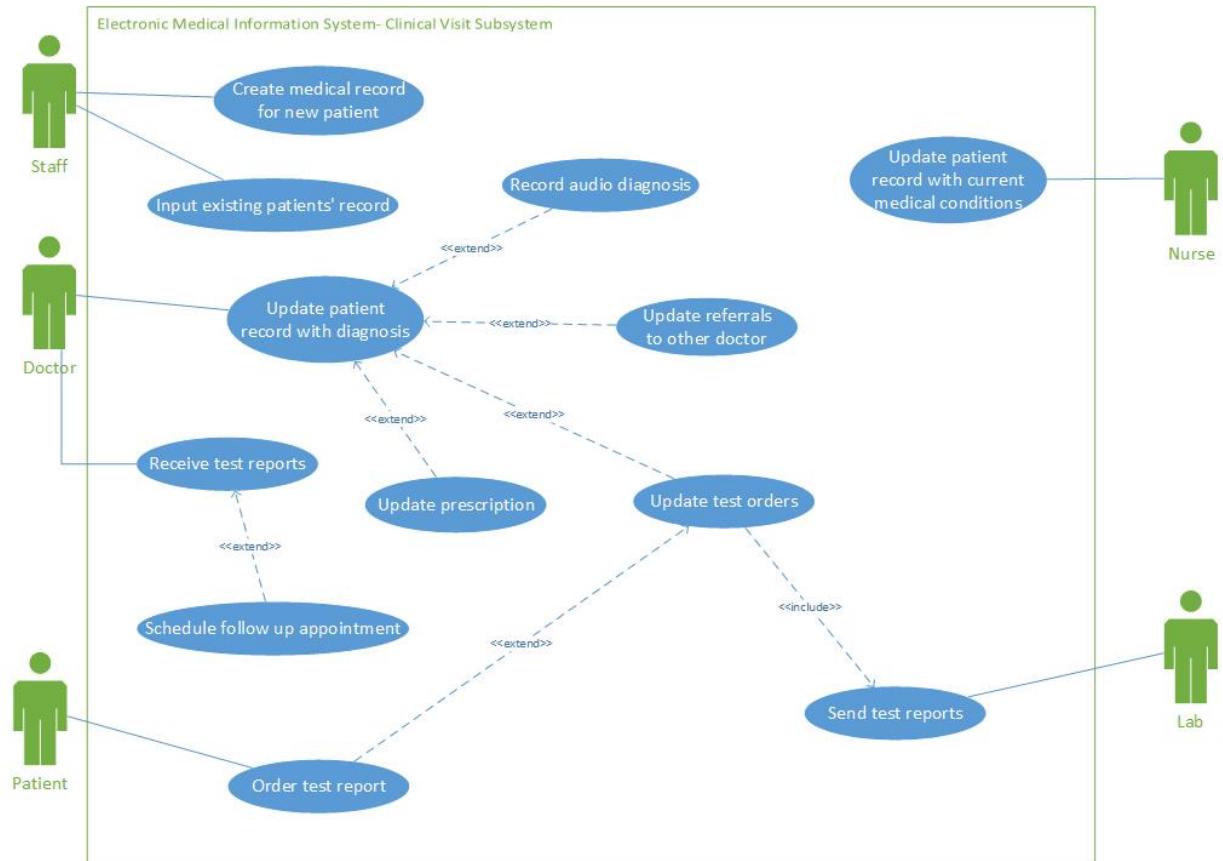
4.1 Use Case Diagrams

The use cases are grouped according to the subsystems of the Electronic Medical Information System (EMIS), which includes three subsystems. A use case diagram for each subsystem is provided in the sub-sections below.

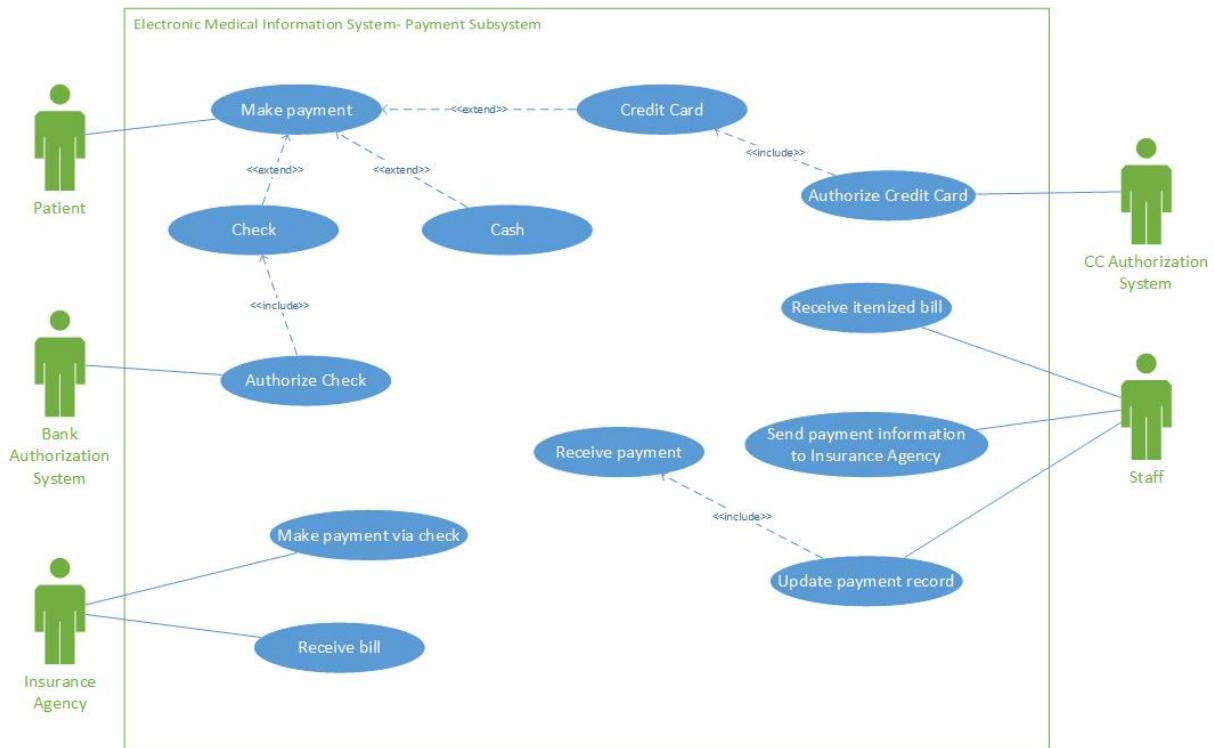
4.1.1 Appointment Scheduling Subsystem



4.1.2 Clinical Visit Subsystem



4.1.3 Payment Subsystem



4.2 Use Case Descriptions

As a requirement of the project, we have done use case description for two of the three subsystems of the EMIS. The following sections provide the use case descriptions for Appointment Scheduling and Patient's CoPayment use cases.

4.2.1 Appointment Scheduling Subsystem

CIS 9490 – Systems Analysis and Design Baruch College	
Project: Team Project Team members: Monica, Anna, Harshad, Gregory	Use Case Descriptions
Use Case: Team 6: Schedule an Appointment	
ID	Schedule an appointment

Brief Description	Patient schedules a doctor appointment by calling or online messaging the clinic receptionist. Receptionist updates the system with appointment schedule. System sends a reminder to the patient 24 hours before the appointment through a text message to the patient's registered cell phone number or an email according to the patient's preference.	
Primary Actors	Patient, Receptionist	
Secondary Actors	Doctor	
Pre-conditions	Patient must have a cell phone number or email address. System must be available.	
	Actor Action	System Response
Main Flow	1. Patient wants to schedule a doctor appointment. 2. Patient calls the clinic. 3. Receptionist receives the call 4. Receptionist checks doctor's schedule. 6. Receptionist informs patient about the doctor's availability. 7. Patient checks his availability according to doctor's available schedule. 8. Patient chooses the date and time. 9. Receptionist asks the patient's preferred mode of contact (email or text). 10. Patient chooses email and provides an email ID. 11. Receptionist updates system. 13. Patient receives the confirmation email.	5. System provides doctor's schedule. 12. System sends confirmation email to patient. 14. System sends email reminder to patient 24 hours before the appointment.

Post-Conditions	<p>Post-conditions on success: Patient has an appointment. Post-conditions on failure: Patient does not have an appointment.</p>
Alternate Flows	<p>Alternate Course A: A.2 Patient sends online message to the receptionist A.3 Receptionist receives the message A.4 The process continues from Main Scenario 4.</p> <p>Alternate Course B: B.2 Patient walks in to the clinic and speak to the receptionist B.3 The process continues from Main Scenario 4.</p> <p>Alternate Course C: C.6 Receptionist informs patient about doctor's unavailability. C.7 Patient chooses another doctor. C.8 The process continues from Main Scenario 4.</p> <p>Alternate Course D: D.6 Receptionist informs patient about doctor's unavailability. D.7 Patient chooses not to schedule appointment. D.8 Use case ends in failure.</p> <p>Alternate Course E: E.8 Patient is not available for the doctor's available schedule. E.9 Patient chooses another doctor. E.10 The process continues from Main Scenario 4.</p> <p>Alternate Scenario F: F.8 Patient is not available for the doctor's available schedule. F.9 Patient chooses not to schedule appointment. F.10 Use case ends in failure.</p> <p>Alternate Course G: G.10 Patient chooses text message as preferred mode of contact and provides a cell phone number. G.11 Receptionist updates the system. G.12 System sends a confirmation text message to patient. G.13 Patient receives the confirmation message. G.14 System sends reminder text message 24 hrs before the appointment.</p> <p>Alternate Course H: H.10 Patient chooses text message as preferred mode of contact and provides a cell phone number. H.11 Receptionist updates the system. H.12 System sends a confirmation text message to patient. H.13 Patient receives the confirmation message. H.14 If appointment is scheduled within less than 24 hrs, system does not send any reminder text message.</p>

	<p>Alternate Course I:</p> <p>I.14 If appointment is scheduled within less than 24 hrs, system does not send any reminder email.</p>
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4.2.2 Patient's Co-Payment

CIS 9490 – Systems Analysis and Design Baruch College		
<i>Project: Team Project</i> <i>Team members: Monica, Anna, Harshad, Gregory</i>	<i>Use Case Descriptions</i>	
Use Case: Team 6: Patient's Co-Payment		
ID	Payment Subsystem	
Brief Description	After the doctor examines patient; patient makes payment for the clinical visit. Patient can choose to pay via cash, credit card or bank check. Once payment is made, staff updates payment record for patient's co-payment.	
Primary Actors	Patient, Staff, Insurance Agency, CC Authorization System, Bank Authorization System	
Secondary Actors	Owner, Accountant, Auditor	
Pre-conditions	Patient must have cash, check or credit card. System must be available.	
	Actor Action	System Response
Main Flow	<ol style="list-style-type: none"> 1. Staff inputs items to be billed. 3. Receives patient and Insurance Agency bills. 4. Staff gives itemized bill to patient for co-payment. 5. Asks patient for mode of payment. 6. Patient chooses bank check as mode of payment. 7. Patient provides bank check. 8. Staff sends bank check to bank for validation. 	<ol style="list-style-type: none"> 2. Prints itemized bill for patient and Insurance Agency.

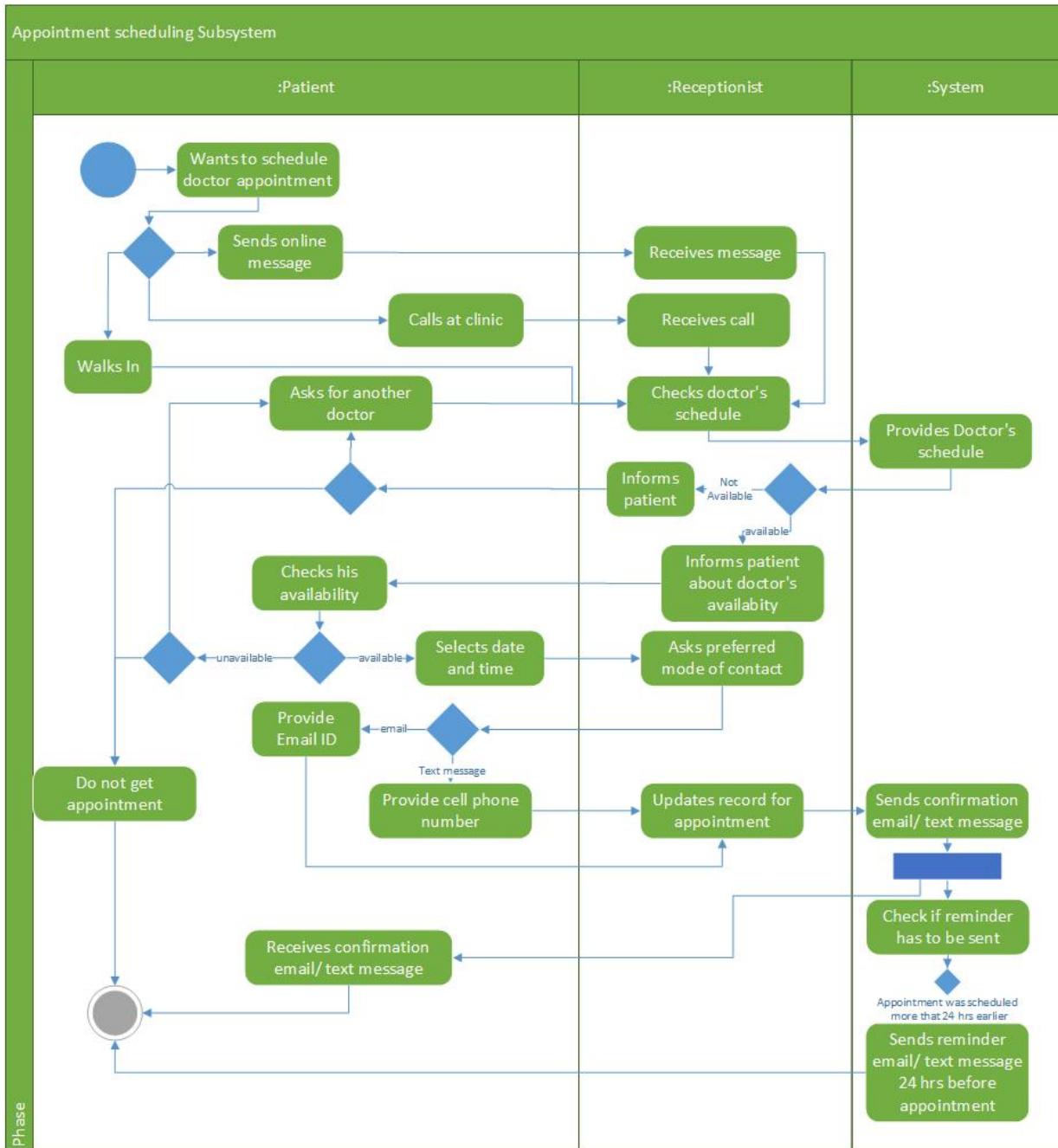
	<p>9. Bank Authorization system validates the check.</p> <p>10. Bank Authorization system authorizes the payment.</p> <p>12. Staff updates payment record with patient's co-payment as received.</p> <p>14. Staff receives receipt.</p> <p>15. Staff sends receipts to patient.</p>	<p>11. System receives authorized payment messages from Bank Authorization System.</p> <p>13. System prints receipt.</p>
Post-Conditions	<p>Post-conditions on success: Patient makes Co-payment.</p> <p>Post-conditions on failure: Patient cannot make Co-payment.</p>	
Alternate Flows	<p>Alternate Course A:</p> <p>A.6 Patient chooses cash as mode of payment.</p> <p>A.7 Patient provides cash.</p> <p>A.8 Staff update patient record with patient's co-payment as received.</p> <p>A.9 System prints receipt.</p> <p>A.10 Staff hands over receipt to the patient.</p> <p>A.11 Use case ends in success.</p> <p>Alternate Course B:</p> <p>B.6 Patient choose credit card as mode of payment.</p> <p>B.7 Patient swipes card.</p> <p>B.8 CC Authorization System checks the card validity.</p> <p>B.9 CC Authorization System authorizes the payment</p> <p>B.10 System receives the payment authorization message from CC Authorization System.</p> <p>B.11 Staff updates payment record with patient's co-payment as received.</p> <p>B.12 System prints patient's receipt.</p> <p>B.13 Staff hands over the receipt to patient.</p> <p>B.14 Use case ends in success.</p> <p>Alternate Course C:</p> <p>C.6 Patient choose credit card as mode of payment.</p> <p>C.7 Patient swipes card.</p> <p>C.8 CC Authorization System checks the card validity.</p> <p>C.9 CC Authorization System sends the payment un-authorization message to the system.</p> <p>C.10 System sends the un-authorization message to patient.</p> <p>C.11 The process continues from Main Scenario 5.</p> <p>Alternate Course D:</p>	

	<p>D.11 Systems receives invalid check message from Bank Authorization System.</p> <p>D.12 Staff contacts patient for cash payment.</p> <p>D.13 Patient receives call from staff to make cash payment within 2 days.</p> <p>D.14 Patient goes to clinic and makes cash payment.</p> <p>D.15 Staff updates payment record with patient's co-payment as received.</p> <p>D.16 System prints patient's receipt.</p> <p>D.17 Staff hands over the receipt to patient.</p> <p>D.18 Use case ends in success.</p>
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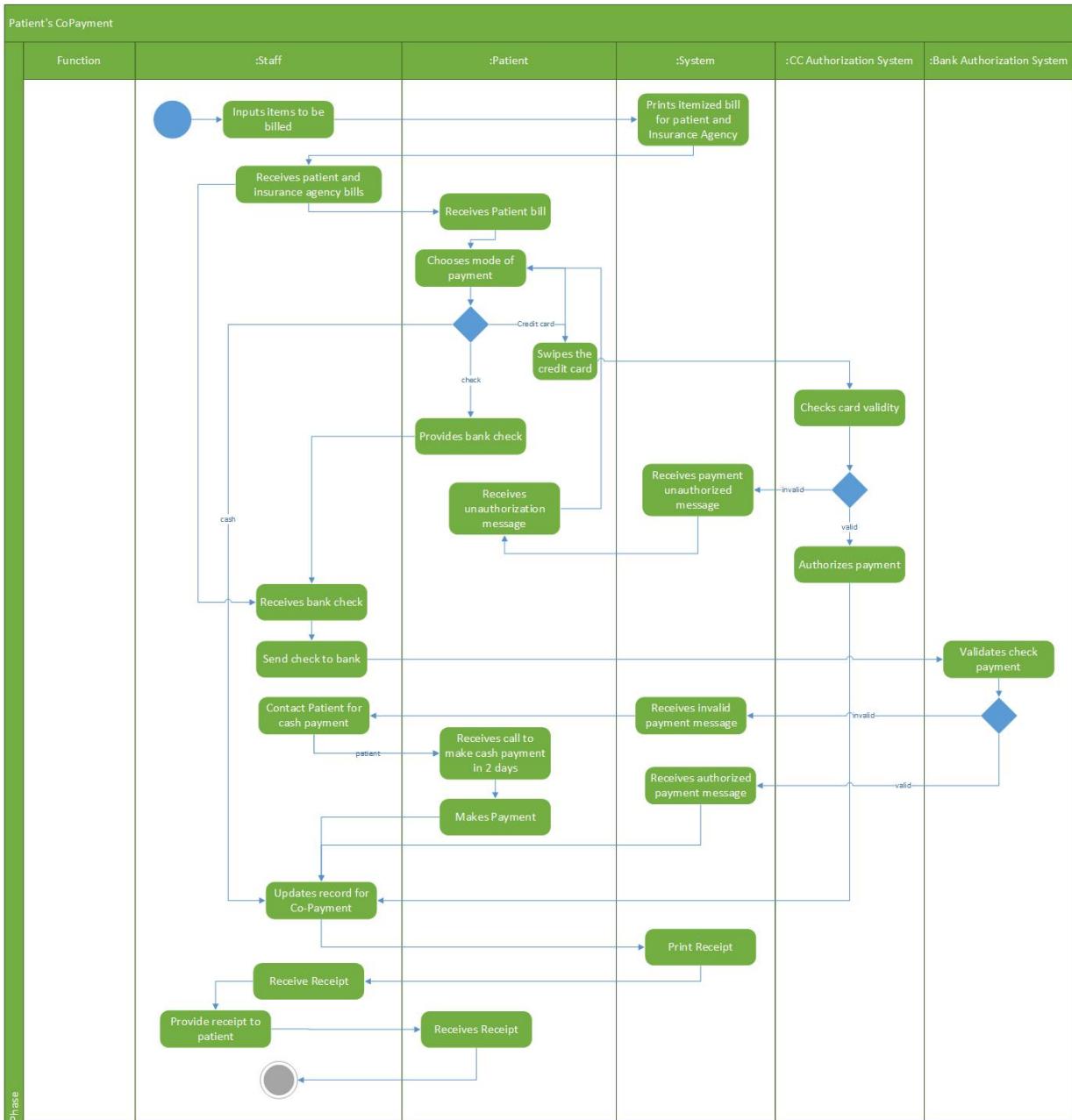
4.3 Activity Diagrams

The activity diagram for the corresponding use case descriptions detailed in the earlier section provides a pictorial view of the subsystems. The following two subsections provides an activity diagram for two subsystems of the Electronic Medical Information System- Appointment Scheduling Subsystem and Patient's Co-Payment.

4.3.1 Appointment Scheduling Subsystem

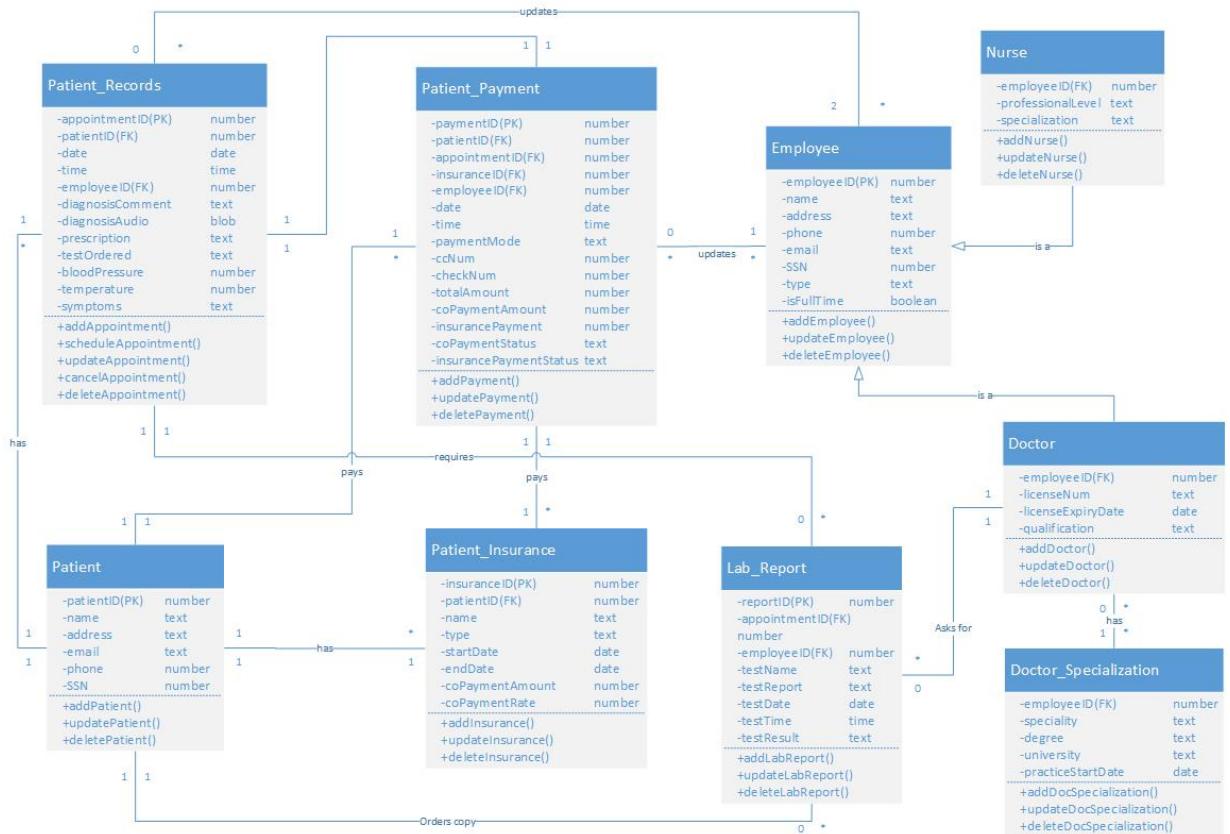


4.3.2 Patient's Co-Payment



4.4 Domain Class Diagram

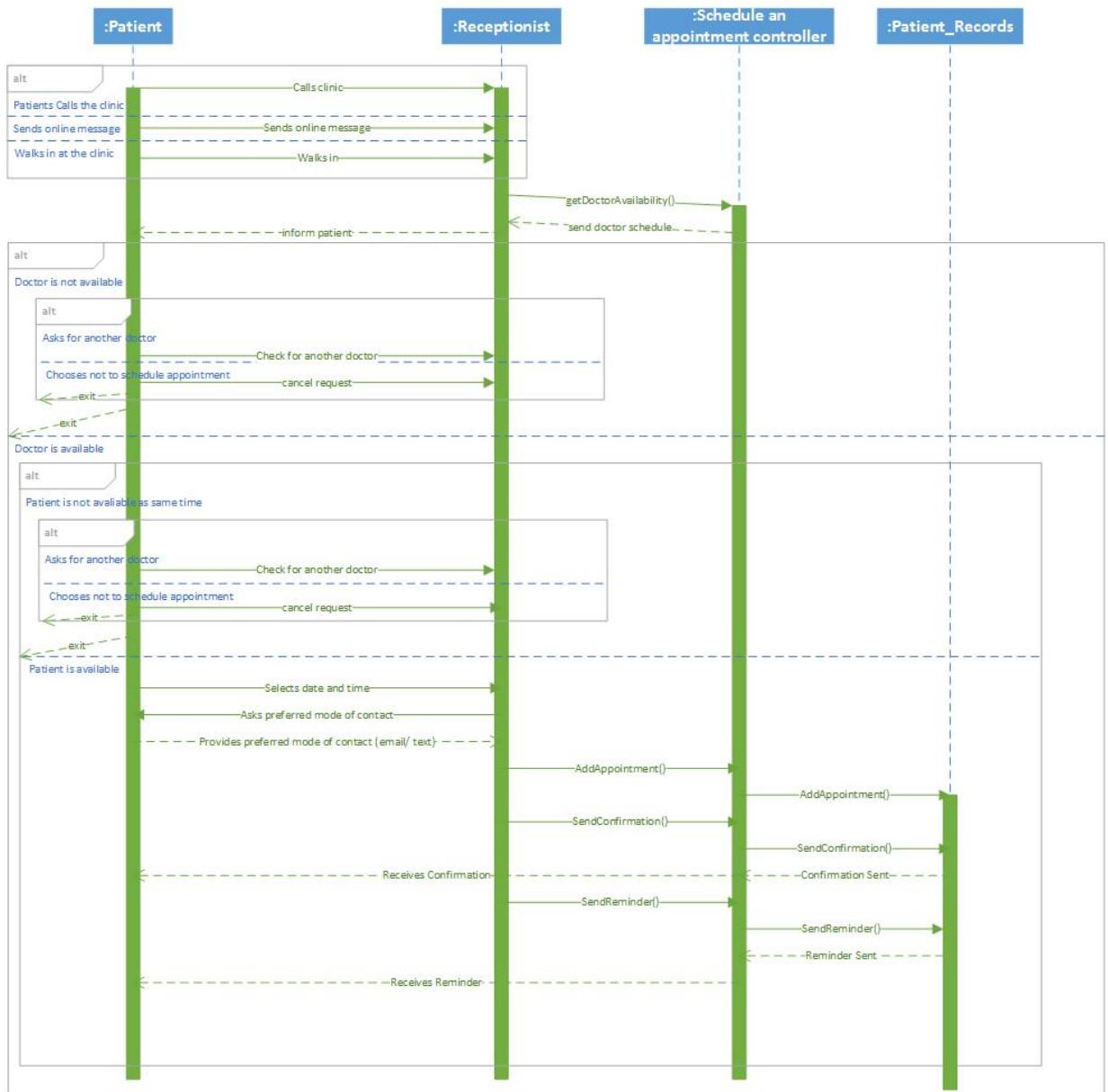
The domain class diagram shows the interaction between different classes in the system in terms of multiplicity, association and inheritance. For each class, the required attributes with their data-types and the methods are mentioned.



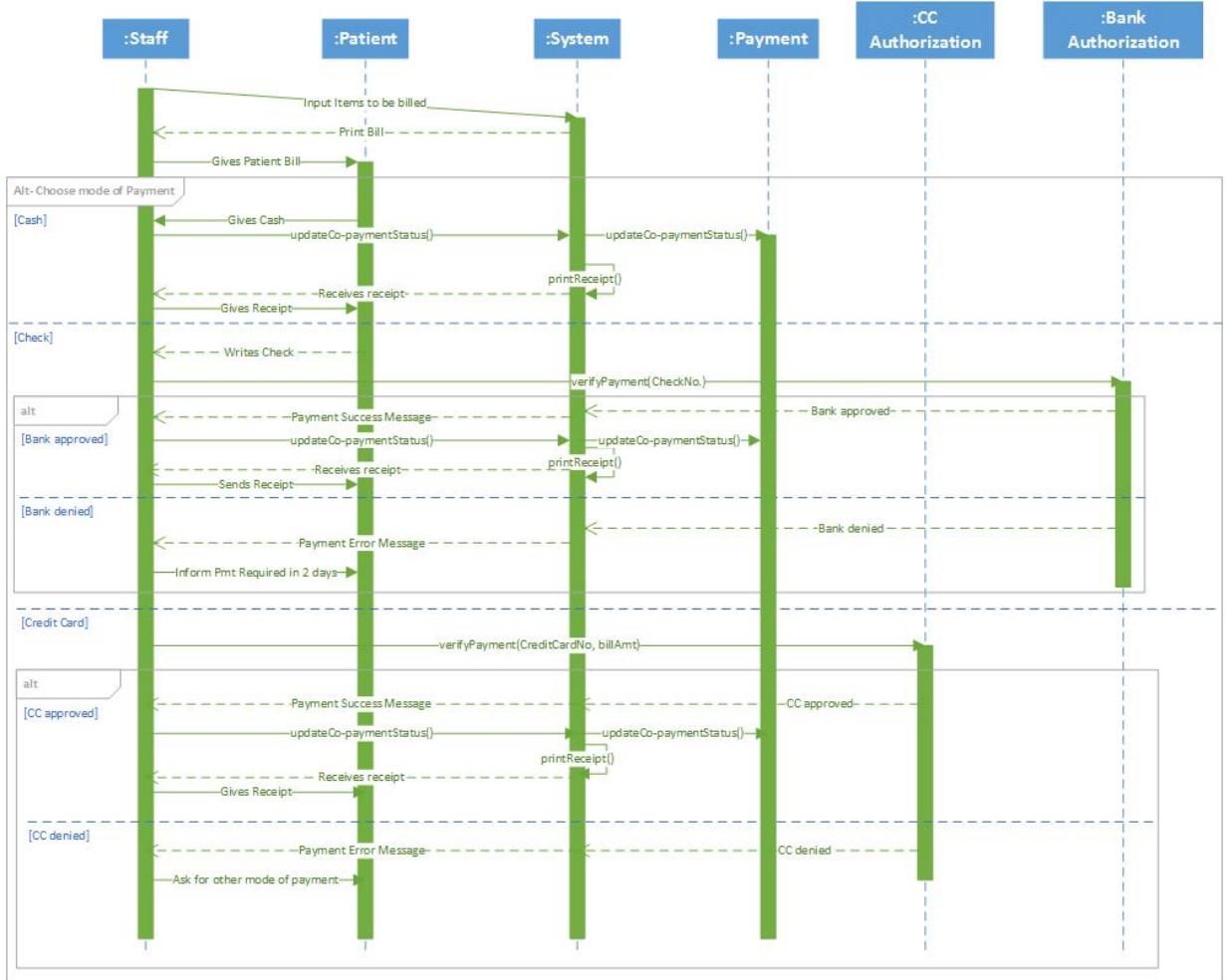
4.5 Sequence Diagrams

This section of the report provides sequence diagrams for two use-cases: Schedule an Appointment and Patient's Co-Payment.

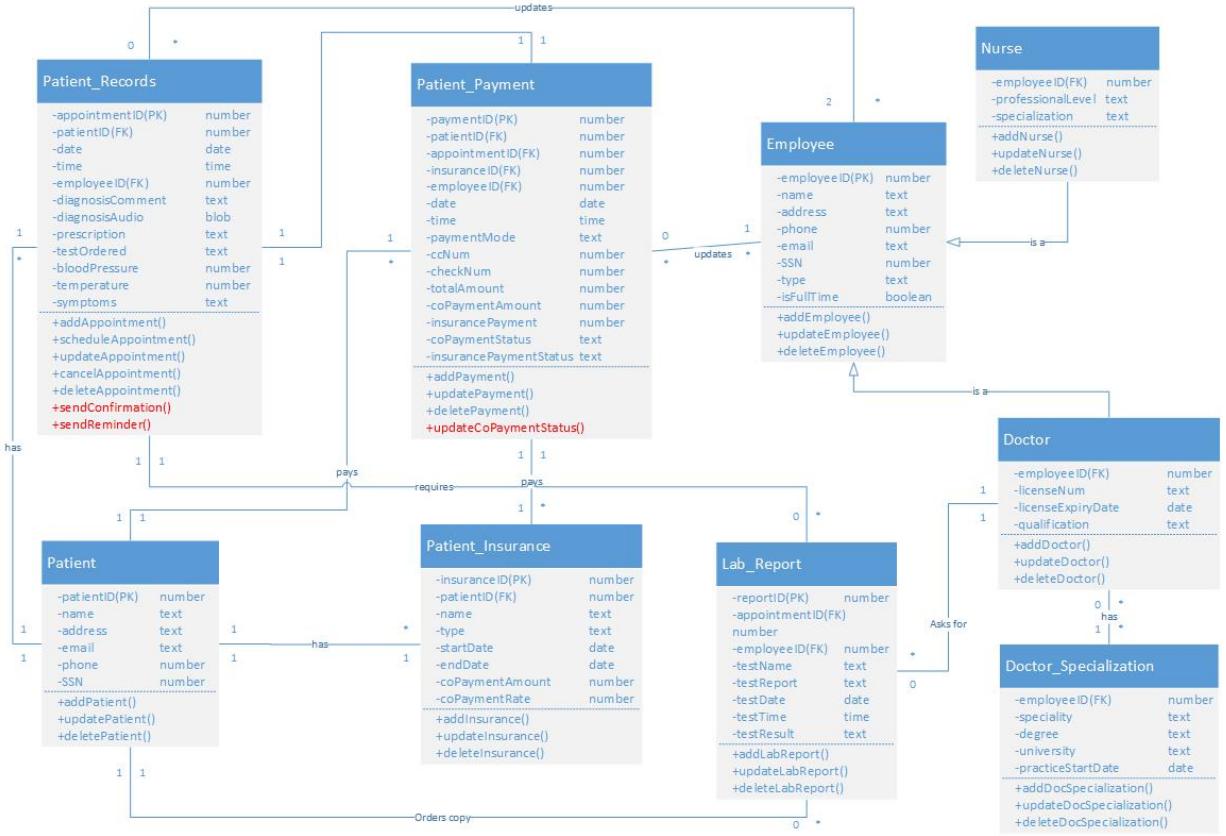
4.5.1 Schedule an Appointment



4.5.2 Patient's Co-Payment



4.5.3 Updated Class Diagram

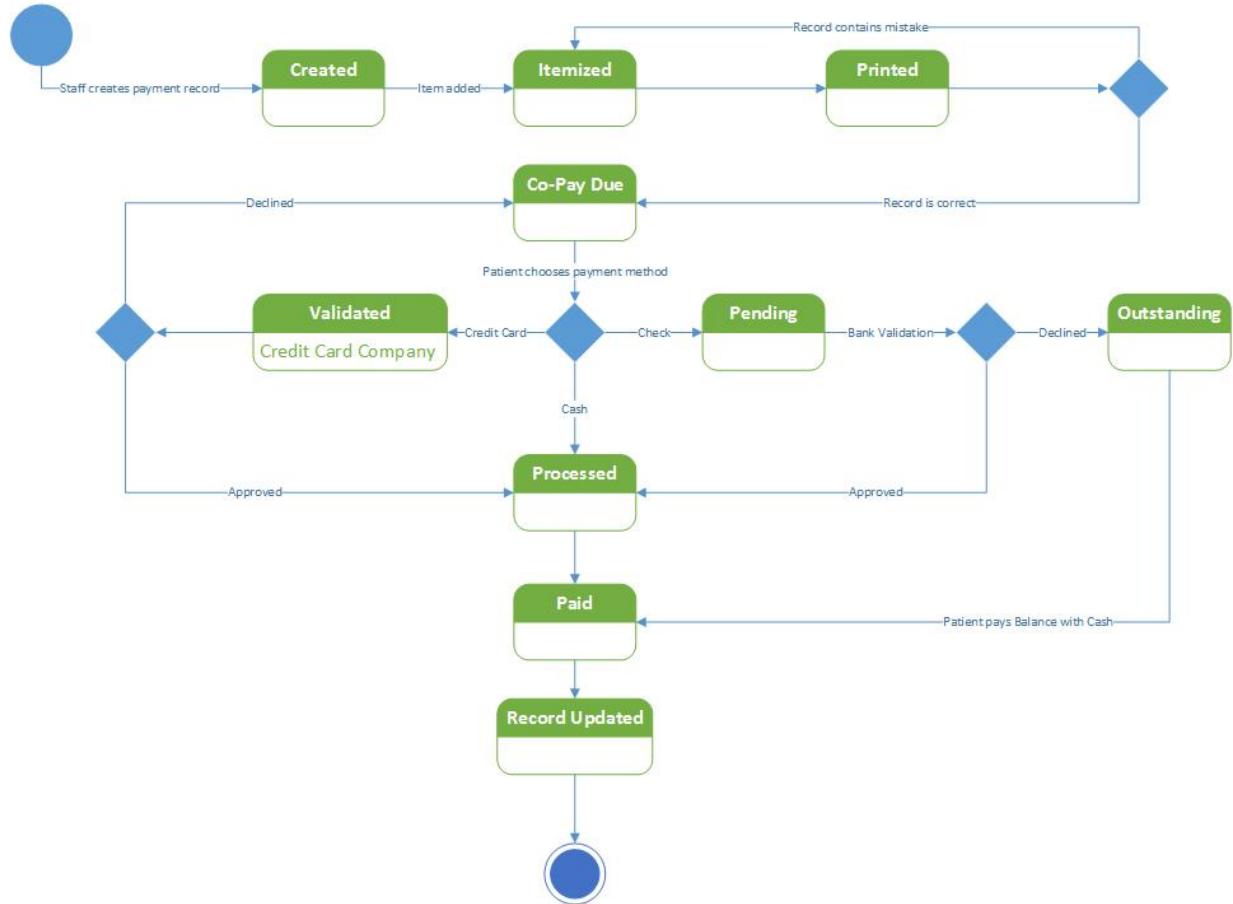


4.6 State Diagrams

The most dynamic entity in the EMIS system is **Patient_Payment** which has status for patient's CoPayment as well as insurance payment. Hence, we have made a state diagram for each status.

4.6.1 Patient's Co-Payment

Team 6 – Payment (copayment)



4.6.2 Insurance Payment

