Эмнэлгийн бүртгэлийн систем

Hospital Registration System

Танилцуулга

Энэ төсөл нь эмнэлгийн оочир дараалал, бүртгэлийг бүрэн хөнгөлөхөд тулгуурласан. Системийн хувьд өвчтөн бүртгэх, эмч дээрх сул цагийг харах, эмч өвчтөний түүх болон эмчилгээ, хэрэглэх эм бэлдмэлийн дэлгэрэнгүй мэдээллийг бичиж хадгалах үйл явцыг хялбаршуулсан.

Гол онцлогууд:

-Өвчтөн нэмэх, засах, устгах

-Эмчийн мэдээлэл бүртгэх

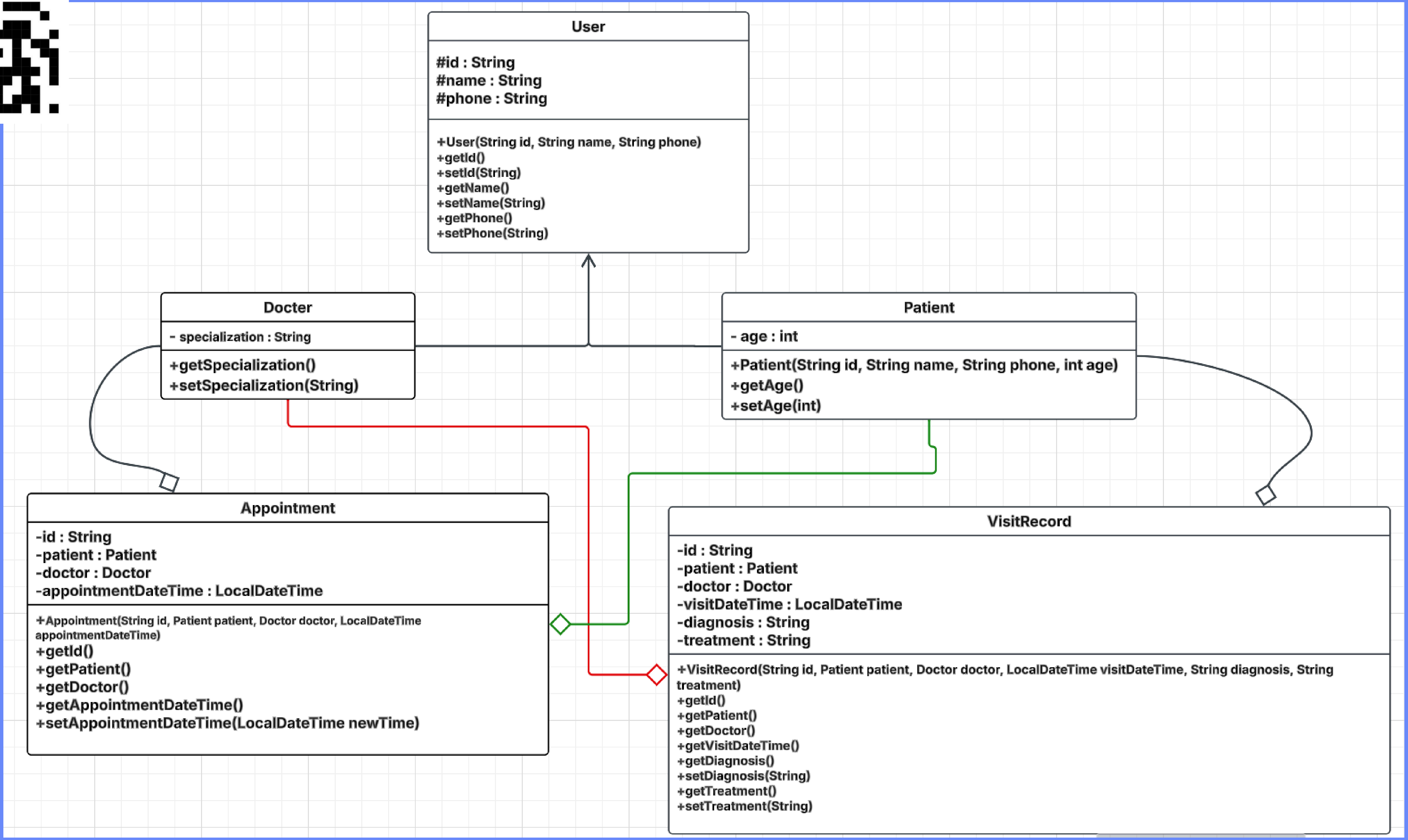
-Цаг захиалгын систем (Appointment)

-Өвчтөний түүх хадгалах (VisitRecord)

-Мэдээлэл хайх, жагсаалтаар харах

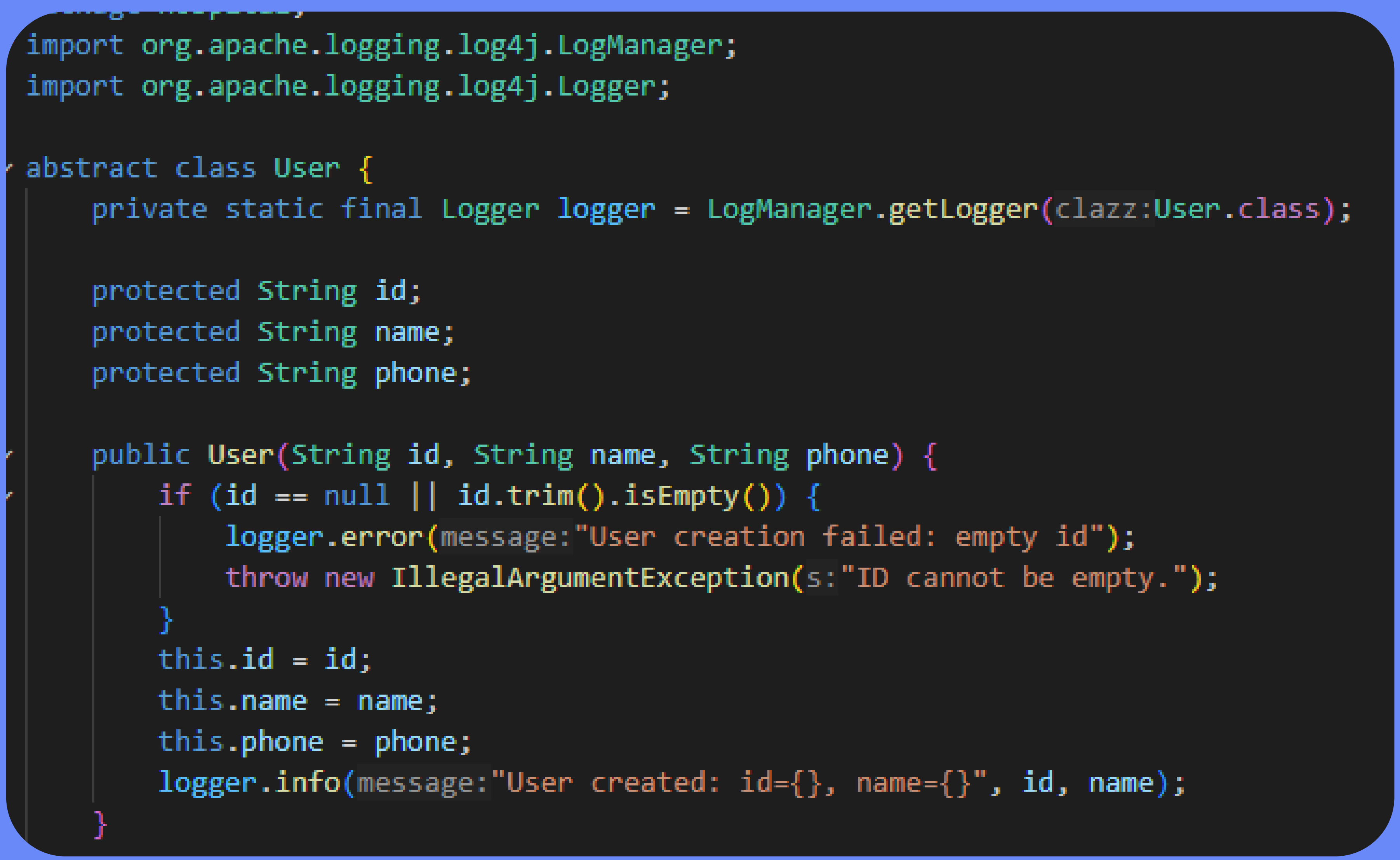
-Ирц, онош, эмчилгээний түүхийн менежмент

UML DIAGRAM


User
#id : String
#name : String
#phone : String
+User(String id, String name, String phone)
+getId()
+setId(String)
+getName()
+setName(String)
+getPhone()
+setPhone(String)
Docter
- specialization : String
+getSpecialization()
+setSpecialization(String)
Patient
- age : int
+Patient(String id, String name, String phone, int age)
+getAge()
+setAge(int)
Appointment
-id : String
-patient : Patient
-doctor : Doctor
-appointmentDateTime : LocalDateTime
+Appointment(String id, Patient patient, Doctor doctor, LocalDateTime appointmentDateTime)
+getId()
+getPatient()
+getDoctor()
+getAppointmentDateTime()
+setAppointmentDateTime(LocalDateTime newTime)
VisitRecord
-id : String
-patient : Patient
-doctor : Doctor
-visitDateTime : LocalDateTime
-diagnosis : String
-treatment : String
+VisitRecord(String id, Patient patient, Doctor doctor, LocalDateTime visitDateTime, String diagnosis, String treatment)
+getId()
+getPatient()
+getDoctor()
+getVisitDateTime()
+getDiagnosis()
+setDiagnosis(String)
+getTreatment()
+setTreatment(String)

USER.JAVA

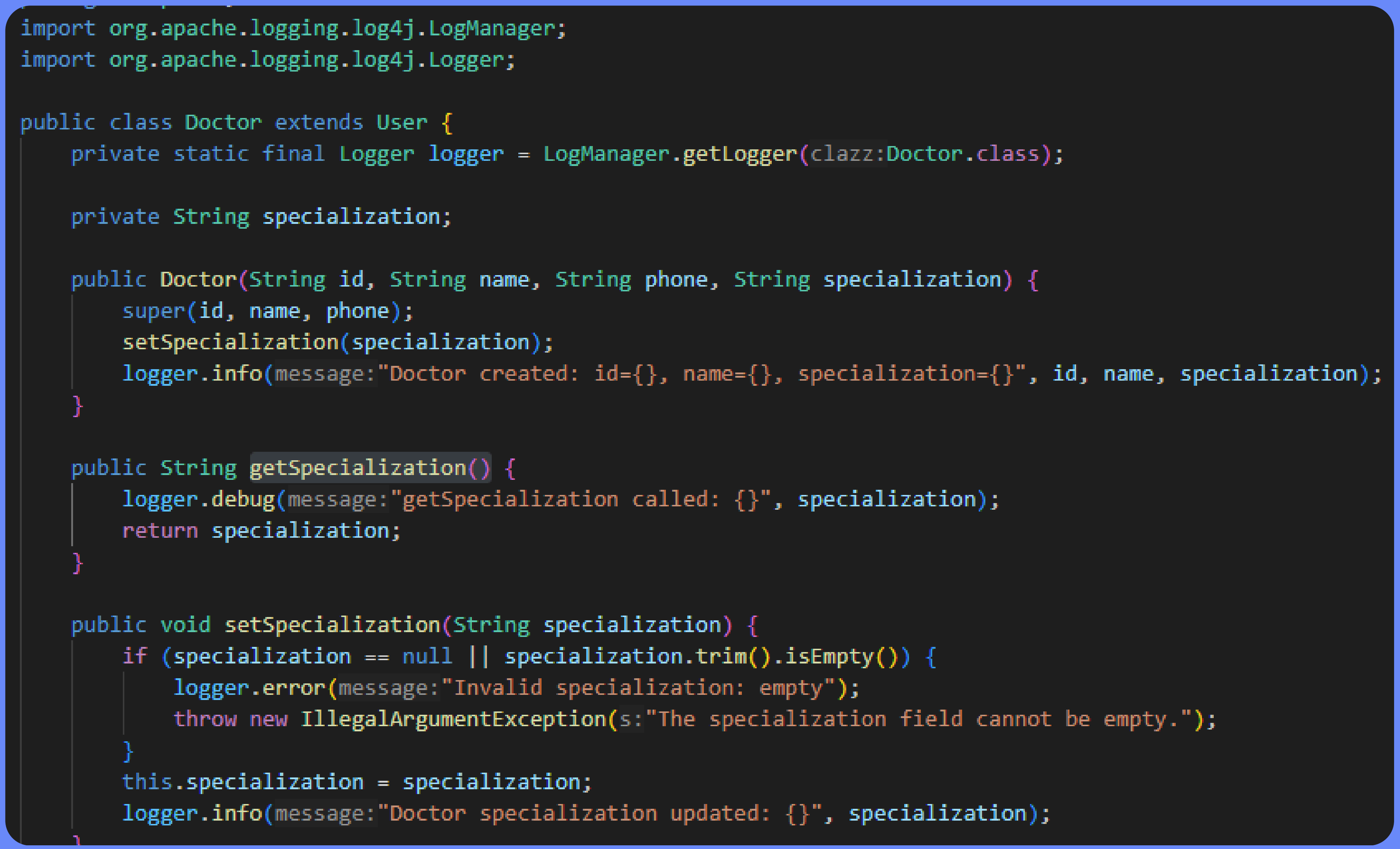
Энэ класс нь эцэг класс бөгөөд эмч, өвчтөн хоёр дээрх кодны давхцалыг арилгаж байгуулагч функц болон “get”,”set” функцуудыг агуулна.



```java
import org.apache.logging.log4j.LogManager;
import org.apache.logging.log4j.Logger;

abstract class User {
    private static final Logger logger = LogManager.getLogger(clazz:User.class);

    protected String id;
    protected String name;
    protected String phone;

    public User(String id, String name, String phone) {
        if (id == null || id.trim().isEmpty()) {
            logger.error(message:"User creation failed: empty id");
            throw new IllegalArgumentException(s:"ID cannot be empty.");
        }
        this.id = id;
        this.name = name;
        this.phone = phone;
        logger.info(message:"User created: id={}, name={}", id, name);
    }
```

DOCTOR.JAVA

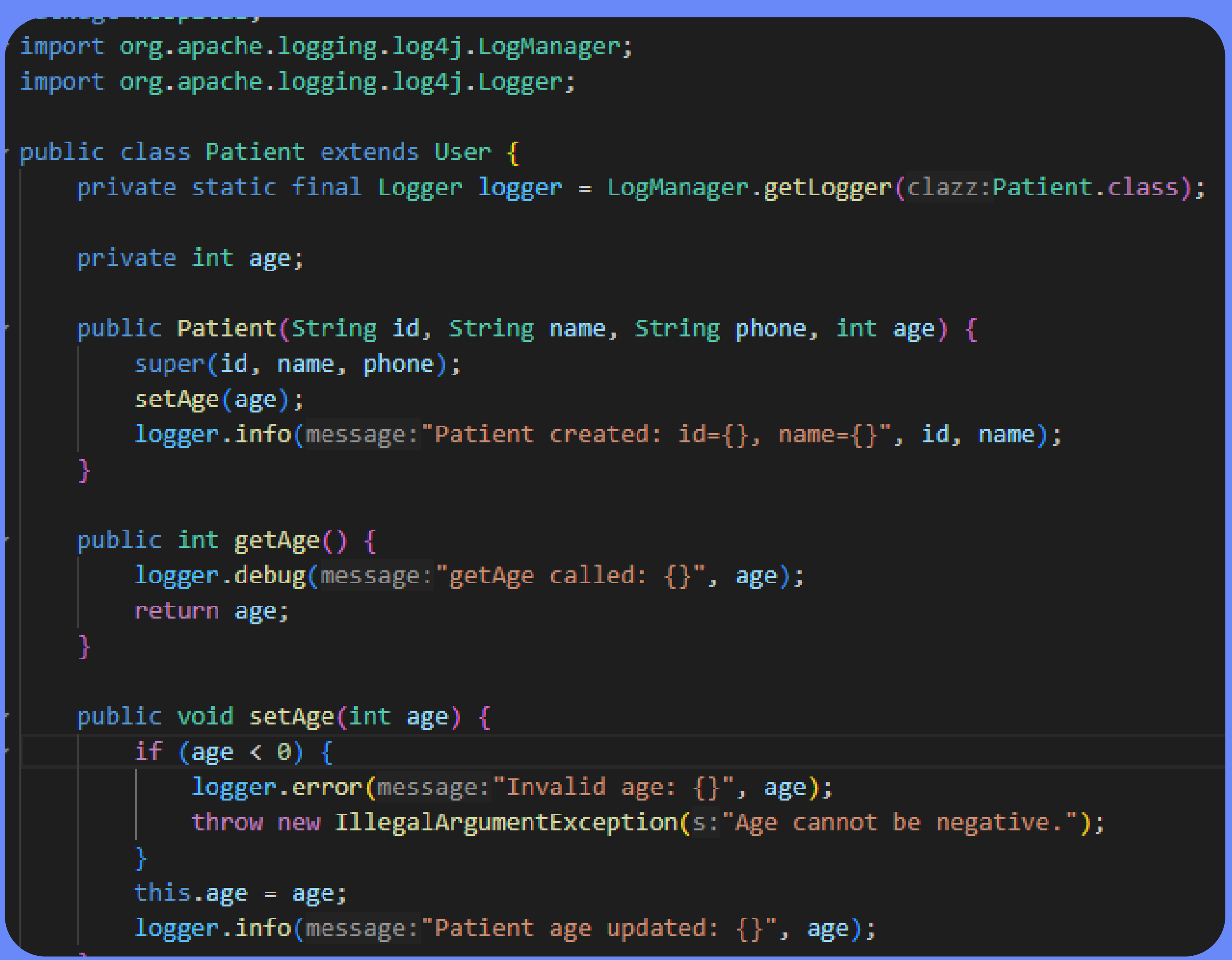
Энэ класс нь USER классаас удамшиж эмчийн мэргэшсэн чиглэлийг авах функцууд агуулсан.



```java
import org.apache.logging.log4j.LogManager;
import org.apache.logging.log4j.Logger;

public class Doctor extends User {
    private static final Logger logger = LogManager.getLogger(clazz:Doctor.class);

    private String specialization;

    public Doctor(String id, String name, String phone, String specialization) {
        super(id, name, phone);
        setSpecialization(specialization);
        logger.info(message:"Doctor created: id={}, name={}, specialization={}", id, name, specialization);
    }

    public String getSpecialization() {
        logger.debug(message:"getSpecialization called: {}", specialization);
        return specialization;
    }

    public void setSpecialization(String specialization) {
        if (specialization == null || specialization.trim().isEmpty()) {
            logger.error(message:"Invalid specialization: empty");
            throw new IllegalArgumentException(s:"The specialization field cannot be empty.");
        }
        this.specialization = specialization;
        logger.info(message:"Doctor specialization updated: {}", specialization);
    }
```

PATIENT.JAVA

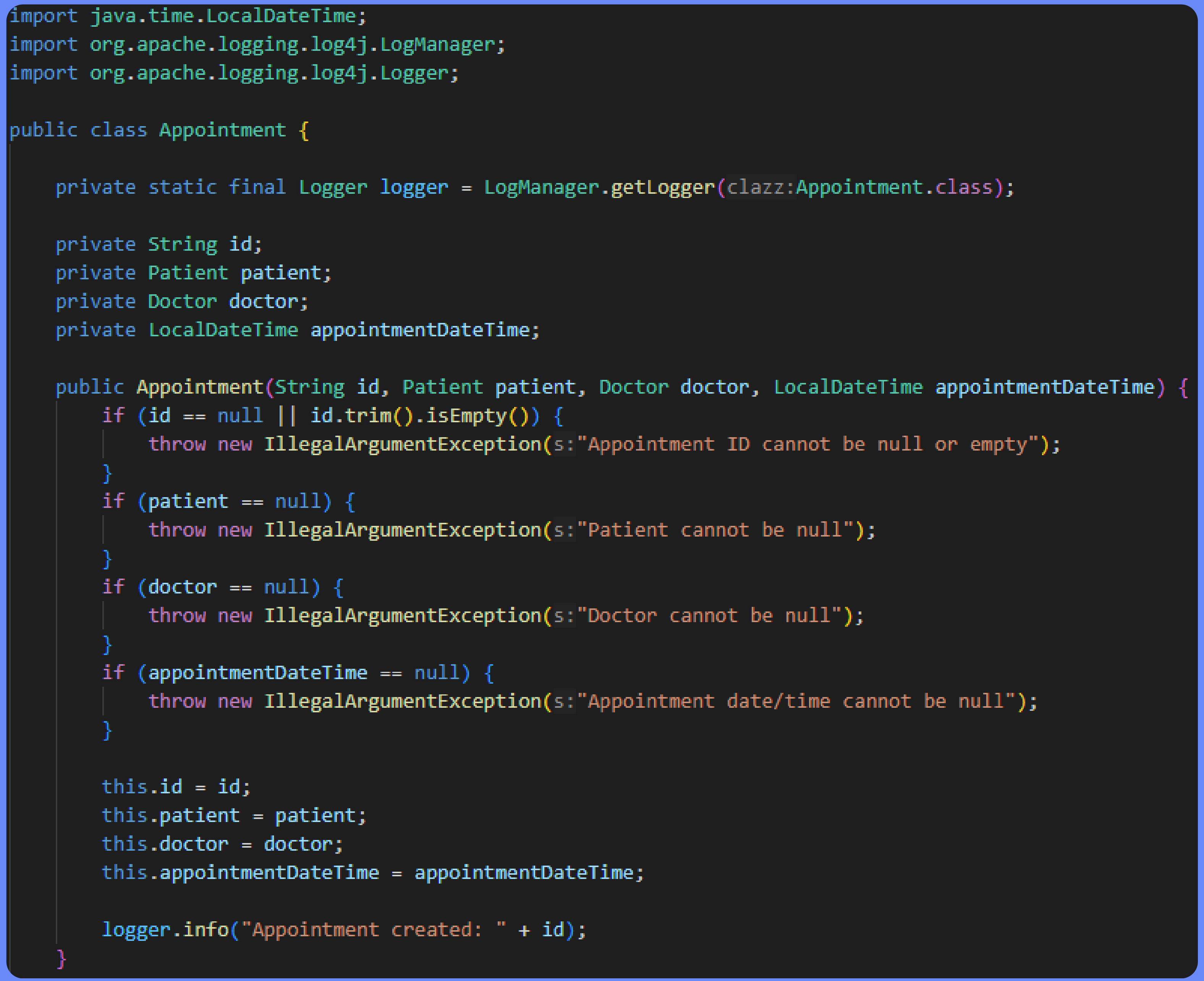
Энэ класс нь USER классаас удамшиж өвчтний мэдээлэл авах болон нас авах “get”,”set” функц бичигдсэн.



```java
import org.apache.logging.log4j.LogManager;
import org.apache.logging.log4j.Logger;

public class Patient extends User {
    private static final Logger logger = LogManager.getLogger(clazz:Patient.class);

    private int age;

    public Patient(String id, String name, String phone, int age) {
        super(id, name, phone);
        setAge(age);
        logger.info(message:"Patient created: id={}, name={}", id, name);
    }

    public int getAge() {
        logger.debug(message:"getAge called: {}", age);
        return age;
    }

    public void setAge(int age) {
        if (age < 0) {
            logger.error(message:"Invalid age: {}", age);
            throw new IllegalArgumentException(s:"Age cannot be negative.");
        }
        this.age = age;
        logger.info(message:"Patient age updated: {}", age);
```

APPOINTMENT.JAVA

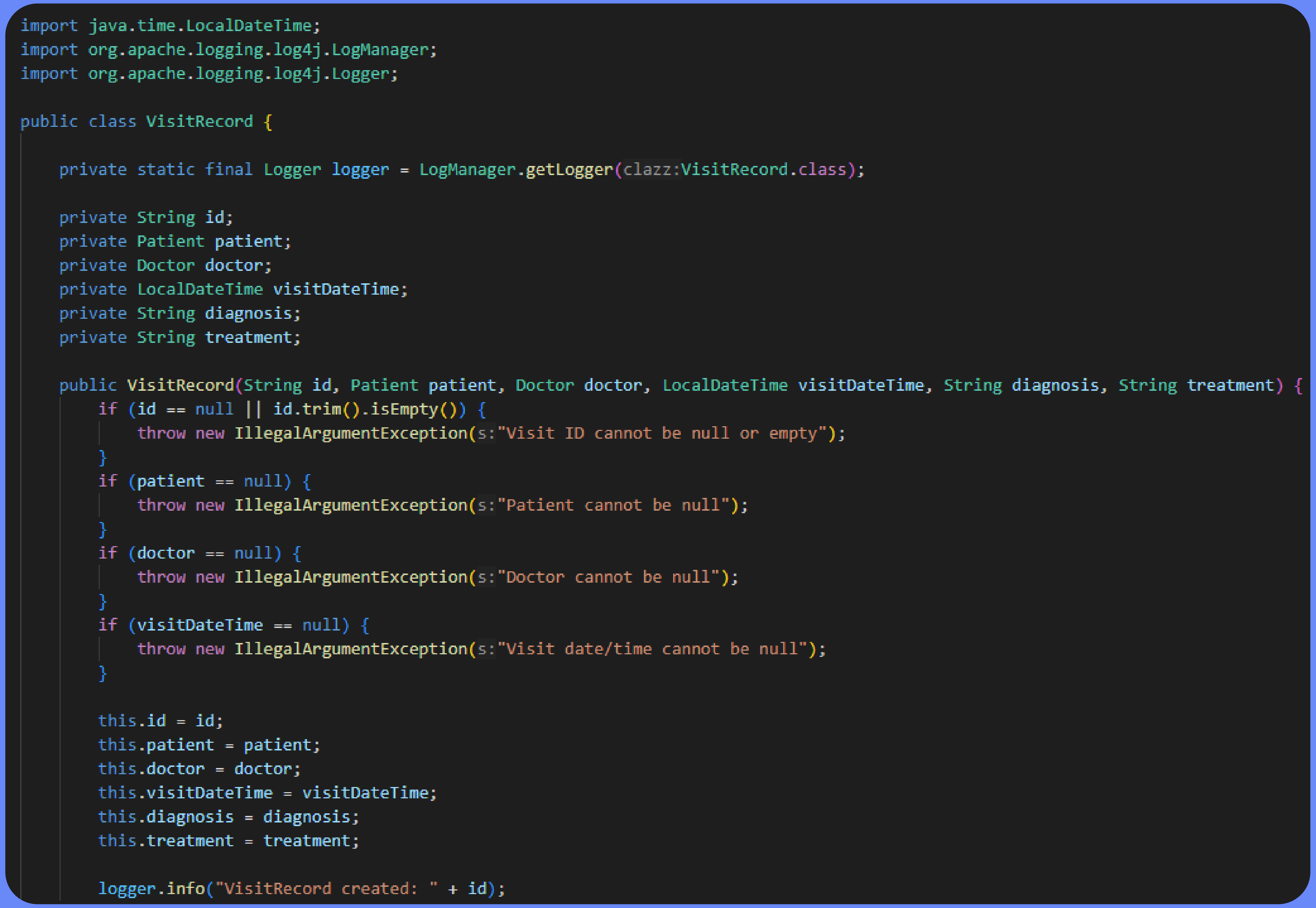
Энэ класс нь захиалгын дугаар, өвчтөн, сонгосон эмч, он сар өдрийг агуулж эдгээр функций “get”,”set” бичигдсэн.



```java
import java.time.LocalDateTime;
import org.apache.logging.log4j.LogManager;
import org.apache.logging.log4j.Logger;

public class Appointment {

    private static final Logger logger = LogManager.getLogger(clazz:Appointment.class);

    private String id;
    private Patient patient;
    private Doctor doctor;
    private LocalDateTime appointmentDateTime;

    public Appointment(String id, Patient patient, Doctor doctor, LocalDateTime appointmentDateTime) {
        if (id == null || id.trim().isEmpty()) {
            throw new IllegalArgumentException(s:"Appointment ID cannot be null or empty");
        }
        if (patient == null) {
            throw new IllegalArgumentException(s:"Patient cannot be null");
        }
        if (doctor == null) {
            throw new IllegalArgumentException(s:"Doctor cannot be null");
        }
        if (appointmentDateTime == null) {
            throw new IllegalArgumentException(s:"Appointment date/time cannot be null");
        }

        this.id = id;
        this.patient = patient;
        this.doctor = doctor;
        this.appointmentDateTime = appointmentDateTime;

        logger.info("Appointment created: " + id);
    }
```

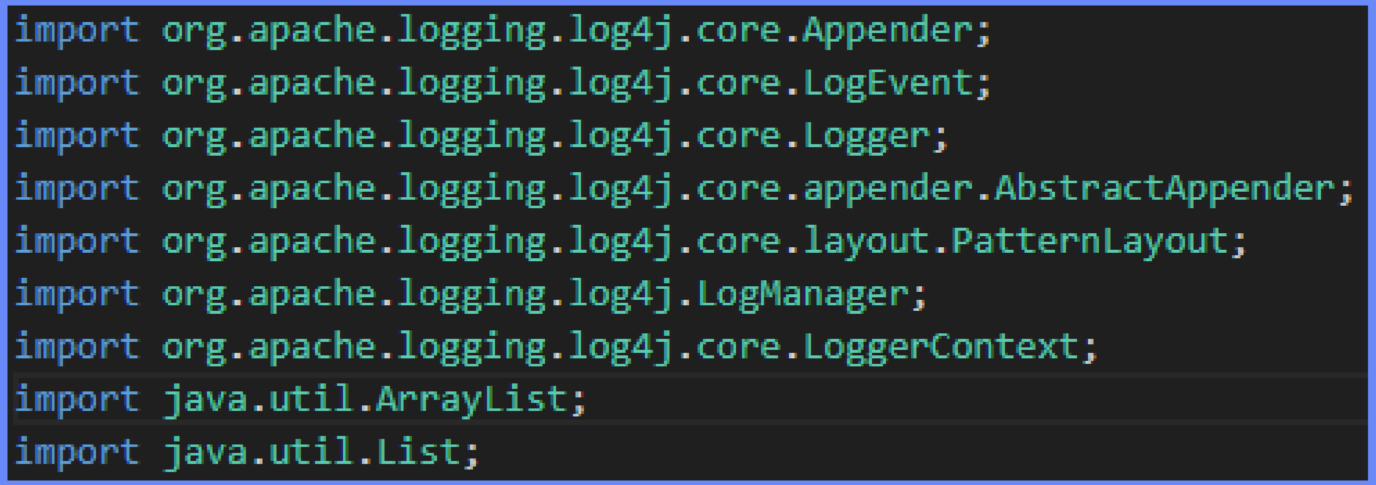
VisitRecord.JAVA

Энэ класс нь үзлэгийн, дугаар, үзүүлсэн өвчтөн, үзлэг хийсэн эмч, үзлэгийн огноо, онош, эмчилгээний мэдээлэл хадгалах функц



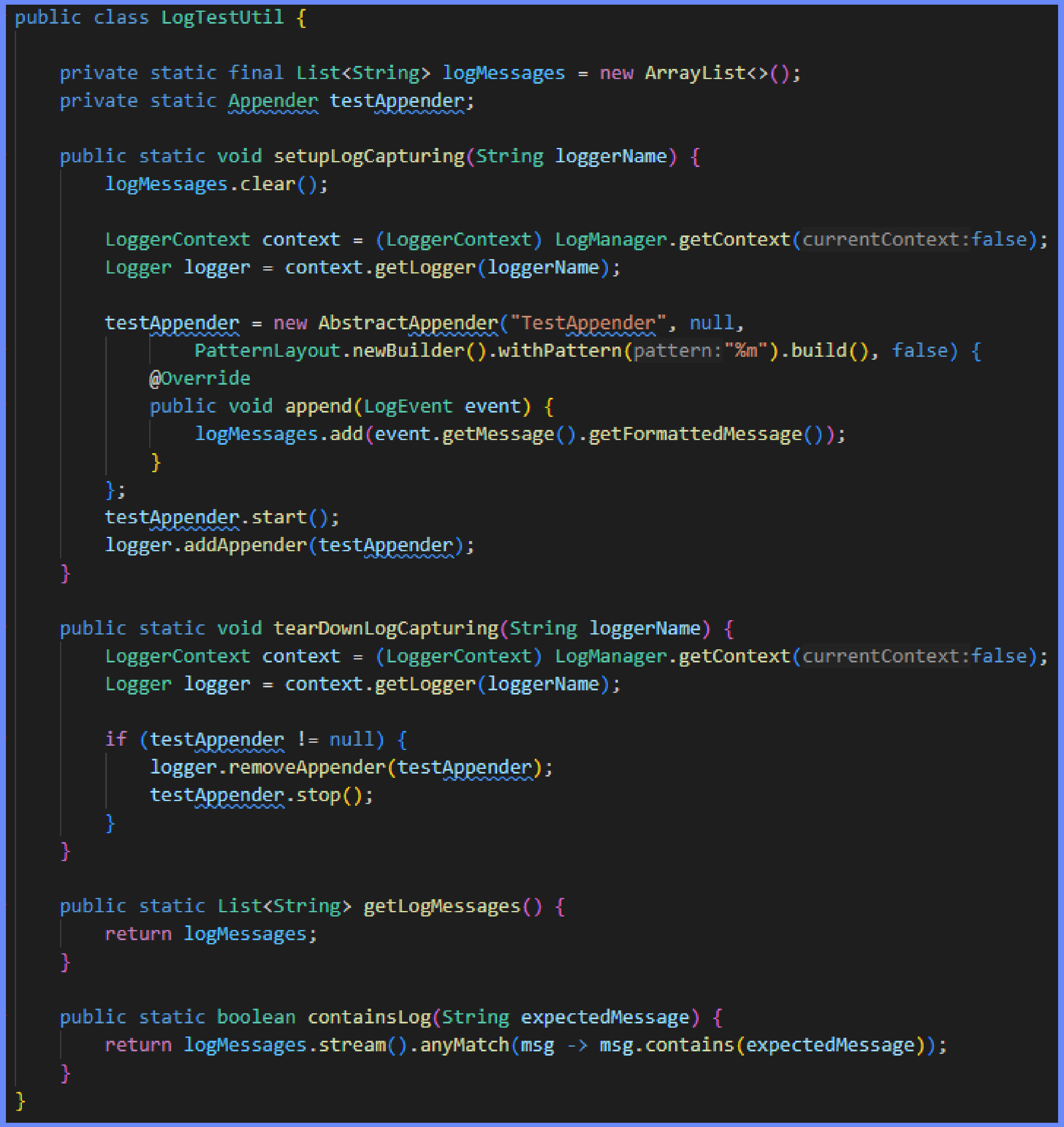
```java
import java.time.LocalDateTime;
import org.apache.logging.log4j.LogManager;
import org.apache.logging.log4j.Logger;

public class VisitRecord {

    private static final Logger logger = LogManager.getLogger(clazz:VisitRecord.class);

    private String id;
    private Patient patient;
    private Doctor doctor;
    private LocalDateTime visitDateTime;
    private String diagnosis;
    private String treatment;

    public VisitRecord(String id, Patient patient, Doctor doctor, LocalDateTime visitDateTime, String diagnosis, String treatment) {
        if (id == null || id.trim().isEmpty()) {
            throw new IllegalArgumentException(s:"Visit ID cannot be null or empty");
        }
        if (patient == null) {
            throw new IllegalArgumentException(s:"Patient cannot be null");
        }
        if (doctor == null) {
            throw new IllegalArgumentException(s:"Doctor cannot be null");
        }
        if (visitDateTime == null) {
            throw new IllegalArgumentException(s:"Visit date/time cannot be null");
        }

        this.id = id;
        this.patient = patient;
        this.doctor = doctor;
        this.visitDateTime = visitDateTime;
        this.diagnosis = diagnosis;
        this.treatment = treatment;

        logger.info("VisitRecord created: " + id);
```

LogTestUtil.JAVA



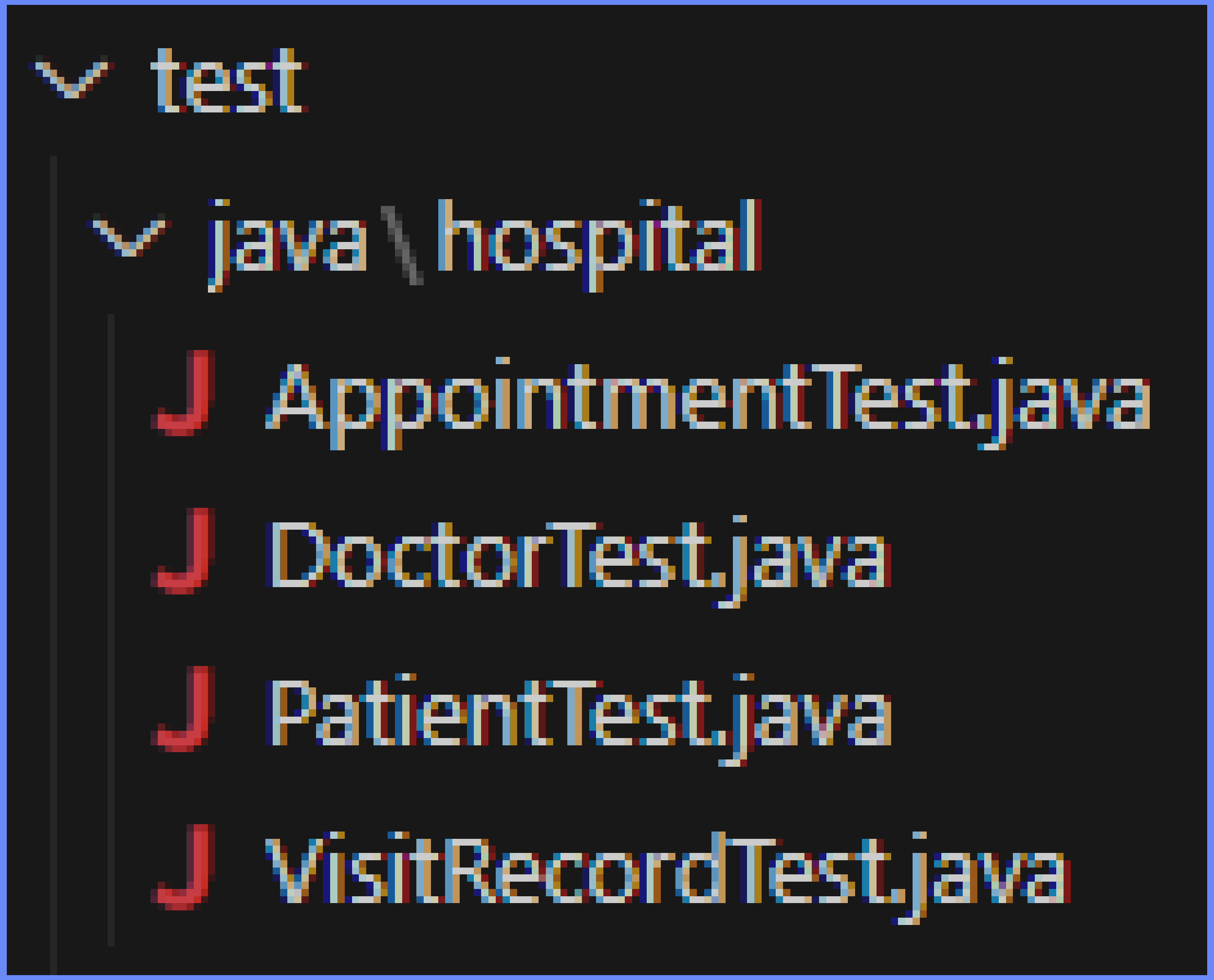
```java
import org.apache.logging.log4j.core.Appender;
import org.apache.logging.log4j.core.LogEvent;
import org.apache.logging.log4j.core.Logger;
import org.apache.logging.log4j.core.appender.AbstractAppender;
import org.apache.logging.log4j.core.layout.PatternLayout;
import org.apache.logging.log4j.LogManager;
import org.apache.logging.log4j.core.LoggerContext;
import java.util.ArrayList;
import java.util.List;
```

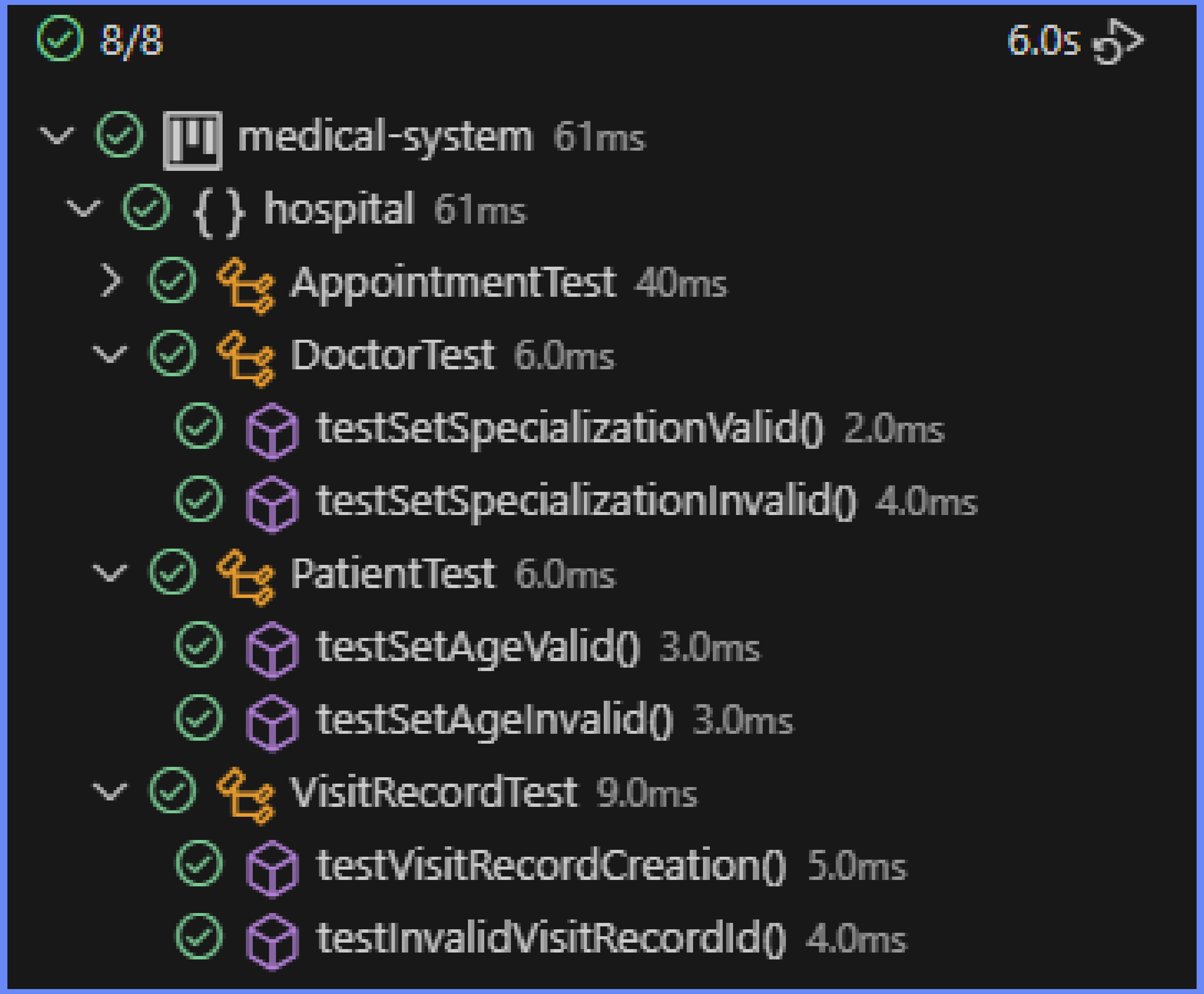
Юнит тестүүдэд Log4j лог мессежүүдийг барих, шалгах зориулалттай туслах класс.



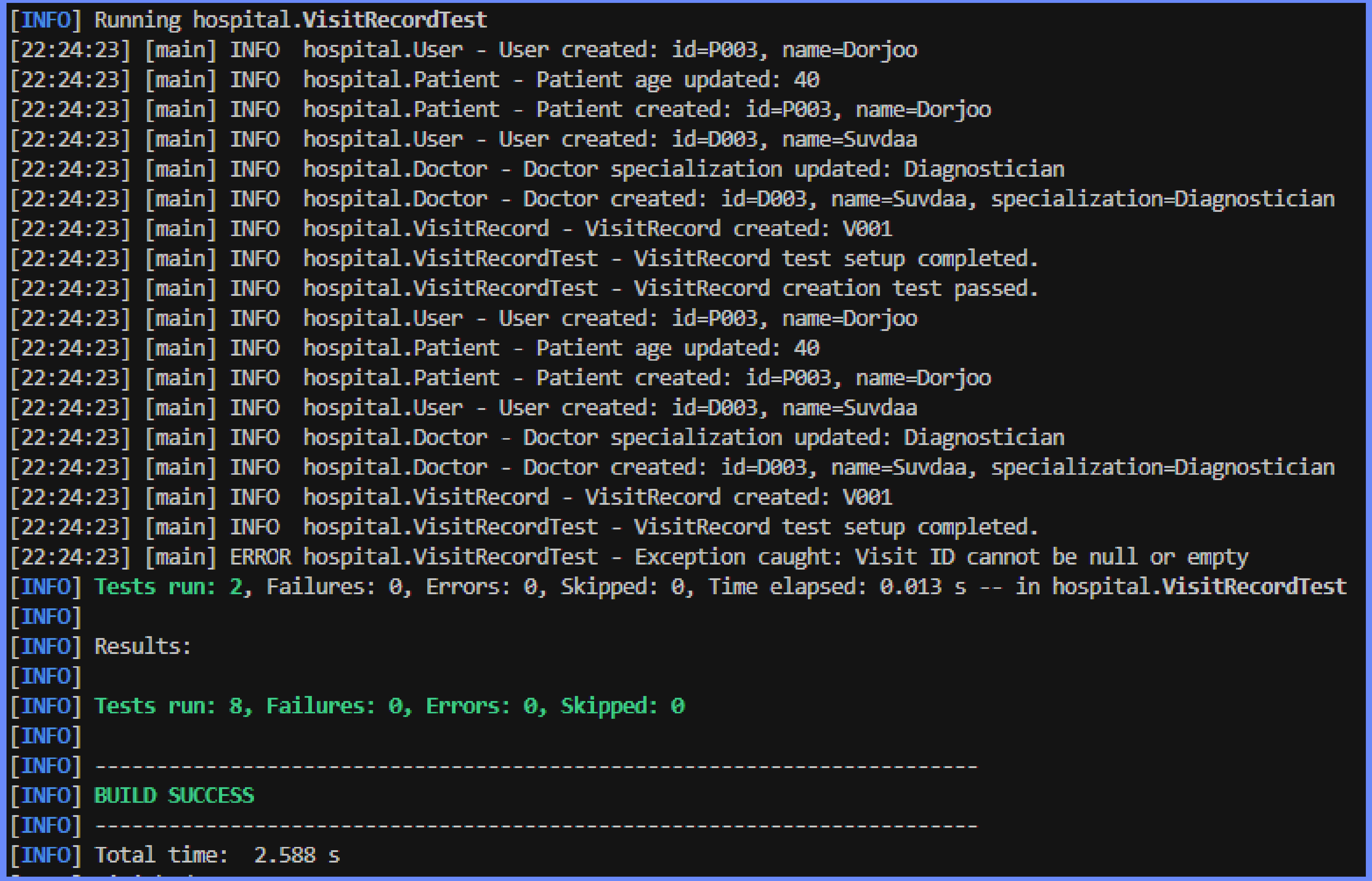
```java
public class LogTestUtil {

    private static final List<String> logMessages = new ArrayList<>();
    private static Appender testAppender;

    public static void setupLogCapturing(String loggerName) {
        logMessages.clear();

        LoggerContext context = (LoggerContext) LogManager.getContext(currentContext:false);
        Logger logger = context.getLogger(loggerName);

        testAppender = new AbstractAppender("TestAppender", null,
                PatternLayout.newBuilder().withPattern(pattern:"%m").build(), false) {
            @Override
            public void append(LogEvent event) {
                logMessages.add(event.getMessage().getFormattedMessage());
            }
        };
        testAppender.start();
        logger.addAppender(testAppender);
    }

    public static void tearDownLogCapturing(String loggerName) {
        LoggerContext context = (LoggerContext) LogManager.getContext(currentContext:false);
        Logger logger = context.getLogger(loggerName);

        if (testAppender != null) {
            logger.removeAppender(testAppender);
            testAppender.stop();
        }
    }

    public static List<String> getLogMessages() {
        return logMessages;
    }

    public static boolean containsLog(String expectedMessage) {
        return logMessages.stream().anyMatch(msg -> msg.contains(expectedMessage));
    }
}
```

Бүх классын функцуудад тест хийх эдгээр класс байгаа.

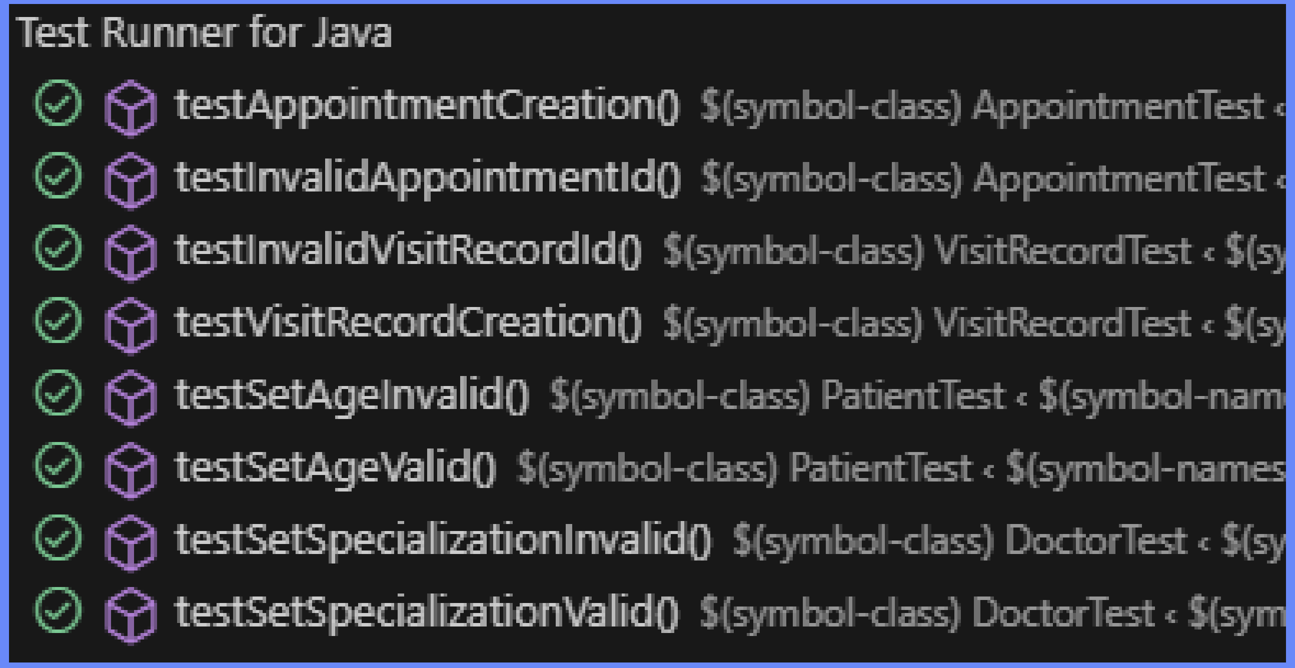

```
∨ test
  ∨ java \ hospital
      AppointmentTest.java
      DoctorTest.java
      PatientTest.java
      VisitRecordTest.java
```


```
8/8                                              6.0s
∨ medical-system 61ms
  ∨ { } hospital 61ms
    > AppointmentTest 40ms
    ∨ DoctorTest 6.0ms
        testSetSpecializationValid() 2.0ms
        testSetSpecializationInvalid() 4.0ms
    ∨ PatientTest 6.0ms
        testSetAgeValid() 3.0ms
        testSetAgeInvalid() 3.0ms
    ∨ VisitRecordTest 9.0ms
        testVisitRecordCreation() 5.0ms
        testInvalidVisitRecordId() 4.0ms
```

ГАРАЛТ



```
[INFO] Running hospital.VisitRecordTest
[22:24:23] [main] INFO  hospital.User - User created: id=P003, name=Dorjoo
[22:24:23] [main] INFO  hospital.Patient - Patient age updated: 40
[22:24:23] [main] INFO  hospital.Patient - Patient created: id=P003, name=Dorjoo
[22:24:23] [main] INFO  hospital.User - User created: id=D003, name=Suvdaa
[22:24:23] [main] INFO  hospital.Doctor - Doctor specialization updated: Diagnostician
[22:24:23] [main] INFO  hospital.Doctor - Doctor created: id=D003, name=Suvdaa, specialization=Diagnostician
[22:24:23] [main] INFO  hospital.VisitRecord - VisitRecord created: V001
[22:24:23] [main] INFO  hospital.VisitRecordTest - VisitRecord test setup completed.
[22:24:23] [main] INFO  hospital.VisitRecordTest - VisitRecord creation test passed.
[22:24:23] [main] INFO  hospital.User - User created: id=P003, name=Dorjoo
[22:24:23] [main] INFO  hospital.Patient - Patient age updated: 40
[22:24:23] [main] INFO  hospital.Patient - Patient created: id=P003, name=Dorjoo
[22:24:23] [main] INFO  hospital.User - User created: id=D003, name=Suvdaa
[22:24:23] [main] INFO  hospital.Doctor - Doctor specialization updated: Diagnostician
[22:24:23] [main] INFO  hospital.Doctor - Doctor created: id=D003, name=Suvdaa, specialization=Diagnostician
[22:24:23] [main] INFO  hospital.VisitRecord - VisitRecord created: V001
[22:24:23] [main] INFO  hospital.VisitRecordTest - VisitRecord test setup completed.
[22:24:23] [main] ERROR hospital.VisitRecordTest - Exception caught: Visit ID cannot be null or empty
[INFO] Tests run: 2, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.013 s -- in hospital.VisitRecordTest
[INFO]
[INFO] Results:
[INFO]
[INFO] Tests run: 8, Failures: 0, Errors: 0, Skipped: 0
[INFO]
[INFO] ------------------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] ------------------------------------------------------------------------
[INFO] Total time:  2.588 s
```

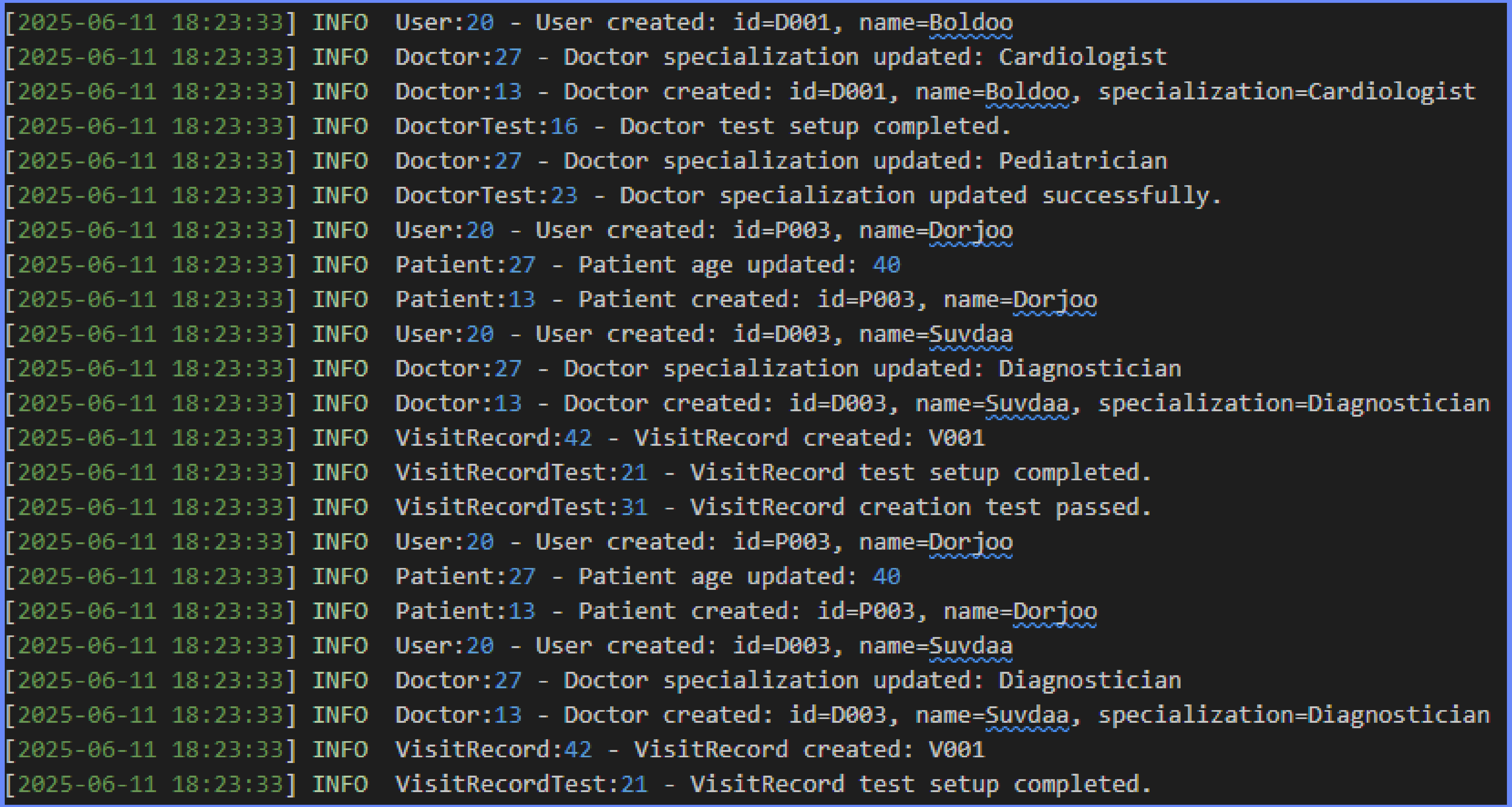


```
Test Runner for Java
✓ testAppointmentCreation() $(symbol-class) AppointmentTest
✓ testInvalidAppointmentId() $(symbol-class) AppointmentTest
✓ testInvalidVisitRecordId() $(symbol-class) VisitRecordTest ‹ $(sy
✓ testVisitRecordCreation() $(symbol-class) VisitRecordTest ‹ $(sy
✓ testSetAgeInvalid() $(symbol-class) PatientTest ‹ $(symbol-nam
✓ testSetAgeValid() $(symbol-class) PatientTest ‹ $(symbol-names
✓ testSetSpecializationInvalid() $(symbol-class) DoctorTest ‹ $(sy
✓ testSetSpecializationValid() $(symbol-class) DoctorTest ‹ $(sym
```

Тест алдаагүй ажиллаж байгаа гаралт

mvn clean test команд өгсөн гаралт

Лог файл



```
[2025-06-11 18:23:33] INFO  User:20 - User created: id=D001, name=Boldoo
[2025-06-11 18:23:33] INFO  Doctor:27 - Doctor specialization updated: Cardiologist
[2025-06-11 18:23:33] INFO  Doctor:13 - Doctor created: id=D001, name=Boldoo, specialization=Cardiologist
[2025-06-11 18:23:33] INFO  DoctorTest:16 - Doctor test setup completed.
[2025-06-11 18:23:33] INFO  Doctor:27 - Doctor specialization updated: Pediatrician
[2025-06-11 18:23:33] INFO  DoctorTest:23 - Doctor specialization updated successfully.
[2025-06-11 18:23:33] INFO  User:20 - User created: id=P003, name=Dorjoo
[2025-06-11 18:23:33] INFO  Patient:27 - Patient age updated: 40
[2025-06-11 18:23:33] INFO  Patient:13 - Patient created: id=P003, name=Dorjoo
[2025-06-11 18:23:33] INFO  User:20 - User created: id=D003, name=Suvdaa
[2025-06-11 18:23:33] INFO  Doctor:27 - Doctor specialization updated: Diagnostician
[2025-06-11 18:23:33] INFO  Doctor:13 - Doctor created: id=D003, name=Suvdaa, specialization=Diagnostician
[2025-06-11 18:23:33] INFO  VisitRecord:42 - VisitRecord created: V001
[2025-06-11 18:23:33] INFO  VisitRecordTest:21 - VisitRecord test setup completed.
[2025-06-11 18:23:33] INFO  VisitRecordTest:31 - VisitRecord creation test passed.
[2025-06-11 18:23:33] INFO  User:20 - User created: id=P003, name=Dorjoo
[2025-06-11 18:23:33] INFO  Patient:27 - Patient age updated: 40
[2025-06-11 18:23:33] INFO  Patient:13 - Patient created: id=P003, name=Dorjoo
[2025-06-11 18:23:33] INFO  User:20 - User created: id=D003, name=Suvdaa
[2025-06-11 18:23:33] INFO  Doctor:27 - Doctor specialization updated: Diagnostician
[2025-06-11 18:23:33] INFO  Doctor:13 - Doctor created: id=D003, name=Suvdaa, specialization=Diagnostician
[2025-06-11 18:23:33] INFO  VisitRecord:42 - VisitRecord created: V001
[2025-06-11 18:23:33] INFO  VisitRecordTest:21 - VisitRecord test setup completed.
```

Сурч мэдсэн зүйлс

JAVA хэлний мэдлэгээ өргөжүүлж мини төсөл хийсэн.

TTD буюу Test-Driven Development аргачлалыг судлан ашиглаж анхан шатны мэдлэгтэй болсон.

Цахим орчинд өөрийн хийсэн зүйлсийг GITHUB ашиглан хадгалж, хуваалцаж сурсан.

JAVA хэл дээр лог бичих зорилгоор Log4j2 ашигласан энэ нь JAVA дээрх хүчирхэг, өндөр гүйцэтгэлтэй фрэймворк юм.

Ашигласан материал:

- Odoo.com - Төсөлийн санаа архитектур
- JAVA version17 - Програмчлалын хэл
- MAVEN - Автоматжуулалтын хэрэгсэл
- Log4j2 - Лог бичих систем
- JUnit 5 - Тестийн фрэймворк
- VS code - IDE
- Github - Код хадгалах, хуваалцах
- Teams - Даалгавар авах, явуулах

Анхаарал тавьсанд баярлалаа!!!