

CSCD01 Team 21

Deliverable #4

Team 21: *The BugWriters*

Chengrong Zhang, Zhongyang Xia, Tan Jiaxin, Zongye Yang,
Xingyuan Zhu

March - April 2020

Contents

0.1 Feature Design

0.1.1 Code Design

0.1.2 UML

0.1.3 Changes with Implementation Plan

0.2 User Guide

0.3 Acceptance Test

0.4 Unit Test

0.5 Project Management

0.5.1 Kanban

0.5.2 Standups

0.5.3 Evidence Of Kanban

0.1 Feature Design

In this section, we will show you how our team designed the feature and how we followed the implementation plan we have created back in deliverable 3.

0.1.1 Code Design

All following modified java files are under the implemented_feature folder:

https://github.com/CSCD01/team_21-project/tree/master/Deliverable4/implemented_feature/api/src/main/java/org/openmrs

Implementation in PatientIdentifierType.java:

The PatientIdentifierType class is implemented inside PatientIdentifierType.java file, thus for adding the new auto-merge feature, the first thing our team needs to do is make the PatientIdentifierType object comparable. Hence, we need to implement a function called isDuplicate() which takes another PatientIdentifierType object as a parameter to compare the self-object with the given one. If the two PatientIdentifierType objects are considered as duplicates, then the function will return true, otherwise, return false. The next thing we need to decide is to declare in what situations the two PatientIdentifierType objects are considered equal. As we can see in PatientIdentifierType.java, the PatientIdentifierType object has two main fields, which are id (integer) and format (string), thus if anyone of those two fields of two PatientIdentifierType objects are the same, then the two objects are considered as the duplicates. But the class also contains other fields for example formatDescription (string) and name (string), as our team did a further discovery, we finally decided three different cases of comparison for two PatientIdentifierType objects:

1. If two PatientIdentifierType objects have the same id or same format, then they are considered duplicates.

2. If two PatientIdentifierType objects have the same format description, then they are considered duplicates.
3. Otherwise, the two PatientIdentifierType objects are not equal.

Here is the code of isDuplicate() function:

```
217     /**
218      * the function checks the similarity of the current IdentifierType and the
219      * given IdentifierType if two consider the same then the function return true,
220      * otherwise return false
221      *
222      * @param patientIdentifier
223      * @return the IdentifierType is equal to the given one
224      */
225     public boolean isDuplicate(PatientIdentifierType patientIdentifier) {
226         // if the id or the format is same, then two PatientIdentifierTypes are same
227         if ((this.patientIdentifierTypeId == patientIdentifier.getPatientIdentifierTypeId())
228             || (this.format == patientIdentifier.getFormat())) {
229             return true;
230         } else if (this.formatDescription != null
231             && (this.formatDescription == patientIdentifier.getFormatDescription())) {
232             // if the formatDescription is same, then two PatientIdentifierTypes are same
233             return true;
234         } else {
235             // else the two given PatientIdentifierTypes are not same then return false
236             return false;
237         }
238     }
```

Figure 1.1: isDuplicate() function

The next function we implemented is called merge(), the function meant to merge all fields of two duplicates into one PatientIdentifierType object, for example: assume the new created PatientIdentifierType object named “type1” is considered as a duplicate with the “type0” that already exists in the database, then the merge() function will check if “type0” has null format, null formatDescription, null validator, null locationBehavior, or null locationBehavior, if so then the function will assign any null fields of “type0” with the value of fields in “type1”.

Here is the code of merge() function:

```
240     public void merge(PatientIdentifierType newType) {
241         // peasant short circuit
242         if (format == null)
243             format = newType.getFormat();
244         required = required || newType.getRequired();
245         if (formatDescription == null)
246             formatDescription = newType.getFormatDescription();
247         if (validator == null)
248             validator = newType.getValidator();
249         if (locationBehavior == null)
250             locationBehavior = newType.getLocationBehavior();
251         if (uniquenessBehavior == null)
252             uniquenessBehavior = newType.getUniquenessBehavior();
253     }
```

Figure 1.2: merge() function

Implementation in HibernatePatientDAO.java:

As we discussed in deliverable 3, the HibernatePatientDAO.java is the file that controls the update/delete of patient-related objects in the database. Therefore, to implement the auto-merge function we need to implement the function called hasDuplicate() inside HibernatePatientDAO.java. The hasDuplicate() function will take a PatientIdentifierType object as a parameter, the function is designed to communicate with the database and get all the existing PatientIdentifierType objects first, then the function will compare all PatientIdentifierType objects with the given parameter PatientIdentifierType, by using the above-implemented comparison function isDuplicate(), if the function returns true, that means the two PatientIdentifierType are equal, and the hasDuplicate() will merge them.

Here is the code of hasDuplicate() function:

```
1041     /**
1042      * Check if there exists a duplicate patientIdentifierType
1043      */
1044     public Optional<PatientIdentifierType> hasDuplicate(PatientIdentifierType patientIdentifierType) {
1045         // Get all patientIdentifierType
1046         Criteria criteria = sessionFactory.getCurrentSession().createCriteria(PatientIdentifierType.class);
1047
1048         criteria.addOrder(Order.desc("required"));
1049         criteria.addOrder(Order.asc("name"));
1050         criteria.addOrder(Order.asc("patientIdentifierTypeId"));
1051
1052         @SuppressWarnings("unchecked")
1053         List<PatientIdentifierType> allList = criteria.list();
1054
1055         for (int i = 0; i < allList.size(); i++) {
1056             PatientIdentifierType type = allList.get(i);
1057             if (type.isDuplicate(patientIdentifierType) == true) {
1058                 // deletePatientIdentifierType(allList.get(i));
1059                 return Optional.of(type);
1060             }
1061         }
1062
1063         return Optional.empty();
1064     }
```

Figure 1.3: hasDuplicate() function

Code from line 1046 to line 1053 is meant to send the required data to the database and get all PatientIdentifierType objects from the database and store them as a list. Code from line 1055 to line 1061 is meant to check every PatientIdentifierType objects with the given one by calling the isDuplicate() function we just implemented in PatientIdentifierType.java, if the two are equal, then the function will the duplicate, otherwise, the function will return an empty Optional.

The above implementation only adds check and merge functionality, by implementing the auto-merge feature we also need to call check_Table() function whenever the database changes. Therefore, we need to rewrite the savePatientIdentifierType() function.

0.1.3 Changes with Implementation Plan

As we carried out the implementation plan from deliverable 3, the only big change we made is we added another function called `merge()`, as the original plan we are thinking about to use `deletePatientIdentifierType()` function to delete one of duplicates if they exist. But in our final work we reconsider the meaning of “merge” and think there might be a better way to merge duplicates not simply delete it.

Therefore we implemented the `merge()` function to merge all fields of two duplicates into one complete `PatientIdentifierType` object. And also we did change the structure of `deletePatientIdentifierType()` function as we wrote in the original plan, since there is no need to track the database to find duplicates when we delete a `PatientIdentifierType` object. Besides we changed some names of functions, we meant to make the function’s purpose more clear to other developers. And anything else is according to the original plan. So here is our final implementation plan:

1. Modify the structure of `PatientIdentifierType` class.
Add a compare function to the `PatientIdentifierType` class thus `PatientIdentifierType` subject can be compared with another.
2. Implement `isDuplicate()` function in `PatientIdentifierType.java`.
`isDuplicate()` function will return `True` if two `PatientIdentifierType` have the same id or same format or same formatDescription, and return `False` otherwise.
3. Implement `merge()` function in `PatientIdentifierType.java`.
`merge()` function will merge all fields of two `PatientIdentifierType` into one.
4. Implement `hasDuplicate()` function inside `HibernatePatientDAO.java`.
`hasDuplicate()` function will return `PatientIdentifierType` if there exist duplicate elements inside the database and merge them, otherwise the method will return empty `Optional` and do nothing.
5. Modify `savePatientIdentifierType()` function in `HibernatePatientDAO.java`.
Call `hasDuplicate()` function at `savePatientIdentifierType()` thus whenever there is a new `PatientIdentifierType` added into the database, the system will merge duplicates.

0.2 User Guide

New Feature User Guide:

The user should make sure their openmrs-core version is up-to-date. Then, put PatientIdentifierType.java under the path:

[openmrs-core/api/src/main/java/org/openmrs/](#)

And put HibernatePatientDAO.java under the path:

[openmrs-core/api/src/main/java/org/openmrs/api/db/hibernate/](#)

The feature implemented by our team will give the OpenMRS software the functionality to auto-merge duplicate patient identifier types whenever a new patient identifier type is added to the database. In particular, the user needs to call the `savePatientIdentifierType()` function from `HibernatePatientDAO.java` to save a new `PatientIdentifierType` object into the database.

```
310      /**
311       * @see org.openmrs.api.db.PatientDAO#savePatientIdentifierType(org.openmrs.PatientIdentifierType)
312       */
313      @Override
314      public PatientIdentifierType savePatientIdentifierType(PatientIdentifierType patientIdentifierType)
315          throws DAOException {
316          PatientIdentifierType ret;
317          Optional<PatientIdentifierType> optionalType = hasDuplicate(patientIdentifierType);
318          if (optionalType.isPresent()) {
319              ret = optionalType.get();
320              ret.merge(patientIdentifierType);
321          } else {
322              ret = patientIdentifierType;
323          }
324          sessionFactory.getCurrentSession().saveOrUpdate(ret);
325          return ret;
326      }
```

Figure 2.1: Modified savePatientIdentifierType() function

And whenever the above function is called, the new feature will auto compare the given `PatientIdentifierType` object with every `PatientIdentifierType` object from the database, to check if there exists a duplicate. And for the definition of duplicate, our team believes if any two of `PatientIdentifierType` objects share the same id or have the same format or have the same formatDescription, then they will be considered as

duplicate. Then, if the duplicate exists, the new feature will auto-merge them by merging all fields of two objects into one.

Finally, if the user wishes to check the new feature to see if it really works, the user can use the following code after saving a new `PatientIdentifierType` object. The following code will print the id and the format of all `PatientIdentifierType` objects from the database. Then the user will be able to check if there exists a duplicate.

```
Criteria criteria = sessionFactory.getCurrentSession().createCriteria(PatientIdentifierType.class);

criteria.addOrder(Order.desc("required"));
criteria.addOrder(Order.asc("name"));
criteria.addOrder(Order.asc("patientIdentifierTypeId"));

for (PatientIdentifierType p : criteria.list()) {
    System.out.println("Id =" + t.getPatientIdentifierTypeId());
    System.out.println("Format =" + t.getFormat());
}
```

Figure 2.2: Code that prints id and format of all PatientIdentifierType objects

Test Files User Guide:

There are two test files folder in git, one folder contains all acceptance test files named `acceptance_tests`, the other one contains all unit test files named `unit_tests`.

To run the tests, first the user should make sure the `openmrs-core` is at the newest version, then the user needs to set up the environment and run maven build success. After that the user need swap `HibernatePatientDAOTest.java` with the old one under the path:

[openmrs-core/api/src/test/java/org/openmrs/api/db/hibernate/](#)

And put `PatientIdentifierType.java` under the path:

[openmrs-core/api/src/test/java/org/openmrs/](#)

And put all acceptance test files under the path:

[openmrs-core/api/src/test/java/org/openmrs/api/db/hibernate/](#)

Now the users are able to run the test files.

0.3 Acceptance Test

In deliverable 3 our team designed a series of acceptance tests, they are all able to run and are valid to test for different cases, but once we actually started our implementation work we found that there are some more cases we can test.

Therefore, we redesigned the acceptance tests by implementing a number of test files, each of them representing a series of user's actions. The following are the final version of our acceptance test files, with a description of each file's functionality. All following acceptance test files are under the acceptance_tests folder:

https://github.com/CSCD01/team_21-project/tree/master/Deliverable4/acceptance_tests/api/src/test/java/org/openmrs/api/db/hibernate

- test_User1.java

When the user creates and saves a new PatientIdentifierType object into the database, with the id different with every other object in the database. Then if the user wants to get a list of all PatientIdentifierType objects in the database. As a result, the list should now contain the new saved PatientIdentifierType object the user created.

```
13 public class test_User1 extends BaseContextSensitiveTest{
14     private HibernatePatientDAO hibernatePatientDao;
15
16     @Before
17     public void beforeEach() {
18         updateSearchIndex();
19         hibernatePatientDao = (HibernatePatientDAO) applicationContext.getBean("patientDAO");
20     }
21
22     @Test
23     public void test() {
24         // Get the id of all PatientIdentifierType objects
25         List<PatientIdentifierType> list = hibernatePatientDao.getAllPatientIdentifierTypes(true);
26         for (int i = 0; i < list.size(); i++) {
27             System.out.println(list.get(i).getId());
28         }
29
30         // Save a new PatientIdentifierType with id be unique
31         PatientIdentifierType type1 = new PatientIdentifierType();
32         type1.setName("type1");
33         hibernatePatientDao.savePatientIdentifierType(type1);
34
35         // The output should be 5 since there are 4 objects already exists in the database
36         assertEquals(5, hibernatePatientDao.getAllPatientIdentifierTypes(true).size());
37     }
38 }
39 }
```

Figure 3.1: test_User1.java

- test_User2.java

When the user creates and saves a new PatientIdentifierType object into the database, with the id = 1. Suppose there already exists a PatientIdentifierType object with id = 1 inside the database, then if the user wants to get a list of all PatientIdentifierType objects in the database. As a result, the list should not contain the new PatientIdentifierType object the user created.

```
1  package org.openmrs.api.db.hibernate;
2
3  import static org.junit.Assert.assertEquals;
4
5  import org.junit.Before;
6  import org.junit.Test;
7  import org.openmrs.PatientIdentifierType;
8
9  import org.openmrs.test.BaseContextSensitiveTest;
10
11 import java.util.List;
12
13 public class test_User2 extends BaseContextSensitiveTest{
14     private HibernatePatientDao hibernatePatientDao;
15
16     @Before
17     public void beforeEach() {
18         updateSearchIndex();
19         hibernatePatientDao = (HibernatePatientDao) applicationContext.getBean("patientDAO");
20     }
21
22     @Test
23     public void test() {
24         // Get the id of all PatientIdentifierType objects
25         List<PatientIdentifierType> list = hibernatePatientDao.getAllPatientIdentifierTypes(true);
26         for (int i = 0; i < list.size(); i++) {
27             System.out.println(list.get(i).getId());
28         }
29
30         // Save a new PatientIdentifierType with id be 1
31         PatientIdentifierType type1 = new PatientIdentifierType();
32         type1.setName("type1");
33         type1.setId(1);
34         hibernatePatientDao.savePatientIdentifierType(type1);
35
36         // The output should be 4 since there are 4 objects already exists in the database and the new one will not save into the database
37         assertEquals(4, hibernatePatientDao.getAllPatientIdentifierTypes(true).size());
38     }
39
40 }
```

Figure 3.2: test_User2.java

- test_User3.java

When the user creates and saves two new PatientIdentifierType objects into the database, both with the unique id and unique format. Then if the user wants to get a list of all PatientIdentifierType objects in the database. As a result, the list should now contain two PatientIdentifierType objects the user created.

```
3 import static org.junit.Assert.assertEquals;
4
5 import org.junit.Before;
6 import org.junit.Test;
7 import org.openmrs.PatientIdentifierType;
8
9 import org.openmrs.test.BaseContextSensitiveTest;
10
11 import java.util.List;
12
13 public class test_User3 extends BaseContextSensitiveTest{
14     private HibernatePatientDAO hibernatePatientDao;
15
16     @Before
17     public void beforeEach() {
18         updateSearchIndex();
19         hibernatePatientDao = (HibernatePatientDAO) applicationContext.getBean("patientDAO");
20     }
21
22     @Test
23     public void test() {
24         // Get the id and the format of all PatientIdentifierType objects
25         List<PatientIdentifierType> list = hibernatePatientDao.getAllPatientIdentifierTypes(true);
26         for (int i = 0; i < list.size(); i++) {
27             System.out.println(list.get(i).getId());
28             System.out.println(list.get(i).getFormat());
29         }
30
31         // Save two new PatientIdentifierType objects with different format
32         PatientIdentifierType type1 = new PatientIdentifierType();
33         type1.setName("type1");
34         type1.setFormat("format 1");
35         PatientIdentifierType type2 = new PatientIdentifierType();
36         type2.setName("type2");
37         type2.setFormat("format 2");
38         hibernatePatientDao.savePatientIdentifierType(type1);
39         hibernatePatientDao.savePatientIdentifierType(type2);
40
41         // The output should be 6 since there are 4 objects already exists in the database
42         assertEquals(6, hibernatePatientDao.getAllPatientIdentifierTypes(true).size());
43     }
44
45 }
```

Figure 3.3: test_User3.java

- test_User4.java

When the user creates and saves two PatientIdentifierType objects into the database, both with the unique id but same format = “format 1”. Then if the user wants to get a list of all PatientIdentifierType objects in the database. As a result, the list should now contain only one PatientIdentifierType object he saved.

```
3  import static org.junit.Assert.assertEquals;
4
5  import org.junit.Before;
6  import org.junit.Test;
7  import org.openmrs.PatientIdentifierType;
8
9  import org.openmrs.test.BaseContextSensitiveTest;
10
11 import java.util.List;
12
13 public class test_User4 extends BaseContextSensitiveTest{
14     private HibernatePatientDAO hibernatePatientDao;
15
16     @Before
17     public void beforeEach() {
18         updateSearchIndex();
19         hibernatePatientDao = (HibernatePatientDAO) applicationContext.getBean("patientDAO");
20     }
21
22     @Test
23     public void test() {
24         // Get the id and the format of all PatientIdentifierType objects
25         List<PatientIdentifierType> list = hibernatePatientDao.getAllPatientIdentifierTypes(true);
26         for (int i = 0; i < list.size(); i++) {
27             System.out.println(list.get(i).getId());
28             System.out.println(list.get(i).getFormat());
29         }
30
31         // Save two new PatientIdentifierType objects with same format
32         PatientIdentifierType type1 = new PatientIdentifierType();
33         type1.setName("type1");
34         type1.setFormat("format 1");
35         PatientIdentifierType type2 = new PatientIdentifierType();
36         type2.setName("type2");
37         type2.setFormat("format 1");
38         hibernatePatientDao.savePatientIdentifierType(type1);
39         hibernatePatientDao.savePatientIdentifierType(type2);
40
41         // The output should be 5 since there are 4 objects already exists in the database, and only one new object saved into database
42         assertEquals(5, hibernatePatientDao.getAllPatientIdentifierTypes(true).size());
43     }
44
45 }
```

Figure 3.4: test_User4.java

Followings are the results of our acceptance tests run:

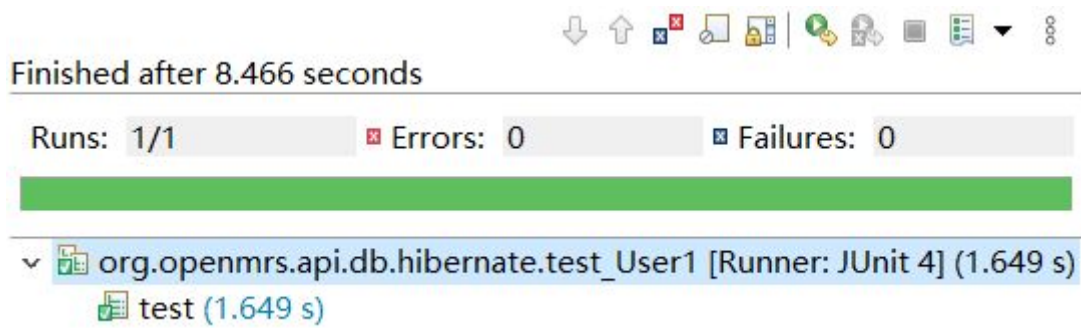


Figure 3.5: `test_User1.java` result

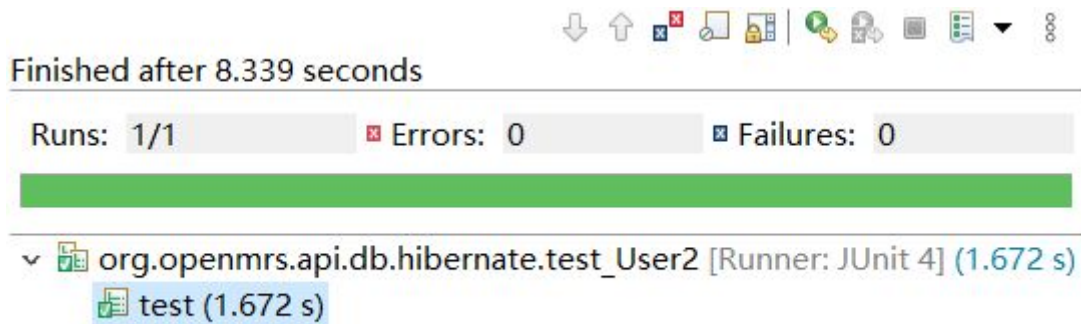


Figure 3.6: `test_User2.java` result

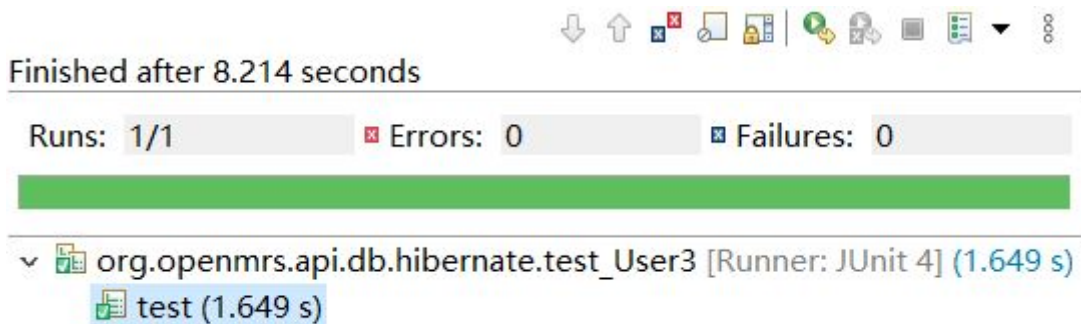


Figure 3.7: `test_User3.java` result

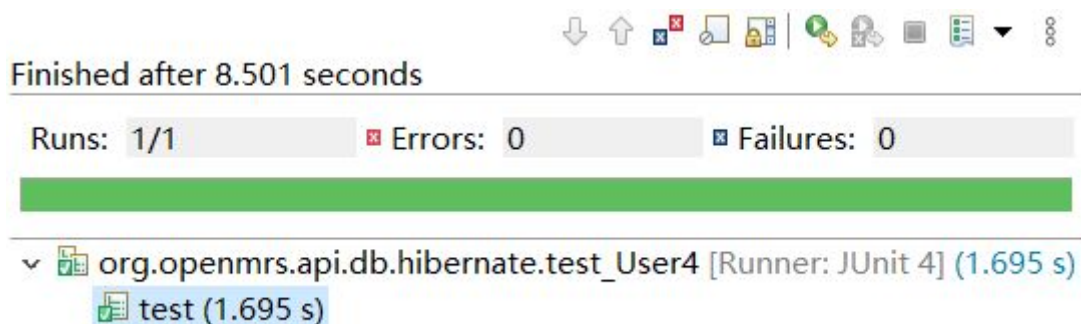


Figure 3.8: `test_User4.java` result

0.4 Unit Test

As we implement the feature by adding and modifying functions inside two java files, we also need two test files to do the unit tests. All following unit test files are under the unit_tests folder:

https://github.com/CSCD01/team_21-project/tree/master/Deliverable4/unit_test/api/src/test/java/org/openmrs

- PatientIdentifierTypeTest.java:

This file is used to test methods in PatientIdentifierType.java

```
1  package org.openmrs;
2
3  import static org.junit.Assert.assertEquals;
4  import static org.junit.Assert.assertFalse;
5  import static org.junit.Assert.assertTrue;
6
7  import org.junit.Test;
8
9  public class PatientIdentifierTypeTest {
10
11     @Test
12     public void testEmpty() {
13         PatientIdentifierType patientIdentifierTypeOne = new PatientIdentifierType();
14         PatientIdentifierType patientIdentifierTypeTwo = new PatientIdentifierType();
15
16         assertTrue(patientIdentifierTypeOne.isDuplicate(patientIdentifierTypeTwo));
17     }
18
19     @Test
20     public void testNoDuplication() {
21         PatientIdentifierType patientIdentifierType = new PatientIdentifierType(1);
22         patientIdentifierType.setFormat("format1");
23         patientIdentifierType.setFormatDescription("formatDescription1");
24         PatientIdentifierType patientIdentifierType2 = new PatientIdentifierType(2);
25         patientIdentifierType2.setFormat("format2");
26         patientIdentifierType2.setFormatDescription("formatDescription2");
27
28         assertFalse(patientIdentifierType.isDuplicate(patientIdentifierType2));
29     }
30 }
```

Figure 4.1: PatientIdentifierTypeTest.java (part 1)


```

31     @Test
32     public void testIdDuplication() {
33         PatientIdentifierType patientIdentifierType = new PatientIdentifierType(1);
34         patientIdentifierType.setFormat("format1");
35         patientIdentifierType.setFormatDescription("formatDescription1");
36         PatientIdentifierType patientIdentifierType2 = new PatientIdentifierType(1);
37         patientIdentifierType2.setFormat("format2");
38         patientIdentifierType2.setFormatDescription("formatDescription2");
39
40         assertTrue(patientIdentifierType.isDuplicate(patientIdentifierType2));
41
42     }
43
44     @Test
45     public void testFormatDuplication() {
46         PatientIdentifierType patientIdentifierType = new PatientIdentifierType(1);
47         patientIdentifierType.setFormat("format");
48         patientIdentifierType.setFormatDescription("formatDescription1");
49         PatientIdentifierType patientIdentifierType2 = new PatientIdentifierType(2);
50         patientIdentifierType2.setFormat("format");
51         patientIdentifierType2.setFormatDescription("formatDescription2");
52
53         assertTrue(patientIdentifierType.isDuplicate(patientIdentifierType2));
54
55     }
56
57     @Test
58     public void testFormatDescDuplication() {
59         PatientIdentifierType patientIdentifierType = new PatientIdentifierType(1);
60         patientIdentifierType.setFormat("format1");
61         patientIdentifierType.setFormatDescription("formatDescription");
62         PatientIdentifierType patientIdentifierType2 = new PatientIdentifierType(2);
63         patientIdentifierType2.setFormat("format2");
64         patientIdentifierType2.setFormatDescription("formatDescription");
65
66         assertTrue(patientIdentifierType.isDuplicate(patientIdentifierType2));
67
68     }

```

Figure 4.2: *PatientIdentifierTypeTest.java (part 2)*

```

70     @Test
71     public void testMergeFormat() {
72         PatientIdentifierType patientIdentifierType = new PatientIdentifierType(1);
73         PatientIdentifierType patientIdentifierType2 = new PatientIdentifierType(1);
74         patientIdentifierType2.setFormat("format2");
75
76         assertTrue(patientIdentifierType.isDuplicate(patientIdentifierType2));
77
78         patientIdentifierType.merge(patientIdentifierType2);
79         assertEquals("format2", patientIdentifierType.getFormat());
80
81     }
82
83     @Test
84     public void testMergeFormatDesc() {
85         PatientIdentifierType patientIdentifierType = new PatientIdentifierType();
86         PatientIdentifierType patientIdentifierType2 = new PatientIdentifierType();
87         patientIdentifierType2.setFormatDescription("formatDescription2");
88
89         assertTrue(patientIdentifierType.isDuplicate(patientIdentifierType2));
90         patientIdentifierType.merge(patientIdentifierType2);
91
92         assertEquals("formatDescription2", patientIdentifierType.getFormatDescription());
93     }
94
95     @Test
96     public void testShortCircuit() {
97         PatientIdentifierType patientIdentifierType = new PatientIdentifierType();
98         patientIdentifierType.setFormat("format1");
99
100        PatientIdentifierType patientIdentifierType2 = new PatientIdentifierType();
101        patientIdentifierType2.setFormat("format2");
102
103        assertEquals("format1", patientIdentifierType.getFormat());
104    }

```

Figure 4.3: *PatientIdentifierTypeTest.java (part 3)*

- **HibernatePatientDAOTest.java:**

This file is used to test methods in `HibernatePatientDAO.java`.

```
12 import static java.util.Collections.emptyList;
13 import static java.util.Collections.singletonList;
14 import static org.hamcrest.Matchers.hasItems;
15 import static org.junit.Assert.assertFalse;
16 import static org.junit.Assert.assertNotNull;
17 import static org.junit.Assert.assertNull;
18 import static org.junit.Assert.assertTrue;
19
20 import java.util.Arrays;
21 import java.util.List;
22 import java.util.stream.Collectors;
23
24 import org.junit.Assert;
25 import org.junit.Before;
26 import org.junit.Test;
27 import org.openmrs.Patient;
28 import org.openmrs.PatientIdentifier;
29 import org.openmrs.PatientIdentifierType;
30 import org.openmrs.test.BaseContextSensitiveTest;
31
32 public class HibernatePatientDAOTest extends BaseContextSensitiveTest {
33
34     private HibernatePatientDAO hibernatePatientDao;
35
36     @Before
37     public void beforeEach() {
38         updateSearchIndex();
39         hibernatePatientDao = (HibernatePatientDAO) applicationContext.getBean("patientDAO");
40     }
41
42     @Test
43     public void getPatientIdentifiers_shouldGetByIdentifierType() {
44         List<PatientIdentifierType> identifierTypes = singletonList(new PatientIdentifierType(2));
45         List<PatientIdentifier> identifiers = hibernatePatientDao.getPatientIdentifiers(null, identifierTypes,
46             emptyList(), emptyList(), null);
47         List<Integer> identifierIds = identifiers.stream().map(PatientIdentifier::getId).collect(Collectors.toList());
48
49         Assert.assertEquals(2, identifiers.size());
50         Assert.assertThat(identifierIds, hasItems(1, 3));
51     }
52 }
```

Figure 4.4: HibernatePatientDAOTest.java (part 1)

```

53     @Test
54     public void getPatientIdentifiers_shouldGetByPatients() {
55         List<Patient> patients = Arrays.asList(hibernatePatientDao.getPatient(6), hibernatePatientDao.getPatient(7));
56         List<PatientIdentifier> identifiers = hibernatePatientDao.getPatientIdentifiers(null, emptyList(), emptyList(),
57             patients, null);
58         List<Integer> identifierIds = identifiers.stream().map(PatientIdentifier::getId).collect(Collectors.toList());
59
60         Assert.assertEquals(2, identifiers.size());
61         Assert.assertThat(identifierIds, hasItems(3, 4));
62     }
63
64     @Test
65     public void checkExistedType() {
66         PatientIdentifierType patientIdentifierType = hibernatePatientDao.getPatientIdentifierType(1);
67         assertTrue(hibernatePatientDao.hasDuplicate(patientIdentifierType).isPresent());
68     }
69
70     @Test
71     public void checkAnotherExistedType() {
72         PatientIdentifierType patientIdentifierType = hibernatePatientDao.getPatientIdentifierType(2);
73         assertTrue(hibernatePatientDao.hasDuplicate(patientIdentifierType).isPresent());
74     }
75
76     @Test
77     public void checkNonExistentType() {
78         assertFalse(hibernatePatientDao.hasDuplicate(new PatientIdentifierType(114514)).isPresent());
79     }
80
81     @Test
82     public void addAndCheckType() {
83         PatientIdentifierType patientIdentifierType = new PatientIdentifierType();
84         patientIdentifierType.setName("test");
85         patientIdentifierType.setDescription("description");
86         patientIdentifierType.setRequired(false);
87
88         assertNull(patientIdentifierType.getPatientIdentifierTypeId());
89
90         hibernatePatientDao.savePatientIdentifierType(patientIdentifierType);
91         assertNotNull(hibernatePatientDao.getPatientIdentifierType(patientIdentifierType.getPatientIdentifierTypeId()));
92
93         assertTrue(hibernatePatientDao.hasDuplicate(patientIdentifierType).isPresent());
94     }

```

Figure 4.5: *HibernatePatientDAOTest.java (part 2)*

```

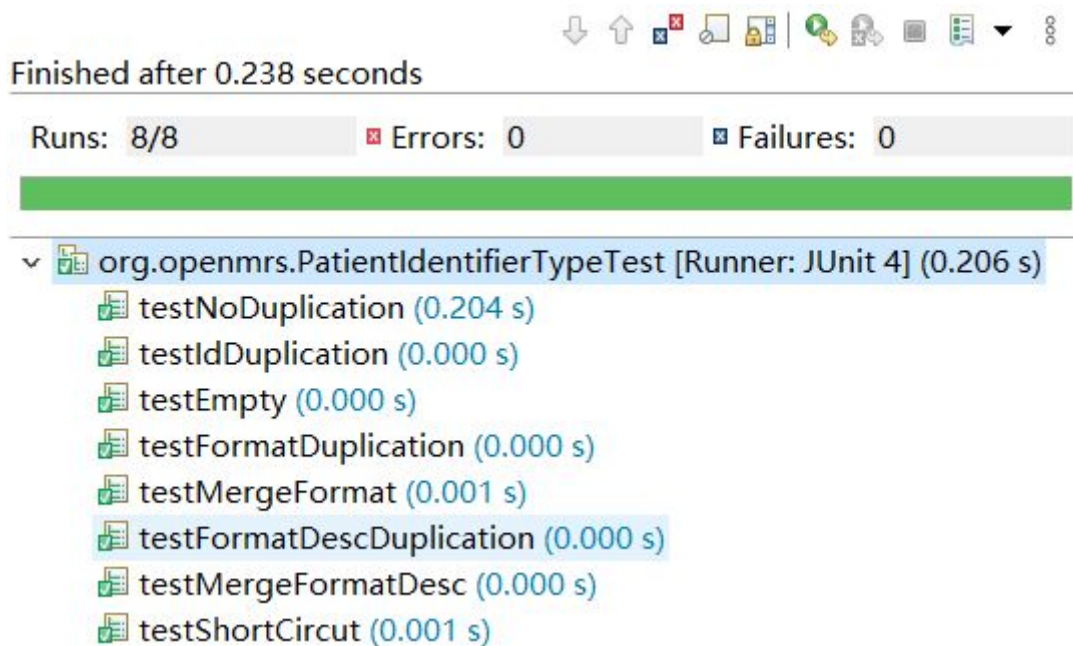
96      @Test
97      public void addAndCheckTypeOfSameFormat() {
98          PatientIdentifierType patientIdentifierTypeOne = new PatientIdentifierType();
99          patientIdentifierTypeOne.setName("name1");
100         patientIdentifierTypeOne.setDescription("description1");
101         patientIdentifierTypeOne.setRequired(false);
102         patientIdentifierTypeOne.setFormat("format");
103
104         PatientIdentifierType patientIdentifierTypeTwo = new PatientIdentifierType();
105         patientIdentifierTypeTwo.setName("name2");
106         patientIdentifierTypeTwo.setDescription("description2");
107         patientIdentifierTypeTwo.setRequired(false);
108         patientIdentifierTypeTwo.setFormat("format");
109
110         hibernatePatientDao.savePatientIdentifierType(patientIdentifierTypeOne);
111
112         assertTrue(hibernatePatientDao.hasDuplicate(patientIdentifierTypeTwo).isPresent());
113     }
114 }

```

Figure 4.6: HibernatePatientDAOTest.java (part 3)

The final version unit tests have some changes with the unit test we designed back in deliverable 3, we add more cases and write better comments in the test files. We mean to make each case easy to understand for any user.

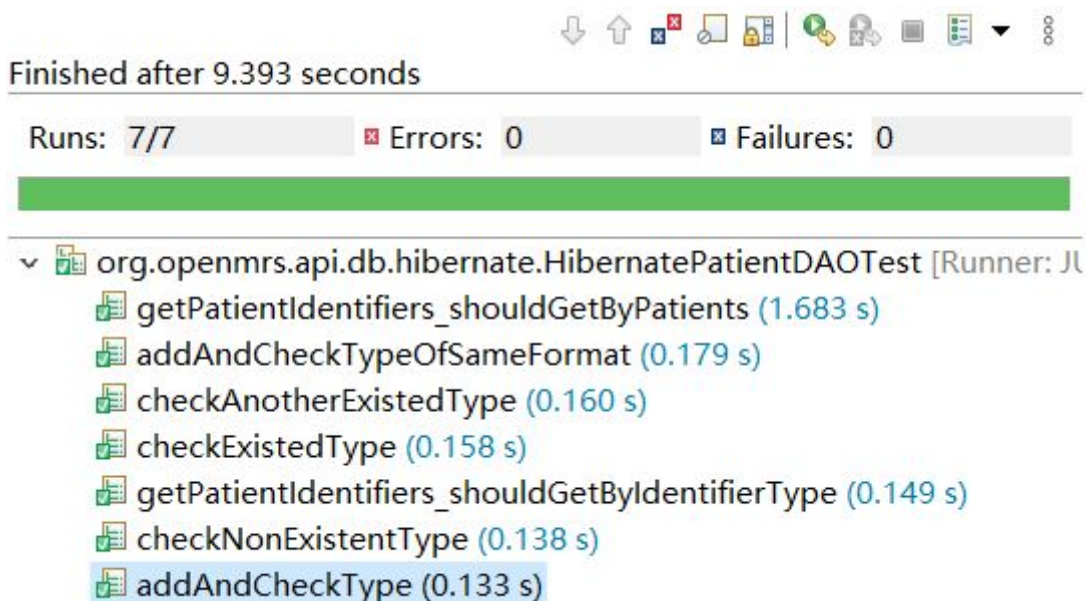
Following are the results of our unit tests run:



The screenshot shows the JUnit test results for the `org.openmrs.PatientIdentifierTypeTest` class. The tests were completed in 0.238 seconds. The summary bar indicates 8/8 runs, 0 errors, and 0 failures. The test list includes:

- testNoDuplication (0.204 s)
- testIdDuplication (0.000 s)
- testEmpty (0.000 s)
- testFormatDuplication (0.000 s)
- testMergeFormat (0.001 s)
- testFormatDescDuplication (0.000 s)
- testMergeFormatDesc (0.000 s)
- testShortCircuit (0.001 s)

Figure 4.7: PatientIdentifierTypeTest.java result



The screenshot shows the JUnit test results for the `org.openmrs.api.db.hibernate.HibernatePatientDAOTest` class. The tests were completed in 9.393 seconds. The summary bar indicates 7/7 runs, 0 errors, and 0 failures. The test list includes:

- getPatientIdentifiers_shouldGetByPatients (1.683 s)
- addAndCheckTypeOfSameFormat (0.179 s)
- checkAnotherExistedType (0.160 s)
- checkExistedType (0.158 s)
- getPatientIdentifiers_shouldGetByIdentifierType (0.149 s)
- checkNonExistentType (0.138 s)
- addAndCheckType (0.133 s)

Figure 4.8: HibernatePatientDAOTest.java result

0.5 Project Management

In this section, we will record how Team 21 manages the project in deliverable 4.

0.5.1 Kanban

Team 21 is continuing to use Kanban as our development process. And we use Trello to support our project management, our Trello board address is here:

<https://trello.com/b/pwP6Xoiq/cscd01-project>

In this final deliverable, we are going to implement the feature we choose from deliverable 3. As we follow the implementation plan, two of our members are going to implement and change the structure of the PatientIdentifierType.java (also writing a complete unit test suite), the other two will implement the changes inside HibernatePatientDAO.java (also write a complete unit test suite), the last member will create the user guide and an acceptance test suite. Finally, the whole team will finish the deliverable 4 reports together.

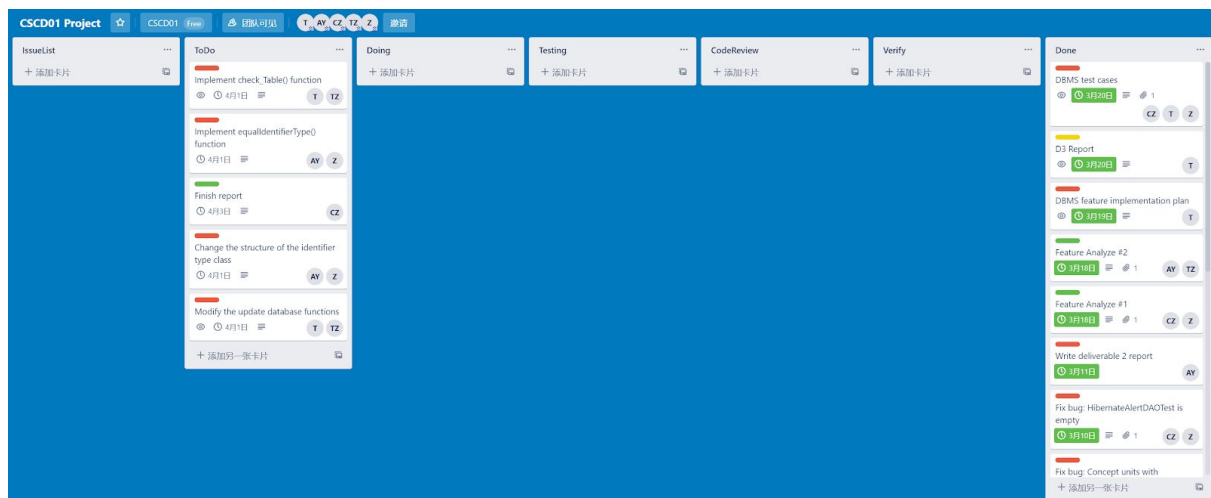


Figure 5.1: Kanban board (at the start of deliverable 4)

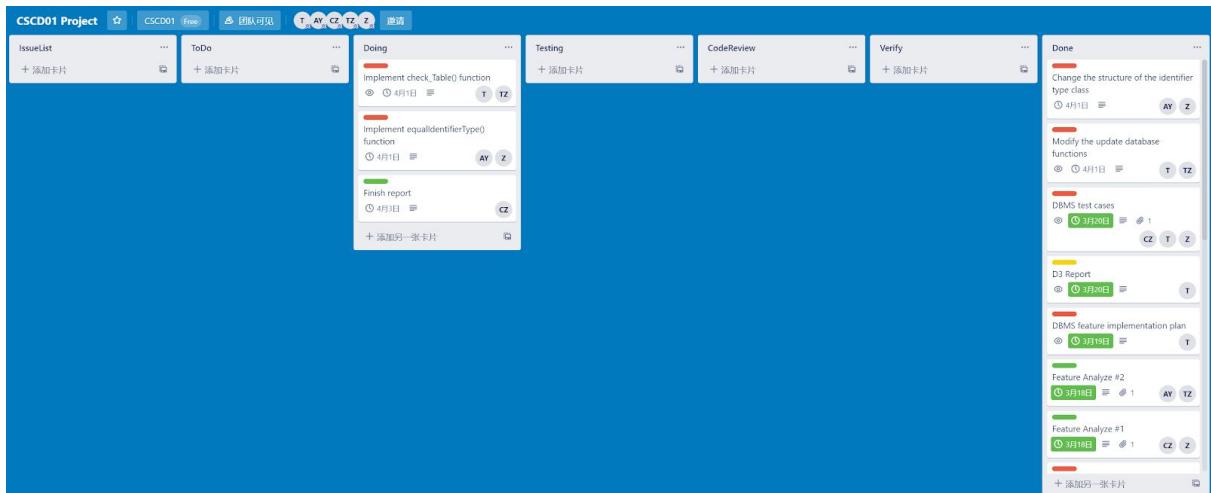


Figure 5.2: Kanban board (after the second meeting)

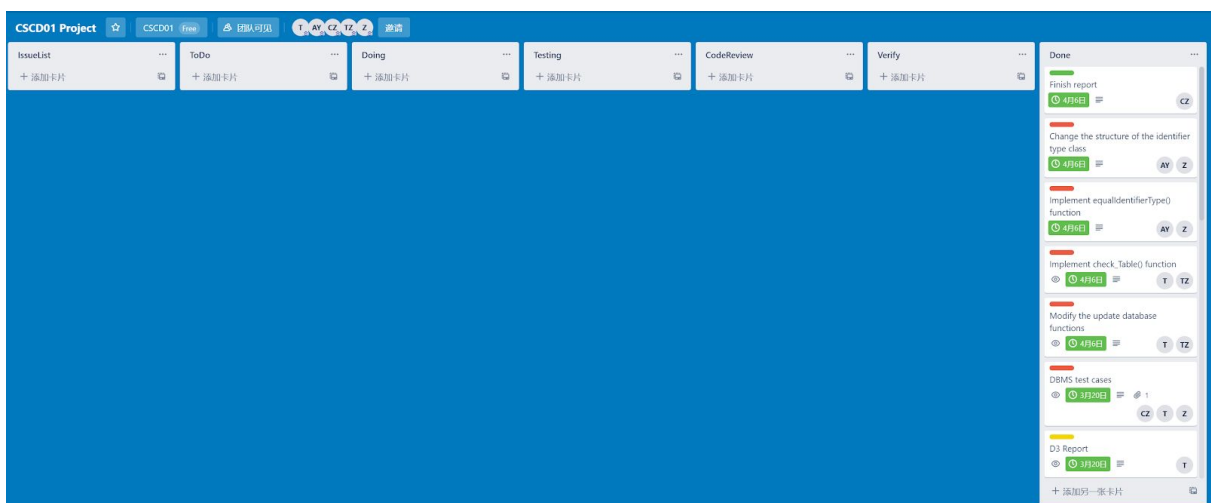


Figure 5.3: Kanban board (at the end of the deliverable 4)

0.5.2 Standups

As part of the Kanban process, we are required to do daily standups. However, since we are students and our schedules are not very flexible, we settled on conducting 4 meetings during the work period of deliverable 4.

Mar. 28th: We got everyone up to speed and reviewed the implementation plan from the deliverable 3. Then we decided to split our team into two groups of two working on two main parts of implementation while the leftover one writes the user guide and an acceptance test suite.

Mar. 30th: We had a meeting to catch up on how everyone was doing, and we talked about changes/differences from the original implementation plan.

April. 1st: We test the feature and make sure everything is fine. After that, we talked about adding more test cases.

(Add one, after Dr.Anya extended the due date)

April. 5th: We reviewed all of our work to make sure everything works fine. Then we check and fix the typo and grammar mistakes for the deliverable report before we make the final submission.

0.5.3 Evidence Of Kanban

As we described in earlier deliverables, Kanban is meant to maximize the speed and quality of output, which is suitable for large size program development. And from the two months of development experience with Kanban, our team very much benefited from it.

One thing that makes Kanban so good at large scale program development is that compared to other software development processes, the Kanban process is more flexible since it does not require software engineers to have exactly the same skill level, it allows the developer team to add tasks anytime during the work period.

Since every member of our team has no experience in development in OpenMRS, we all practically learn new stuff (ex. OpenMRS structure, API structure) during development, thus it is very common that some tasks need to be changed or added during the process. Kanban's flexibility is helping us with such problems, every time our team decides to change something we just change it without a thought, we don't need to follow an unchangeable task till the end of a sprint like other development processes do, the flexibility saves us a bunch of time.

Another feature that made Kanban unique is limit work in progress (WIP), by limiting the number of tasks it will improve our focus on a few tasks and to identify bottlenecks. Our team has set the number of WIP to be five during the whole development period. It ensures that each member of the team has only one task to

do, such that the quality of our work will remain high and the workload of each person is very likely equal.

Overall, Kanban helps our team a lot during the work term, and we are glad to choose Kanban as our development process so that we can finish the development together.