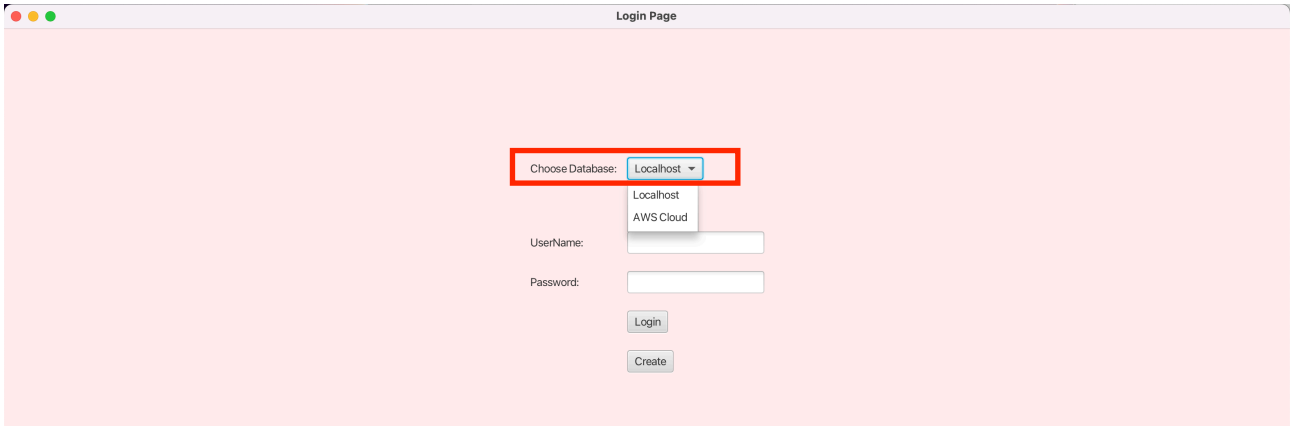
GitLink(https://gitlab.ecs.vuw.ac.nz/wangming3/encryptdecryptapp)

1.Login Page

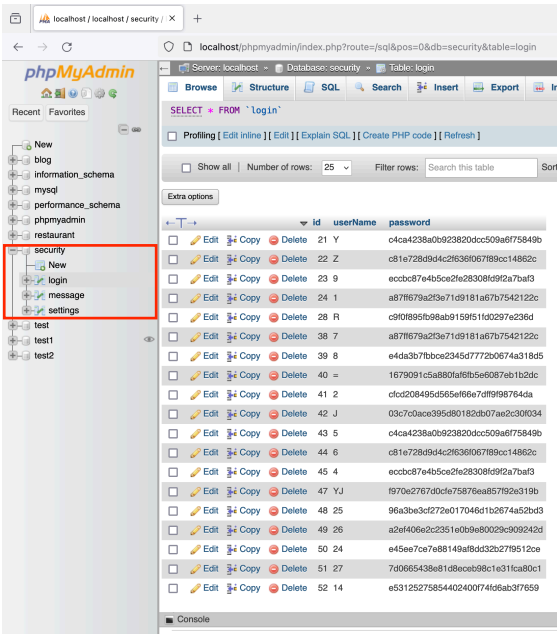
1.1 Choose Database

User can choose Localhost Database or AWS Cloud Database to connect.

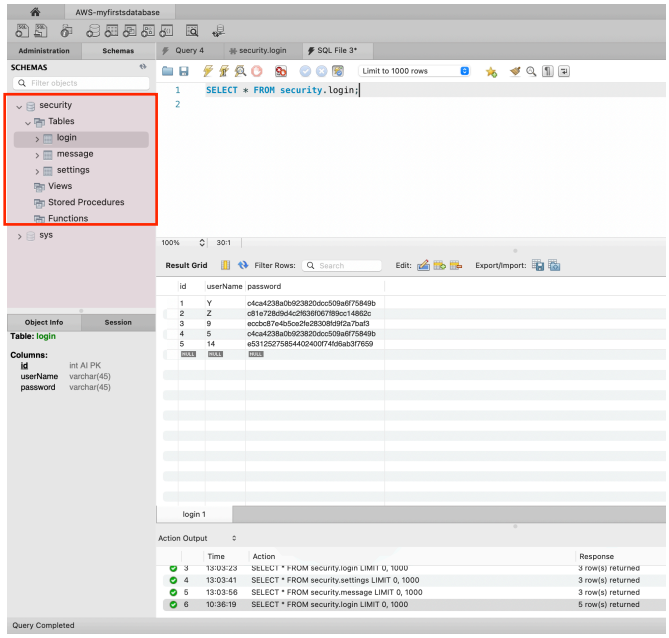



```
Label chooseDataLabel = new Label("Choose Database: ");
MenuButton dataMenuButton = new MenuButton();
MenuItem localData = new MenuItem("Localhost");
MenuItem cloudData = new MenuItem("AWS Cloud");
dataMenuButton.getItems().addAll(localData,cloudData);
dataMenuButton.setText(chosenData);

localData.setOnAction(e ->{
    chosenData = localData.getText();
    dataMenuButton.setText(chosenData);
    JDBC_URL = "jdbc:mysql://localhost:3306/security";
    USERNAME = "root";
    PASSWORD = "";
});

cloudData.setOnAction(e ->{
    chosenData = cloudData.getText();
    dataMenuButton.setText(chosenData);
    JDBC_URL = "jdbc:mysql://myfirstdatabase.cf8sld5urrxi.ap-southeast-2.rds.amazonaws.com:3306/security";
    USERNAME = "admin";
    PASSWORD = "willawilla";
});
```

Localhost Database

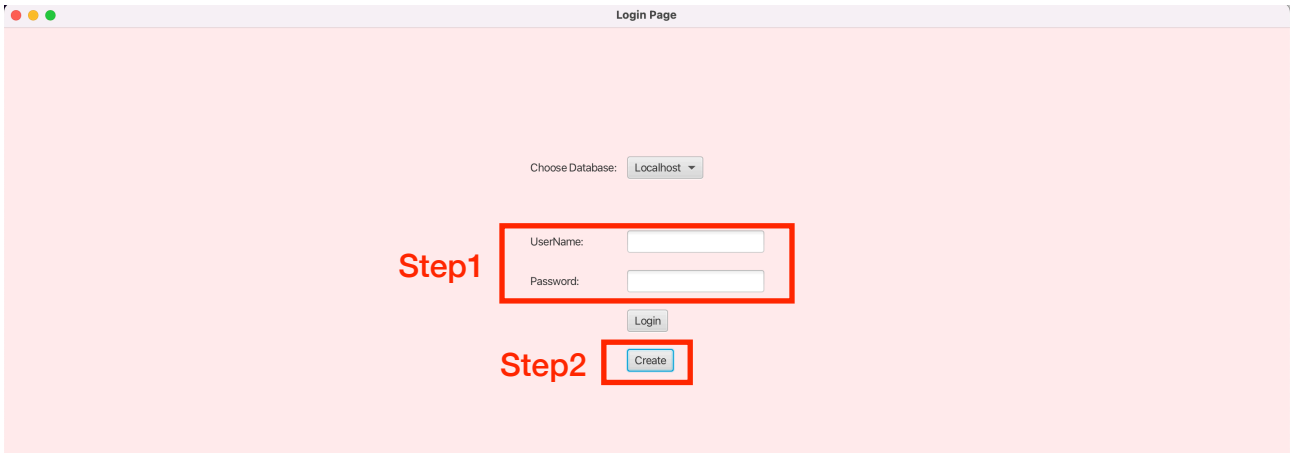


AWS Cloud Database

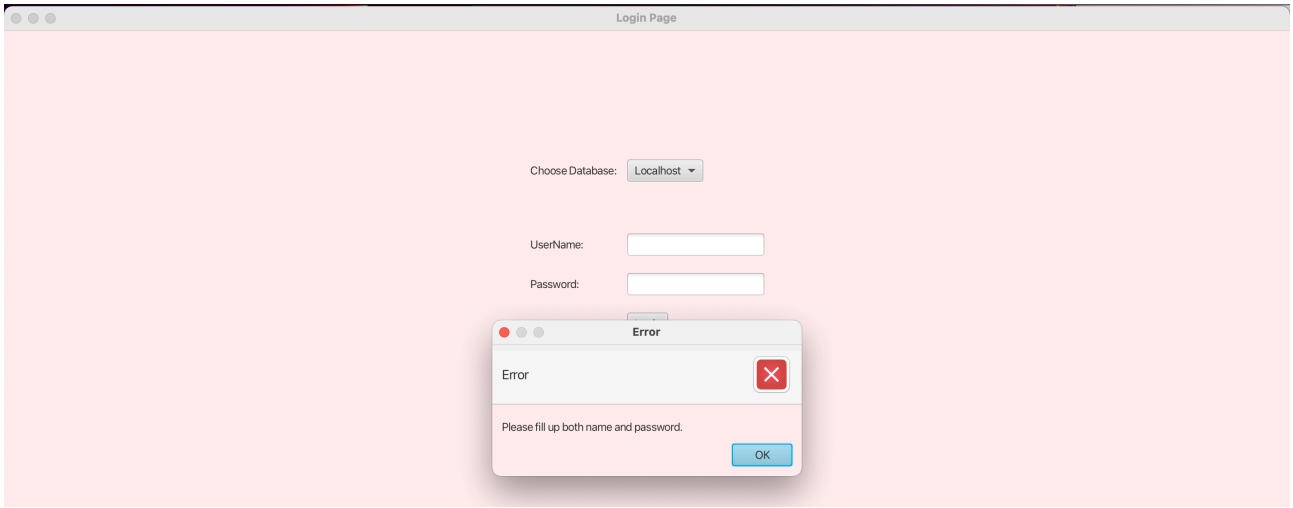


1.2 Create Account

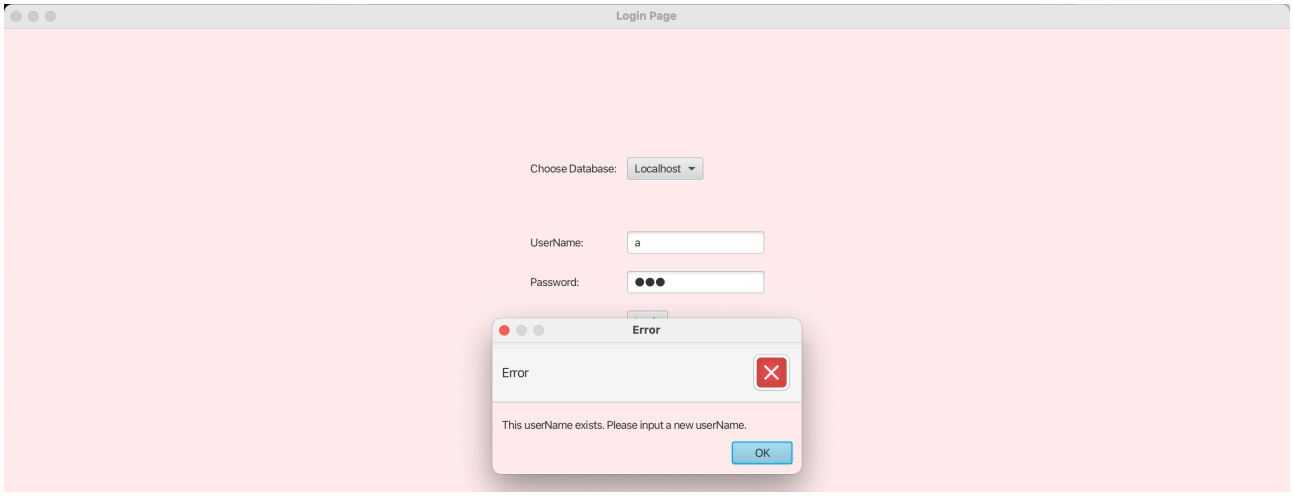
User can input UserName and Password, then click “Create” button to create a new account.



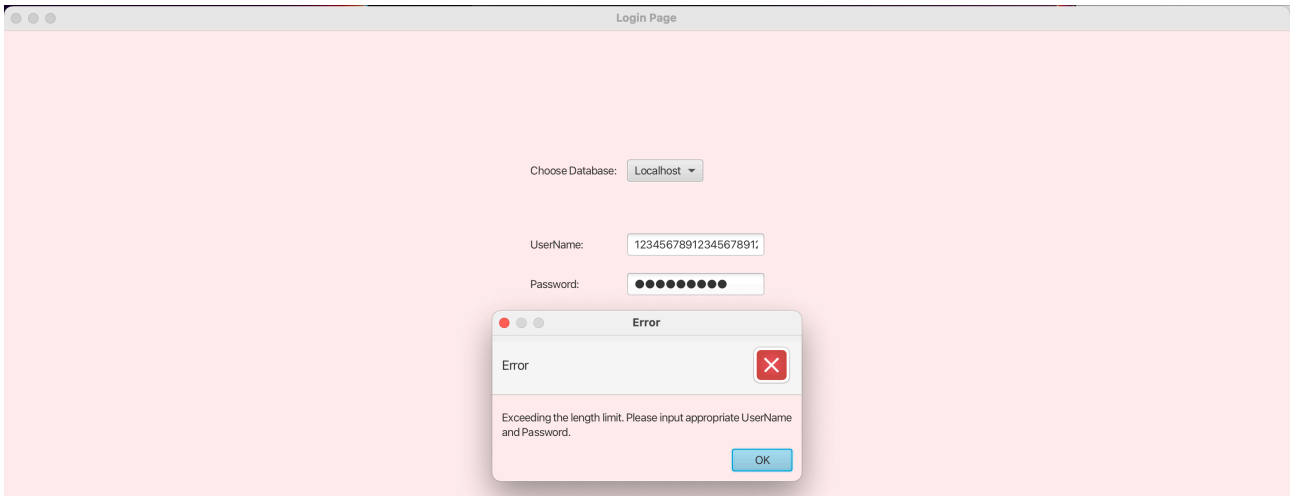
(1). If either the username or password is empty, when click “Create”, will get an error “Please fill up both name and password.”



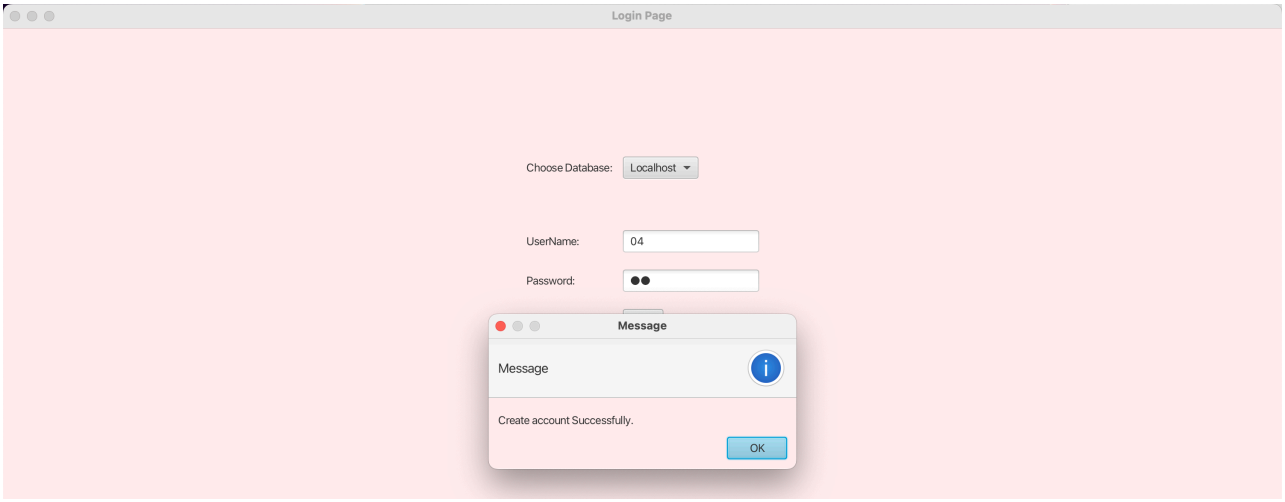
(2).If the input username already exists in database, when click “Create”, will get an error "This userName exists. Please input a new userName.”

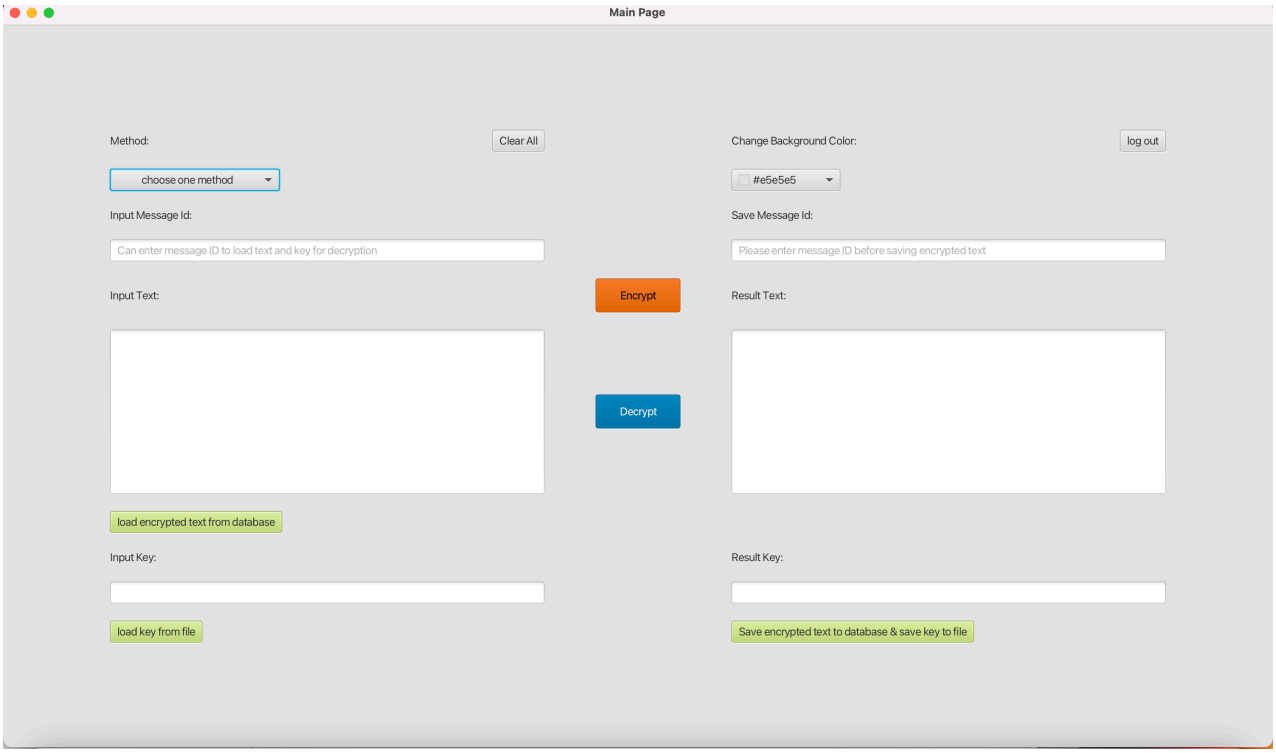


(3).If the username or password exceeds the length limit, will get an error “Unsuccessfully”.



(4).If username and password both provided appropriately, and username is new, will get a message "Create account Successfully.” Then Click “OK” button to load the default main page.





(5). Coding Logic in Create Function

Step 1: input username will be encrypted by caesarEncrypt Method(Key = 3) and password will be encrypted by hashEncrypt Method.
Step 2: check if the encrypted userName exists in database.
Step 3: if input userName is empty or encrypted userName exists, will show error alert.
Step 4: check if the encrypted userName and encrypted password is valid in length.

If not valid, show error alert.

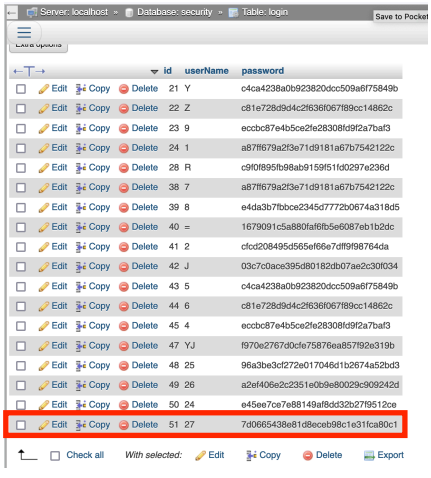
If valid, the encrypted username and password will be inserted into database (security.login table).This ensures the userName and password stored in database have already been encrypted. HashEncrypted Password can't be decrypted, so this database will be more security.

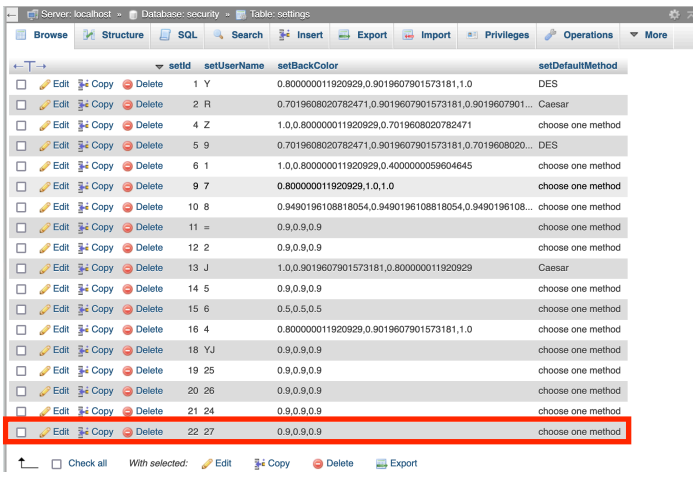
At the same time, a default setting row will also be created for this new account (security.settings table)

```
private void createUser(Stage primaryStage) {
    try {
        Class.forName("com.mysql.cj.jdbc.Driver");
        Connection connection = DriverManager.getConnection(JDBC_URL, USERNAME, PASSWORD);

Step1
        String userName = usernameField.getText();
        String secretUserName = method1.caesarEncrypt(userName, 3); // when create, use caeser method to encrypt username (key = 3)
        String password = passwordField.getText();
        String secretPassword = method1.hashEncrypt(password); //hashed password can't be decrypted, store hashed password in database more security. When log

Step2
        String checkUserNameSql = "SELECT * FROM login WHERE userName = ?";
        PreparedStatement checkStatement = connection.prepareStatement(checkUserNameSql);
        checkStatement.setString(1, secretUserName);
        ResultSet checkResult = checkStatement.executeQuery();

Step3
        if (userName.trim().isEmpty() || password.trim().isEmpty()) {
            Alert alert = new Alert(Alert.AlertType.ERROR, "Please fill up both name and password.");
            alert.initOwner(primaryStage);
            alert.showAndWait();
        } else if (checkResult.next()) {
            Alert alert = new Alert(Alert.AlertType.ERROR, "This userName exists. Please input a new userName.");
            alert.initOwner(primaryStage);
            alert.showAndWait();
        } else {
            String sql = "INSERT INTO login (`userName`, `password`) VALUES (?, ?)";
            try (PreparedStatement preparedStatement = connection.prepareStatement(sql)) {
                preparedStatement.setString(1, secretUserName);
                preparedStatement.setString(2, secretPassword);
                try {
                    int rowsAffected = preparedStatement.executeUpdate();
                    if (rowsAffected > 0) {
                        Alert alert = new Alert(Alert.AlertType.INFORMATION, "Create account Successfully.");
                        alert.initOwner(primaryStage);
                        alert.showAndWait();
                        createUserSetting(secretUserName); // when create account successfully, create a related user setting row in settings table
                        mainPage(primaryStage, secretUserName);
                    }
                } catch (Exception e) {
                    Alert alert = new Alert(Alert.AlertType.ERROR, "Exceeding the length limit. Please input appropriate UserName and Password.");
                    alert.initOwner(primaryStage);
                    alert.showAndWait();
                }
                preparedStatement.close();
            } catch (SQLException e) {
                e.printStackTrace();
            }
        }
        checkStatement.close();
        connection.close();
    } catch (Exception e) {
        System.out.println("createUser Error");
    }
}
```

Step4

```
public void createUserSetting(String userNameString) {
    try {
        Class.forName("com.mysql.cj.jdbc.Driver");
        Connection connection = DriverManager.getConnection(JDBC_URL, USERNAME, PASSWORD);
        String sql = "INSERT INTO settings (`setUserName`,`setBackColor`,`setDefaultMethod`) VALUES (?, ?, ?)";
        PreparedStatement statement = connection.prepareStatement(sql);
        String color = "0.9,0.9,0.9";   //default background color
        String method = "choose one method";
        statement.setString(1, userNameString);
        statement.setString(2, color);
        statement.setString(3, method);
        statement.executeUpdate();
        statement.close();
        connection.close();
    } catch (Exception e2) {
        System.out.println("createUserSetting Error");
    }
}
```



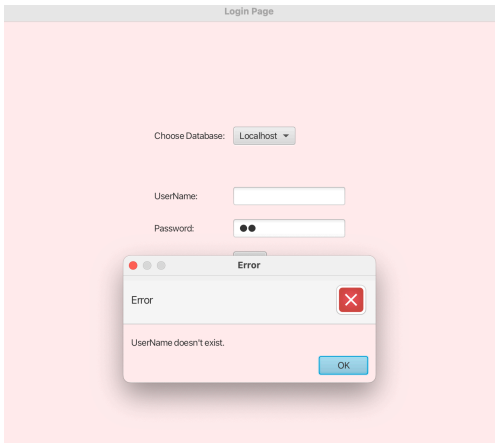


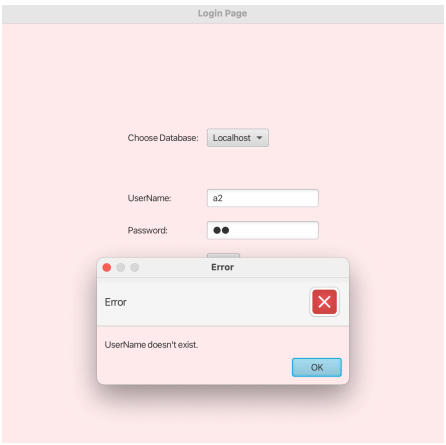
1.3 Log in

User input UserName and Password, then click “Login” button to load the user’s main page.

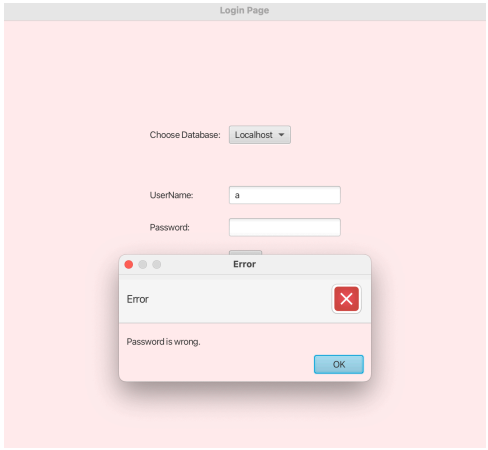
(Can use userName = a, password = 1 for testing)

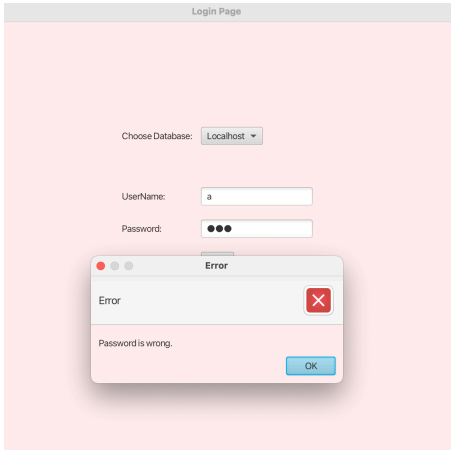
(1). If username is empty or not exist, will get an error “UserName doesn’t exist.”



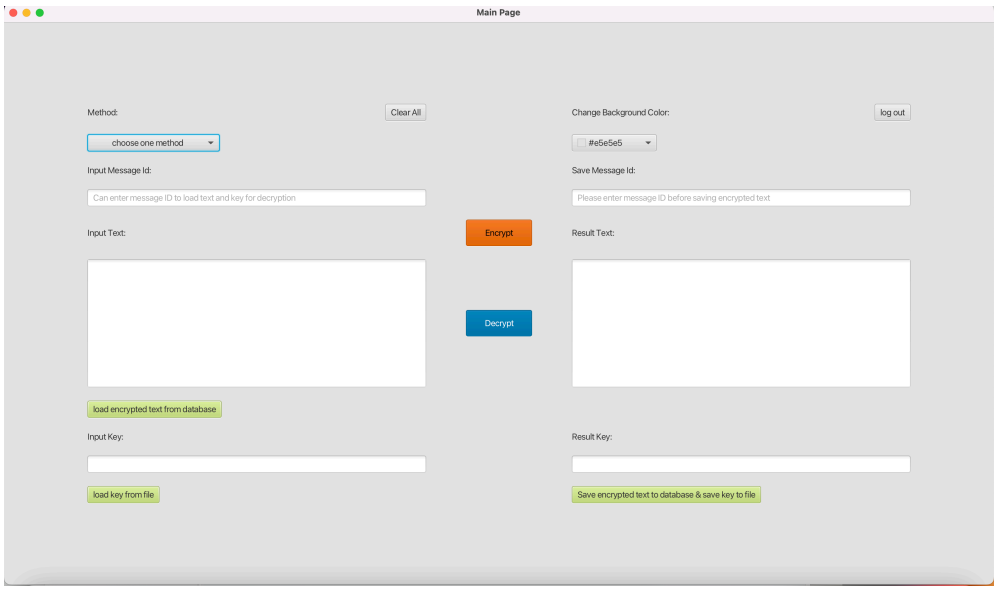


(2). If username exists, password is empty or not correct, will get an error “Password is wrong.”





(3). If username and password match, will automatically load the main page with this user’s setting.



(4). Coding Logic in Login Function

Step 1: input userName will be encrypted by caesarEncrypt method(Key=3) and input password will be encrypted by hashEncrypt method.

Step 2: check if the encrypted userName exists in database.

Step 3: If encrypted userName doesn't exist, show error.
If encrypted userName exists, check if encrypted password match.
If encrypted password doesn't match, show error.
If encrypted password matches, will log in successfully, load this user's main page

```
public void login(Stage primaryStage) {
    try {
        Class.forName("com.mysql.cj.jdbc.Driver");
        Connection connection = DriverManager.getConnection(JDBC_URL, USERNAME, PASSWORD);
        Statement statement = connection.createStatement();

        String userName = usernameField.getText();
        String secretUserName = method1.caesarEncrypt(userName, 3);
        String password = passwordField.getText();
        String secretPassword = method1.hashEncrypt(password);

        String sql = "SELECT * FROM login where userName = \"" + secretUserName + "\"";
        ResultSet resultSet = statement.executeQuery(sql);
        if (resultSet.next()) {
            String hashPassword = resultSet.getString("password");
            if (secretPassword.equals(hashPassword)) {
                mainPage(primaryStage, secretUserName);
            } else {
                Alert alert = new Alert(Alert.AlertType.ERROR, "Password is wrong.");
                alert.initOwner(primaryStage);
                alert.showAndWait();
            }
        } else {
            Alert alert = new Alert(Alert.AlertType.ERROR, "UserName doesn't exist.");
            alert.initOwner(primaryStage);
            alert.showAndWait();
        }
        resultSet.close();
        statement.close();
        connection.close();
    } catch (Exception e) {
        e.printStackTrace();
    }
}
```

Step 1

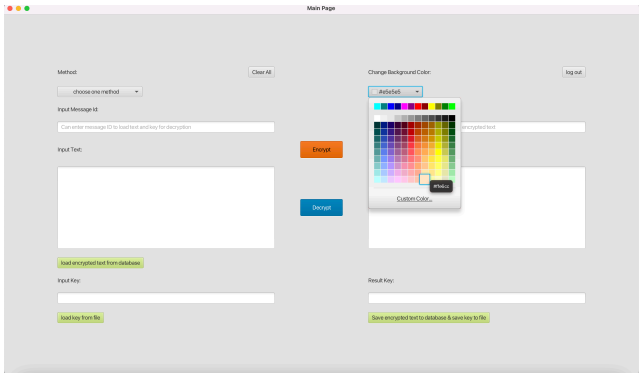
Step 2

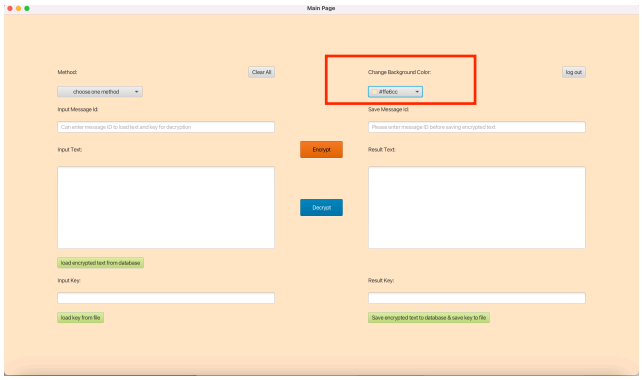
Step 3

2.Main Page

2.1 setting Colour

Use colorPicker to change the background colour, the choose colour will be updated in database(security.settings table).
If user log out and log in next time, will automatically load this user's previous stored colour from database as background colour. And in colorPicker section, chosen colour will also follow the stored colour.
Each user account can save its own colour.



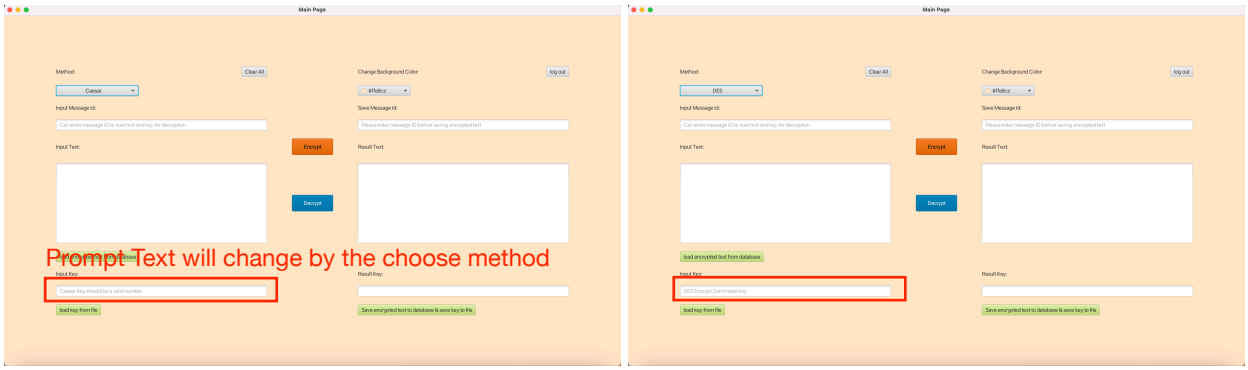



```
// save this user's set color to database
public void saveColorToDatabase(String userName, Color c) {
    try {
        Class.forName("com.mysql.cj.jdbc.Driver");
        Connection connection = DriverManager.getConnection(JDBC_URL, USERNAME, PASSWORD);

        String updateColorSql = "UPDATE settings SET setBackColor = ? WHERE setUserName = ? ";
        PreparedStatement updateStatement = connection.prepareStatement(updateColorSql);
        String colorString = c.getRed() + "," + c.getGreen() + "," + c.getBlue();
        System.out.println("print color :" + colorString);
        updateStatement.setString(1, colorString);
        updateStatement.setString(2, userName);
        updateStatement.executeUpdate();

        updateStatement.close();
        connection.close();
    } catch (Exception e2) {
        System.out.println("saveColorToDatabase Error");
    }
}

// load user's set color from database
public void loadColorFromDatabase(String userName, GridPane grid) {
    try {
        Class.forName("com.mysql.cj.jdbc.Driver");
        Connection connection = DriverManager.getConnection(JDBC_URL, USERNAME, PASSWORD);
        Statement statement = connection.createStatement();
        String sql = "SELECT setBackColor FROM settings WHERE setUserName = \"" + userName + "\"";
        ResultSet resultSet = statement.executeQuery(sql);
        if (resultSet.next()) {
            String colorString = resultSet.getString("setBackColor");
            String colors[] = colorString.split(",");
            Color newColor = new Color(Double.parseDouble(colors[0]), Double.parseDouble(colors[1]),
                    Double.parseDouble(colors[2]), 1);
            grid.setBackground(new Background(new BackgroundFill(newColor, null, null)));
            chosenColor = newColor;
        }
    } catch (Exception e2) {
        System.out.println("loadColorFromDatabase Error");
    }
}
```

2.2 setting method

User can choose one method(Caesar, DES, AES) from the menu, the input key field will show different prompt text by the choose method.
If choose Caesar, the input key field will show “Caesar Key should be a valid number”.
If choose DES, the input key field will show “DES Encrypt don’t need key”.
If choose AES, the input key field will show “AES Encrypt don’t need key”.
And at the same time, the choose method will be updated in database(security.settings table).

If user log out and log in again, will automatically load this user’s stored method from database. Each user account can save its own prefer method.

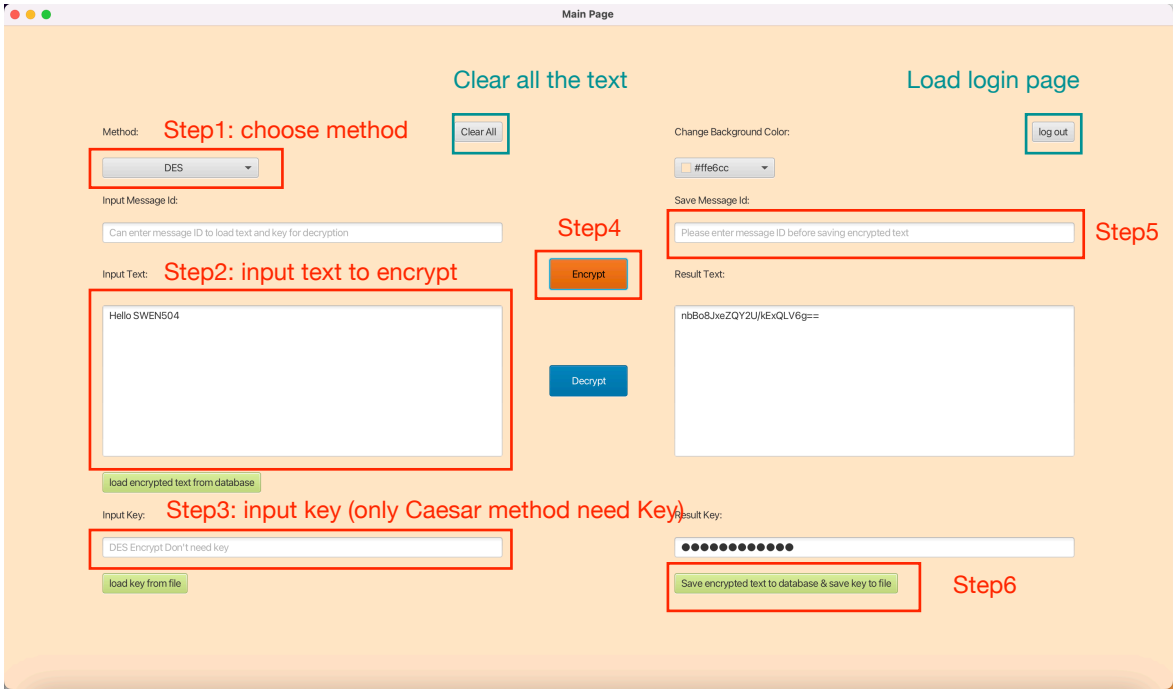



```
// save this user's set method to database
public void saveMethodToDatabase(String userName, String methodString) {
    try {

        Class.forName("com.mysql.cj.jdbc.Driver");
        Connection connection = DriverManager.getConnection(JDBC_URL, USERNAME, PASSWORD);

        String updateColorSql = "UPDATE settings SET setDefaultMethod = ? WHERE setUserName = ? ";
        PreparedStatement updateStatement = connection.prepareStatement(updateColorSql);
        updateStatement.setString(1, methodString);
        updateStatement.setString(2, userName);
        updateStatement.executeUpdate();

        updateStatement.close();
        connection.close();
    } catch (Exception e2) {
        System.out.println("saveMethodToDatabase Error");
    }
}

// load user's set method from database
public void loadMethodFromDatabase(String userName) {
    try {
        Class.forName("com.mysql.cj.jdbc.Driver");
        Connection connection = DriverManager.getConnection(JDBC_URL, USERNAME, PASSWORD);
        Statement statement = connection.createStatement();
        String sql = "SELECT setDefaultMethod FROM settings WHERE setUserName = \"" + userName + "\"";
        ResultSet resultSet = statement.executeQuery(sql);
        if (resultSet.next()) {
            String methodString = resultSet.getString("setDefaultMethod");
            chosenMethod = methodString;

        }
        statement.close();
        connection.close();
    } catch (Exception e2) {
        System.out.println("loadMethodFromDatabase Error");
    }
}
```

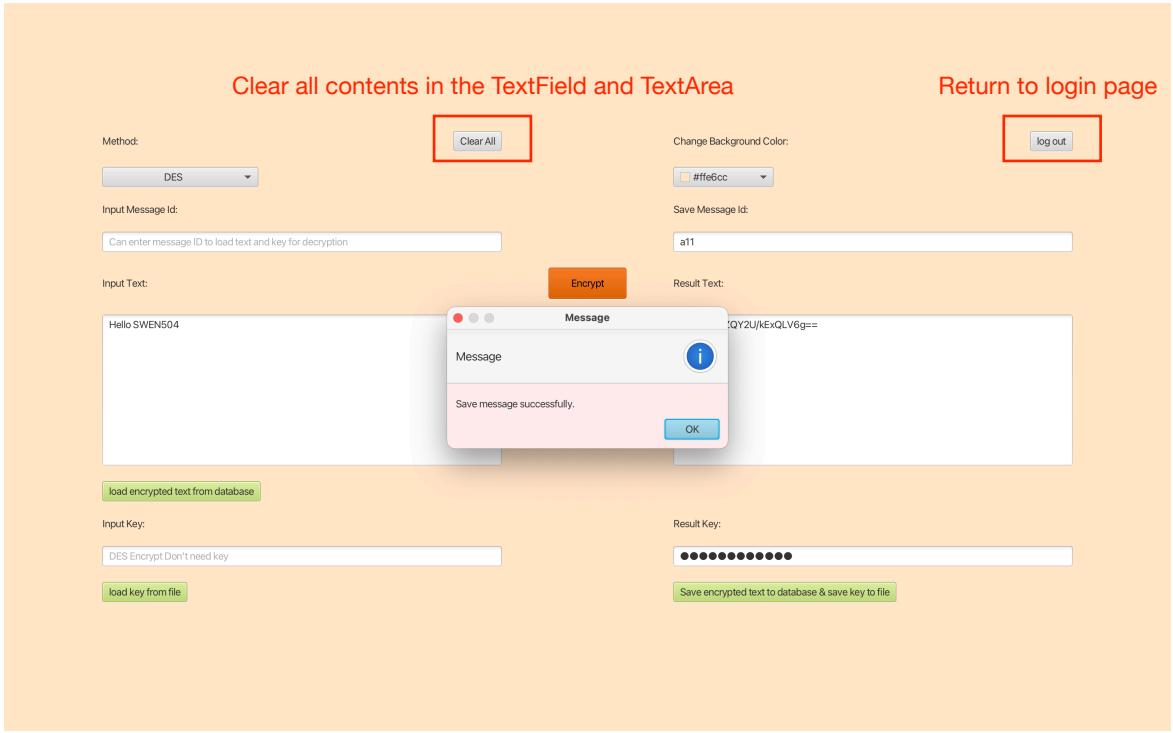
2.3 Encrypt Function

Follow from step1 to step4, can encrypt text.
The encrypted text and the key will show in the result text and result key.

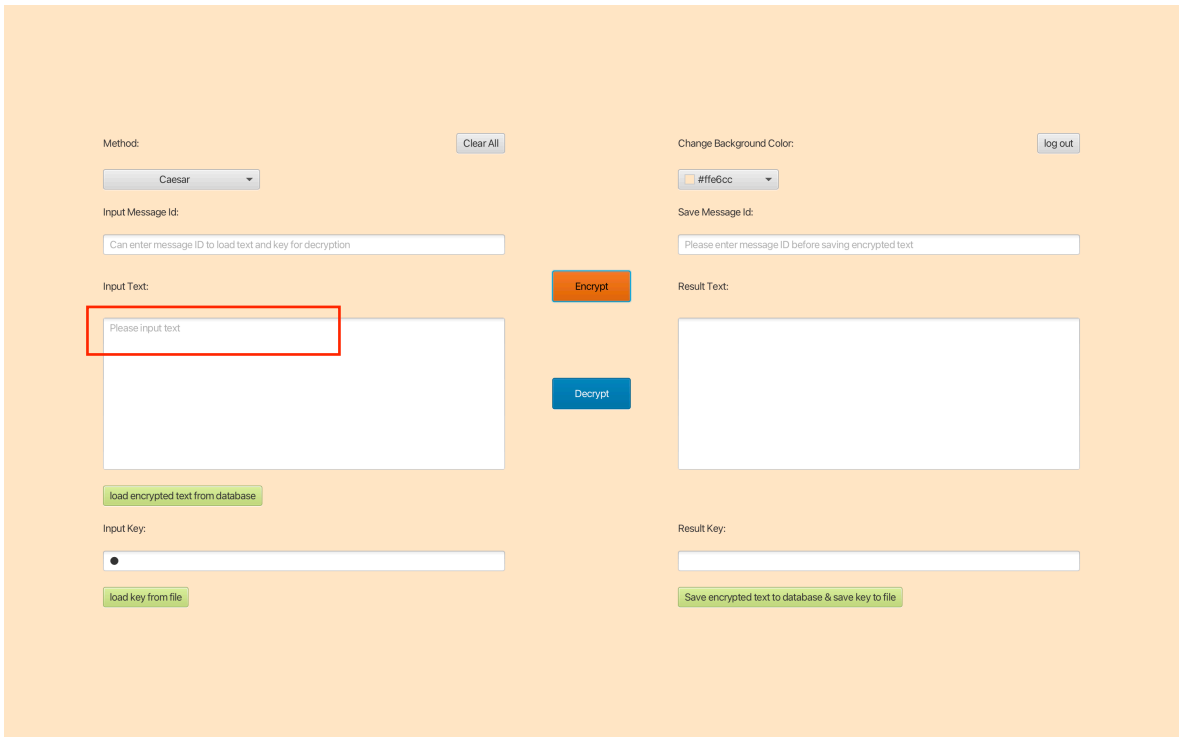
If user wants to save the encrypted message, add step5 and step6. The encrypted text will be saved to database, key will be encrypted by master key (using DES method) and then stored in local file.



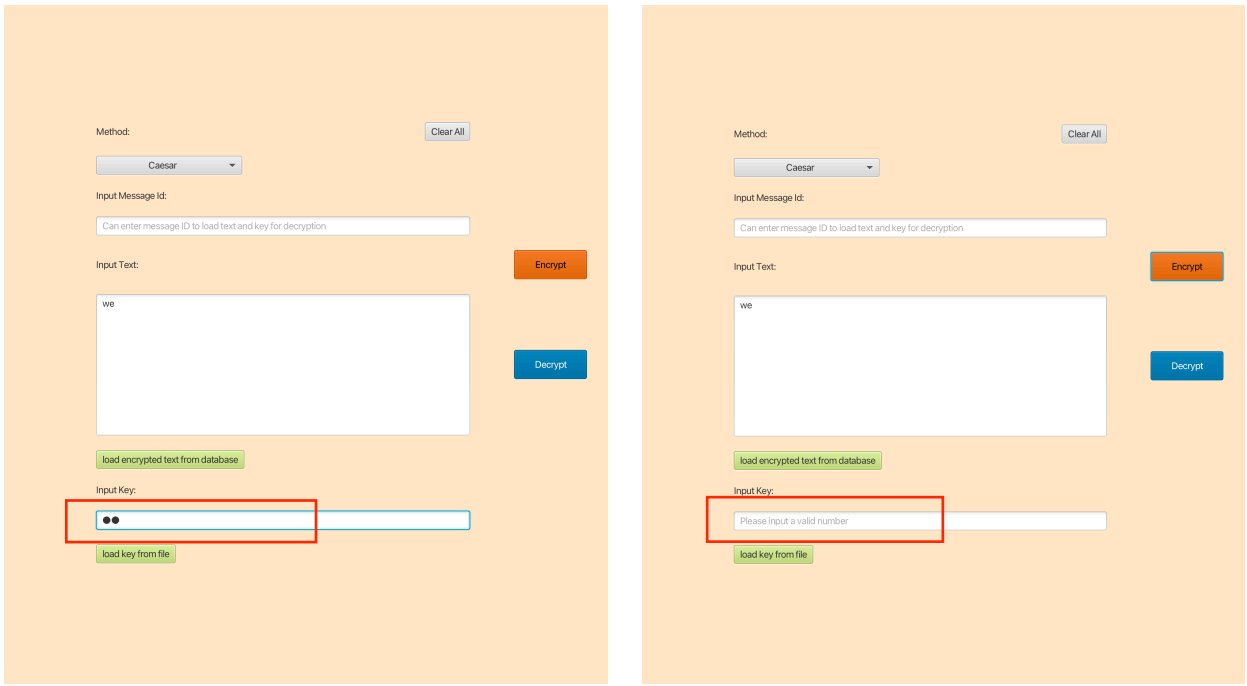
If the input save message id doesn't exist in this user's account, get an message show "Save message successfully".



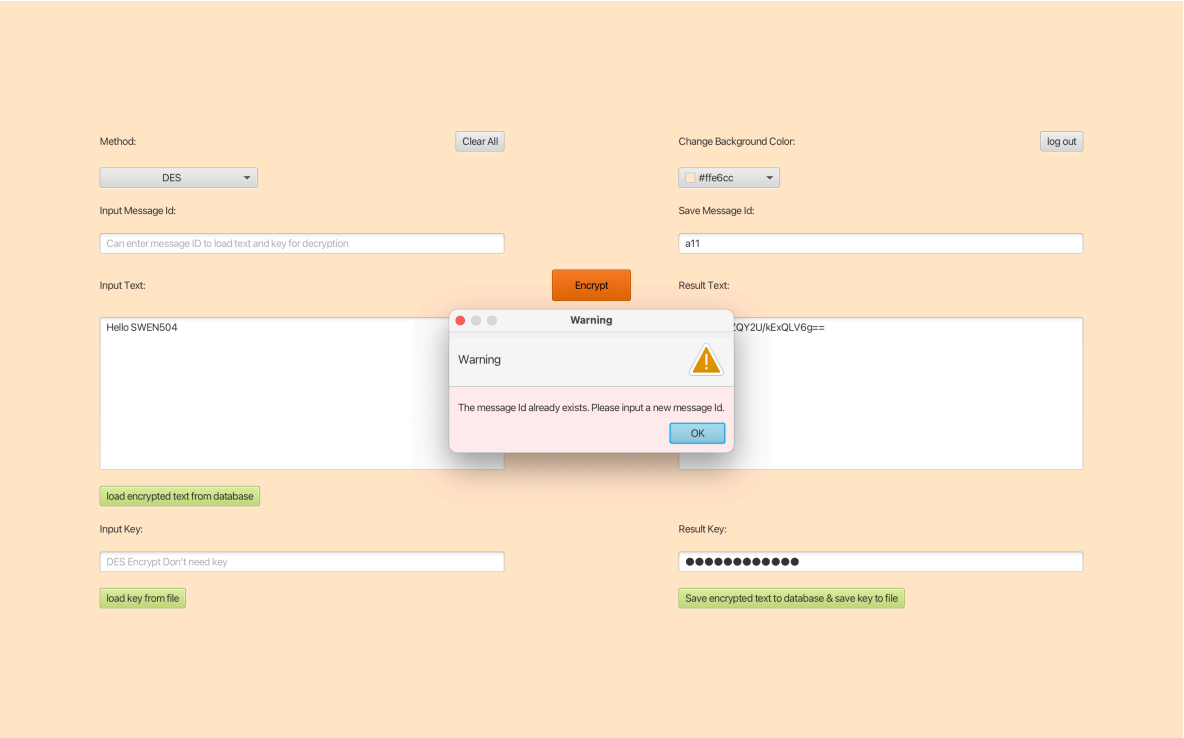
Error Conditions:
(1). If after choose method, user only input key and click “Encrypt” button, will get a prompt text in the input text show “Please input text”



(2). If user choose Caesar method to encrypt text, but the input key field is empty or not number, will clear the input key and show a prompt text.



(3).If the save message id already exists in this user's account, will get an warning.



Coding Logic in Encrypt Function

```
encryptBtn.setOnAction(e -> {
    String inputTextString = inputTextField.getText();
    String inputKeyString = inputKeyField.getText();

    if (inputTextString.trim().isEmpty()) {
        inputTextField.setPromptText("Please input text");
    } else if (chosenMethod.equals("Caesar")) {
        try {
            int key = Integer.parseInt(inputKeyString);
            String decryptString = method1.caesarEncrypt(inputTextString, key);
            resultText.setText(decryptString);
            resultKey.setText(String.valueOf(key));
        } catch (NumberFormatException f) {
            inputKeyField.clear();
            inputKeyField.setPromptText("Please input a valid number");
            f.printStackTrace();
        }
    } else if (chosenMethod.equals("DES")) {
        try {
            DES des = new DES();
            SecretKey secretKey = des.getSecretkey();
            String secretKeyString = Base64.getEncoder().encodeToString(secretKey.getEncoded());
            String decryptString = method1.desEncrypt(secretKey, inputTextString);
            resultText.setText(decryptString);
            resultKey.setText(secretKeyString);
        } catch (NumberFormatException | NoSuchAlgorithmException f) {
            f.printStackTrace();
        }
    } else if (chosenMethod.equals("AES")) {
        try {
            AES aes = new AES();
            SecretKey secretKey = aes.getSecretkey();
            String secretKeyString = Base64.getEncoder().encodeToString(secretKey.getEncoded());
            String decryptString = method1.aesEncrypt(secretKey, inputTextString);
            resultText.setText(decryptString);
            resultKey.setText(secretKeyString);
        } catch (NoSuchAlgorithmException f) {
            f.printStackTrace();
        }
    }
});
```

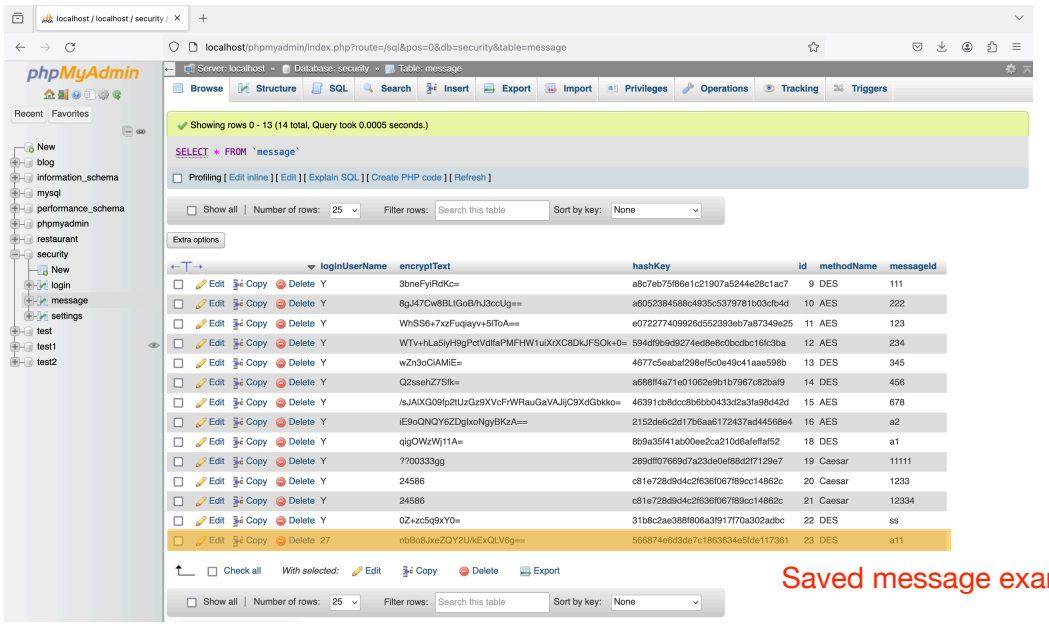
Coding Logic in Save Encrypted Text Function

```
        saveMessageButton.setOnAction(e -> {
            String message = resultText.getText();
            String key = resultKey.getText();
            String secretKey = method1.hashEncrypt(key);
            String messageIdString = saveMessageIdField.getText();
            String methodName = chosenMethod;

            String saveKeyString = resultKey.getText();
            byte[] secretKeyBytes = method1.desEncrypt(desMasterKey, saveKeyString);

            if (!messageIdString.trim().isEmpty()) {
                saveMessageById(primaryStage, userName, message, secretKey, messageIdString, methodName, secretKeyBytes);
            } else {
                Alert alert = new Alert(Alert.AlertType.ERROR, "Please input save id.");
                alert.initOwner(primaryStage);
                alert.showAndWait();
            }
        });
```

```
public void saveMessageById(Stage primaryStage, String userName, String message, String key, String idString,
        String methodName, byte[] secretKeyB) {
    try {
        Class.forName("com.mysql.cj.jdbc.Driver");
        Connection connection = DriverManager.getConnection(JDBC_URL, USERNAME, PASSWORD);

        //first check if this message id already exists in this userName's message row.
        String checkMessageIdSql = "SELECT * FROM message WHERE loginUserName = ? AND messageId = ? ";
        PreparedStatement checkMessageIdStatement = connection.prepareStatement(checkMessageIdSql);
        checkMessageIdStatement.setString(1, userName);
        checkMessageIdStatement.setString(2, idString);
        ResultSet checkMessageIdResult = checkMessageIdStatement.executeQuery();

        if (checkMessageIdResult.next()) {
            Alert alert = new Alert(Alert.AlertType.WARNING, "The message Id already exists. Please input a new message Id.");
            alert.initOwner(primaryStage);
            alert.showAndWait();
        } else {
            String updateMessageSql = "INSERT INTO message (`methodName`,`encryptText`,`hashKey`,`loginUserName`,`messageId`) VALUES (?, ?, ?, ?, ?) ";
            PreparedStatement updateStatement = connection.prepareStatement(updateMessageSql);
            updateStatement.setString(1, methodName);
            updateStatement.setString(2, message);
            updateStatement.setString(3, key);
            updateStatement.setString(4, userName);
            updateStatement.setString(5, idString);
            int rowsAffected = updateStatement.executeUpdate();
            if (rowsAffected > 0) {
                String saveFileName = userName + idString+ ".txt";
                method1.saveKeyFile(saveFileName, secretKeyB);
                Alert alert = new Alert(Alert.AlertType.INFORMATION, "Save message successfully.");
                alert.initOwner(primaryStage);
                alert.showAndWait();
            } else {
                Alert alert = new Alert(Alert.AlertType.ERROR, "Unsuccessfully.");
                alert.initOwner(primaryStage);
                alert.showAndWait();
            }
            updateStatement.close();
        }
        checkMessageIdStatement.close();
        connection.close();
    } catch (Exception e2) {
        System.out.println("saveMessageToDatabaseById Error");
    }
}
```

Save encrypted text to database

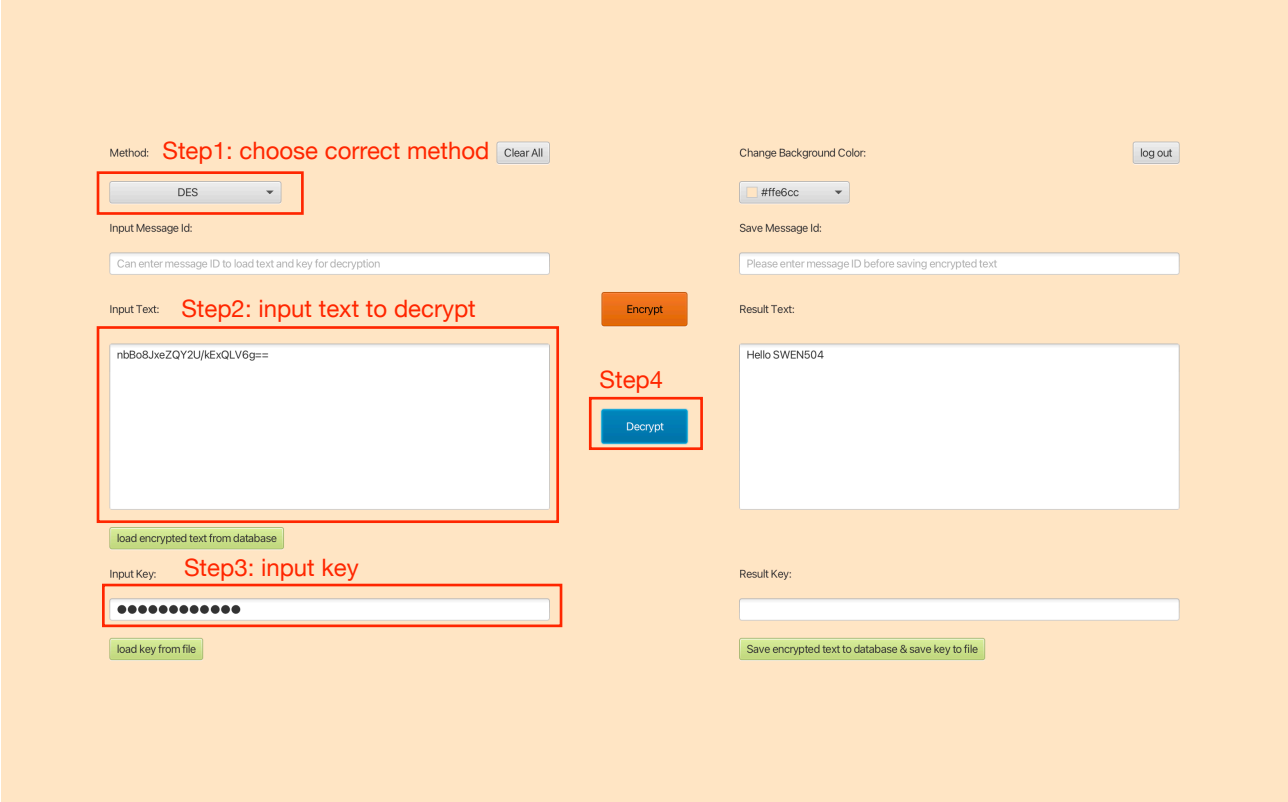
Save encrypted key to local file



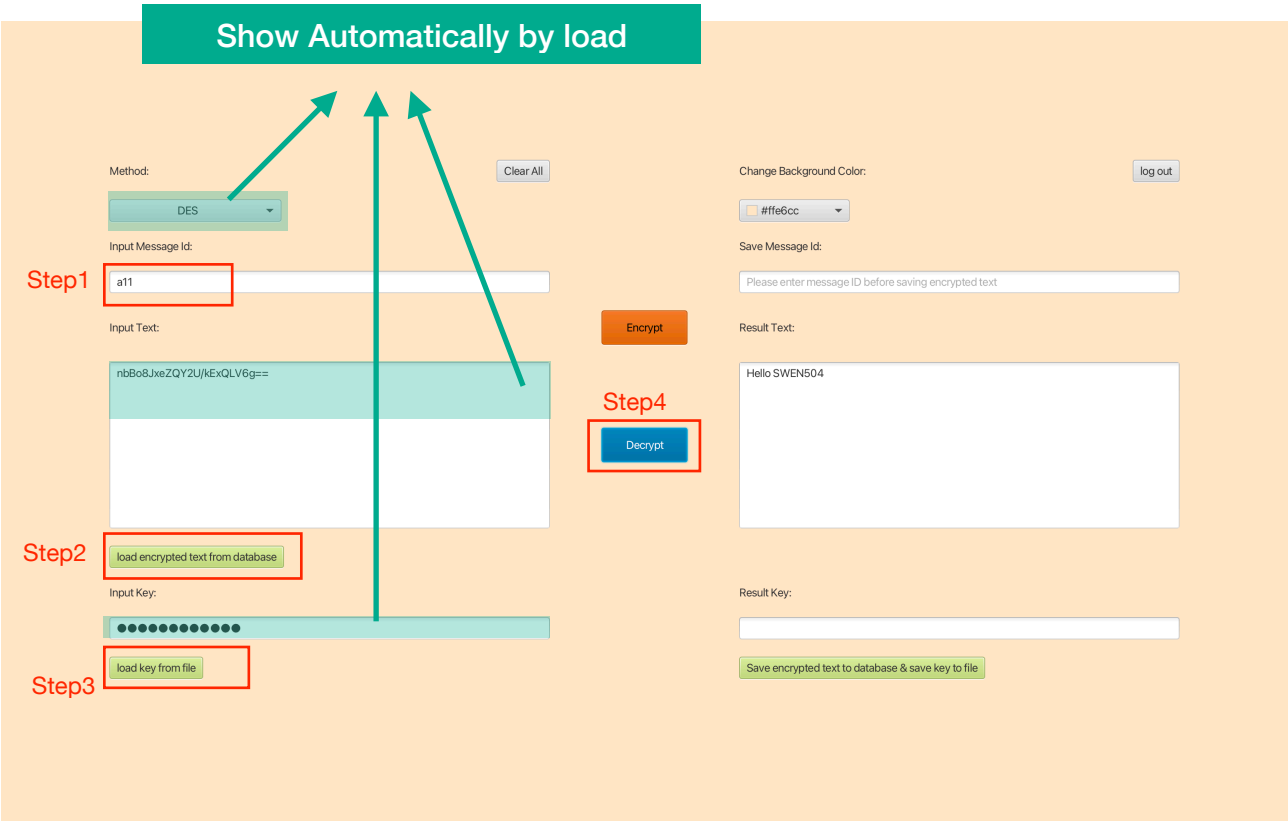
Saved message example

2.4 Decrypt Function

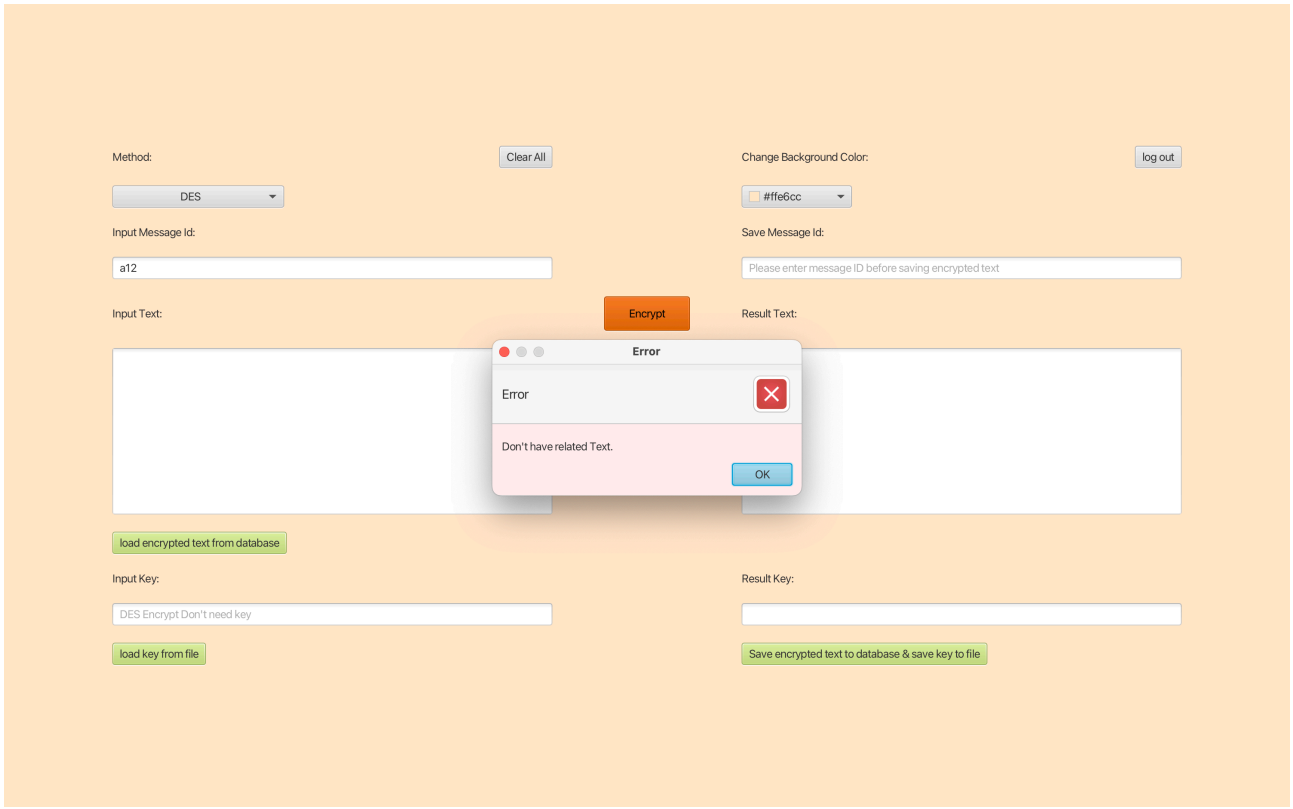
Follow from step1 to step4, can decrypt text.
The decrypted text and the key will show in the result text and result key.

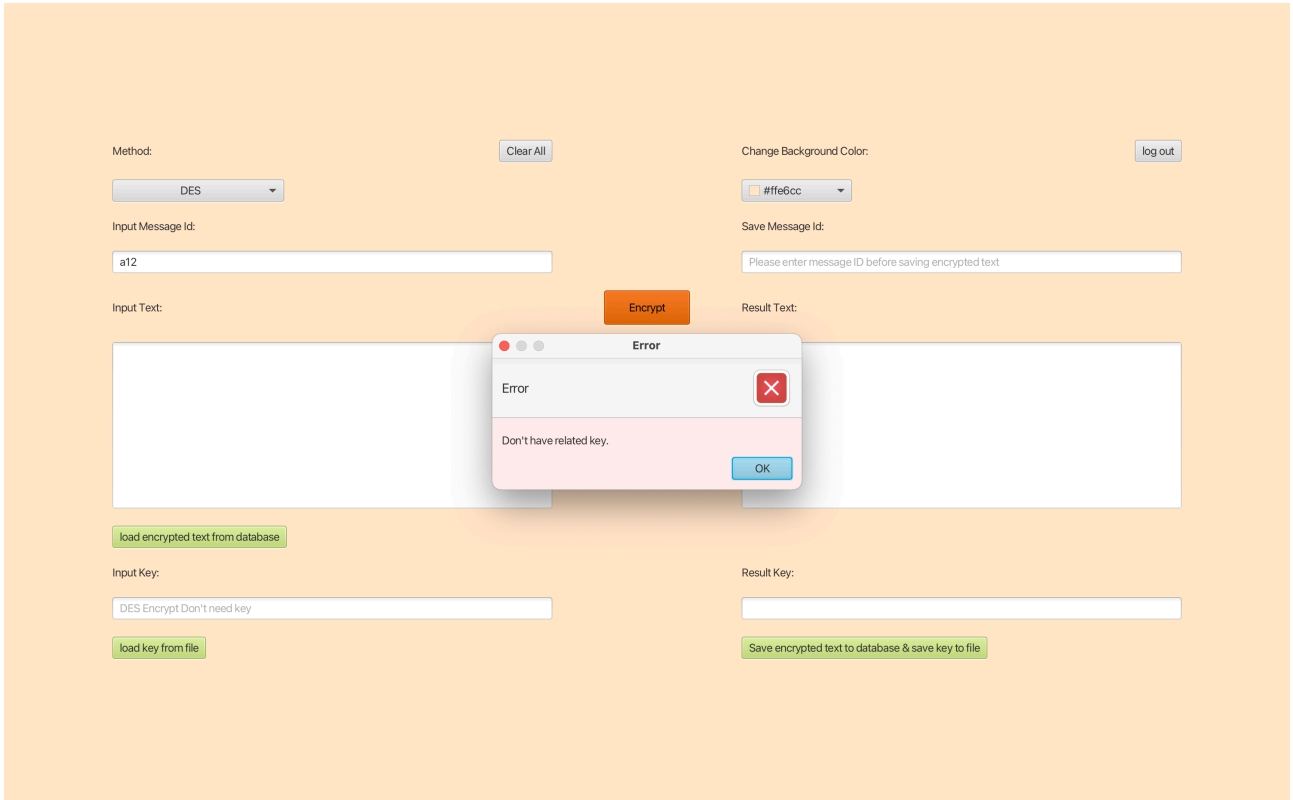


If user wants to use the encrypted message that already stored in database and file, can choose load button, the stored decrypt method, stored encrypted text and key will show automatically.



If the save message id doesn’t exist in this user’s account, when load text and load key, will get an warning.





Coding Logic in Decrypt Function

```
decryptBtn.setOnAction(e -> {
    String inputTextString = inputTextField.getText();
    String inputKeyString = inputKeyField.getText();

    if (inputTextString.trim().isEmpty()) {
        inputTextField.setPromptText("Please input text");
    } else if (chosenMethod.equals("Caesar")) {
        try {
            int key = Integer.parseInt(inputKeyField.getText());
            try {
                String encryptString = method1.caesarDecrypt(inputTextString, key);
                resultText.setText(encryptString);
            } catch (Exception e2) {
                e2.printStackTrace();
            }
        } catch (Exception f) {
            inputKeyField.clear();
            inputKeyField.setPromptText("Please input a valid number");
            f.printStackTrace();
        }
    } else if (chosenMethod.equals("DES")) {
        try {
            String decryptString = method1.desDecrypt(inputKeyString, inputTextString);
            resultText.setText(decryptString);
        } catch (Exception f) {
            f.printStackTrace();
        }
    } else if (chosenMethod.equals("AES")) {
        try {
            String decryptString = method1.aesDecrypt(inputKeyString, inputTextString);
            resultText.setText(decryptString);
        } catch (Exception f) {
            f.printStackTrace();
        }
    }
});
```

Coding Logic in Loading Encrypted Text and Key

```
loadTextButton.setOnAction(e -> {
    inputTextField.clear();
    inputTextField.setPromptText("");
    // get the correct key name by userName and input id
    String inputIdText = inputMessageIdField.getText();
    String textString = getMessageTextById(primaryStage, userName, inputIdText);
    inputTextField.setText(textString);

});

loadKeyButton.setOnAction(e -> {
    inputKeyField.clear();
    inputTextField.setPromptText("");

    // get the correct key name by userName and input id
    String inputIdText = inputMessageIdField.getText();
    String idString = getKeyFileIndexById(primaryStage, userName, inputIdText);

    if (!idString.trim().isEmpty()) {
        // read and decrypt key
        String file  = userName + idString+".txt";
        String loadKey = "";
        try {
            loadKey = method1.loadKeyFile(file);
        } catch (Exception f) {
            f.printStackTrace();
        }
        String keyString = method1.desDecrypt(desMasterKey, loadKey);
        System.out.println("2key string " + keyString);
        inputKeyField.setText(keyString);
        if (!chosenMethod.isEmpty()) {
            methodMenuButton.setText(chosenMethod);
        }
    } else {
        System.out.println("The key file doesn't exist");
    }
});
```

```
public String getMessageTextById(Stage primaryStage, String userName, String inputId) {
    String getMessageText = "";
    try {
        Class.forName("com.mysql.cj.jdbc.Driver");
        Connection connection = DriverManager.getConnection(JDBC_URL, USERNAME, PASSWORD);

        String checkSql = "SELECT * FROM message WHERE loginUserName = ? AND messageId = ? ";
        PreparedStatement checkStatement = connection.prepareStatement(checkSql);
        checkStatement.setString(1, userName);
        checkStatement.setString(2, inputId);
        ResultSet checkResult = checkStatement.executeQuery();
        if (checkResult.next()) {
            getMessageText = checkResult.getString("encryptText");
            chosenMethod = checkResult.getString("methodName");
        } else {
            Alert alert = new Alert(Alert.AlertType.ERROR, "Don't have related Text.");
            alert.initOwner(primaryStage);
            alert.showAndWait();
        }
        checkStatement.close();
        connection.close();
    } catch (Exception e2) {
        System.out.println("getMessageTextById Error");
    }
    return getMessageText;
}



public String getKeyFileIndexById(Stage primaryStage, String userName, String inputId) {
    String keyFileIndex = "";
    try {
        Class.forName("com.mysql.cj.jdbc.Driver");
        Connection connection = DriverManager.getConnection(JDBC_URL, USERNAME, PASSWORD);

        String checkSql = "SELECT * FROM message WHERE loginUserName = ? AND messageId = ? ";
        PreparedStatement checkStatement = connection.prepareStatement(checkSql);
        checkStatement.setString(1, userName);
        checkStatement.setString(2, inputId);
        ResultSet checkResult = checkStatement.executeQuery();
        if (checkResult.next()) {
            keyFileIndex = checkResult.getString("messageId");
            // change the default method when call
            chosenMethod = checkResult.getString("methodName");
        } else {
            Alert alert = new Alert(Alert.AlertType.ERROR, "Don't have related key.");
            alert.initOwner(primaryStage);
            alert.showAndWait();
        }
        checkStatement.close();
        connection.close();
    } catch (Exception e2) {
        System.out.println("checkMessageId Error");
    }
    return keyFileIndex;
}
```