HOMEWISE

SMART HOME SYSTEM MOBILE APP FOR PREDICTIVE MAINTENANCE

ABSTRACT

- The aim of this project is to develop a mobile application that collects data from sensors in home appliances and transfers this data to users. Thus, users will be able to monitor and detect potential problems in their smart home devices through the mobile application. The name of the application is "**HomeWise**".

PLANNING AND REQUIREMENTS

Scope:

-laundry machine

-dishwasher

-fridge

-climate

-Robot Vacuum Cleaners

PLANNING AND REQUIREMENTS

Functional requirement:

-Microcontrollers in the device analyze error codes

-Sensors automatically calculate the maintenance period

-The data from the sensors is transferred to the cloud via Wi-Fi

Non-functional requirements:

-The system must work stably in any environment.

-Data must be well secured.

-Easy to develop.

DESIGN

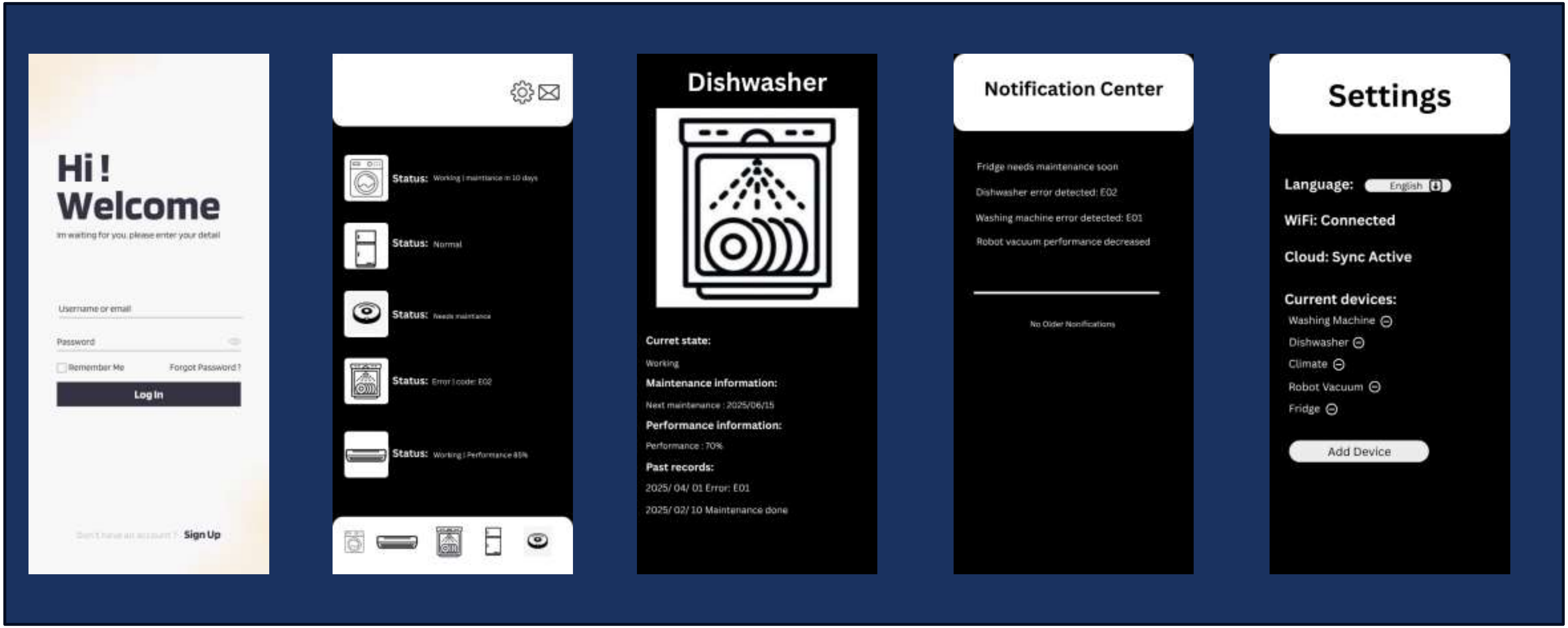
System Layers:

Smart home device layer: collects and analyzes data from devices and identifies error codes.

Cloud-based server layer: stores, analyzes and processes the transmitted data and forwards it to the mobile app.

Mobile Application layer: is the mobile application user interface, providing the user with information about fault information, error codes, device history, performance status and maintenance schedule.

UI DESIGNS



Hi !
Welcome

Im waiting for you, please enter your detail

Username or email

Password

□ Remember Me

Forgot Password ?

Log In

Don't have an account ? Sign Up

Status: Working | maintiance in 10 days

Status: Normal

Status: Needs maintiance

Status: Error | code: E02

Status: Working | Performance 85%

Dishwasher

Curret state:

Working

Maintenance information:

Next maintenance : 2025/06/15

Performance information:

Performance : 70%

Past records:

2025/ 04/ 01 Error: E01

2025/ 02/ 10 Maintenance done

Notification Center

Fridge needs maintenance soon

Dishwasher error detected: E02

Washing machine error detected: E01

Robot vacuum performance decreased

No Older Notifications

Settings

Language: English

WiFi: Connected

Cloud: Sync Active

Current devices:

Washing Machine ⊖

Dishwasher ⊖

Climate ⊖

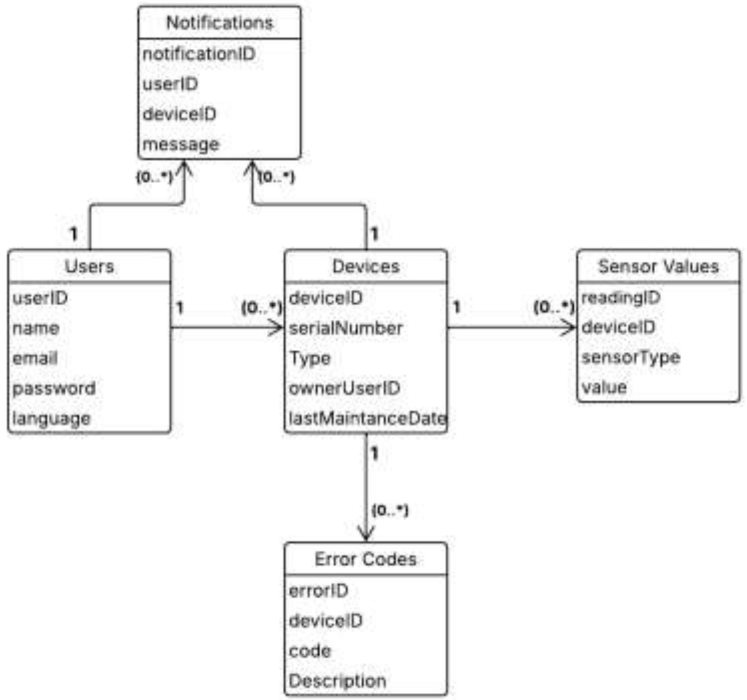
Robot Vacuum ⊖

Fridge ⊖

Add Device

DESIGN

DIAGRAMS:



Notifications
- notificationID
- userID
- deviceID
- message

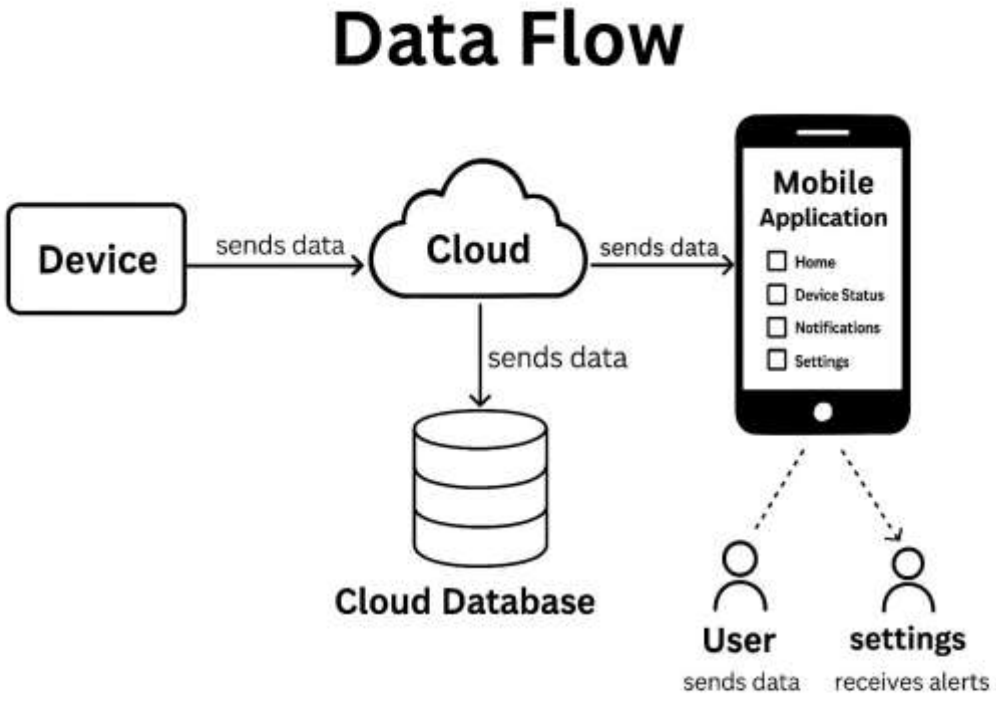
Users
- userID
- name
- email
- password
- language

Devices
- deviceID
- serialNumber
- Type
- ownerUserID
- lastMaintanceDate

Sensor Values
- readingID
- deviceID
- sensorType
- value

Error Codes
- errorID
- deviceID
- code
- Description

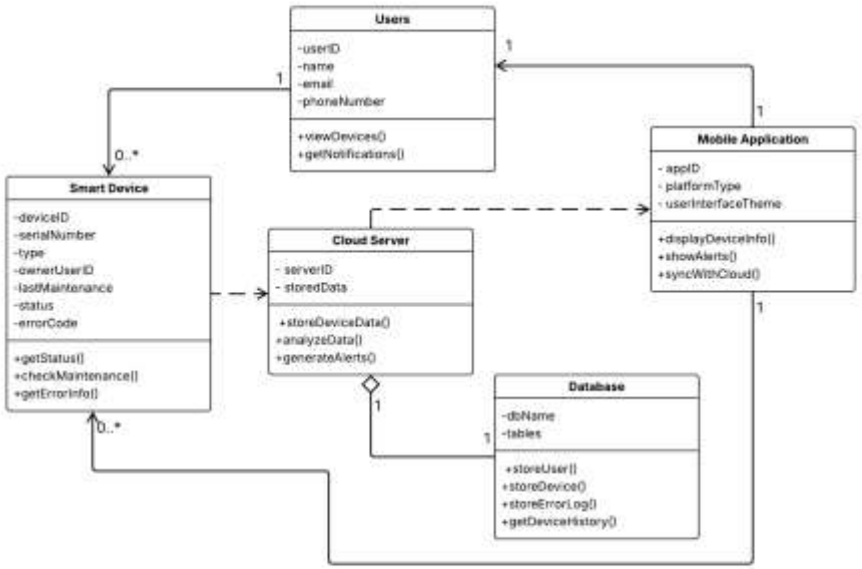
DATABASE DIAGRAM



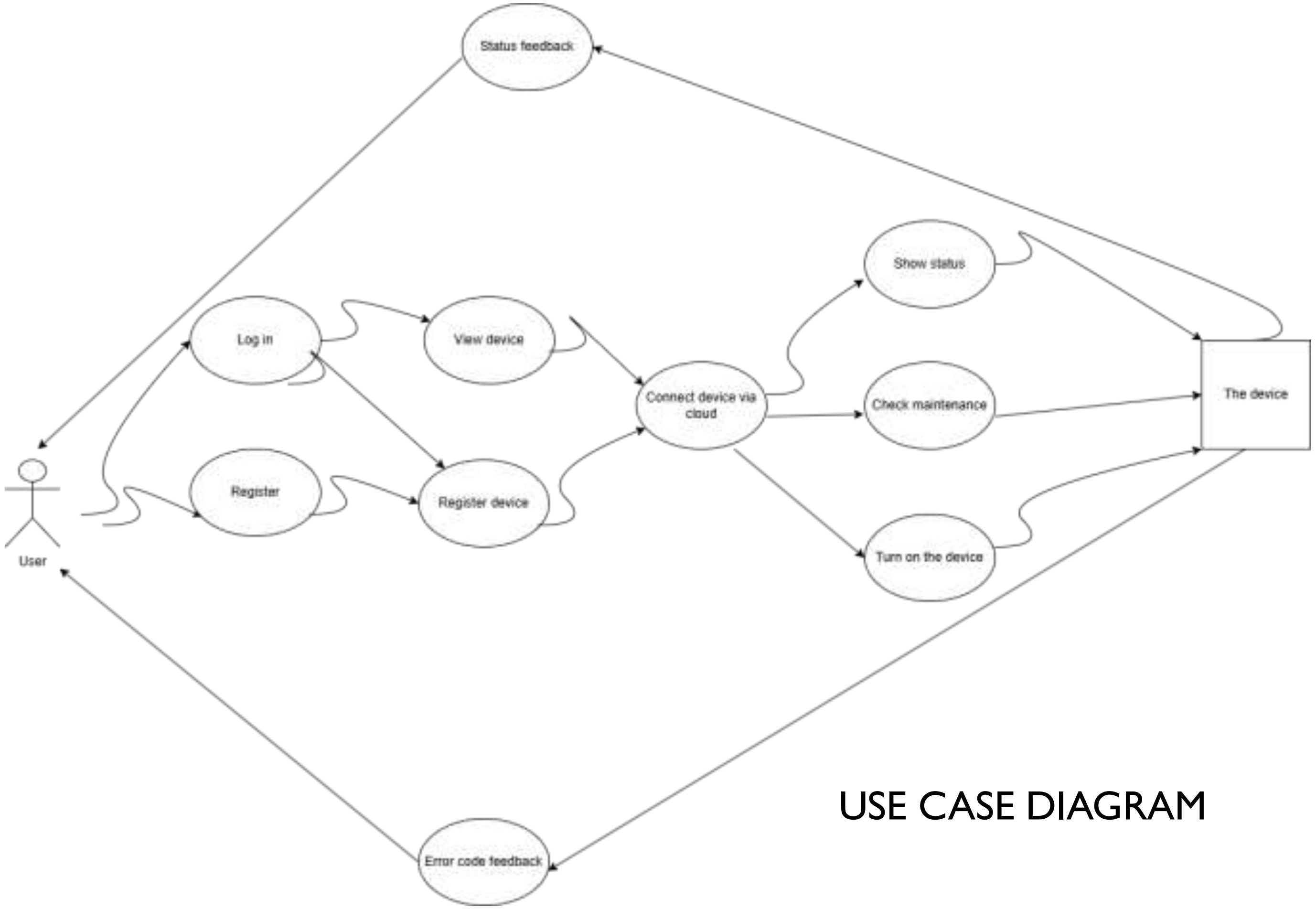
Data Flow

DATAFLOW DIAGRAM

DESIGN



UML CLASS DIAGRAM



USE CASE DIAGRAM

DESIGN

System Dependency:

-Hardware Compatibility

-Network Connections

-Cloud Servers

-Mobile Application

METHODOLOGY

Tools and Technologies Used:

Programming Language : **Python**

Database : Firebase cloud-based data storage and real-time data synchronization

IDE: Thonny IDE is preferred because its interface is simple and understandable.

METHODOLOGY

agile methodology was considered for the project developed, the project was divided into sprints and a dynamic mindset was adopted for each sprint, and it was prepared with team awareness by distributing different tasks to different people.

METHODOLOGY

Some alghorithms examples:

-Getting the error code

-Sending the error code to user

-Check the maintenance

-Showing device status

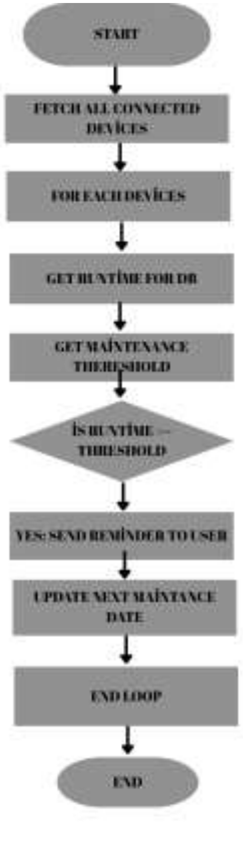
-Water heater control

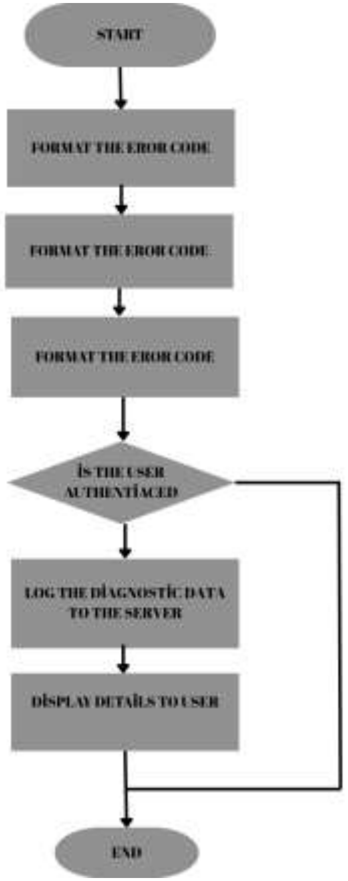
Getting the error code

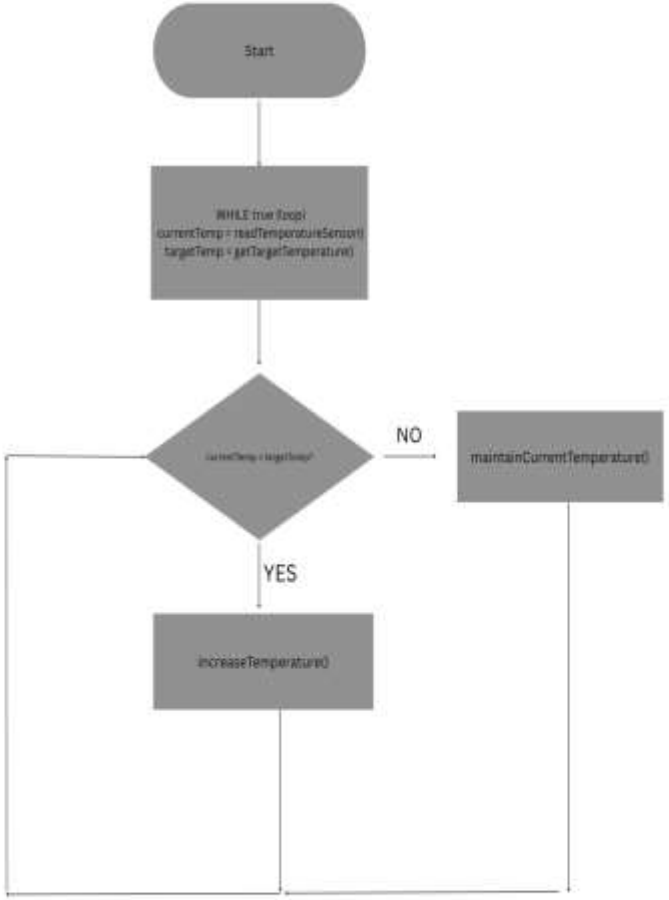
1) algorithm does error checking the moment the application is opened
2) Checks if any device has received an error
3) Send to the database if any error is found
4) If no errors are found, terminate the process

METHODOLOGY

Flowcharts:


START
FETCH ALL CONNECTED DEVİCES
FOR EACH DEVİCES
GET RUNTİME FOR DB
GET MAİNTENANCE THERESHOLD
İS RUNTİME — THRESHOLD
YES: SEND REMİNDER TO USER
UPDATE NEXT MAİNTANCE DATE
END LOOP
END




Start
WHILE true (loop)
currentTemp = readTemperatureSensor()
targetTemp = getTargetTemperature()
currentTemp < targetTemp?
NO
maintainCurrentTemperature()
YES
increaseTemperature()

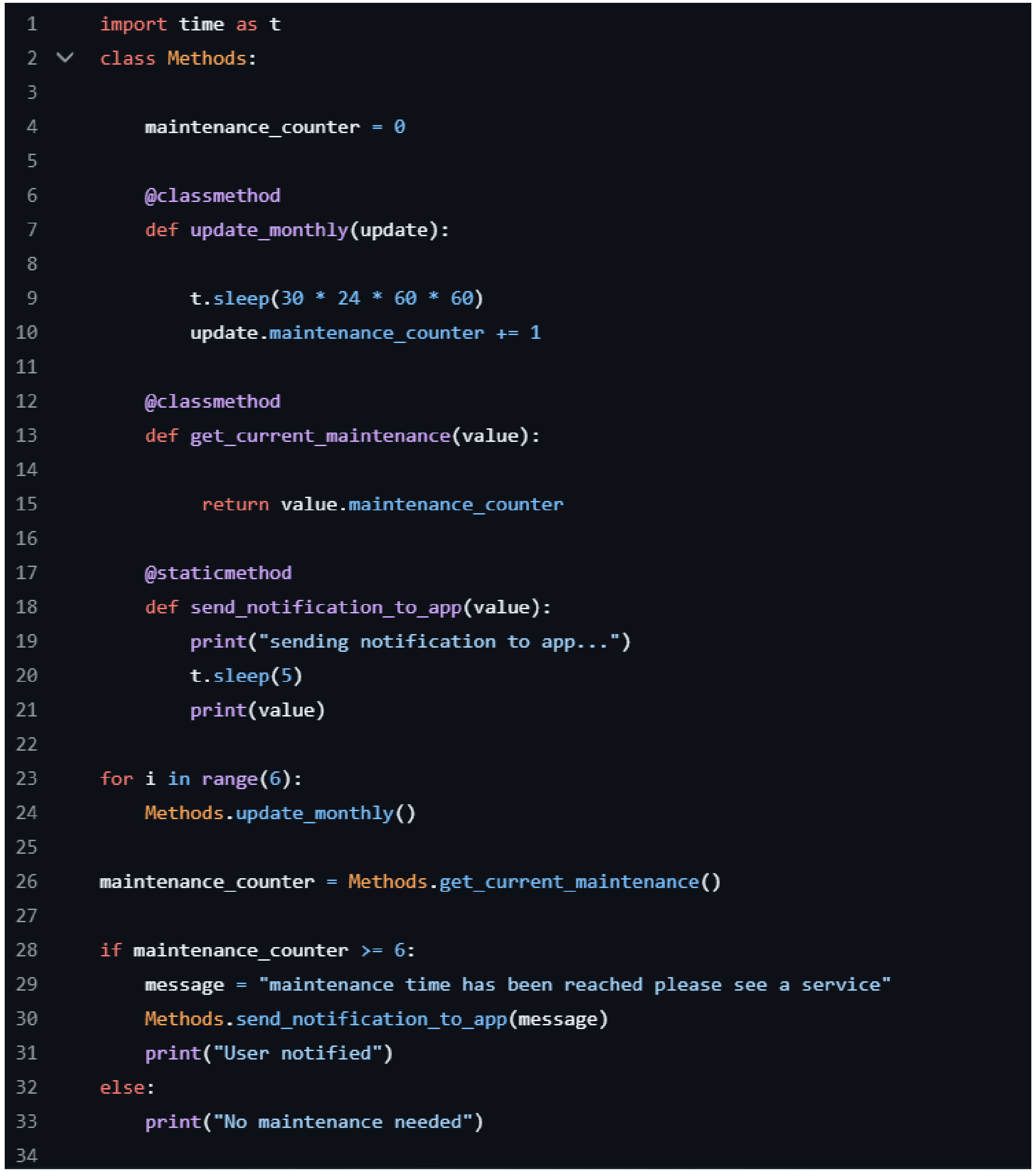
IMPLEMENTATION

First, a data processing module was developed to detect the fault codes of the devices, then a fault code matching algorithm was created to make sense of this data.

Another important part of the application was the calculation of maintenance times. An algorithm was developed that dynamically estimates the maintenance time for each device based on its usage time, fault history and model. Thanks to this algorithm, the maintenance time of the device could be notified to the user via the mobile application.

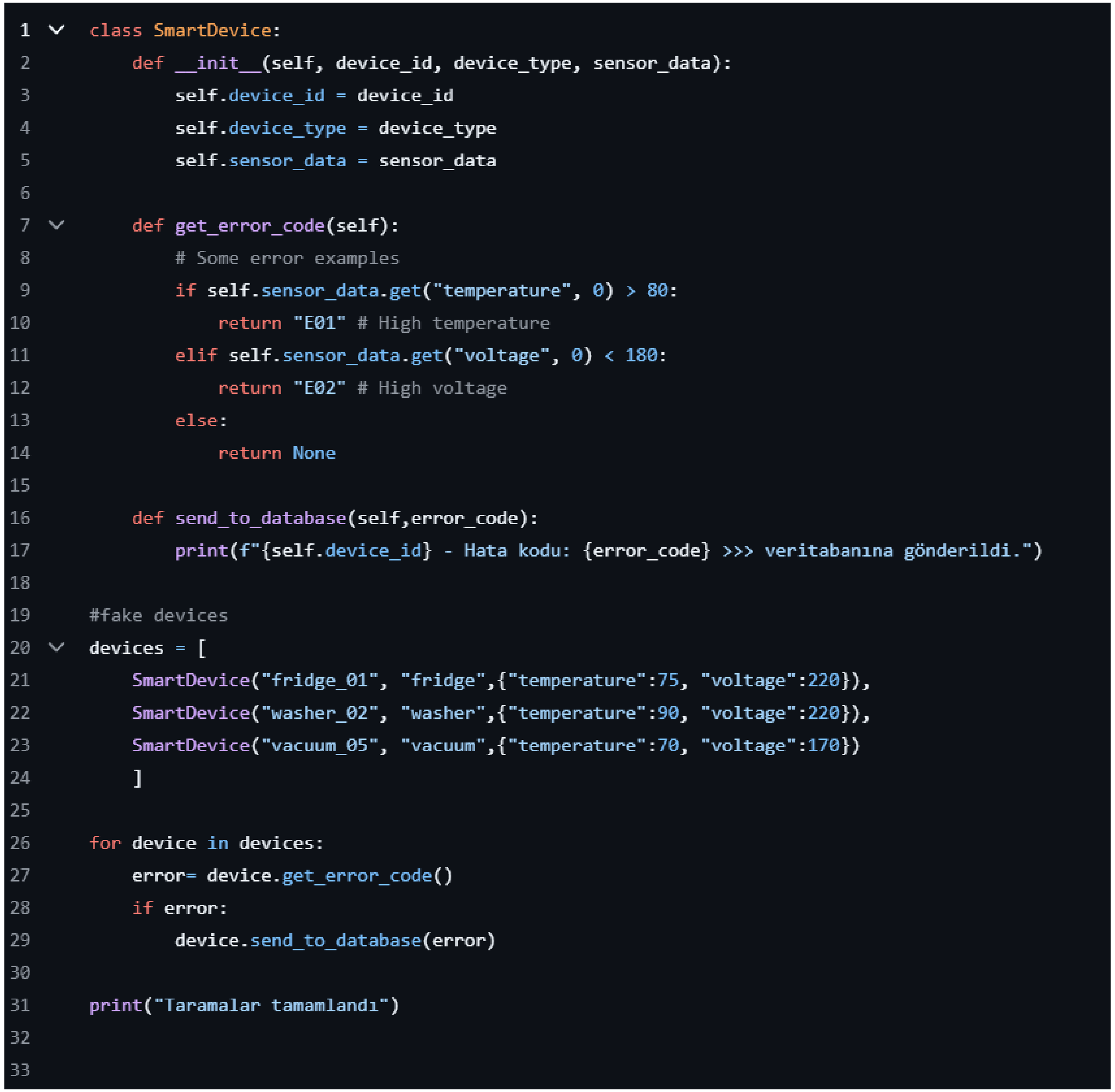
The python codes of the algorithms are given in a simplified form.

NOTE: These codes are draft and do not reflect the actual implementation



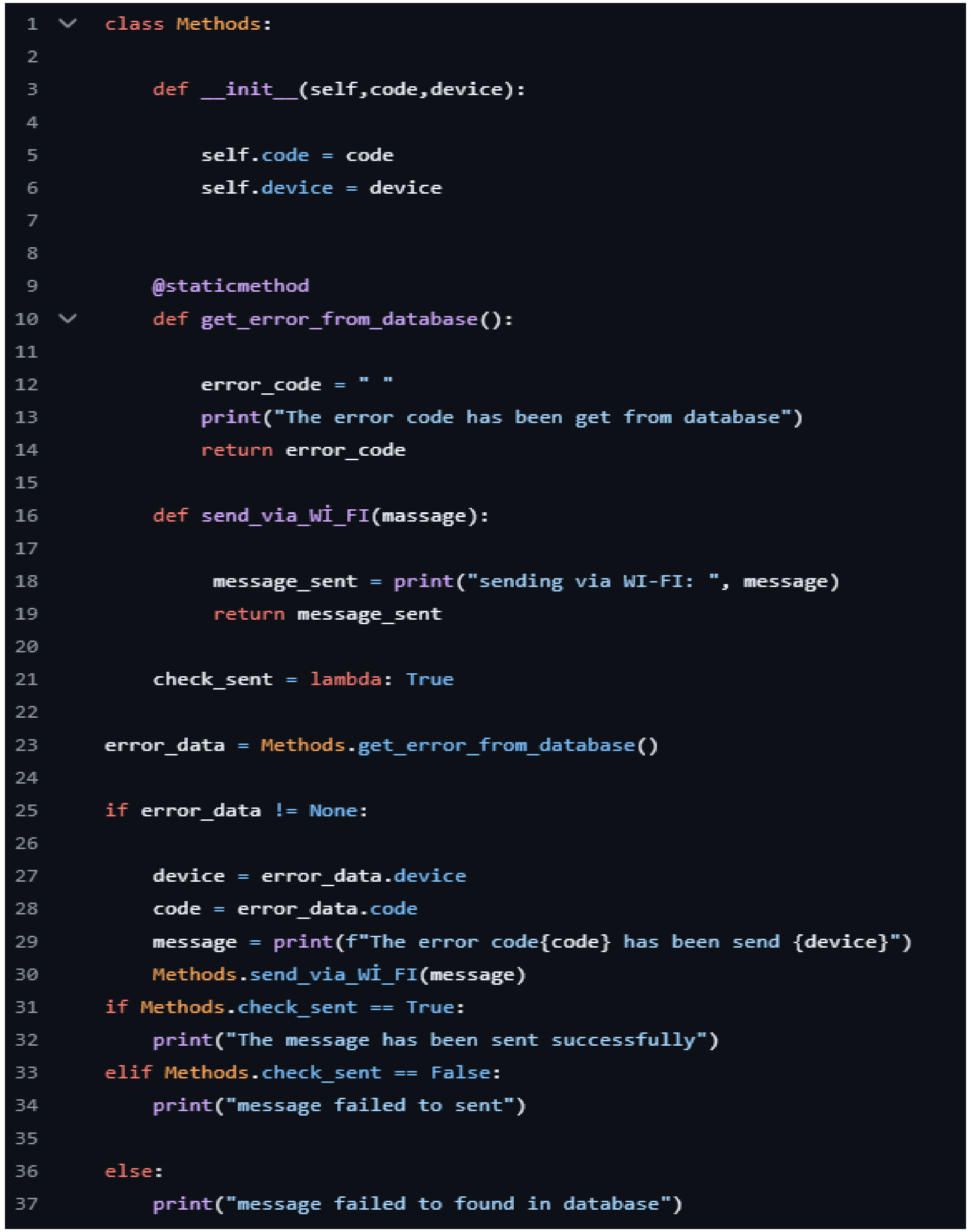
```
import time as t
class Methods:

    maintenance_counter = 0

    @classmethod
    def update_monthly(update):

        t.sleep(30 * 24 * 60 * 60)
        update.maintenance_counter += 1

    @classmethod
    def get_current_maintenance(value):

         return value.maintenance_counter

    @staticmethod
    def send_notification_to_app(value):
        print("sending notification to app...")
        t.sleep(5)
        print(value)

for i in range(6):
    Methods.update_monthly()

maintenance_counter = Methods.get_current_maintenance()

if maintenance_counter >= 6:
    message = "maintenance time has been reached please see a service"
    Methods.send_notification_to_app(message)
    print("User notified")
else:
    print("No maintenance needed")

```

This script allows to check the maintenance date monthly



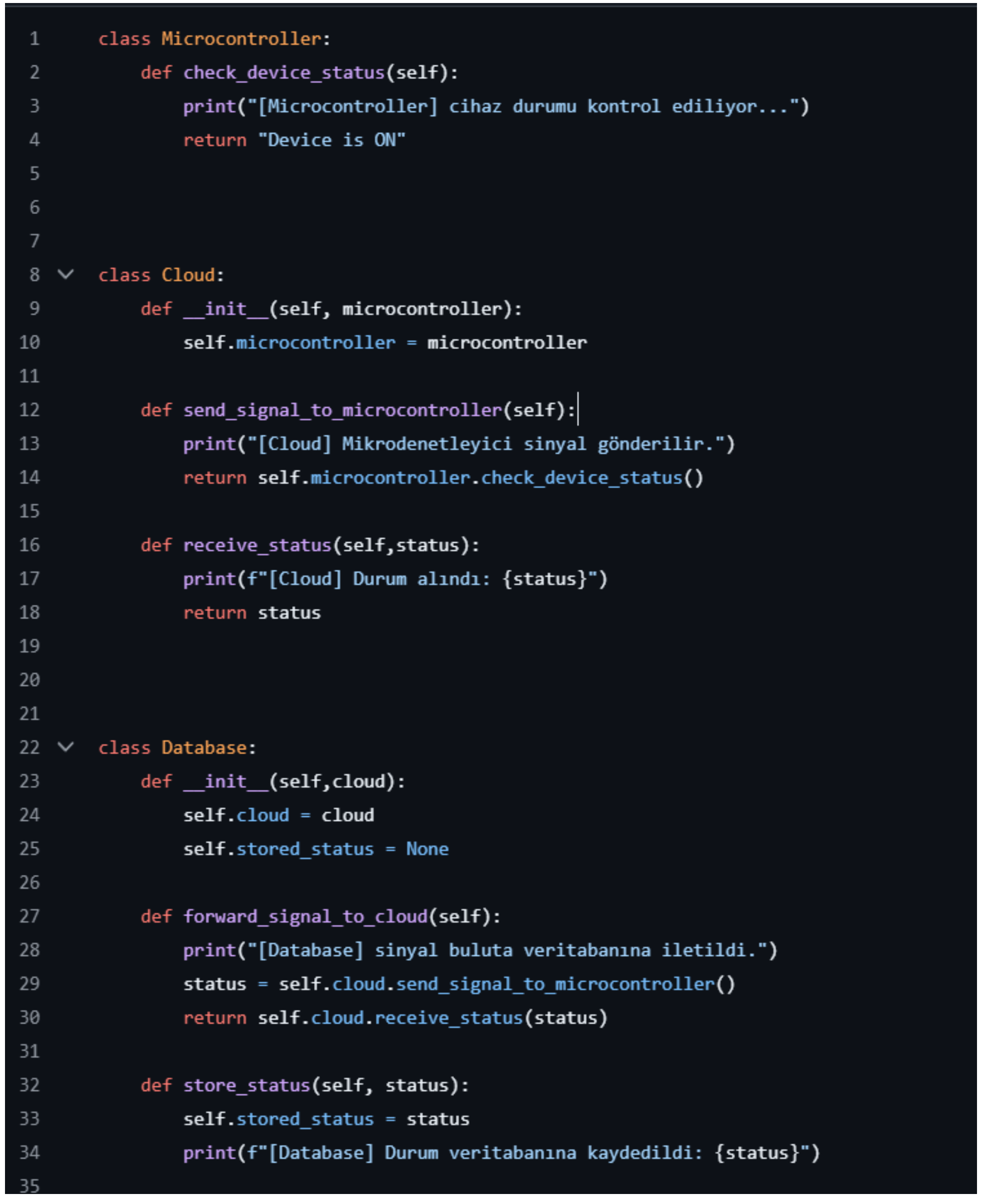
```python
class SmartDevice:
    def __init__(self, device_id, device_type, sensor_data):
        self.device_id = device_id
        self.device_type = device_type
        self.sensor_data = sensor_data

    def get_error_code(self):
        # Some error examples
        if self.sensor_data.get("temperature", 0) > 80:
            return "E01" # High temperature
        elif self.sensor_data.get("voltage", 0) < 180:
            return "E02" # High voltage
        else:
            return None

    def send_to_database(self,error_code):
        print(f"{self.device_id} - Hata kodu: {error_code} >>> veritabanına gönderildi.")

#fake devices
devices = [
    SmartDevice("fridge_01", "fridge",{"temperature":75, "voltage":220}),
    SmartDevice("washer_02", "washer",{"temperature":90, "voltage":220}),
    SmartDevice("vacuum_05", "vacuum",{"temperature":70, "voltage":170})
    ]

for device in devices:
    error= device.get_error_code()
    if error:
        device.send_to_database(error)

print("Taramalar tamamlandı")
```

This script allows to getting error codes

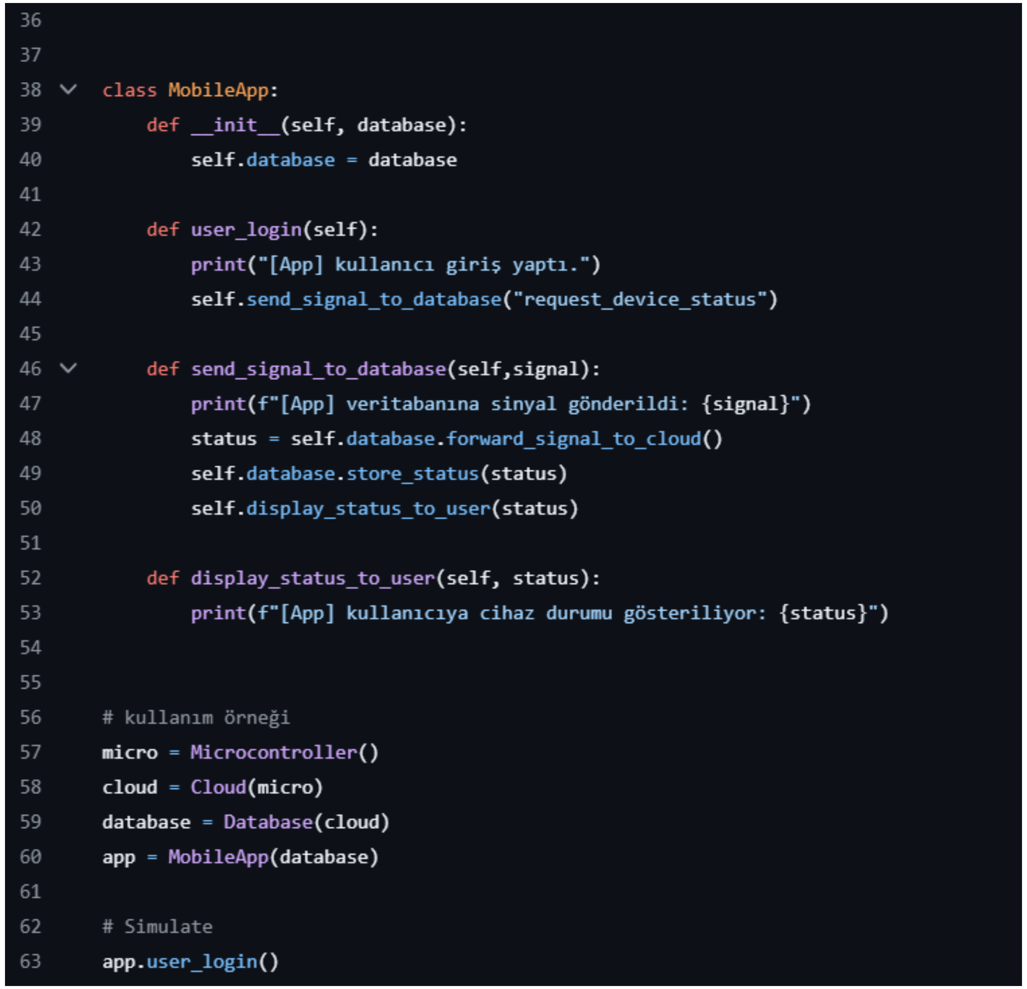


```python
class Methods:

    def __init__(self,code,device):

        self.code = code
        self.device = device


    @staticmethod
    def get_error_from_database():

        error_code = " "
        print("The error code has been get from database")
        return error_code

    def send_via_Wİ_FI(massage):

         message_sent = print("sending via WI-FI: ", message)
         return message_sent

    check_sent = lambda: True

error_data = Methods.get_error_from_database()

if error_data != None:

    device = error_data.device
    code = error_data.code
    message = print(f"The error code{code} has been send {device}")
    Methods.send_via_Wİ_FI(message)
if Methods.check_sent == True:
    print("The message has been sent successfully")
elif Methods.check_sent == False:
    print("message failed to sent")

else:
    print("message failed to found in database")
```

This script allows to sending error codes to user



```python
class Microcontroller:
    def check_device_status(self):
        print("[Microcontroller] cihaz durumu kontrol ediliyor...")
        return "Device is ON"



class Cloud:
    def __init__(self, microcontroller):
        self.microcontroller = microcontroller

    def send_signal_to_microcontroller(self):
        print("[Cloud] Mikrodenetleyici sinyal gönderilir.")
        return self.microcontroller.check_device_status()

    def receive_status(self,status):
        print(f"[Cloud] Durum alındı: {status}")
        return status



class Database:
    def __init__(self,cloud):
        self.cloud = cloud
        self.stored_status = None

    def forward_signal_to_cloud(self):
        print("[Database] sinyal buluta veritabanına iletildi.")
        status = self.cloud.send_signal_to_microcontroller()
        return self.cloud.receive_status(status)

    def store_status(self, status):
        self.stored_status = status
        print(f"[Database] Durum veritabanına kaydedildi: {status}")

```



```python


class MobileApp:
    def __init__(self, database):
        self.database = database

    def user_login(self):
        print("[App] kullanıcı giriş yaptı.")
        self.send_signal_to_database("request_device_status")

    def send_signal_to_database(self,signal):
        print(f"[App] veritabanına sinyal gönderildi: {signal}")
        status = self.database.forward_signal_to_cloud()
        self.database.store_status(status)
        self.display_status_to_user(status)

    def display_status_to_user(self, status):
        print(f"[App] kullanıcıya cihaz durumu gösteriliyor: {status}")


# kullanım örneği
micro = Microcontroller()
cloud = Cloud(micro)
database = Database(cloud)
app = MobileApp(database)

# Simulate
app.user_login()
```

This script allows to show device status

TEST PROCESS

The mobile application developed in the project was tested for basic functions such as real-time data retrieval, error code processing and maintenance time calculation. This testing process was carried out to increase the stability, reliability and user experience of the software and to eliminate potential errors.

-Unit testing:

Unit tests were performed to see if each module worked correctly individually.

-System Testing:

All components of the system were assembled and tested end-to-end.

-Security Testing:

Login, user authentication and database access permissions were checked on Firebase for data security.

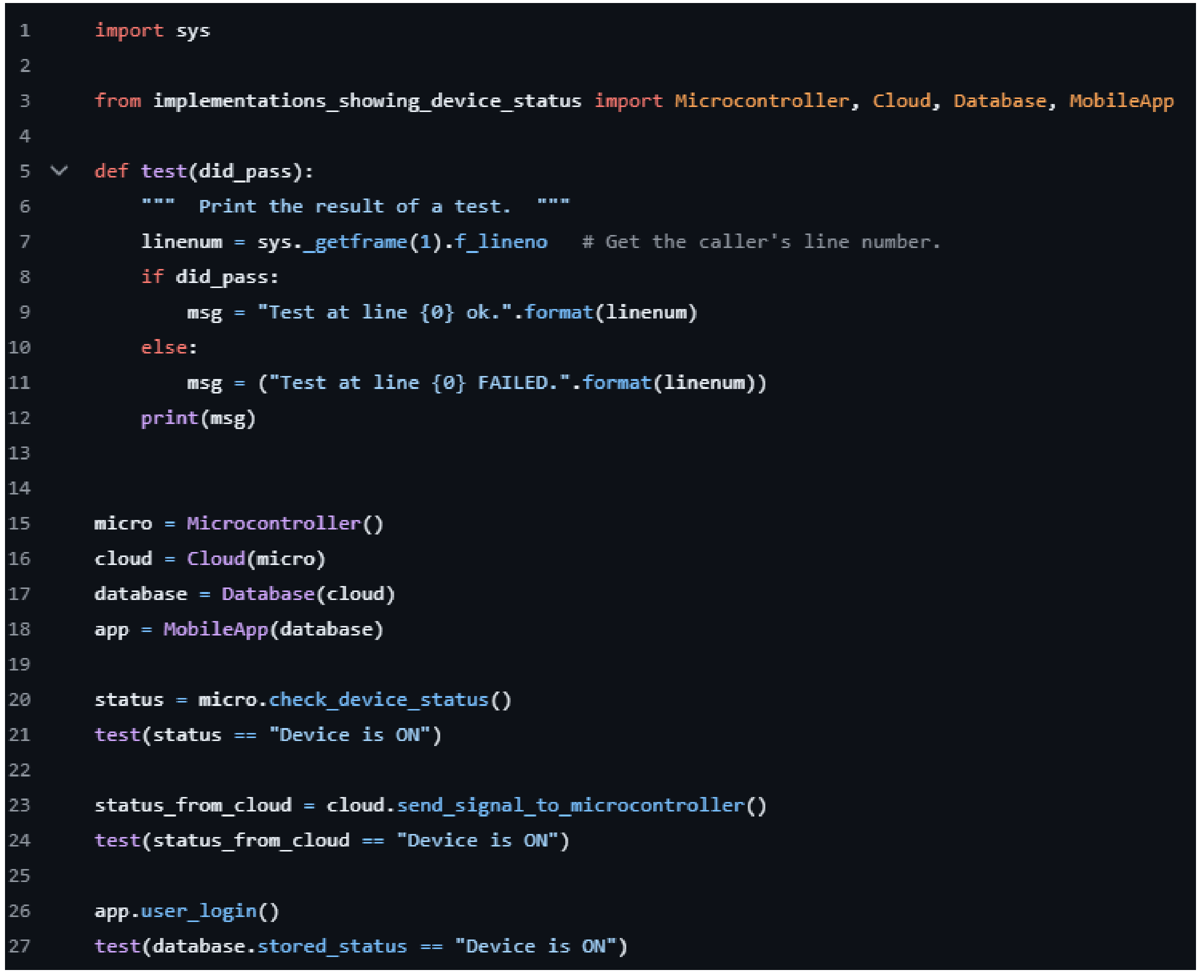
-Acceptance Test:

User scenarios were created to test whether the application is functional for the end user.

TEST PROCESS

Example of unittes script

this code does unit testing and checks that the software works correctly.



```python
import sys

from implementations_showing_device_status import Microcontroller, Cloud, Database, MobileApp

def test(did_pass):
    """  Print the result of a test.  """
    linenum = sys._getframe(1).f_lineno   # Get the caller's line number.
    if did_pass:
        msg = "Test at line {0} ok.".format(linenum)
    else:
        msg = ("Test at line {0} FAILED.".format(linenum))
    print(msg)


micro = Microcontroller()
cloud = Cloud(micro)
database = Database(cloud)
app = MobileApp(database)

status = micro.check_device_status()
test(status == "Device is ON")

status_from_cloud = cloud.send_signal_to_microcontroller()
test(status_from_cloud == "Device is ON")

app.user_login()
test(database.stored_status == "Device is ON")
```

DEPLOYMENT AND MAINTENANCE

Deployment:

After the completion of this project, the software is not only intended to be published, but also to be easy, efficient and functional for the users. Several steps were taken to achieve this goal:

-User Guides

-Education Support

-On-Site Support

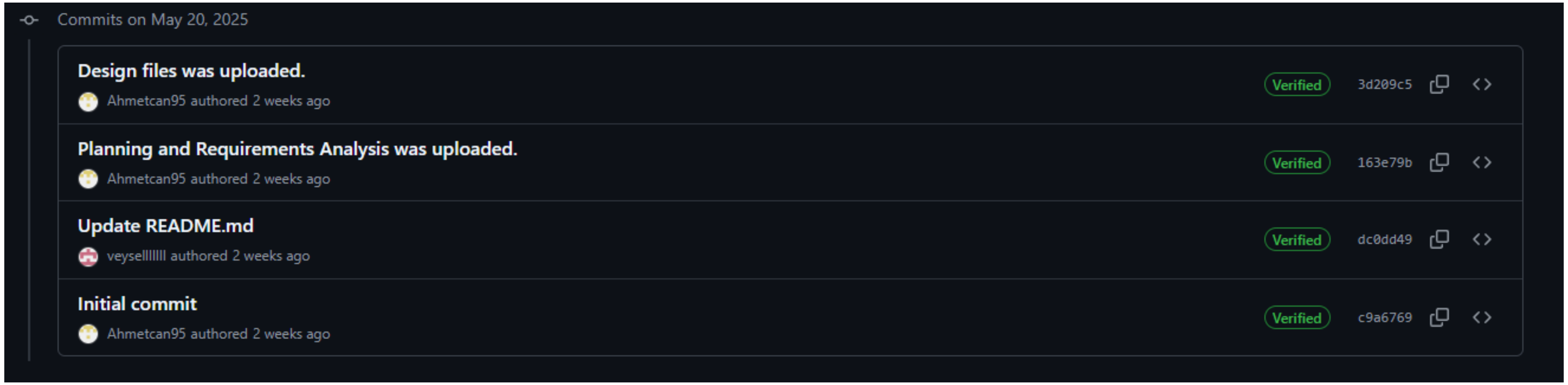
Maintenance:

It is designed to ensure that the system can be easily adapted to new software during the maintenance process without interruption in the long term. Maintenance has several critical points:

-Updates and Bug Fixes

-User Online Support

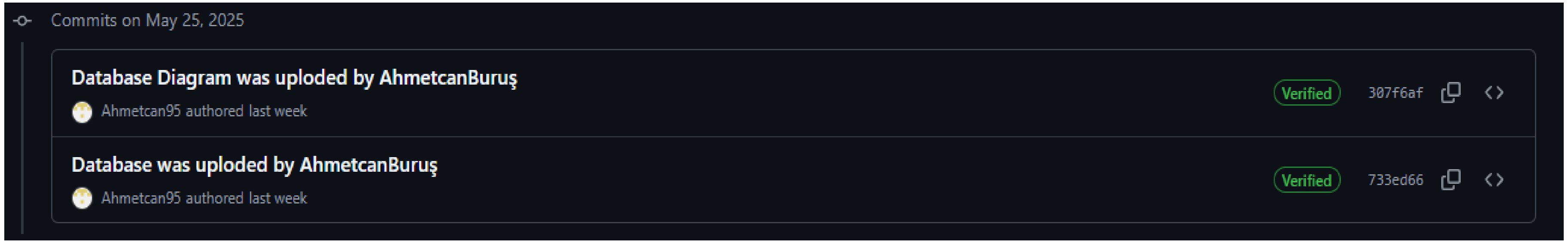
GITHUB LOGS



Commits on May 20, 2025

- **Design files was uploaded.**
  Ahmetcan95 authored 2 weeks ago — Verified — 3d209c5
- **Planning and Requirements Analysis was uploaded.**
  Ahmetcan95 authored 2 weeks ago — Verified — 163e79b
- **Update README.md**
  veysellllllll authored 2 weeks ago — Verified — dc0dd49
- **Initial commit**
  Ahmetcan95 authored 2 weeks ago — Verified — c9a6769

May 20, 2025



Commits on May 25, 2025

- **Database Diagram was uploded by AhmetcanBuruş**
  Ahmetcan95 authored last week — Verified — 307f6af
- **Database was uploded by AhmetcanBuruş**
  Ahmetcan95 authored last week — Verified — 733ed66

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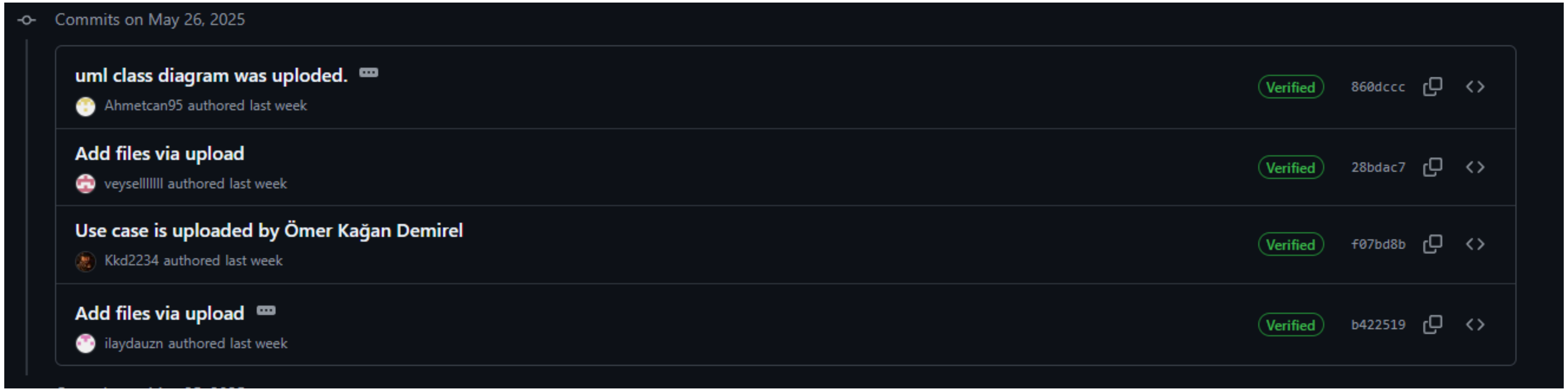
May 26, 2025



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uml class diagram was uploded.
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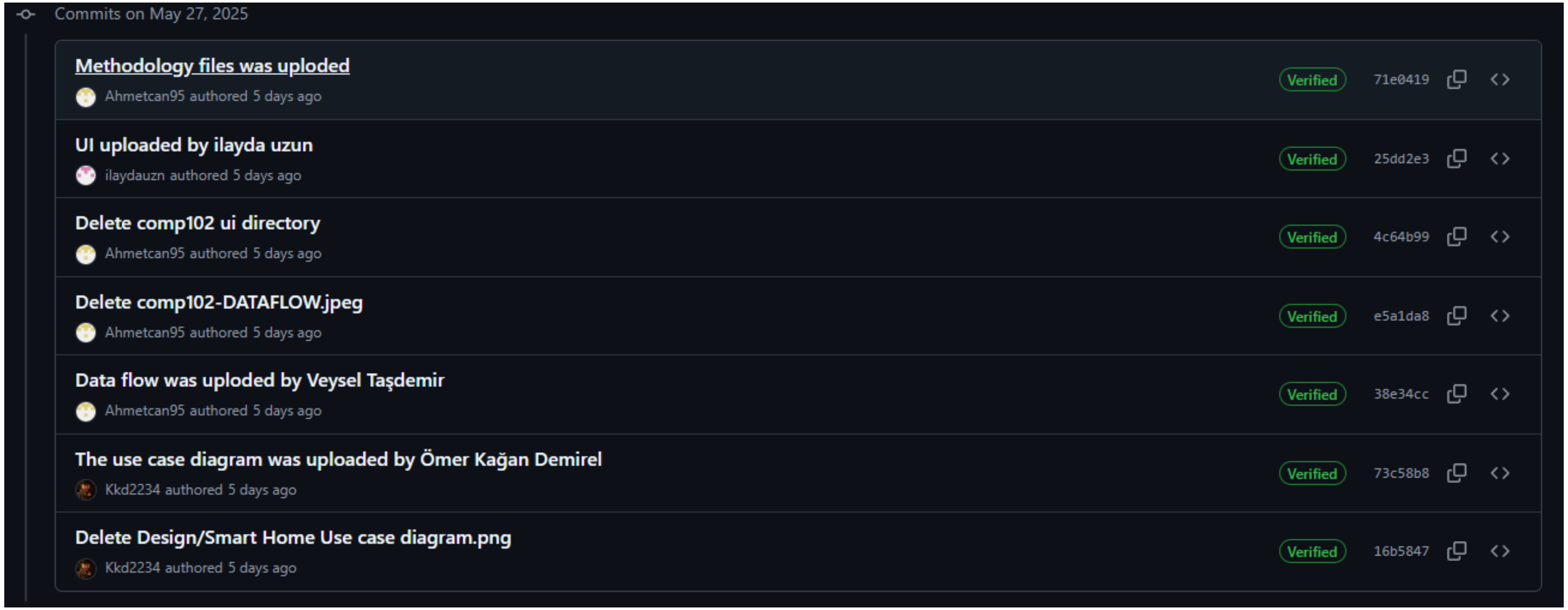

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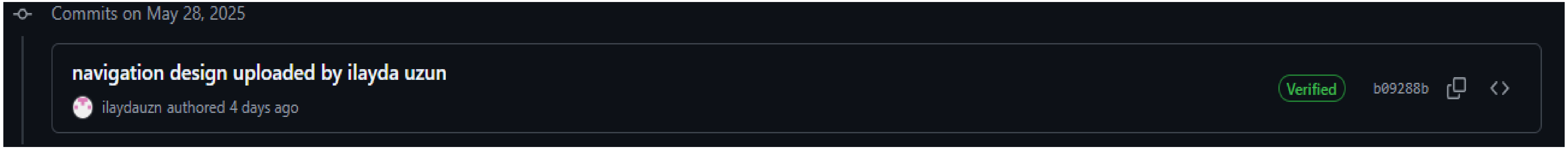

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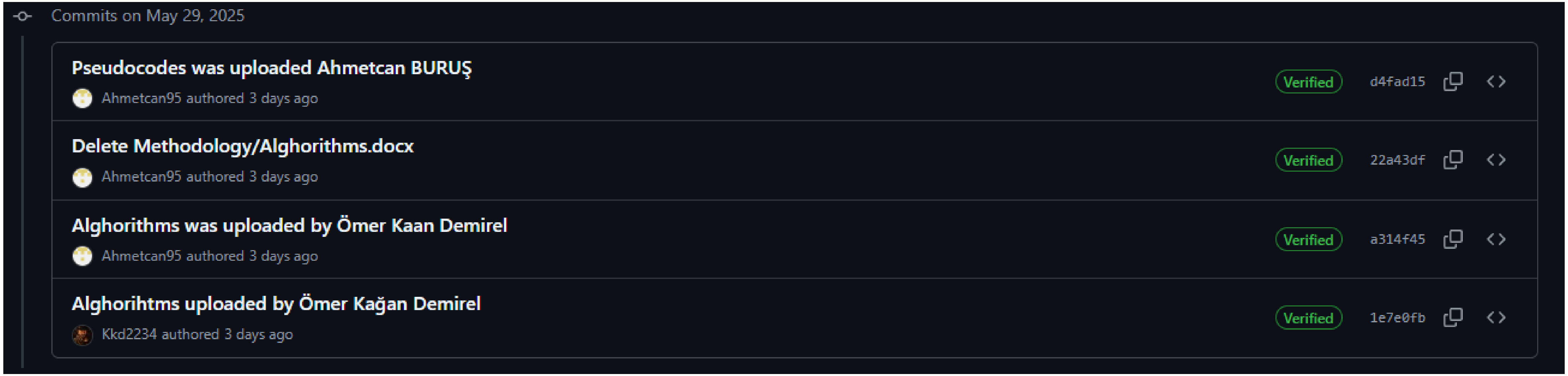

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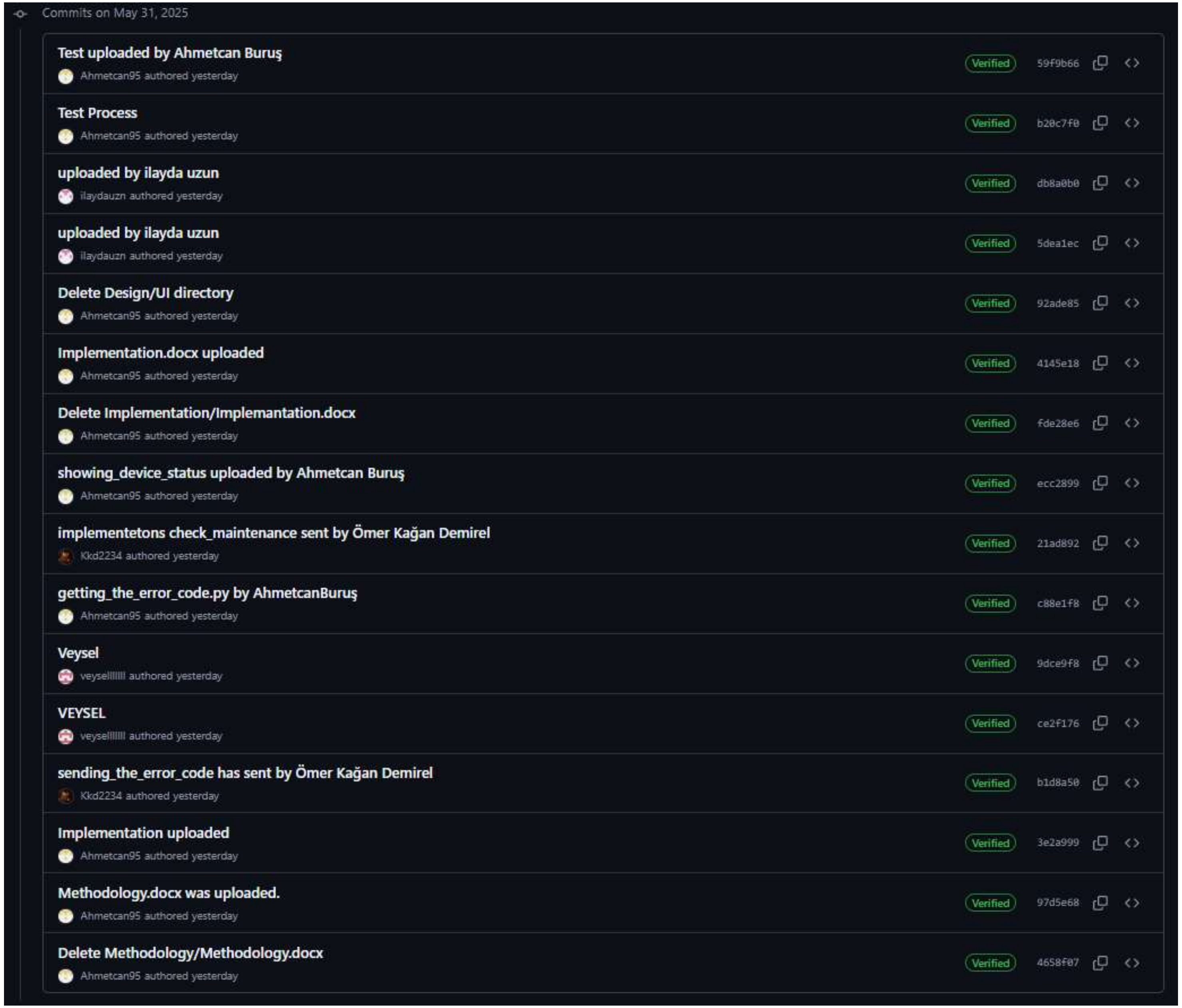

Commits on May 31, 2025

Test uploaded by Ahmetcan Buruş
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Test Process
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implementetons check_maintenance sent by Ömer Kağan Demirel
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getting_the_error_code.py by AhmetcanBuruş
Ahmetcan95 authored yesterday
Verified c88e1f8

Veysel
veysellllll authored yesterday
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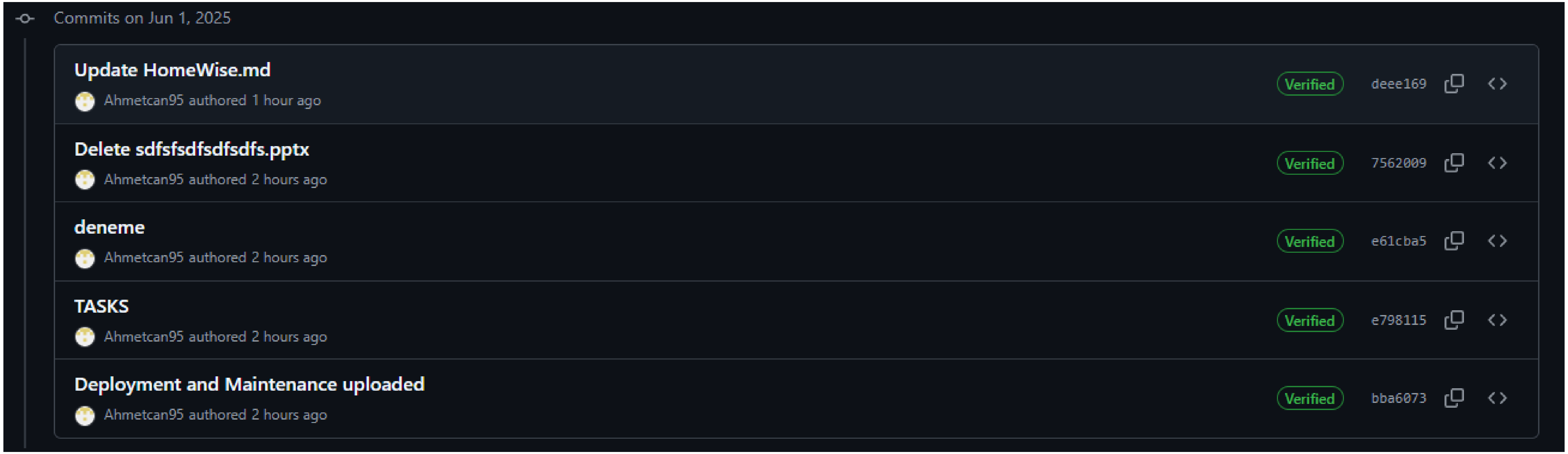

Commits on Jun 1, 2025

Update HomeWise.md
Ahmetcan95 authored 1 hour ago
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Delete sdfsfsdfsdfsdfs.pptx
Ahmetcan95 authored 2 hours ago
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Jun 1, 2025

THANK YOU FOR LISTENING

Prepared by

-Ahmetcan Buruş
-Ömer Kaan Demirel
-İlayda Uzun
-Veysel Taşdemir