OOAD: #4 OOI

202211318 엄정석 / 202211334 이동훈 / 202211384 차민우 / 202211392 최환

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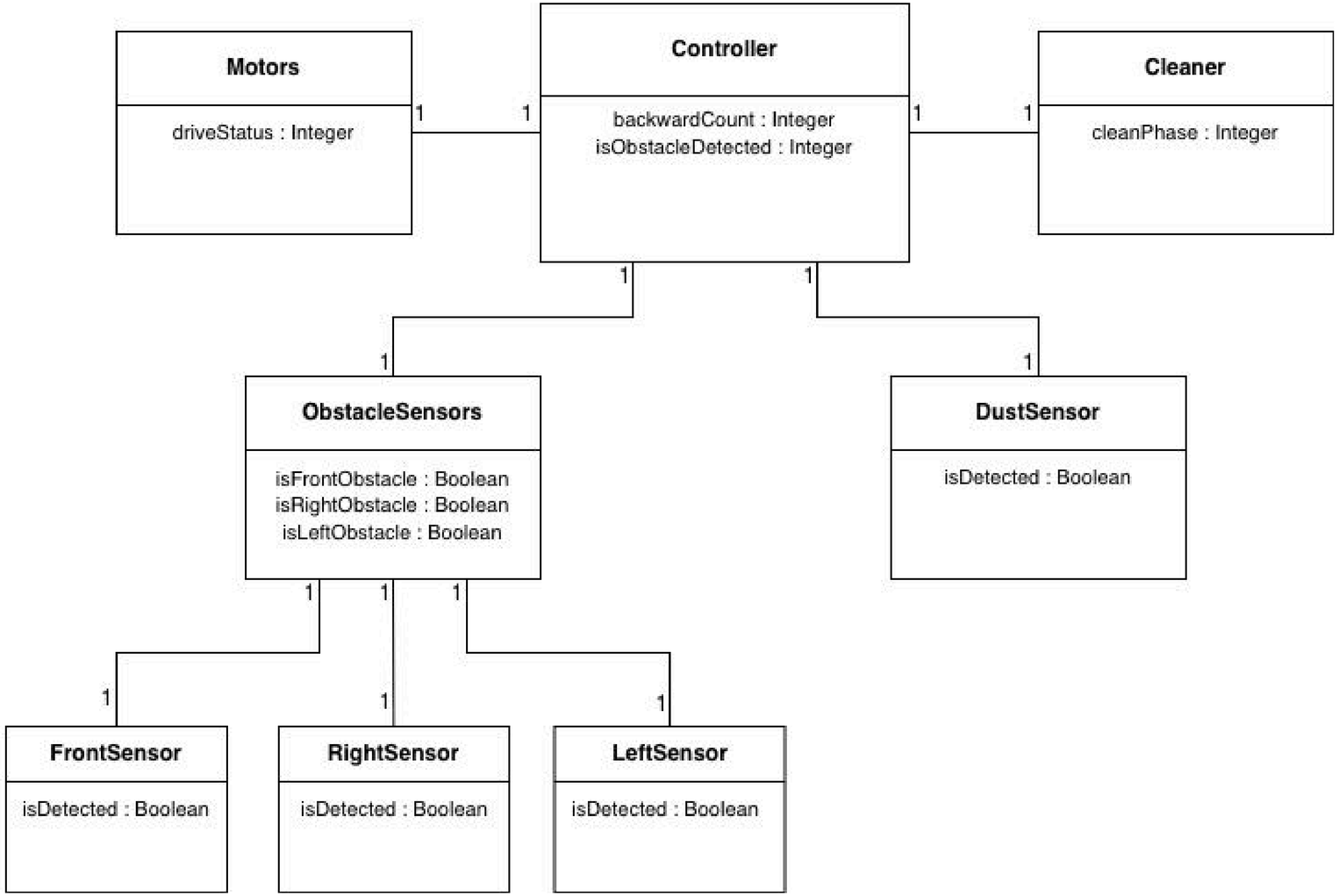
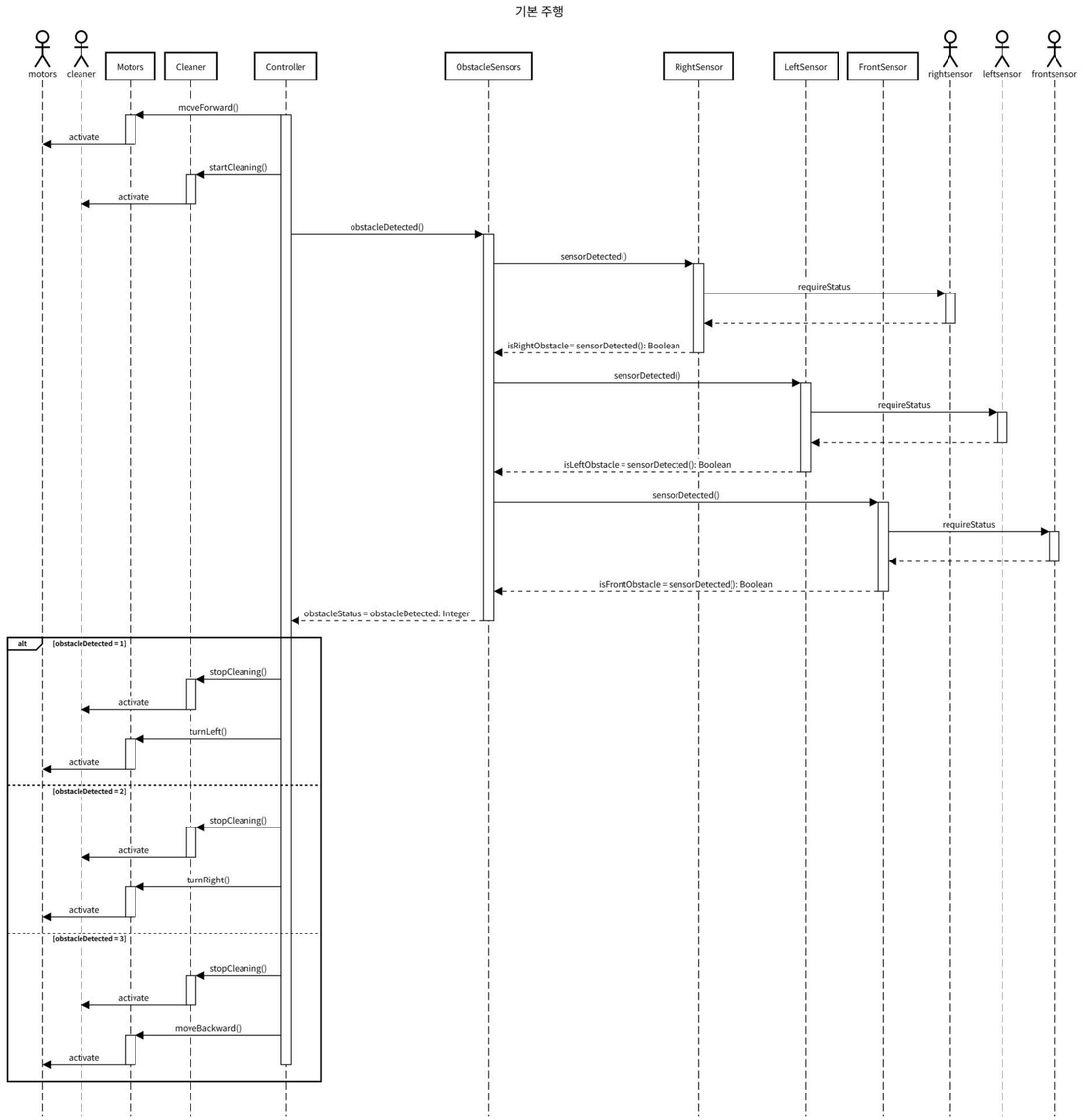


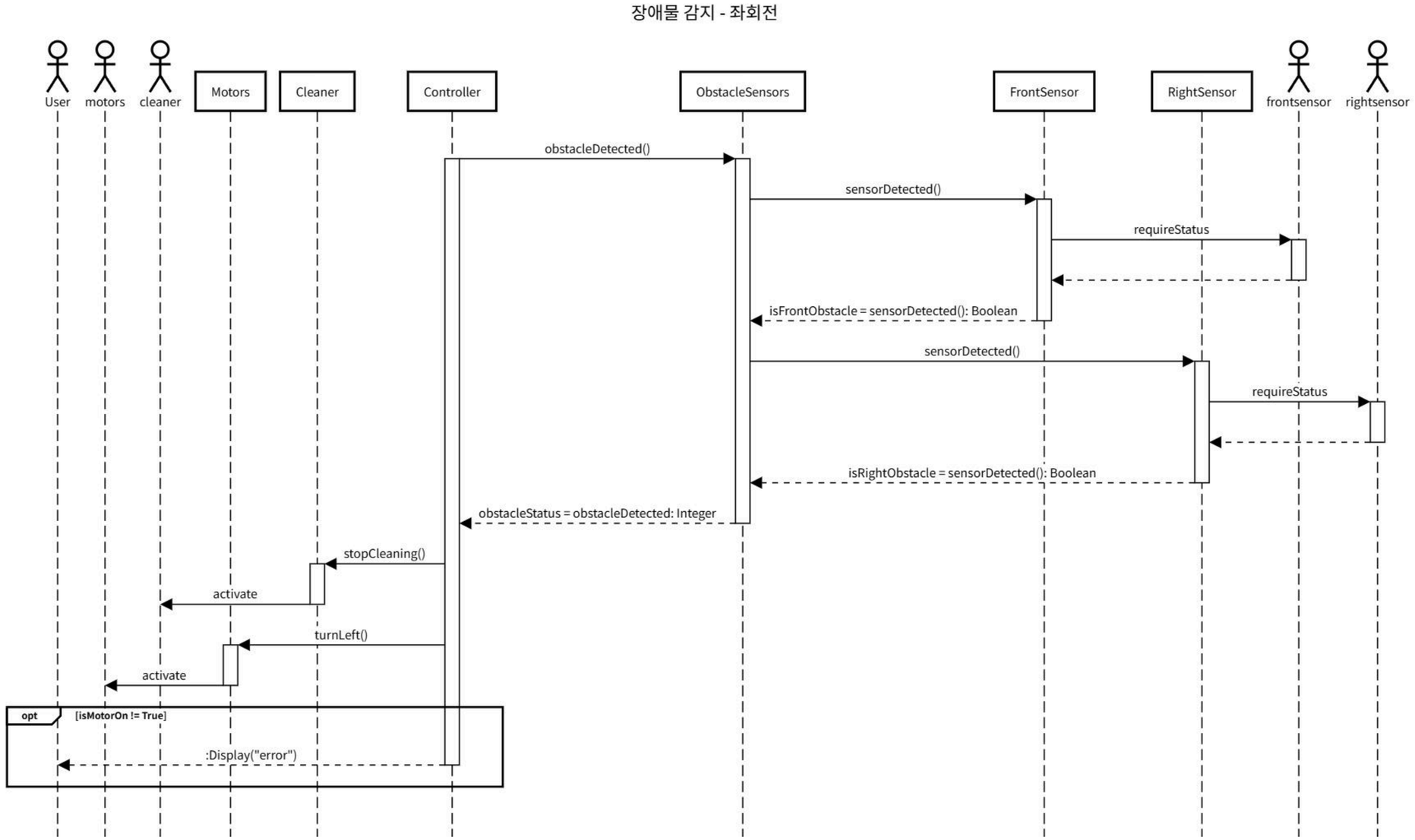
[OOD] Sequence Diagrams

UC-03



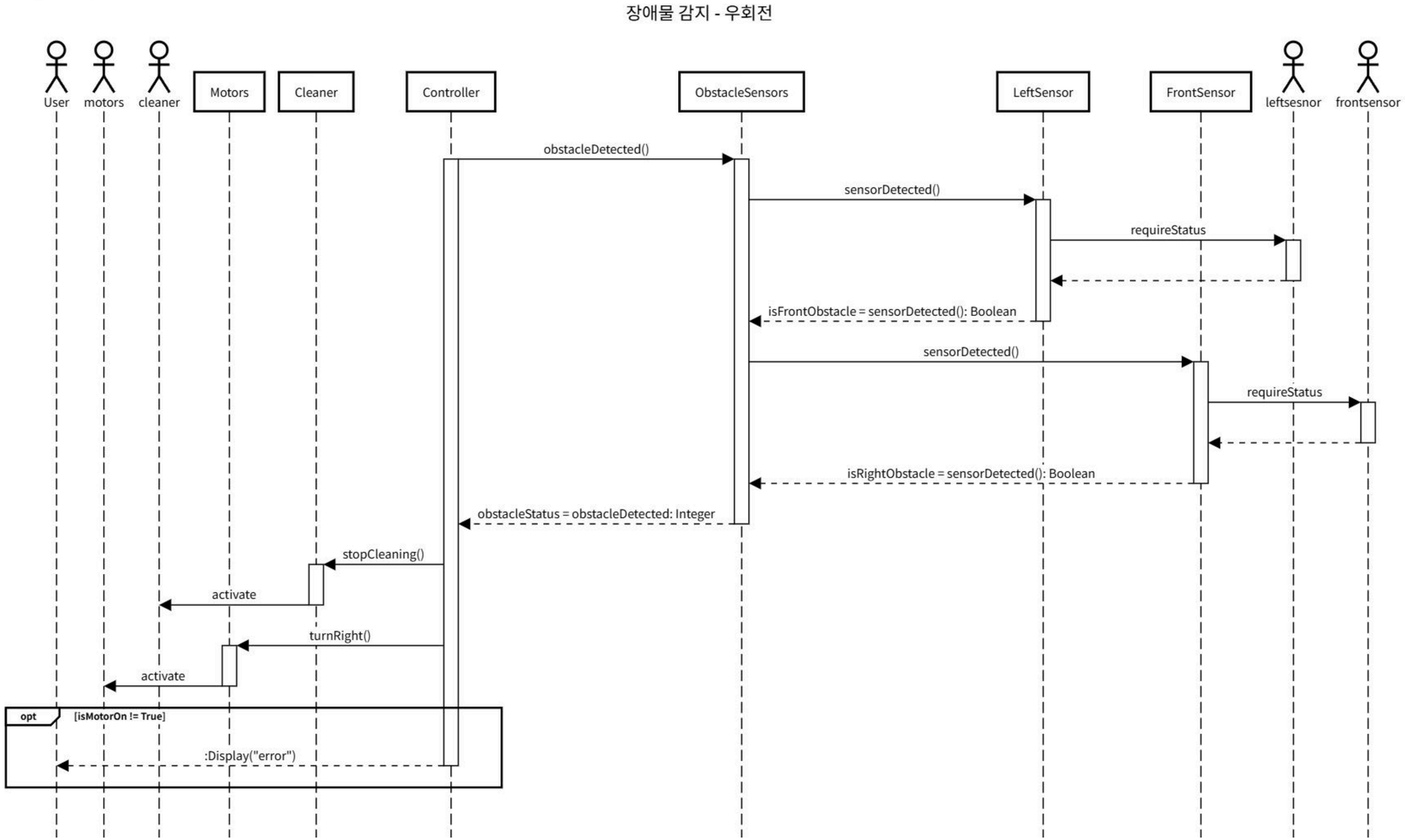
[OOD] Sequence Diagrams

UC-04



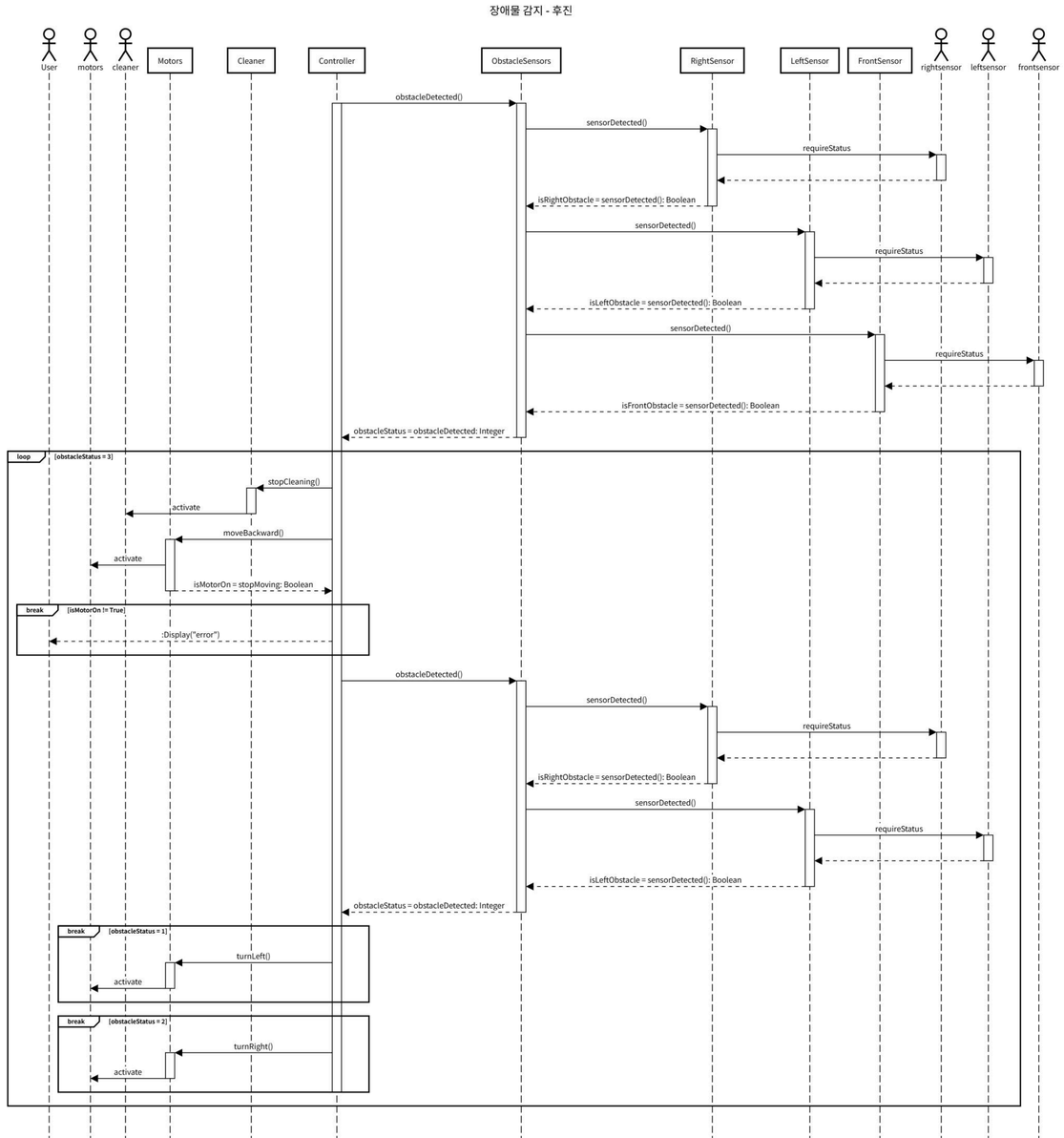
[OOD] Sequence Diagrams

UC-05



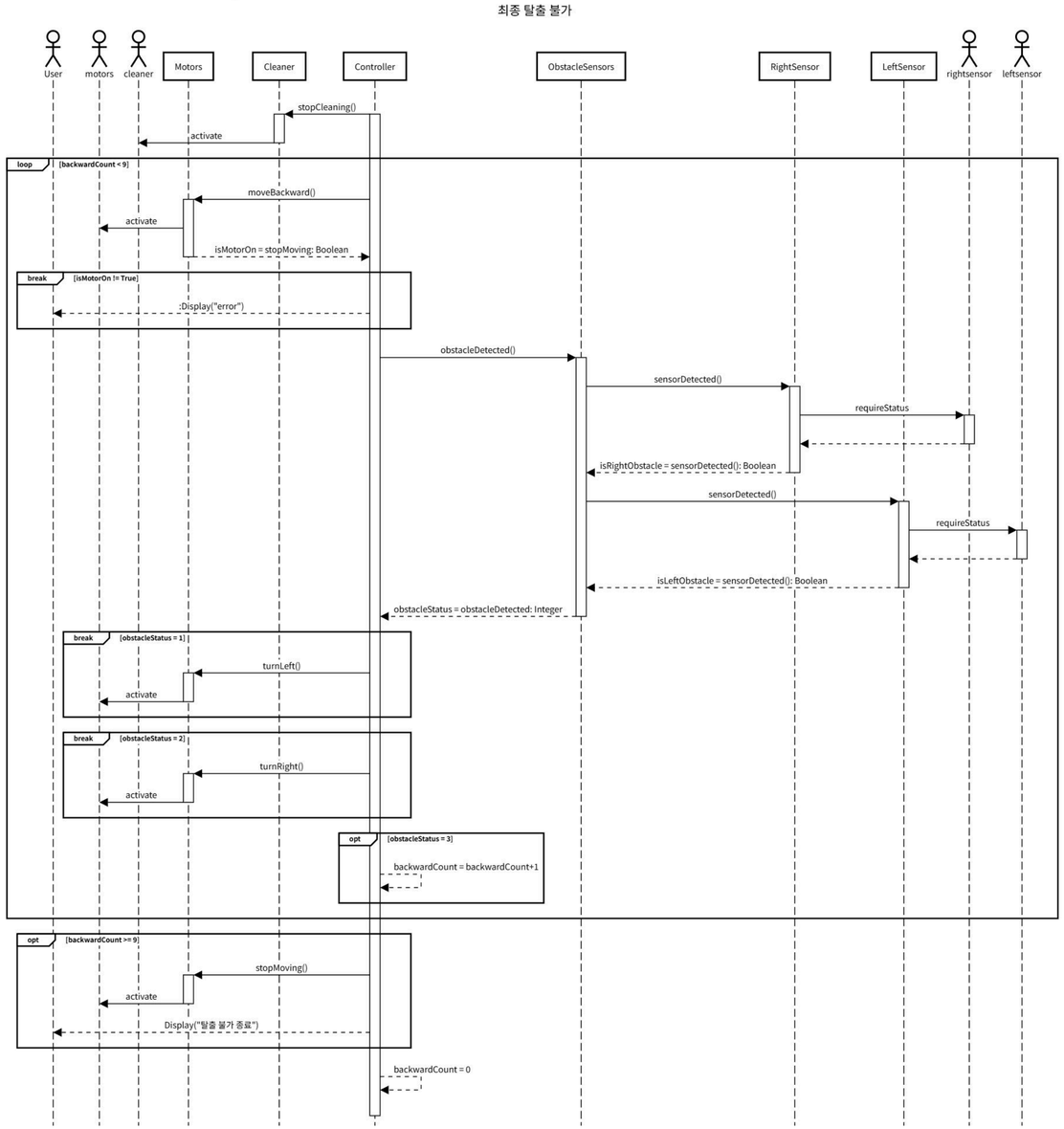
[OOD] Sequence Diagrams

UC-06



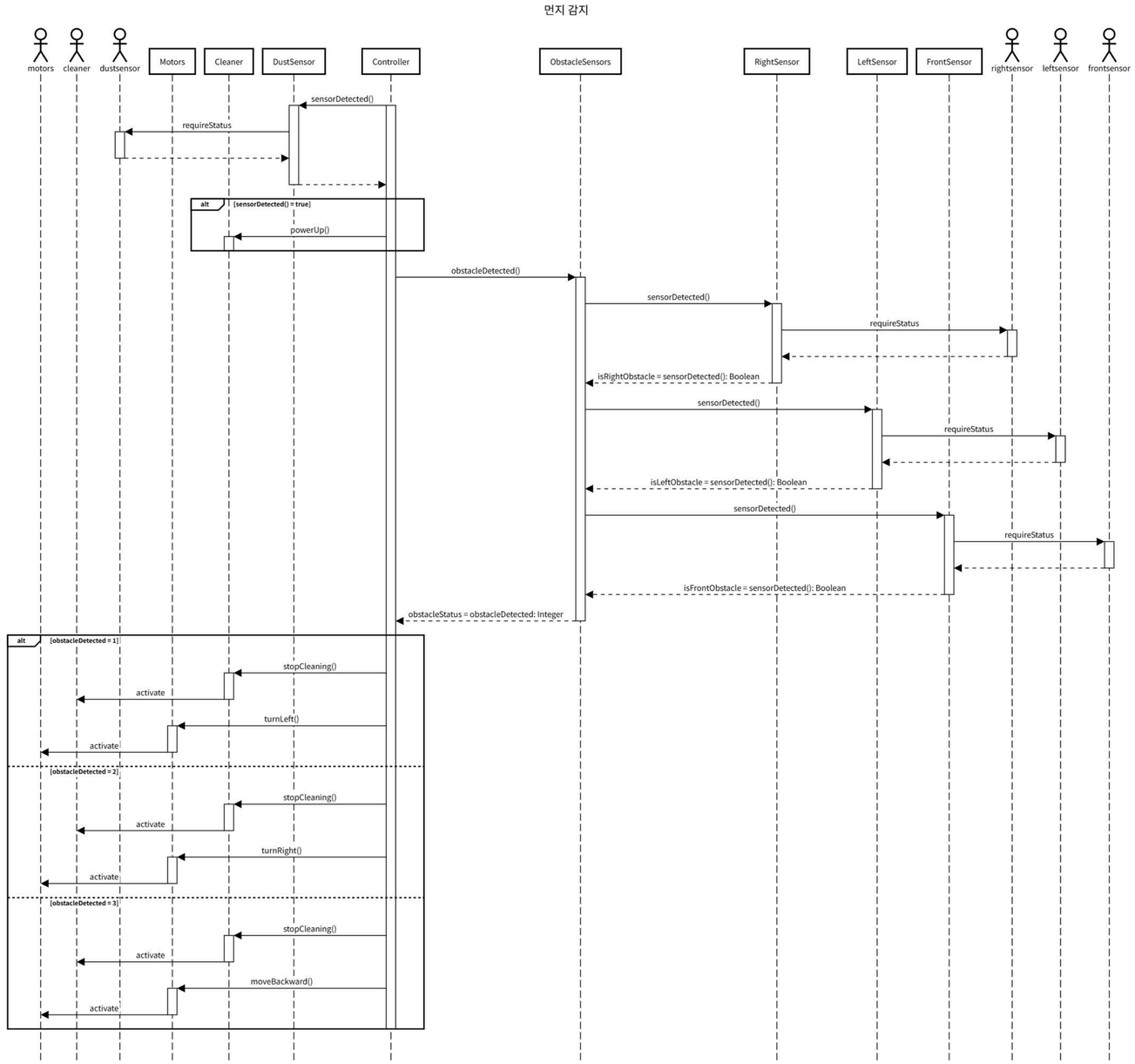
[OOD] Sequence Diagrams

UC-07

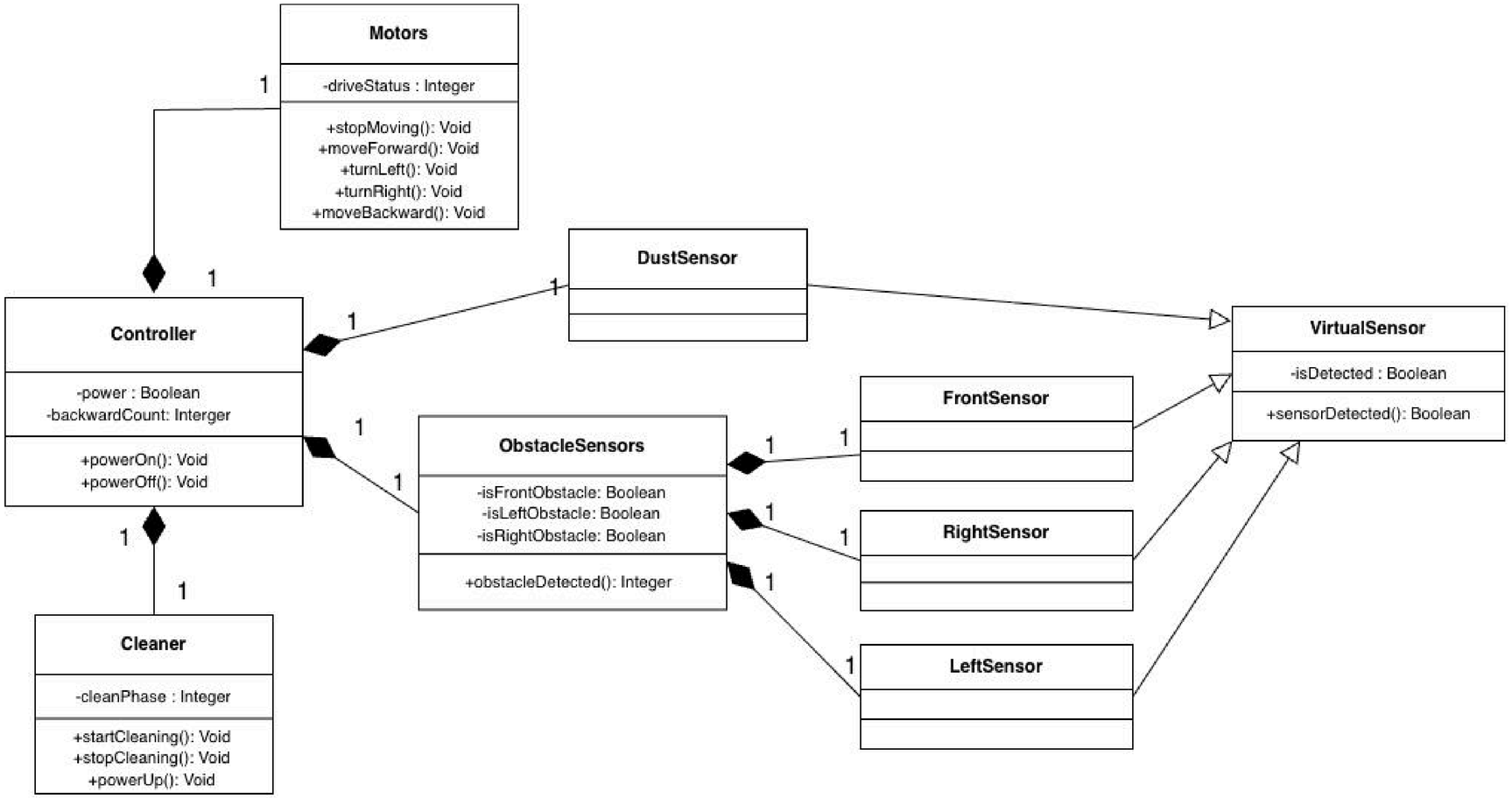


[OOD] Sequence Diagrams

UC-08



[OOD] Class Diagram



구현 (Coding)

Pair Programming

Pair Programming

이동훈 & 최환	엄정석 & 차민우
pre-commit, settings	CMakeLists, yaml
• Controller.h • ObstacleSensors.h • SimulationData.h • Virtual Cleaner.h • Virtual Motors.h • VirtualSensor.h	• test_cleaner.cpp • test_motors.cpp • test_obstacleSensors.cpp • test_sensors.cpp

구현 (Coding)

Unit Test

Unit Test

: MotorsTest

Constructor & Destructor Tests

```
TEST(MotorsTest, Constructor_test) {
  auto motors = std::make_unique<Motors>();
  EXPECT_EQ(motors->driveStatus, 0);
}

TEST(MotorsTest, Destructor_Test) {
  auto motors = std::make_unique<Motors>();
  motors->moveForward();
}
```

Function Tests

```
TEST(MotorsTest,moveForward_test) {
  auto motors = std::make_unique<Motors>();
  motors->moveForward();
  EXPECT_EQ(motors->driveStatus, 1);
}

TEST(MotorsTest, stopMoving_test) {
  auto motors = std::make_unique<Motors>();
  motors->stopMoving();
  EXPECT_EQ(motors->driveStatus, 0);
}

TEST(MotorsTest, turnLeft_test) {
  auto motors = std::make_unique<Motors>();
  motors->turnLeft();
  EXPECT_EQ(motors->driveStatus, 2);
}

TEST(MotorsTest, turnRight_test) {
  auto motors = std::make_unique<Motors>();
  motors->turnRight();
  EXPECT_EQ(motors->driveStatus, 3);
}

TEST(MotorsTest, moveBackward_test) {
  auto motors = std::make_unique<Motors>();
  motors->moveBackward();
  EXPECT_EQ(motors->driveStatus, -1);
}
```

Unit Test

: MotorsTest

SequentialTurn_test

```
TEST(MotorsTest, SequentialTurn_test) {
  auto motors = std::make_unique<Motors>();

  motors->turnLeft();
  EXPECT_EQ(motors->driveStatus, 2);

  motors->turnRight();
  EXPECT_EQ(motors->driveStatus, 3);

  motors->stopMoving();
  EXPECT_EQ(motors->driveStatus, 0);
}
```

FullMovement_test

```
TEST(MotorsTest, FullMovement_test) {
  auto motors = std::make_unique<Motors>();

  motors->moveForward();
  EXPECT_EQ(motors->driveStatus, 1);

  motors->moveBackward();
  EXPECT_EQ(motors->driveStatus, -1);

  motors->stopMoving();
  EXPECT_EQ(motors->driveStatus, 0);
}
```

Unit Test

: MotorsTest

RepeatAction_test

```
TEST(MotorsTest, RepeatAction_test) {
  auto motors = std::make_unique<Motors>();

  motors->moveForward();
  motors->moveForward();
  EXPECT_EQ(motors->driveStatus, 1);

  motors->stopMoving();
  EXPECT_EQ(motors->driveStatus, 0);
}
```

EmergencySwitch_test

```
TEST(MotorsTest, EmergencySwitch_test) {
  auto motors = std::make_unique<Motors>();

  motors->moveForward();
  motors->stopMoving();
  EXPECT_EQ(motors->driveStatus, 0);

  motors->moveBackward();
  EXPECT_EQ(motors->driveStatus, -1);
}
```

ZigZag_test

```
TEST(MotorsTest, ZigZag_test) {
  auto motors = std::make_unique<Motors>();

  motors->turnLeft();
  EXPECT_EQ(motors->driveStatus, 2);

  motors->turnRight();
  EXPECT_EQ(motors->driveStatus, 3);

  motors->turnLeft();
  EXPECT_EQ(motors->driveStatus, 2);

  motors->stopMoving();
  EXPECT_EQ(motors->driveStatus, 0);
}
```

Unit Test

: MotorsTest

SystemFullCycle_test

```
TEST(MotorsTest, SystemFullCycle_test) {
  auto motors = std::make_unique<Motors>();

  int statuses[] = {1, 2, 3, -1, 0};

  motors->moveForward();
  EXPECT_EQ(motors->driveStatus, statuses[0]);

  motors->turnLeft();
  EXPECT_EQ(motors->driveStatus, statuses[1]);

  motors->turnRight();
  EXPECT_EQ(motors->driveStatus, statuses[2]);

  motors->moveBackward();
  EXPECT_EQ(motors->driveStatus, statuses[3]);

  motors->stopMoving();
  EXPECT_EQ(motors->driveStatus, statuses[4]);
}
```

Unit Test

: CleanerTest

Constructor & Destructor Tests

```
TEST(CleanerTest, Constructor_test) {
    auto cleaner = std::make_unique<Cleaner>();
    EXPECT_EQ(cleaner->cleanPhase, 0);
}

TEST(CleanerTest, Destructor_Test) {
    auto cleaner = std::make_unique<Cleaner>();
    cleaner->startCleaning();
}
```

Function Tests

```
TEST(CleanerTest, startCleaning_test) {
    auto cleaner = std::make_unique<Cleaner>();
    cleaner->startCleaning();
    EXPECT_EQ(cleaner->cleanPhase, 1);
}

TEST(CleanerTest, stopCleaning_test) {
    auto cleaner = std::make_unique<Cleaner>();
    cleaner->startCleaning();
    cleaner->stopCleaning();
    EXPECT_EQ(cleaner->cleanPhase, 0);
}

TEST(CleanerTest, powerUp_test) {
    auto cleaner = std::make_unique<Cleaner>();
    cleaner->startCleaning();
    cleaner->powerUp();
    EXPECT_EQ(cleaner->cleanPhase, 2);
}
```

Unit Test

: CleanerTest

SequentialCleaning_test

```
TEST(CleanerTest, SequentialCleaning_test) {
    auto cleaner = std::make_unique<Cleaner>();

    cleaner->startCleaning();
    EXPECT_EQ(cleaner->cleanPhase, 1);

    cleaner->powerUp();
    EXPECT_EQ(cleaner->cleanPhase, 2);

    cleaner->stopCleaning();
    EXPECT_EQ(cleaner->cleanPhase, 0);
}
```

MultipleStart_test

```
TEST(CleanerTest, MultipleStart_test) {
    auto cleaner = std::make_unique<Cleaner>();

    cleaner->startCleaning();
    cleaner->startCleaning();
    EXPECT_EQ(cleaner->cleanPhase, 1);

    cleaner->stopCleaning();
    EXPECT_EQ(cleaner->cleanPhase, 0);
}
```

Unit Test

: CleanerTest

EmergencyStop_test

```
TEST(CleanerTest, EmergencyStop_test) {
    auto cleaner = std::make_unique<Cleaner>();

    cleaner->startCleaning();
    cleaner->stopCleaning();
    EXPECT_EQ(cleaner->cleanPhase, 0);

    cleaner->powerUp();
    EXPECT_EQ(cleaner->cleanPhase, 2);
}
```

FullCycle_test

```
TEST(CleanerTest, FullCycle_test) {
    auto cleaner = std::make_unique<Cleaner>();

    int phases[] = {1, 2, 0};

    cleaner->startCleaning();
    EXPECT_EQ(cleaner->cleanPhase, phases[0]);

    cleaner->powerUp();
    EXPECT_EQ(cleaner->cleanPhase, phases[1]);

    cleaner->stopCleaning();
    EXPECT_EQ(cleaner->cleanPhase, phases[2]);
}
```

Unit Test

: SensorTest - DustSensor

Function Tests

```
TEST(SensorTest, DustSensorTest_Default) {
  auto data = std::make_shared<SimulationData>();
  auto dustSensor = std::make_unique<DustSensor>(data);

  data->dust = false;
  EXPECT_FALSE(dustSensor->sensorDetected());
}

TEST(SensorTest, DustSensorTest_Detected) {
  auto data = std::make_shared<SimulationData>();
  auto dustSensor = std::make_unique<DustSensor>(data);

  data->dust = true;
  EXPECT_TRUE(dustSensor->sensorDetected());
}
```

Sequential Test

```
TEST(SensorTest, DustSensorTest_Sequencial) {
  auto data = std::make_shared<SimulationData>();
  auto dustSensor = std::make_unique<DustSensor>(data);

  data->dust = false;
  EXPECT_FALSE(dustSensor->sensorDetected());

  data->dust = true;
  EXPECT_TRUE(dustSensor->sensorDetected());
}
```

Unit Test

: SensorTest - FrontSensor

Function Tests

```
TEST(SensorTest, FrontSensorTest_Default) {
  auto data = std::make_shared<SimulationData>();
  auto frontSensor = std::make_unique<FrontSensor>(data);

  data->frontObstacle = false;
  EXPECT_FALSE(frontSensor->sensorDetected());
}

TEST(SensorTest, FrontSensorTest_Detected) {
  auto data = std::make_shared<SimulationData>();
  auto frontSensor = std::make_unique<FrontSensor>(data);

  data->frontObstacle = true;
  EXPECT_TRUE(frontSensor->sensorDetected());
}
```

Sequential Test

```
TEST(SensorTest, FrontSensorTest_Sequential) {
  auto data = std::make_shared<SimulationData>();
  auto frontSensor = std::make_unique<FrontSensor>(data);

  data->frontObstacle = false;
  EXPECT_FALSE(frontSensor->sensorDetected());

  data->frontObstacle = true;
  EXPECT_TRUE(frontSensor->sensorDetected());
}
```

Unit Test

: SensorTest - LeftSensor

Function Tests

```
TEST(SensorTest, LeftSensorTest_Default) {
  auto data = std::make_shared<SimulationData>();
  auto leftSensor = std::make_unique<LeftSensor>(data);

  data->leftObstacle = false;
  EXPECT_FALSE(leftSensor->sensorDetected());
}

TEST(SensorTest, LeftSensorTest_Detected) {
  auto data = std::make_shared<SimulationData>();
  auto leftSensor = std::make_unique<LeftSensor>(data);

  data->leftObstacle = true;
  EXPECT_TRUE(leftSensor->sensorDetected());
}
```

Sequential Test

```
TEST(SensorTest, LeftSensorTest_Sequential) {
  auto data = std::make_shared<SimulationData>();
  auto leftSensor = std::make_unique<LeftSensor>(data);

  data->leftObstacle = false;
  EXPECT_FALSE(leftSensor->sensorDetected());

  data->leftObstacle = true;
  EXPECT_TRUE(leftSensor->sensorDetected());
}
```

Unit Test

: SensorTest - RightSensor

Function Tests

```
TEST(SensorTest,RightSensorTest_Default) {
  auto data = std::make_shared<SimulationData>();
  auto rightSensor = std::make_unique<RightSensor>(data);

  data->rightObstacle = false;
  EXPECT_FALSE(rightSensor->sensorDetected());
}

TEST(SensorTest, RightSensorTest_Detected) {
  auto data = std::make_shared<SimulationData>();
  auto rightSensor = std::make_unique<RightSensor>(data);

  data->rightObstacle = true;
  EXPECT_TRUE(rightSensor->sensorDetected());
}
```

Sequential Test

```
TEST(SensorTest, RightSensorTest_Sequential) {
  auto data = std::make_shared<SimulationData>();
  auto rightSensor = std::make_unique<RightSensor>(data);

  data->rightObstacle = false;
  EXPECT_FALSE(rightSensor->sensorDetected());

  data->rightObstacle = true;
  EXPECT_TRUE(rightSensor->sensorDetected());
}
```

Unit Test

: ObstacleSensorsTest

Default

```
TEST(ObstacleSensorsTest, Default) {
  auto data = std::make_shared<SimulationData>();
  auto frontSensor = std::make_shared<FrontSensor>(data);
  auto rightSensor = std::make_shared<RightSensor>(data);
  auto leftSensor = std::make_shared<LeftSensor>(data);

  auto obstacleSensors = std::make_shared<ObstacleSensors>(frontSensor, leftSensor, rightSensor);

  EXPECT_EQ(obstacleSensors->obstacleDetected(), 0);
}
```

Front

```
TEST(ObstacleSensorsTest, Front) {
  auto data = std::make_shared<SimulationData>();
  auto frontSensor = std::make_shared<FrontSensor>(data);
  auto rightSensor = std::make_shared<RightSensor>(data);
  auto leftSensor = std::make_shared<LeftSensor>(data);

  auto obstacleSensors = std::make_shared<ObstacleSensors>(frontSensor, leftSensor, rightSensor);

  data->frontObstacle = true;

  EXPECT_EQ(obstacleSensors->obstacleDetected(), 1);
}
```

Unit Test

: ObstacleSensorsTest

Left

```
TEST(ObstacleSensorsTest, Left) {
  auto data = std::make_shared<SimulationData>();
  auto frontSensor = std::make_shared<FrontSensor>(data);
  auto rightSensor = std::make_shared<RightSensor>(data);
  auto leftSensor = std::make_shared<LeftSensor>(data);

  auto obstacleSensors = std::make_shared<ObstacleSensors>(frontSensor, leftSensor, rightSensor);

  data->leftObstacle = true;

  EXPECT_EQ(obstacleSensors->obstacleDetected(), 0);
}
```

Right

```
TEST(ObstacleSensorsTest, Right) {
  auto data = std::make_shared<SimulationData>();
  auto frontSensor = std::make_shared<FrontSensor>(data);
  auto rightSensor = std::make_shared<RightSensor>(data);
  auto leftSensor = std::make_shared<LeftSensor>(data);

  auto obstacleSensors = std::make_shared<ObstacleSensors>(frontSensor, leftSensor, rightSensor);

  data->rightObstacle = true;

  EXPECT_EQ(obstacleSensors->obstacleDetected(), 0);
}
```

Unit Test

: ObstacleSensorsTest

Front_Left

```
TEST(ObstacleSensorsTest, Front_Left) {
  auto data = std::make_shared<SimulationData>();
  auto frontSensor = std::make_shared<FrontSensor>(data);
  auto rightSensor = std::make_shared<RightSensor>(data);
  auto leftSensor = std::make_shared<LeftSensor>(data);

  auto obstacleSensors = std::make_shared<ObstacleSensors>(frontSensor, leftSensor, rightSensor);

  data->frontObstacle = true;
  data->leftObstacle = true;

  EXPECT_EQ(obstacleSensors->obstacleDetected(), 2);
}
```

Front_Right

```
TEST(ObstacleSensorsTest, Front_Right) {
  auto data = std::make_shared<SimulationData>();
  auto frontSensor = std::make_shared<FrontSensor>(data);
  auto rightSensor = std::make_shared<RightSensor>(data);
  auto leftSensor = std::make_shared<LeftSensor>(data);

  auto obstacleSensors = std::make_shared<ObstacleSensors>(frontSensor, leftSensor, rightSensor);

  data->frontObstacle = true;
  data->rightObstacle = true;

  EXPECT_EQ(obstacleSensors->obstacleDetected(), 3);
}
```

Unit Test

: ObstacleSensorsTest

Front_Left_Right

```
TEST(ObstacleSensorsTest, Front_Left_Right) {
  auto data = std::make_shared<SimulationData>();
  auto frontSensor = std::make_shared<FrontSensor>(data);
  auto rightSensor = std::make_shared<RightSensor>(data);
  auto leftSensor = std::make_shared<LeftSensor>(data);

  auto obstacleSensors = std::make_shared<ObstacleSensors>(frontSensor, leftSensor, rightSensor);

  data->frontObstacle = true;
  data->leftObstacle = true;
  data->rightObstacle = true;

  EXPECT_EQ(obstacleSensors->obstacleDetected(), 4);
}
```

Front_Right

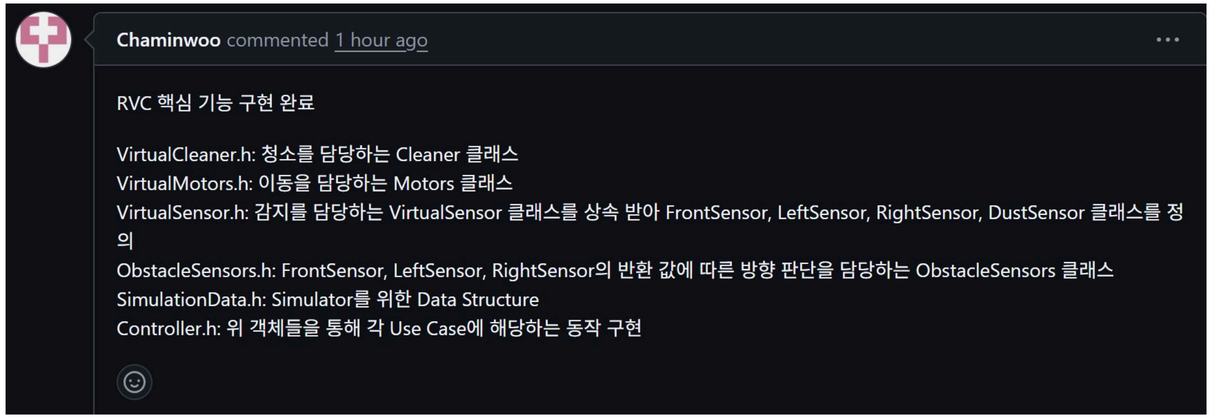
```
TEST(ObstacleSensorsTest, Left_Right) {
  auto data = std::make_shared<SimulationData>();
  auto frontSensor = std::make_shared<FrontSensor>(data);
  auto rightSensor = std::make_shared<RightSensor>(data);
  auto leftSensor = std::make_shared<LeftSensor>(data);

  auto obstacleSensors = std::make_shared<ObstacleSensors>(frontSensor, leftSensor, rightSensor);

  data->leftObstacle = true;
  data->rightObstacle = true;

  EXPECT_EQ(obstacleSensors->obstacleDetected(), 5);
}
```

구현 (Coding)

Code Review

Code Review

: main



PR Description

Review

Code Review

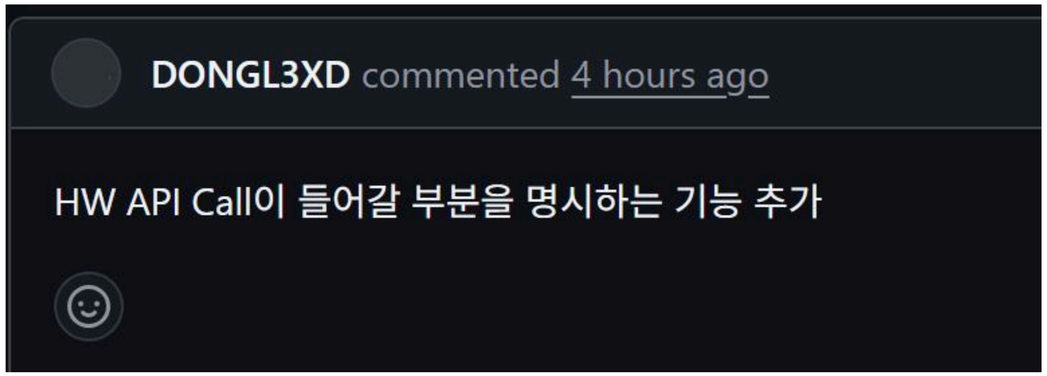
: Sensors

Review

Code Review

: API call

PR Description

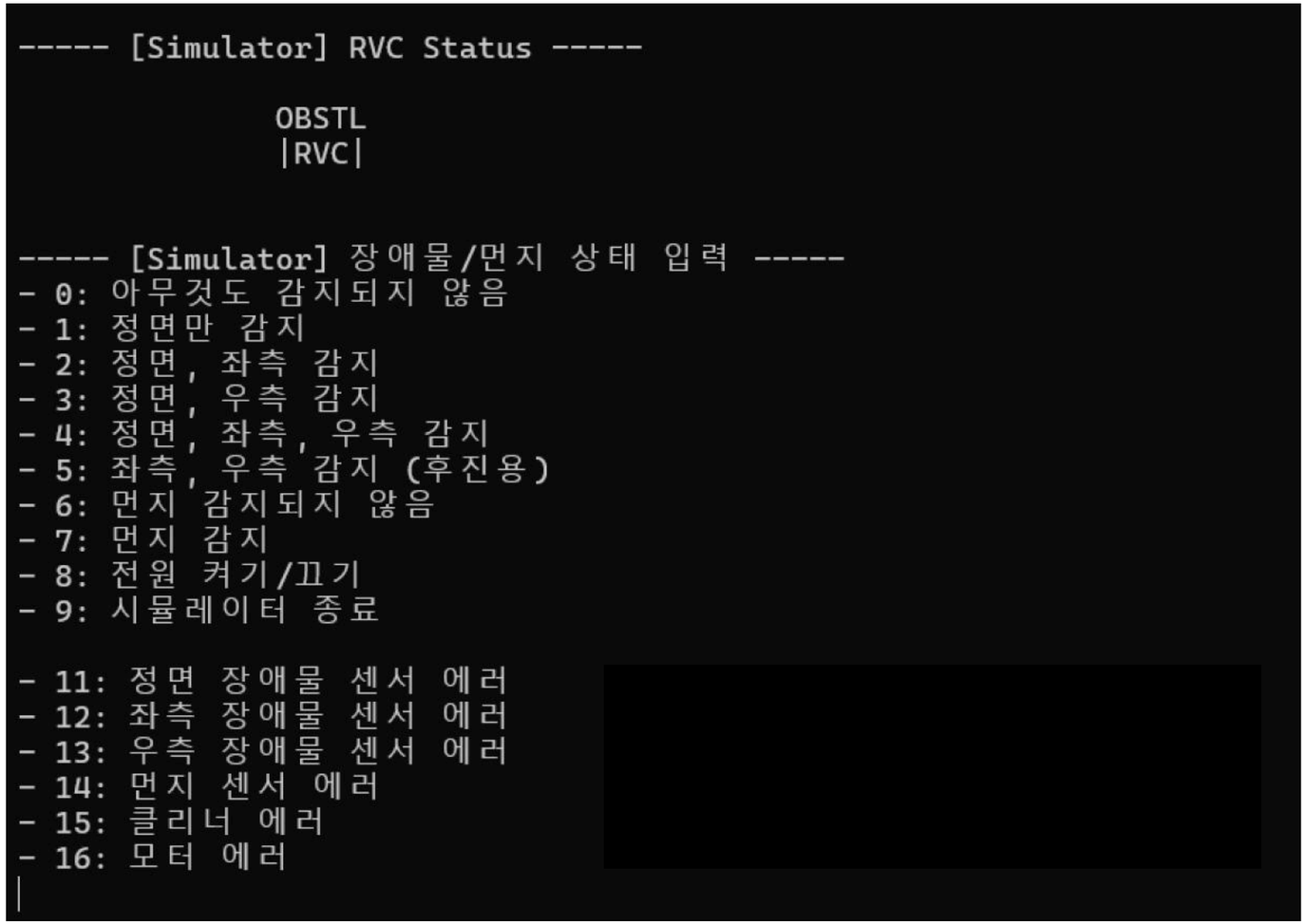


Review

System Test

Simulator

Simulator


----- [Simulator] RVC Status -----
OBSTL
|RVC|
----- [Simulator] 장애물/먼지 상태 입력 -----
- 0: 아무것도 감지되지 않음
- 1: 정면만 감지
- 2: 정면, 좌측 감지
- 3: 정면, 우측 감지
- 4: 정면, 좌측, 우측 감지
- 5: 좌측, 우측 감지 (후진용)
- 6: 먼지 감지되지 않음
- 7: 먼지 감지
- 8: 전원 켜기/끄기
- 9: 시뮬레이터 종료
- 11: 정면 장애물 센서 에러
- 12: 좌측 장애물 센서 에러
- 13: 우측 장애물 센서 에러
- 14: 먼지 센서 에러
- 15: 클리너 에러
- 16: 모터 에러

System Test

System Test Cases

System Test Cases

positive	negative
전원 켜기	전원 켜는 중 클리너 오작동
전원 끄기	전원 켜는 중 전체 장애물 센서 고장
기본 주행	먼지 흡입 후 power up 유지
전방 장애물 감지	최종 탈출 불가
전방, 좌측 장애물 감지	전방 장애물 감지 실패
전방, 우측 장애물 감지	좌측 장애물 감지 실패 (논리상 우회전 불가로 좌회전)
전방, 좌우측 장애물 감지	모터 에러 (장애물 감지에도 이동 불능)

System Test Cases

positive	negative
먼지 감지	좌회전 시작 후 우측 센서 고장
후진 중 탈출	우회전 시작 후 cleaner 고장으로 청소 재개 불가
전방 장애물 감지 및 먼지 감지	후진 중 좌,우측 센서 고장으로 전진
전방, 좌측 장애물 감지 및 먼지 감지	주행 중 청소 불가
전방, 우측 장애물 감지 및 먼지 감지	회전 후 청소 불가
전방, 좌우측 장애물 감지 및 먼지 감지	
후진 후 우측 장애물 감지	

System Test Cases

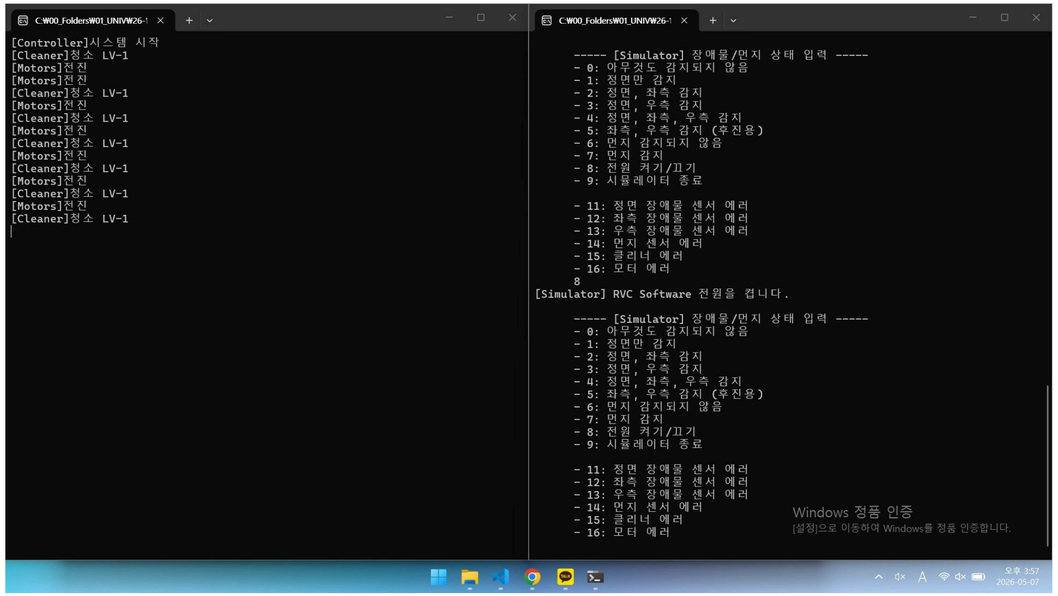
Positive	Negative
후진 후 좌측 장애물 감지	
후진 후 장애물 감지하지 않을 경우	
좌회전 시작 후 센서 값이 “전방+좌측”으로 바껴도 중단 없이 회전	
우회전 시작 후 센서 값이 “전방+우측”으로 바껴도 중단없이 회전	

System Test

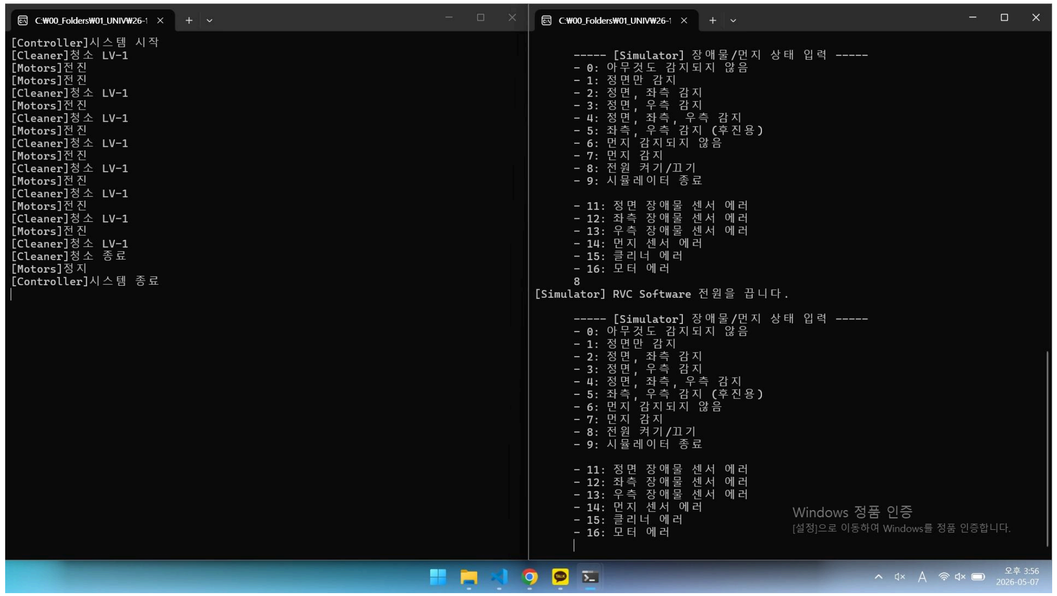
Test 수행 과정 및 결과

Test 수행 과정 및 결과

1. 전원 켜기

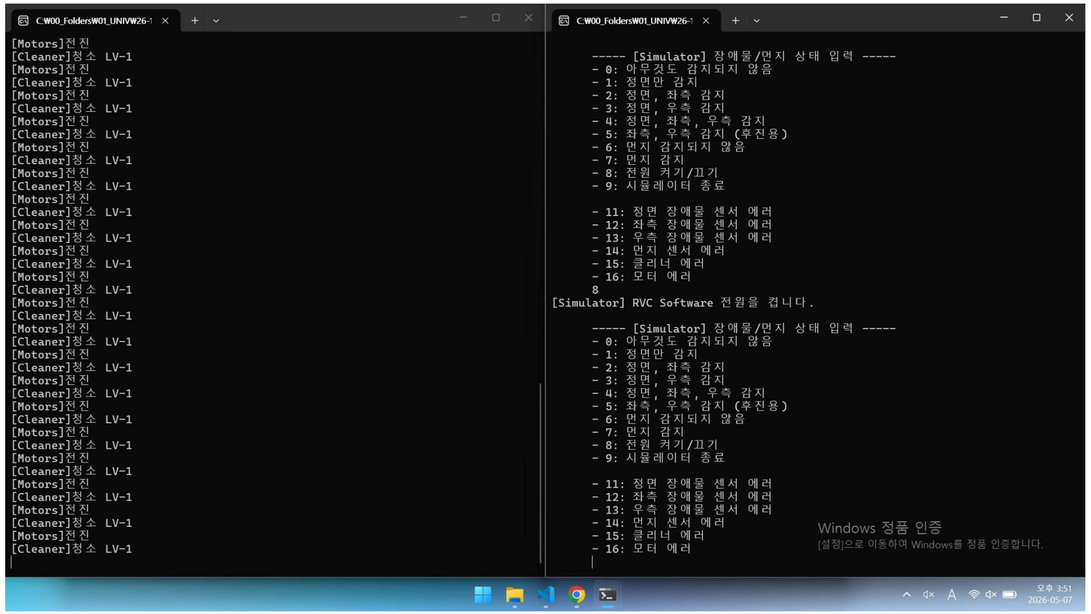


2. 전원 끄기

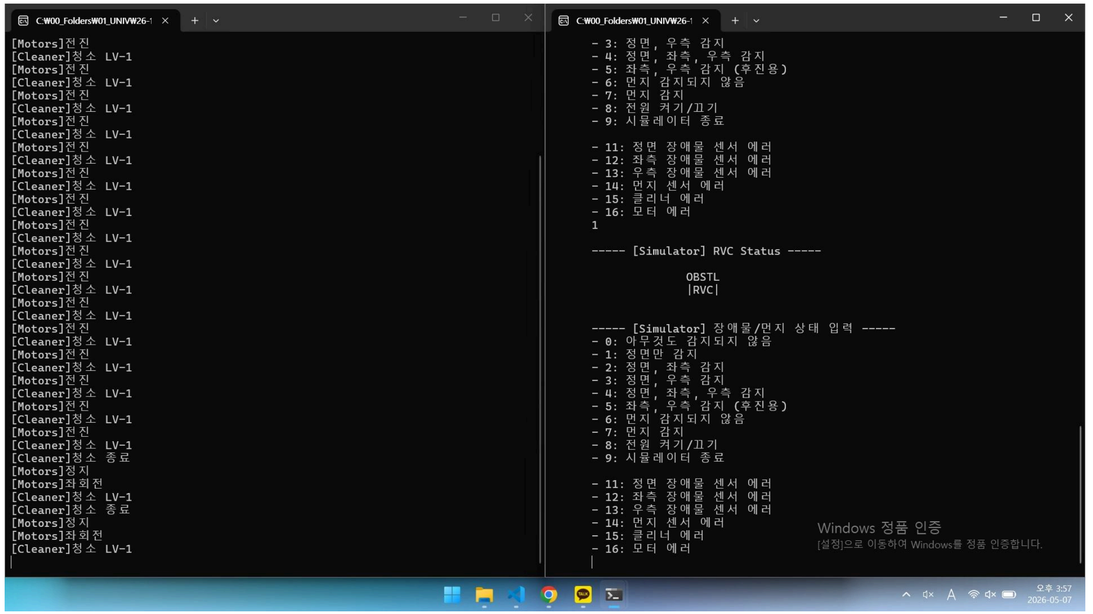


Test 수행 과정 및 결과

3. 기본 주행

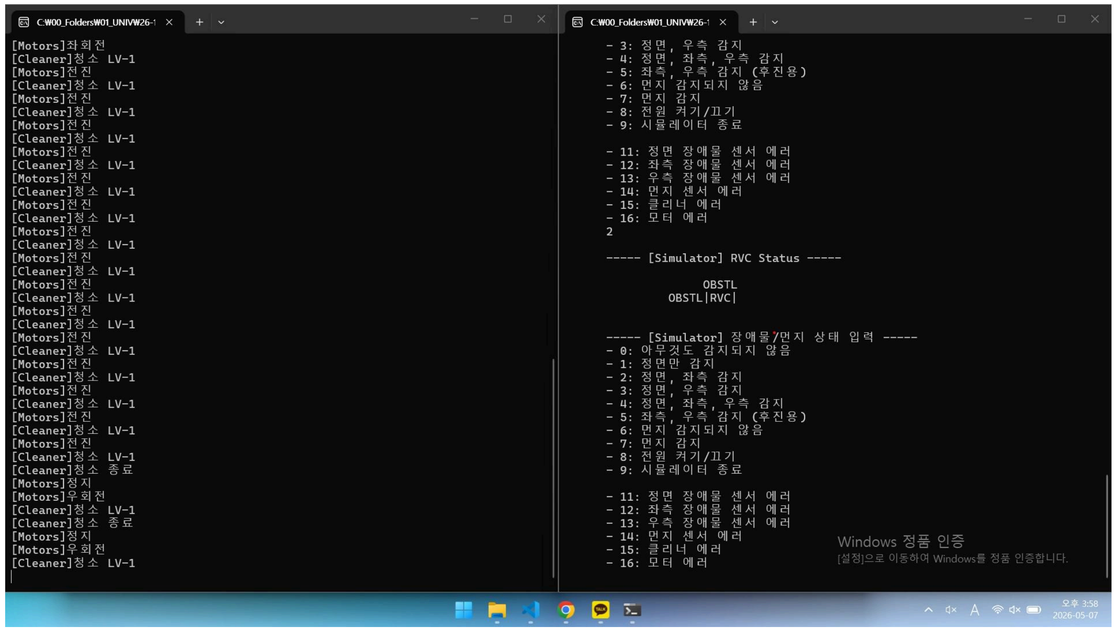


4. 전방 장애물 감지

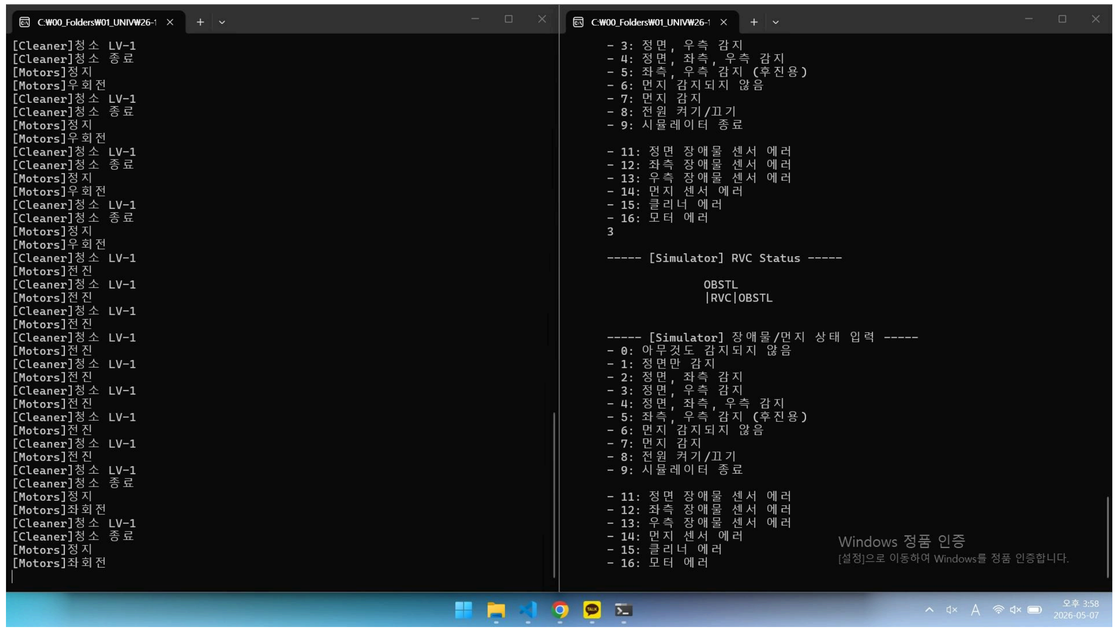


Test 수행 과정 및 결과

5. 전방, 좌측 장애물 감지

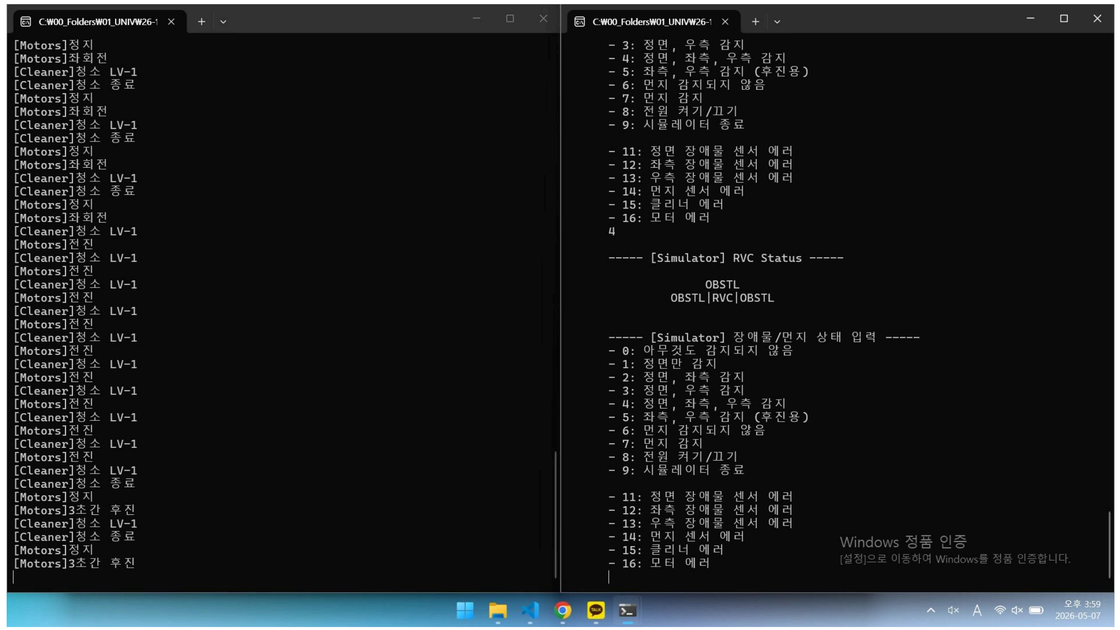


6. 전방, 우측 장애물 감지

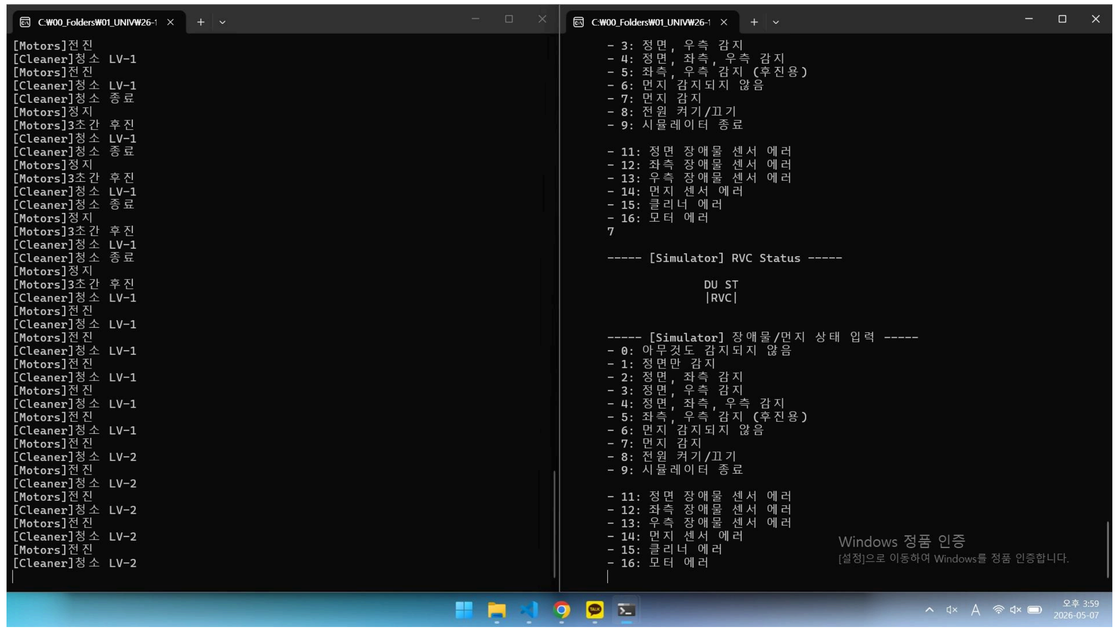


Test 수행 과정 및 결과

7. 전방, 좌우측 장애물 감지

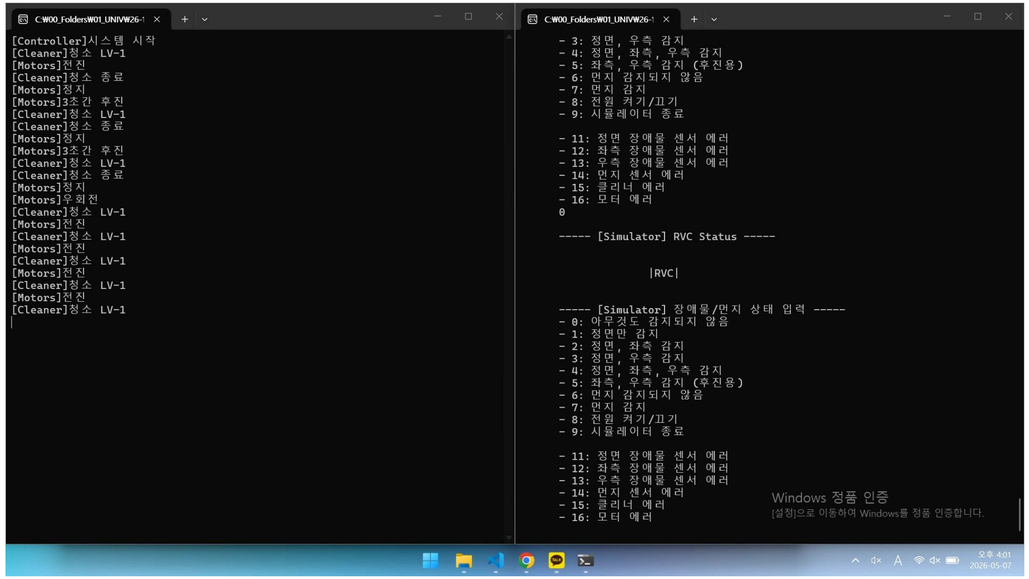


8. 먼지 감지

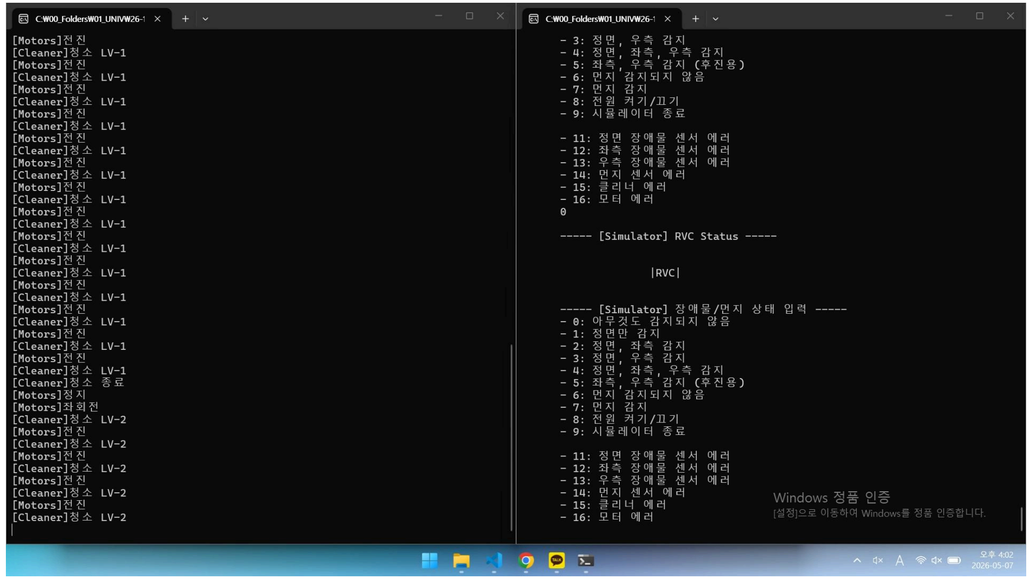


Test 수행 과정 및 결과

9. 후진 중 탈출

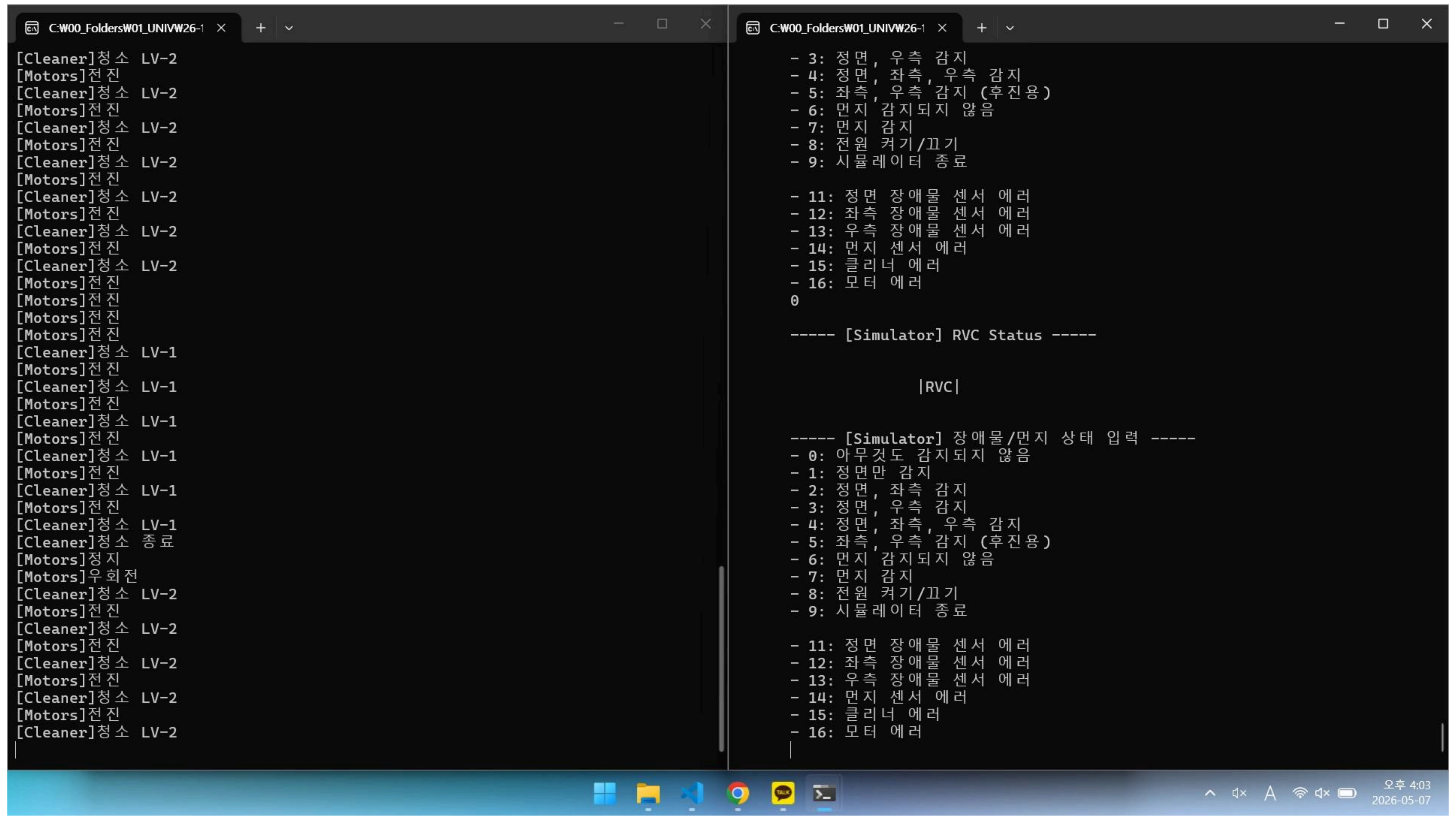


10. 전방 장애물 감지 및 먼지 감지

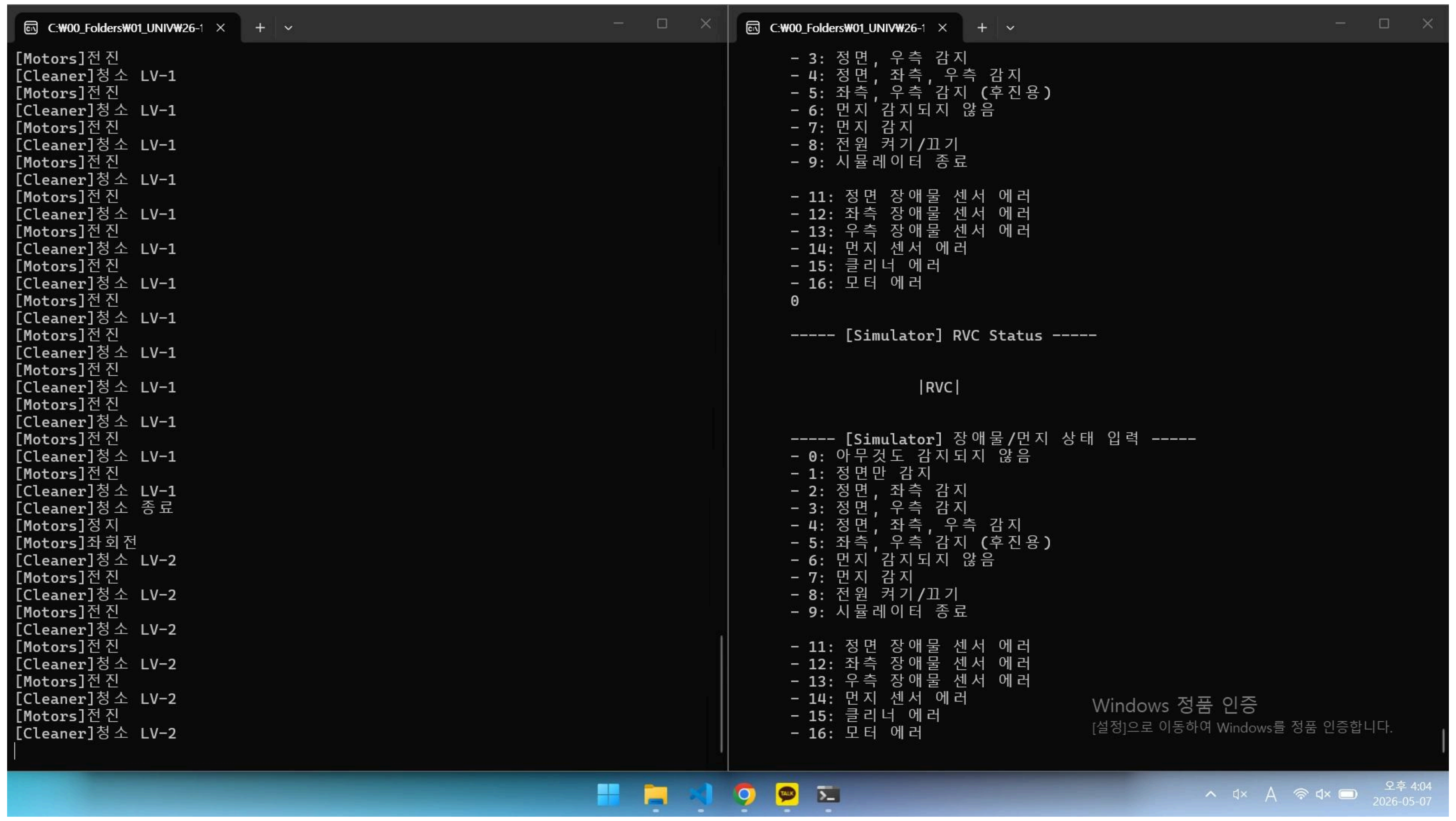


Test 수행 과정 및 결과

11. 전방, 좌측 장애물 감지 및 먼지 감지

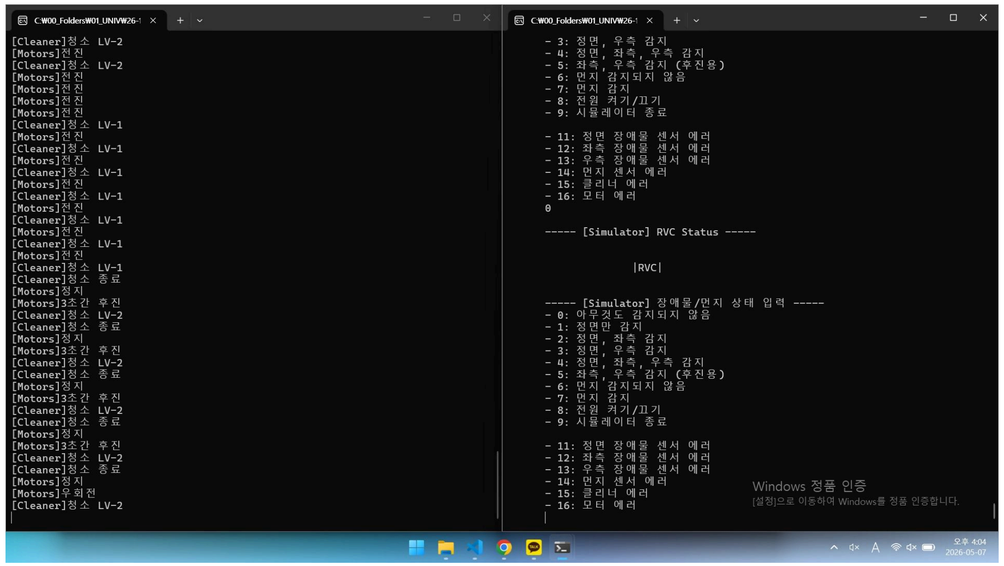


12. 전방, 우측 장애물 감지 및 먼지 감지

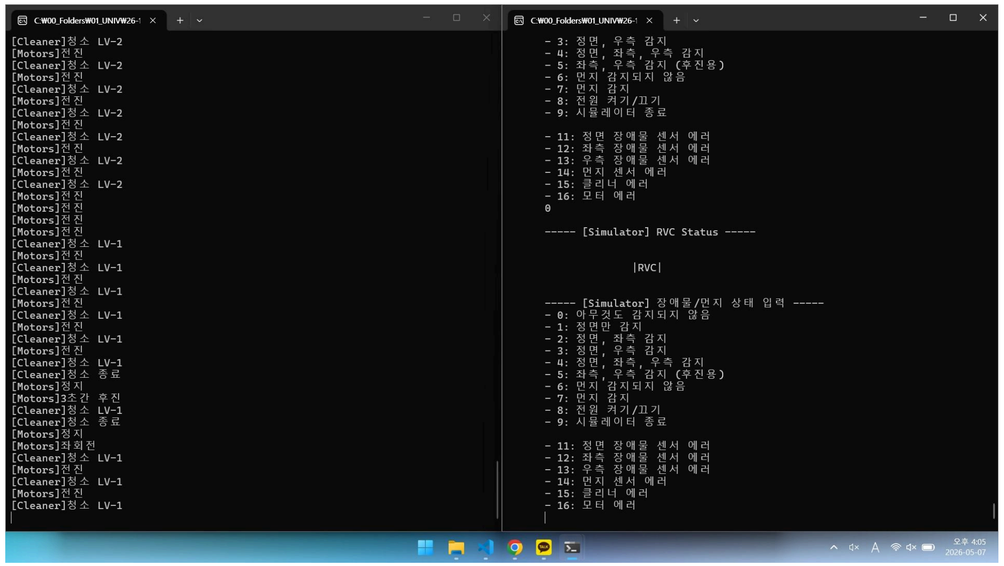


Test 수행 과정 및 결과

13. 전방, 좌우측 장애물 감지 및 먼지 감지

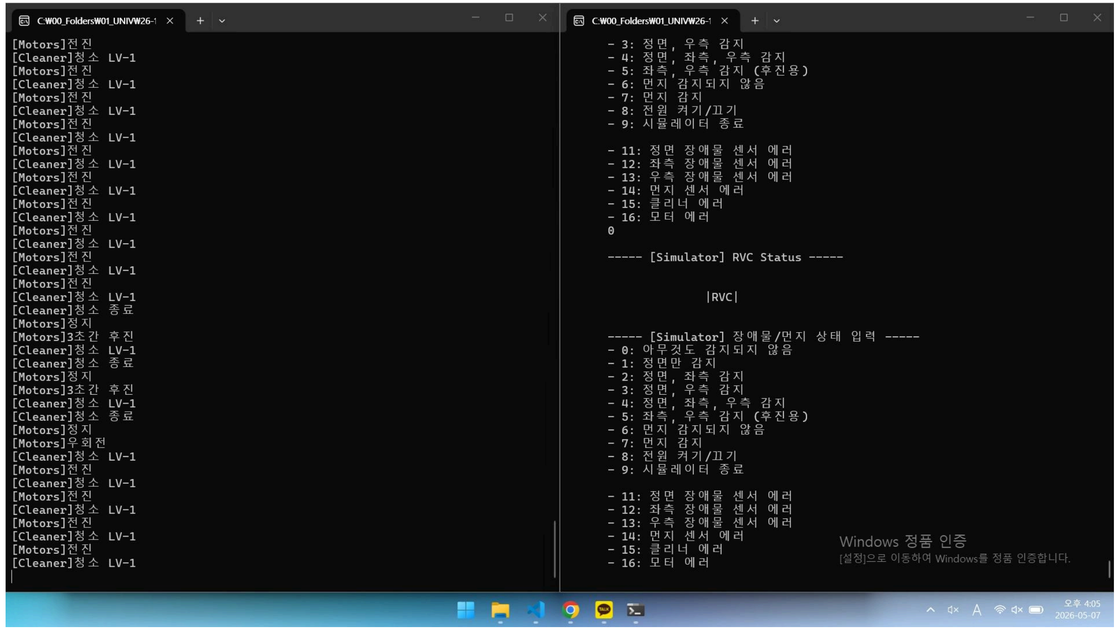


14. 후진 후 우측 장애물 감지

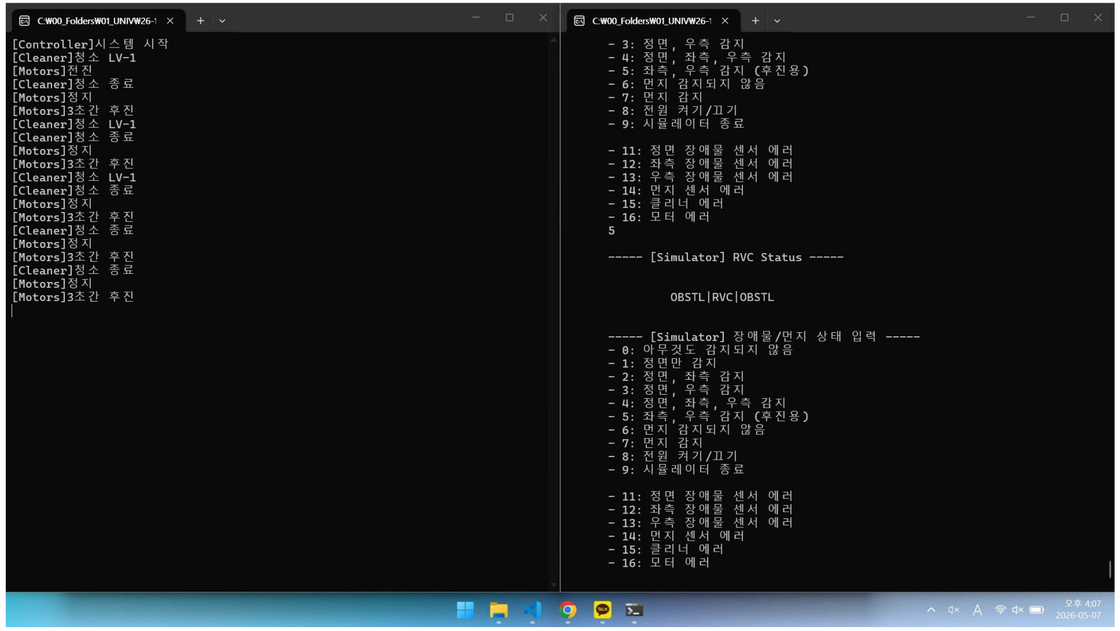


Test 수행 과정 및 결과

15. 후진 후 좌측 장애물 감지

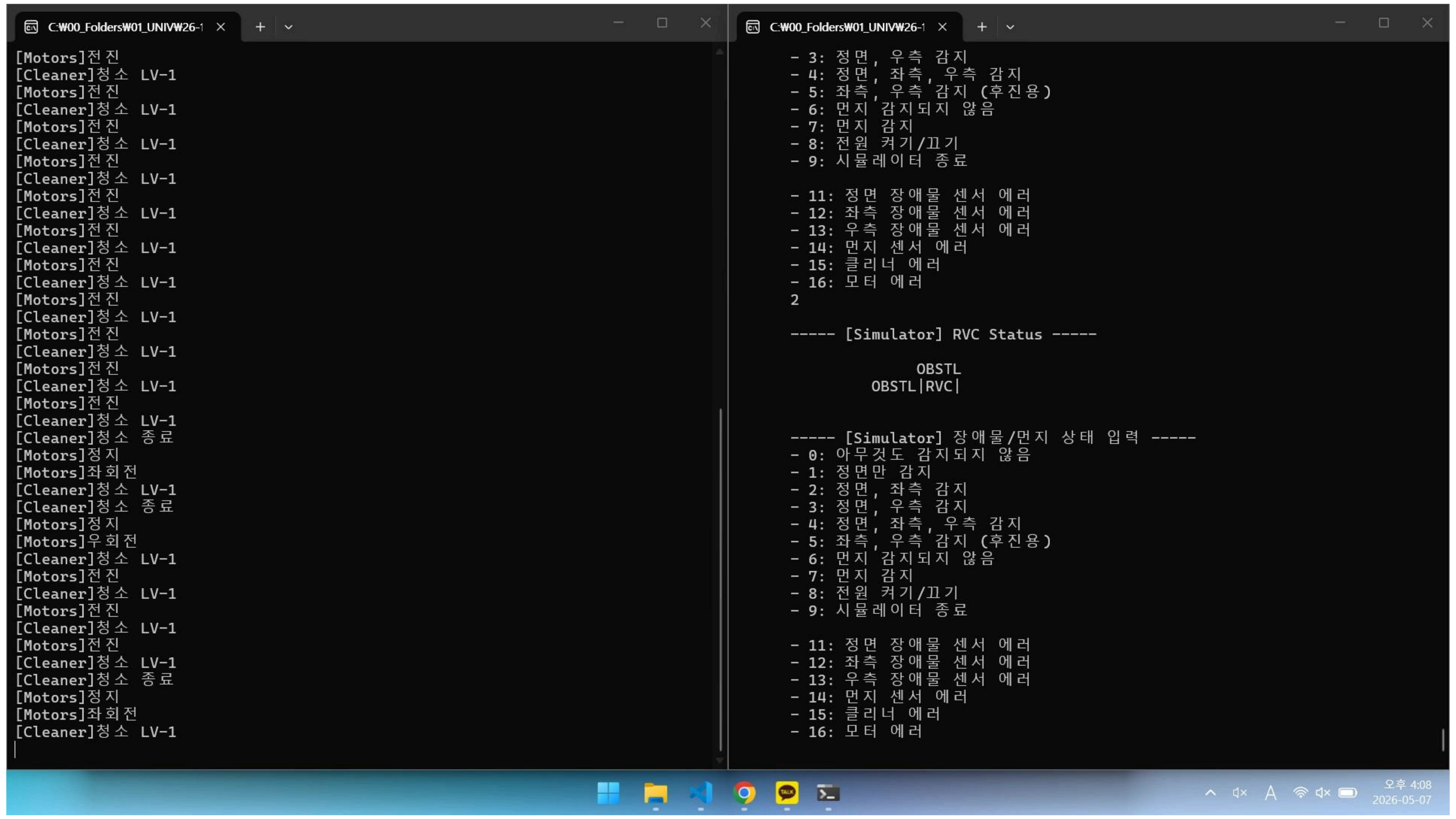


16. 후진 후 장애물 감지하지 않을 경우

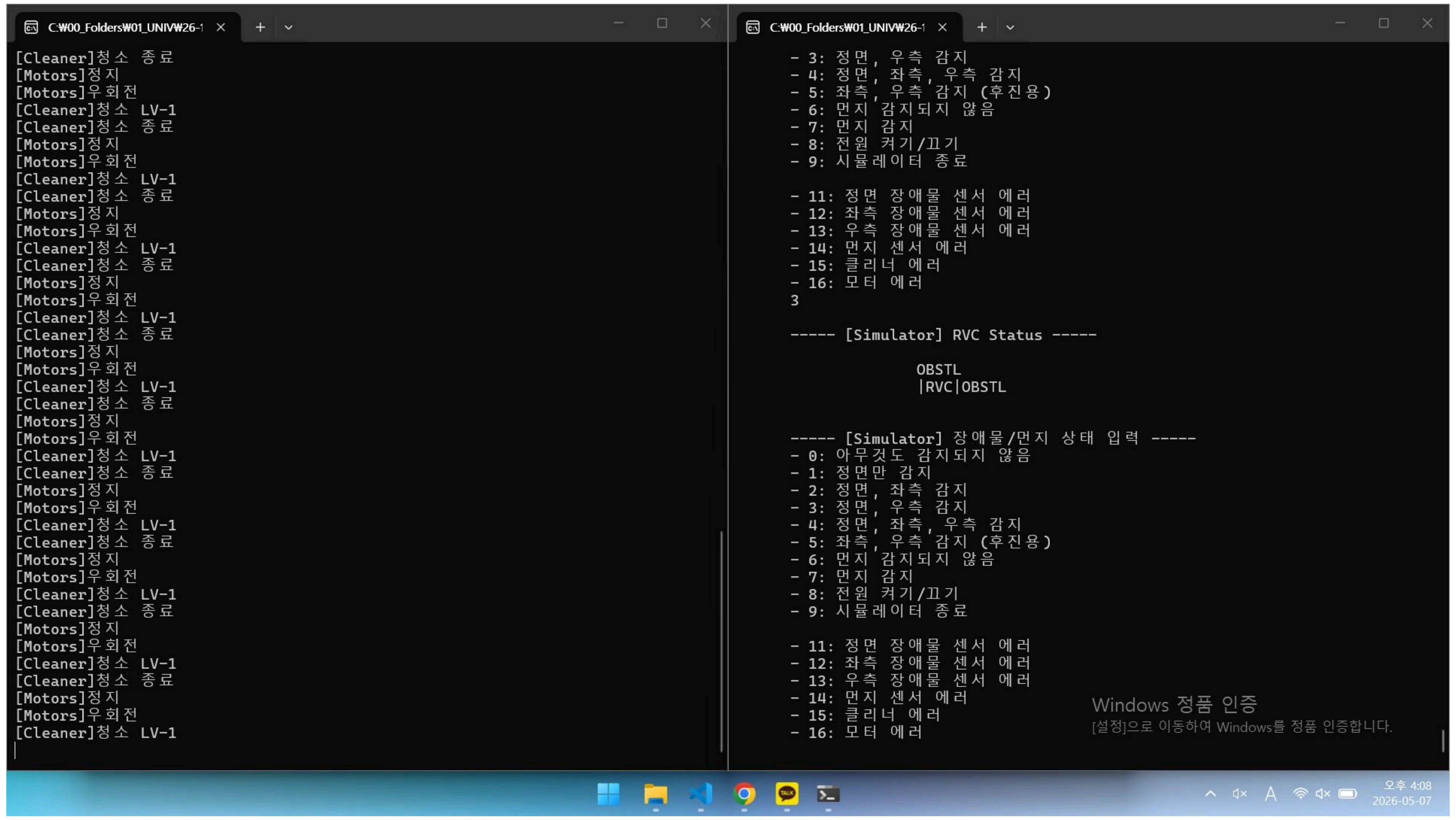


Test 수행 과정 및 결과

17. 좌회전 시작 후 센서 값이 “전방+좌측”으로 바껴도 중단 없이 회전

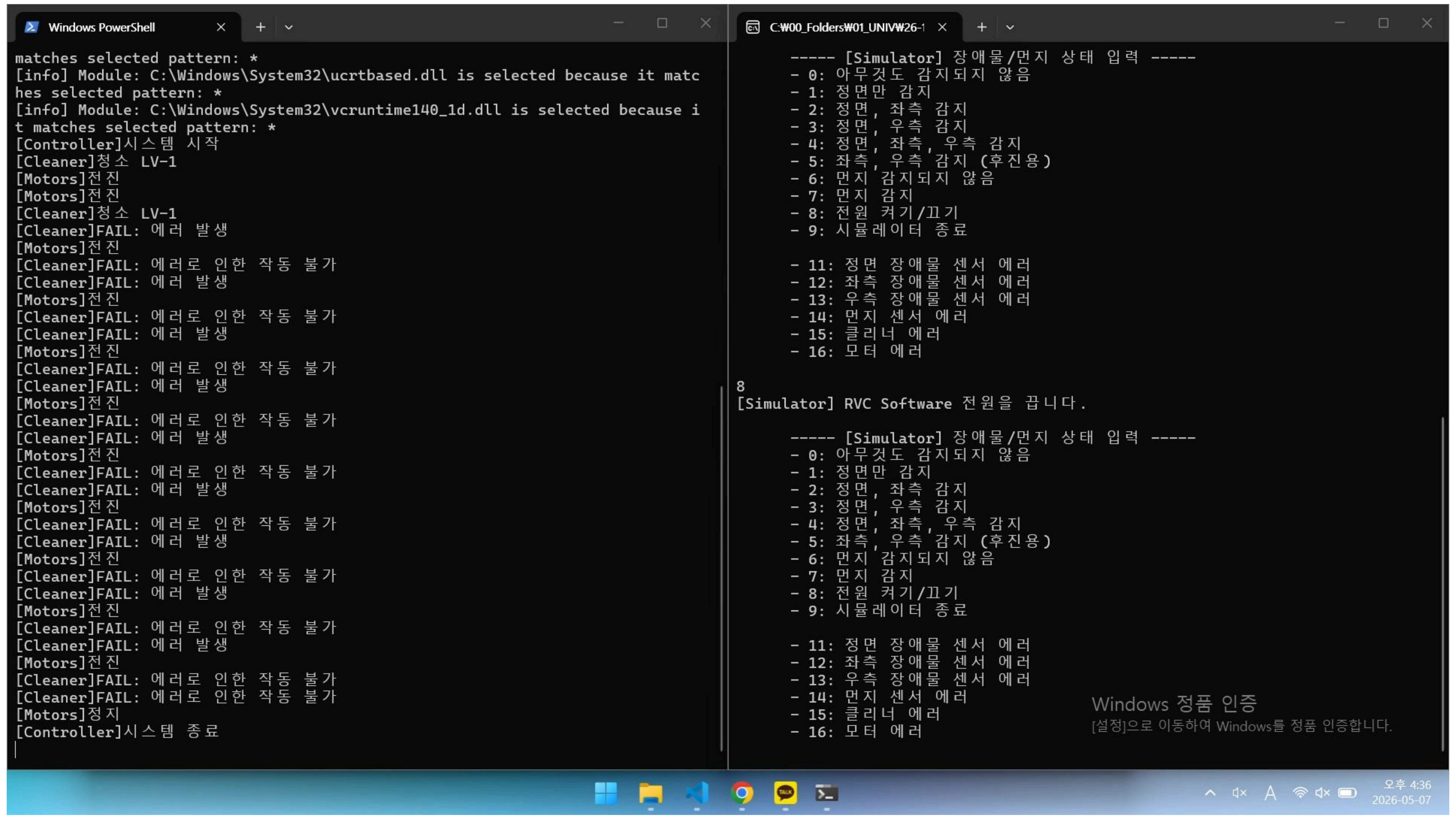


18. 우회전 시작 후 센서 값이 “전방+우측”으로 바껴도 중단없이 회전

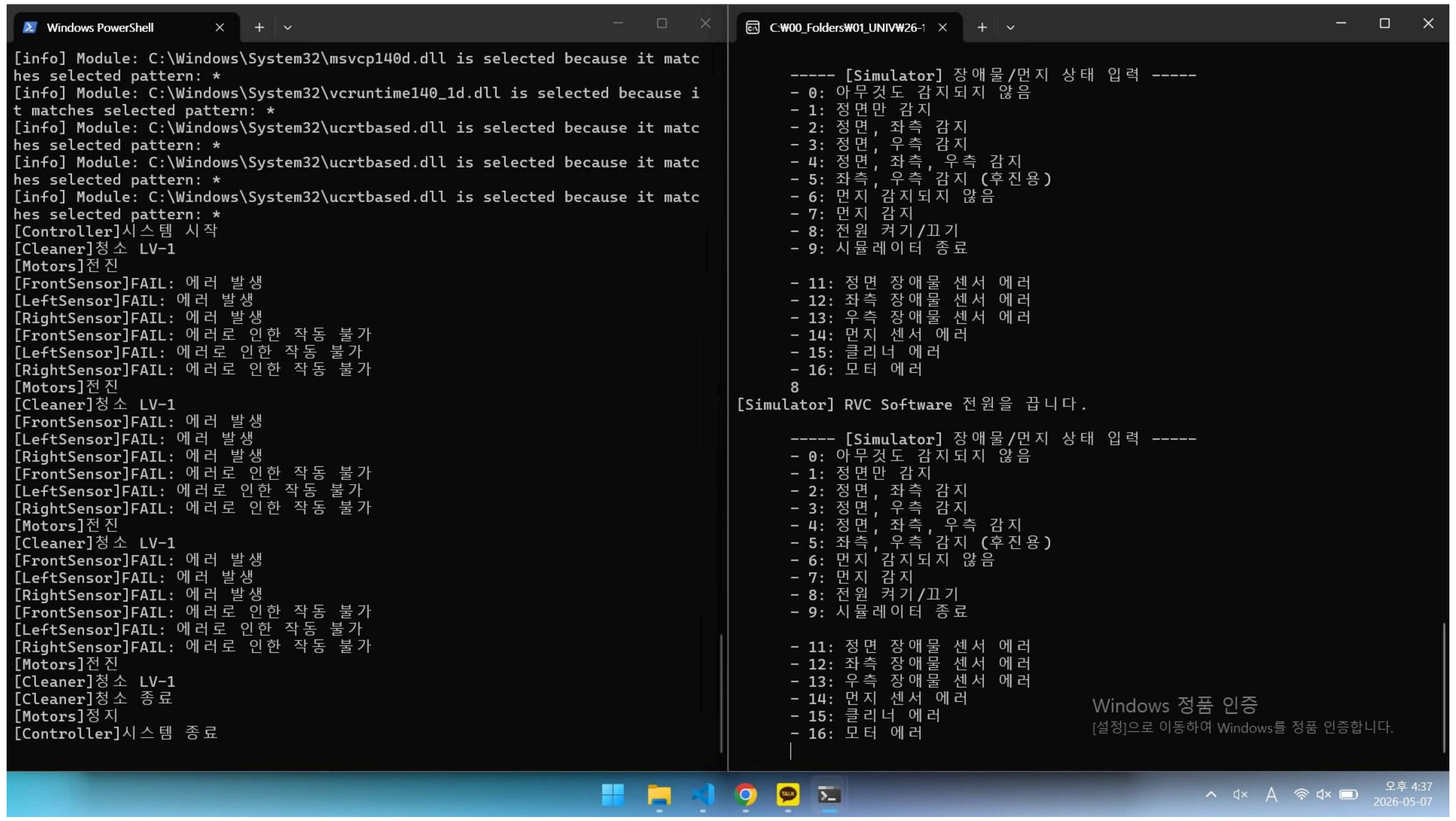


Test 수행 과정 및 결과

19. 전원 켜는 중 클리너 오작동으로 전진만 수행

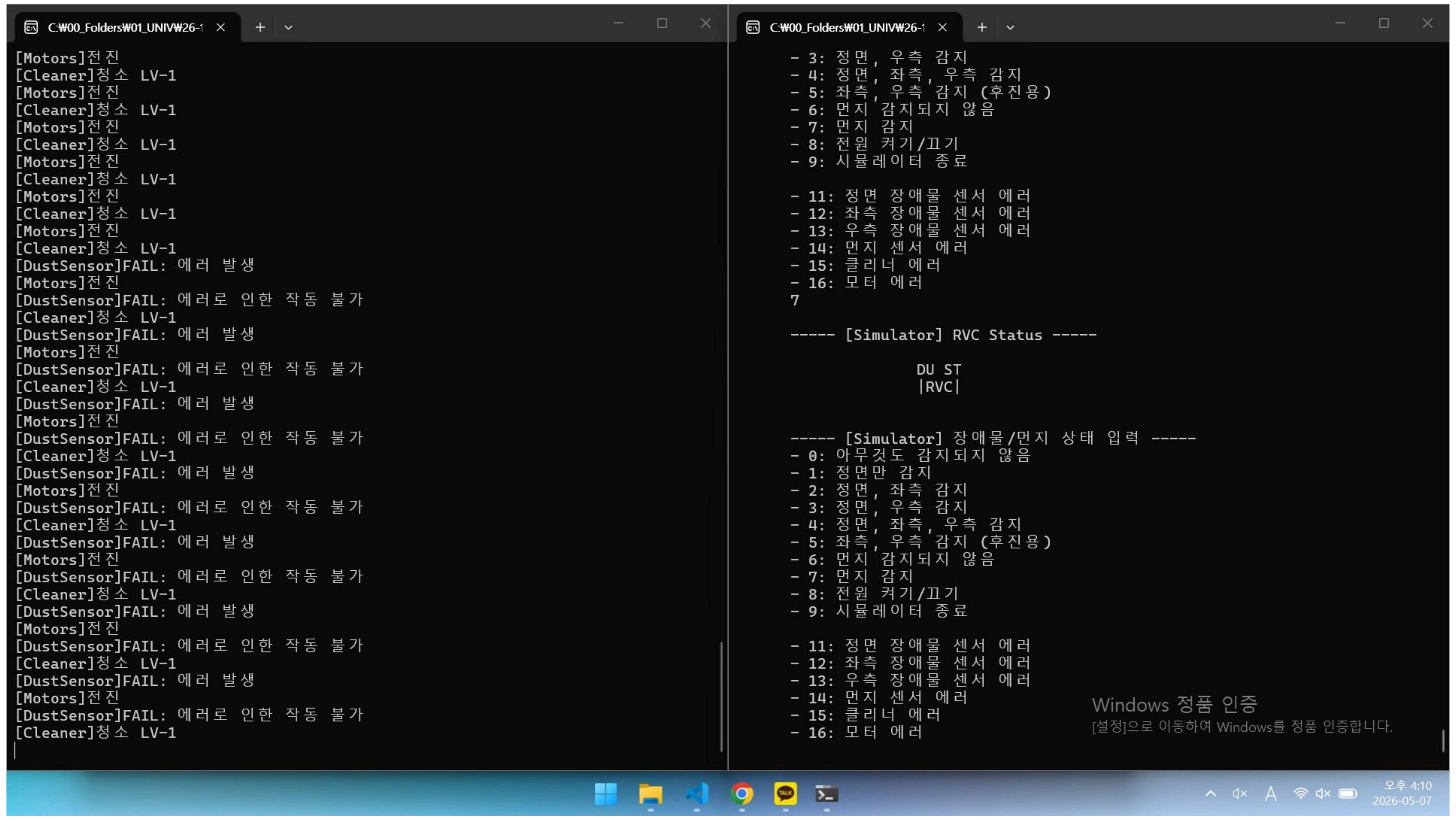


20. 전원 켜는 중 전체 장애물 센서 고장으로 전진만 수행

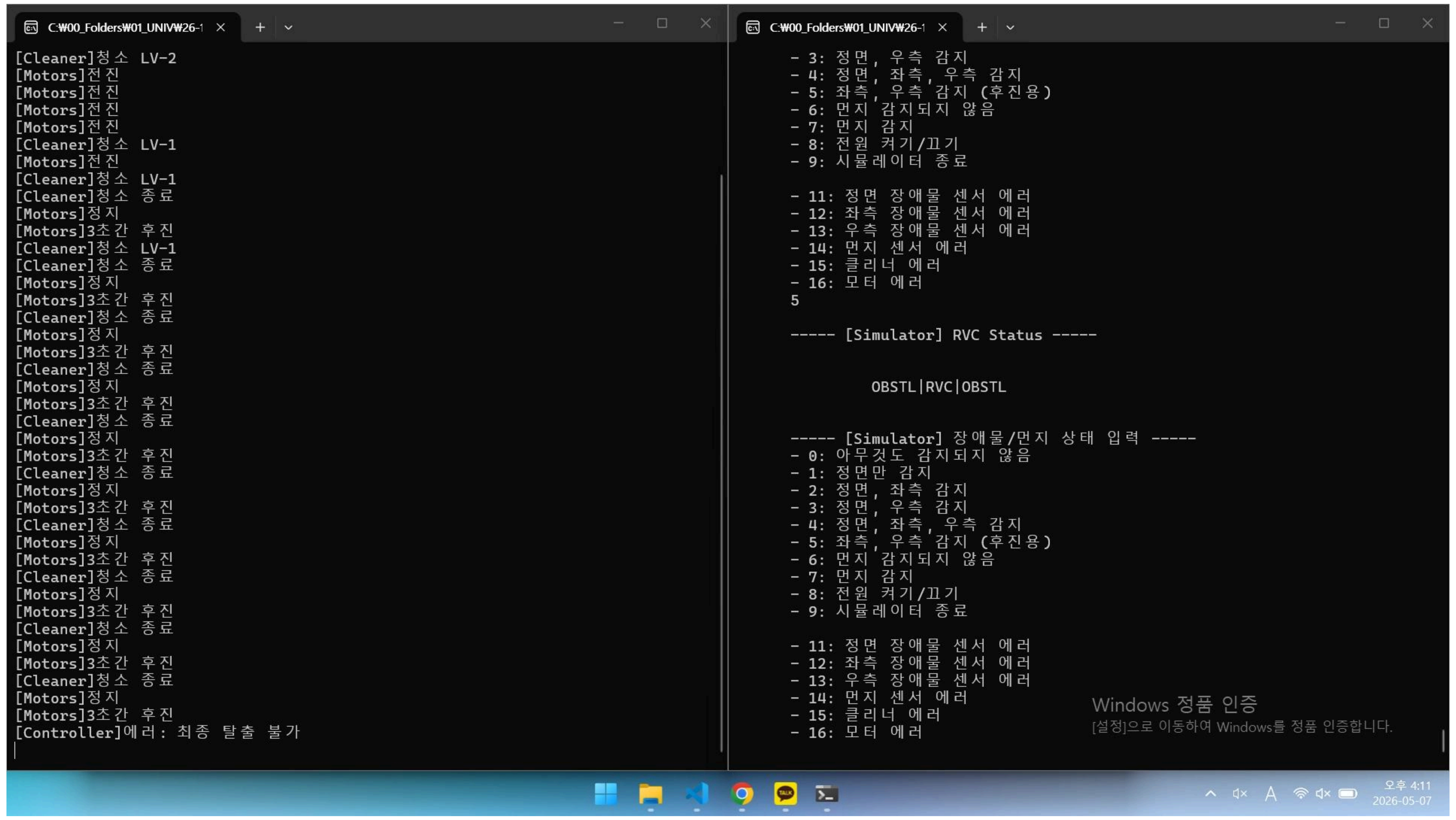


Test 수행 과정 및 결과

21. 먼지 흡입 후 power up 유지

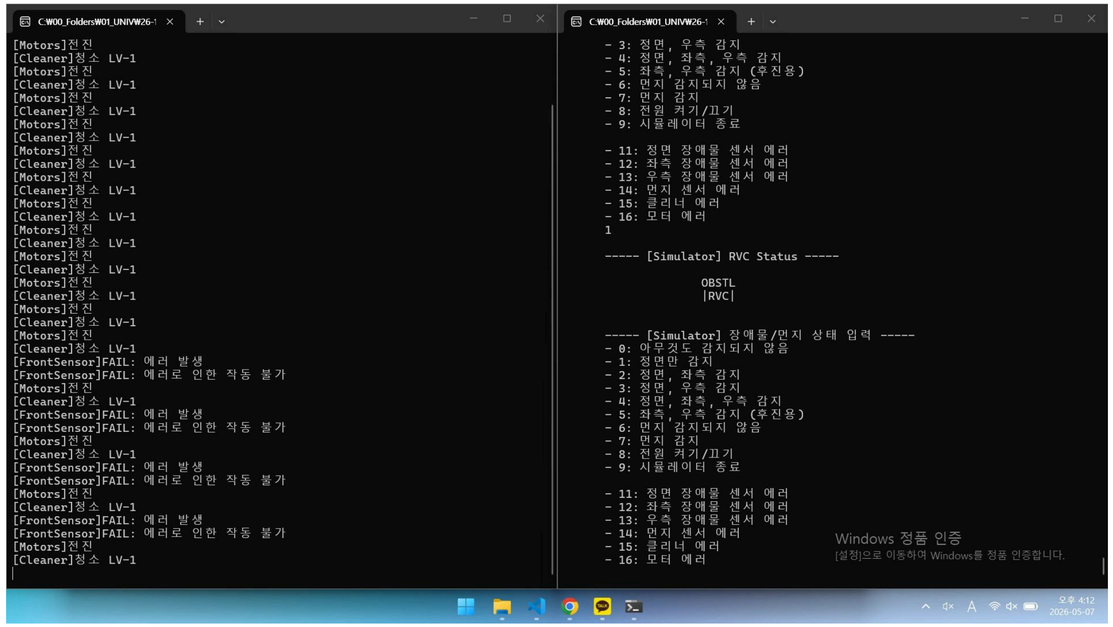


22. 최종 탈출 불가

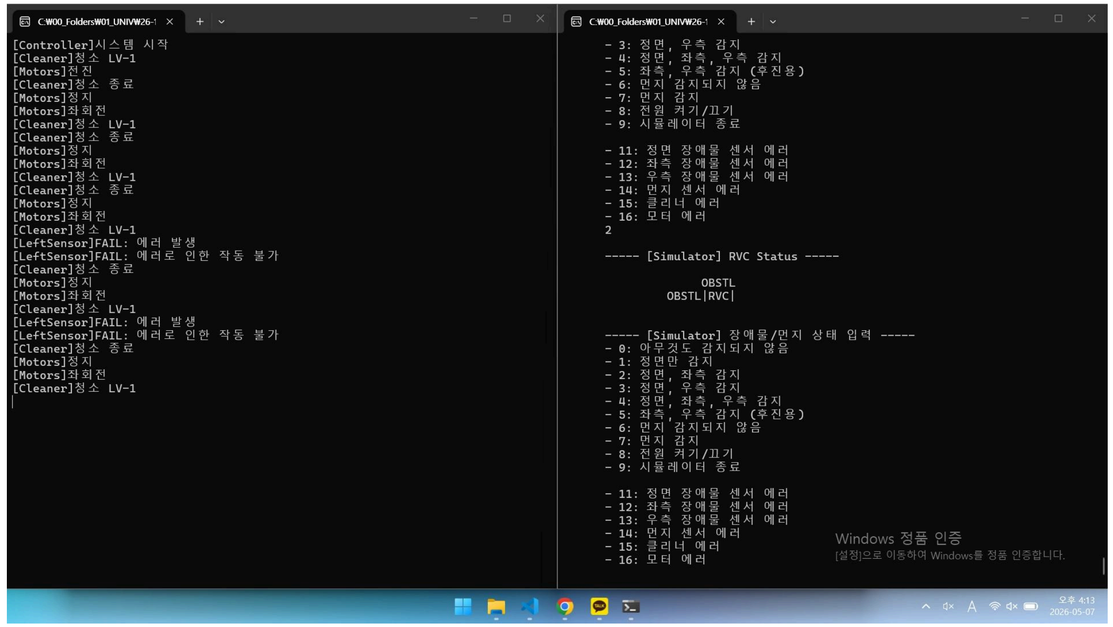


Test 수행 과정 및 결과

23. 전방 장애물 감지 실패

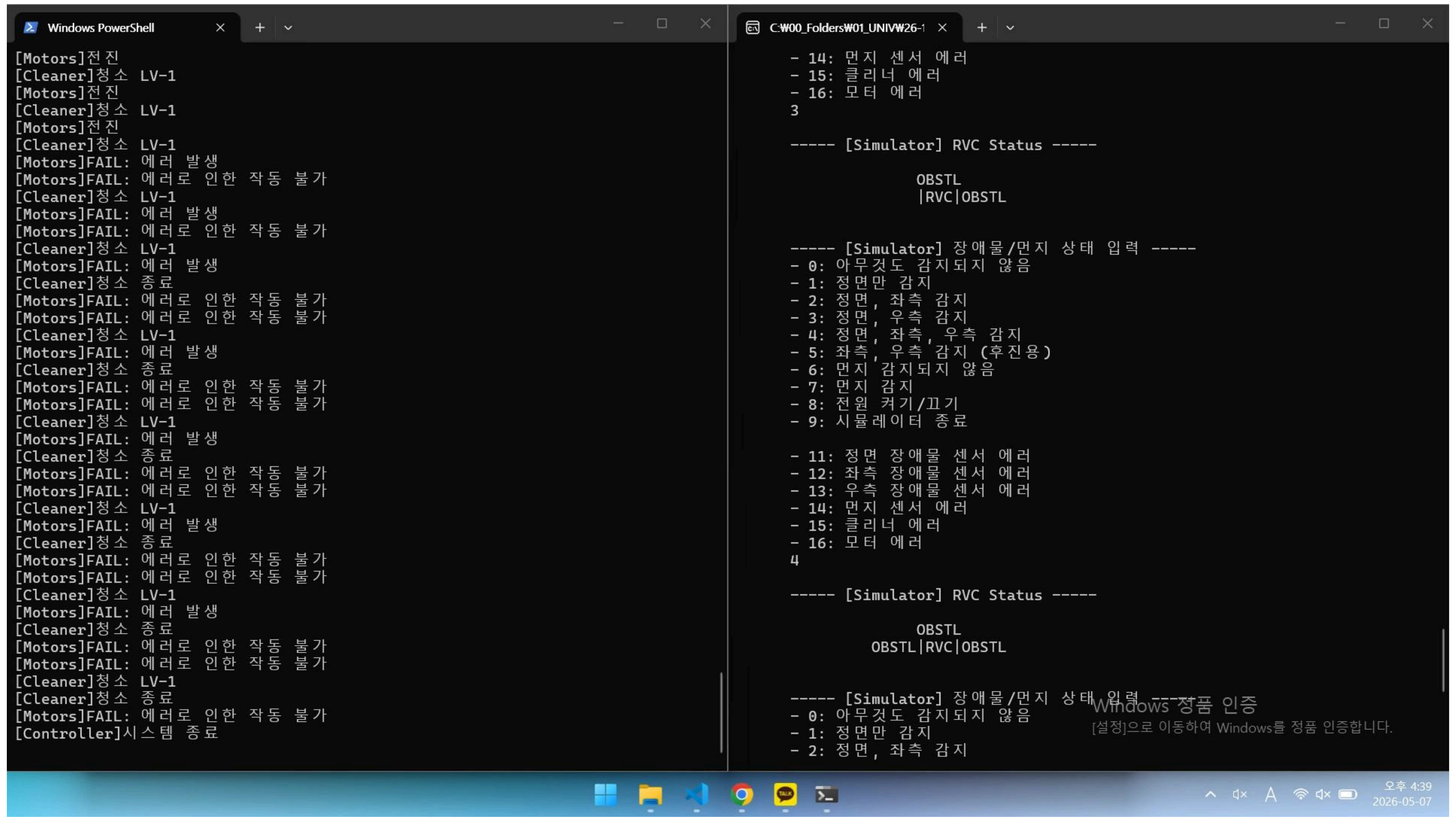


24. 좌측 장애물 감지 실패 (논리 상 우회전 불가로 좌회전)

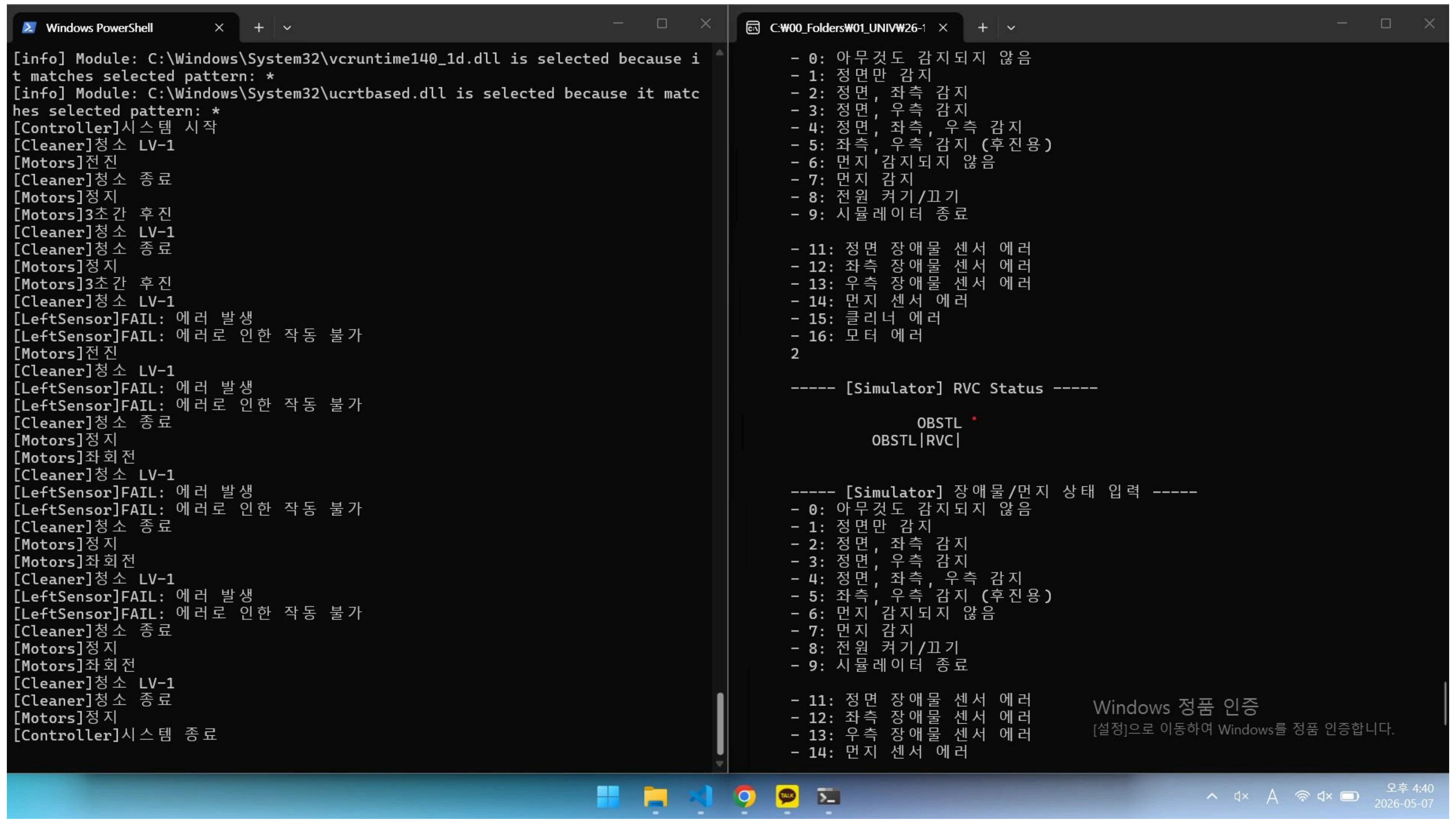


Test 수행 과정 및 결과

25. 모터 에러 (장애물 감지에도 이동 불능)

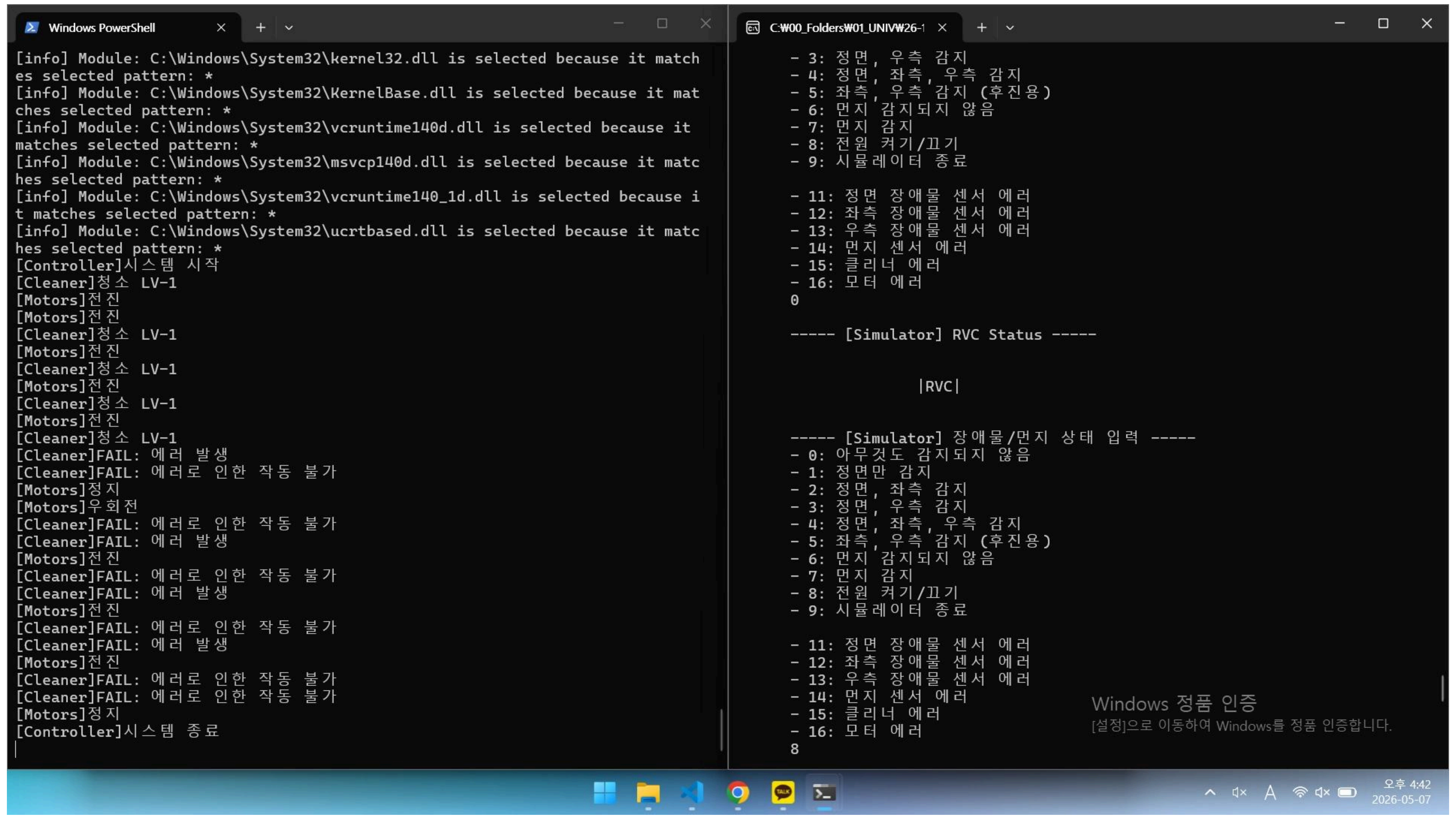


26. 좌회전 시작 후 우측 센서 고장

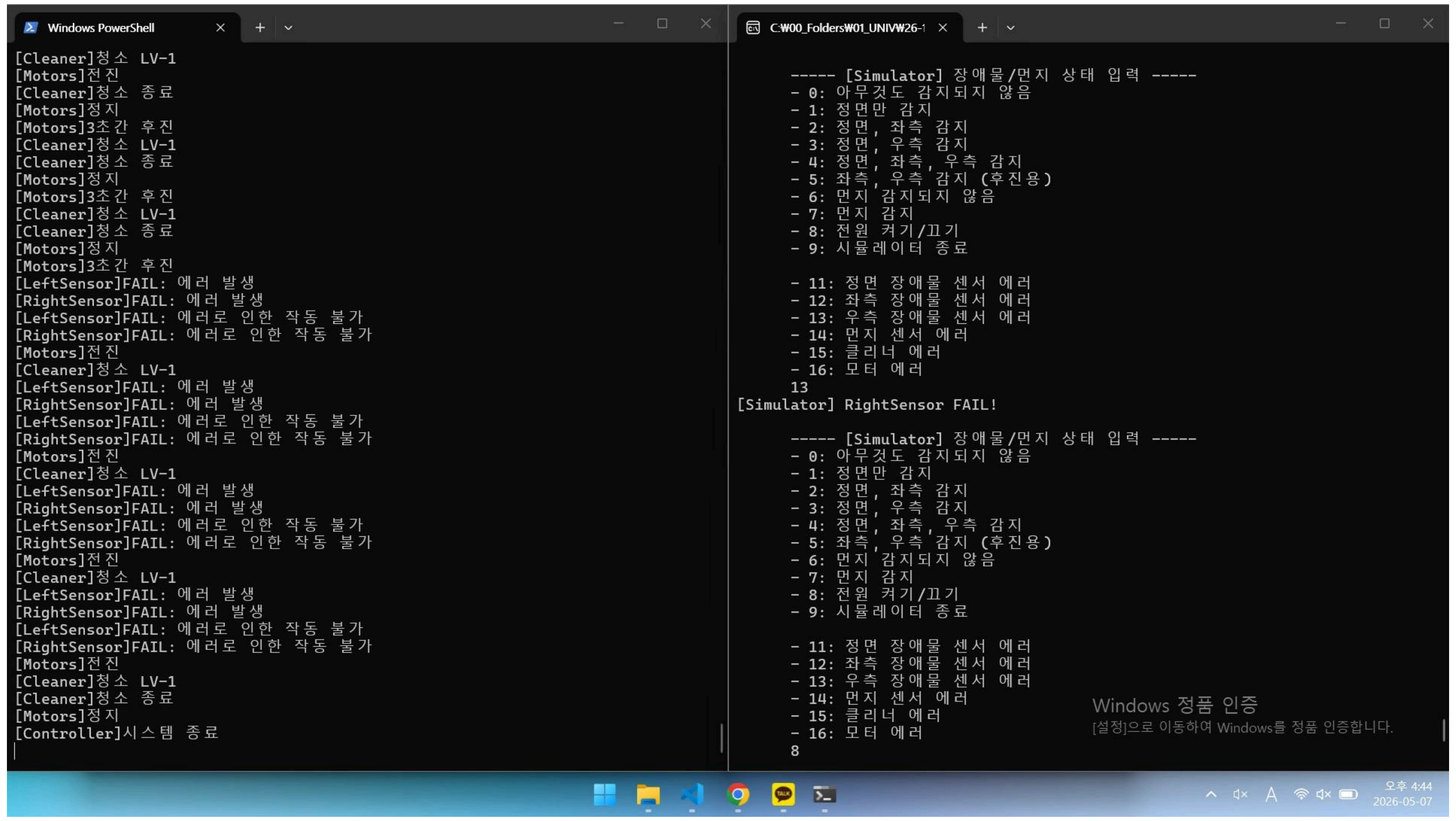


Test 수행 과정 및 결과

27. 우회전 시작 후 cleaner 고장으로 청소 재개 불가

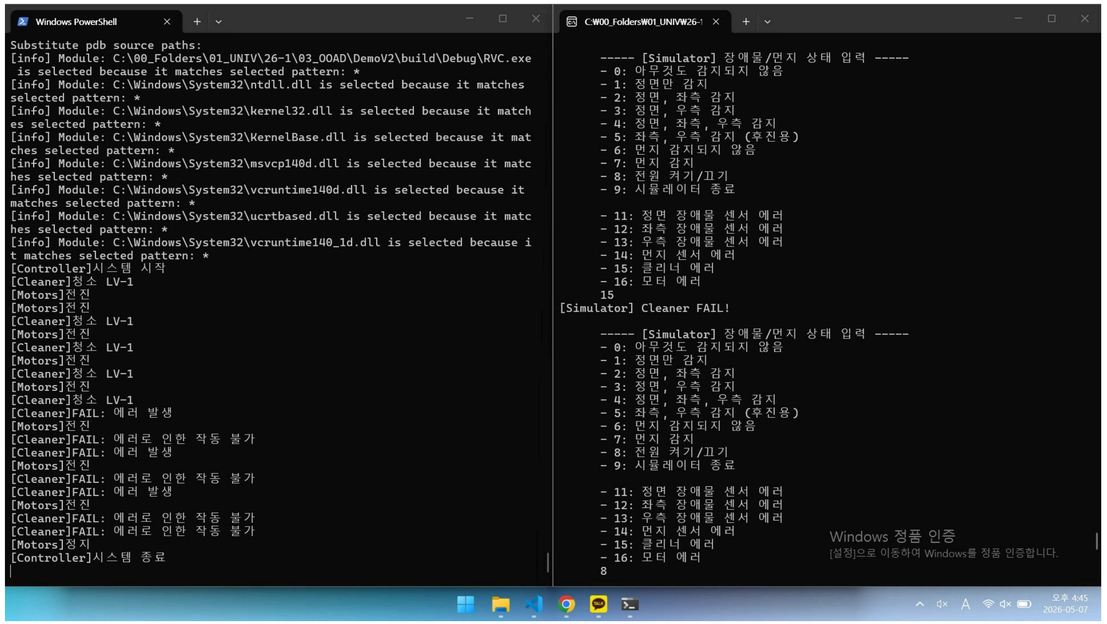


28. 후진 중 좌,우측 센서 고장으로 전진

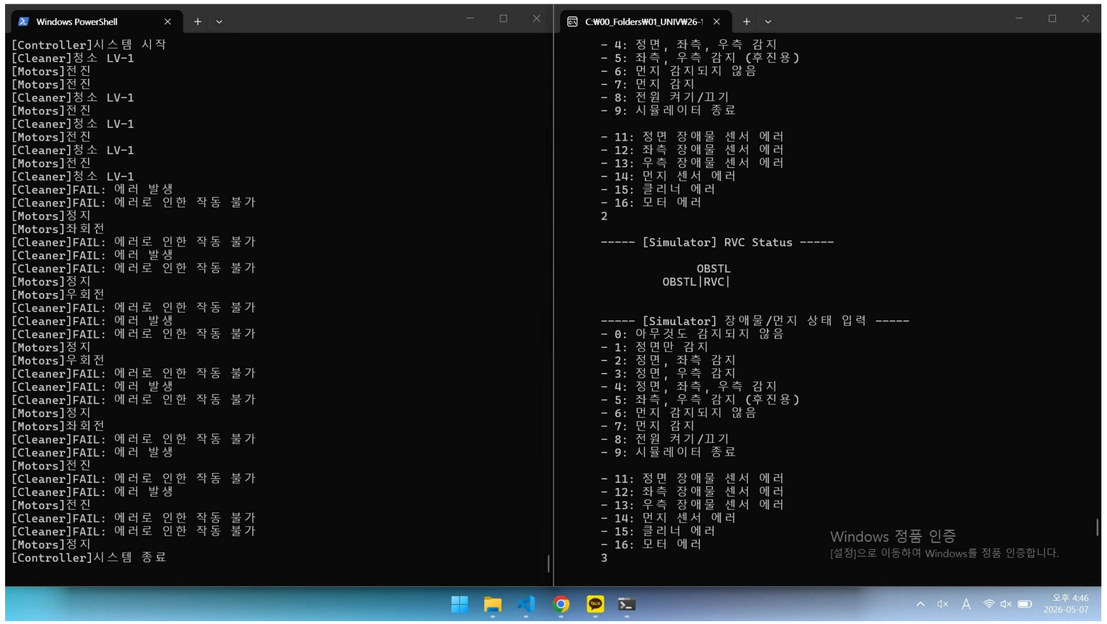


Test 수행 과정 및 결과

29. 주행 중 청소 불가



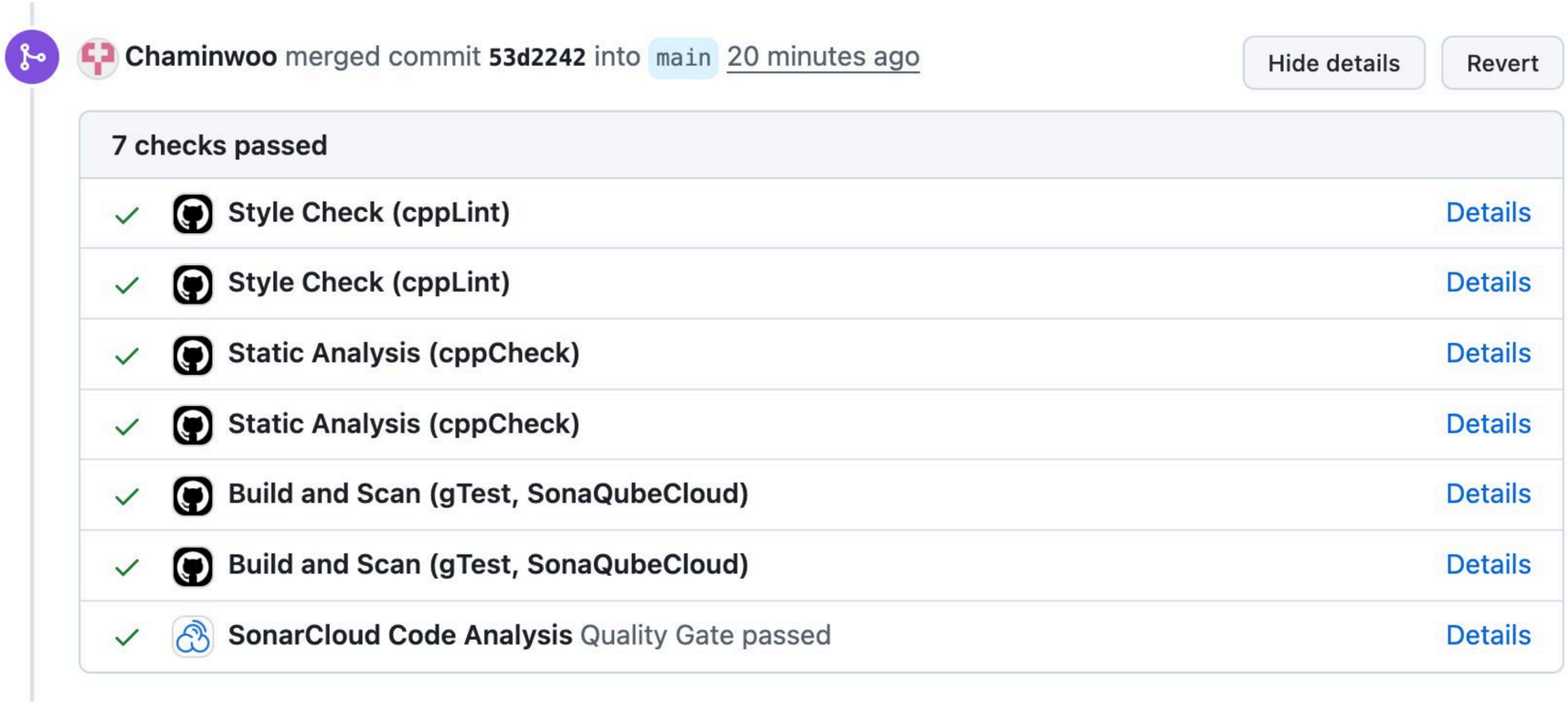
30. 회전 후 청소 불가



Static Code Analysis

정적분석 수행

정적분석 수행

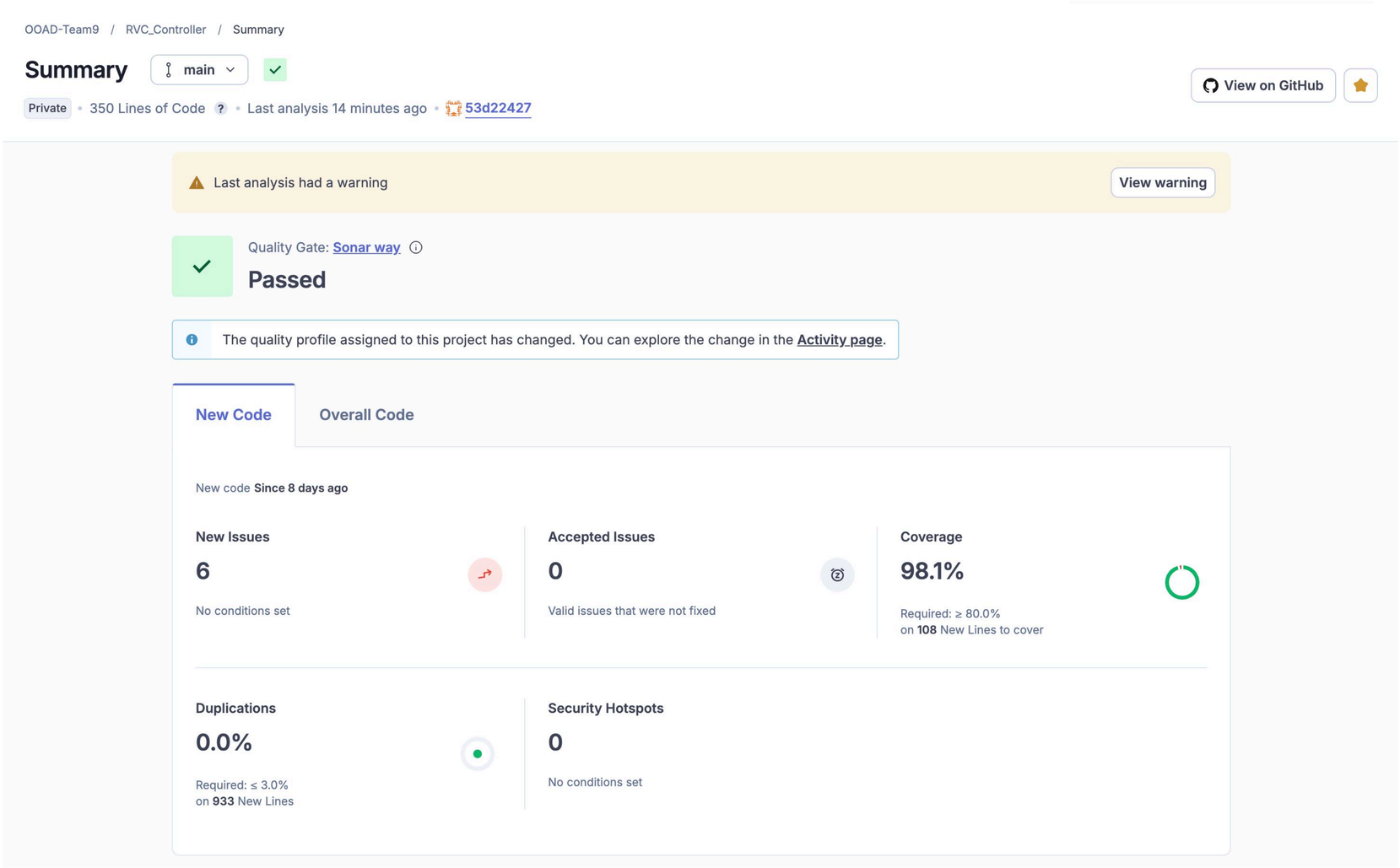


< cppLint & cppCheck & SonaQubeCloud >

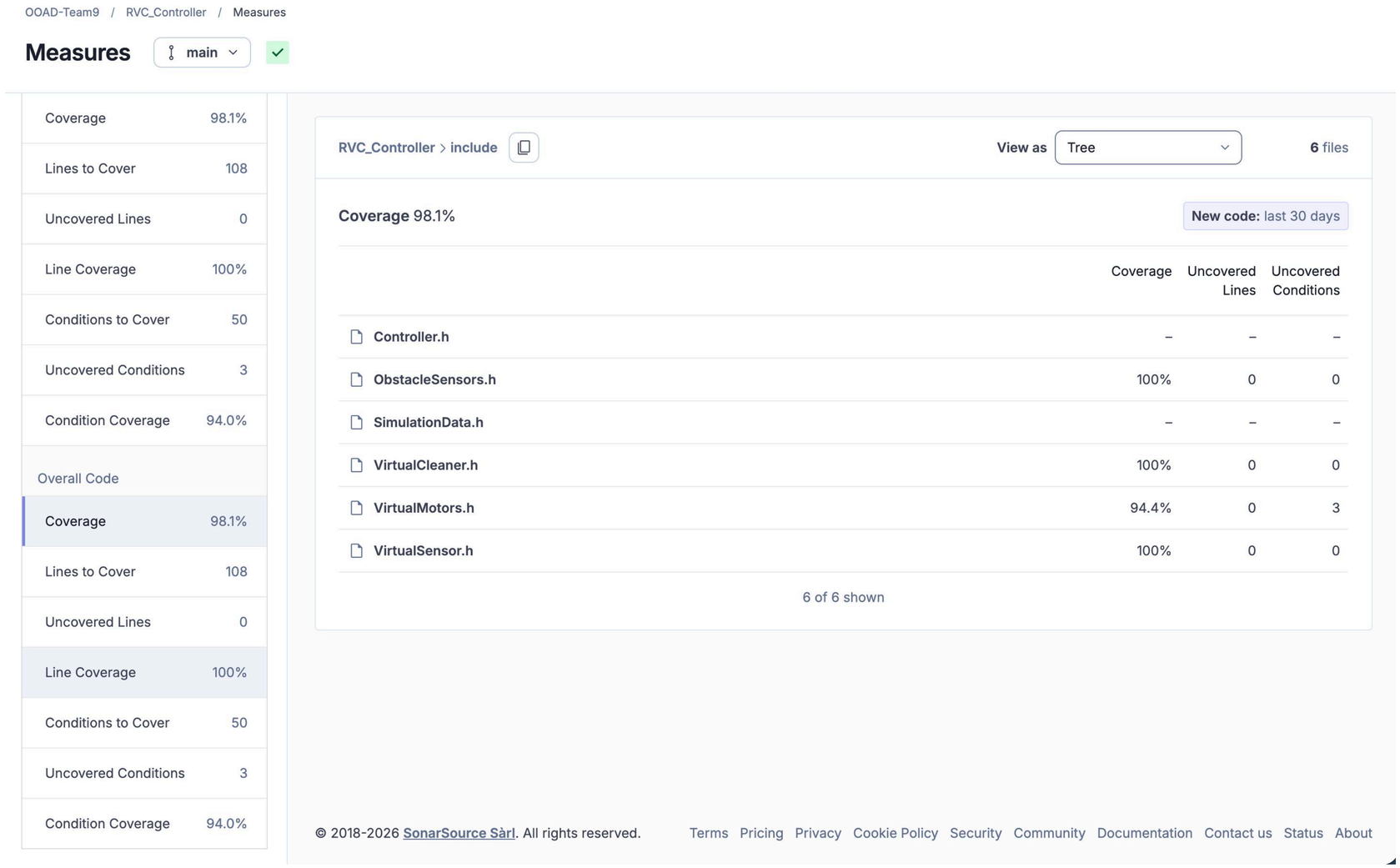
Static Code Analysis

수행 결과

수행 결과


OOAD-Team9 / RVC_Controller / Summary
Summary
main
Private • 350 Lines of Code • Last analysis 14 minutes ago • 53d22427
View on GitHub
Last analysis had a warning
View warning
Quality Gate: Sonar way
Passed
The quality profile assigned to this project has changed. You can explore the change in the Activity page.
New Code
Overall Code
New code Since 8 days ago
New Issues
6
No conditions set
Accepted Issues
0
Valid issues that were not fixed
Coverage
98.1%
Required: ≥ 80.0%
on 108 New Lines to cover
Duplications
0.0%
Required: ≤ 3.0%
on 933 New Lines
Security Hotspots
0
No conditions set

수행 결과


OOAD-Team9 / RVC_Controller / Measures
Measures
main
Coverage 98.1%
Lines to Cover 108
Uncovered Lines 0
Line Coverage 100%
Conditions to Cover 50
Uncovered Conditions 3
Condition Coverage 94.0%
Overall Code
Coverage 98.1%
Lines to Cover 108
Uncovered Lines 0
Line Coverage 100%
Conditions to Cover 50
Uncovered Conditions 3
Condition Coverage 94.0%
RVC_Controller > include
View as Tree
6 files
Coverage 98.1%
New code: last 30 days
Coverage
Uncovered Lines
Uncovered Conditions
Controller.h – – –
ObstacleSensors.h 100% 0 0
SimulationData.h – – –
VirtualCleaner.h 100% 0 0
VirtualMotors.h 94.4% 0 3
VirtualSensor.h 100% 0 0
6 of 6 shown
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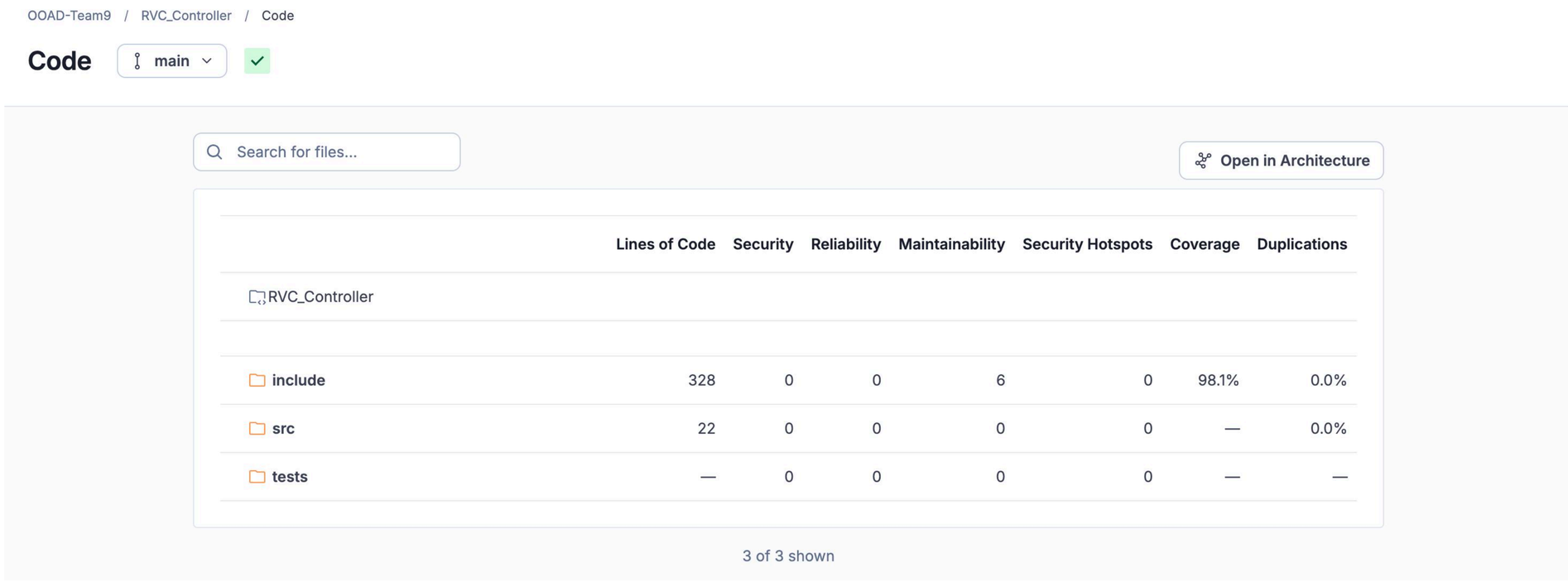
수행 결과


OOAD-Team9 / RVC_Controller / Code
Code
main
Search for files...
Open in Architecture
Lines of Code
Security
Reliability
Maintainability
Security Hotspots
Coverage
Duplications
RVC_Controller
include 328 0 0 6 0 98.1% 0.0%
src 22 0 0 0 0 — 0.0%
tests — 0 0 0 0 — —
3 of 3 shown

감사합니다.