



객체지향개발방법론

1팀 4주차 발표

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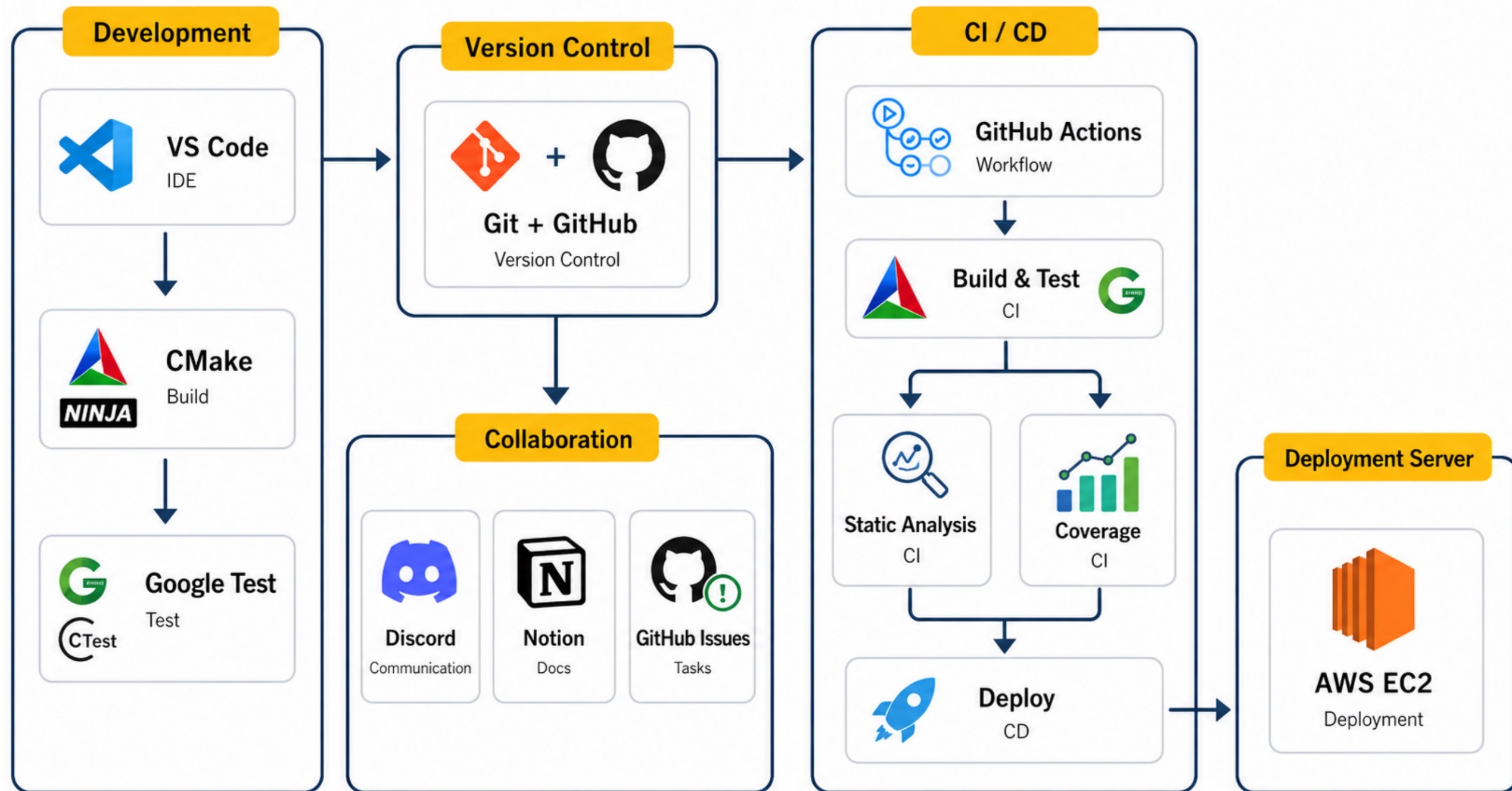
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Review & Analysis Report

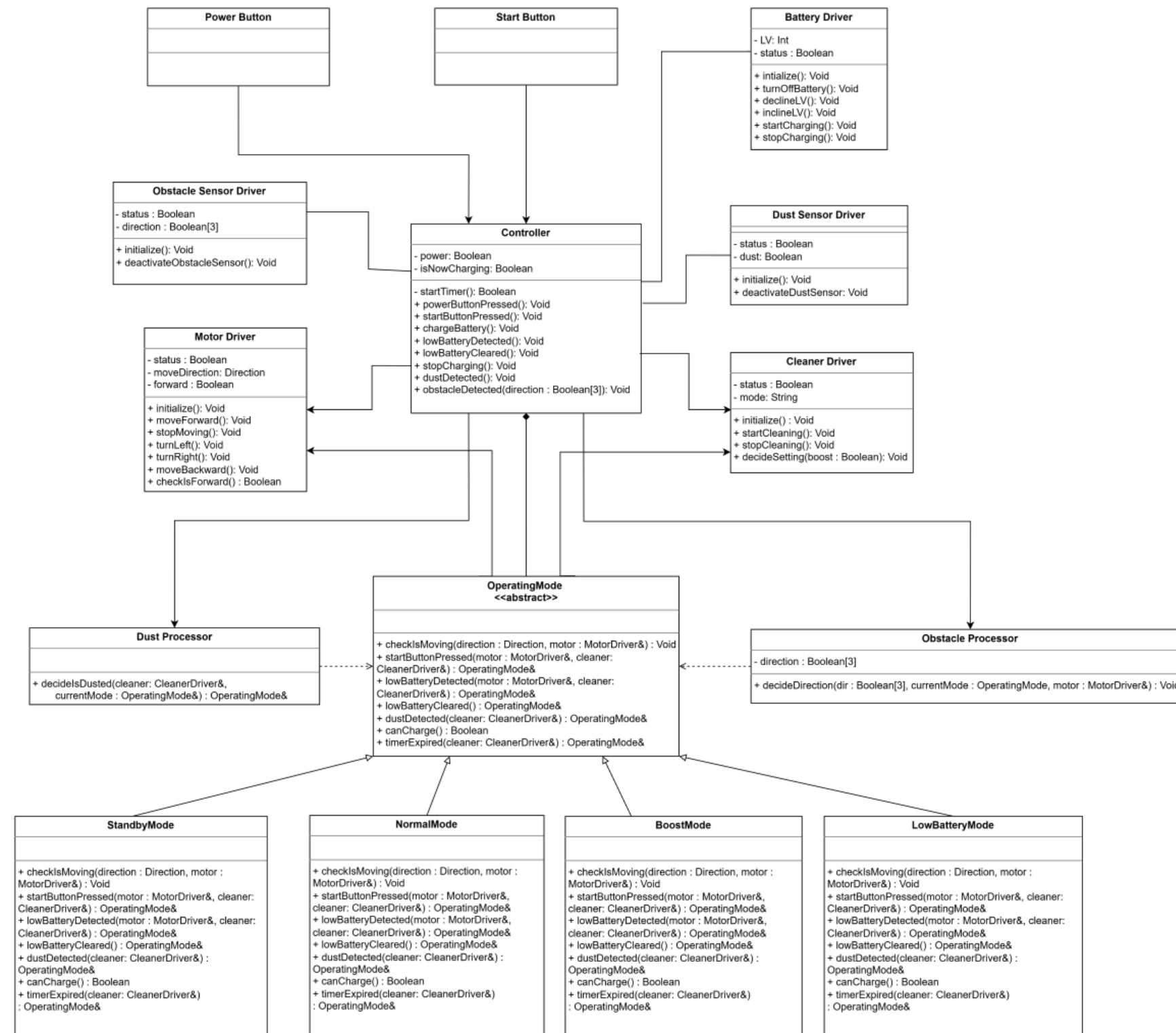
Part1

: (수정) CI / CD Overview



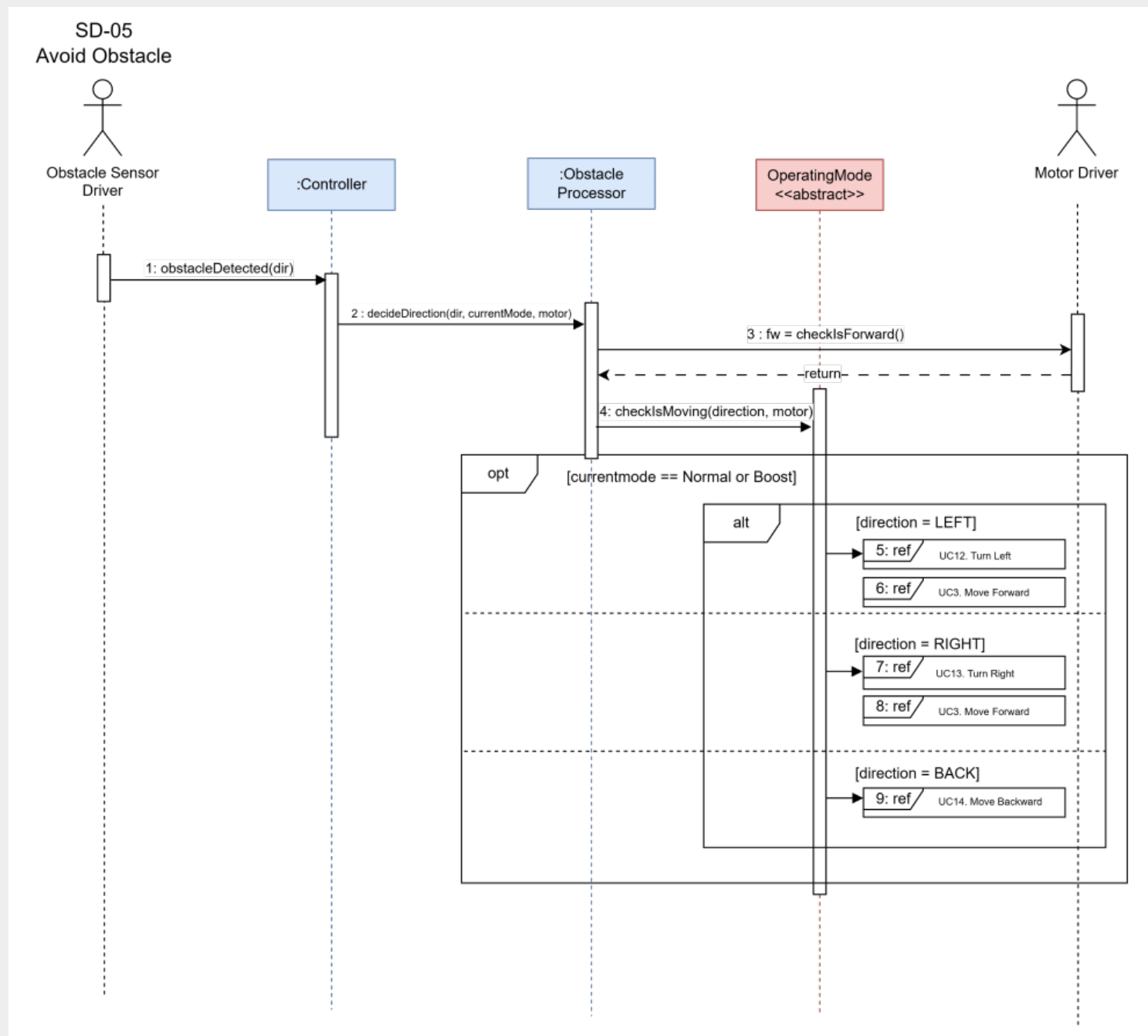
Part1

: (수정) Class Diagram

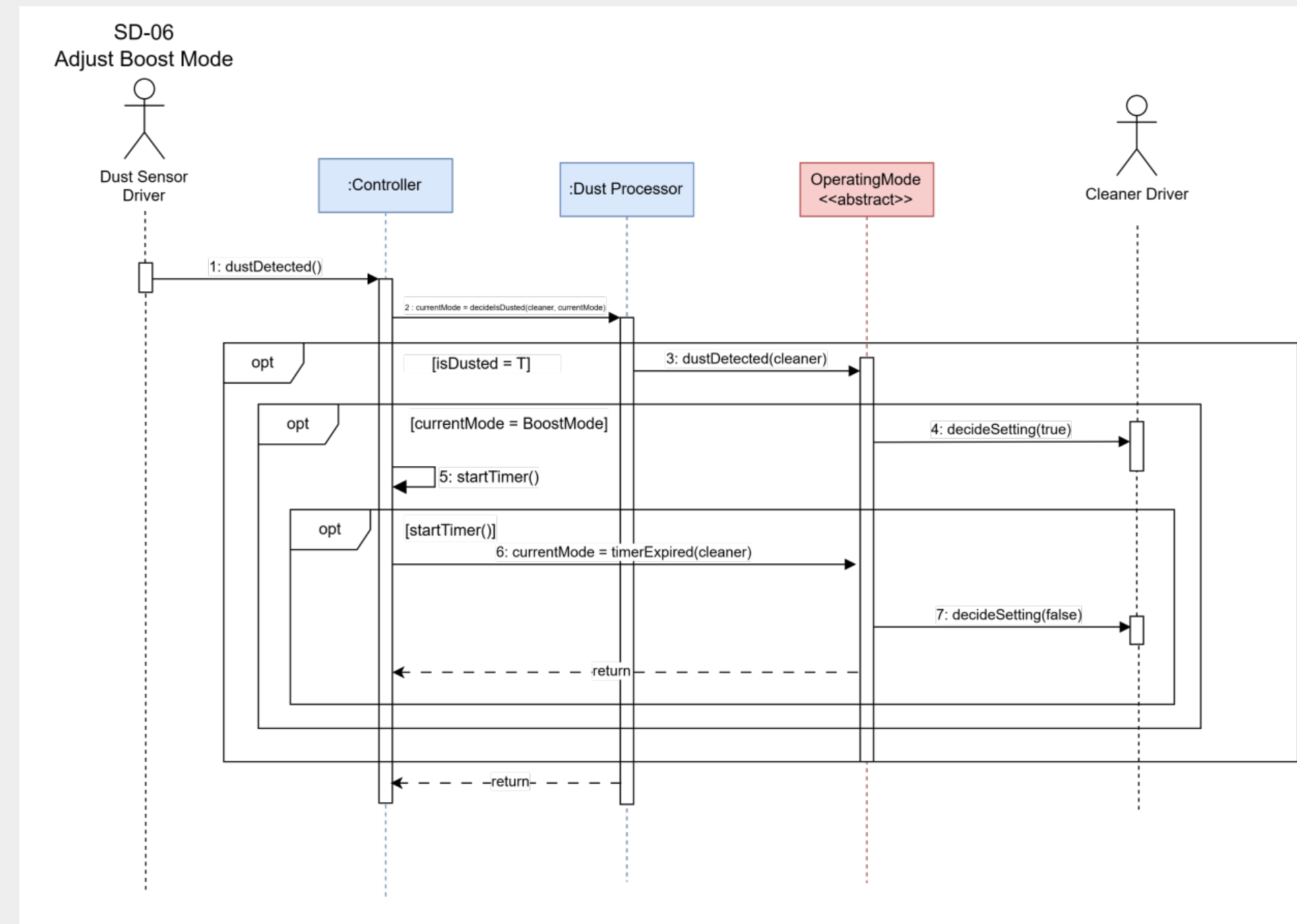


Part1

: (수정) Sequence Diagrams UC5&UC6



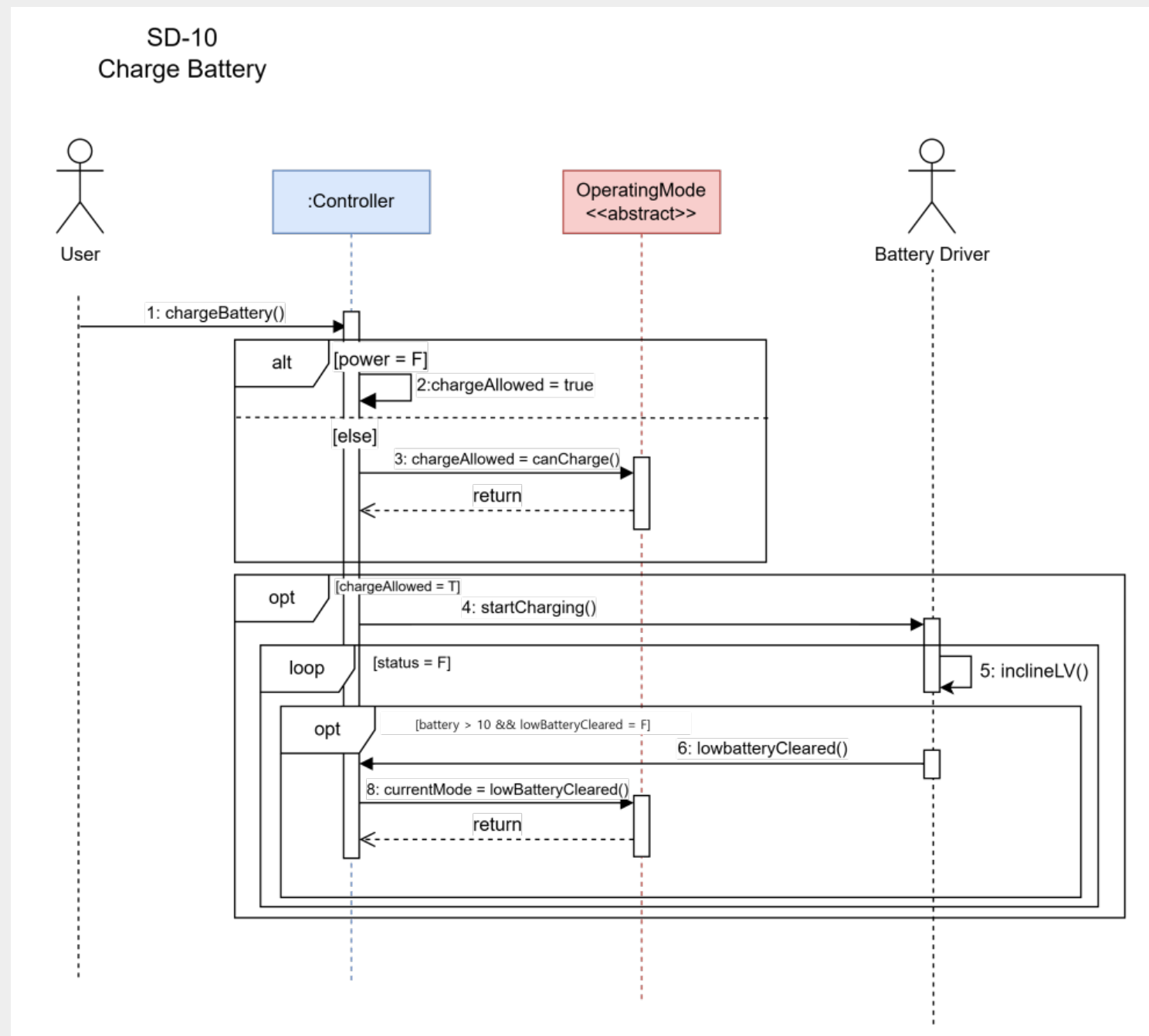
SD-05 AVOID OBSTACLE



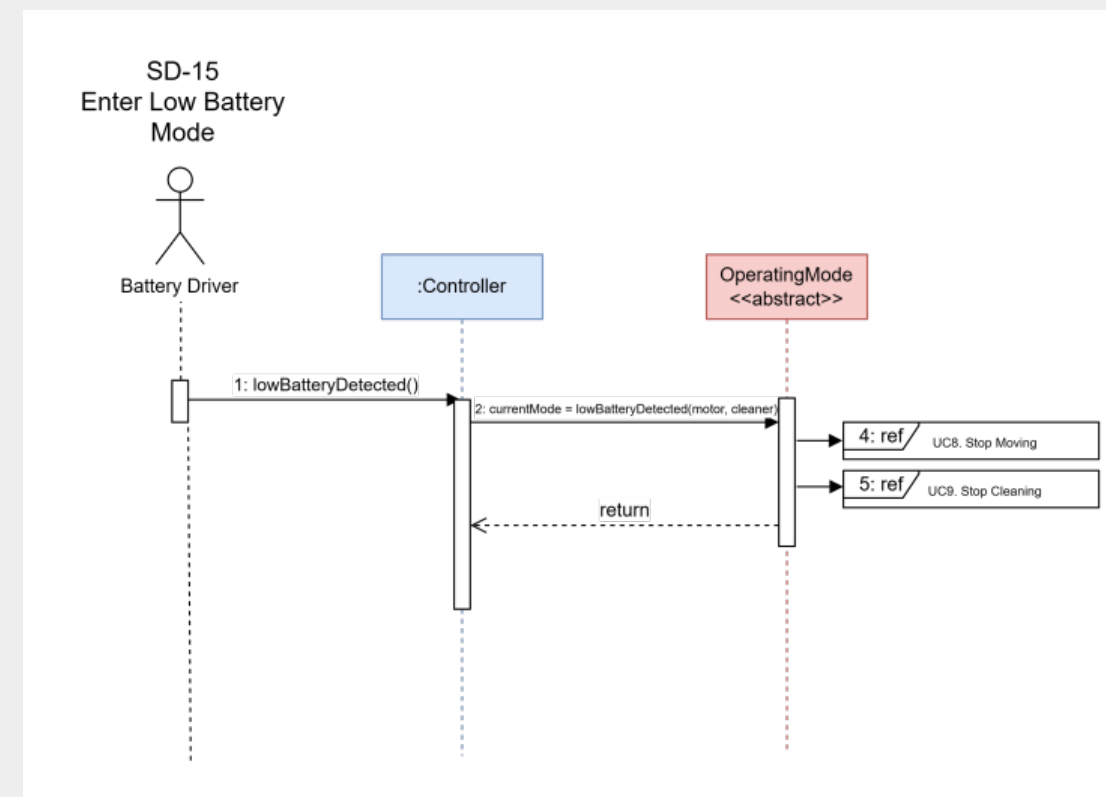
SD-06 ADJUST BOOST MODE

Part1

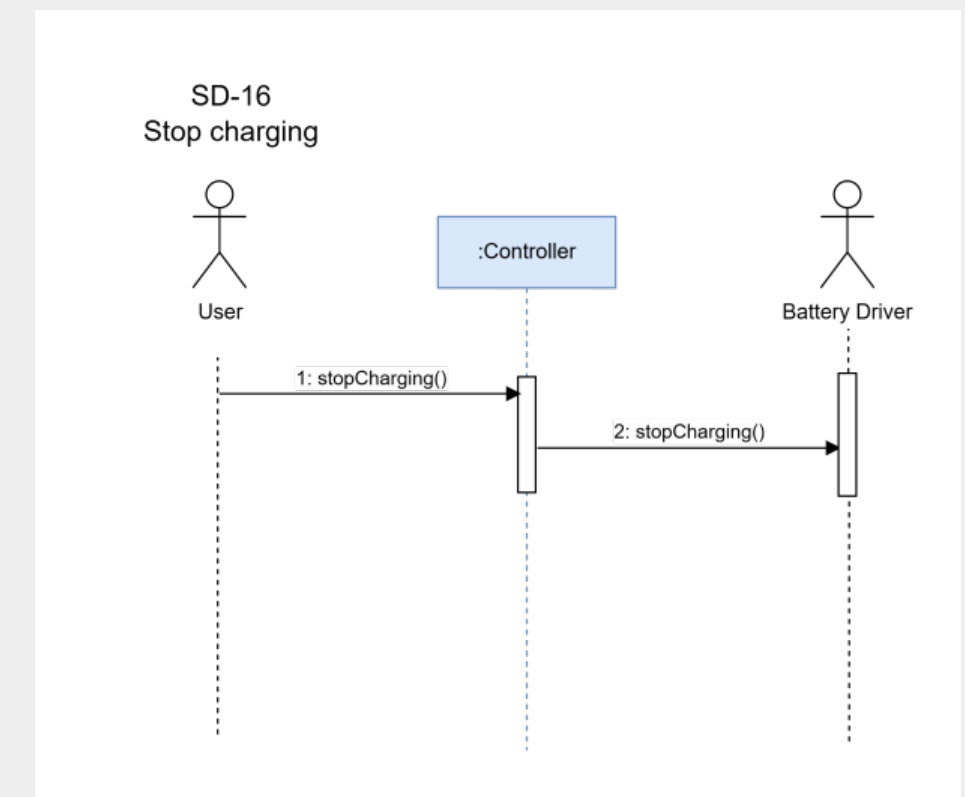
: (수정) Sequence Diagrams UC10&UC15&UC16



SD-10 CHARGE BATTERY



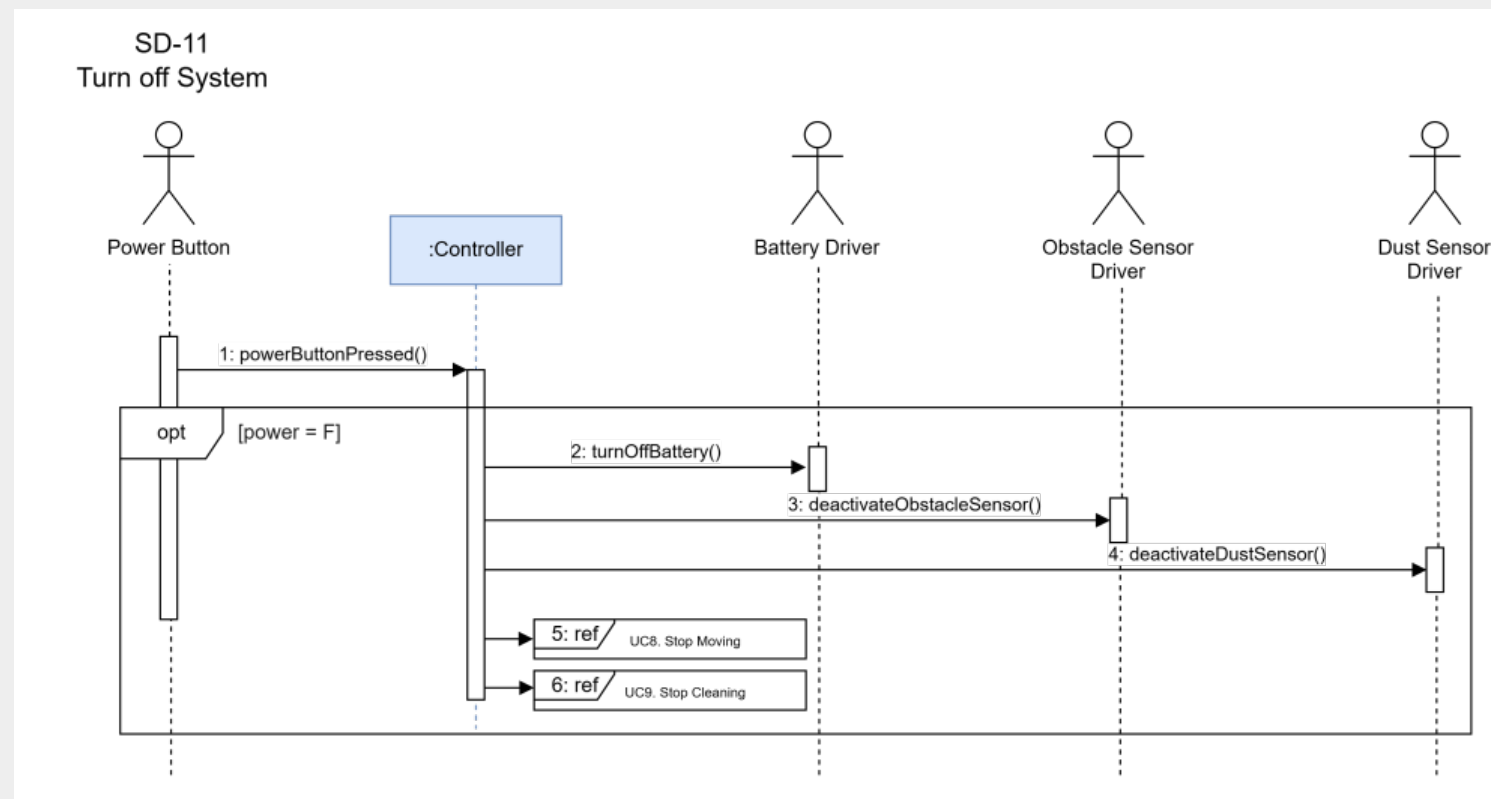
SD-15 ENTER LOW BATTERY MODE



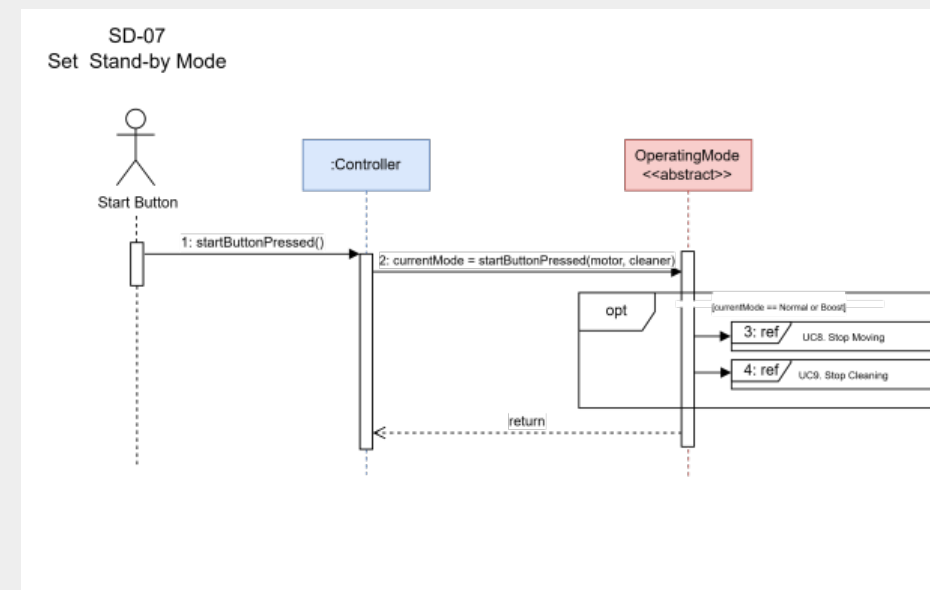
SD-16 STOP CHARGING

Part1

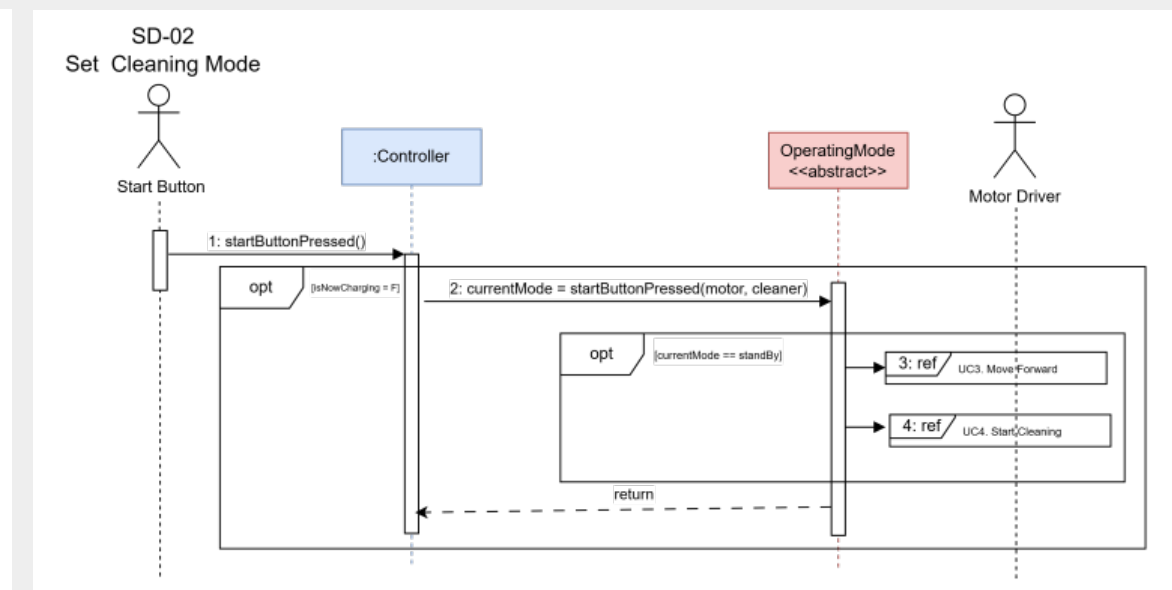
: (수정) Sequence Diagrams UC10&UC15&UC16



SD-11 TURN OFF SYSTEM



SD-07 SET STAND-BY MODE

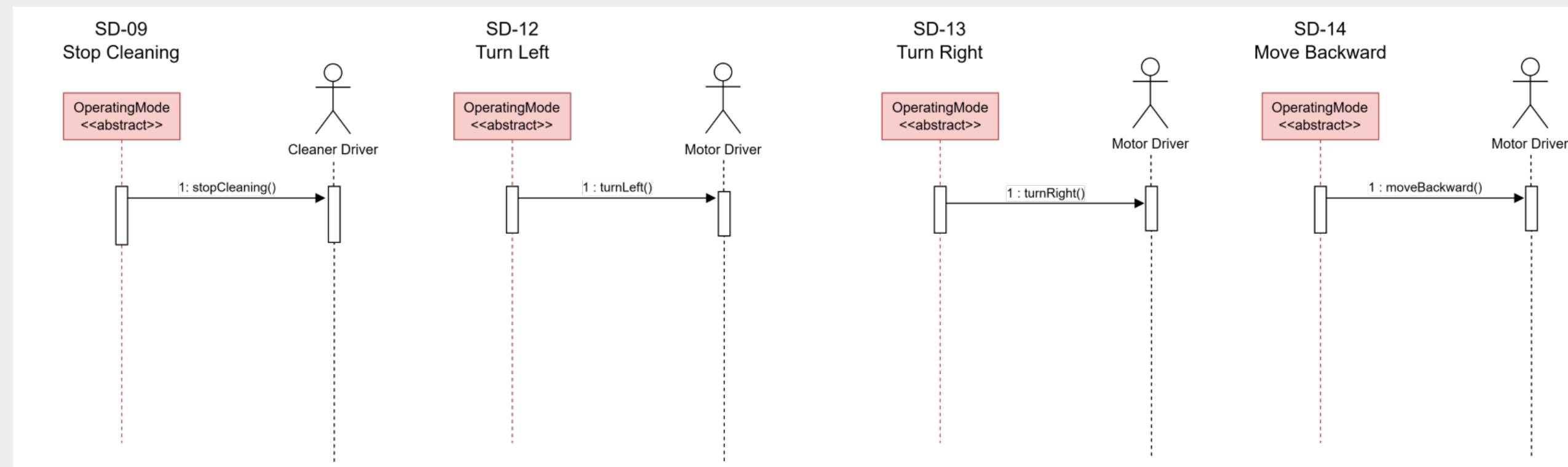
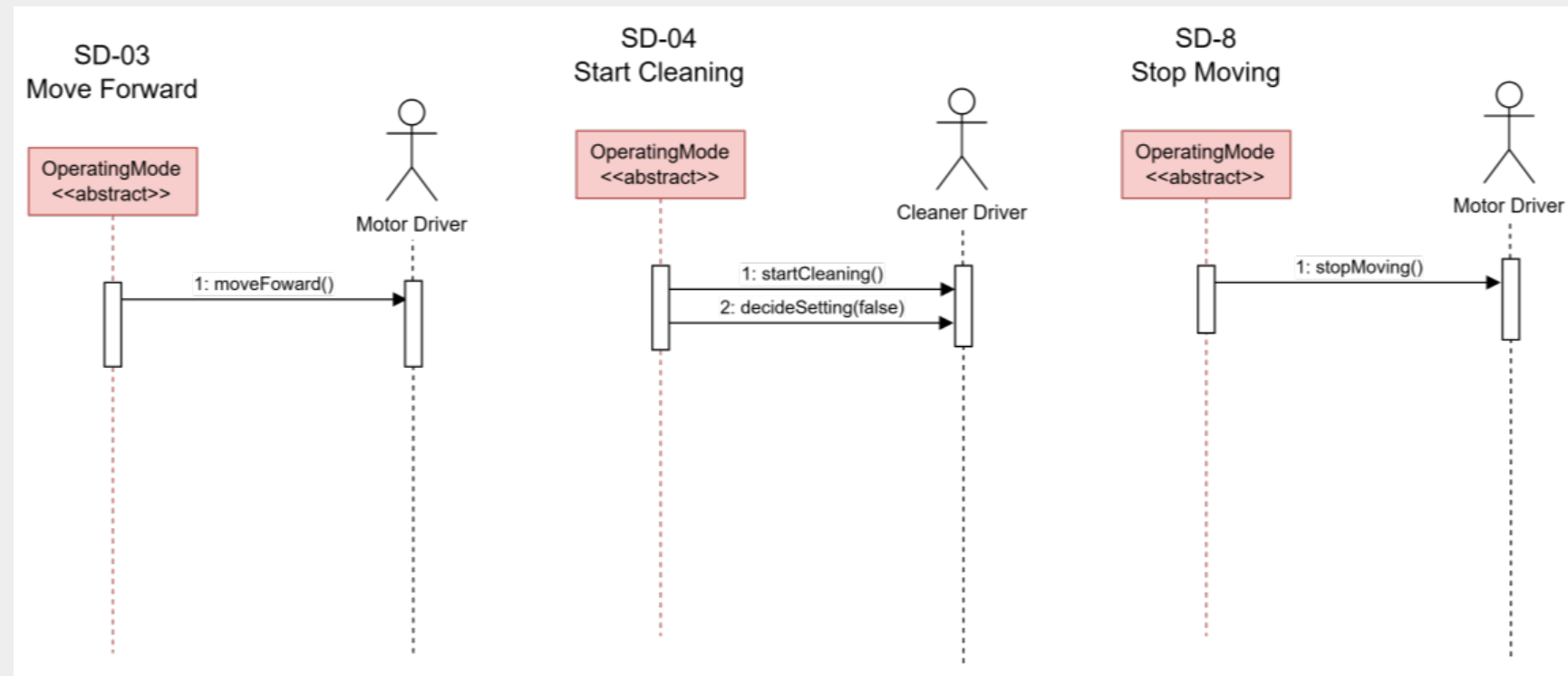


SD-02 SET CLEANING MODE

Part1

: (수정) Sequence Diagrams

UC3&UC4&UC8&UC9&UC12&UC13&UC14





Part2

: Coding

System Operations

dustDetected() — SD-06 Adjust Boost Mode

startButtonPressed() — SD-02 Set Cleaning Mode, SD-07 Set Stand-by Mode

powerButtonPressed() — SD-01 Turn On, SD-11 Turn Off

chargeBattery() — SD-10 Charge Battery

stopCharging() — SD-16 Stop Charging

lowBatteryDetected() — SD-15 Enter Low Battery Mode

obstacleDetected() — SD-05 Avoid Obstacle

TurnOn() — SD-01 Turn On System

TurnOff() — SD-11 Turn Off System

Part2

: Coding

```
class Controller
{
private:
    bool power;
    bool isNowCharging;

    OperatingMode *currentMode; // non-owning pointer to mode singleton

    BatteryDriver *batteryDriver;
    CleanerDriver *cleanerDriver;
    DustSensorDriver *dustSensorDriver;
    MotorDriver *motorDriver;
    ObstacleSensorDriver *obstacleSensorDriver;
    ObstacleProcessor *obstacleProcessor;
    DustProcessor *dustProcessor;

    bool canStartCharging() const;
```

- Controller

System Operation을 받고 내부 객체들에게 메시지를 전달

- OperatingMode

현재 Mode를 관리하고 다음 Mode를 결정

- Driver

실제 장치 동작을 수행하거나 상태를 저장

ex) CleanerDriver, MotorDriver, BatteryDriver

- Processor

센서 정보를 바탕으로 판단 로직 수행

ex) DustProcessor, ObstacleProcessor

Part2

: Code Review

code review

feat: dustDetected() unit test (SD-06) 구현 #19

🔗 Open SeOinm wants to merge 2 commits into main from feat/dust-detected-test

🗨 Conversation 4 | ↩ Commits 2 | 📄 Checks 6 | 📄 Files changed 1



SeOinm commented 15 minutes ago

Collaborator

```
Note: Google Test filter = DustDetectedControllerTest.*
-----
Running 20 tests from 1 test suite.
-----
Global test environment set-up.
-----
20 tests from DustDetectedControllerTest
[ RUN      ] DustDetectedControllerTest.DustDetectedDoesNothingWhenPowerIsOff
[ RUN      ] DustDetectedControllerTest.DustDetectedDoesNothingWhenPowerIsOff (0 ms)
[ RUN      ] DustDetectedControllerTest.DustDetectedInStandbyModeKeepsStandbyMode
[ RUN      ] DustDetectedControllerTest.DustDetectedInStandbyModeKeepsStandbyMode (0 ms)
[ RUN      ] DustDetectedControllerTest.DustDetectedInNormalModeChangesToBoostMode
[ RUN      ] DustDetectedControllerTest.DustDetectedInNormalModeChangesToBoostMode (5601 ms)
[ RUN      ] DustDetectedControllerTest.DustDetectedInNormalModeSetsCleanerToBoost
[ RUN      ] DustDetectedControllerTest.DustDetectedInNormalModeSetsCleanerToBoost (5604 ms)
[ RUN      ] DustDetectedControllerTest.DustDetectedInNormalModeKeepsPowerOn
[ RUN      ] DustDetectedControllerTest.DustDetectedInNormalModeKeepsPowerOn (5600 ms)
[ RUN      ] DustDetectedControllerTest.DustDetectedInNormalModeKeepsCurrentModeExists
[ RUN      ] DustDetectedControllerTest.DustDetectedInNormalModeKeepsCurrentModeExists (5603 ms)
[ RUN      ] DustDetectedControllerTest.BoostModeReturnsToNormalModeAfterTimerExpired
[ RUN      ] DustDetectedControllerTest.BoostModeReturnsToNormalModeAfterTimerExpired (5605 ms)
[ OK       ] DustDetectedControllerTest.BoostModeReturnsToNormalModeAfterTimerExpired (5605 ms)
```

tests/DustDetectedTest.cpp

Comment on lines +137 to +143

```
137 + TEST(DustDetectedControllerTest, CleanerModeStaysBoostAfterTimerExpired)
138 + {
139 +     Controller controller;
140 +     powerOnAndEnterNormalMode(controller);
141 +
142 +     controller.dustDetected();
143 +     ASSERT_EQ(ModeKind::Boost, controller.currentModeKind());
```

YoonBoorue 3 minutes ago Owner

타이머 만료 후 NormalMode로 복귀했는데 cleanerMode가 "boost"로 유지되는 것이 의도된 스펙인지, 아니면 미구현 상태인지 궁금합니다.

SeOinm 1 minute ago Collaborator Author

현재 구현 방식에서 의도된 동작입니다.

Reply...

tests/DustDetectedTest.cpp

```
40 + EXPECT_FALSE(controller.hasCurrentMode());
41 + EXPECT_EQ("Off", controller.currentModeName());
42 + }
43 +
```

YoonBoorue 4 minutes ago Owner

controller의 초기값이 mode가 nullptr로 되어 있는데, 해당부분이 고려된 test인지 혹은 test자체에서 그 부분이 중요하지 않은지 확인가능하실까요?

SeOinm now Collaborator Author

셋업에서 powerButtonPressed()와 startButtonPressed()를 호출해서 NormalMode로 진입한 후 테스트를 시작하므로 currentMode가 nullptr인 경우는 고려되지 않습니다. nullptr 케이스는 TC-01(전원 OFF 상태)에서 별도로 검증하고 있습니다.

Reply...

Part2

: Code Review

code review

feat: startButtonPressed() 구현 및 unit test #12

🔗 Open Mr-Planner wants to merge 9 commits into main from feat/startButtonPressed-unit-test

🗨 Conversation 8 ↩ Commits 9 📄 Checks 5 📄 Files changed 6

Mr-Planner commented 2 days ago · edited ▾ Collaborator ⋮

SD-2,7번의 Set Cleaning Mode에 대한 구현입니다.

- system operation : startButtonPressed()
- 각 TC 설명은 StartButtonPressedTest.cpp에 주석으로 설명되어있습니다.
- TC : 21개

unit test결과

```

OOAD_TEAM/build # ./startButtonPressed-unit-test --gtest_filter="ControllerStartButtonPressedTest.*"
[ 42%] Built target ooad_core
[ 50%] Built target OOAD_TEAM
[ 57%] Built target rvc_simulator
[ 60%] Built target gtest
[ 73%] Built target gtest_main
[ 76%] Building CXX object OOAD_FILES/ooad_tests.dir/tests/StartButtonPressedTest.cpp.o
[ 80%] Linking CXX executable ooad_tests
[ 84%] Built target ooad_tests
[ 92%] Built target gmock
[100%] Built target gmock_main
Running main() from /Users/plannersroom/KonkukUniv/4-1/OOAD_TEAM/build/deps/googletest-src/googletest/src/gtest_main.cc
  
```

```

src/rvc/Controller.cpp
38 45 void Controller::startButtonPressed()
39 46 {
40 - // TODO
47 + if (!this->isNowCharging)
  
```

- SeOinm** yesterday Collaborator ⋮
SD-02에는 [isNowCharging == F] 조건이 명시되어 있지만 SD-07에는 해당 조건이 없습니다. isNowCharging 체크가 SD-02 전용 조건인지 SD-07에도 동일하게 적용되는지, 아니면 SD-07 그림에서 조건이 누락된 것인지 궁금합니다.
- Mr-Planner** 16 hours ago Collaborator Author ⋮
해당 부분은 강민님과 상의후에 답변 및 수정하겠습니다!
- Mr-Planner** 4 hours ago Collaborator Author ⋮
SD-02와 SD-07이 동일한 Controller::startButtonPressed()를 사용하고 있어서 isNowCharging 조건이 공통으로 적용되는 것처럼 보일 수 있습니다.
다만 해당 조건은 충전 중 StandbyMode에서 충소를 시작하는 SD-02 동작을 막기 위한 조건입니다.
우리 시스템에서는 Normal/BoostMode 상태에서 충전 중일 수 없고, 충전 중에는 Normal/BoostMode로 도달하지 않으므로 SD-07 시나리오에서는 이 조건이 항상 통과됩니다. 이 전제가 코드에서 잘 보이도록 주석을 추가했습니다.



SeOinm reviewed yesterday

View reviewed changes

```

tests/StartButtonPressedTest.cpp
7 + // TC-13~TC-21: 실제 구현만으로 관찰하기 어려운 위임 횟수, 전달 인자, 반환 모드 갱신만 Stub 사용
8 +
9 + // 현재 Controller 생성자는 currentMode 초기화가 없어서 테스트에서만 내부 상태 세팅
10 + #define private public
  
```

- SeOinm** yesterday Collaborator ⋮
#define private public을 사용하고 있는데 테스트용 생성자나 의존성 주입 방식으로 개선하면 더 안전하지 않을까요?
- SeOinm** 16 hours ago · edited ▾ Collaborator ⋮
Controller 생성자에서 currentMode 자체는 nullptr로 초기화되고 있어서, "초기화가 없다"보다는 "실제 모드 객체가 설정되지 않는다"는 표현이 더 정확해 보입니다
- Mr-Planner** 16 hours ago Collaborator Author ⋮
#define private public을 사용하고 있는데 테스트용 생성자나 의존성 주입 방식으로 개선하면 더 안전하지 않을까요?

현재 Controller에는 테스트에서 currentMode, isNowCharging, driver 상태를 세팅하거나 확인할 수 있는 public API가 없어서, SD-02/SD-07 단위 테스트 범위에서만 제한적으로 사용했습니다. 테스트용 생성자나 의존성 주입 방식은 구조 변경이 필요해서, 이번 PR에서는 주석으로 의도를 명확히 하고 추후 개선 항목으로 분리하겠습니다.

Controller 생성자에서 currentMode 자체는 nullptr로 초기화되고 있어서, "초기화가 없다"보다는 "실제 모드 객체가 설정되지 않는다"는 표현이 더 정확해 보입니다

넵, currentMode가 아예 초기화되지 않는다는 의미가 아니라, 테스트 실행에 필요한 실제 모드 객체가 설정되지 않는다는 의미였습니다. 주석을 더 정확하게 수정하겠습니다.

Part2

: Code Review

code review

feat: dustDetected() 구현 및 unit test #14

Merged YoonBoorue merged 6 commits into main from feat/dust-boost_UC6 31 minutes ago

Conversation 10 Commits 6 Checks 5 Files changed 6



SeOinm commented yesterday · edited Collaborator

SD-06 Adjust Boost Mode에 대한 구현입니다.

system operation : dustDetected()

TC : 20개

* 상현님 PR 머지 후에 충돌 해결하겠습니다 코드 리뷰 먼저 부탁드립니다

```

(base) → OOAD_TEAM1 git:(feat/dust-boost_UC6) x cmake --build build && ./build/ooad_tests --gtest_filter="ControllerDustDetectedTest.*"
[ 42%] Built target ooad_core
[ 50%] Built target OOAD_TEAM1
[ 57%] Built target rvc_simulator
[ 65%] Built target gtest
[ 73%] Built target gtest_main
[ 76%] Building CXX object CMakeFiles/ooad_tests.dir/tests/DustDetectedTest.cpp.o
[ 80%] Linking CXX executable ooad_tests
[ 84%] Built target ooad_tests
[ 92%] Built target gmock
[100%] Built target gmock_main
Running main() from /Users/oonsi/RVC/OOAD_TEAM1/build/_deps/googletest-src/googletest/src/gtest_main.cc

```

```

src/rvc/DustProcessor.cpp Outdated
6 6 bool DustProcessor::decideIsDusted(const OperatingMode & /*currentMode*/, Cle
7 7 {
8 - return false;
8 + return true;

```

Mr-Planner 15 hours ago Collaborator

decideIsDusted()가 항상 true를 반환하고 있어서 실제 먼저 판단 로직이 없습니다. SD의 [isDusted = T] 조건을 검증하려면 true/false 판단 기준이 필요해 보입니다.

SeOinm 4 hours ago Collaborator Author

DustSensorDriver::hasDust()를 호출해 센서값을 읽고, 그 값을 decideIsDusted()에 전달하는 방식으로 수정했습니다.

Reply...

```

src/rvc/Controller.cpp Outdated
77 +
78 +     if (isDusted) {
79 +         currentMode = &currentMode->dustDetected(*cleanerDriver);
80 +         startTimer();

```

Mr-Planner 15 hours ago Collaborator

startTimer()는 SD상 currentMode가 BoostMode일 때만 실행되어야 하는데, 현재는 isDusted가 true이면 항상 호출됩니다. dustDetected() 이후 실제로 BoostMode로 전환된 경우에만 timer를 시작하도록 조건이 필요해 보입니다. SD와 비교해서 확인 부탁드립니다.

SeOinm 4 hours ago Collaborator Author

dynamic_cast로 BoostMode 여부 확인 후 startTimer()를 호출하도록 수정했습니다.

Reply...

Resolve conversation

Part2

: Unit Test

- Google Test 프레임워크 활용
- system operation 단위로 테스트 설계
- Driver — 실제 actor 대신 system operation을 호출하는 역할
- Stub — 실제 구현 대신 위임 호출 횟수, 반환 모드를 제어하는 역할
- 로컬 및 CI(GitHub Actions)에서 실행 확인

Part2

: Unit Test

실행 결과

```

(base) → OOAD_TEAM1 git:(feat/dust-detected-test) ./build/ood_tests --gtest_filter="ControllerChargeBatteryTest.*"
Running main() from /Users/oonsi/RVC/OOAD_TEAM1/build/_deps/googletest-src/googletest/src/gtest_main.cc
Note: Google Test filter = ControllerChargeBatteryTest.*
[====] Running 20 tests from 1 test suite.
[-----] Global test environment set-up.
[-----] 20 tests from ControllerChargeBatteryTest
[ RUN   ] ControllerChargeBatteryTest.PowerOffAllowsChargingWhenBatteryIsBelowMax
[ OK    ] ControllerChargeBatteryTest.PowerOffAllowsChargingWhenBatteryIsBelowMax (0 ms)
[ RUN   ] ControllerChargeBatteryTest.PowerOffRejectsChargingWhenBatteryIsFull
[ OK    ] ControllerChargeBatteryTest.PowerOffRejectsChargingWhenBatteryIsFull (0 ms)
[ RUN   ] ControllerChargeBatteryTest.PowerOffChargingFromNinetyStopsAtFull
[ OK    ] ControllerChargeBatteryTest.PowerOffChargingFromNinetyStopsAtFull (0 ms)
[ RUN   ] ControllerChargeBatteryTest.PowerOffChargingFromZeroIncreasesBattery
[ OK    ] ControllerChargeBatteryTest.PowerOffChargingFromZeroIncreasesBattery (0 ms)
[ RUN   ] ControllerChargeBatteryTest.PowerOffChargingFromLowBatteryLevelDoesNotCreateMode
[ OK    ] ControllerChargeBatteryTest.PowerOffChargingFromLowBatteryLevelDoesNotCreateMode (0 ms)
[ RUN   ] ControllerChargeBatteryTest.StandbyModeAllowsChargingWhenBatteryIsBelowMax
[ OK    ] ControllerChargeBatteryTest.StandbyModeAllowsChargingWhenBatteryIsBelowMax (0 ms)
[ RUN   ] ControllerChargeBatteryTest.StandbyModeRejectsChargingWhenBatteryIsFull
[ OK    ] ControllerChargeBatteryTest.StandbyModeRejectsChargingWhenBatteryIsFull (0 ms)
[ RUN   ] ControllerChargeBatteryTest.StandbyModeChargingFromNinetyStopsAtFull
[ OK    ] ControllerChargeBatteryTest.StandbyModeChargingFromNinetyStopsAtFull (0 ms)
[ RUN   ] ControllerChargeBatteryTest.NormalModeRejectsCharging
[ OK    ] ControllerChargeBatteryTest.NormalModeRejectsCharging (0 ms)
[ RUN   ] ControllerChargeBatteryTest.NormalModeRejectsChargingEvenWhenBatteryIsLow
[ OK    ] ControllerChargeBatteryTest.NormalModeRejectsChargingEvenWhenBatteryIsLow (0 ms)
[ RUN   ] ControllerChargeBatteryTest.LowBatteryModeAllowsCharging
[ OK    ] ControllerChargeBatteryTest.LowBatteryModeAllowsCharging (0 ms)
[ RUN   ] ControllerChargeBatteryTest.LowBatteryModeChargingClearsLowBatteryWhenLevelExceedsThreshold
[ OK    ] ControllerChargeBatteryTest.LowBatteryModeChargingClearsLowBatteryWhenLevelExceedsThreshold (0 ms)
[ RUN   ] ControllerChargeBatteryTest.LowBatteryModeAtThresholdClearsAfterOneChargeStep
[ OK    ] ControllerChargeBatteryTest.LowBatteryModeAtThresholdClearsAfterOneChargeStep (0 ms)
[ RUN   ] ControllerChargeBatteryTest.LowBatteryModeWithFullBatteryDoesNotStartCharging
[ OK    ] ControllerChargeBatteryTest.LowBatteryModeWithFullBatteryDoesNotStartCharging (0 ms)
[ RUN   ] ControllerChargeBatteryTest.ChargingTickContinuesChargingAfterChargeBattery
[ OK    ] ControllerChargeBatteryTest.ChargingTickContinuesChargingAfterChargeBattery (0 ms)
[ RUN   ] ControllerChargeBatteryTest.RepeatedChargingTicksStopAtFull
[ OK    ] ControllerChargeBatteryTest.RepeatedChargingTicksStopAtFull (0 ms)
[ RUN   ] ControllerChargeBatteryTest.ChargingTickDoesNothingWhenNotCharging
[ OK    ] ControllerChargeBatteryTest.ChargingTickDoesNothingWhenNotCharging (0 ms)
[ RUN   ] ControllerChargeBatteryTest.StopChargingPreventsFurtherChargingTickIncrease
[ OK    ] ControllerChargeBatteryTest.StopChargingPreventsFurtherChargingTickIncrease (0 ms)
[ RUN   ] ControllerChargeBatteryTest.StartButtonIsIgnoredWhileChargingInStandbyMode
[ OK    ] ControllerChargeBatteryTest.StartButtonIsIgnoredWhileChargingInStandbyMode (0 ms)
[ RUN   ] ControllerChargeBatteryTest.SecondChargeBatteryCallWhileAlreadyChargingAdvancesOneMoreStep
[ OK    ] ControllerChargeBatteryTest.SecondChargeBatteryCallWhileAlreadyChargingAdvancesOneMoreStep (0 ms)
[-----] 20 tests from ControllerChargeBatteryTest (0 ms total)

[-----] Global test environment tear-down
[====] 20 tests from 1 test suite ran. (0 ms total)
[ PASSED ] 20 tests.

```

ChargeBattery

```

(base) → OOAD_TEAM1 git:(feat/dust-detected-test) ./build/ood_tests --gtest_filter="ControllerEnterLowBatteryModeTest.*"
Running main() from /Users/oonsi/RVC/OOAD_TEAM1/build/_deps/googletest-src/googletest/src/gtest_main.cc
Note: Google Test filter = ControllerEnterLowBatteryModeTest.*
[====] Running 20 tests from 1 test suite.
[-----] Global test environment set-up.
[-----] 20 tests from ControllerEnterLowBatteryModeTest
[ RUN   ] ControllerEnterLowBatteryModeTest.PowerOffIgnoresLowBatteryDetected
[ OK    ] ControllerEnterLowBatteryModeTest.PowerOffIgnoresLowBatteryDetected (0 ms)
[ RUN   ] ControllerEnterLowBatteryModeTest.StandbyModeEntersLowBatteryMode
[ OK    ] ControllerEnterLowBatteryModeTest.StandbyModeEntersLowBatteryMode (0 ms)
[ RUN   ] ControllerEnterLowBatteryModeTest.NormalModeEntersLowBatteryMode
[ OK    ] ControllerEnterLowBatteryModeTest.NormalModeEntersLowBatteryMode (0 ms)
[ RUN   ] ControllerEnterLowBatteryModeTest.BoostModeEntersLowBatteryMode
[ OK    ] ControllerEnterLowBatteryModeTest.BoostModeEntersLowBatteryMode (0 ms)
[ RUN   ] ControllerEnterLowBatteryModeTest.RepeatedLowBatteryDetectedKeepsLowBatteryMode
[ OK    ] ControllerEnterLowBatteryModeTest.RepeatedLowBatteryDetectedKeepsLowBatteryMode (0 ms)
[ RUN   ] ControllerEnterLowBatteryModeTest.LowBatteryDetectedDoesNotChangeBatteryLevel
[ OK    ] ControllerEnterLowBatteryModeTest.LowBatteryDetectedDoesNotChangeBatteryLevel (0 ms)
[ RUN   ] ControllerEnterLowBatteryModeTest.LowBatteryDetectedDoesNotStartCharging
[ OK    ] ControllerEnterLowBatteryModeTest.LowBatteryDetectedDoesNotStartCharging (0 ms)
[ RUN   ] ControllerEnterLowBatteryModeTest.LowBatteryModeAllowsChargingAfterEnteringFromStandby
[ OK    ] ControllerEnterLowBatteryModeTest.LowBatteryModeAllowsChargingAfterEnteringFromStandby (0 ms)
[ RUN   ] ControllerEnterLowBatteryModeTest.LowBatteryModeAllowsChargingAfterEnteringFromNormal
[ OK    ] ControllerEnterLowBatteryModeTest.LowBatteryModeAllowsChargingAfterEnteringFromNormal (0 ms)
[ RUN   ] ControllerEnterLowBatteryModeTest.StartButtonIsIgnoredInLowBatteryMode
[ OK    ] ControllerEnterLowBatteryModeTest.StartButtonIsIgnoredInLowBatteryMode (0 ms)
[ RUN   ] ControllerEnterLowBatteryModeTest.DustDetectedIsIgnoredInLowBatteryMode
[ OK    ] ControllerEnterLowBatteryModeTest.DustDetectedIsIgnoredInLowBatteryMode (0 ms)
[ RUN   ] ControllerEnterLowBatteryModeTest.TimerExpiredKeepsLowBatteryMode
[ OK    ] ControllerEnterLowBatteryModeTest.TimerExpiredKeepsLowBatteryMode (0 ms)
[ RUN   ] ControllerEnterLowBatteryModeTest.ChargeBatteryClearsLowBatteryModeWhenLevelExceedsThreshold
[ OK    ] ControllerEnterLowBatteryModeTest.ChargeBatteryClearsLowBatteryModeWhenLevelExceedsThreshold (0 ms)
[ RUN   ] ControllerEnterLowBatteryModeTest.LowBatteryModeAtThresholdClearsAfterCharging
[ OK    ] ControllerEnterLowBatteryModeTest.LowBatteryModeAtThresholdClearsAfterCharging (0 ms)
[ RUN   ] ControllerEnterLowBatteryModeTest.FullBatteryEventStillEntersLowBatteryModeWhenDetectedEventArrives
[ OK    ] ControllerEnterLowBatteryModeTest.FullBatteryEventStillEntersLowBatteryModeWhenDetectedEventArrives (0 ms)
[ RUN   ] ControllerEnterLowBatteryModeTest.FullBatteryLowBatteryModeDoesNotStartCharging
[ OK    ] ControllerEnterLowBatteryModeTest.FullBatteryLowBatteryModeDoesNotStartCharging (0 ms)
[ RUN   ] ControllerEnterLowBatteryModeTest.PowerButtonTurnsOffFromLowBatteryMode
[ OK    ] ControllerEnterLowBatteryModeTest.PowerButtonTurnsOffFromLowBatteryMode (0 ms)
[ RUN   ] ControllerEnterLowBatteryModeTest.LowBatteryDetectedAfterClearedCanEnterAgain
[ OK    ] ControllerEnterLowBatteryModeTest.LowBatteryDetectedAfterClearedCanEnterAgain (0 ms)
[ RUN   ] ControllerEnterLowBatteryModeTest.LowBatteryDetectedFromBoostHasPriorityOverBoostTimer
[ OK    ] ControllerEnterLowBatteryModeTest.LowBatteryDetectedFromBoostHasPriorityOverBoostTimer (0 ms)
[ RUN   ] ControllerEnterLowBatteryModeTest.LowBatteryDetectedDoesNotPreventManualPowerOff
[ OK    ] ControllerEnterLowBatteryModeTest.LowBatteryDetectedDoesNotPreventManualPowerOff (0 ms)
[-----] 20 tests from ControllerEnterLowBatteryModeTest (0 ms total)

[-----] Global test environment tear-down
[====] 20 tests from 1 test suite ran. (0 ms total)
[ PASSED ] 20 tests.

```

Low Battery Mode

Part2

: Unit Test

실행 결과

```
(base) → OOAD_TEAM1 git:(feat/dust-detected-test) ./build/ooad_tests --gtest_filter="ControllerStopChargingTest.*"
Running main() from /Users/oonsi/RVC/OOAD_TEAM1/build/_deps/googletest-src/googletest/src/gtest_main.cc
Note: Google Test filter = ControllerStopChargingTest.*
[====] Running 20 tests from 1 test suite.
[-----] Global test environment set-up.
[-----] 20 tests from ControllerStopChargingTest
[ RUN   ] ControllerStopChargingTest.PowerOffNotChargingStopChargingKeepsNotCharging
[ OK    ] ControllerStopChargingTest.PowerOffNotChargingStopChargingKeepsNotCharging (0 ms)
[ RUN   ] ControllerStopChargingTest.PowerOffChargingStopChargingStopsCharging
[ OK    ] ControllerStopChargingTest.PowerOffChargingStopChargingStopsCharging (0 ms)
[ RUN   ] ControllerStopChargingTest.StopChargingDoesNotChangeBatteryLevel
[ OK    ] ControllerStopChargingTest.StopChargingDoesNotChangeBatteryLevel (0 ms)
[ RUN   ] ControllerStopChargingTest.ChargingTickAfterStopChargingDoesNotIncreaseBattery
[ OK    ] ControllerStopChargingTest.ChargingTickAfterStopChargingDoesNotIncreaseBattery (0 ms)
[ RUN   ] ControllerStopChargingTest.RepeatedStopChargingIsIdempotent
[ OK    ] ControllerStopChargingTest.RepeatedStopChargingIsIdempotent (0 ms)
[ RUN   ] ControllerStopChargingTest.StopChargingAtFullBatteryKeepsFullBattery
[ OK    ] ControllerStopChargingTest.StopChargingAtFullBatteryKeepsFullBattery (0 ms)
[ RUN   ] ControllerStopChargingTest.StopChargingAfterChargingToFullKeepsNotCharging
[ OK    ] ControllerStopChargingTest.StopChargingAfterChargingToFullKeepsNotCharging (0 ms)
[ RUN   ] ControllerStopChargingTest.StandbyChargingStopChargingStopsCharging
[ OK    ] ControllerStopChargingTest.StandbyChargingStopChargingStopsCharging (0 ms)
[ RUN   ] ControllerStopChargingTest.StandbyStopChargingPreservesStandbyMode
[ OK    ] ControllerStopChargingTest.StandbyStopChargingPreservesStandbyMode (0 ms)
[ RUN   ] ControllerStopChargingTest.NormalModeStopChargingIsNoOpWhenNotCharging
[ OK    ] ControllerStopChargingTest.NormalModeStopChargingIsNoOpWhenNotCharging (0 ms)
[ RUN   ] ControllerStopChargingTest.NormalModeRejectedChargeThenStopChargingKeepsNormalMode
[ OK    ] ControllerStopChargingTest.NormalModeRejectedChargeThenStopChargingKeepsNormalMode (0 ms)
[ RUN   ] ControllerStopChargingTest.BoostModeStopChargingIsNoOpWhenNotCharging
[ OK    ] ControllerStopChargingTest.BoostModeStopChargingIsNoOpWhenNotCharging (0 ms)
[ RUN   ] ControllerStopChargingTest.LowBatteryChargingThenStopChargingStopsCharging
[ OK    ] ControllerStopChargingTest.LowBatteryChargingThenStopChargingStopsCharging (0 ms)
[ RUN   ] ControllerStopChargingTest.LowBatteryChargingStopPreventsFurtherTick
[ OK    ] ControllerStopChargingTest.LowBatteryChargingStopPreventsFurtherTick (0 ms)
[ RUN   ] ControllerStopChargingTest.StopChargingDoesNotPowerOnSystem
[ OK    ] ControllerStopChargingTest.StopChargingDoesNotPowerOnSystem (0 ms)
[ RUN   ] ControllerStopChargingTest.StopChargingDoesNotCreateModeWhenPowerOff
[ OK    ] ControllerStopChargingTest.StopChargingDoesNotCreateModeWhenPowerOff (0 ms)
[ RUN   ] ControllerStopChargingTest.StopChargingBeforeChargeBatteryDoesNotBlockFutureCharging
[ OK    ] ControllerStopChargingTest.StopChargingBeforeChargeBatteryDoesNotBlockFutureCharging (0 ms)
[ RUN   ] ControllerStopChargingTest.StopChargingAfterOneChargingTickFreezesBatteryLevel
[ OK    ] ControllerStopChargingTest.StopChargingAfterOneChargingTickFreezesBatteryLevel (0 ms)
[ RUN   ] ControllerStopChargingTest.StopChargingAfterMultipleChargingTicksFreezesBatteryLevel
[ OK    ] ControllerStopChargingTest.StopChargingAfterMultipleChargingTicksFreezesBatteryLevel (0 ms)
[ RUN   ] ControllerStopChargingTest.StartButtonWorksAfterStoppingChargingInStandbyMode
[ OK    ] ControllerStopChargingTest.StartButtonWorksAfterStoppingChargingInStandbyMode (0 ms)
[-----] 20 tests from ControllerStopChargingTest (0 ms total)

[-----] Global test environment tear-down
[====] 20 tests from 1 test suite ran. (0 ms total)
[ PASSED ] 20 tests.
```

Stop Charging

```
(base) → OOAD_TEAM1 git:(feat/dust-detected-test) ./build/ooad_tests --gtest_filter="ControllerTurnOffSystemTest.*"
Running main() from /Users/oonsi/RVC/OOAD_TEAM1/build/_deps/googletest-src/googletest/src/gtest_main.cc
Note: Google Test filter = ControllerTurnOffSystemTest.*
[====] Running 20 tests from 1 test suite.
[-----] Global test environment set-up.
[-----] 20 tests from ControllerTurnOffSystemTest
[ RUN   ] ControllerTurnOffSystemTest.TurnOffChangesPowerOnToPowerOff
[ OK    ] ControllerTurnOffSystemTest.TurnOffChangesPowerOnToPowerOff (0 ms)
[ RUN   ] ControllerTurnOffSystemTest.TurnOffRemovesCurrentMode
[ OK    ] ControllerTurnOffSystemTest.TurnOffRemovesCurrentMode (0 ms)
[ RUN   ] ControllerTurnOffSystemTest.TurnOffStopsCharging
[ OK    ] ControllerTurnOffSystemTest.TurnOffStopsCharging (0 ms)
[ RUN   ] ControllerTurnOffSystemTest.TurnOffDoesNotChangeBatteryLevelExceptPreviousChargingStep
[ OK    ] ControllerTurnOffSystemTest.TurnOffDoesNotChangeBatteryLevelExceptPreviousChargingStep (0 ms)
[ RUN   ] ControllerTurnOffSystemTest.TurnOffDeactivatesDustSensor
[ OK    ] ControllerTurnOffSystemTest.TurnOffDeactivatesDustSensor (0 ms)
[ RUN   ] ControllerTurnOffSystemTest.TurnOffDeactivatesObstacleSensor
[ OK    ] ControllerTurnOffSystemTest.TurnOffDeactivatesObstacleSensor (0 ms)
[ RUN   ] ControllerTurnOffSystemTest.TurnOffStopsCleanerFromNormalMode
[ OK    ] ControllerTurnOffSystemTest.TurnOffStopsCleanerFromNormalMode (0 ms)
[ RUN   ] ControllerTurnOffSystemTest.TurnOffStopsMotorFromNormalMode
[ OK    ] ControllerTurnOffSystemTest.TurnOffStopsMotorFromNormalMode (0 ms)
[ RUN   ] ControllerTurnOffSystemTest.TurnOffFromStandbyKeepsCleanerOff
[ OK    ] ControllerTurnOffSystemTest.TurnOffFromStandbyKeepsCleanerOff (0 ms)
[ RUN   ] ControllerTurnOffSystemTest.TurnOffFromStandbyKeepsMotorStopped
[ OK    ] ControllerTurnOffSystemTest.TurnOffFromStandbyKeepsMotorStopped (0 ms)
[ RUN   ] ControllerTurnOffSystemTest.TurnOffFromLowBatteryModeKeepsCleanerStopped
[ OK    ] ControllerTurnOffSystemTest.TurnOffFromLowBatteryModeKeepsCleanerStopped (0 ms)
[ RUN   ] ControllerTurnOffSystemTest.TurnOffFromLowBatteryModeKeepsMotorStopped
[ OK    ] ControllerTurnOffSystemTest.TurnOffFromLowBatteryModeKeepsMotorStopped (0 ms)
[ RUN   ] ControllerTurnOffSystemTest.TurnOffWhileChargingInStandbyStopsChargingAndKeepsBatteryLevel
[ OK    ] ControllerTurnOffSystemTest.TurnOffWhileChargingInStandbyStopsChargingAndKeepsBatteryLevel (0 ms)
[ RUN   ] ControllerTurnOffSystemTest.TurnOffAfterChargingFullKeepsBatteryFull
[ OK    ] ControllerTurnOffSystemTest.TurnOffAfterChargingFullKeepsBatteryFull (0 ms)
[ RUN   ] ControllerTurnOffSystemTest.TurnOffThenStartButtonDoesNothing
[ OK    ] ControllerTurnOffSystemTest.TurnOffThenStartButtonDoesNothing (0 ms)
[ RUN   ] ControllerTurnOffSystemTest.TurnOffThenLowBatteryDetectedDoesNothing
[ OK    ] ControllerTurnOffSystemTest.TurnOffThenLowBatteryDetectedDoesNothing (0 ms)
[ RUN   ] ControllerTurnOffSystemTest.TurnOffThenObstacleDetectedDoesNothing
[ OK    ] ControllerTurnOffSystemTest.TurnOffThenObstacleDetectedDoesNothing (0 ms)
[ RUN   ] ControllerTurnOffSystemTest.TurnOffThenChargingCanStillStartWhenBatteryIsNotFull
[ OK    ] ControllerTurnOffSystemTest.TurnOffThenChargingCanStillStartWhenBatteryIsNotFull (0 ms)
[ RUN   ] ControllerTurnOffSystemTest.TurnOffCanBeCalledAfterPowerOnWithoutStart
[ OK    ] ControllerTurnOffSystemTest.TurnOffCanBeCalledAfterPowerOnWithoutStart (0 ms)
[ RUN   ] ControllerTurnOffSystemTest.PowerButtonAfterTurnOffTurnsSystemOnAgain
[ OK    ] ControllerTurnOffSystemTest.PowerButtonAfterTurnOffTurnsSystemOnAgain (0 ms)
[-----] 20 tests from ControllerTurnOffSystemTest (0 ms total)

[-----] Global test environment tear-down
[====] 20 tests from 1 test suite ran. (0 ms total)
[ PASSED ] 20 tests.
```

Turn Off

Part2

: Unit Test

실행 결과

```

Running main() from /Users/oonsi/RVC/OOAD_TEAM1/build/_deps/googletest-src/googletest/src/gtest_main.cc
Note: Google Test filter = DustDetectedControllerTest.*
[====] Running 20 tests from 1 test suite.
[-----] Global test environment set-up.
[-----] 20 tests from DustDetectedControllerTest
[ RUN   ] DustDetectedControllerTest.DustDetectedDoesNothingWhenPowerIsOff
[ OK    ] DustDetectedControllerTest.DustDetectedDoesNothingWhenPowerIsOff (0 ms)
[ RUN   ] DustDetectedControllerTest.DustDetectedInStandbyModeKeepsStandbyMode
[ OK    ] DustDetectedControllerTest.DustDetectedInStandbyModeKeepsStandbyMode (0 ms)
[ RUN   ] DustDetectedControllerTest.DustDetectedInNormalModeChangesToBoostMode
[ OK    ] DustDetectedControllerTest.DustDetectedInNormalModeChangesToBoostMode (5604 ms)
[ RUN   ] DustDetectedControllerTest.DustDetectedInNormalModeSetsCleanerToBoost
[ OK    ] DustDetectedControllerTest.DustDetectedInNormalModeSetsCleanerToBoost (5601 ms)
[ RUN   ] DustDetectedControllerTest.DustDetectedInNormalModeKeepsPowerOn
[ OK    ] DustDetectedControllerTest.DustDetectedInNormalModeKeepsPowerOn (5604 ms)
[ RUN   ] DustDetectedControllerTest.DustDetectedInNormalModeKeepsCurrentModeExists
[ OK    ] DustDetectedControllerTest.DustDetectedInNormalModeKeepsCurrentModeExists (5604 ms)
[ RUN   ] DustDetectedControllerTest.BoostModeReturnsToNormalModeAfterTimerExpired
[ OK    ] DustDetectedControllerTest.BoostModeReturnsToNormalModeAfterTimerExpired (5605 ms)
[ RUN   ] DustDetectedControllerTest.CleanerModeStaysBoostAfterTimerExpired
[ OK    ] DustDetectedControllerTest.CleanerModeStaysBoostAfterTimerExpired (5605 ms)
[ RUN   ] DustDetectedControllerTest.CleanerStillCleaningAfterTimerExpired
[ OK    ] DustDetectedControllerTest.CleanerStillCleaningAfterTimerExpired (5603 ms)
[ RUN   ] DustDetectedControllerTest.RepeatedDustDetectedInBoostModeKeepsBoostModeImmediately
[ OK    ] DustDetectedControllerTest.RepeatedDustDetectedInBoostModeKeepsBoostModeImmediately (5603 ms)
[ RUN   ] DustDetectedControllerTest.DustDetectedCanBoostAgainAfterTimerExpired
[ OK    ] DustDetectedControllerTest.DustDetectedCanBoostAgainAfterTimerExpired (11208 ms)
[ RUN   ] DustDetectedControllerTest.DustDetectedDoesNothingWhileCharging
[ OK    ] DustDetectedControllerTest.DustDetectedDoesNothingWhileCharging (0 ms)
[ RUN   ] DustDetectedControllerTest.DustDetectedDoesNothingAfterPowerOff
[ OK    ] DustDetectedControllerTest.DustDetectedDoesNothingAfterPowerOff (0 ms)
[ RUN   ] DustDetectedControllerTest.DustDetectedInLowBatteryModeKeepsLowBatteryMode
[ OK    ] DustDetectedControllerTest.DustDetectedInLowBatteryModeKeepsLowBatteryMode (0 ms)
[ RUN   ] DustDetectedControllerTest.DustDetectedDoesNotChangeBatteryLevel
[ OK    ] DustDetectedControllerTest.DustDetectedDoesNotChangeBatteryLevel (5604 ms)
[ RUN   ] DustDetectedControllerTest.DustSensorStaysActiveAfterDustDetected
[ OK    ] DustDetectedControllerTest.DustSensorStaysActiveAfterDustDetected (5605 ms)
[ RUN   ] DustDetectedControllerTest.DustProcessorInStandbyModeReturnsStandbyMode
[ OK    ] DustDetectedControllerTest.DustProcessorInStandbyModeReturnsStandbyMode (0 ms)
[ RUN   ] DustDetectedControllerTest.DustProcessorInNormalModeReturnsBoostMode
[ OK    ] DustDetectedControllerTest.DustProcessorInNormalModeReturnsBoostMode (0 ms)
[ RUN   ] DustDetectedControllerTest.DustProcessorInBoostModeKeepsBoostMode
[ OK    ] DustDetectedControllerTest.DustProcessorInBoostModeKeepsBoostMode (0 ms)
[ RUN   ] DustDetectedControllerTest.DustProcessorInLowBatteryModeKeepsLowBatteryMode
[ OK    ] DustDetectedControllerTest.DustProcessorInLowBatteryModeKeepsLowBatteryMode (0 ms)
[-----] 20 tests from DustDetectedControllerTest (67249 ms total)

[-----] Global test environment tear-down
[====] 20 tests from 1 test suite ran. (67249 ms total)
[ PASSED ] 20 tests.
(base) → OOAD_TEAM1 git:(feat/dust-detected-test) x

```

dustDetected

```

(base) → OOAD_TEAM1 git:(feat/dust-detected-test) ./build/ooad_tests --gtest_filter="ControllerTurnOnSystemTest.*"
Running main() from /Users/oonsi/RVC/OOAD_TEAM1/build/_deps/googletest-src/googletest/src/gtest_main.cc
Note: Google Test filter = ControllerTurnOnSystemTest.*
[====] Running 20 tests from 1 test suite.
[-----] Global test environment set-up.
[-----] 20 tests from ControllerTurnOnSystemTest
[ RUN   ] ControllerTurnOnSystemTest.InitialControllerIsPoweredOff
[ OK    ] ControllerTurnOnSystemTest.InitialControllerIsPoweredOff (0 ms)
[ RUN   ] ControllerTurnOnSystemTest.PowerButtonTurnsSystemOn
[ OK    ] ControllerTurnOnSystemTest.PowerButtonTurnsSystemOn (0 ms)
[ RUN   ] ControllerTurnOnSystemTest.TurnOnCreatesCurrentMode
[ OK    ] ControllerTurnOnSystemTest.TurnOnCreatesCurrentMode (0 ms)
[ RUN   ] ControllerTurnOnSystemTest.TurnOnSetsCurrentModeToStandby
[ OK    ] ControllerTurnOnSystemTest.TurnOnSetsCurrentModeToStandby (0 ms)
[ RUN   ] ControllerTurnOnSystemTest.TurnOnReportsStandbyModeName
[ OK    ] ControllerTurnOnSystemTest.TurnOnReportsStandbyModeName (0 ms)
[ RUN   ] ControllerTurnOnSystemTest.TurnOnInitializesBatteryWithoutStartingChargingWhenFull
[ OK    ] ControllerTurnOnSystemTest.TurnOnInitializesBatteryWithoutStartingChargingWhenFull (0 ms)
[ RUN   ] ControllerTurnOnSystemTest.TurnOnKeepsHalfBatteryLevel
[ OK    ] ControllerTurnOnSystemTest.TurnOnKeepsHalfBatteryLevel (0 ms)
[ RUN   ] ControllerTurnOnSystemTest.TurnOnKeepsLowBatteryLevel
[ OK    ] ControllerTurnOnSystemTest.TurnOnKeepsLowBatteryLevel (0 ms)
[ RUN   ] ControllerTurnOnSystemTest.TurnOnKeepsThresholdBatteryLevel
[ OK    ] ControllerTurnOnSystemTest.TurnOnKeepsThresholdBatteryLevel (0 ms)
[ RUN   ] ControllerTurnOnSystemTest.TurnOnKeepsEmptyBatteryLevel
[ OK    ] ControllerTurnOnSystemTest.TurnOnKeepsEmptyBatteryLevel (0 ms)
[ RUN   ] ControllerTurnOnSystemTest.TurnOnActivatesDustSensor
[ OK    ] ControllerTurnOnSystemTest.TurnOnActivatesDustSensor (0 ms)
[ RUN   ] ControllerTurnOnSystemTest.TurnOnActivatesObstacleSensor
[ OK    ] ControllerTurnOnSystemTest.TurnOnActivatesObstacleSensor (0 ms)
[ RUN   ] ControllerTurnOnSystemTest.TurnOnInitializesCleanerToOff
[ OK    ] ControllerTurnOnSystemTest.TurnOnInitializesCleanerToOff (0 ms)
[ RUN   ] ControllerTurnOnSystemTest.TurnOnDoesNotStartCleaner
[ OK    ] ControllerTurnOnSystemTest.TurnOnDoesNotStartCleaner (0 ms)
[ RUN   ] ControllerTurnOnSystemTest.TurnOnInitializesMotorStopped
[ OK    ] ControllerTurnOnSystemTest.TurnOnInitializesMotorStopped (0 ms)
[ RUN   ] ControllerTurnOnSystemTest.TurnOnDoesNotMoveForward
[ OK    ] ControllerTurnOnSystemTest.TurnOnDoesNotMoveForward (0 ms)
[ RUN   ] ControllerTurnOnSystemTest.TurnOnFromPowerOffThenStartButtonCanEnterNormalMode
[ OK    ] ControllerTurnOnSystemTest.TurnOnFromPowerOffThenStartButtonCanEnterNormalMode (0 ms)
[ RUN   ] ControllerTurnOnSystemTest.TurnOnDoesNotActivateCleanerBeforeStartButton
[ OK    ] ControllerTurnOnSystemTest.TurnOnDoesNotActivateCleanerBeforeStartButton (0 ms)
[ RUN   ] ControllerTurnOnSystemTest.TurnOnDoesNotActivateMotorBeforeStartButton
[ OK    ] ControllerTurnOnSystemTest.TurnOnDoesNotActivateMotorBeforeStartButton (0 ms)
[ RUN   ] ControllerTurnOnSystemTest.SystemCanBeTurnedOnAgainAfterTurnOff
[ OK    ] ControllerTurnOnSystemTest.SystemCanBeTurnedOnAgainAfterTurnOff (0 ms)
[-----] 20 tests from ControllerTurnOnSystemTest (0 ms total)

[-----] Global test environment tear-down
[====] 20 tests from 1 test suite ran. (0 ms total)
[ PASSED ] 20 tests.

```

Turn On

Part2

: Unit Test

실행 결과

```

Note: Google Test filter = ButtonTest.*
[====] Running 28 tests from 1 test suite.
[====] Global test environment set-up.
[====] 28 tests from ButtonTest
[ RUN ] ButtonTest.InitialStateIsPoweredOff
[ OK ] ButtonTest.InitialStateIsPoweredOff (0 ms)
[ RUN ] ButtonTest.PowerButtonTurnsSystemOnFromOff
[ OK ] ButtonTest.PowerButtonTurnsSystemOnFromOff (0 ms)
[ RUN ] ButtonTest.PowerButtonSetsInitialModeToStandby
[ OK ] ButtonTest.PowerButtonSetsInitialModeToStandby (0 ms)
[ RUN ] ButtonTest.PowerButtonActivatesBothSensors
[ OK ] ButtonTest.PowerButtonActivatesBothSensors (0 ms)
[ RUN ] ButtonTest.PowerButtonDoesNotStartMotorOnTurnOn
[ OK ] ButtonTest.PowerButtonDoesNotStartMotorOnTurnOn (0 ms)
[ RUN ] ButtonTest.PowerButtonDoesNotStartCleanerOnTurnOn
[ OK ] ButtonTest.PowerButtonDoesNotStartCleanerOnTurnOn (0 ms)
[ RUN ] ButtonTest.PowerButtonTurnsSystemOffWhenOn
[ OK ] ButtonTest.PowerButtonTurnsSystemOffWhenOn (0 ms)
[ RUN ] ButtonTest.PowerButtonOffDeactivatesBothSensors
[ OK ] ButtonTest.PowerButtonOffDeactivatesBothSensors (0 ms)
[ RUN ] ButtonTest.PowerButtonOffStopsMotor
[ OK ] ButtonTest.PowerButtonOffStopsMotor (0 ms)
[ RUN ] ButtonTest.PowerButtonOffStopsCleaner
[ OK ] ButtonTest.PowerButtonOffStopsCleaner (0 ms)
[ RUN ] ButtonTest.PowerButtonPreservesBatteryLevelOnCycle
[ OK ] ButtonTest.PowerButtonPreservesBatteryLevelOnCycle (0 ms)
[ RUN ] ButtonTest.PowerButtonTogglesOnOffOn
[ OK ] ButtonTest.PowerButtonTogglesOnOffOn (0 ms)
[ RUN ] ButtonTest.StartButtonWhenPowerOffDoesNothing
[ OK ] ButtonTest.StartButtonWhenPowerOffDoesNothing (0 ms)
[ RUN ] ButtonTest.StartButtonInStandbyTransitionsToNormal
[ OK ] ButtonTest.StartButtonInStandbyTransitionsToNormal (0 ms)
[ RUN ] ButtonTest.StartButtonInStandbyStartsMotor
[ OK ] ButtonTest.StartButtonInStandbyStartsMotor (0 ms)
[ RUN ] ButtonTest.StartButtonInStandbyStartsCleanerInNormalMode
[ OK ] ButtonTest.StartButtonInStandbyStartsCleanerInNormalMode (0 ms)
[ RUN ] ButtonTest.StartButtonInNormalReturnsToStandby
[ OK ] ButtonTest.StartButtonInNormalReturnsToStandby (0 ms)
[ RUN ] ButtonTest.StartButtonInNormalStopsMotor
[ OK ] ButtonTest.StartButtonInNormalStopsMotor (0 ms)
[ RUN ] ButtonTest.StartButtonInNormalStopsCleaner
[ OK ] ButtonTest.StartButtonInNormalStopsCleaner (0 ms)
[ RUN ] ButtonTest.StartButtonInLowBatteryModeIsIgnored
[ OK ] ButtonTest.StartButtonInLowBatteryModeIsIgnored (0 ms)
[ RUN ] ButtonTest.StartButtonIgnoredWhileCharging
[ OK ] ButtonTest.StartButtonIgnoredWhileCharging (0 ms)
[ RUN ] ButtonTest.StartButtonAfterPowerCycleRestoresNormalOperation
[ OK ] ButtonTest.StartButtonAfterPowerCycleRestoresNormalOperation (0 ms)
[ RUN ] ButtonTest.DoubleStartButtonTogglesBackToStandby
[ OK ] ButtonTest.DoubleStartButtonTogglesBackToStandby (0 ms)
[ RUN ] ButtonTest.PowerButtonOffFromLowBatteryStopsEverything
[ OK ] ButtonTest.PowerButtonOffFromLowBatteryStopsEverything (0 ms)
[ RUN ] ButtonTest.StartButtonDoesNotActivateSensorsOnOff
[ OK ] ButtonTest.StartButtonDoesNotActivateSensorsOnOff (0 ms)
[ RUN ] ButtonTest.PowerButtonOffStopsChargingFromStandby
[ OK ] ButtonTest.PowerButtonOffStopsChargingFromStandby (0 ms)
[ RUN ] ButtonTest.StartButtonMultiplePressesToggleCleanerState
[ OK ] ButtonTest.StartButtonMultiplePressesToggleCleanerState (0 ms)
[ RUN ] ButtonTest.PowerButtonOffWithLowBatteryKeepsBatteryLevel
[ OK ] ButtonTest.PowerButtonOffWithLowBatteryKeepsBatteryLevel (0 ms)
[====] 28 tests from ButtonTest (0 ms total)

[====] Global test environment tear-down
[====] 28 tests from 1 test suite ran. (0 ms total)
[ PASSED ] 28 tests.

```

Power Button, Start Button

```

(base) → OOAD_TEAM1 git:(main) ./build/ooad_tests --gtest_filter="ControllerObstacleDetectedTest.*"
Running main() from /Users/moonsi/RVC/OOAD_TEAM1/build/_deps/googletest-src/googletest/src/gtest_main.cc
Note: Google Test filter = ControllerObstacleDetectedTest.*
[====] Running 21 tests from 1 test suite.
[====] Global test environment set-up.
[====] 21 tests from ControllerObstacleDetectedTest
[ RUN ] ControllerObstacleDetectedTest.NormalModeFrontClearKeepsMovingForward
[ OK ] ControllerObstacleDetectedTest.NormalModeFrontClearKeepsMovingForward (0 ms)
[ RUN ] ControllerObstacleDetectedTest.NormalModeForwardFrontBlockedTurnsLeft
[ OK ] ControllerObstacleDetectedTest.NormalModeForwardFrontBlockedTurnsLeft (0 ms)
[ RUN ] ControllerObstacleDetectedTest.NormalModeForwardFrontAndLeftBlockedTurnsRight
[ OK ] ControllerObstacleDetectedTest.NormalModeForwardFrontAndLeftBlockedTurnsRight (0 ms)
[ RUN ] ControllerObstacleDetectedTest.NormalModeForwardAllBlockedMovesBackward
[ OK ] ControllerObstacleDetectedTest.NormalModeForwardAllBlockedMovesBackward (0 ms)
[ RUN ] ControllerObstacleDetectedTest.NormalModeBackwardLeftClearTurnsLeftAndMovesForward
[ OK ] ControllerObstacleDetectedTest.NormalModeBackwardLeftClearTurnsLeftAndMovesForward (0 ms)
[ RUN ] ControllerObstacleDetectedTest.NormalModeBackwardRightClearTurnsRightAndMovesForward
[ OK ] ControllerObstacleDetectedTest.NormalModeBackwardRightClearTurnsRightAndMovesForward (0 ms)
[ RUN ] ControllerObstacleDetectedTest.NormalModeBackwardNoSideClearKeepsBackward
[ OK ] ControllerObstacleDetectedTest.NormalModeBackwardNoSideClearKeepsBackward (0 ms)
[ RUN ] ControllerObstacleDetectedTest.BoostModeFrontClearKeepsMovingForward
[ OK ] ControllerObstacleDetectedTest.BoostModeFrontClearKeepsMovingForward (0 ms)
[ RUN ] ControllerObstacleDetectedTest.BoostModeForwardFrontBlockedTurnsLeft
[ OK ] ControllerObstacleDetectedTest.BoostModeForwardFrontBlockedTurnsLeft (0 ms)
[ RUN ] ControllerObstacleDetectedTest.BoostModeForwardFrontAndLeftBlockedTurnsRight
[ OK ] ControllerObstacleDetectedTest.BoostModeForwardFrontAndLeftBlockedTurnsRight (0 ms)
[ RUN ] ControllerObstacleDetectedTest.BoostModeForwardAllBlockedMovesBackward
[ OK ] ControllerObstacleDetectedTest.BoostModeForwardAllBlockedMovesBackward (0 ms)
[ RUN ] ControllerObstacleDetectedTest.BoostModeBackwardLeftClearTurnsLeftAndMovesForward
[ OK ] ControllerObstacleDetectedTest.BoostModeBackwardLeftClearTurnsLeftAndMovesForward (0 ms)
[ RUN ] ControllerObstacleDetectedTest.BoostModeBackwardRightClearTurnsRightAndMovesForward
[ OK ] ControllerObstacleDetectedTest.BoostModeBackwardRightClearTurnsRightAndMovesForward (0 ms)
[ RUN ] ControllerObstacleDetectedTest.BoostModeBackwardNoSideClearKeepsBackward
[ OK ] ControllerObstacleDetectedTest.BoostModeBackwardNoSideClearKeepsBackward (0 ms)
[ RUN ] ControllerObstacleDetectedTest.PowerOffObstacleDetectedDoesNothing
[ OK ] ControllerObstacleDetectedTest.PowerOffObstacleDetectedDoesNothing (0 ms)
[ RUN ] ControllerObstacleDetectedTest.NullDirectionDoesNothingInNormalMode
[ OK ] ControllerObstacleDetectedTest.NullDirectionDoesNothingInNormalMode (0 ms)
[ RUN ] ControllerObstacleDetectedTest.StandbyModeObstacleDetectedDoesNotMoveMotor
[ OK ] ControllerObstacleDetectedTest.StandbyModeObstacleDetectedDoesNotMoveMotor (0 ms)
[ RUN ] ControllerObstacleDetectedTest.LowBatteryModeObstacleDetectedDoesNotMoveMotor
[ OK ] ControllerObstacleDetectedTest.LowBatteryModeObstacleDetectedDoesNotMoveMotor (0 ms)
[ RUN ] ControllerObstacleDetectedTest.StubModeReceivesLeftDirectionWhenForwardAndFrontBlocked
[ OK ] ControllerObstacleDetectedTest.StubModeReceivesLeftDirectionWhenForwardAndFrontBlocked (0 ms)
[ RUN ] ControllerObstacleDetectedTest.StubModeReceivesRightDirectionWhenBackwardAndRightClear
[ OK ] ControllerObstacleDetectedTest.StubModeReceivesRightDirectionWhenBackwardAndRightClear (0 ms)
[ RUN ] ControllerObstacleDetectedTest.StubModeIsNotCalledWhenDirectionPointerIsNull
[ OK ] ControllerObstacleDetectedTest.StubModeIsNotCalledWhenDirectionPointerIsNull (0 ms)
[====] 21 tests from ControllerObstacleDetectedTest (0 ms total)

[====] Global test environment tear-down
[====] 21 tests from 1 test suite ran. (0 ms total)
[ PASSED ] 21 tests.

```

ObstacleDetected



Part2

: Unit Test

테스트 품질 측정

GCC Code Coverage Report

Directory: ./

Date: 2026-05-07 08:46:33

Coverage: low: $\geq 0\%$ medium: $\geq 75.0\%$ high: $\geq 90.0\%$













Exec Total Coverage

Lines: 321 761 42.2%

Functions: 98 137 71.5%

Branches: 105 1155 9.1%

[List of functions](#)

File	Lines	Functions	Branches
include/rvc/OperatingMode.hpp	 100.0% 1 / 1	100.0% 1 / 1	-% 0 / 0
simulator/main.cpp	 0.0% 0 / 391	0.0% 0 / 24	0.0% 0 / 992
src/main.cpp	 0.0% 0 / 2	0.0% 0 / 1	-% 0 / 0
src/rvc/BatteryDriver.cpp	 82.1% 32 / 39	83.3% 10 / 12	50.0% 1 / 2
src/rvc/CleanerDriver.cpp	 100.0% 8 / 8	100.0% 7 / 7	75.0% 3 / 4
src/rvc/Controller.cpp	 93.2% 123 / 132	93.1% 27 / 29	60.9% 67 / 110
src/rvc/DustProcessor.cpp	 100.0% 2 / 2	100.0% 1 / 1	-% 0 / 0
src/rvc/DustSensorDriver.cpp	 91.7% 11 / 12	80.0% 4 / 5	-% 0 / 0
src/rvc/Modes.cpp	 86.7% 78 / 90	78.6% 33 / 42	76.2% 16 / 21
src/rvc/MotorDriver.cpp	 65.4% 34 / 52	100.0% 10 / 10	42.9% 6 / 14
src/rvc/ObstacleProcessor.cpp	 100.0% 17 / 17	100.0% 1 / 1	100.0% 12 / 12
src/rvc/ObstacleSensorDriver.cpp	 100.0% 15 / 15	100.0% 4 / 4	-% 0 / 0

Generated by: [GCOVR \(Version 7.0\)](#)

: System Test

시뮬레이터 소개

C++ CLI 기반 RVC 시뮬레이터

- 인터랙티브 모드: 메뉴 선택으로 직접 시스템 조작 가능 (전원, 청소, 먼지 감지, 충전, 장애물 등)
- 스크립트 모드: .rvc 파일로 시스템 테스트 케이스 자동 실행
- expect 명령어로 각 상태 값 검증 후 PASS/FAIL 결과 출력

CI 자동화

- PR 및 main 브랜치 push 시 시스템 테스트 자동 실행
- CMake로 시뮬레이터 빌드 후 ctest로 .rvc 스크립트 기반 테스트 수행
- 테스트 로그를 Artifact로 저장해 결과 확인 가능

Part2

: System Test

test case

TC	분류	시나리오
TC1-2	전원	전원 ON/OFF
TC3-7	시작 버튼	각 모드별 시작 버튼
TC8-14	충전	각 모드별 충전
TC15-18	배터리	저배터리 감지/해제
TC19-23	먼지 감지	Boost 전환/유지
TC24-43	장애물	방향별 회피

: System Test

실행 결과

```

===== RVC Simulator =====
-----
Mode   : Off
Battery : 100%
Motor  : Stopped
Cleaner : off
-----
1. Power On
2. Start Cleaning
3. Dust Detected
4. Low Battery
5. Charge Battery
6. Obstacle Detected
0. Exit
Select: 1

[System] Power On → StandbyMode

-----
Mode   : StandbyMode
Battery : 100%
Motor  : Stopped
Cleaner : off
-----
1. Power Off
2. Start Cleaning
3. Dust Detected
4. Low Battery
5. Charge Battery
6. Obstacle Detected
0. Exit
Select: 2

[System] Start Button → NormalMode
[Cleaner] Start Cleaning...
[Motor] Move Forward

-----
Mode   : NormalMode
Battery : 100%
Motor  : FRONT / Forward
Cleaner : normal
-----
1. Power Off
2. Stop Cleaning
3. Dust Detected
4. Low Battery
5. Charge Battery
6. Obstacle Detected
0. Exit
Select: 3

[Dust Detected] → BoostMode
[Cleaner] Boost Cleaning for 5 sec...

-----
Mode   : BoostMode
Battery : 100%
Motor  : FRONT / Forward
Cleaner : boost
-----

```

```

[Dust Detected] → BoostMode
[Cleaner] Boost Cleaning for 5 sec...

-----
Mode   : BoostMode
Battery : 100%
Motor  : FRONT / Forward
Cleaner : boost
-----
1. Power Off
2. Stop Cleaning
3. Dust Detected
4. Low Battery
5. Charge Battery
6. Obstacle Detected
0. Exit
Select: 6

Input [front,left,right] (e.g. [1,0,0]): [1,0,0]

[Obstacle Detected] front=blocked left=clear right=clear
[Motor] Direction: LEFT, Forward: true

-----
Mode   : NormalMode
Battery : 100%
Motor  : LEFT / Forward
Cleaner : normal
-----
1. Power Off
2. Stop Cleaning
3. Dust Detected
4. Low Battery
5. Charge Battery
6. Obstacle Detected
0. Exit
Select: 6

Input [front,left,right] (e.g. [1,0,0]): [1,0,0]

[Obstacle Detected] front=blocked left=clear right=clear
[Motor] Direction: BACK, Forward: true

-----
Mode   : NormalMode
Battery : 100%
Motor  : BACK / Forward
Cleaner : normal
-----
1. Power Off
2. Stop Cleaning
3. Dust Detected
4. Low Battery
5. Charge Battery
6. Obstacle Detected
0. Exit
Select: 6

Input [front,left,right] (e.g. [1,0,0]): [1,1,0]

[Obstacle Detected] front=blocked left=blocked right=clear
[Motor] Direction: LEFT, Forward: true

-----
Mode   : NormalMode
Battery : 100%
Motor  : LEFT / Forward
Cleaner : normal
-----

```

```

[Obstacle Detected] front=blocked left=blocked right=clear
[Motor] Direction: LEFT, Forward: true

-----
Mode   : NormalMode
Battery : 100%
Motor  : LEFT / Forward
Cleaner : normal
-----
1. Power Off
2. Stop Cleaning
3. Dust Detected
4. Low Battery
5. Charge Battery
6. Obstacle Detected
0. Exit
Select: 4

[Battery] Low Battery Detected! → LowBatteryMode
[Cleaner] Stop Cleaning
[Motor] Stopped

-----
Mode   : LowBatteryMode
Battery : 100%
Motor  : Stopped
Cleaner : off
-----
1. Power Off
2. Start Cleaning
3. Dust Detected
4. Low Battery
5. Charge Battery
6. Obstacle Detected
0. Exit
Select: 1

[System] Power Off

-----
Mode   : Off
Battery : 100%
Motor  : Stopped
Cleaner : off
-----
1. Power On
2. Start Cleaning
3. Dust Detected
4. Low Battery
5. Charge Battery
6. Obstacle Detected
0. Exit
Select: 0

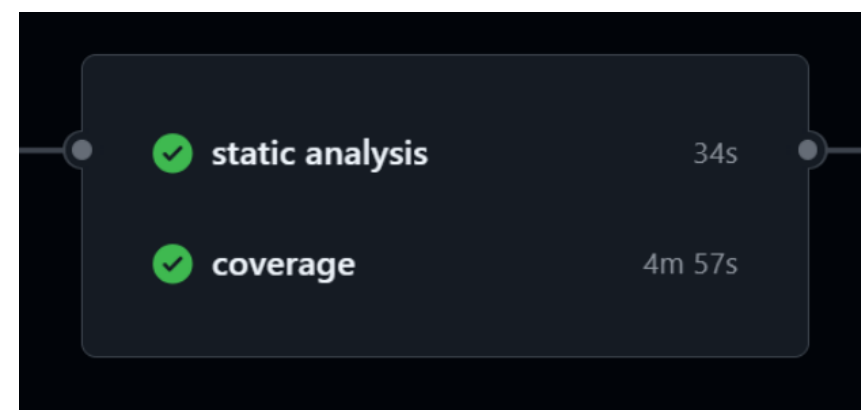
```

Part2

: Static Code Analysis

```
✓ Clang-Tidy
1 ▶ Run mkdir -p build/static-analysis
19 clang-tidy target files:
20 src/main.cpp
21 src/rvc/MotorDriver.cpp
22 src/rvc/DustSensorDriver.cpp
23 src/rvc/ObstacleSensorDriver.cpp
24 src/rvc/BatteryDriver.cpp
25 src/rvc/CleanerDriver.cpp
26 src/rvc/DustProcessor.cpp
27 src/rvc/Controller.cpp
28 src/rvc/Modes.cpp
29 src/rvc/ObstacleProcessor.cpp
30 simulator/main.cpp
31 simulator/rvc_simulator_main.cpp
```

```
✓ Cppcheck
1 ▶ Run mkdir -p build/static-analysis
15 Checking src/main.cpp ...
16 1/12 files checked 0% done
17 Checking src/rvc/BatteryDriver.cpp ...
18 2/12 files checked 3% done
19 Checking src/rvc/CleanerDriver.cpp ...
20 3/12 files checked 4% done
21 Checking src/rvc/Controller.cpp ...
22 4/12 files checked 20% done
23 Checking src/rvc/DustProcessor.cpp ...
24 5/12 files checked 20% done
25 Checking src/rvc/DustSensorDriver.cpp ...
26 6/12 files checked 21% done
27 Checking src/rvc/Modes.cpp ...
28 7/12 files checked 34% done
29 Checking src/rvc/MotorDriver.cpp ...
30 8/12 files checked 38% done
31 Checking src/rvc/ObstacleProcessor.cpp ...
32 9/12 files checked 40% done
33 Checking src/rvc/ObstacleSensorDriver.cpp ...
34 10/12 files checked 41% done
35 Checking simulator/main.cpp ...
36 simulator/main.cpp:218:26: style: Parameter 'argv' can be declared as const array [constParameter]
37 int main(int argc, char *argv[])
38         ^
39 11/12 files checked 73% done
40 Checking simulator/rvc_simulator_main.cpp ...
41 12/12 files checked 100% done
42 Cppcheck completed. Findings are recorded in cppcheck-report.txt.
```



Part2

: Static Code Analysis

clang-tidy와 cppcheck 두 가지 도구를 사용하여 수행

```
clang-tidy-report.txt
clang-tidy target files:
src/main.cpp
src/rvc/MotorDriver.cpp
src/rvc/DustSensorDriver.cpp
src/rvc/ObstacleSensorDriver.cpp
src/rvc/BatteryDriver.cpp
src/rvc/CleanerDriver.cpp
src/rvc/DustProcessor.cpp
src/rvc/Controller.cpp
src/rvc/Modes.cpp
src/rvc/ObstacleProcessor.cpp
simulator/main.cpp
simulator/rvc_simulator_main.cpp
/home/runner/work/OOAD_TEAM1/OOAD_TEAM1/.clang-tidy:12:1: error: unknown key 'AnalyzeTemporaryDtors'
AnalyzeTemporaryDtors: false
~~~~~
Error parsing /home/runner/work/OOAD_TEAM1/OOAD_TEAM1/.clang-tidy: Invalid argument
/home/runner/work/OOAD_TEAM1/OOAD_TEAM1/.clang-tidy:12:1: error: unknown key 'AnalyzeTemporaryDtors'
AnalyzeTemporaryDtors: false
~~~~~
Error parsing /home/runner/work/OOAD_TEAM1/OOAD_TEAM1/.clang-tidy: Invalid argument
/home/runner/work/OOAD_TEAM1/OOAD_TEAM1/.clang-tidy:12:1: error: unknown key 'AnalyzeTemporaryDtors'
AnalyzeTemporaryDtors: false
~~~~~
Error parsing /home/runner/work/OOAD_TEAM1/OOAD_TEAM1/.clang-tidy: Invalid argument
[1/12] Processing file /home/runner/work/OOAD_TEAM1/OOAD_TEAM1/src/main.cpp.
/home/runner/work/OOAD_TEAM1/OOAD_TEAM1/.clang-tidy:12:1: error: unknown key 'AnalyzeTemporaryDtors'
AnalyzeTemporaryDtors: false
~~~~~
Error parsing /home/runner/work/OOAD_TEAM1/OOAD_TEAM1/.clang-tidy: Invalid argument
/home/runner/work/OOAD_TEAM1/OOAD_TEAM1/.clang-tidy:12:1: error: unknown key 'AnalyzeTemporaryDtors'
AnalyzeTemporaryDtors: false
~~~~~
Error parsing /home/runner/work/OOAD_TEAM1/OOAD_TEAM1/.clang-tidy: Invalid argument
[2/12] Processing file /home/runner/work/OOAD_TEAM1/OOAD_TEAM1/src/rvc/MotorDriver.cpp.
/home/runner/work/OOAD_TEAM1/OOAD_TEAM1/.clang-tidy:12:1: error: unknown key 'AnalyzeTemporaryDtors'
AnalyzeTemporaryDtors: false
~~~~~
Error parsing /home/runner/work/OOAD_TEAM1/OOAD_TEAM1/.clang-tidy: Invalid argument
/home/runner/work/OOAD_TEAM1/OOAD_TEAM1/.clang-tidy:12:1: error: unknown key 'AnalyzeTemporaryDtors'
AnalyzeTemporaryDtors: false
~~~~~
```

```
cppcheck-report.txt
Checking src/main.cpp ...
1/12 files checked 0% done
Checking src/rvc/BatteryDriver.cpp ...
2/12 files checked 3% done
Checking src/rvc/CleanerDriver.cpp ...
3/12 files checked 4% done
Checking src/rvc/Controller.cpp ...
4/12 files checked 20% done
Checking src/rvc/DustProcessor.cpp ...
5/12 files checked 20% done
Checking src/rvc/DustSensorDriver.cpp ...
6/12 files checked 21% done
Checking src/rvc/Modes.cpp ...
7/12 files checked 34% done
Checking src/rvc/MotorDriver.cpp ...
8/12 files checked 38% done
Checking src/rvc/ObstacleProcessor.cpp ...
9/12 files checked 40% done
Checking src/rvc/ObstacleSensorDriver.cpp ...
10/12 files checked 41% done
Checking simulator/main.cpp ...
simulator/main.cpp:218:26: style: Parameter 'argv' can be declared as const array
[constParameter]
int main(int argc, char *argv[])
                        ^
11/12 files checked 73% done
Checking simulator/rvc_simulator_main.cpp ...
12/12 files checked 100% done
```

- Target: src/ 및 simulator/의 C++ source file 12개
- clang-tidy: .clang-tidy 설정 파일의 AnalyzeTemporaryDtors 옵션 인식 오류 발생
- cppcheck: 전체 12개 파일 분석 완료, style warning 1건 발견

감사합니다.

