RVC SA 보완

T4
200511306 김성훈
200710115 김철웅
200712692 진형남
201011316 김성엽

Statement of Purpose

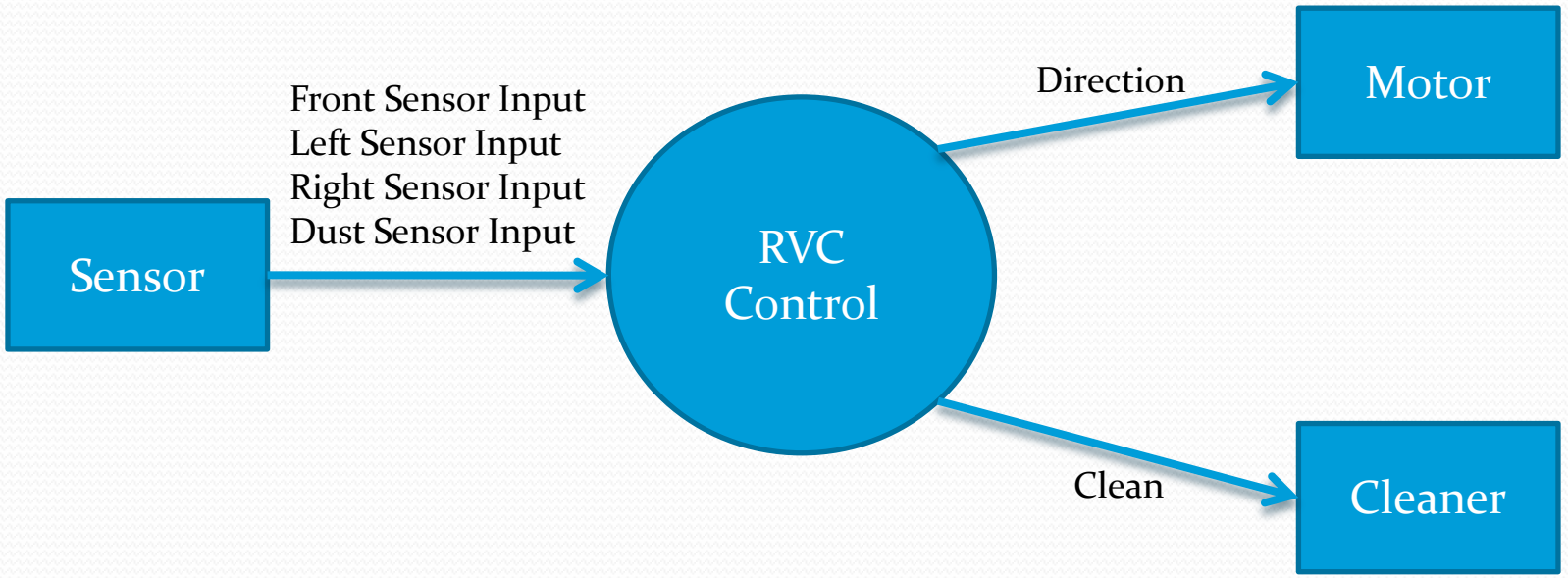
Robot Vacuum Cleaner (RVC)

- An RVC automatically cleans and mops household surface.
- It goes straight forward while cleaning.
- If its sensors found an obstacle, it stops cleaning, turns aside, and goes forward with cleaning.
- If it detects dust, power up the cleaning for a while
- We do not consider the detail design and implementation on HW controls.
- We only focus on the automatic cleaning function.

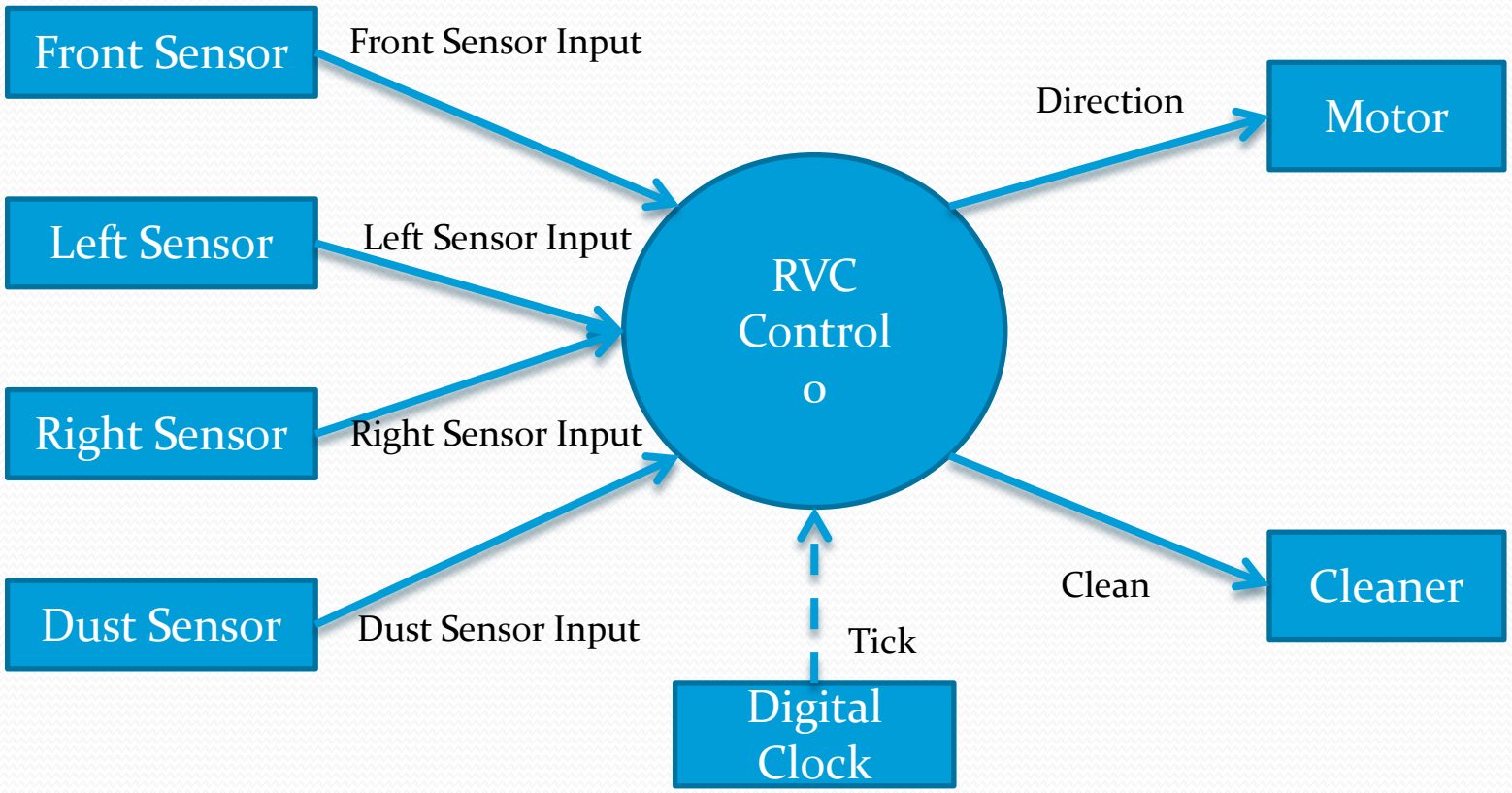
Process 관련 부분

- Go straight forward & Cleaning
- Find an obstacle
  : Stops going & cleaning → Turn → Go forward & Cleaning
- Detect Dust : Power-Up (for a while)

System context diagram



DFD Level 0


Front Sensor
Front Sensor Input
Left Sensor
Left Sensor Input
Right Sensor
Right Sensor Input
Dust Sensor
Dust Sensor Input
RVC Control o
Direction
Motor
Clean
Cleaner
Tick
Digital Clock

DFD Level 0

- Data Dictionary

Input / Output Event	Description	Format / Type
Front Sensor Input	Detects obstacles in front of the RVC	True / False , Interrupt
Left Sensor Input	Detects obstacles in left side of the RVC periodically	True / False , Periodic
Right Sensor Input	Detects obstacles in right side of the RVC periodically	True / False , Periodic
Dust Sensor Input	Detects dust on the floor periodically	True / False , Periodic
Direction	Direction Commands to the motor (go forward / turn left with an angle / turn right with an angle)	Forward / **Pause** / Left / Right
Clean	Turn off / Turn on / Power-Up / **Power-Down**	On / Off / Up / **Down**

- Direction의 Stop 명령어가 상태의 Stop과 용어 중첩 : Pause로 변경
- Power-Up 상태를 되돌리는 Power-Down 명령어 추가

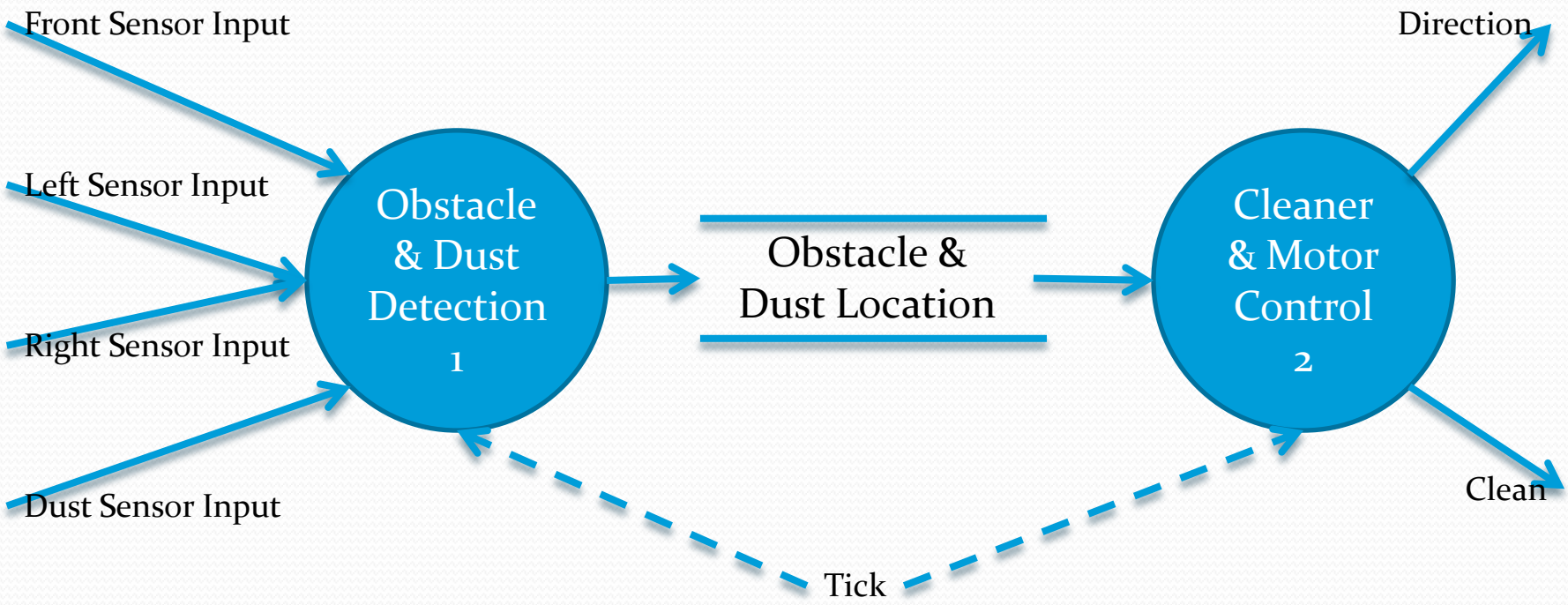
DFD Level 0

- Process Specification

Reference No.	0
Name	RVB Control
Input	Left Sensor Input, Right Sensor Input, Front Sensor Input, Dust Sensor Input, Tick
Output	Direction, Clean
Process Description	Sensor(Front, Left, Right, Dust)로부터 Input 값을 입력받아 Motor와 Cleaner에게 명령어를 전달하여 동작시킨다.

DFD Level 1

- RVC Control o



DFD Level 1

- Process Specification

Reference No.	1
Name	Obstacle & Dust Detection
Input	Left Sensor Input, Right Sensor Input, Front Sensor Input, Dust Sensor Input, Tick
Output	Obstacle & Dust Location
Process Description	Sensor(Front, Left, Right, Dust)로부터 Input 값을 입력받아 Obstacle & Dust Location 데이터 영역에 저장한다.

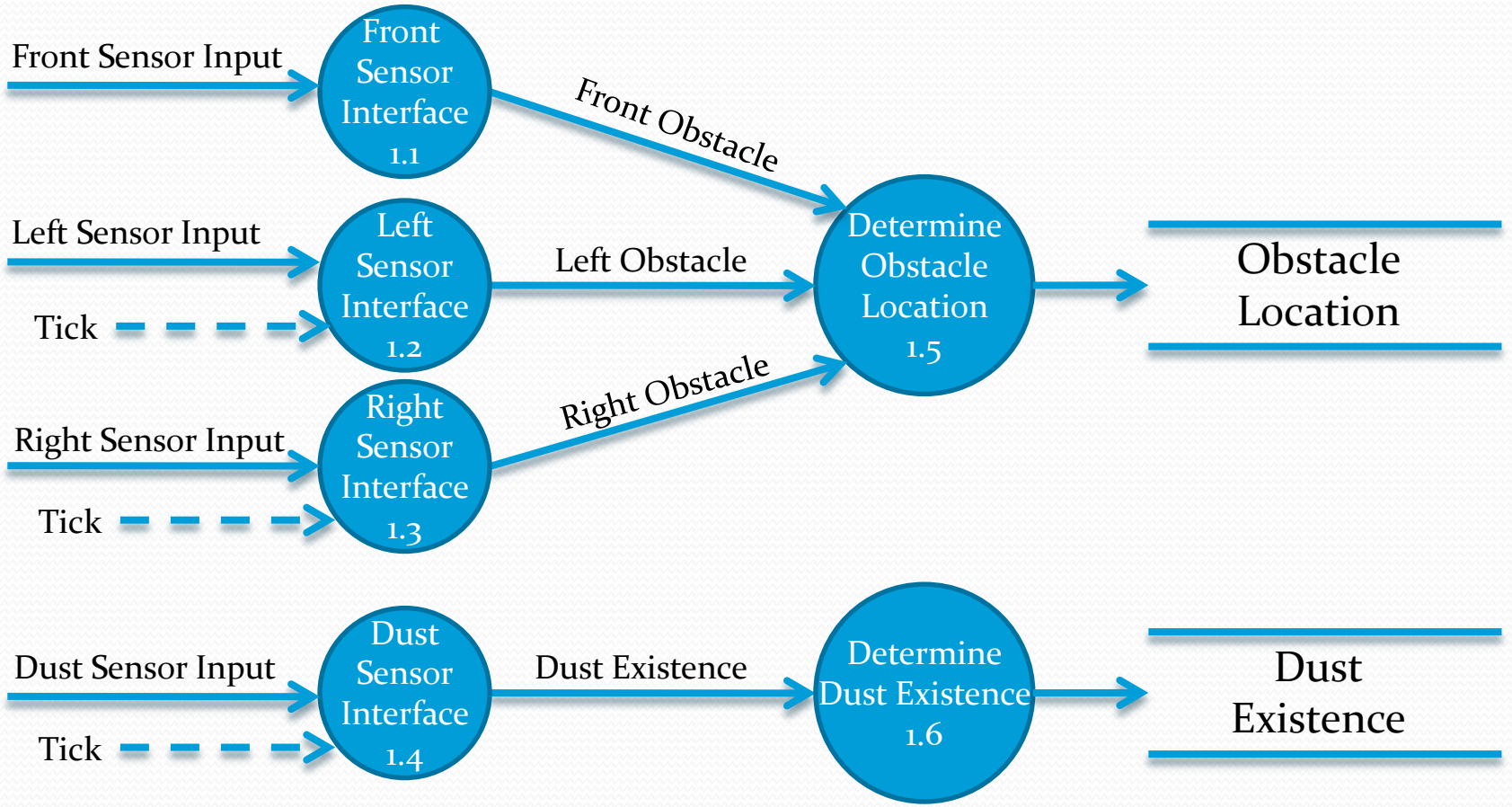
DFD Level 1

- Process Specification

Reference No.	2
Name	Cleaner & Motor Control
Input	Obstacle & Dust Location
Output	Direction & Clean
Process Description	Obstacle & Dust Location 데이터 영역에서 값을 전달받아 Cleaner와Motor의 동작을 결정하여 명령어를 통해 동작시킨다.

DFD Level 2

- Obstacle & Dust Detection 1



DFD Level 1

- Process Specification

Reference No.	1.1
Name	Front Sensor Interface
Input	Front Sensor Input
Output	Front Obstacle
Process Description	Front Sensor로부터 신호를 전달받아 True/False와 같은 디지털 값 형태로 변환 후 출력값 Front Obstacle에 할당한다.

Reference No.	1.2
Name	Left Sensor Interface
Input	Left Sensor Input
Output	Left Obstacle
Process Description	Left Sensor로부터 신호를 전달받아 True/False와 같은 디지털 값 형태로 변환 후 출력값 Left Obstacle에 할당한다.

DFD Level 1

- Process Specification

Reference No.	1.3
Name	Right Sensor Interface
Input	Right Sensor Input, Tick
Output	Right Obstacle
Process Description	Right Sensor로부터 신호를 전달받아 True/False와 같은 디지털 값 형태로 변환 후 출력값 Right Obstacle에 할당한다.

Reference No.	1.4
Name	Dust Sensor Interface
Input	Dust Sensor Input, Tick
Output	Dust Existence
Process Description	Dust Sensor로부터 신호를 전달받아 True/False와 같은 디지털 값 형태로 변환 후 출력값 Dust Existence에 할당한다.

DFD Level 1

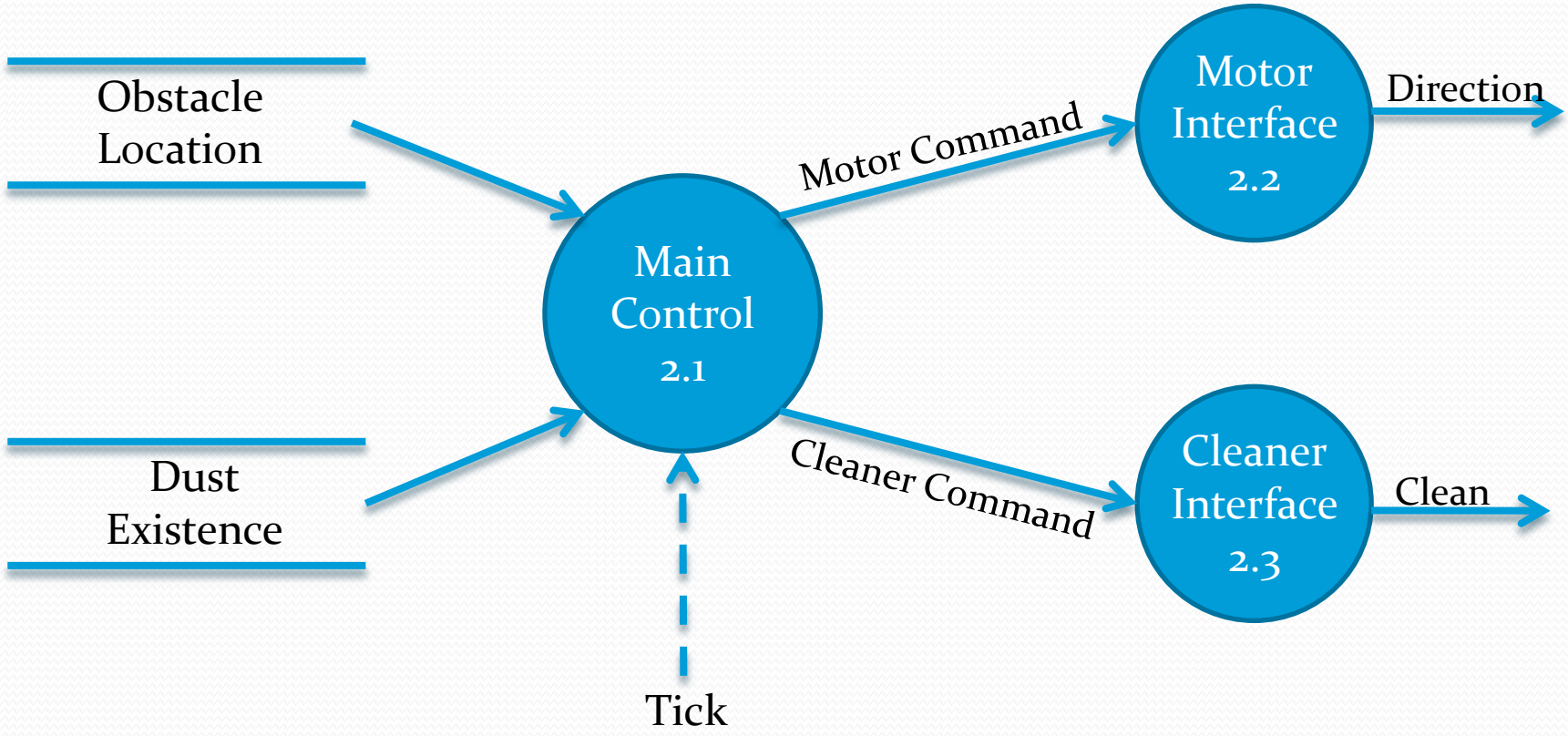
- Process Specification

Reference No.	1.5
Name	Determine Obstacle Location
Input	Front Obstacle, Left Obstacle, Right Obstacle
Output	Obstacle Location
Process Description	Interface들(Front, Left, Right)로부터 입력받은 디지털 값을 Obstacle Location데이터 영역에 저장한다.

Reference No.	1.6
Name	Determine Dust Existence
Input	Dust Existence
Output	Dust Existence
Process Description	Dust Sensor Interface로 입력받은 디지털 값을 Dust Existence 데이터 영역에 저장한다.

DFD Level 2

- Cleaner & Motor Control 2



DFD Level 2

- Process Specification

Reference No.	2.1
Name	Main Control
Input	Obstacle Location, Dust Existence, Tick
Output	Motor Command, Cleaner Command
Process Description	데이터 영역(Obstacle Location, Dust Existence)에서 입력받아 Motor와 Cleaner 동작을 결정하여 각 Interface에 Command를 전달한다.

DFD Level 2

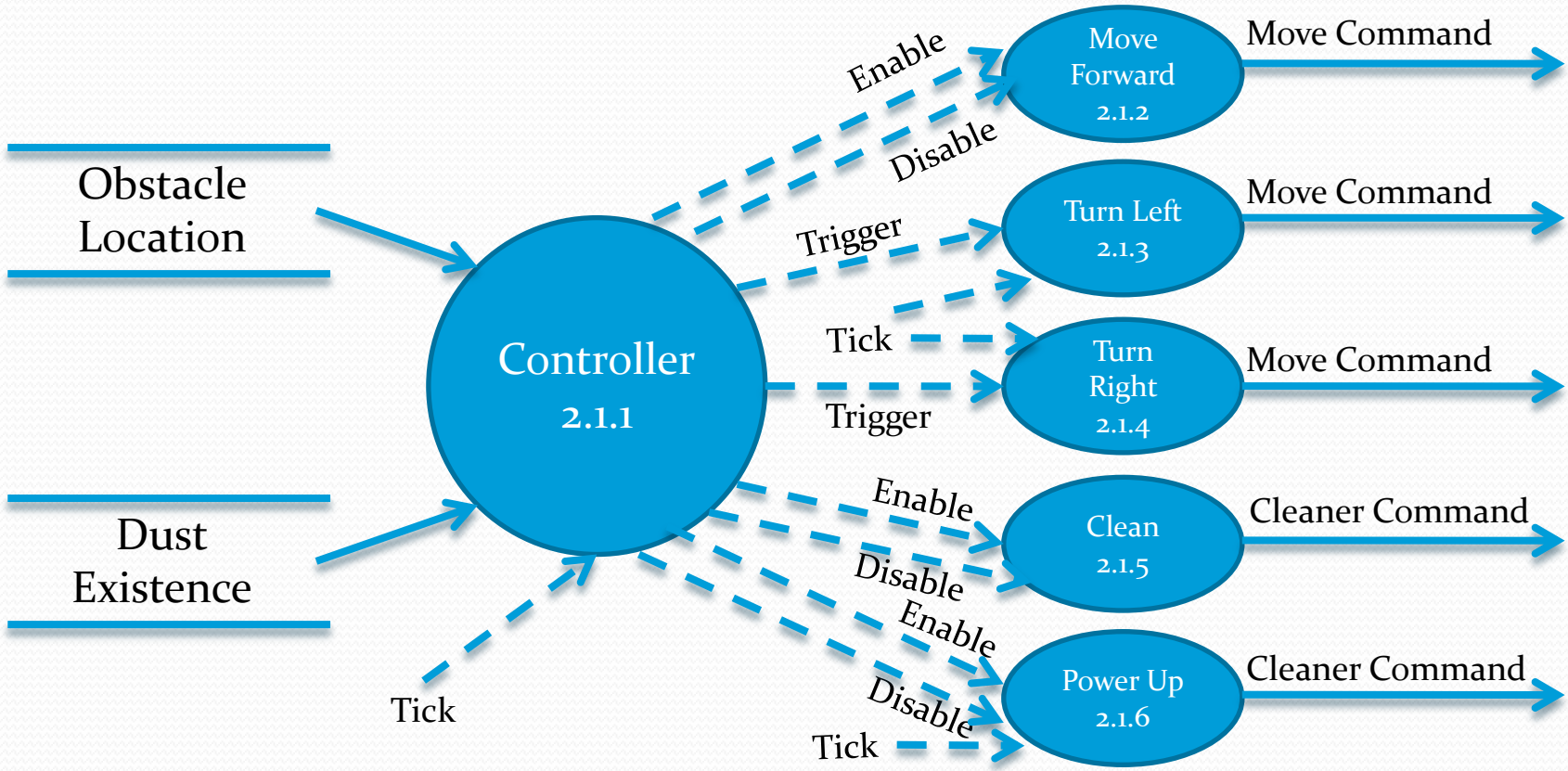
- Process Specification

Reference No.	2.2
Name	Motor Interface
Input	Mortor Command
Output	Direction
Process Description	입력 받은 Motor Command에 따라 Motor를 동작시키는 신호(Forward / Pause / Left / Right)를 보낸다.

Reference No.	2.3
Name	Main Control
Input	Cleaner Command
Output	Clean
Process Description	입력 받은 Cleaner Command에 따라 Cleaner를 동작시키는 신호(ON / OFF / UP / DOWN)를 보낸다.

DFD Level 3

- Main Control 2.1



- 기존 Controller가 직접 Cleaner Interface으로 명령어를 전달하는 방식이 아닌 Cleaner 관련 프로세스를 추가

DFD Level 3

- Process Specification

Reference No.	2.1.1
Name	Controller
Input	Obstacle Location, Dust Existence, Tick
Output	Enable, Disable, Trigger
Process Description	데이터 영역(Obstacle Location, Dust Existence)에서 입력받아 Motor와 Cleaner 동작을 결정하여 Motor와 Cleaner를 동작시키는 프로세스에 신호(Enable/Disable, Trigger)를 보낸다.

DFD Level 3

- Process Specification

Reference No.	2.1.2
Name	Move Forward
Input	Enable, Disable
Output	Move Command
Process Description	Controller로부터 신호(Enable, Disable)를 받아 Move Interface로 Move Command[Forward, Pause]를 보낸다.

DFD Level 3

- Process Specification

Reference No.	2.1.3
Name	Turn Left
Input	Trigger, Tick
Output	Move Command
Process Description	Controller로부터 신호(Trigger)를 받아 Move Interface로 Move Command[Left]를 보낸다.

Reference No.	2.1.4
Name	Turn Right
Input	Trigger, Tick
Output	Move Command
Process Description	Controller로부터 신호(Trigger)를 받아 Move Interface로 Move Command[Right]를 보낸다.

DFD Level 3

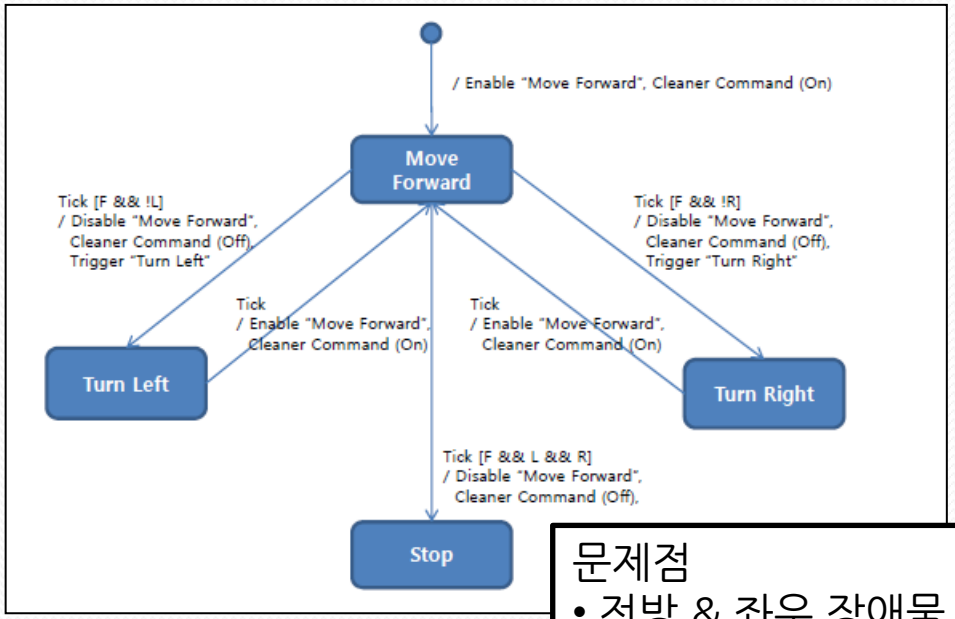
- Process Specification

Reference No.	2.1.5
Name	Clean
Input	Enable, Disable
Output	Cleaner Command
Process Description	Controller로부터 신호(Enable, Disable)를 받아 Cleaner Interface로 Cleaner Command[ON, OFF]를 보낸다.

Reference No.	2.1.6
Name	Power-Up
Input	Enable, Disable
Output	Cleaner Command
Process Description	Controller로부터 신호(Enable, Disable)를 받아 Cleaner Interface로 Cleaner Command[UP, DOWN]를 보낸다.

DFD Level 4

- Example of State Transition Diagram for Controller 2.1.1

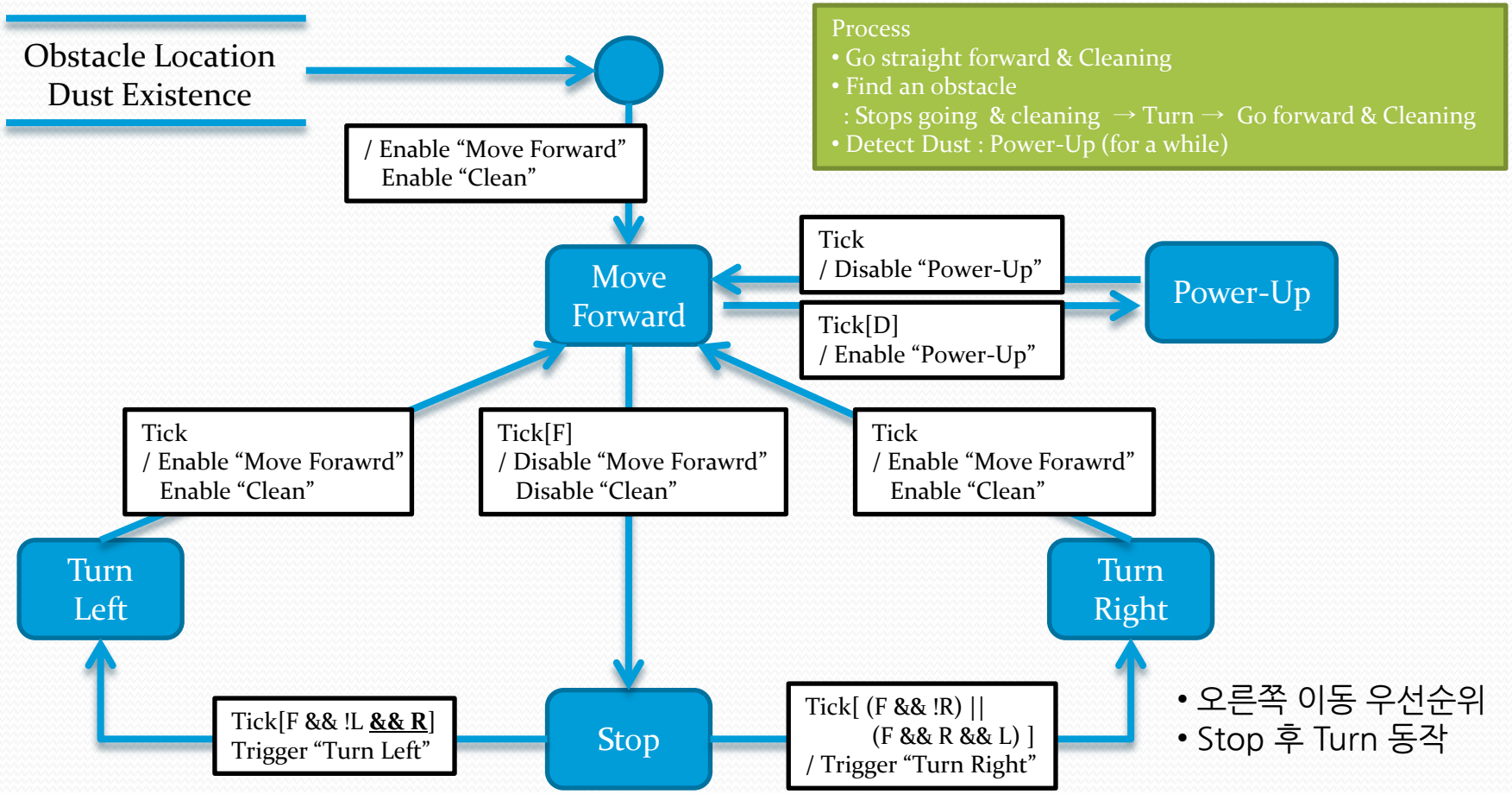


문제점

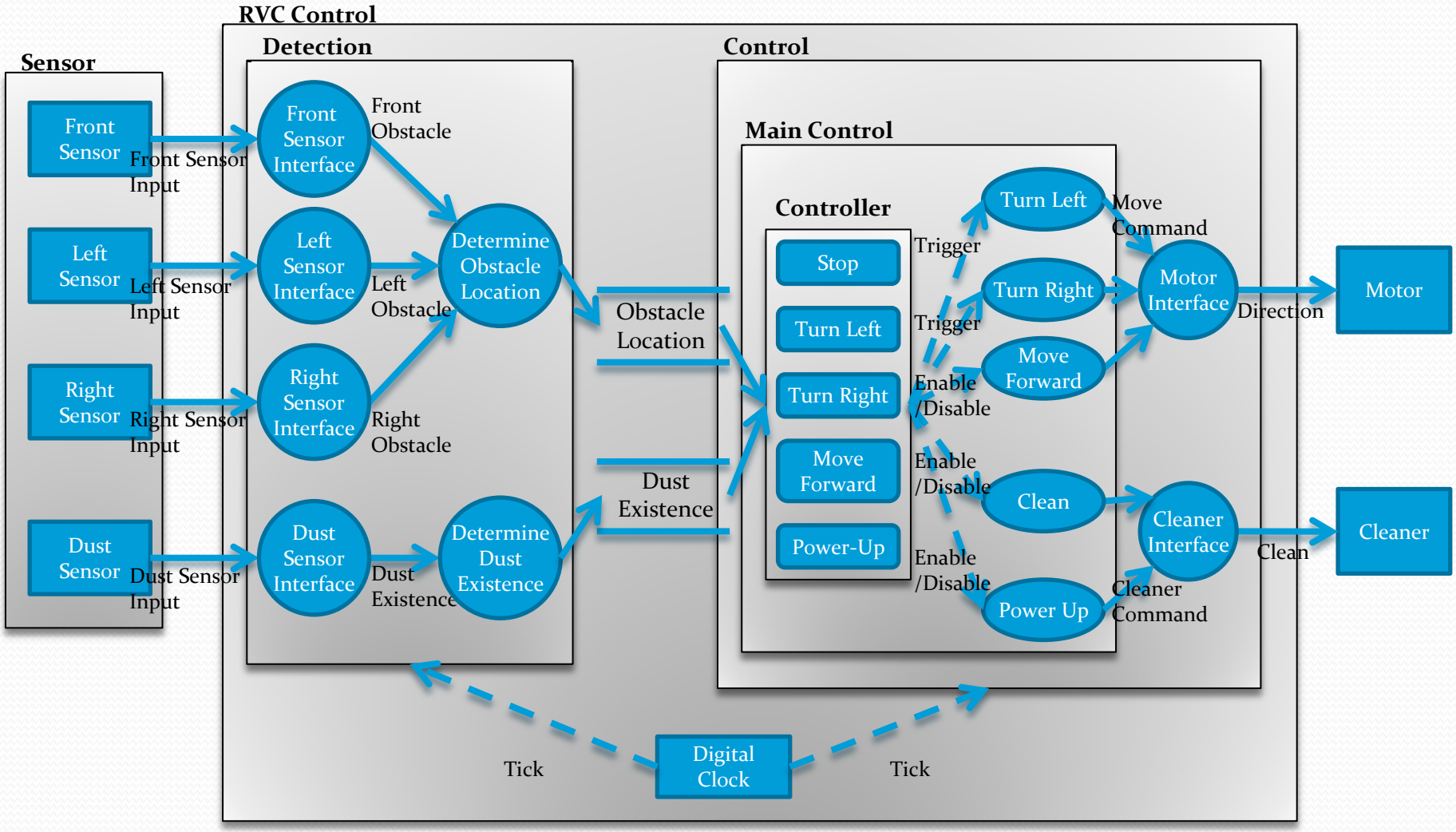
- 전방 & 좌우 장애물 발견 시 Stop 되어 더 이상 동작 불가능
- 먼지 발견에 대한 고려를 하지 않음 (Power-Up)
- 전방의 장애물 발견 시 좌우에 장애물이 없는 경우
  (Tick[F && !L && !R] 인 경우)
  Turn Left, Turn Right 동작을 예측 할 수 없음(우선순위 부재)

DFD Level 4

- State Transition Diagram for Controller 2.1.1



DFD


RVC Control
Sensor
Detection
Control
Front Sensor
Front Sensor Input
Left Sensor
Left Sensor Input
Right Sensor
Right Sensor Input
Dust Sensor
Dust Sensor Input
Front Sensor Interface
Left Sensor Interface
Right Sensor Interface
Dust Sensor Interface
Front Obstacle
Left Obstacle
Right Obstacle
Dust Existence
Determine Obstacle Location
Determine Dust Existence
Obstacle Location
Dust Existence
Main Control
Controller
Stop
Turn Left
Turn Right
Move Forward
Power-Up
Trigger
Trigger
Enable /Disable
Enable /Disable
Enable /Disable
Turn Left
Turn Right
Move Forward
Clean
Power Up
Move Command
Cleaner Command
Motor Interface
Cleaner Interface
Direction
Clean
Motor
Cleaner
Tick
Digital Clock
Tick