Software Engineering
- SASD

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KU KONKUK UNIVERSITY

1 DFD(Data Flow Datagram)

RVC's statement of Purpose

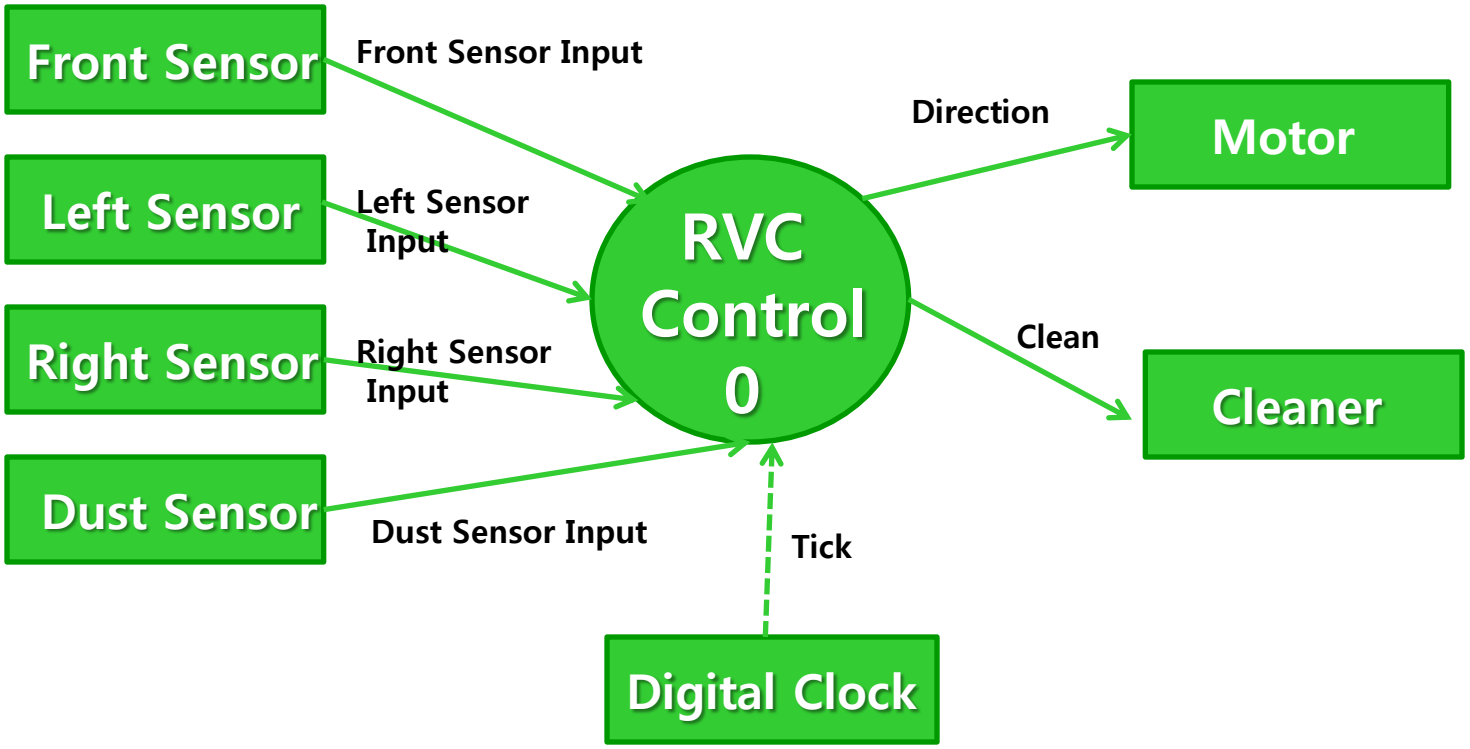
Robot Vacuum Cleaner (RVC)

- 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.

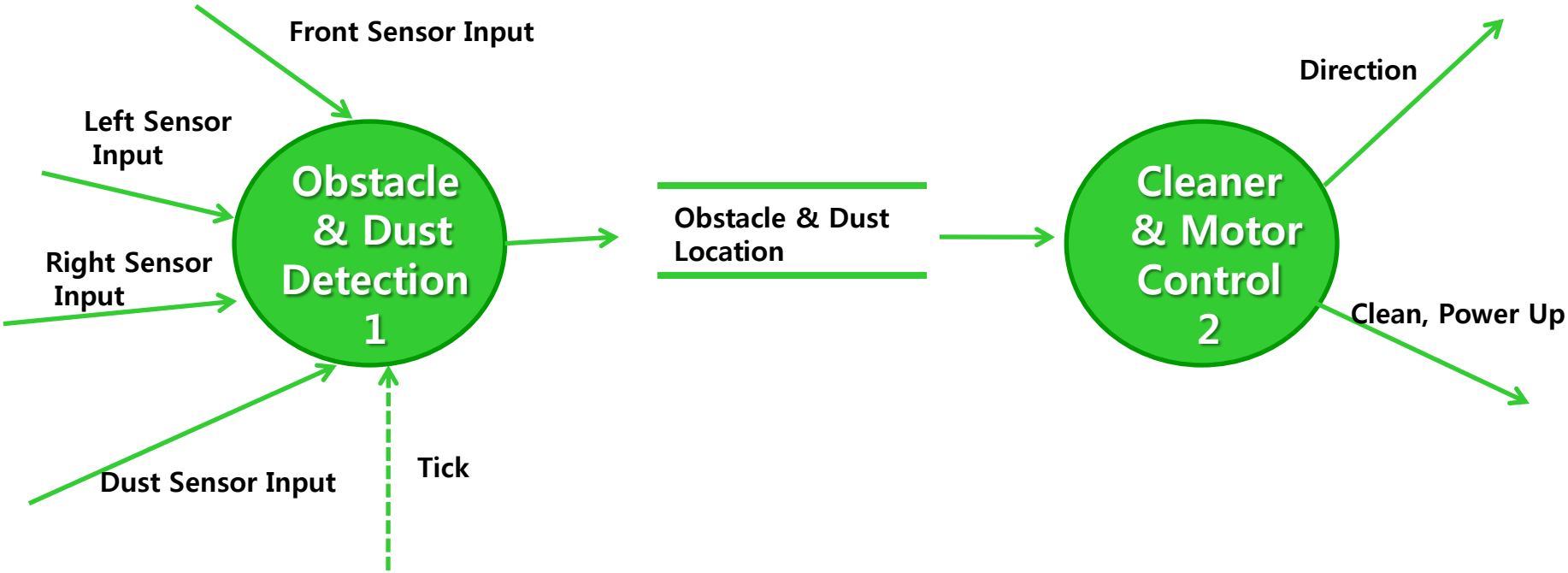
RVC Cleaner Statement

Motor Statement / Dust Existence	Move Forward	Turn
Detects Dust	Clean(Power Up)	X
Non-Detects Dust	Clean	X

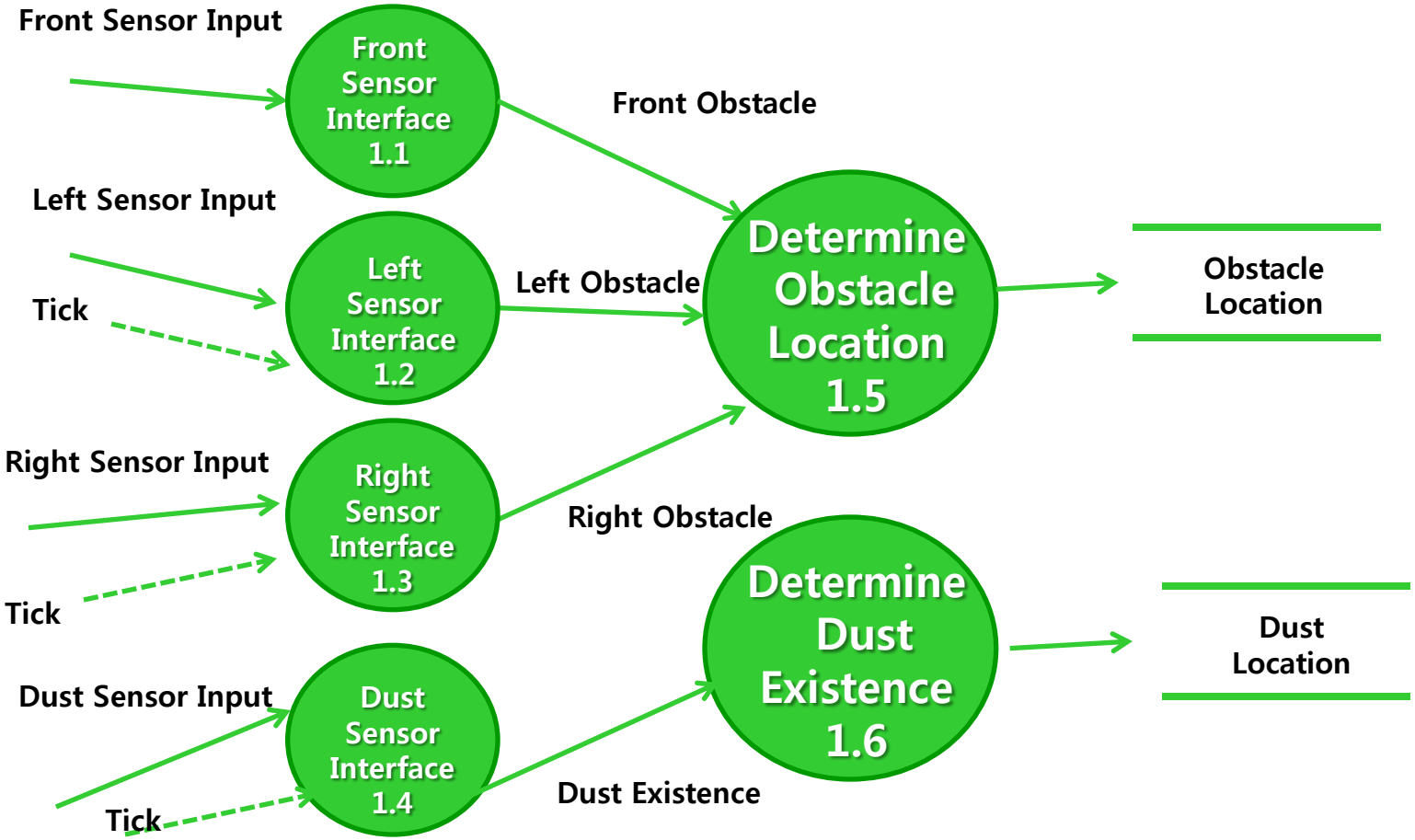
DFD Level 0


Front Sensor
Front Sensor Input
Left Sensor
Left Sensor Input
Right Sensor
Right Sensor Input
Dust Sensor
Dust Sensor Input
RVC Control 0
Direction
Motor
Clean
Cleaner
Tick
Digital Clock

DFD Level 1


Front Sensor Input
Left Sensor Input
Right Sensor Input
Obstacle & Dust Detection 1
Dust Sensor Input
Tick
Obstacle & Dust Location
Cleaner & Motor Control 2
Direction
Clean, Power Up

DFD Level 2 (1/2)



Data Store (Obstacle Location)

Front Obstacle	Left Obstacle	Right Obstacle
O	O	O
O	O	X
O	X	O
O	X	X
X	O	O
X	O	X
X	X	O
X	X	X

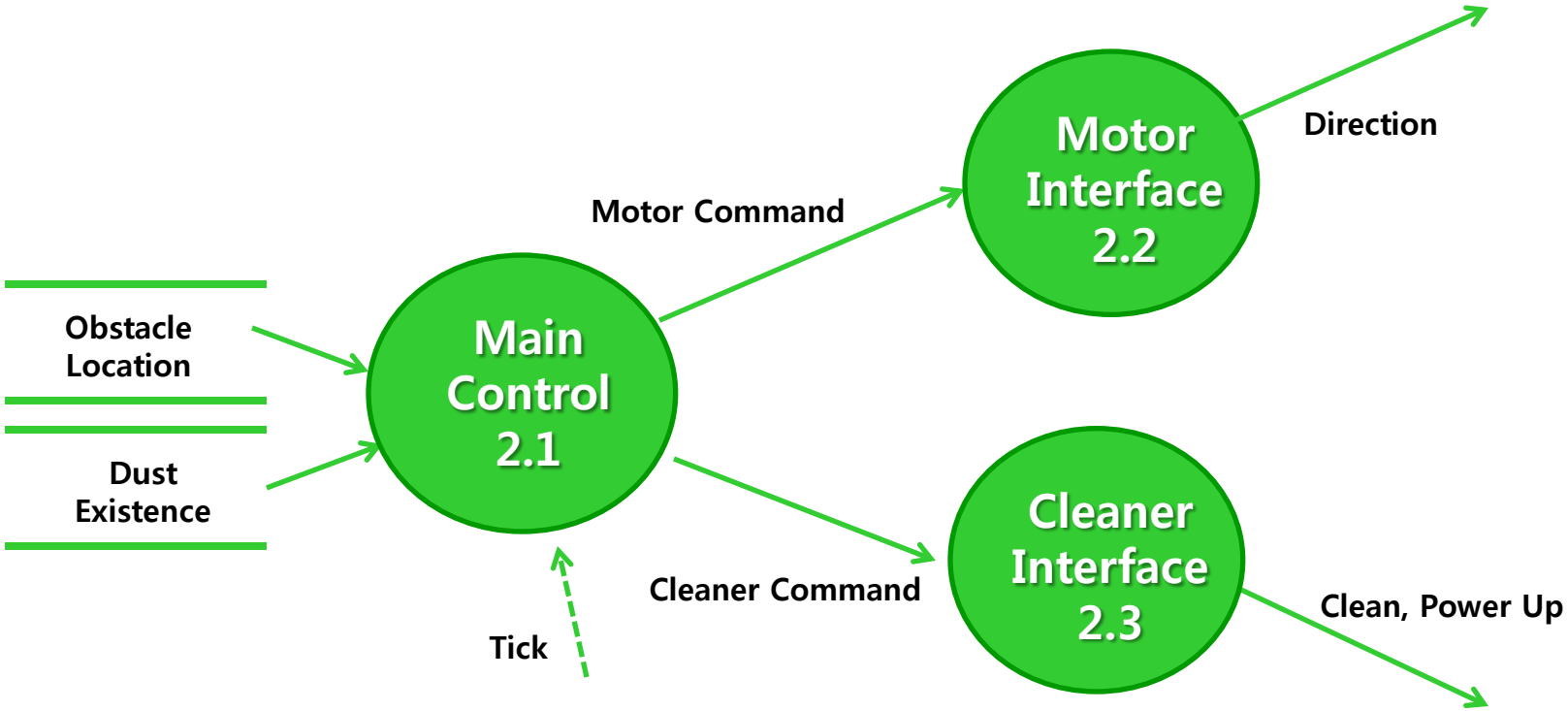
It stores 8 types of data

Data Store (Dust Existence)

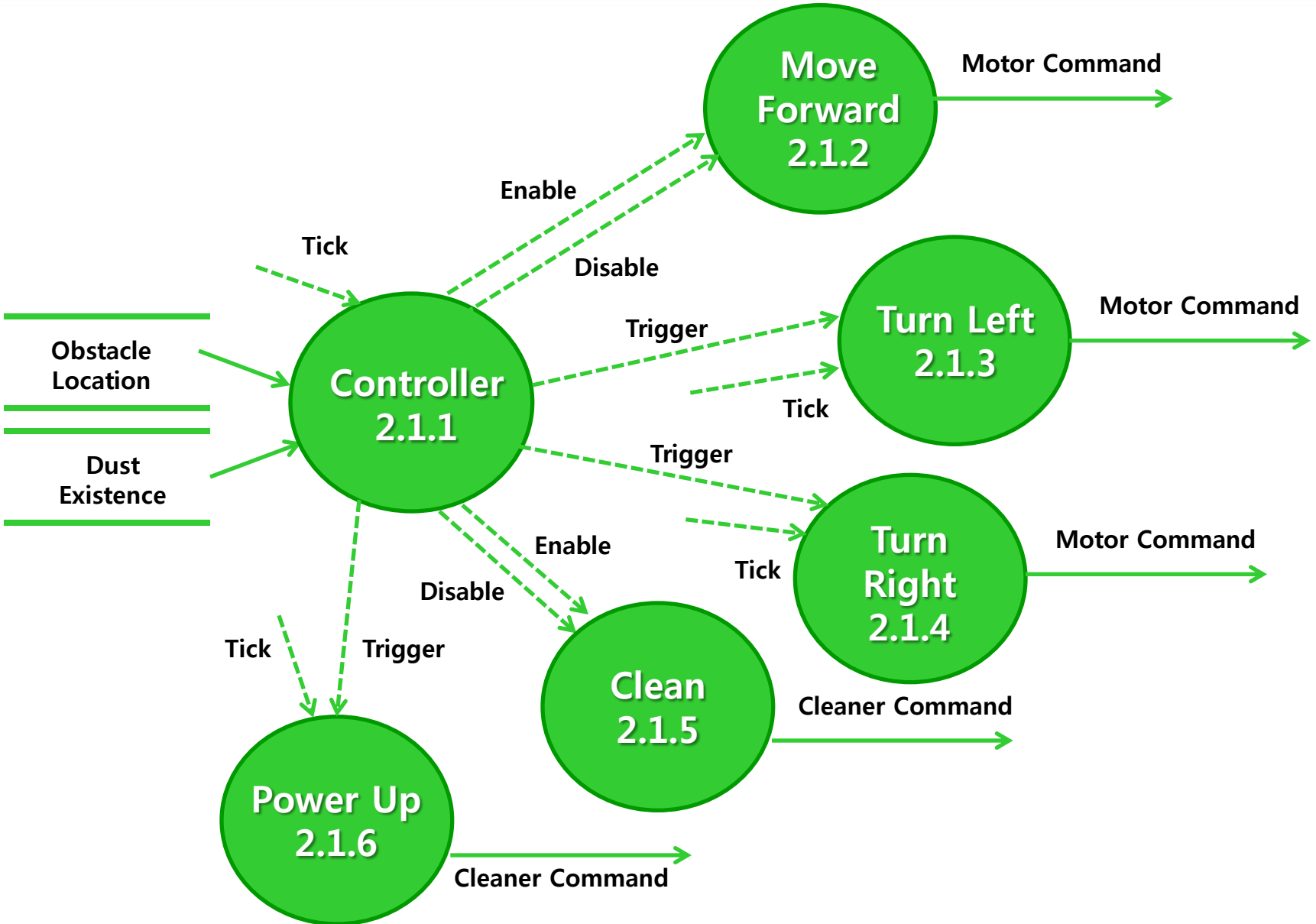
Dust Existence
O
X

It stores 2 types of data

DFD Level 2 (2/2)

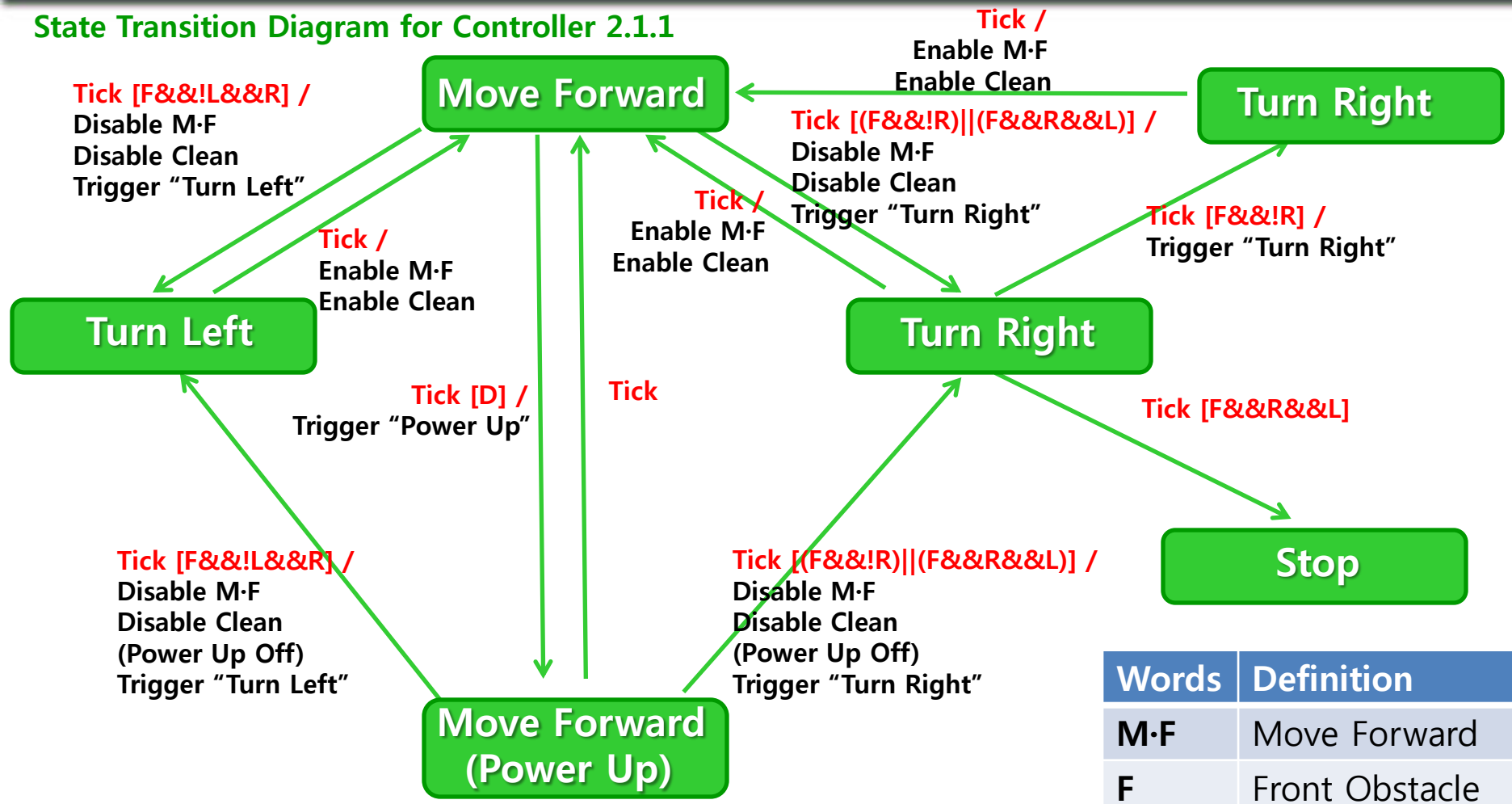


DFD Level 3


Move Forward 2.1.2
Motor Command
Enable
Disable
Tick
Obstacle Location
Dust Existence
Controller 2.1.1
Trigger
Turn Left 2.1.3
Motor Command
Tick
Trigger
Turn Right 2.1.4
Motor Command
Tick
Enable
Disable
Tick
Trigger
Clean 2.1.5
Cleaner Command
Power Up 2.1.6
Cleaner Command

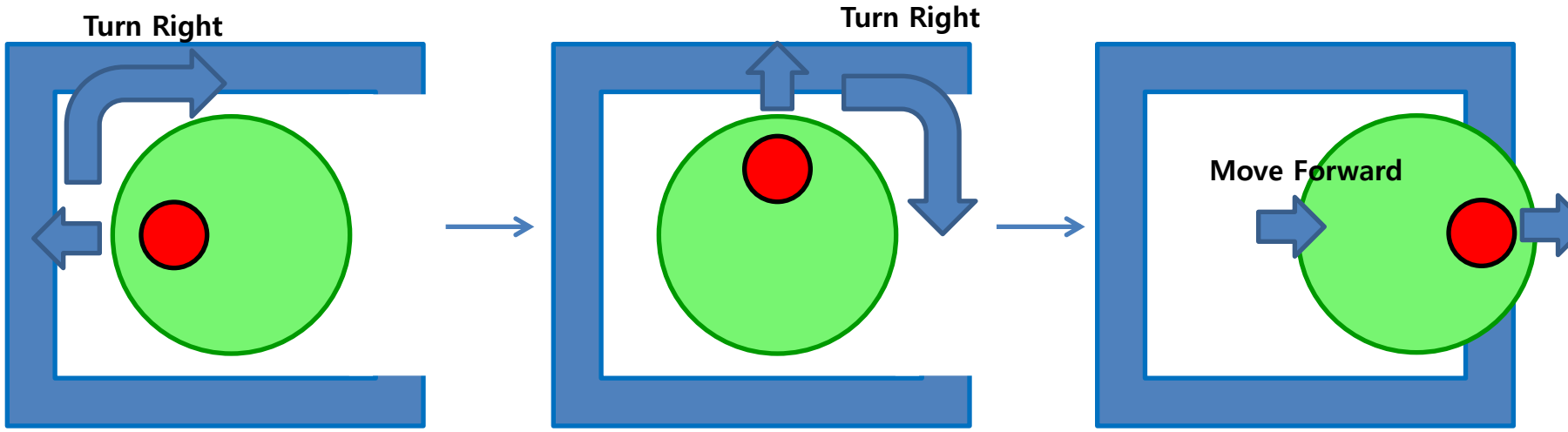
DFD Level 4

State Transition Diagram for Controller 2.1.1



Words	Definition
M·F	Move Forward
F	Front Obstacle
L	Left Obstacle
R	Right Obstacle
D	Dust Existence

A case with blocked three corners



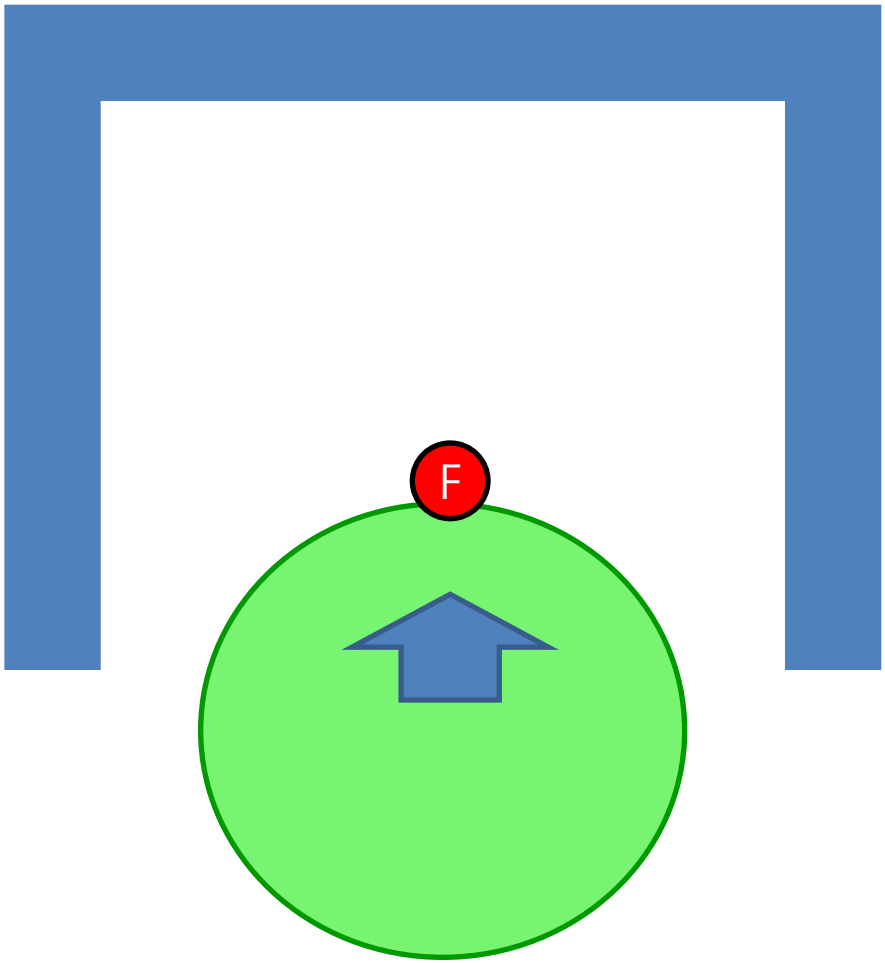
Tick [(F&&R&&L)] /
Disable M·F
Cleaner Command(Off)
Trigger “Turn Right”

Tick [(F&&!R)] /
Disable M·F
Cleaner Command(Off)
Trigger “Turn Right”

Tick /
Enable M·F
Cleaner Command(On)

Move Forward → Turn Right → Turn Right → Move Forward

A case with blocked three corners

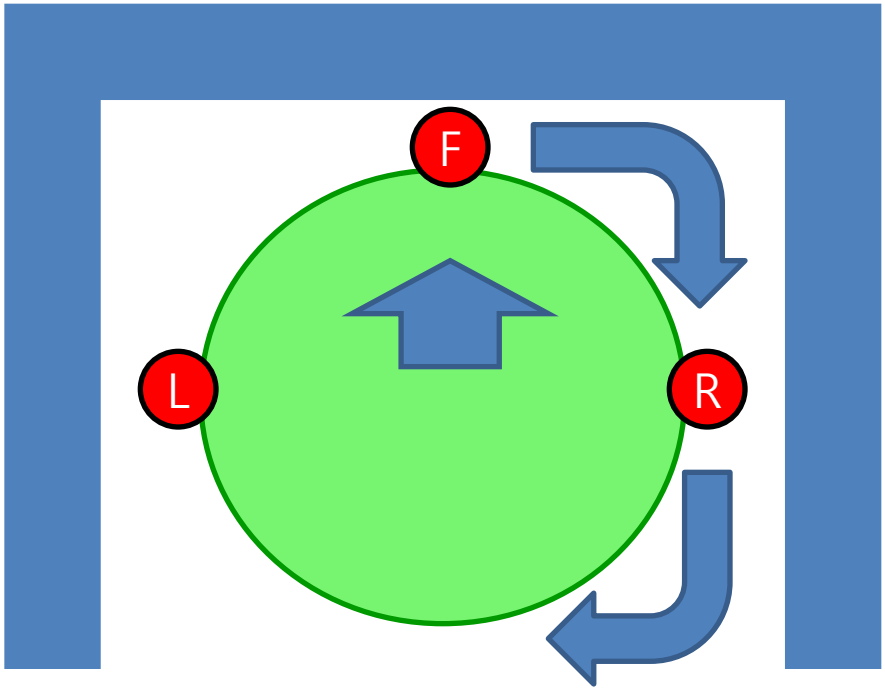


Front Obstacle !

A case with blocked three corners

Left Sensor

Left Obstacle !



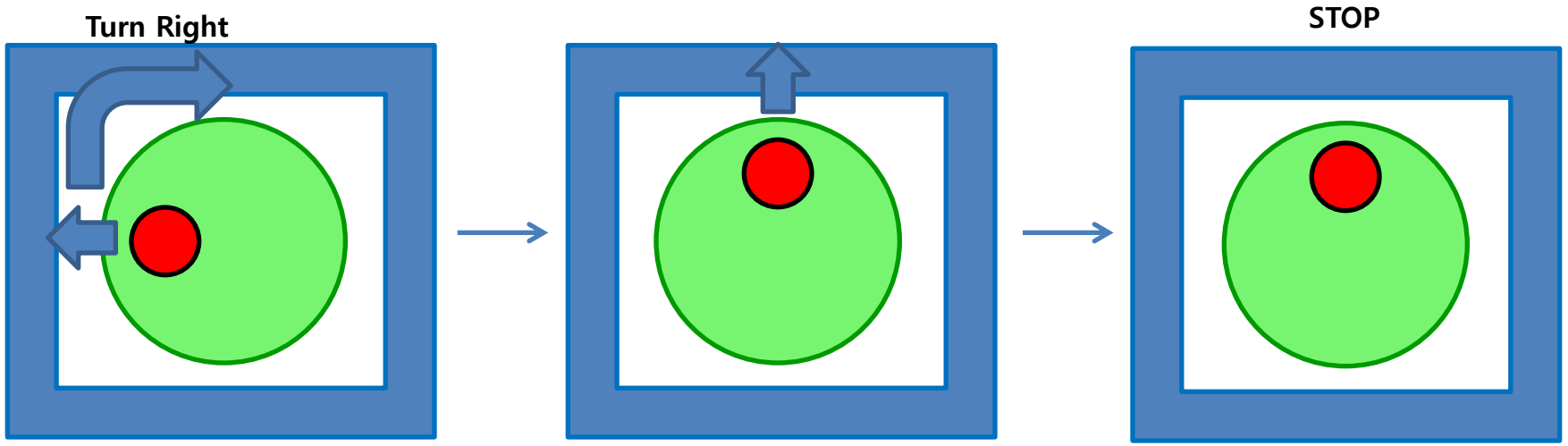
Turn Right

Right Sensor

Right Obstacle !

Turn Right

A case with blocked four corners



Tick [(F&&R&&L)] /
Disable M·F
Cleaner Command(Off)
Trigger “Turn Right”

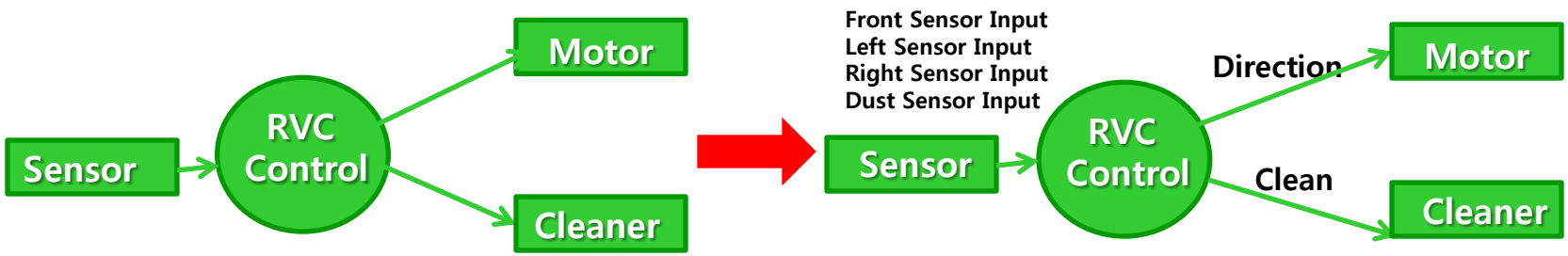
Tick [(F&&R&&L)]

Move Forward → Turn Right → Stop …

2 Event List

Event List

Input / Output Event	Description
Front Sensor Input	Detects Obstacles in front of the RVC
Left Sensor Input	Detects Obstacles in the left side of the RVC periodically
Right Sensor Input	Detects Obstacles in the right side of the RVC periodically
Dust Sensor Input	Detects dust on the floor periodically
Direction	Direction commands to the motor (go forward/turn left with an angle/turn right with an angle
Clean	Turn off / Turn on / Power up



Context Diagram for RVC

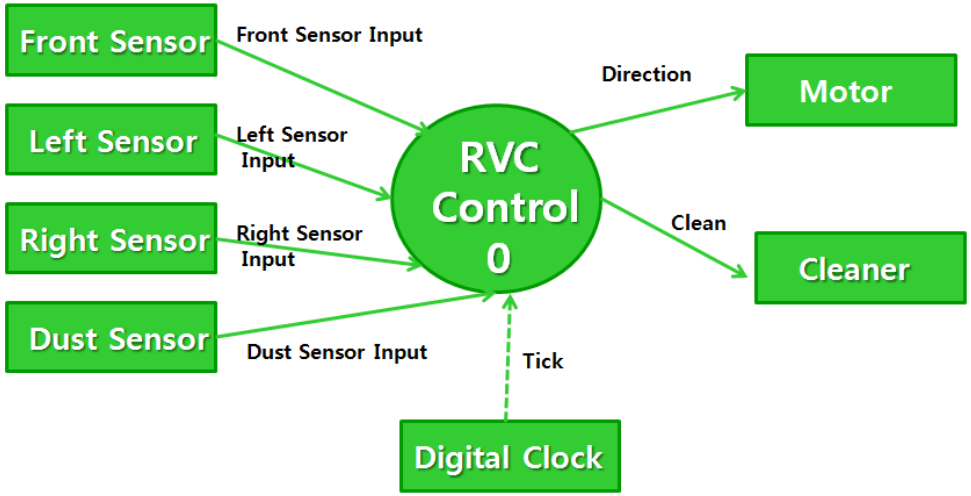
3 Data Dictionary

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 the left side of the RVC periodically	True / False, Periodic
Right Sensor Input	Detects Obstacles in the 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 / Left / Right / Stop
Clean	Turn off / Turn on / Power up	On / Off / Up

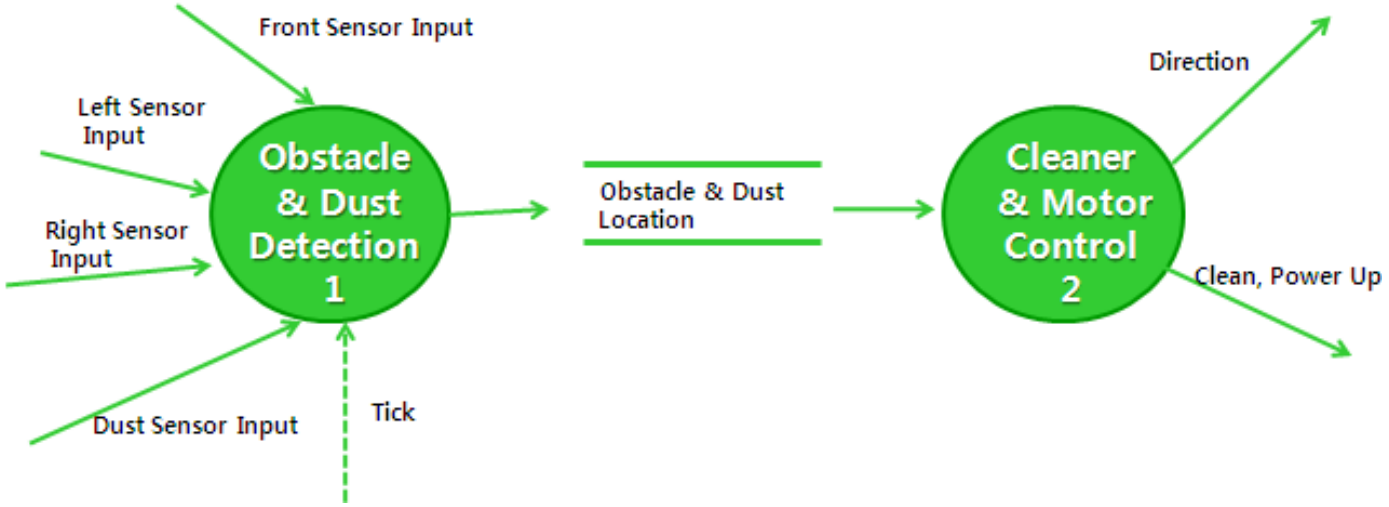
4 Process Specification

Process Specification (1/18)



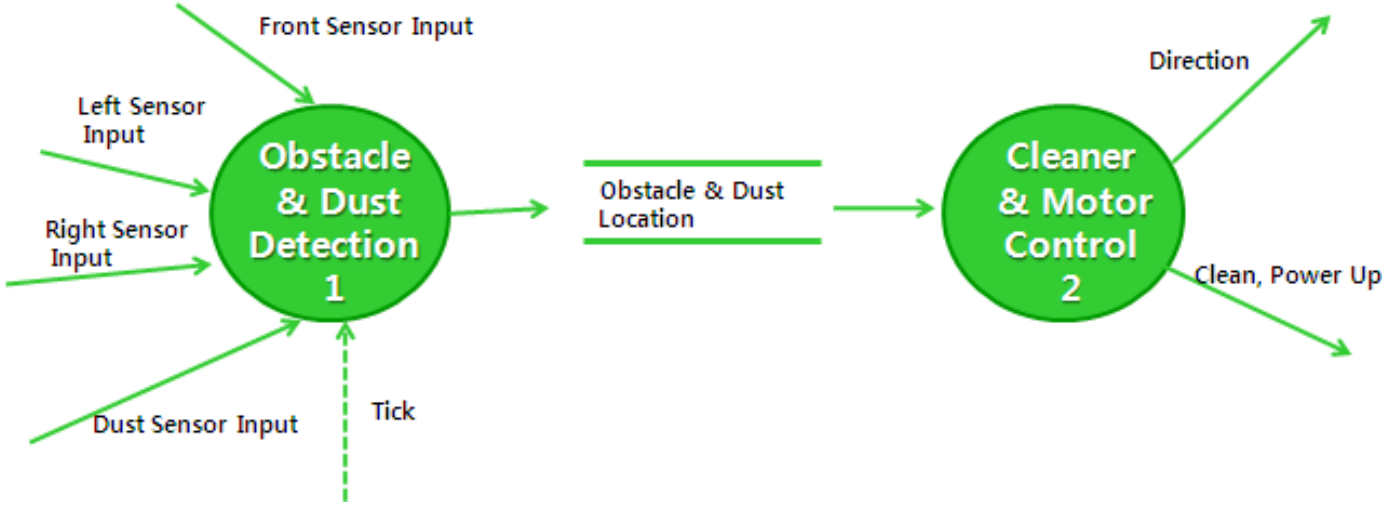
Reference No.	0
Name	RVC Control
Input	Front Sensor Input, Left Sensor Input, Right Sensor Input, Dust Sensor Input, Tick
Output	Direction, Clean
Process Description	A analog data that is received from 4 sensors, is converted and intergrated, after that, it will be sent to proper direction command and clean command.

Process Specification (2/18)



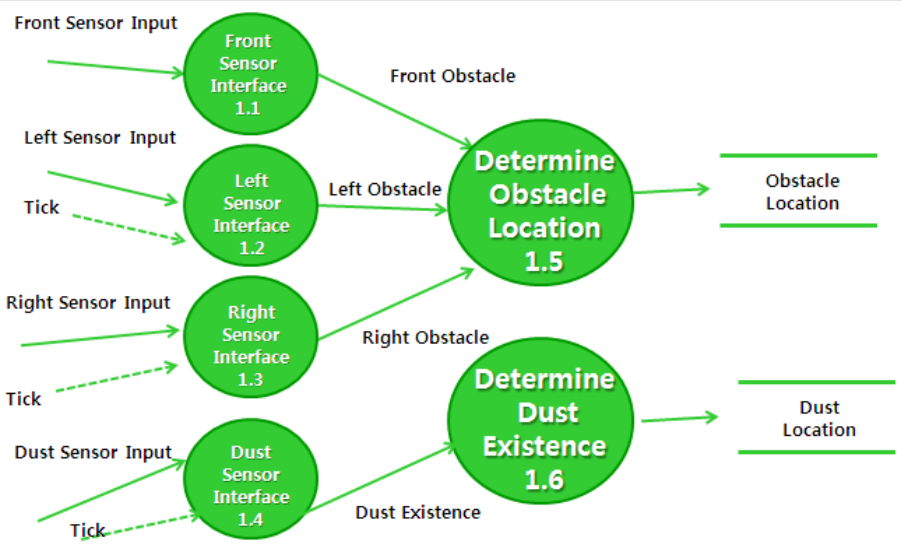
Reference No.	1
Name	Obstacle & Dust Detection
Input	Front Sensor Input, Left Sensor Input, Right Sensor Input, Dust Sensor Input, Tick
Output	Obstacle Location, Dust Location
Process Description	A analog data from 4 sensors is converted into digital data value(true/false) and intergrated , assigned to "Obstacle Location" variable and "Dust Location" variable

Process Specification (3/18)



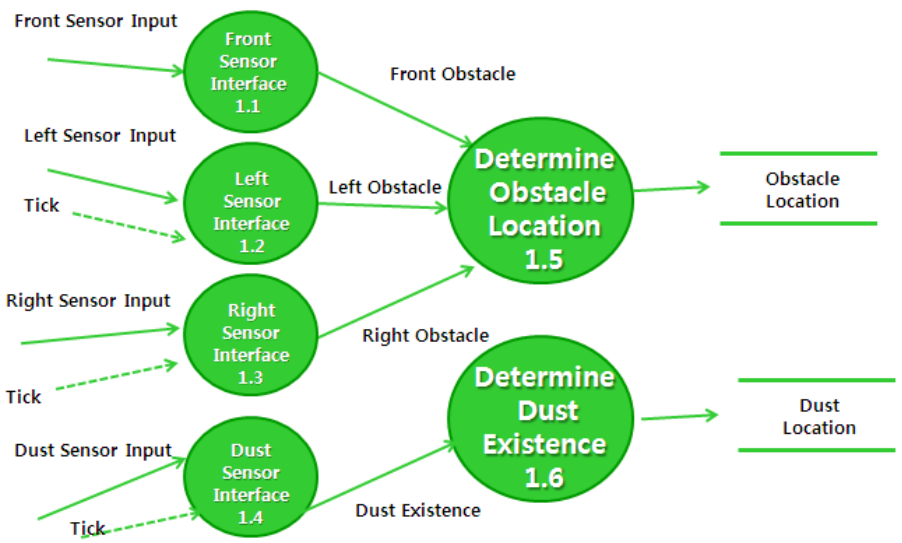
Reference No.	2
Name	Cleaner & Motor Control
Input	Obstacle & Dust Location
Output	Direction, Clean
Process Description	The Obstacle Location variable and Dust Existence variable are transferred to Cleaner or Motor control , and is converted into direction command or Clean, Power up command respectively.

Process Specification (4/18)



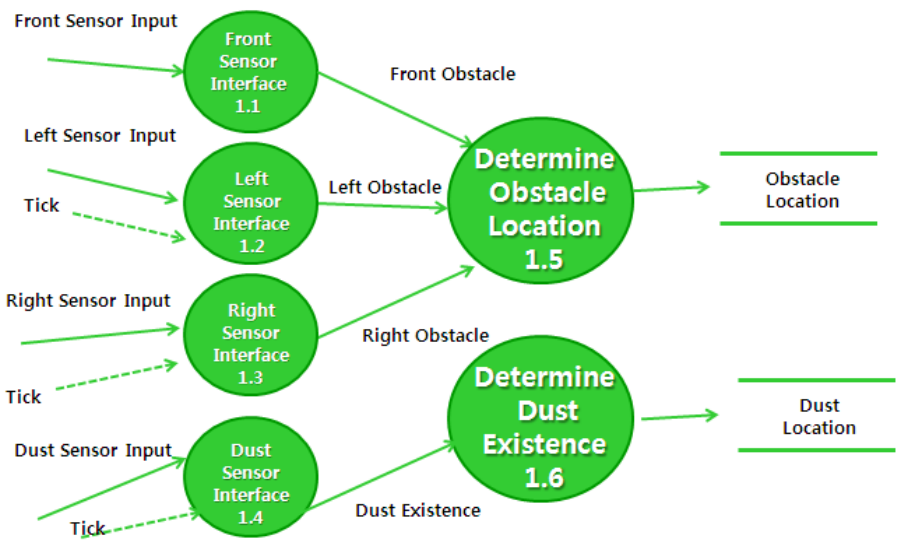
Reference No.	1.1
Name	Front Sensor Interface
Input	Front Sensor Input
Output	Front Obstacle
Process Description	Whether "Front Sensor Input " process interrupts or not ,will be converted into digital data of true or false type and is assigned to "Front Obstacle" variable.

Process Specification (5/18)



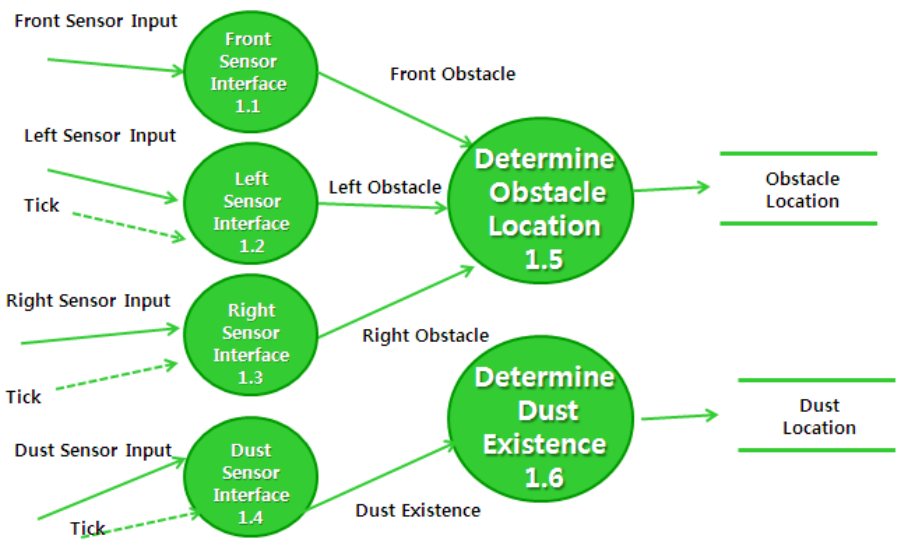
Reference No.	1.2
Name	Left Sensor Interface
Input	Left Sensor Input, Tick
Output	Left Obstacle
Process Description	"Left Sensor Input" process reads a analog value of the left sensor periodically, converts it into a digital value such as True/False, and assigns it into output variable "Left Obstacle"

Process Specification (6/18)



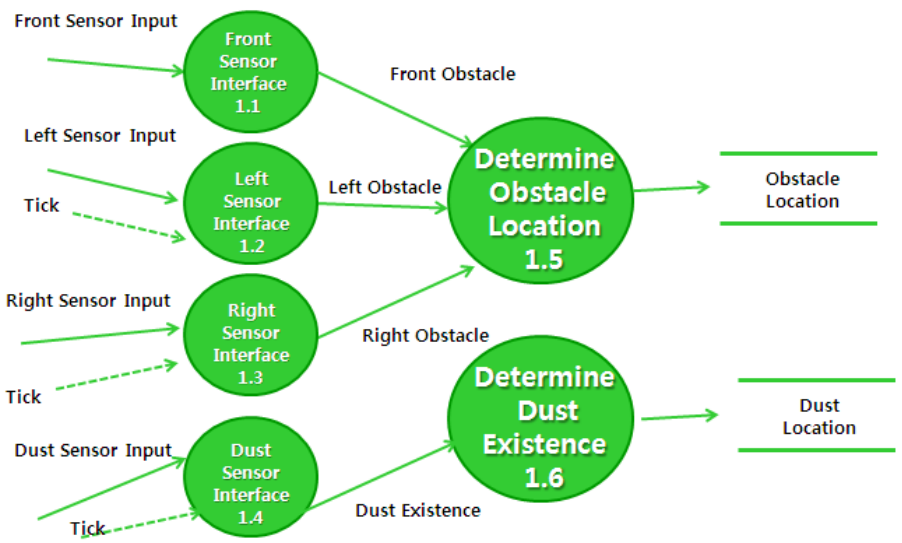
Reference No.	1.3
Name	Right Sensor Interface
Input	Right Sensor Input, Tick
Output	Right Obstacle
Process Description	"Right Sensor Input" process reads a analog value of the right sensor periodically, converts it into a digital value such as True/False, and assigns it into output variable "Left Obstacle"

Process Specification (7/18)



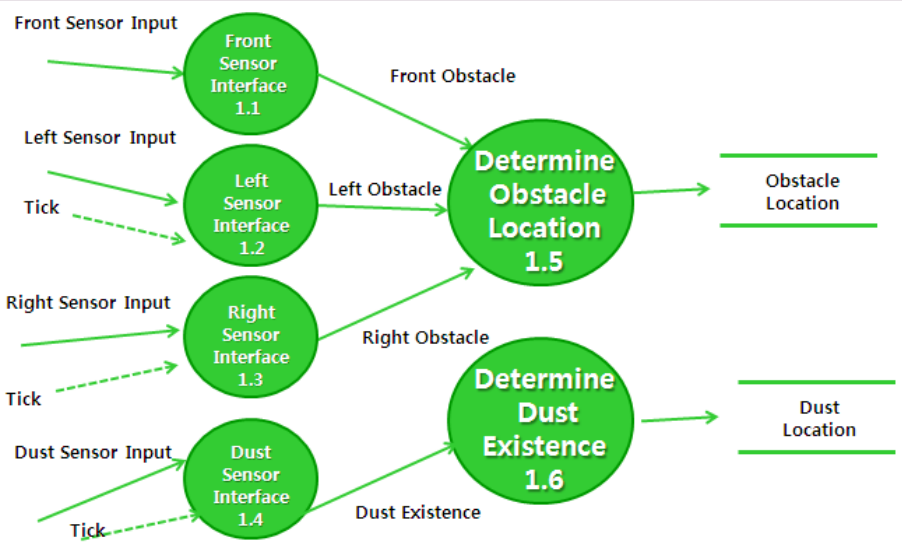
Reference No.	1.4
Name	Dust Sensor Interface
Input	Dust Sensor Input, Tick
Output	Dust Existence
Process Description	"Dust Sensor Input" process reads a analog value of the dust sensor periodically, converts it into a digital value such as True/False, and assigns it into output variable "Dust Existence"

Process Specification (8/18)



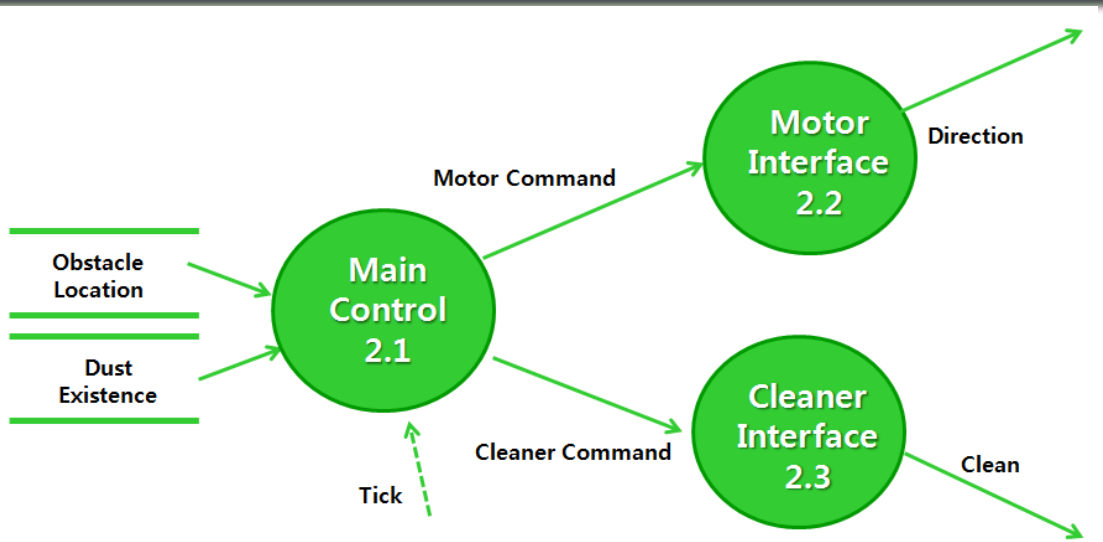
Reference No.	1.5
Name	Determine Obstacle Location
Input	Front Obstacle, Left Obstacle, Right Obstacle
Output	Obstacle Location
Process Description	The variables from "Front Sensor Interface" process, "Left Sensor Interface" process, "Right Sensor Interface" process are intergrated and assigned to "Obstacle Location" variable.

Process Specification (9/18)



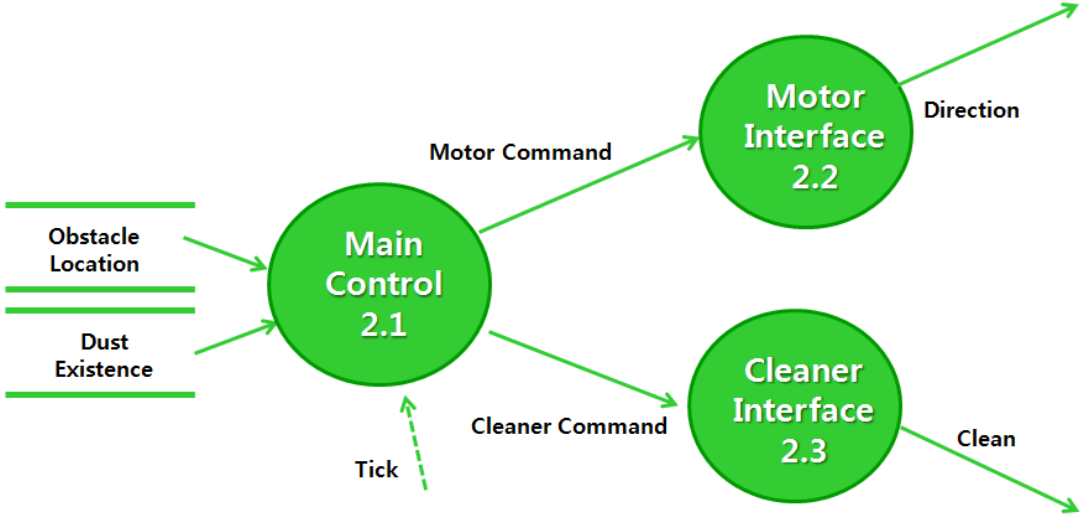
Reference No.	1.6
Name	Determine Dust Existence
Input	Dust Existence
Output	Dust Existence
Process Description	The variable sent from "Dust Existence process" variable is stored in "Dust Existence" data store.

Process Specification (10/18)



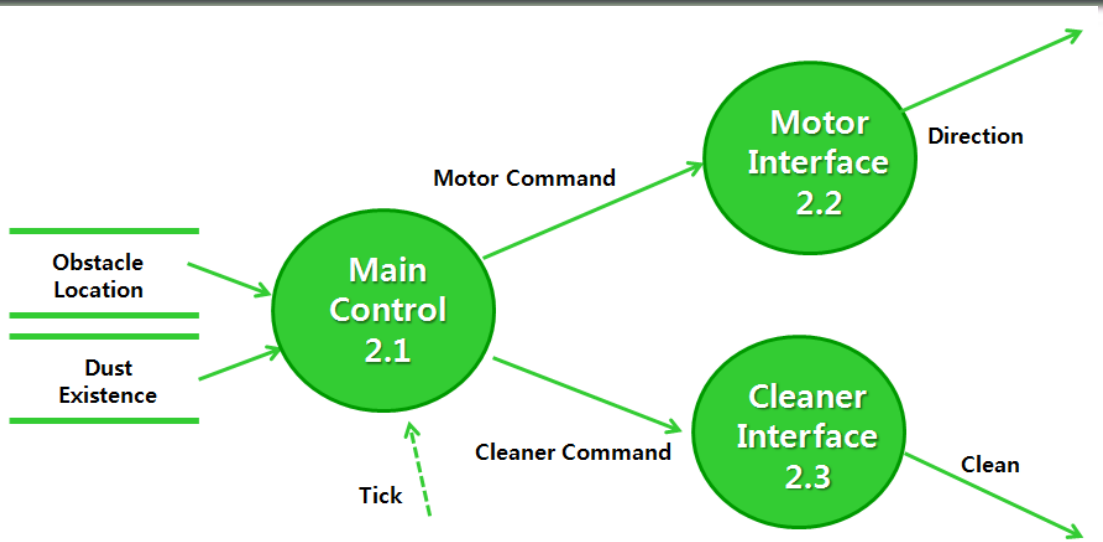
Reference No.	2.1
Name	Main Control
Input	Obstacle Location, Dust Existence
Output	Motor Command, Cleaner Command
Process Description	Whenever "Obstacle Location", "Dust Existence" is changed, the control function will call the function that adjusts Motor Command, Cleaner Command respectively.

Process Specification (11/18)



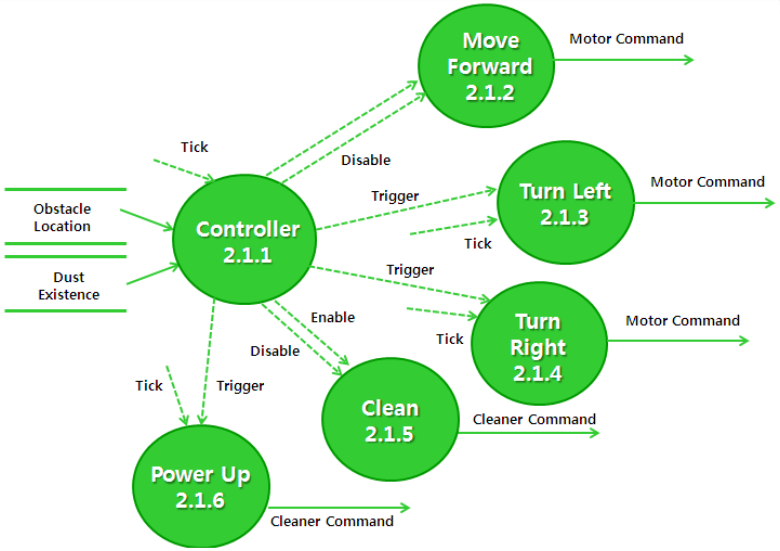
Reference No.	2.2
Name	Motor Interface
Input	Motor Command
Output	Direction
Process Description	After reading "Motor Command" sent from "Main Control" process , "Direction" variable that controls Motor is assigned.

Process Specification (12/18)



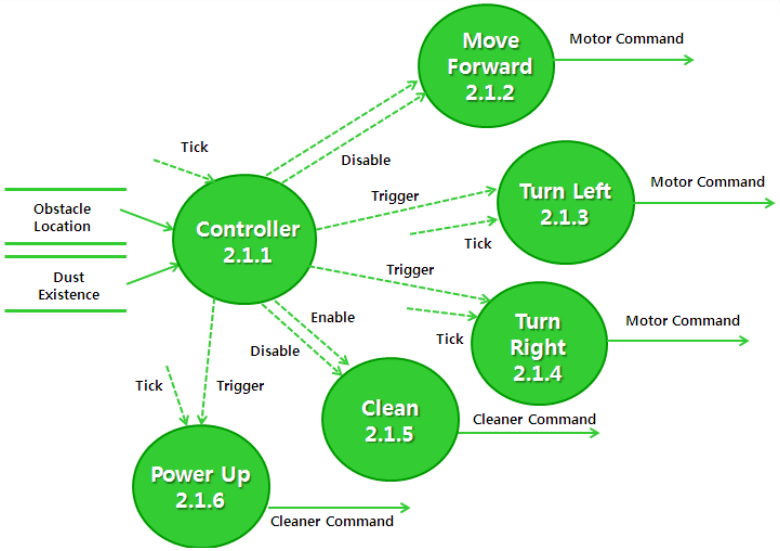
Reference No.	2.3
Name	Cleaner Interface
Input	Cleaner Command
Output	Clean
Process Description	The "Cleaner Command" sent from "Main Control" process is converted into Clean variable.

Process Specification (13/18)



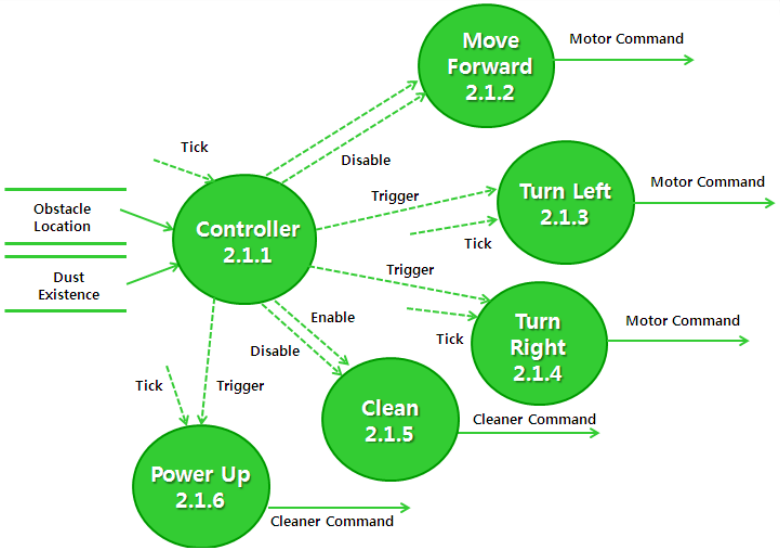
Reference No.	2.1.1
Name	Controller
Input	Obstacle Location / Dust Existence / Tick
Output	Commands about Control Flow
Process Description	Takes "Obstacle Location" or "Dust Existence" and has a role to output proper control flows depending on the situation.

Process Specification (14/18)



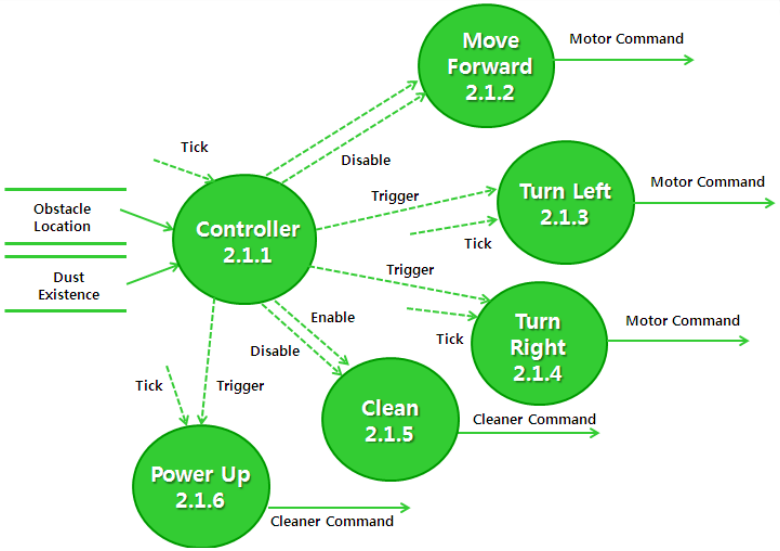
Reference No.	2.1.2
Name	Move Forward
Input	Enable / Disable
Output	Motor Command
Process Description	Enabled when there is no front obstacle signal from Controller , disabled when there is a front obstacle signal from Controller.

Process Specification (15/18)



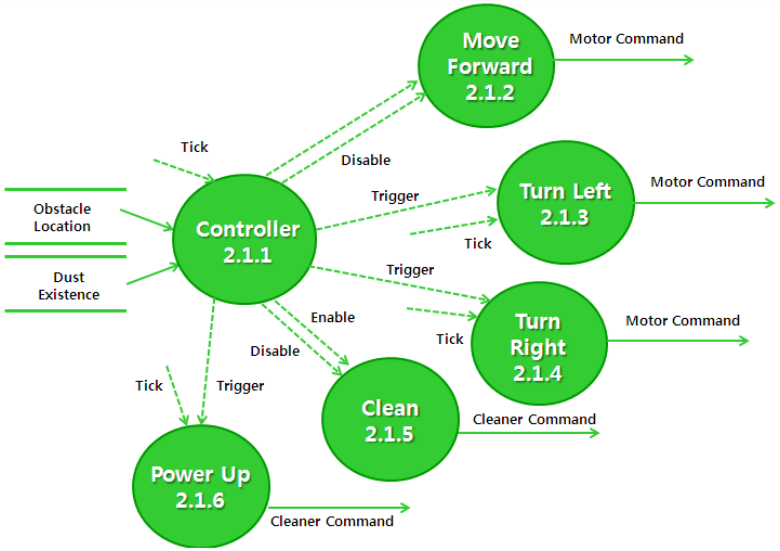
Reference No.	2.1.3
Name	Turn Left
Input	Trigger / Tick
Output	Motor Command
Process Description	Tick and Trigger(activate for a while) are received from Controller that recognizes "Front and Right Obstacle" and command to the Motor to move.

Process Specification (16/18)



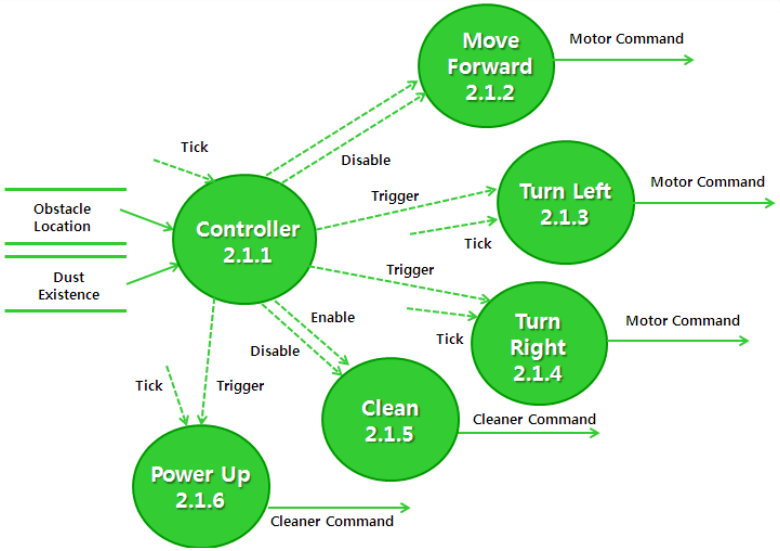
Reference No.	2.1.4
Name	Turn Right
Input	Trigger / Tick
Output	Motor Command
Process Description	Has a role to command to the Motor whenever it receives Tick and Trigger(activate for a while) from Controller that recognizes "Front and Left Obstacle' or 'Front ,Right and Left Obstacle'

Process Specification (17/18)



Reference No.	2.1.5
Name	Clean
Input	Enable / Disable
Output	Cleaner Command
Process Description	Changes the state from Enable to Disable or From Disable to Enable when it receives the command from Controller.

Process Specification (18/18)



Reference No.	2.1.6
Name	Power Up
Input	Trigger / Tick
Output	Cleaner Command
Process Description	Has a role to command to Cleaner when it receives Tick and Trigger(activate for a while) from Controller that recognizes Dust Existence.

5 Q & A