

Software Requirement Analysis for AAA System

Project Team

Team 3

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1 Introduction

1.1 Purpose

Digital watch System에서 사용할 수 있는 SW를 구현하기 위한 요구사항을 명시한 문서이다.

1.2 Scope

1.2.1 개발팀

3팀

1.2.2 제한사항

HW (손목시계)와 연동까지 고려하지 않고, SW로만 구동할 수 있도록 한다

1.2.3 제품의 활용도

개발이 완료된 후 실제 손목시계의 SW를 개발하기 위한 프로토타입으로 삼을 수 있다.

1.2.4 개발환경

IDE: Eclipse, Text editor Compiler: GCC (MinGW, Cygwin)

1.3 Definition, acronyms, and abbreviations

SW: Software

HW: Hardware

1.4 Reference

IEEE Std. 830-1998

1.5 Overview

2 Overall Description

2.1 Product Perspective

대상 제품은 실제 손목시계에 사용될 수 있는 제품이 될 수 있다. HW(버튼) 에 의한 동작을 처리하고, 처리한 결과는 HW (화면) 에 출력한다. 실제 HW에 의한 동작은 SW

및 console화면으로 처리하여 기능의 동작 유무를 확인하도록 한다. 시계 HW는 4 개의 버튼과 LCD 화면을 가진 것으로 한다.

2.2 Product functions

2.2.1 Date-Time

화면에 일자와 시간을 표시한다.

오후 시간 표시는 24시로 표현한다.

2.2.2 Stopwatch

시간의 경과를 알려주고, 특정 순간의 시간을 알려준다.

1/100 초 단위로 측정이 가능하다.

Lap time 기록이 가능하다.

2.2.3 Backlight

출력하는 문자의 색깔을 노란색으로 표시한다.

2.2.4 Alarm

alarm이 설정되면 alarm indicator가 켜진다.

정해 놓은 시간에 소리(beep 음)로 알려준다.

알람은 5 초간 울린다. 알람이 울릴 때 a, b, c, d 중 아무 버튼을 누르면 소리가 꺼진다.

2.3 User characteristics

2.4 Constraints

날짜의 표기법은 '월-일' 이다.

초기 시간은 2019년 01월 01일 00시 00분 00초이다.

2019-1-1 부터 2099년까지 표시가 가능하다. 알람을 설정할 때 시, 분은 반드시 설정해야 한다.

2.5 Assumptions and dependencies

버튼입력은 키보드 입력으로 대신한다. 버튼이 여러 개 입력되었을 때 우선순위는 $D > C > B > A$ 이다. 시간을 수정할

때 선택된 부분이 깜박이는 표현은 숫자 밑에 밑줄을 표시하는 것으로 대체한다.

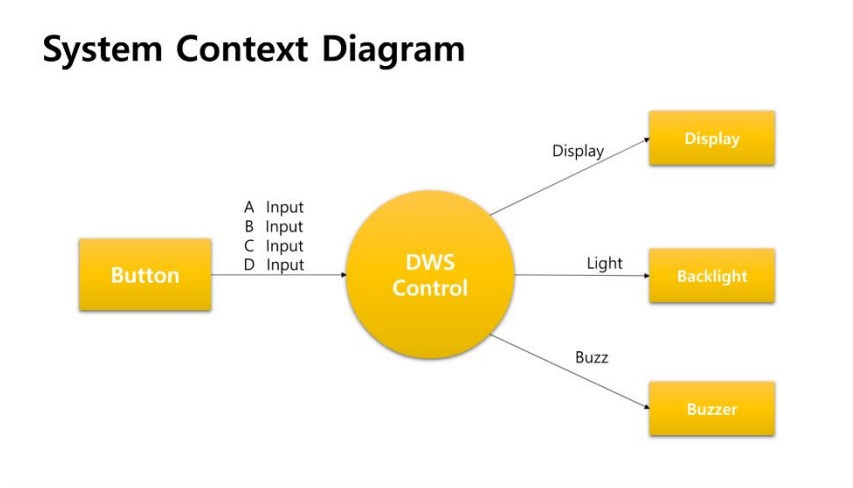
Backlight는 실제 시계의 경우 LED를 켜는 것으로 구현되어야 하지만 출력되는 문자의 색을 바꾸는 것으로 대체한다.

알람 음은 PC의 Beep로 대체한다.

3 Structured Analysis

3.1 System Context Diagram

3.1.1 System Context Diagram



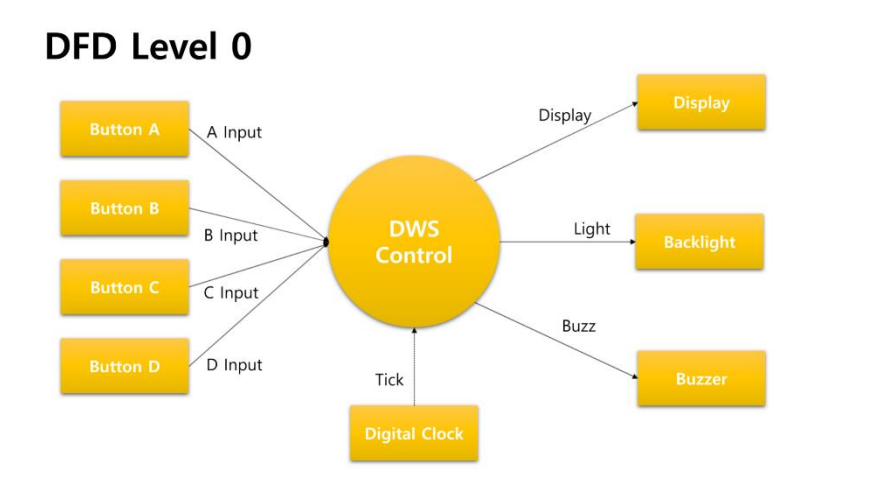
3.1.2 Event List

Event	Description
A input	Detect "A button" is pushed or not
B input	Detect "B button" is pushed or not
C input	Detect "C button" is pushed or not
D input	Detect "D button" is pushed or not
Display	Display time or menu of each mode.
Light	Turn on the light on display.
Buzz	Sound "Beep".

3.2 Data Flow Diagram

3.2.1 DFD level 0

3.2.1.1 DFD



3.2.1.2 Process Specification

3.2.1.2.1 Process 1

Reference No	0
Name	DWS Control
Input	A Input, B Input, C Input, D Input , Tick
Output	Display , Buzz
Process Description	"A Input", "B Input", "C Input", "D Input" process read analog value as an interrupt, converts into a digital value such as True/False , and DWS Control determine Display, Light, Buzz Command .

...

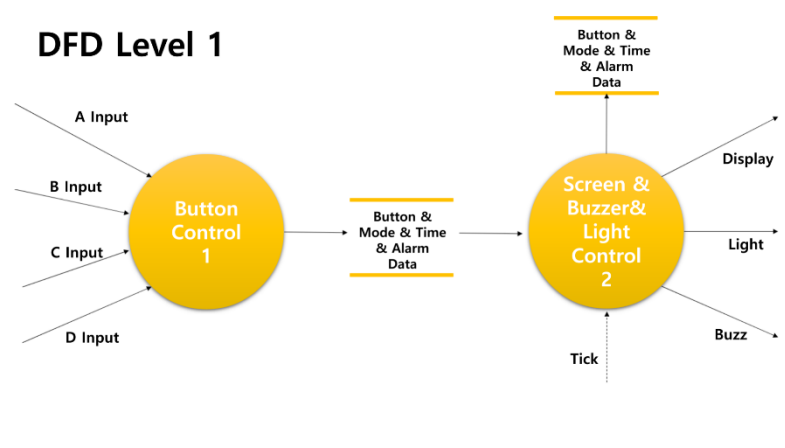
3.2.1.3 Data Dictionary

Input/ Output Event	Description	Format/Type
A Input	Button Input from user	Analog Value, Interrupt
B Input	Button Input from user	Analog Value, Interrupt
C Input	Button Input from user	Analog Value, Interrupt

D Input	Button Input from user	Analog Value, Interrupt
Display	Time to display	Day of week /Month/Date/Hour/Minute/Second/Al arm Indicator/Mode Indicator
Light	Turn the light on	Boolean
Buzz	Ring the buzzer	Boolean

3.2.2 DFD Level 1

3.2.2.1 DFD



3.2.2.2 Process Specification

3.2.2.2.1 Process #1

Reference no	1
Name	Button Control
Input	A Button Input, B Button Input, C Button Input, D Button Input
Output	Button & Mode & Time & Alarm Data
Process Description	"Button Control" process reads a analog value of the Button sensors by interrupt, converts it into a digital value such as True/False, and assigns it into output variable "Button & Mode & Time & Alarm Data"

3.2.2.2.2 Process #2

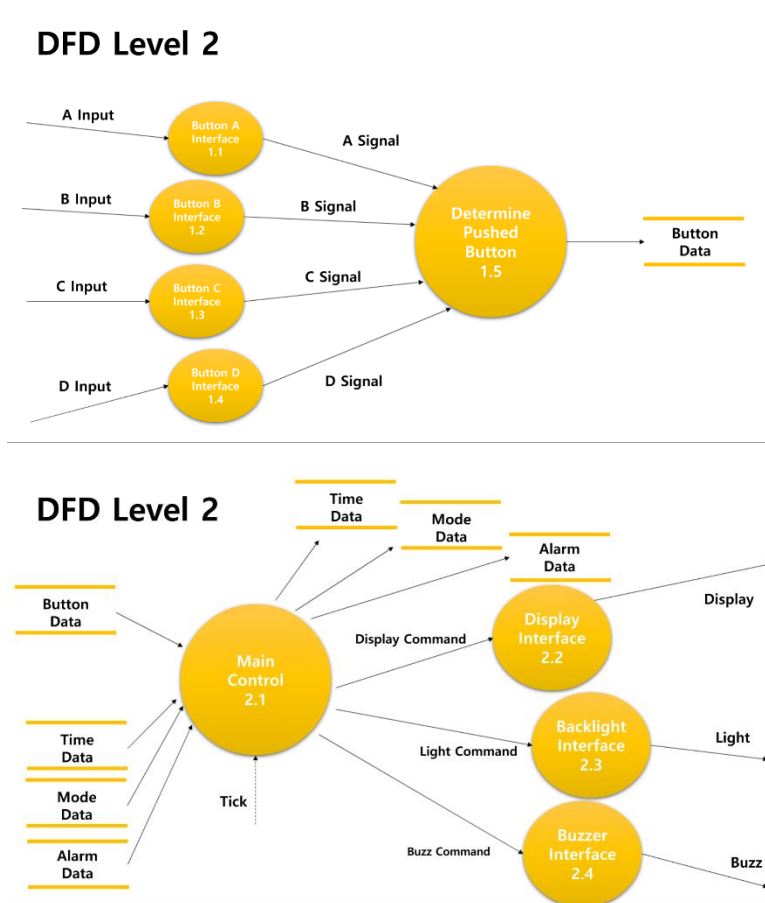
Reference No	2
Name	Screen & Buzzer & Light Control
Input	Button, Time, Mode, Alarm Data
Output	Display, Light, Buzz
Process Description	"Screen & Buzzer & Light Control" process gets the Data of Button, Time, Mode, Alarm and then determine what to display, Turning light on or not and how to buzz.

3.2.2.2.3 Data Dictionary

Output	Description	Format/ Type
Button Data	Data of what button was pushed	Char ('A', 'B', 'C', 'D')
Time Data	Data of time	String
Mode Data	Data that signify each modes.	Integer (1,2,3,4,5.....)
Alarm Data	Data of Alarm. :Setting time :Alarm status :Ringing status	Struct data :String :Boolean :Boolean
Stopwatch Time Data	Data of Stop watch :passed time :Laptime data	Struct data :String :String

3.2.3 DFD Level 2

3.2.3.1 DFD



3.2.3.2 Process Specification

3.2.3.2.1 Process 1.1

Reference No	1.1
Name	Button A Interface
Input	A Input
Output	A Signal
Process Description	"A Input", process read analog value as an interrupt, converts into a digital value such as True/False, and make it into output variable "A Signal".

3.2.3.2.2 Process 1.2

Reference No	1.2
Name	Button B Interface
Input	B Input
Output	B Signal
Process Description	"B Input", process read analog value as an interrupt, converts into a digital value such as True/False, and make it into output variable "B Signal".

3.2.3.2.3 Process 1.3

Reference No	1.3
Name	Button C Interface
Input	C Input
Output	C Signal
Process Description	"C Input", process read analog value as an interrupt, converts into a digital value such as True/False, and make it into output variable "C Signal".

3.2.3.2.4 Process 1.4

Reference No	1.4
Name	Button D Interface
Input	D Input
Output	D Signal
Process Description	"D Input", process read analog value as an interrupt, converts into a digital value such as True/False, and make it into output variable "D Signal".

3.2.3.2.5 Process 1.5

Reference No	1.5
Name	Determine Pushed Button
Input	A Signal, B Signal, C Signal, D Signal
Output	Button Data
Process Description	<p>"Determine Pushed Button" process read Boolean input(A,B,C,D Signal) and make a Button Data as a Integer.</p> <p>(ex) if)A==true -> Button Data=1</p> <p>Else if)B==true -> Button Data=2</p> <p>Else if)C==true -> Button Data=3</p> <p>Else if)D==true -> Button Data=4)</p>

3.2.3.2.6 Process 2.1

Reference No	2.1
Name	Main Control
Input	Button Data, Time Data, Mode Data, Alarm Data, Tick
Output	Display Command, Buzz Command
Process Description	<p>"Main Control" process reads Data of Button, Time, Mode, and Alarm and determine "Display Command", "Buzz Command", "Light Command" and transfer them to their interfaces and renew Button, Time, Mode, and Alarm Data.</p>

3.2.3.2.7 Process 2.2

Reference No	2.2
Name	Display Interface
Input	Display Command
Output	Display
Process Description	<p>"Display Interface" process gets "Display Command " and display on the watch display followed by its command.</p>

3.2.3.2.8 Process 2.3

Reference No	2.3
Name	BackLight Interface
Input	Light Command
Output	Light
Process Description	"BackLight Interface" process gets "Light Command " and turn light on the display followed by its command.

3.2.3.2.9 Process 2.4

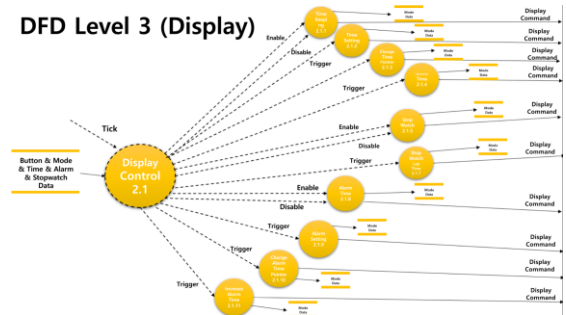
Reference No	2.4
Name	Buzzer Interface
Input	Buzz Command
Output	Buzz
Process Description	"Buzz Interface" process gets "Buzz Command " and make beep sound followed by its command.

3.2.3.2.10 Data Dictionary

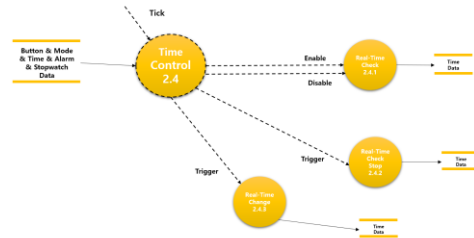
Input/ Output Event	Description	Format/Type
Display Command	Display Command to display	Timekeeping mode/ Stopwatch mode/ Alarm mode
Light Command	Light on, Light Off	On / Off
Buzz Command	Beep sound on /Beep sound off	On / Off

3.2.4 DFD Level 3

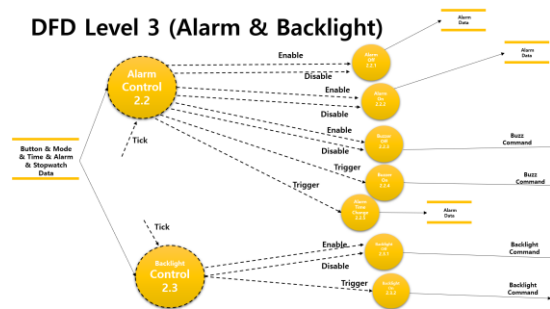
3.2.4.1 DFD



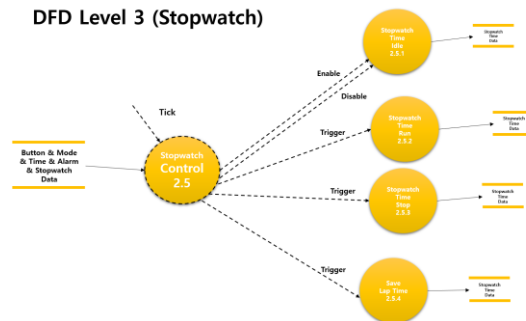
DFD Level 3 (Time)



DFD Level 3 (Alarm & Backlight)



DFD Level 3 (Stopwatch)



3.2.4.2 Process Specification

3.2.4.2.1 Process 2.1

Reference No	2.1
Name	Display Control
Input	Button & Mode & Time & Alarm Data
Output	Trigger, Enable/Disable
Process Description	This Process gets the data of Button & Time & Alarm Data and then determine what to display.

3.2.4.2.2 Process 2.1.1

Reference No	2.1.1
Name	Time Keeping
Input	Enable / Disable
Output	Mode data, Display Command
Process Description	When there is "Enable" input, set the Mode data 1. And Display "Time Keeping Mode" that show time of now.

3.2.4.2.3 Process 2.1.2

Reference No	2.1.2
Name	Time Setting
Input	Trigger
Output	Mode data, Display Command
Process Description	Set the Mode data 2. And send display command that display "Time Setting Mode". It seems like the "Time Keeping Mode" but the difference is that the time is stop and second or minute or hour or date or month or year flickers.

3.2.4.2.4 Process 2.1.3

Reference No	2.1.3
Name	Change Time Pointer
Input	Trigger
Output	Mode data, Display Command
Process Description	When there is trigger of "Time Setting" , this is operated(enable input) together. If mode data is "2"(Time Setting Mode), it sets mode data as "21"(second change mode), if mode data is "21" it sets mode data as

	<p>"22"(minute change mode), if mode data is "22", it sets mode data as "23"(hour change mode), if mode data is "23", sets mode data as "24"(date change mode), if mode data is "24", sets mode data as "25"(year change mode).</p> <p>And send display command. If mode data is 21,22,23,24 and 25, the part of second, minute, hour, date, year on the display flicker in orderly.</p> <p>Ex) the mode data =21, the second part will flicker.</p>
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3.2.4.2.5 Process 2.1.4

Reference No	2.1.4
Name	Increase Time
Input	Trigger
Output	Mode data, Display Command
Process Description	Increase the time by 1 followed by "Change time Pointer". For example, if mode data is 21(second change mode). This trigger means that it increase the second by 1 and display it.

3.2.4.2.6 Process 2.1.5

Reference No	2.1.5
Name	Stop Watch
Input	Enable / Disable
Output	Mode data, Display Command
Process Description	When there is "Enable" input, set the Mode data 3. And display "Stop Watch Mode". It displayed refer to passed time in "Stopwatch time Data".

3.2.4.2.7 Process 2.1.7

Reference No	2.1.7
Name	Stop Watch Lap Time
Input	Trigger
Output	Mode Data, Display Command
Process Description	Set the mode data as 32. And display the laptime of "Stopwatch Time Data" on the display.

3.2.4.2.8 Process 2.1.8

Reference No	2.1.8
Name	Alarm Time
Input	Enable / Disable
Output	Mode data, Display Command
Process Description	When there is "Enable" input, set the Mode data 4. And display "Alarm setting Mode" that show status of alarm.

3.2.4.2.9 Process 2.1.9

Reference No	2.1.9
Name	Alarm Setting
Input	Trigger
Output	Mode data, Display Command
Process Description	Set the mode data as 5. Display the Alarm Setting mode. That can change the time of alarm.

3.2.4.2.10 Process 2.1.10

Reference No	2.1.10
Name	Change Alarm Time Pointer
Input	Trigger
Output	Mode data, Display Command
Process Description	If there is trigger of "Alarm Setting", this is operated together. If mode data is "5", it sets mode data as "51"(second change mode), if mode data is "51" it sets mode data as "52"(minute change mode), if mode data is "52", it sets mode data as "53"(hour change mode). If mode data is 51, 52 and 53, the part of second, minute, hour on the display flicker in orderly. Ex) the mode data =51, the second part will flicker

3.2.4.2.11 Process 2.1.11

Reference No	2.1.11
Name	Increase Alarm Time
Input	Trigger
Output	Mode data, Display Command
Process Description	Increase the time by 1 followed by "Change Alarm Time Pointer". For example, if mode data is 51(second change mode). This trigger means that it increase the second by 1 and display it.

3.2.4.2.12 Process 2.2

Reference No	2.2
Name	Alarm Control
Input	Button & Mode & Time & Alarm Data
Output	Trigger, Enable/Disable
Process Description	This Process gets the data of Button & Time & Alarm Data and then determine to turn on or off the alarm & ring the alarm.

3.2.4.2.13 Process 2.2.1

Reference No	2.2.1
Name	Alarm Off
Input	Enable / Disable
Output	Alarm Data
Process Description	When there is "Enable" input, set the status data of "Alarm Data" False.

3.2.4.2.14 Process 2.2.2

Reference No	2.2.2
Name	Alarm On
Input	Enable/Disable
Output	Alarm Data
Process Description	When there is "Enable" input, set the status data of "Alarm Data" True.

3.2.4.2.15 Process 2.2.3

Reference No	2.2.3
Name	Buzzer Off
Input	Enable / Disable
Output	Alarm Data, Buzz Command
Process Description	When there is "Enable" input, set the ringing status of "Alarm Data" False. And make buzz command to stop sounding.

3.2.4.2.16 Process 2.2.4

Reference No	2.2.4
Name	Buzzer On
Input	Trigger
Output	Alarm Data, Buzz Command
Process Description	Set the Ringing status of "Alarm Data" True. And make buzz command to sound.

3.2.4.2.17 Process 2.2.5

Reference No	2.2.5
Name	Alarm Time Change
Input	Trigger
Output	Alarm Data, Buzz Command
Process Description	Change the "Time Data".

3.2.4.2.18 Process 2.3

Reference No	2.3
Name	Backlight Control
Input	Button Data, Mode Data
Output	Backlight Command
Process Description	"Backlight Control" Process gets "Button Data" and "Mode Data" to determine Backlight On or Off.

3.2.4.2.19 Process 2.3.1

Reference No	2.3.1
Name	Backlight Off
Input	Enable, Disable
Output	Backlight Command
Process Description	"Backlight Off" process gets Enable/ Disable to represent Backlight status Off or not.

3.2.4.2.20 Process 2.3.2

Reference No	2.3.2
Name	Backlight On
Input	Trigger
Output	Backlight Command
Process Description	When "Backlight On" process gets Trigger, it makes Backlight light on.

3.2.4.2.21 Process 2.4

Reference No	2.4
Name	Time Control
Input	Button Data, Mode Data, Time Data, Alarm Data
Output	Enable, Disable
Process Description	"Time Control" process make decision to enable / disable to check Real-Time ..

3.2.4.2.22 Process 2.4.1

Reference No	2.4.1
Name	Real-Time Check
Input	Enable/ Disable
Output	Time Data
Process Description	Checking Real-Time to make Time Data

3.2.4.2.23 Process 2.4.2

Reference No	2.4.2
Name	Real-Time Check Stop
Input	Trigger
Output	Time Data
Process Description	Stop the checking Real-Time by making Time Data.

3.2.4.2.24 Process 2.4.3

Reference No	2.4.3
Name	Real-Time Change
Input	Trigger
Output	Time Data
Process Description	Change the "Time Data".

3.2.4.2.25 Process 2.5

Reference No	2.5
Name	Stopwatch Control
Input	Button Data, Mode Data, Time Data, Alarm Data, Stopwatch Data
Output	Enable, Disable, Trigger
Process Description	"Stopwatch Control" process gets data to control stopwatch state.

3.2.4.2.26 Process 2.5.1

Reference No	2.5.1
Name	Stopwatch Time Idle
Input	Enable, Disable
Output	Stopwatch Time data
Process Description	"Stopwatch Time Idle" gets Enable/ Disable control and makes Stopwatch Time Data Idle state.

3.2.4.2.27 Process 2.5.2

Reference No	2.5.2
Name	Stopwatch Time Run
Input	Trigger
Output	Stopwatch Time data
Process Description	"Stopwatch Time Run" gets Trigger control and makes Stopwatch Time Data Run state.

3.2.4.2.28 Process 2.5.3

Reference No	2.5.3
Name	Stopwatch Time Stop
Input	Trigger
Output	Stopwatch Time data
Process Description	"Stopwatch Time Run" gets Trigger control and makes Stopwatch Time Data Stop state.

3.2.4.2.29 Process 2.5.4

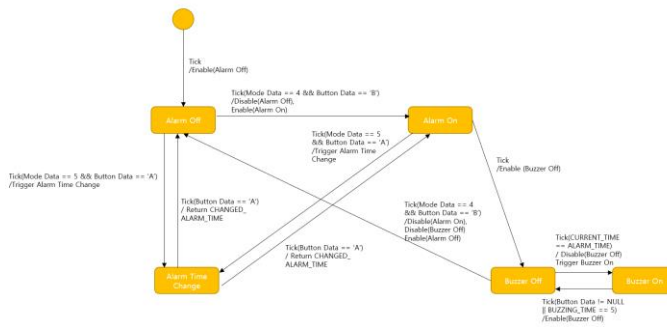
Reference No	2.5.4
Name	Save Lap Time
Input	Trigger
Output	Stopwatch Time data
Process Description	"Save Lap Time" gets Trigger control and saves stopwatch time as Lap Time.

3.2.4.3 State Transition Diagram (Name of Controller)

DFD Level 4 (Display Control)



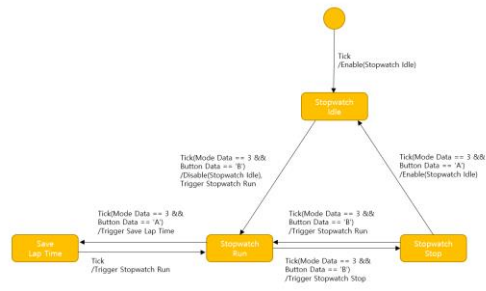
DFD Level 4 (Alarm Control)



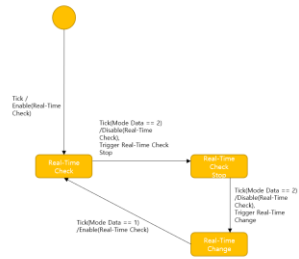
DFD Level 4 (Backlight Control)



DFD Level 4 (Stopwatch Control)



DFD Level 4 (Time Control)



3.2.5 Overall DFD

