

# Software Requirement Analysis for Digital Watch System

Project Team

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## 1 Introduction

### 1.1 Purpose

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

### 1.2 Scope

#### 1.2.1 제한사항

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

#### 1.2.2 제품의 활용도

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

### 1.3 Definition, acronyms, and abbreviations

### 1.4 Reference

### 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 4개의 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 설정 해야 한다.

## 2.5 Assumptions and dependencies

버튼입력은 키보드 입력으로 대신한다. 버튼이 여러 개 입력되었을 때 우선순위는 D>C>B>A이다.

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. 알람음은 PC의 Beep로 대체한다.

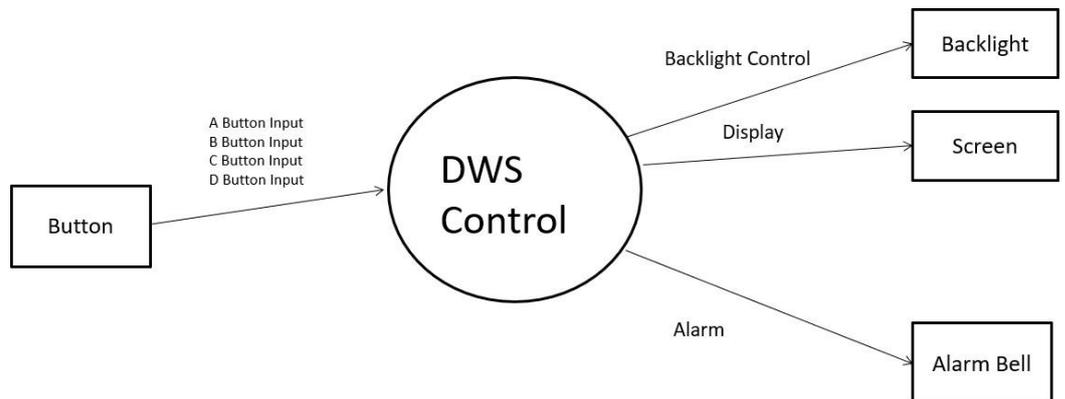
### 3 Structured Analysis

#### 3.1 System Context Diagram

##### 3.1.1 Event List

Input/Output Event	Description
A Button Input B Button Input C Button Input D Button Input	Detects whether A button is clicked or not Detects whether B button is clicked or not Detects whether C button is clicked or not Detects whether D button is clicked or not
Backlight Control	Make Backlight Enable/Disable
Display	Display command to Screen
Alarm	Make Alarm Bell ring

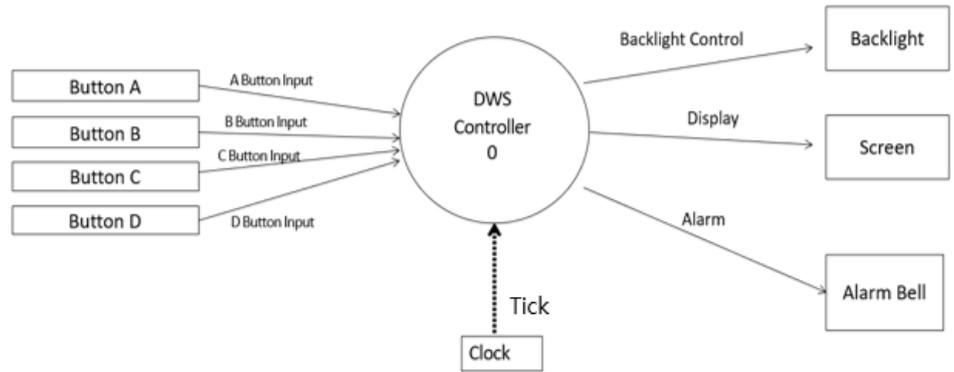
##### 3.1.2 The System Context Diagram



### 3.2 Data Flow Diagram

#### 3.2.1 DFD level 0

##### 3.2.1.1 DFD



##### 3.2.1.2 Process Specification

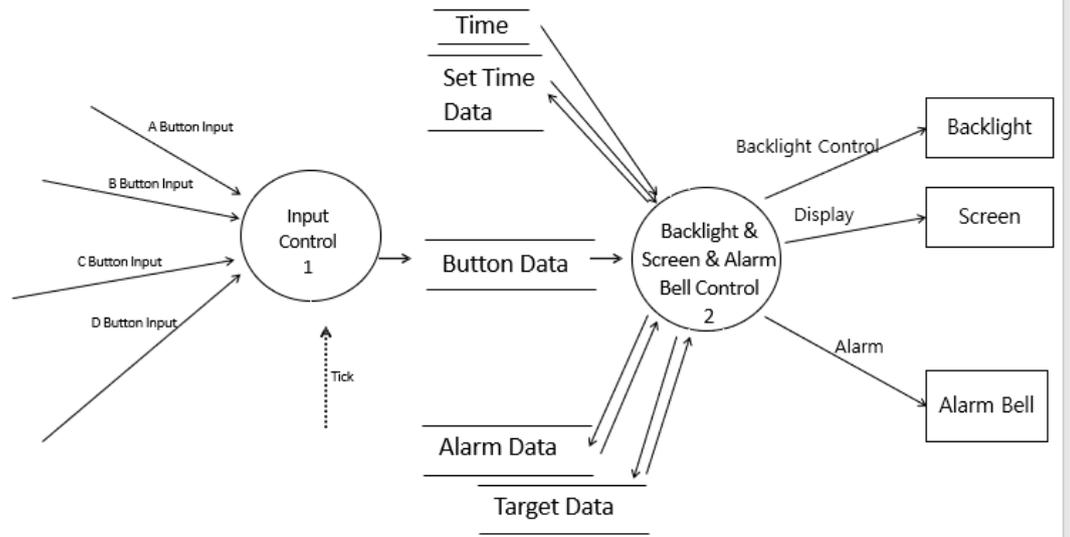
Reference No	0
Name	DWS Controller 0
Input	A Button Input, B Button Input, C Button Input, D Button Input, Tick
Output	Backlight Control, Display, Alarm
Process Description	It obtains Button Information and make orders (Backlight Control, Display, Alarm).

### 3.2.1.3 Data Dictionary

Input/Output Event	Description	Format
A Button Input	Detects whether A button is clicked or not	Char
B Button Input	Detects whether B button is clicked or not	Char
C Button Input	Detects whether C button is clicked or not	Char
D Button Input	Detects whether D button is clicked or not	Char
Backlight Control	Make Backlight enable/disable	Boolean
Display	Display	
Alarm	Make Alarm Bell ring	

### 3.2.2 DFD Level 1

#### 3.2.2.1 DFD



## 3.2.2.2 Process Specification

Reference No	1
Name	Input Control
Input	A Button Input, B Button Input, C Button Input, D Button Input, Tick
Output	Button Data
Process Description	Obtain A Button Input, B Button Input, C Button Input, D Button Input and store Button Data.

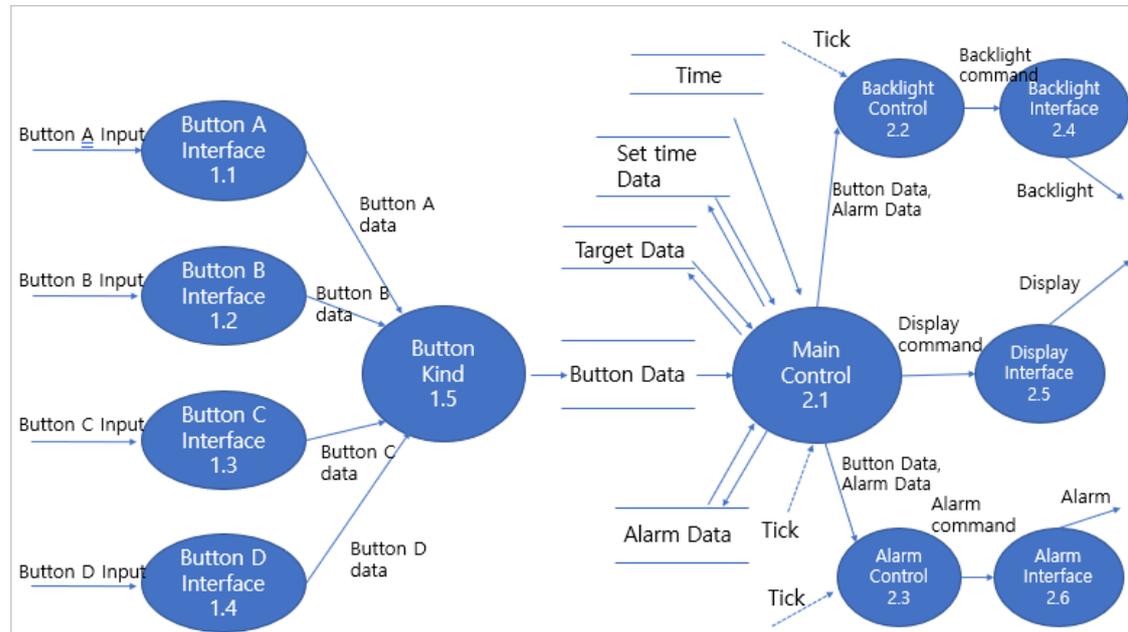
Reference No	2
Name	Screen & Backlight & Alarm Bell Control
Input	Button Data
Output	Backlight Control, Display, Alarm
Process Description	Obtain Button Data and command orders (Backlight Control, Display, Alarm).

## 3.2.2.3 Data Dictionary

Data Store	Description	Format
Time	Obtain Time information by tick	Int
Set Time Data	Obtain Set Time information and interact with main control	Int
Alarm Data	Obtain Alarm Time information, Alarm Ringing and interact with main control	Struct
Target Data	Data about target while setting. (ex: Hour, Minute, Second)	Int
Button Data	Data about buttons (A,B,C,D)	Char

### 3.2.3 DFD Level 2

#### 3.2.3.1 DFD



## 3.2.3.2 Process Specification

Reference No	1.1
Name	Button <u>A</u> Interface
Input	Button <u>A</u> Input
Output	Button A Data
Process Description	Obtain Button <u>A</u> Input and give Button A Data to Button Kind.

Reference No	1.2
Name	Button B Interface
Input	Button B Input
Output	Button B Data
Process Description	Obtain Button B Input and give Button B Data to Button Kind.

Reference No	1.3
Name	Button C Interface
Input	Button C Input
Output	Button C Data
Process Description	Obtain Button C Input and give Button C Data to Button Kind.

Reference No	1.4
Name	Button D Interface
Input	Button D Input
Output	Button D Data
Process Description	Obtain Button D Input and give Button D Data to Button Kind.

Reference No	1.5
Name	Button Kind
Input	Button A Data, Button B Data, Button C Data, Button D Data
Output	Button Data
Process Description	Obtain Button A Data, Button B Data, Button C Data, Button D Data and prioritize button data and send data to Button Data.

Reference No	2.1
Name	Main Control
Input	Time, Set Time Data, Target Data, Button data, Alarm Data, Tick
Output	Display command, Button Data, Alarm Data
Process Description	Obtain Button Data, interact with Data Stores (Time, Set Time, Target Data, Alarm data) and give Button Data, Alarm Data to each interface.

Reference No	2.2
Name	Backlight Control
Input	Button Data, Alarm Data
Output	Backlight Command
Process Description	Get Button Data, Alarm Data from main control if condition is <u>sufficient</u> and give Backlight command to Backlight Interface

Reference No	2.3
Name	Alarm Control
Input	Button Data, Alarm Data
Output	Alarm Command
Process Description	Get Button Data, Alarm Data from main control if condition is <u>sufficient</u> and give Alarm Command to Alarm Interface.

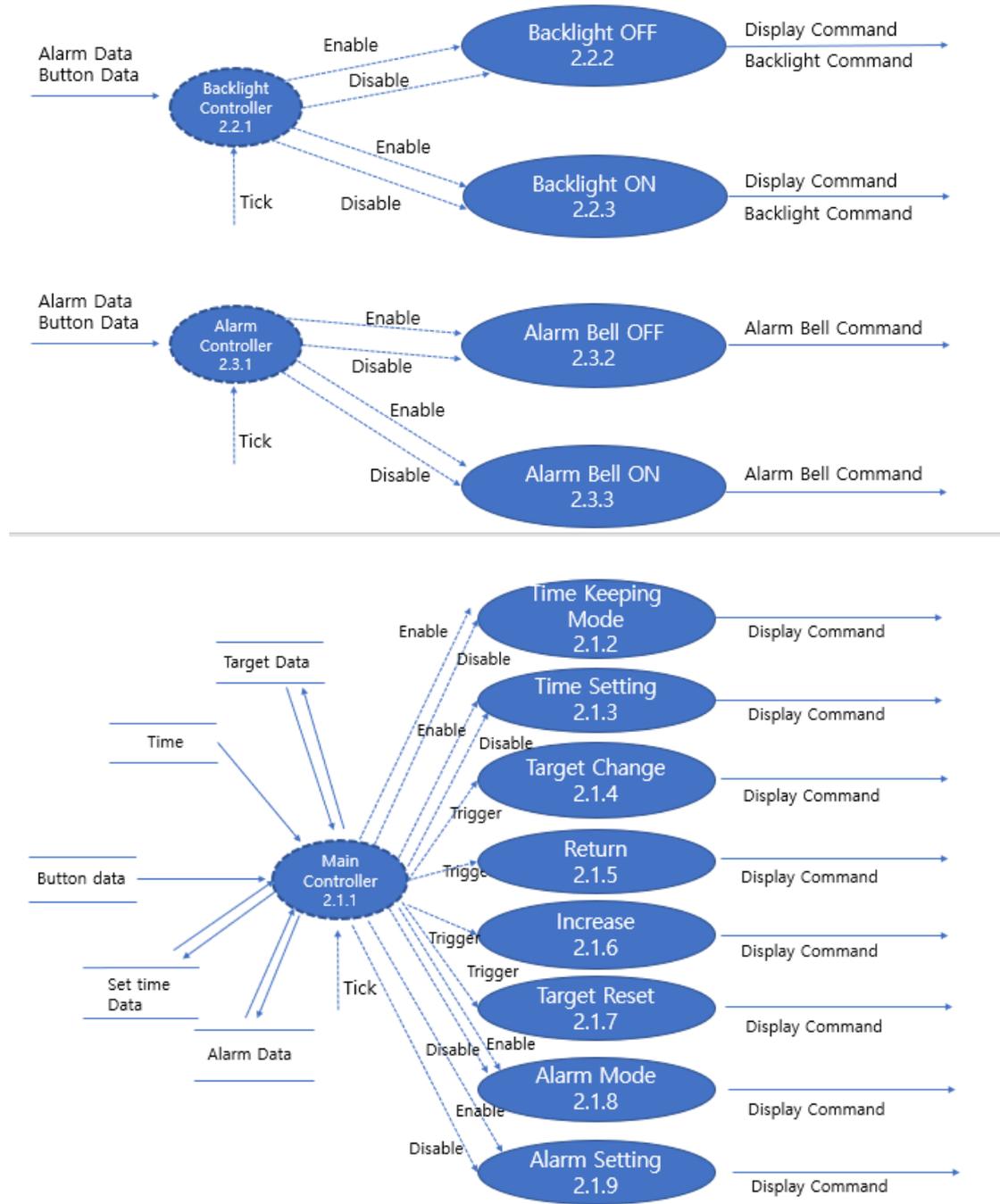
Reference No	2.4
Name	Backlight Interface
Input	Backlight Command
Output	Backlight
Process Description	Enable and disable screen backlight mode on and off.

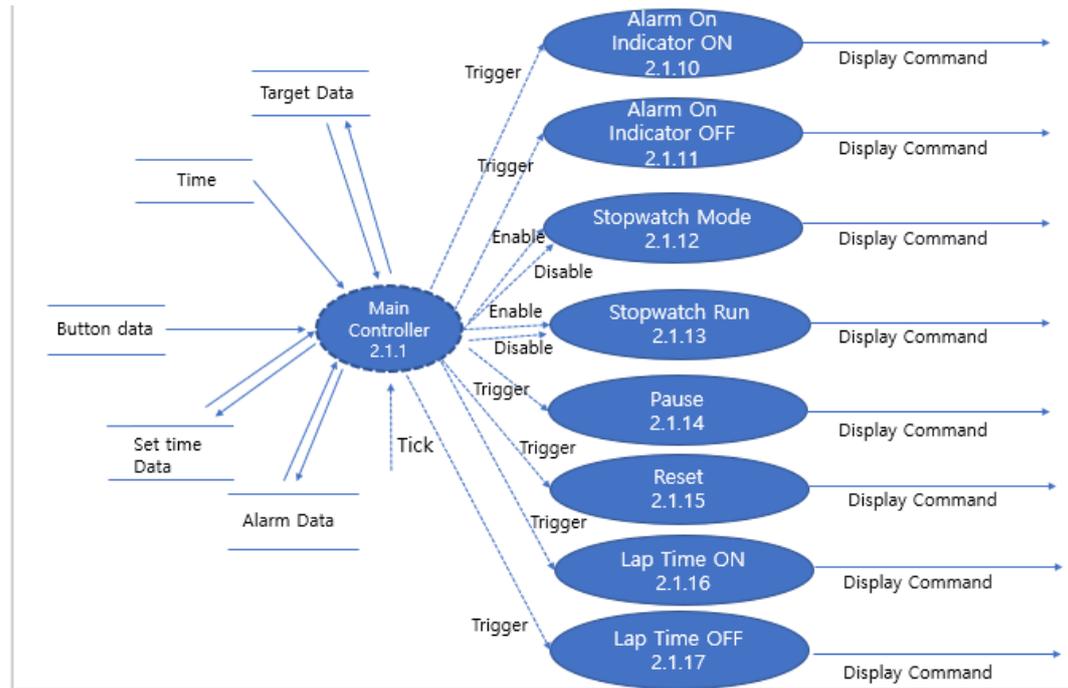
Reference No	2.5
Name	Display Interface
Input	Display command
Output	Display
Process Description	Get display command and display data to screen.

Reference No	2.6
Name	Alarm Interface
Input	Alarm command
Output	Alarm
Process Description	Get alarm command and give order to alarm.

3.2.4 DFD Level3

3.2.4.1 DFD





## 3.2.4.2 Process Specification

Reference No	2.2.1
Name	Backlight Controller
Input	Button Data, Alarm Data, Tick
Output	Enable, Disable
Process Description	Obtain Button Data and Alarm Data Enable/disable Backlight Off and Backlight On.

Reference No	2.2.2
Name	Backlight Off
Input	Enable, Disable
Output	Display Command, Backlight Command
Process Description	Get Enable and Disable as inputs Give Display command to screen Give Backlight command to Backlight Make screen in backlight off state

Reference No	2.2.3
Name	Backlight On
Input	Enable, Disable
Output	Display Command, Backlight Command
Process Description	Get Enable, Disable as input Give Display command to screen Give Backlight command to Backlight Make screen in backlight on state

Reference No	2.3.1
Name	Alarm Controller
Input	Button Data, Alarm Data, Tick
Output	Enable, Disable
Process Description	Obtain Button Data and Alarm Data Enable/disable Alarm Bell OFF and Alarm Bell ON.

Reference No	2.3.2
Name	Alarm Bell Off
Input	Enable, Disable
Output	Alarm Bell Command
Process Description	Get Enable and Disable as inputs Give Alarm Bell command to Alarm Make watch alarm not ring

Reference No	2.3.3
Name	Alarm Bell On
Input	Enable, Disable
Output	Alarm Bell Command
Process Description	Get Enable and Disable as inputs Give Alarm Bell command to Alarm Make watch alarm ring

Reference No	2.1.1
Name	Main Controller
Input	Button Data, Time, Alarm Data, Set Time, Target Data, Tick
Output	Enable, Disable, Trigger
Process Description	Obtain Button Data, Time, Alarm data, Set Time Data, Target Data Enable/disable Timekeeping Mode, Time Setting, Alarm Mode, Alarm Setting, Stopwatch Mode, Stopwatch Run and trigger Target Change, Return, Increase, Target Reset, Alarm On Indicator ON/OFF, Pause, Reset, Lap Time ON/OFF. Store data to Data Stores (Alarm Time, Set Time, Target Data).

Reference No	2.1.2
Name	Timekeeping Mode
Input	Enable, Disable
Output	Display Command
Process Description	Get Enable and Disable as inputs Give Display command to screen Basic Mode of the watch Shows set time

Reference No	2.1.3
Name	Time Setting
Input	Enable, Disable
Output	Display Command
Process Description	Get Enable and Disable as inputs Give Display command to screen Can set time

Reference No	2.1.4
Name	Target Change
Input	Trigger
Output	Display Command
Process Description	Get Trigger as input Give Display Command to Screen Change Target while setting (ex: Hour -> Minute)

Reference No	2.1.5
Name	Return
Input	Trigger
Output	Display Command
Process Description	Get Trigger as input Give Display Command to Screen Finish Setting and go back to the recent state

Reference No	2.1.6
Name	Increase
Input	Trigger
Output	Display Command
Process Description	Get Trigger as input Give Display Command to Screen Increase current target value by 1 while setting

Reference No	2.1.7
Name	Target Reset
Input	Trigger
Output	Display Command
Process Description	Get Trigger as input Give Display command to screen Reset the data while setting If target value == target limit, reset current target value

Reference No	2.1.8
Name	Alarm Mode
Input	Enable, Disable
Output	Display Command
Process Description	Get Enable and Disable as inputs Give Display command to screen

Reference No	2.1.9
Name	Alarm Setting
Input	Enable, Disable
Output	Display Command
Process Description	Get Enable and Disable as inputs Give Display command to screen Can set Alarm in this mode

Reference No	2.1.10
Name	Alarm On Indicator ON
Input	Trigger
Output	Display Command
Process Description	Get Trigger as input Give Display command to screen Make Alarm On Indicator ON

Reference No	2.1.11
Name	Alarm On Indicator OFF
Input	Trigger
Output	Display Command
Process Description	Get Trigger as input Give Display command to screen Make Alarm On Indicator OFF

Reference No	2.1.12
Name	Stopwatch Mode
Input	Enable, Disable
Output	Display Command
Process Description	Get Enable and Disable as inputs Give Display command to screen

Reference No	2.1.13
Name	Stopwatch Run
Input	Enable, Disable
Output	Display Command
Process Description	Get Enable and Disable as inputs Give Display command to screen Make stopwatch run

Reference No	2.1.14
Name	Pause
Input	Trigger
Output	Display Command
Process Description	Get Trigger as input Give Display Command to Screen Make stopwatch pause while running

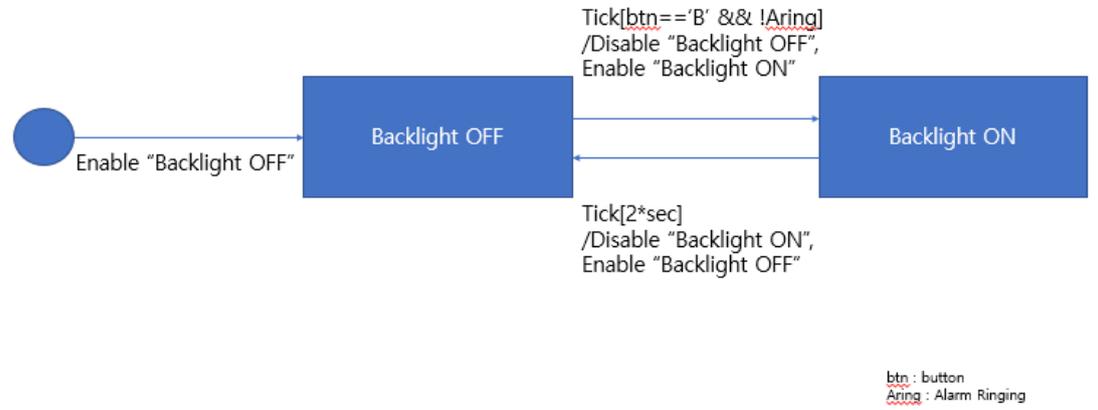
Reference No	2.1.15
Name	Reset
Input	Trigger
Output	Display Command
Process Description	Get Trigger as input Give Display Command to Screen Reset time in stopwatch mode

Reference No	2.1.16
Name	Lap Time ON
Input	Trigger
Output	Display Command
Process Description	Get Trigger as input Give Display Command to Screen

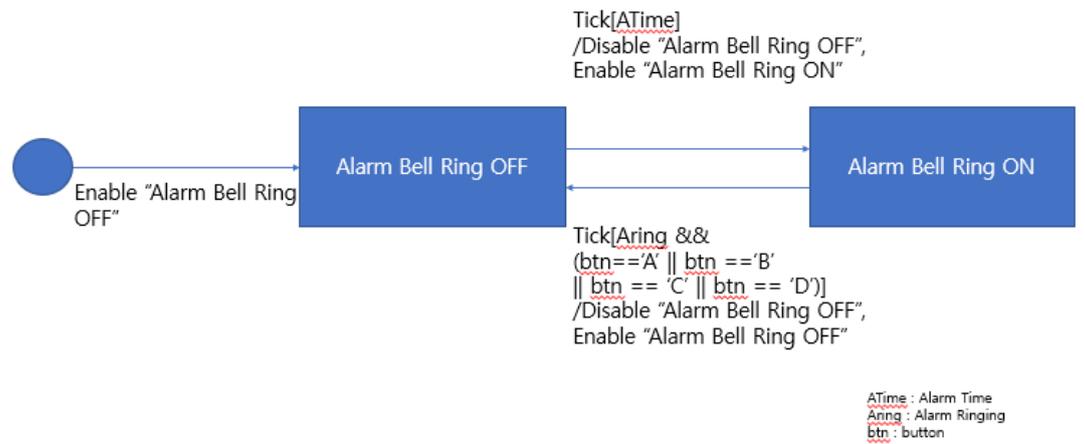
Reference No	2.1.17
Name	Lap Time OFF
Input	Trigger
Output	Display Command
Process Description	Get Trigger as input Give Display Command to Screen

3.2.5 DFD Level 4

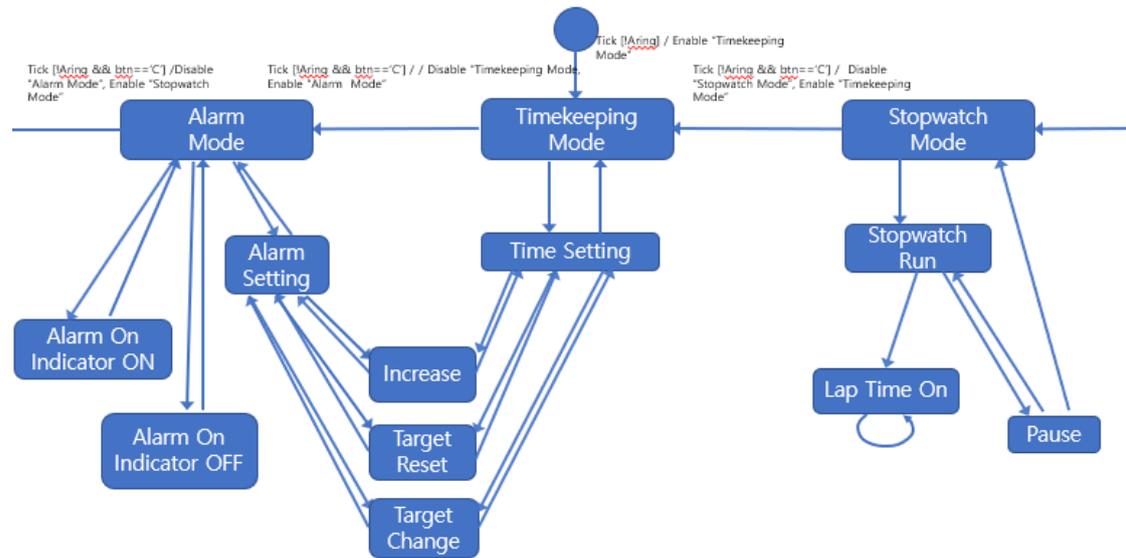
3.2.5.1 STD for Controller 2.2.1



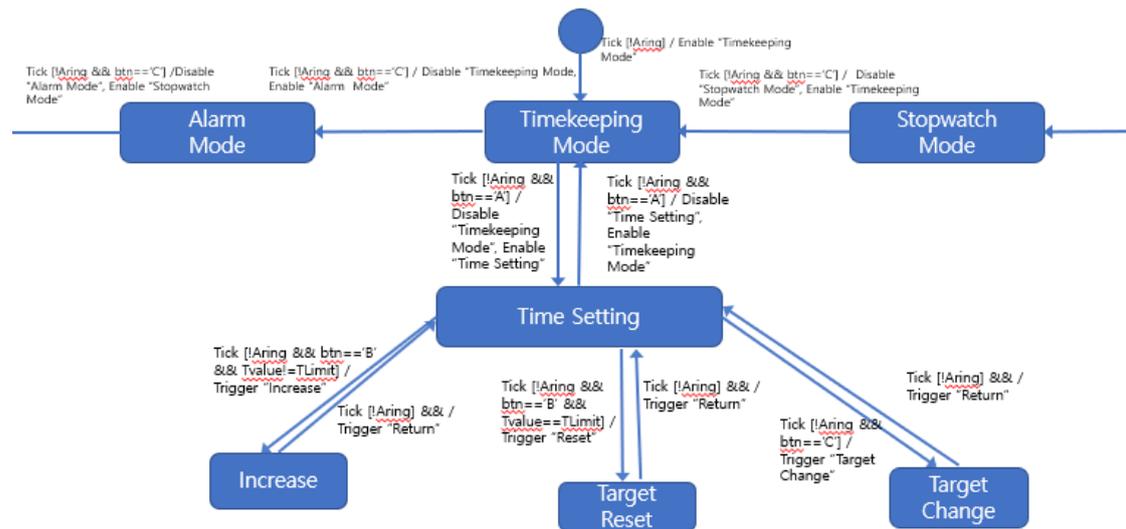
3.2.5.2 STD for Controller 2.3.1



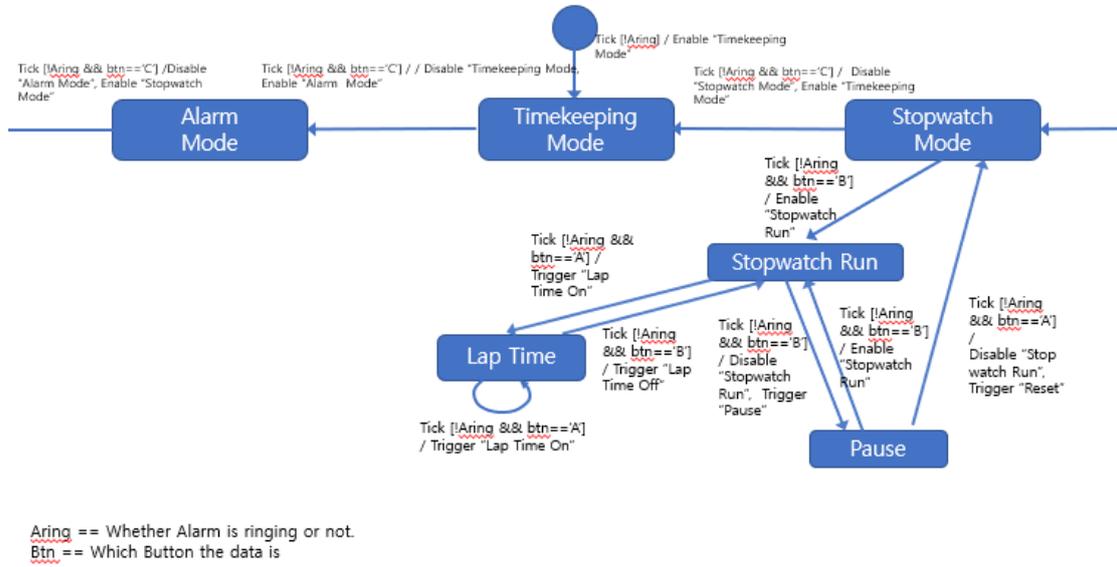
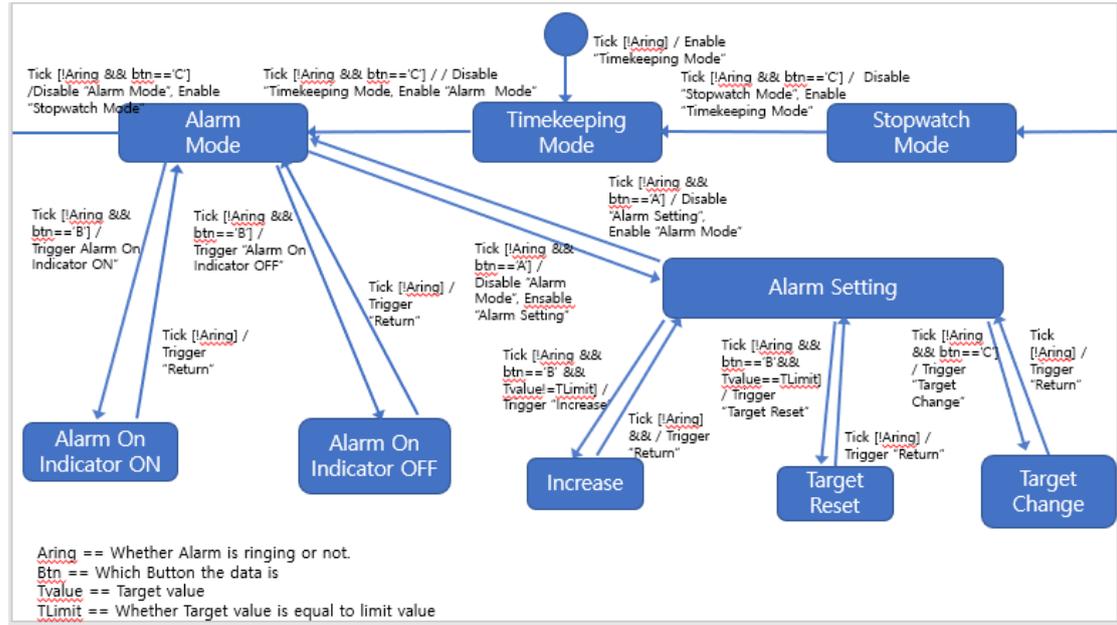
3.2.5.3 STD for Controller 2.1.1



Aring == Whether Alarm is ringing or not.  
 Btn == Which Button the data is



Aring == Whether Alarm is ringing or not.  
 Btn == Button data  
 Tvalue == Target value  
 TLimit == Whether Target value is equal to limit value



### 3.2.6 Overall DFD

#### 3.2.6.1 Overall DFD

