Projeto 2
Smart Fridge

DCA0212.0 - Circuitos Digitais

Componentes:

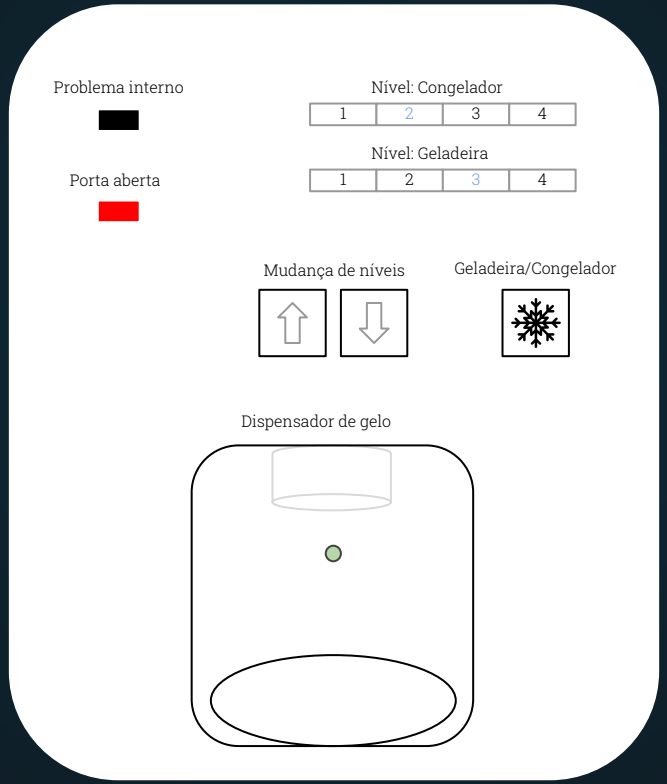
- IGOR SÉRGIO DE FRANÇA CORREIA
- NEUMAN FABRICIO DE OLIVEIRA FERNANDES
- THIAGO THEIRY DE OLIVEIRA

Introdução

Smart Fridge (Geladeira Inteligente)

- Botões no de regular o nível da temperatura no painel;
- Detecção e tentativa de correção de problemas internos relacionados a temperatura;
- Luzes internas acendem/apagam, dependendo da porta estar aberta ou fechada;
- Led no painel que avisa se a porta está aberta;
- Sensor que detecta copo e libera gelo;

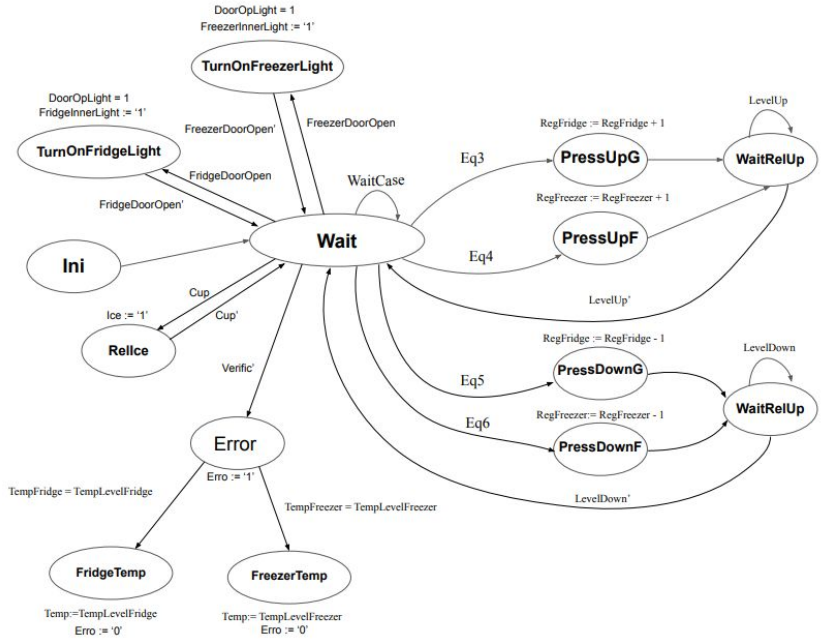
Painel


Problema interno
Porta aberta
Nível: Congelador
1 2 3 4
Nível: Geladeira
1 2 3 4
Mudança de níveis
Geladeira/Congelador
Dispensador de gelo

Desenvolvimento

Captura do comportamento da máquina de estados de alto nível	Step 1
Criação do caminho de dados (datapath)	Step 2A
Conexão do caminho de dados ao controlador	Step 2B
Conversão da HSLM para FSM	Step 2C

Step 1 - Captura do comportamento (HLSM)



Entradas: LevelUp (bit), LevelDown (bit), toggle(bit), Cup (bit), DoorSwitch (bit), FridgeDoorOpen (bit), FreezerDoorOpen (bit), TempFridge (14 bits), TempFreezer(14 bits),TempLevelFridge(4bits),TempLevelFreezer(4bits);
Saídas: LevelFridge(4 bits), LevelFreezer (4 bits), Ice (bit), FridgeInnerLight (bit), FreezerInnerLight (bit), DoorOpLight (bit), Erro(bit);
***Registradores*:** RegFridge (3 bits), RegFreezer (3 bits),RegTempFridge(3 bits), RegTemp Freezer (3 bits),

Eq1 := (toggle'(LevelUp*LevelDown'(RegG < 4) + LevelUp'*LevelDown (RegG > 1)))'

Eq2 := (toggle(LevelUp*LevelDown'(RegF < 4) + TempUp'*TempDown (RegF > 1)))'

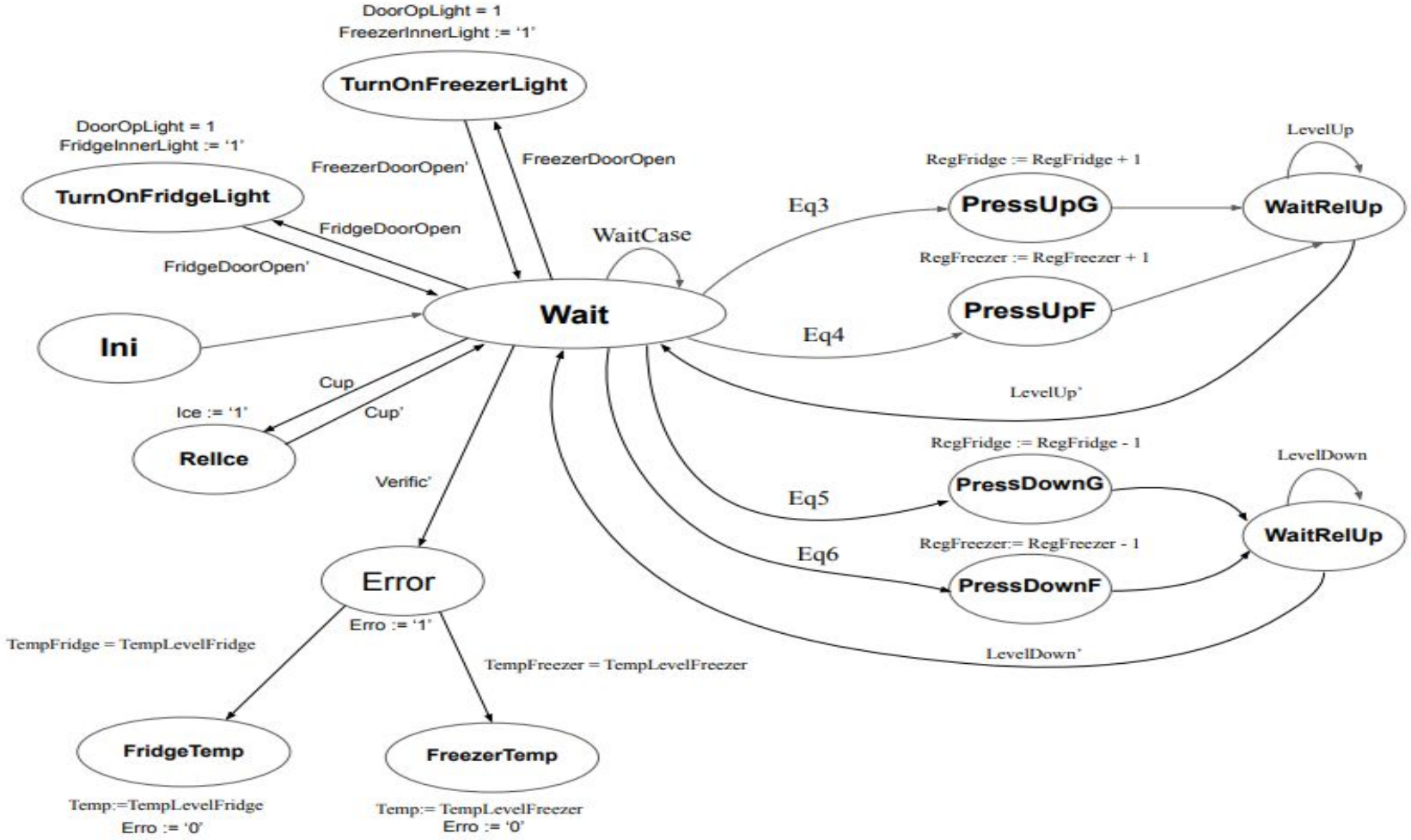
Eq3 := toggle'(LevelUp*LevelDown'(RegG < 4) **Eq5** := toggle'(LevelUp'*LevelDown(RegG > 1)

Eq4 := toggle(LevelUp*LevelDown'(RegG < 4) **Eq6** := toggle(LevelUp'*LevelDown(RegG > 1)

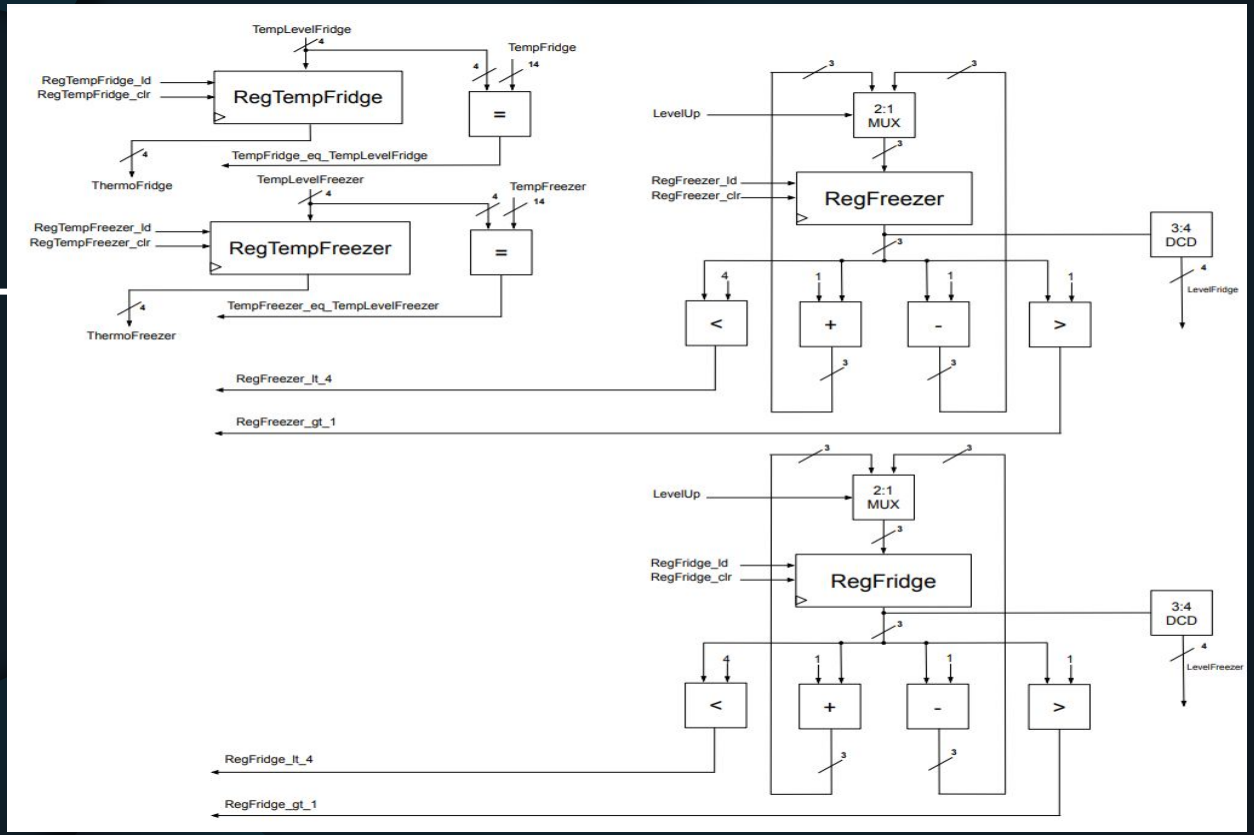
Verific := (TempFridge = TempLevelFridge)*(TempFreezer = TempLevelFreezer);

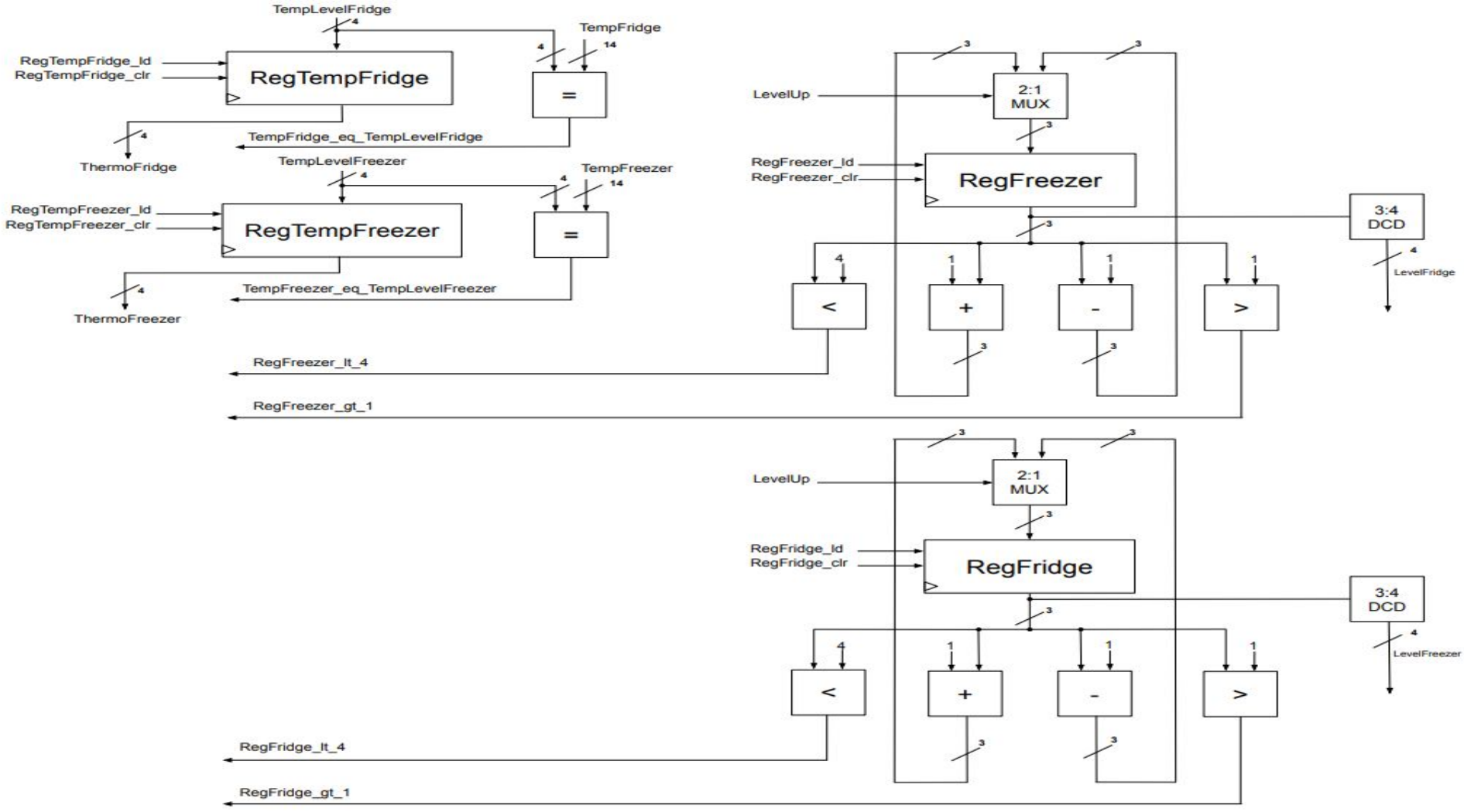
WaitCase := Eq1 + Eq2 + Verific + FreezerDoorOpen' + FridgeDoorOpen' + Cup';

Fridge Level 1: 10° C; Freezer Level 1: -1° C;
Fridge Level 2: 6° C; Freezer Level 2: -2° C;
Fridge Level 3: 2° C; Freezer Level 3: -3° C;
Fridge Level 4: -2° C; Freezer Level 4: -4° C;

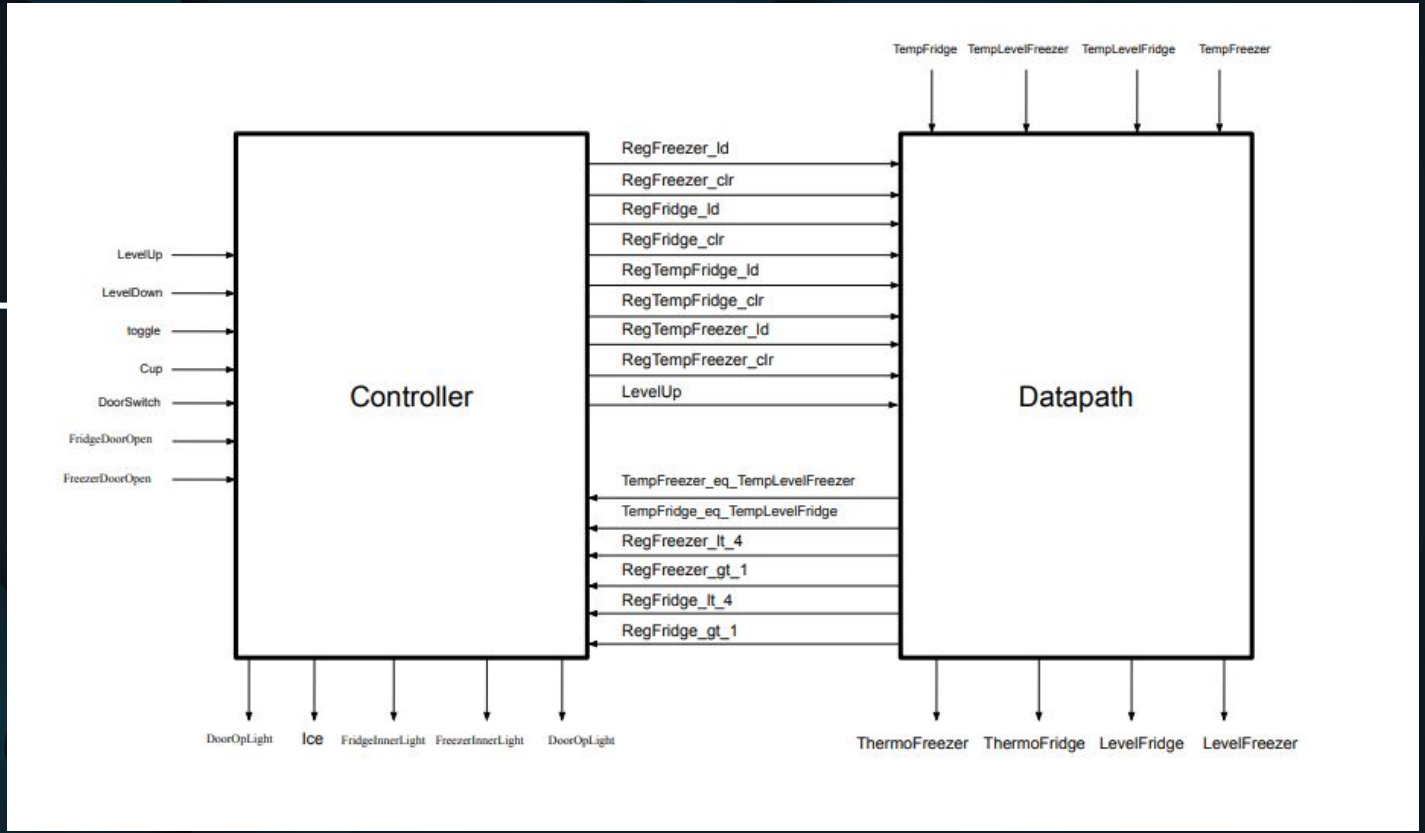

DoorOpLight = 1
FreezerInnerLight := '1'
TurnOnFreezerLight
DoorOpLight = 1
FridgeInnerLight := '1'
TurnOnFridgeLight
FreezerDoorOpen'
FreezerDoorOpen
FridgeDoorOpen
FridgeDoorOpen'
WaitCase
Ini
Wait
Cup
Ice := '1'
Cup'
RelIce
Verific'
Error
Erro := '1'
TempFridge = TempLevelFridge
TempFreezer = TempLevelFreezer
FridgeTemp
Temp:=TempLevelFridge
Erro := '0'
FreezerTemp
Temp:= TempLevelFreezer
Erro := '0'
Eq3
RegFridge := RegFridge + 1
PressUpG
LevelUp
WaitRelUp
RegFreezer := RegFreezer + 1
PressUpF
Eq4
LevelUp'
RegFridge := RegFridge - 1
PressDownG
LevelDown
WaitRelUp
Eq5
Eq6
RegFreezer:= RegFreezer - 1
PressDownF
LevelDown'

Step 2A - Caminho de dados (Datapath)

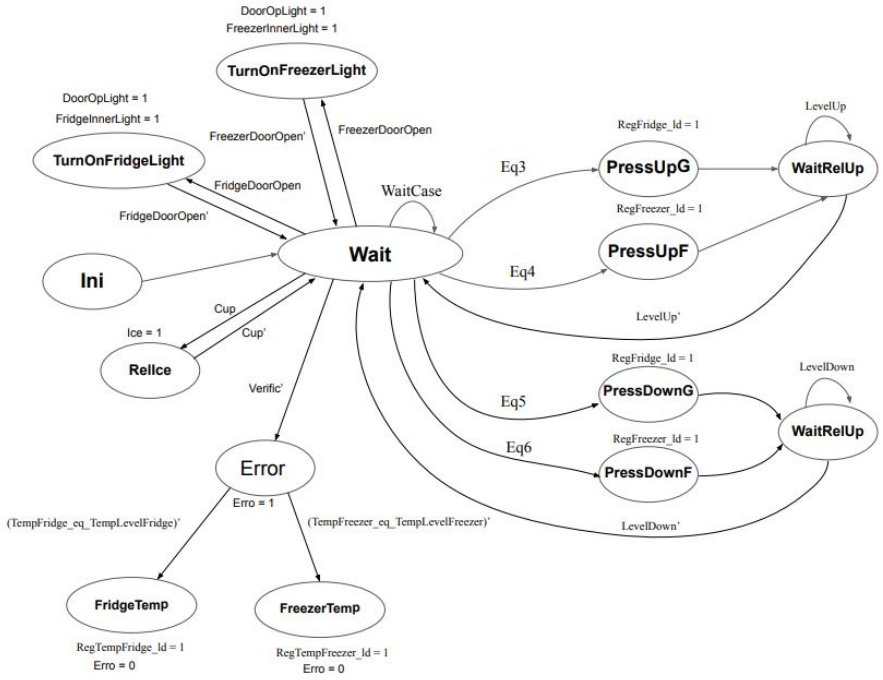



TempLevelFridge
4
TempFridge
4
14
RegTempFridge_ld
RegTempFridge_clr
RegTempFridge
=
4
ThermoFridge
TempFridge_eq_TempLevelFridge
TempLevelFreezer
4
TempFreezer
4
14
RegTempFreezer_ld
RegTempFreezer_clr
RegTempFreezer
=
4
ThermoFreezer
TempFreezer_eq_TempLevelFreezer
LevelUp
3
2:1
MUX
3
RegFreezer_ld
RegFreezer_clr
RegFreezer
3
3:4
DCD
4
LevelFridge
4
1
1
1
<
+
-
>
3
3
RegFreezer_lt_4
RegFreezer_gt_1
LevelUp
3
2:1
MUX
3
RegFridge_ld
RegFridge_clr
RegFridge
3
3:4
DCD
4
LevelFreezer
4
1
1
1
<
+
-
>
3
3
RegFridge_lt_4
RegFridge_gt_1

Step 2B - Conexão Controlador-Datapath



Step 2C - Conversão HLSM - FSM



Entradas: LevelUp (bit), LevelDown (bit), toggle(bit), Cup (bit), DoorSwitch (bit), FridgeDoorOpen (bit), FreezerDoorOpen (bit), TempFreezer_eq_TempLevelFreezer(bit), TempFridge_eq_TempLevelFridge(bit), RegFreezer_lt_4(bit), RegFreezer_gt_1(bit), RegFridge_lt_4(bit), RegFridge_gt_1(bit);
Saídas: Ice (bit), FridgeInnerLight (bit), FreezerInnerLight (bit), DoorOpLight (bit), RegFreezer_ld(bit), RegFreezer_clr(bit), RegFridge_ld(bit), RegFridge_clr(bit), LevelUp(bit), Erro(bit);

Eq1 := (toggle'((LevelUp*LevelDown')RegFridge_lt_4 + (LevelUp'*LevelDown)RegFridge_gt_1))'

Eq2 := (toggle((LevelUp*LevelDown')RegFreezer_lt_4 + (LevelUp'*LevelDown)RegFreezer_gt_1))'

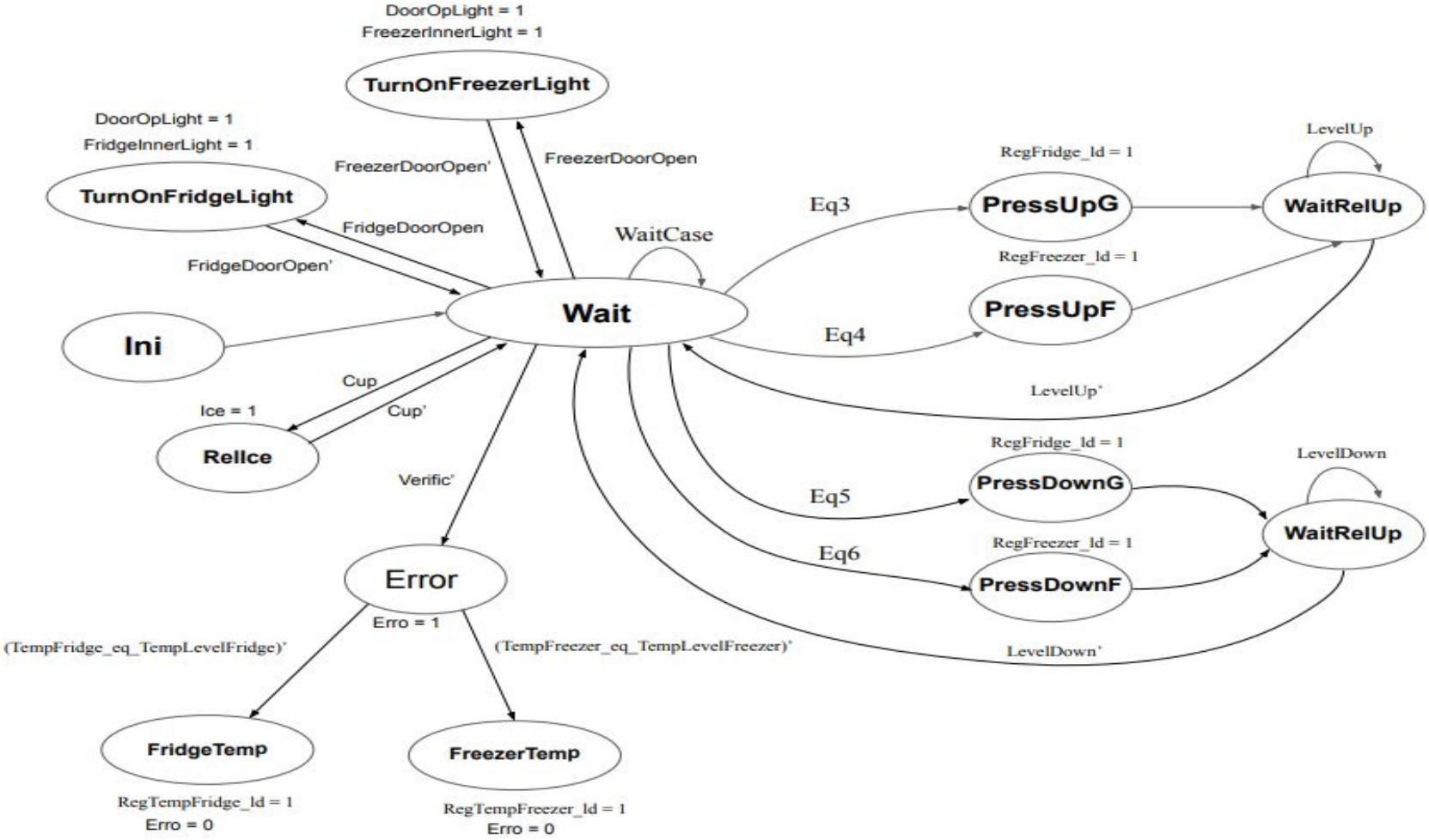
Eq3 := toggle'(LevelUp*LevelDown')RegFridge_lt_4 **Eq5** := toggle'(LevelUp'*LevelDown)RegFridge_gt_1

Eq4 := toggle(LevelUp*LevelDown')RegFreezer_lt_4 **Eq6** := toggle(LevelUp'*LevelDown)RegFreezer_gt_1

Verific := (TempFridge_eq_TempLevelFridge)*(TempFreezer_eq_TempLevelFreezer);

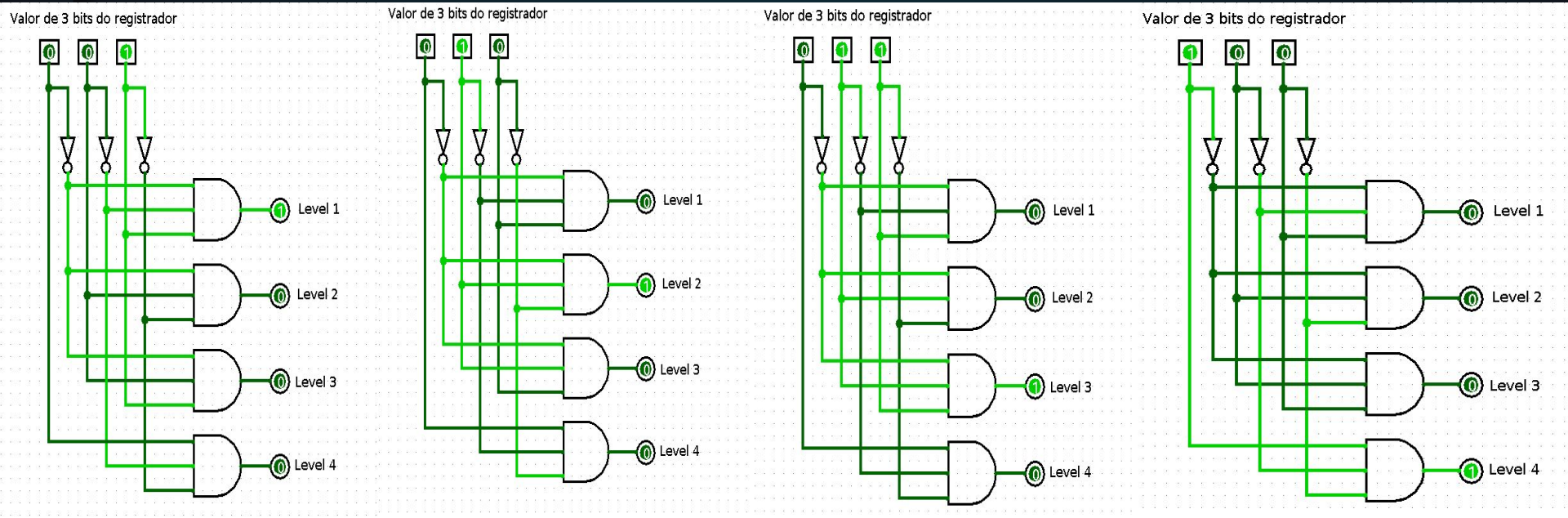
WaitCase := Eq1 + Eq2 + Verific+ FreezerDoorOpen' + FridgeDoorOpen' + Cup';

Fridge Level 1: 10° C; Freezer Level 1: -1° C;
Fridge Level 2: 6° C; Freezer Level 2: -2° C;
Fridge Level 3: 2° C; Freezer Level 3: -3° C;
Fridge Level 4: -2° C; Freezer Level 4: -4° C;


DoorOpLight = 1
FreezerInnerLight = 1
TurnOnFreezerLight
DoorOpLight = 1
FridgeInnerLight = 1
TurnOnFridgeLight
FreezerDoorOpen'
FreezerDoorOpen
FridgeDoorOpen
FridgeDoorOpen'
WaitCase
Wait
Ini
Cup
Cup'
Ice = 1
RelIce
Verific'
Error
Erro = 1
(TempFridge_eq_TempLevelFridge)'
(TempFreezer_eq_TempLevelFreezer)'
FridgeTemp
RegTempFridge_ld = 1
Erro = 0
FreezerTemp
RegTempFreezer_ld = 1
Erro = 0
Eq3
PressUpG
RegFridge_ld = 1
LevelUp
WaitRelUp
RegFreezer_ld = 1
PressUpF
Eq4
LevelUp'
RegFridge_ld = 1
PressDownG
LevelDown
Eq5
WaitRelUp
Eq6
RegFreezer_ld = 1
PressDownF
LevelDown'

Dificuldades e Soluções

Decoder 3x4:



Componentes:

- IGOR SÉRGIO DE FRANÇA CORREIA
- NEUMAN FABRICIO DE OLIVEIRA FERNANDES
- THIAGO THEIRY DE OLIVEIRA

Obrigado pela atenção!