Module Interface Specification for Pot-pulator

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1 Revision History

Date	Version	Notes
2023-01-18	Juan Moncada, Aaron Billones, Steven Ramundi, Gillian Ford	Initial release
2023-04-05	Steven Ramundi, Aaron Billones	Updated for final documentation

2 Symbols, Abbreviations and Acronyms

See SRS Documentation at https://github.com/aaronbilly22/The_Nursery_Project/blob/main/docs/SRS/SRS.pdf

Contents

3 Introduction

The following document details the Module Interface Specifications for The Nursery Project. Complementary documents include the System Requirement Specifications and Module Guide. The full documentation and implementation can be found at https://github.com/aaronbilly22/The_Nursery_Project/blob/main/docs/SRS/SRS.pdf.

4 Notation

The structure of the MIS for modules comes from Hoffman and Strooper (1995), with the addition that template modules have been adapted from Ghezzi et al. (2003). The mathematical notation comes from Chapter 3 of Hoffman and Strooper (1995). For instance, the symbol := is used for a multiple assignment statement and conditional rules follow the form $(c\_1 \Rightarrow r\_1 | c\_2 \Rightarrow r\_2 | ... | c\_n \Rightarrow r\_n)$.

The following table summarizes the primitive data types used by Pot-pulator.

Data Type	Notation	Description
character	char	a single symbol or digit
integer	$\mathbb{Z}$	a number without a fractional component in (-∞, ∞)
natural number	$\mathbb{N}$	a number without a fractional component in [1, ∞)
real	$\mathbb{R}$	any number in (-∞, ∞)

5 Module Decomposition

The following table is taken directly from the Module Guide document for this project.

Level 1	**Level 2**
Hardware-Hiding Module	
Behaviour-Hiding Module	Pot Dropping Input Module Pot Dropping Stepper Module Pot Dropping Output Module Conveyor Input Module Conveyor Movement Module Tray Dispenser Input Module Tray Dispenser Output Module Verification Output Module
Software Decision Module	Pot dropping Position Module Verifications Analysis Module Communication Module Front End Module

Table 1: Module Hierarchy

6 MIS of Pot Dropping Input Module

6.1 Pot Dropping Input

6.2 Uses

Pot Dropping Position Module (M4)

6.3 Syntax

6.3.1 Exported Constants

trigPin: ultrasonic range finder trigger pin
echoPin: ultrasonic range finder echo pin
LIMIT_SWITCH_PIN_L: left servo limit switch pin
LIMIT_SWITCH_PIN_R: right servo limit switch pin

6.3.2 Exported Access Programs

N/A

6.4 Semantics

6.4.1 State Variables

duration := float
distance := float

6.4.2 Environment Variables

trigPin: output pin sending signal to ultrasonc range finder
echoPin: input pin receiving signal from ultrasonc range finder
LIMIT_SWITCH_PIN_L: input pin receiving signal from arm switch attached to servo
LIMIT_SWITCH_PIN_R: input pin receiving signal from arm switch attached to servo
Servo Servo1: servo object of servo motor 1
Servo Servo2: servo object of servo motor 2

6.4.3 Assumptions

N/A

6.4.4 Access Routine Semantics

N/A

6.4.5 Local Functions

loop, setup

7 MIS of Pot Dropping Stepper Module

7.1 Pot Dropping Stepper

7.2 Uses

Pot Dropping Output Module (M6)

7.3 Syntax

7.3.1 Exported Constants

const int stepPin1: step pin of stepper 1
const int dirPin1: direction pin of stepper 1
const int stepPin2: step pin of stepper 2
const int dirPin2: direction pin of stepper 2

7.3.2 Exported Access Programs

N/A

7.4 Semantics

7.4.1 State Variables

N/A

7.4.2 Environment Variables

const int stepPin1: output pin sending signal to stepper 1
const int dirPin1: output pin sending signal to stepper 1
const int stepPin2: output pin sending signal to stepper 2
const int dirPin2: output pin sending signal to stepper 2

7.4.3 Assumptions

N/A

7.4.4 Access Routine Semantics

N/A

7.4.5 Local Functions

N/A

8 MIS of Pot Dropping Output Module

8.1 Pot Dropping Output

8.2 Uses

Communication (section 16)

8.3 Syntax

8.3.1 Exported Constants

servoPin 1: servo 1 command pin
servoPin 2: servo2 command pin
errorPin: user interface error pin
conveyorPin: conveyor control pin

8.3.2 Exported Access Programs

N/A

8.4 Semantics

8.4.1 State Variables

N/A

8.4.2 Environment Variables

servoPin 1: output pin sending signal to servo 1
servoPin 2: output pin sending signal to servo 2
errorPin: output pin sending error signal to front-end

conveyorPin: output pin sneding stop/start signal to conveyor

8.4.3 Assumptions

N/A

8.4.4 Access Routine Semantics

N/A

8.4.5 Local Functions

N/A

9 MIS of Conveyor Input Module

9.1 Conveyor Input

9.2 Uses

Conveyor Movement 10

9.3 Syntax

9.3.1 Exported Constants

const int stopPin: stop pin to conveyor

9.3.2 Exported Access Programs

N/A

9.4 Semantics

9.4.1 State Variables

N/A

9.4.2 Environment Variables

const int stopPin: input pin receiving signal from pot dropper to stop/start conveyor movement

9.4.3 Assumptions

N/A

9.4.4 Access Routine Semantics

N/A

9.4.5 Local Functions

N/A

10 MIS of Conveyor Movement Module

10.1 Conveyor Movement

10.2 Uses

Communication 16

10.3 Syntax

10.3.1 Exported Constants

const int relayPin: relay pin from conveyor

10.3.2 Exported Access Programs

N/A

10.4 Semantics

10.4.1 State Variables

N/A

10.4.2 Environment Variables

const int relayPin: output pin sending stop/start signal to conveyor relay

10.4.3 Assumptions

N/A

10.4.4 Access Routine Semantics

N/A

10.4.5 Local Functions

N/A

11 MIS of Tray Dispenser Input Module

11.1 Tray Dispenser Input

11.2 Uses

Tray Dispenser Output 12

11.3 Syntax

11.3.1 Exported Constants

const int trigPin: ultrasonic range finder trigger pin
const int echoPin: ultrasonic range finder echo pin

11.3.2 Exported Access Programs

N/A

11.4 Semantics

11.4.1 State Variables

distance := int
duration := long

11.4.2 Environment Variables

const int trigPin: output pin sending signal to ultrasonc range finder
const int echoPin: input pin receiving signal from ultrasonc range finder

11.4.3 Assumptions

N/A

11.4.4 Access Routine Semantics

N/A

11.4.5 Local Functions

GetDistance(): returns distance as read from ultrasonic range finder

12 MIS of Tray Dispenser Output Module

12.1 Tray Dispenser Output

12.2 Uses

Communication 16

12.3 Syntax

12.3.1 Exported Constants

const int ms1: stepping mode
const int ms2: stepping mode
const int ms3: stepping mode
cosnt int stepPin: step pin of stepper motors
const int dirPin: direction pin of stepper motors

12.3.2 Exported Access Programs

N/A

12.4 Semantics

12.4.1 State Variables

N/A

12.4.2 Environment Variables

const int ms1: output pin to set stepping mode
const int ms2: output pin to set stepping mode
const int ms3: output pin to set stepping mode
cosnt int stepPin: output pin sending signal to stepper motors
const int dirPin: output pin sending signal to stepper motors

12.4.3 Assumptions

N/A

12.4.4 Access Routine Semantics

N/A

12.4.5 Local Functions

N/A

13 MIS of Verification Output Module

13.1 Verification Output

13.2 Uses

Communication 16

13.3 Syntax

13.3.1 Exported Constants

const int LED_PIN: pin to LED and front-end

13.3.2 Exported Access Programs

N/A

13.4 Semantics

13.4.1 State Variables

N/A

13.4.2 Environment Variables

const int LED_PIN: output pin to LED and front-end to signify failure in verification

13.4.3 Assumptions

N/A

13.4.4 Access Routine Semantics

N/A

13.4.5 Local Functions

N/A

14 MIS of Pot Dropping Position Module

14.1 Pot Dropping Position

14.2 Uses

Pot Dropping Stepper 7

14.3 Syntax

14.3.1 Exported Constants

LIMIT_SWITCH_PIN_L: left servo limit switch pin
LIMIT_SWTCH_PIN_R: right servo limit switch pin

14.3.2 Exported Access Programs

N/A

14.4 Semantics

14.4.1 State Variables

distance := float

14.4.2 Environment Variables

LIMIT_SWITCH_PIN_L: input pin to determine if tray has made contact with left limit switch
LIMIT_SWTCH_PIN_R: input pin to determine if tray has made contact with right limit switch

14.4.3 Assumptions

N/A

14.4.4 Access Routine Semantics

N/A

14.4.5 Local Functions

N/A

15 MIS of Verification Analysis Module

15.1 Module

15.2 Uses

Verification Output 13

15.3 Syntax

15.3.1 Exported Constants

const int TRIG_PIN: ultrasonic range finder trigger pin
cosnt int ECHO_PIN: ultrasonic range finder echo pin
const int TRIG_PIN2: ultrasonic range finder trigger pin
cosnt int ECHO_PIN2: ultrasonic range finder echo pin

15.3.2 Exported Access Programs

N/A

15.4 Semantics

15.4.1 State Variables

duration_us := float
distance_cm := float
duration2_us := float
distance2_cm := float

15.4.2 Environment Variables

const int TRIG_PIN: output pin to ultrasonic range finder
cosnt int ECHO_PIN: input pin from ultrasonic range finder
const int TRIG_PIN2: output pin to ultrasonic range finder

cosnt int ECHO_PIN2: input pin from ultrasonic range finder

15.4.3 Assumptions

N/A

15.4.4 Access Routine Semantics

N/A

15.4.5 Local Functions

N/A

16 MIS of Communication Module

16.1 Communication

16.2 Uses

N/A

16.3 Syntax

16.3.1 Exported Constants

N/A

16.3.2 Exported Access Programs

N/A

16.4 Semantics

16.4.1 State Variables

N/A

16.4.2 Environment Variables

N/A

16.4.3 Assumptions

N/A

16.4.4 Access Routine Semantics

N/A

16.4.5 Local Functions

N/A

17 MIS of Front End Module

17.1 Front End

17.2 Uses

Communication 16

17.3 Syntax

17.3.1 Exported Constants

LCD_CS: chip select pin
LCD_CD: command/data pin
LCD_WR: write pin
LCD_RD: read pin
LCD_RESET: reset pin

17.3.2 Exported Access Programs

N/A

17.4 Semantics

17.4.1 State Variables

status

:= byte
state

:= byte
oldstate

:= byte

17.4.2 Environment Variables

LCD_CS: chip select pin
LCD_CD: command/data pin
LCD_WR: write pin
LCD_RD: read pin
LCD_RESET: reset pin

17.4.3 Assumptions

N/A

17.4.4 Access Routine Semantics

masterSwitchON(): writes master switch on status to display
masterSwitchOFF(): write master switch off status to display
verification() writes verification clear to display
verifcationDetected(): writes verification error to display
trayJam(): writes tray jam status warning to display
trayStock(): writes tray stock status clear to display
potJam(): writes pot jam status warning to display
potStock(): write pot stock status warning to display

17.4.5 Local Functions

N/A

References

Carlo Ghezzi, Mehdi Jazayeri, and Dino Mandrioli. *Fundamentals of Software Engineering*. Prentice Hall, Upper Saddle River, NJ, USA, 2nd edition, 2003.

Daniel M. Hoffman and Paul A. Strooper. *Software Design, Automated Testing, and Maintenance: A Practical Approach*. International Thomson Computer Press, New York, NY, USA, 1995. URL http://citeseer.ist.psu.edu/428727.html.