

COMP9032 Project

User Manual

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Abstract

This document shows how a user may use the emulator which includes how to setup the AVR lab board, how to interact with the emulator and what are the expected outcome.

1. Introduction

The emulator remotely controls a toy helicopter flying in a confined space. The simulation is done on COM9032 Lab board which is based on AVR ATmega 2560 microcontroller.

2. Board Setup

2.1 Precautions

As electrostatic discharge may occur, the user needs to discharge himself by touching a coin, a key or other metallic objects.

2.2 Power

The board runs at 5V which can be supply by using a USB (A-B) cable connecting to a computer device and/or by using a 5-12V DC power supply. Note that the board should never be fed with power until wiring has been done properly.

2.3 Wiring

Wiring should be carefully done by jumper wires in accordance with the following:

Port Group	Pin	Port Group	Pin
PORT A	PA3	MOTOR	LED
PORT A	PA4	LCD CTRL	BE
PORT A	PA5	LCD CTRL	RW
PORT A	PA6	LCD CTRL	E
PORT A	PA7	LCD CTRL	RS
PORT C	PC0	LED BAR	LED2
PORT C	PC1	LED BAR	LED3
PORT C	PC2	LED BAR	LED4
PORT C	PC3	LED BAR	LED5
PORT C	PC4	LED BAR	LED6
PORT C	PC5	LED BAR	LED7
PORT C	PC6	LED BAR	LED8
PORT C	PC7	LED BAR	LED9
PORT G	PG2	LED BAR	LED0
PORT G	PG3	LED BAR	LED1

PORT L	PL0	KEYPAD	C3
PORT L	PL1	KEYPAD	C2
PORT L	PL2	KEYPAD	C1
PORT L	PL3	KEYPAD	C0
PORT L	PL4	KEYPAD	R3
PORT L	PL5	KEYPAD	R2
PORT L	PL6	KEYPAD	R1
PORT L	PL7	KEYPAD	R0
P11	+5V (any)	MOTOR	OpE

Note that the pins in MOTOR pin group are optional.

3. Component and Functions

3.1 Reset

The LCD will display “Start:” when pressing the red Reset button or upon power on.

3.2 Input

The user controls with the emulator by pressing keypad as shown



The keys from key pad function as summarized below

1 - Down	2 - Forward	3 - Up	A
4 - Left	5 - Backward	6 - Right	B
7	8	9	C - Speed Up
* - Hover/Resume	0	# - Take off/Land	D - Speed Down

- Key 1, 2, 3, 4, 5 and 6 are direction controls. For example, if 1 is pressed, the helicopter will set its direction to downwards.

- Key C speeds up the helicopter and key D slows it down. The speeds are limited to be one of these speeds: 1m/s, 2m/s, 3m/s, and 4m/s.
- Key # is used for taking off and landing. When # is first pressed, the helicopter goes upward at 2m/s indicating the helicopter has taken off. It will head down at 1m/s until it lands on the ground, if # is pressed for a second time.
- Key * is used for hovering and resuming. When * is first pressed, the helicopter doesn't change its location until * is pressed again when the flight resumes the previous flying state (speed and direction)
- The key 7, 8, 9, 0, A and B are not used.

3.3 Output

LCD, LED and motor show the status of the emulation.



- When the simulation starts, "Start:" should appear until # is pressed. Pressing other keys will have no effect on display. After # is pressed, the helicopter flies.
- The LCD will refresh at 1 second.
- When the helicopter is flying, the location, current direction and speed of the helicopters are shown on the LCD as shown below

PO	D	SPD
(25, 25, 00)	U	2

As illustrated above, the position (PO) of the helicopter is (25, 25, 00) which locates at the center of the hall. D stands for direction which can be the following: U – Up, D – Down, L – Left, R – Right, F – forward, B – Backward and H – Hovering. Speed (SPD) can be 1, 2, 3 and 4. If the speed limit is reached, any input that will try to exceed the limit will have no effect whatsoever.

- The motor spinning will spin faster when the speed is higher and lower if the speed is lower.
- Pressing # will land the helicopter and when the helicopter is properly landed the motor should stop spinning.
- When the helicopter properly landed, the LCD should display total travel time and distance as

Distance:	205m
Duration:	081s

- For the likely events of crashes, LCD shows the location of crashing site as

CRASHED!
P0 (25, 25, 10)

and LED bar flashes until reset is pressed or power is off.

Examples

If current location is (25, 25, 5) with a direction U (up) and speed of 2:

- When press C, we should expect the value under SPD to be 3 on the display and location to be (25, 25, 8).
- When press 1, we should expect the value under D to be D (down) and location to be (25, 25, 2)
- When press #, we should expect the SPD to be 1, D to be D and Z position will gradually change from 5 to 1. Then distance and duration will show up.

Reference

- [1] UNSW, COMP9032 Board Test Procedure, UNSW, 2015
- [2] UNSW, COMP9032 Lab_board_pin, UNSW, 2015
- [3] UNSW, COMP9032 Project Description, UNSW, 2015