

# USER MANUAL

*Yu Feng z5094935*

## 1. How to wire up the lab board.

AVR Pins (top and bottom row)		Input/Output Device Pins (middle row)	
Port Group	Pin	Port Group	Pin
PORT F	PF0	LCD DATA	D0
PORT F	PF1	LCD DATA	D1
PORT F	PF2	LCD DATA	D2
PORT F	PF3	LCD DATA	D3
PORT F	PF4	LCD DATA	D4
PORT F	PF5	LCD DATA	D5
PORT F	PF6	LCD DATA	D6
PORT F	PF7	LCD DATA	D7
PORT K	PK8	INPUTS	POT
PORT K	PK9	INPUTS	LDR
PORT K	PK10	AUDIO	MiO
PORT E	PE5	LCD CTRL	BL
PORT E	PE3	AUDIO	Ain
PORT E	PE2	MOTOR	Mot
PORT D	TDX2	MOTOR	OpO
PORT D	RDX3	INPUTS	PB1
PORT D	RDX4	INPUTS	PB0
PORT A	PA2	-	-
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	PG0	-	-

PORT G	PG1	AUDIO	ASD
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

## 2. Control outline

RESET: restart program

PB0: slow down the speed

PB1: speed up

Keypad:

2: go up  
4: turn left                      6: turn right  
\*: hover                      8: go down      #: take off or landing

A: auto model. At start, first press enter auto model, second press enter default value model.

LED: it will flash when the flight crash.

LCD: when processing, it will display the position of the flight. When the flight take off, it displays the duration and distance of the flight.

### 2.1 INPUT<sup>i</sup>

Key '#' is used for taking off and landing. When this key is pressed, the helicopter goes from the ground upward at 1m/s. When this key is pressed again, the flight starts to descend vertically at the speed of 1m/s. When it touches to the ground, the helicopter stops.

There are two models, auto model and manual model.

For the manual flight mode. Five keys on the key pad are used for the five flight directions: U-up, D-down, F-forward, L-left, and R-right.

1. Pushing buttons (or another two keys on the key pad), PB0 and PB1, are used for the speed up/down control. Within the given speed range. If PB0 is pressed, the helicopter speed is increased by one level; if PB1 is pressed, the helicopter speed is decreased by one level. The speed changing from one level to another level takes 0.1 seconds.
2. Key '\*' is used for hovering control. When this key is pressed, the helicopter is put in

the hovering state with its position unchanged. When this key is pressed again, the flight resumes the previous flight speed and direction.

For the auto flight mode

1. The auto flight mode is set by key 'A'. When this key is pressed, the user should input the destination, the flight height and speed through the key pad; otherwise, press 'A' again, the default values will be used.

## 2.2 OUTPUT

LCD, LEDs and motor are used to indicate the status of the helicopter.

1. When the simulation is started or after the reset button on the board is pressed, "start" is displayed on LCD, as shown Figure 2(a), where 'M' indicates the manual flight mode.



Start: (M)

Figure 2 (a)


2. During flight, the location, current direction, and speed of the helicopter are displayed on the LCD. An example of the LCD display is given in Figure 2(b), where the helicopter is flying upward at the speed 1m/s and the current location is (25, 25, 0). There are 6 direction: N, E, S, W, U, D indicate North, East, South, West, Up, Down.



pos	dir	spd
25, 25, 0	E	1

Figure 2(b)

3. For a successful flight (i.e, landing safely), the distance and total time of the flight are displayed on LCD, as illustrated in Figure 2(c).



Distance: 25 m  
Duration: 40 s

Figure 2 (c)

When the helicopter crashes, LCD displays the location of the helicopter and the LED bar flashes.

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<sup>i</sup> Annie Guo. Project1. UNSW web page 2016. Web. 20 Oct 2016  
<http://webapps.cse.unsw.edu.au/webcms2/course/showfile.php?cid=2446&color=teal&addr=Assignments/project.pdf>