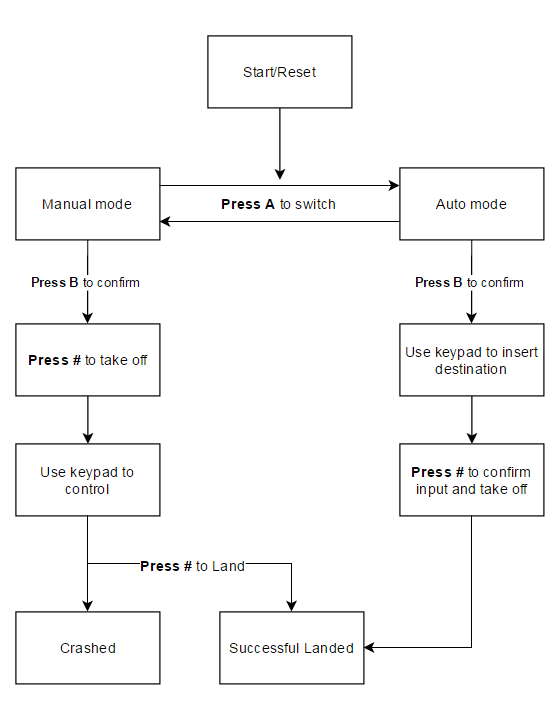
**COMP9032 Project – Design Manual**

# **System Control Flow**



The entire control system is based related to the input signal of the keypad on the AVR lab board. Depend on the flying modes that user has selected, each key on the keypad has different functionality to the lab board.

Before take off

* The user will need to press key B to confirm flying mode. E.g. A for auto, M for manual.
* In M mode, the user can press # key to perform take off, the motor will start spinning with speed of 1m/s
* The default position is x=25, y= 25, z =0 and direction is flying upward
* In A mode, the user will require to use keypad to insert the desired destination
* The default destination is x = 40, y=40, z=8 and flying speed 1m/s
* User will need to press key B to perform taking off

During flying

* In M mode, the key 1, 2, 3, 4 and 6 will be used to change the flying direction, upward, forward, downward, turning left and right respectively
* Key C and D is use to increase and decrease flying speed in between 1- 4
* Key \* is used to perform hovering and resume previous position after hovering
* Key # is perform landing with current position and current speed with downward direction.
* In A mode, no key is required to be pressed

End of flight

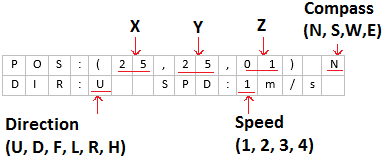
* In both mode, if the height (z) become zero, the system will treat is as a successful land
* In A mode, although the motor speed has been setup before the flight, the speed will be adjusted automatically to avoid crash. For example, if the remaining distance is 3 meters and the pre-set speed is 4m/s, the speed will be amended to 3m/s
* In M mode, the flying direction and speed are controlled by the user, if the position is over the boundary of the accessible area, for instance, hitting the celling at 10 meters, this will be considered as a crash event.

Following is the detail actions for both manual mode and auto mode while a key is pressed

|  |  |  |
| --- | --- | --- |
| Key | Manual Mode | Auto Mode |
| 0 | N/A | value 0 on LCD |
| 1 | Moving Upward - U | value 1 on LCD |
| 2 | Moving forward - F | value 2 on LCD |
| 3 | Moving downward - D | value 3 on LCD |
| 4 | Rotate to right - R | value 4 on LCD |
| 5 | N/A | value 5 on LCD |
| 6 | Rotate to left - L | value 6 on LCD |
| 7 | N/A | value 7 on LCD |
| 8 | N/A | value 8 on LCD |
| 9 | N/A | value 9 on LCD |
| A | Switch to Auto Mode | N/A |
| B | N/A | confirm Input |
| C | Increase speed by 1 | N/A |
| D | Decrease speed by 1 | N/A |
| \* | Hovering/resume previous position - H | N/A |
| # | Take off/ landing | N/A |

# **Data Structures**

## LCD



The LCD displayer is used for presenting all the information

## LED

At the beginning of the program or after reset, full led bar will be lighted up

During the flight in manual mode, if any valid key is pressed, the led bar will display the corresponding bar as described below:

* Key 1 pressed: 0b00000001
* Key 2 pressed: 0b00000011
* Key 3 pressed: 0b00000111
* Key 4 pressed: 0b00001111
* Key 6 pressed: 0b00111111
* Key # pressed: 0b11110001
* Key \* pressed: 0b11110011
* Key A pressed: 0b00010111
* Key B pressed: 0b00110111
* Key C pressed: 0b01110111
* Key D pressed: 0b11110111

If a crash event occurred, the full light bar will be lighted up for 120ms and turn off for another 120ms and turn on again to form flash

# **Module Specification**

## sdf

## 3. LCD

The LCD display is used to display various of information during the flight

* Instruction for take-off in manual mode
* Set destination and speed
* Position, direction, compass and speed during flight
* Flight duration and distance after landing
* Crashed position and speed once it reaches boundary

3.1 Before take-off

Start (M mode):

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| S | t | a | r | t | : | ( | M | ) |  |  |  |  |  |  |  |
| K | e | y |  | B |  | t | o |  | C | o | n | f | i | r | m |

* Once the program is started or reset, above message will be displayed as default.
* **Press key B** to confirm current mode

Start (Auto mode):

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| S | t | a | r | t | : | ( | A | ) |  |  |  |  |  |  |  |
| K | e | y |  | B |  | t | o |  | C | o | n | f | i | r | m |

* **Press key A** on the keypad to switch to Auto mode.
* **Press key A** again to switch back to manual mode.
* **Press key B** to confirm current mode.

Before take-off (M mode selected):

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| M |  | m | o | d | e |  | s | e | l | e | c | t | e | d |  |
| K | e | y |  | # |  | t | o |  | C | o | n | f | i | r | m |

* When M mode is selected, **press key #** to perform taking-off action

Before take-off (Insert destination and flying speed)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | X |  |  |  | Y |  |  | Z |  |  | S | p | e | e | d |
| 4 | 0 | , |  | 4 | 0 | , |  | 8 | , |  | 1 | m | / | s |  |

* When A mode is selected, insert numerical value from keypad to set up destination.
* **Press key B** to confirm input destination at anytime

## 3.2 During flying

## 3.3 End of flight

Successful landed

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| D | i | s | t | a | n | c | e | : | 4 | 6 | m |  |  |  |  |
| D | u | r | a | t | i | o | n | : | 1 | 4 | s |  |  |  |  |

* Motor stop spinning,
* total distance and flying time

End of flight (Crashed)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| P | O | S | : | ( | 1 | 9 | , | - | 2 | , | 0 | 3 | ) |  | N |
| D | I | R | : | F |  |  | S | P | D | : | 3 | m | / | s |  |

* Motor stop spinning
* Crashed position, direction and speed
* Full LED bar flash on and off continuously

## 4. Motor

The motor has 4 spinning speed:

* Slow spinning when speed is 1m/s
* Median spinning when speed is 2m/s
* High spinning when speed is 3m/s
* Max spinning when speed is 4m/s

The motor remains non-spinning during setup, landed or crashed phases

## 5. Constraints

**Constraints**

* Start position (x = 25, y = 25, z = 0) where x is length, y is width, z is height

|  |  |  |
| --- | --- | --- |
| Accessible area: | Min (meter) | Max (meters) |
| X (length) | 1 | 49 |
| Y (width) | 1 | 49 |
| Z (height) | 1 | 9 |

* Auto mode need to be set before flight
* Speed range: 1m/s, 2m/s, 3m/s and 4m/s

Appendix

1. Wiring

|  |  |  |  |
| --- | --- | --- | --- |
| Port Group | Pin | PortGroup | 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 E | PE5 | LCD CTRL | BL |
| 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 K | PK15 | KEYPAD | C3 |
| PORT K | PK14 | KEYPAD | C2 |
| PORT K | PK13 | KEYPAD | C1 |
| PORT K | PK12 | KEYPAD | C0 |
| PORT K | PK11 | KEYPAD | R3 |
| PORT K | PK10 | KEYPAD | R2 |
| PORT K | PK9 | KEYPAD | R1 |
| PORT K | PK8 | KEYPAD | R0 |
| PORT L | PL4 | MOTOR | JP91 |
| N/A\* | POT | MOTOR | Mot |

\* Remove cap of JP91 and use jumper wire to connect Potential meter with the Motor to prevent large current been drawn through the motor to cause damage

2. Operation flowchart

