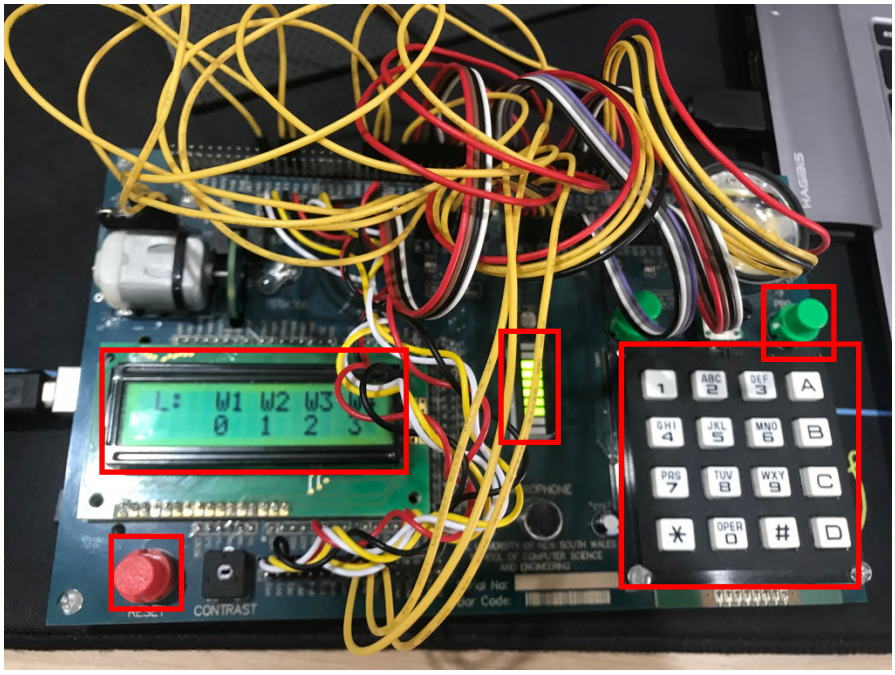
COMP9032 Project Instruction Manual

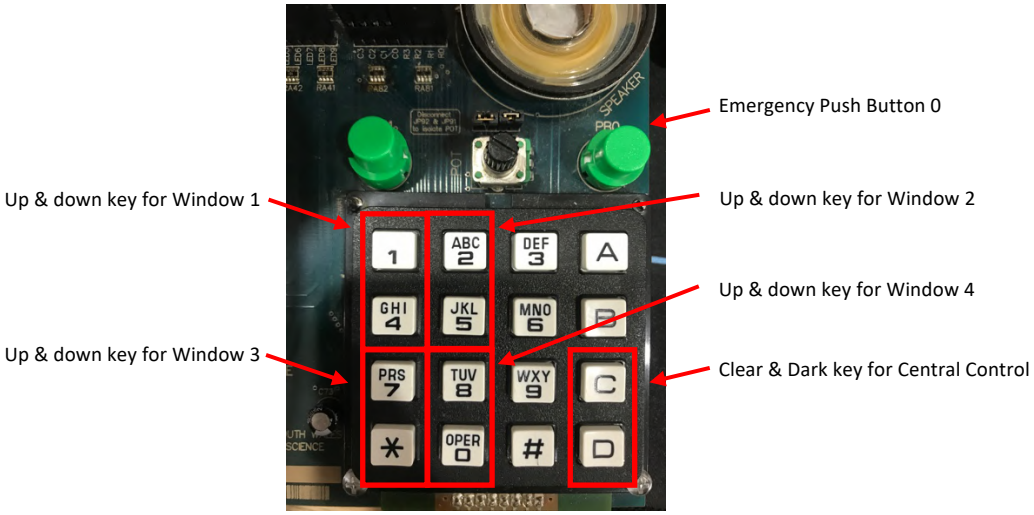
The lab board are designed to simulate the window control operations in an airplane.



By adjust the brightness of LED bit pairs, we simulate the opaque level of corresponding window. There are 4 levels of opaque: clear (0), light opaque (1), medium opaque (2), and dark (3).

The ***inputs*** include:

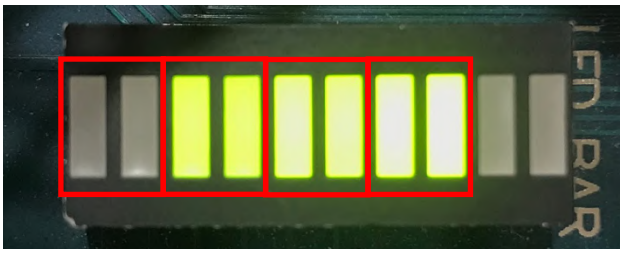
- keys '1' & '4' for window 1 opaque level up & down;
- keys '2' & '5' for window 2 opaque level up & down;
- keys '7' & '*' for window 3 opaque level up & down;
- keys '8' & '0' for window 4 opaque level up & down;
- keys 'C' & 'D' for central control all windows to CLEAR & DARK;
- push button 0 to simulate occurrence of emergency and all windows set to clear;
- reset push button to restart the whole simulation system.



The ***outputs*** include:

LED bars:

bit 0&1 for window 1,
bit 2&3 for window 2,
bit 4&5 for window 3,
bit 6&7 for window 4.



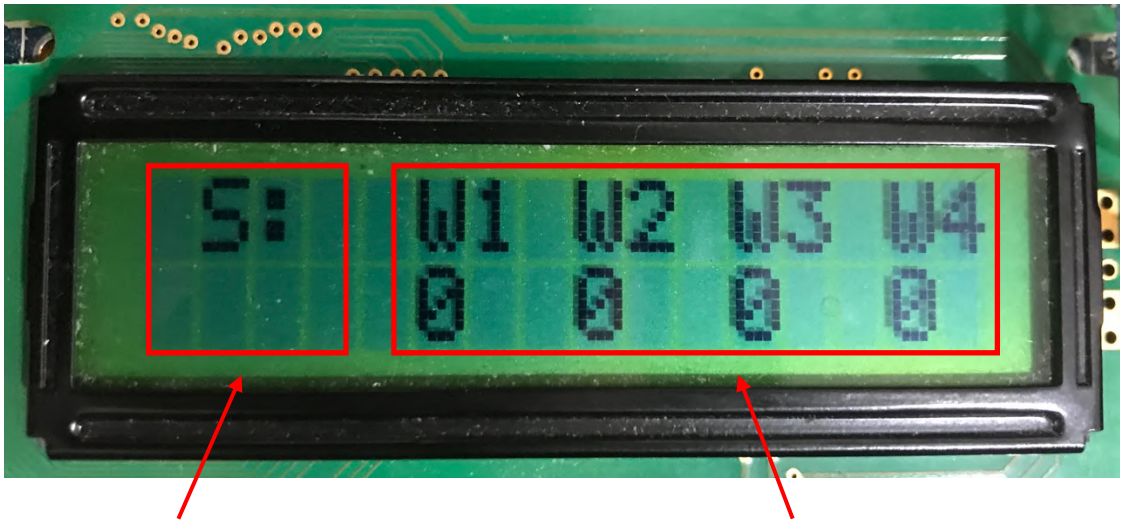
Window 1 (level 0) Window 2 (level 1) Window 3 (level 2) Window 4 (level 3)

LCD screen:

Left part of the screen shows the state of the simulation,

the states include: Initial state (S), Local control (L), Central control (C) and Emergency (!!)

Right part of the screen shows the opaque level of each individual window



the state of the simulation (Initial state)

the opaque level of each window

Something worth noting:

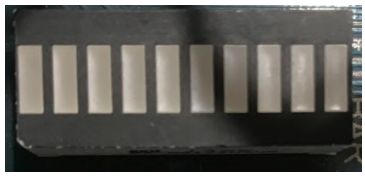
With respect to priority hierarchy: Emergency > Central control > Local control.

Lower priority control can be overwritten by higher priority, while higher priority control cannot be overwritten by lower priority.

Also, each Local control has individual 0.5 sec timer delay for change to happen, that is 0.5 sec need to be waited for a local control operation on the window opaque level to actually take place. No delay restrains on different window controls, central control and emergency control.

Some possible LCD & LED displays:

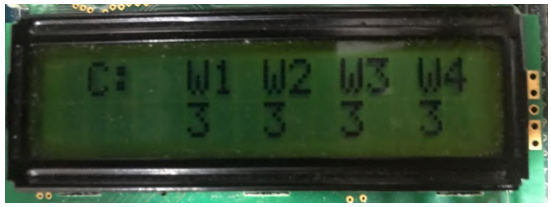
(a) 



(a) in the initial state, all windows are set to clear

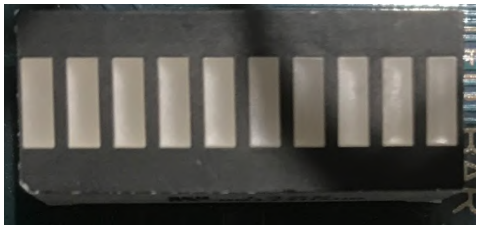
(b) 

(b) in a local control state, where windows W2 and W4 are adjusted to different opaque levels

(c) 

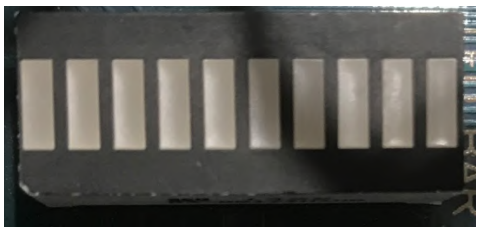
(c) in a central control state, where all windows are set to dark

(d) 



(d) in a central control state, where all windows are set to clear

(e) 



(e) in the emergency state, all windows are set to clear

How the simulation system is designed:

This system uses LED output frequency to simulate brightness.

For opaque level 2: LED light level loops from 0~2, if light level < opaque level, LED corresponding bits are on, otherwise LED corresponding bits are off.

For example: if window 1 is at opaque level 2, while all other windows are clear (opaque level 0), LED sequences are:

0b00000011 (LED light level loop value: 0, smaller than opaque level)

0b00000011 (LED light level loop value: 1, smaller than opaque level)

0b00000000 (LED light level loop value: 2, not smaller than opaque level)

So, 2/3 of the time, the LED bits 0&1 are on, 1/3 of the time, the LED bits 0&1 are off. This generates 66% brightness of corresponding bits. The opaque level can be understood as threshold value for whether the corresponding LED bits to be on/off.

The emergency trigger is designed as interrupts, whenever interrupts happens, emergency flag is switched. Central Control CLEAR & DARK are designed as regular key input. Whenever 'C' or 'D' is pressed, centrC/centrD flag is flipped. The LCD simulation status displays according to three flags (also consider priority)

Each local control has one timer, emergency, centrC & centrD share same timer. So, totally 5 timers are used. Each system loop delay 2ms, timer count 250 would generate 0.5s delay for local control.