Embedded Summer Camps – Fan Project

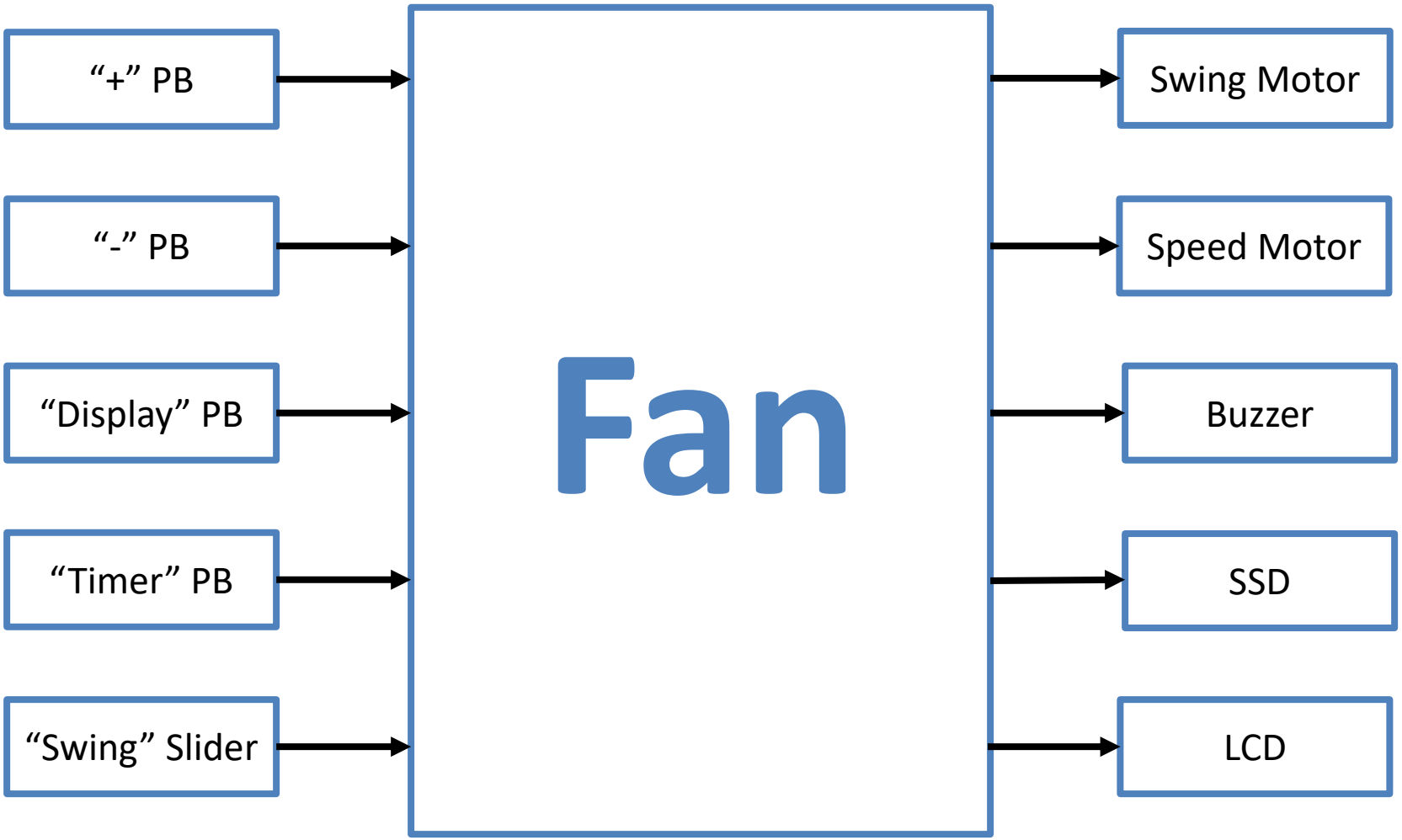
Required

- Analyzing Requirements
- Designing Software
- Implementing Software
- Testing Software

Main Fan Features

- Speed Control: 3 speeds (max, mid and min)
- Swing Control: 9 angles (0, 45, 90, 135, 180, 225, 270, 315, 360)
- Timer: Turn off fan after (1, 2, or 4 hours)
- Buzzer: Indicate PB valid press (2 seconds buzz) or a change in the swing value
- SSD and LCD: Indicate current fan mode

System Description



HW Interfaces

- Use board #3 in pic_sim_lab @ clock 8 MHz.
  - Please, refer to the schematic to know the exact connections

IO	Board Device
“+” PB	S1
“-” PB	S2
“Display” PB	S3
“Timer” PB	S4
“Swing” Slider	Potentiometer 1
SSD	Two most left SSD to display hours Two most right SSD to display minutes
LCD	LCD
Buzzer	Buzzer
Speed Motor	None
Swing Motor	None

Speed Control

- 3 speeds are supported (max, mid and min).
- Default is min after power up.
- AC speed motor is connected to the controller via a triac.
- A triac opens if a pulse is applied on it for 100 µs @ least.
- Please select an empty pin to output the triac pulse
- Speed is varied by varying the position of the pulse after the zero crossing of the AC line signal.

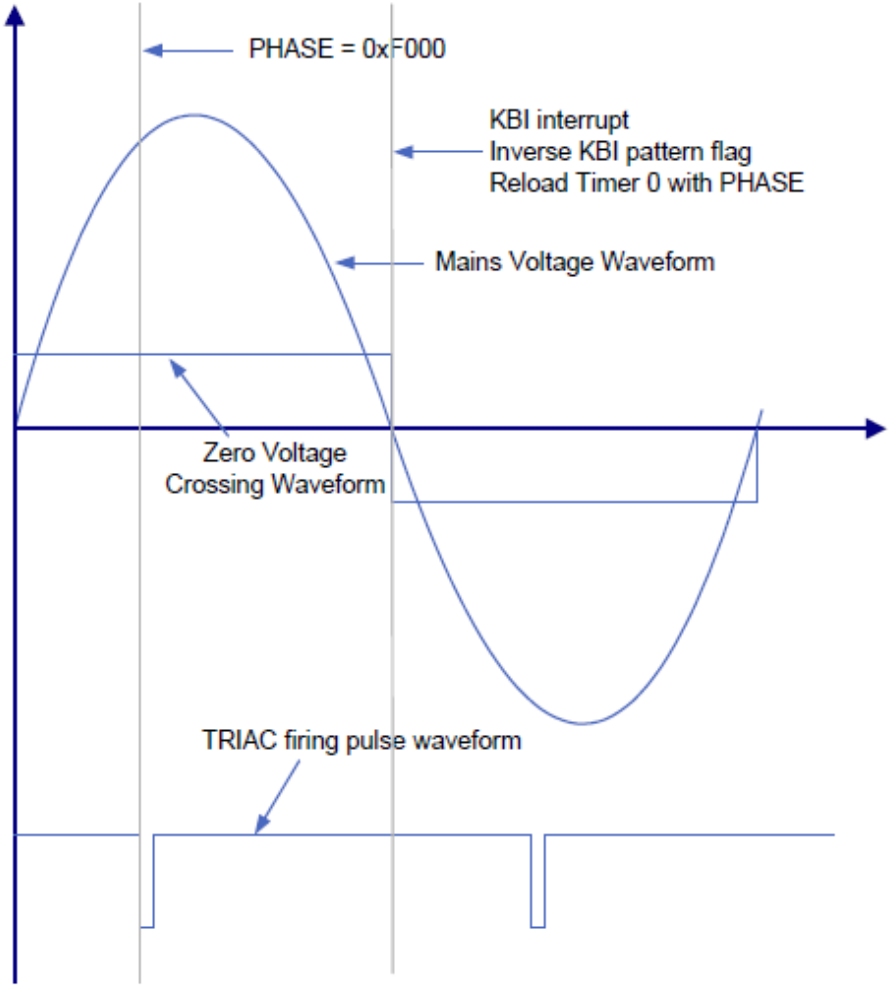
Speed Control cont'd

- We will use a timer to simulate Zero-Crossing of the mains signal. It should generate an interrupt every 10 ms to simulate a half sinewave.

- Speed can only be changed as follows:
  - "+" PB increases the speed if it is released and the speed is not max.
  - "-" PB decreases the speed if it is released and the speed is not min.

Firing for Speed Control

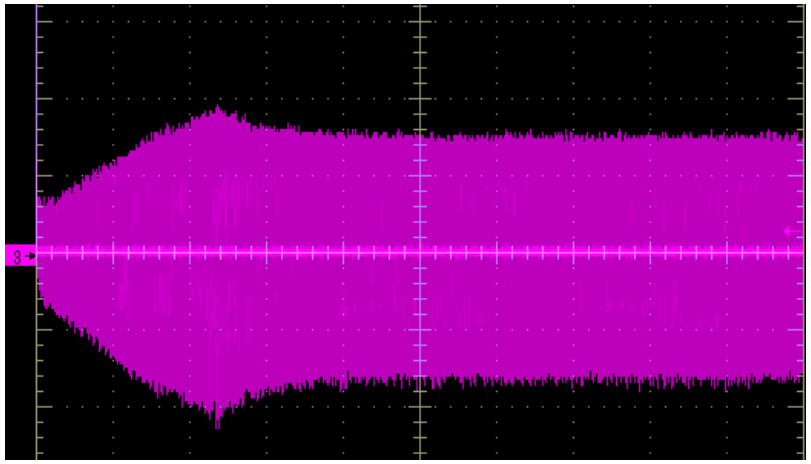
Speed	Firing angle (degrees)
Max	10
Mid	90
Min	140



Cautions for AC Motor Control

Startup Delay

- To reduce the startup surge current
- Initial speed is @ 170 degrees
- Speed is changed gradually till reaching min speed
- Rate of change is 1 degree every 80 ms.



Soft Switching

- To controlling the speed smoothly when changing speeds
- Speed is changed step by step gradually if the current speed is not the desired speed.
- Rate of change is 1 degree every 80 ms.

Swing Control

- Swing angle can only be changed through the slider.
- Please select an empty 4 pins to output the swing angle

Swing Angle	Swing Motor Value
0	0000
45	0001
90	0010
135	0011
180	0100
225	0101
270	0110
315	0111
360	1xxx

Timer

- A Timer can be used to turn off the fan automatically after the selected time.
- The supported times are 0, 1, 2 and 4 hours.
- Whenever the “Timer” PB is pressed for 10 ms @ least, the timer setting should change and count down restarts.
- Timer setting changes as follows with every valid press 0h ➔ 1h ➔ 2h ➔ 4h ➔ 0h and so on.

Seven Segment Display

- After startup " HI " should be displayed for 10 seconds on the SSD.
  - SSD can be updated after the 10 seconds to show the timer settings.
  - System should respond to timer settings during the first 10 seconds.
- SSD should display the remaining time to turn off the fan with the following format "HH.MM".
- If the timer setting is 0h, "00.00" is displayed.
- If timer setting is changed and not 0h, "HH.MM" should be displayed showing the current timer setting.
- During timer count down, the fields should be updated and the dot blinks every second.

LCD

- Should display the current speed of the motor by default as follows:

		M	o	t	o	r		S	p	e	e	d		
S	p	e	e	d	=	x	x	x		d	e	g	r	e	e

- If the “Display” PB is pressed for 200 ms @ least, the LCD should display the Swing state as follows:

0 degrees

		S	w	i	n	g		V	a	l	u	e		

45 degrees

		S	w	i	n	g		V	a	l	u	e		
							*	*						

LCD cont'd

90 degrees

		S	w	i	n	g		V	a	l	u	e		
						*	*	*	*					

360 degrees

		S	w	i	n	g		V	a	l	u	e		
*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

- The LCD should display the motor speed again after 20 seconds or after a valid "Display" PB press.

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