KF6010 Mini Project — Addendum

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Here are some design notes on my version of the pedestrian crossing.

A Threads/Tasks

There are three threads running the tasks, within each task timings are handled by simple `wait` calls.

Vehicles handles the light sequence for the vehicle lights.

Pedestrians handles the light sequence for the pedestrians.

Bleep handles the on-off mechanism for the audible signal.

B Control, Synchronisation, and Signalling

B.1 Mutex

The crossing is a critical shared resource.

A Mutex is used to control access to the shared piece of tarmac, so only vehicles or pedestrians can use the crossing.

B.2 Button signal

The push button to signal a pedestrian is waiting. The thread handling the vehicle lights, waits on a semaphore while the light is green.

Interrupt The interrupt handler for the button(s) releases the semaphore waited on by the vehicle thread.

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Semaphore `tocross` signals that pedestrians are waiting. (The vehicle thread uses `tocross.wait()`

Semaphore `bleeping` is used to start and stop the bleeping in synchronisation with the pedestrian crossing thread.

C Calculations

C.1 Frequency

The tone can be generated with a PWM output. The period for the PWM output is calculated in table 1

Table 1: Audible tone frequency

Frequency	2	kHz
	2000	Hz
period	0.0005	s
	0.5	ms
PWM period	500	µs

C.2 Pulse

The pulse timing is calculated in tables 2 and 3 A mark-space ratio of 1.5:1 is 3:2

Table 2: Audible pulse timings

Pulses	240	min^{-1}
	4	Hz
period	0.25	s
	250	ms

Table 3: Mark-space ratio

mark	$\frac{3}{5}$ period	150	ms
space	$\frac{2}{5}$ period	100	ms