

# ENCE461 Schematic Review

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**Bring your schematics, printed on A3 paper**

## 1 Common

1. Student names and group number in title block
2. Battery fusing (this is mandatory)
3. Use serial wire debug interface for programming
4. 3.3 V MCU regulator can be back driven
5. Short circuit protection for MCU pio pins going to external headers
6. Battery voltage monitoring
7. Do the analogue inputs to the MCU exceed 3.3 V?
8. LEDs for debugging
9. Jumpers for mode configuration (radio channel select)
10. Pullup resistors on TWI (I2C) bus
11. Test points
12. Ground test points
13. USB signals are not swapped
14. USB has series termination resistors (27 ohm)
15. VBUS detection through voltage divider to PIO pin. This is needed so that the MCU can tell when USB is plugged in or removed. You will also need diodes (or jumpers) so that the USB 5 V can be connected to the 5 V from the switching regulator.
16. Power supply filtering for radio (recommend ferrite bead or resistor in series with power rail with parallel capacitor)
17. The radio needs to be connected to SPI pins (MISO/PA12, MOSI/PA13, SCK/PA14)
18. Radio IRQ connected to MCU PIO pin
19. Radio uses SPI clock (SCK) not the TWI clock (TWCK)

20. TWI uses TWCK0/PA4 and TWD0/PA3 or TWCK1/PB5 and TWD1/PB4.
21. SAM4S erase pin on testpoint
22. SAM4S has 12 MHz crystal
23. Reset button connected to NRST pin
24. Power on/off button connected to WKUPn pin
25. Avoid PB4–PB5 for general I/O (they default to JTAG pins on reset but can be reconfigured in software)
26. Have external pull-down resistors to ensure chips are disabled on power-up
27. Have a few spare PIO pins connected to pads for last minute mods.

## **2 Hat board**

1. Battery can be charged from USB
2. Fall-back option if IMU does not work
3. Nav-switch or joystick for remote control
4. Drive circuit for piezo tweeter
5. IMU nCS pin connected high to enable I2C operation
6. IMU AUX pins not connected

## **3 Racer board**

1. MOSFET(s) for actuator (if use p-channel MOSFET need transistor to provide sufficient gate voltage to turn MOSFET off)
2. H-bridge driven by four PWM signals (it is best to use PWMHx, note PWMLx and PWMHx are complementary)
3. H-bridge AISEN and BISEN pins connected to ground (unless using current control)