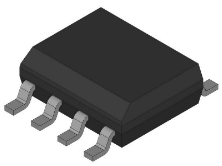
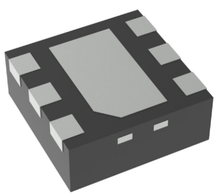
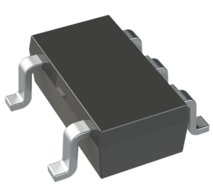
Component Selection

Major Component Selection

Temperature Sensor (Sensor 1 Subsystem)

Solution 1	Pros	Cons
 LM77CIM-3-TI $2.77 Link	• I2C • -55 to 125 degrees C • Accuracy: ±0.3 degrees • Separate open-drain outputs for Interrupt and Critical Temperature shutdown	• 9-bit • Supply voltage is higher 3.0 V to 5.5 V • 8 wires for soldering

Solution 2	Pros	Cons
 TMP117 $5.32 Link	• -55 to 150 degrees C • I2C • Accuracy: ±0.3 degrees • Low power consumption • Programmable temperature alert limits	• Most expensive • Accuracy changes based on temperature range • Soldering pads instead of pins, making it harder to align

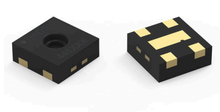
Solution 3	Pros	Cons
 TC74 $1.15 Link	• I2C • Lowest Price • Best Size • Experienced Soldering already	• No application for an OpAmp • Accuracy varies by 3 degrees C • Not able to test new temperature sensor

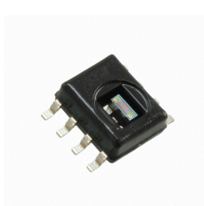
Choice: Solution 3 - TC 74

Rationale: It is an I2C sensor so that fulfills one of the sensor requirements. One of the product requirements listed creating an alert based on certain readings, and this sensor aligns perfectly with that goal. This sensor also means that I do not need to use an OpAmp as it is already highly accurate and doesn't require any signal conditioning.

Humidity Sensor (Sensor 2 Subsystem)

Solution 1	Pros	Cons
 SHT40-AD1B-R3 2.40$ Link	• I2C • Humidity Range 0 ~ 100% RH • Output 16b • Accuracy ±1.8% RH • 4 wires • Least expensive	• Response Time 4 s • Voltage 1.08V ~ 3.6V

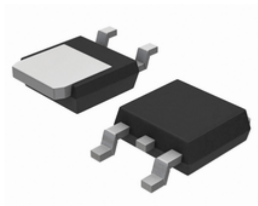
Solution 2	Pros	Cons
 BPS240-D2P0-S10E 3.02$ Link	• Accuracy ±2% RH • 1.62V ~ 5.5V • Cheaper • Humidity Range 0 ~ 100% RH	• Digital output • Output 10 b • Response time 30 s

Solution 3	Pros	Cons
 HIH6030-021-001 14.59$ Link	• Humidity Range 0 ~ 100% RH • Accuracy ±2% RH • 1.62V ~ 5.5V • Can hand solder it • big	• Most expensive • Operating range -40°C ~ 105°C • 8 wires

Choice: Solution 3 - HIH6030-021-001

Rationale:. This is realistically the only option we could pick as we have the requirement of hand soldering it and this is the biggest and cheapest option we could go with. All the other options are comparable in accuracy, humidity range, voltage, accuracy, and power draw. So the main contributing factor in making my pick was the ease of mounting to the PCB as we have to do so by hand for our project.

Voltage Regulator (Micro-Controller Subsystem)

Solution 1	Pros	Cons
 LM317MDTRKG $0.60 Link	• Thermal overload protection • Internal short-circuit limiting • The output voltage is adjustable in a wide range that fits our needs • Cheap	• Has a dropout voltage of 2-3V • Requires heatsink at high currents • Less efficient than switching regulators

Solution 2	Pros	Cons
 LM2575D2T-ADJG Link $3.16	• Very efficient (85-88%) • Can handle 1 Amp of current • Adjustable • Has current limiting protections	• Generates electrical noise, more so than linear regulators. • The switching frequency is fixed at 52kHz which is lower compared to newer regulators • Generates a lot of heat

Solution 3	Pros	Cons
 LM2596DSADJR4G Link $2.70	• Very high maximum output current of 3A • 90% efficiency • Switching at 150kHz • Has a high-voltage range	• Generates a lot of noise • Dropout voltage of 2-4V • Generates the most heat

Choice: Solution 3- LM2596SADJ4G

Rationale: Despite the high dropout voltage, this can be remedied using a 12-volt battery to give it more drop-off room. The benefits of using this regulator are that it can support 3A of current which gives us enough room to work with, and has a very high efficiency rating compared to other options given on the list.

Motor (Actuator Subsystem)

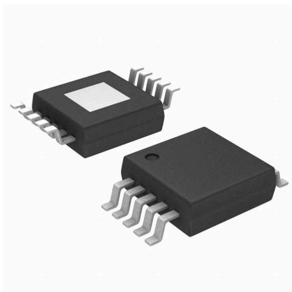
Solution 1	Pros	Cons
 ROB-11696 $2.10 Link	• High RPM (6600 RPM at 12V), suitable for hobby applications like RC boats. • Easily codable and easy to integrate.	• Has a limited torque. • Requires external speed control. • The circular design may be harder to mount.

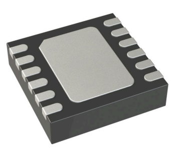
Solution 2	Pros	Cons
 PPN7PA12C1 $2.35 Link	• High RPM (11,605 RPM at 5V), ideal for fast boat propulsion. • More efficient at lower voltages • Has a flat surface for easier mounting	• It may be too much rpm without proper speed control • May overheat over time without proper speed control • Most expensive

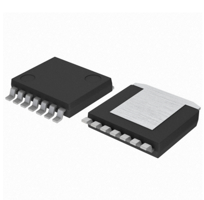
Solution 3	Pros	Cons
 VZ43FC1B5640005L $1.85 Link	• Most inexpensive. • Designed for high-vibration scenarios which may be useful for an RC boat. • Coreless design	• Lowest RPM • Designed for scenarios that are not RC-suited so may be difficult to code and integrate

Choice: Solution 2 - PPN7PA12C1
Rationale: While it is the most expensive, it offers the most suitable pros for our scenario. It is a brushed DC standard motor which will fulfill our requirements. The higher RPM allows for the most customization that we will be able to use with our motor driver. The flat surface on the motor will allow for the easiest mounting abilities without the use of any custom mounting. This motor being able to handle best at lower voltages is also ideal for our scenario as we will be operating at 3.3-5V.

Motor Driver (Actuator Subsystem)

Solution 1	Pros	Cons
 DRV8830DGQR $1.64 Link	• 3.6A peak output. • Built-in fault protection. • PWM control • Legs for easier soldering • Lowest price.	• No built-in feedback control will require more coding. • May require a heatsink to control overheating.

Solution 2	Pros	Cons
 MAX14870ETC+T $6.60 Link	• Wide voltage range. • Low power consumption. • Built-in fault protection.	• Complex control system for integrating. • Will require external components for complete functions. • Most expensive

Solution 3	Pros	Cons
 BD6210HFP-TR $2.82 Link	• Integrated H-bridge and PWM control. • Supports a wide voltage range. • Built-in protection circuits • Legs for easy soldering.	• Limited current handling. • Much more effort in the design phase to be able to integrate it.

Choice: Solution 1 - DRV8830DGQR
Rationale: This motor driver allows for the most pros out of all drivers and will be most accessible in our scenario. Having the lowest cost will help us drastically with our budget. The peak 3.6A output will be more than enough for the RC boat. The built-in fault protection will help limit any faults that may happen during the design phase of the project. It also allows for PWM control which will be needed for the project requirements and also allows for speed control on our higher RPM

motor choice. The 8 legs sticking out of the driver allow for easy soldering and easier mounting while surface mounting, limiting the amount of faults that will occur during construction.