Semester Project Proposal

ECE 315: Introductory Microprocessor Laboratory
Scuba speed/pressure watch
Team 05
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Project Introduction:

Our group's project idea will be a scuba pressure sensor and timer. Its purpose is to provide two important details to diver during ascent:pressure. Generally, if a diver ascends too quickly the nitrogen buildup, due to breathing compressed gas, causes decompression sickness. Our design will make sure to alert the diver if he is ascending too quickly and therefore preventing harm.

Essential Components:

Power

The lithium coin cell battery (5396-9921) will be the primary power supply as it is small and can be easily replaced. It will be used with a linear regulator to supply 3.3V to all main components.

MCU

An STM32F303K8T6 Cortex-M4 microcontroller will act as the main controller of the scuba pressure board. As part of the ARM Cortex-M Architecture series of microprocessors that has a dedicated floating point unit for DSP computations, this SoC has 64KB of SRAM, an internal clock speed of up to 72MHz, an NVIC for handling interrupts, and dedicated ports for UART and SPI. The application code running on the MCU will be written in C.

USB-to-UART Bridge

The UART-to-USB bridge will be connected to one of the MCU's three USART ports that can communicate at speeds up to 9 Mbits/s. Specifically, the peripheral will enable the board to be

flashed with program code as well as provide a serial debug interface that can be used during software development. With an additional internal voltage regulator, the bridge can interface with a standalone power supply.

Sensor (I2C)

To measure ambient pressure, a barometer can be implemented using the MPL3115A2. The block diagram on page two of the datasheet indicates two functionalities that can be implemented:

- General information about pressure and altitude through I2C communication with the MCU
- User-defined warning about pressure limits through two pressure interrupt ports

As additional specifications, the MPL3115A2 measures ambient pressures up to 500kPa, which will allow it to function at depths as low as 40 meters. An existing development board provides precedence for creating a barometer.

PS2 Joystick (GPIO In)

- make sure you acknowledged warning
- Rotate 3 times to remove warning light/silence all

The purpose of the joystick is that it should be used as an alarm recognition system. When the driver acknowledges the alarm by rotating it it will be silenced. It should be rotated three times to make sure the driver purposely intended to silence it. The joystick will generate an interrupt when rotated to silence the alarm.

Status LEDs (GPIO Out)

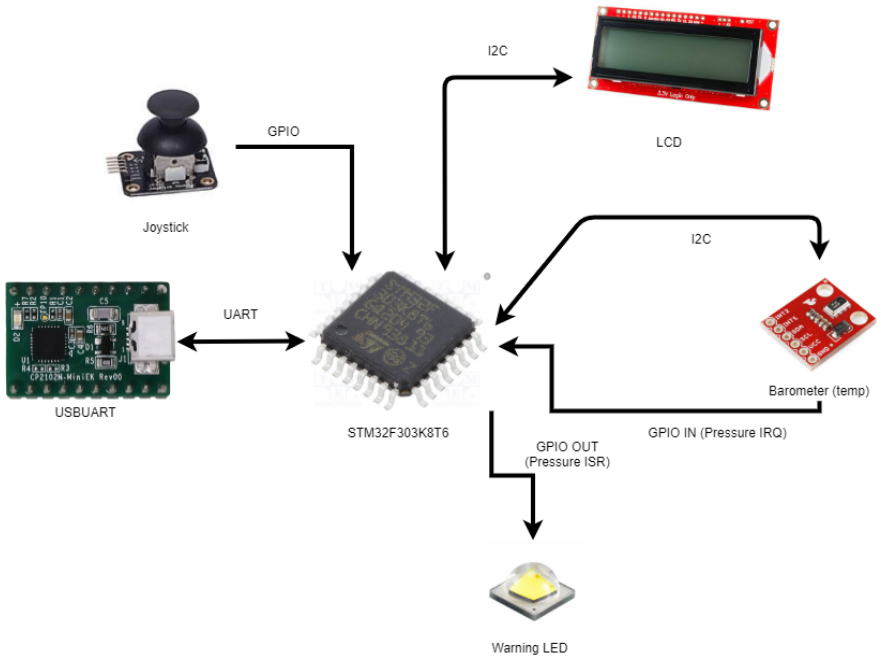
The WS2812 LEDs interfacing with the GPIO port pins of the STM32F303K8T6 processor will serve to indicate visual warnings regarding pressure. Combined with the interrupts generated by the pressure sensor, such warnings can be delivered in real time.

LCD Display (I2C)

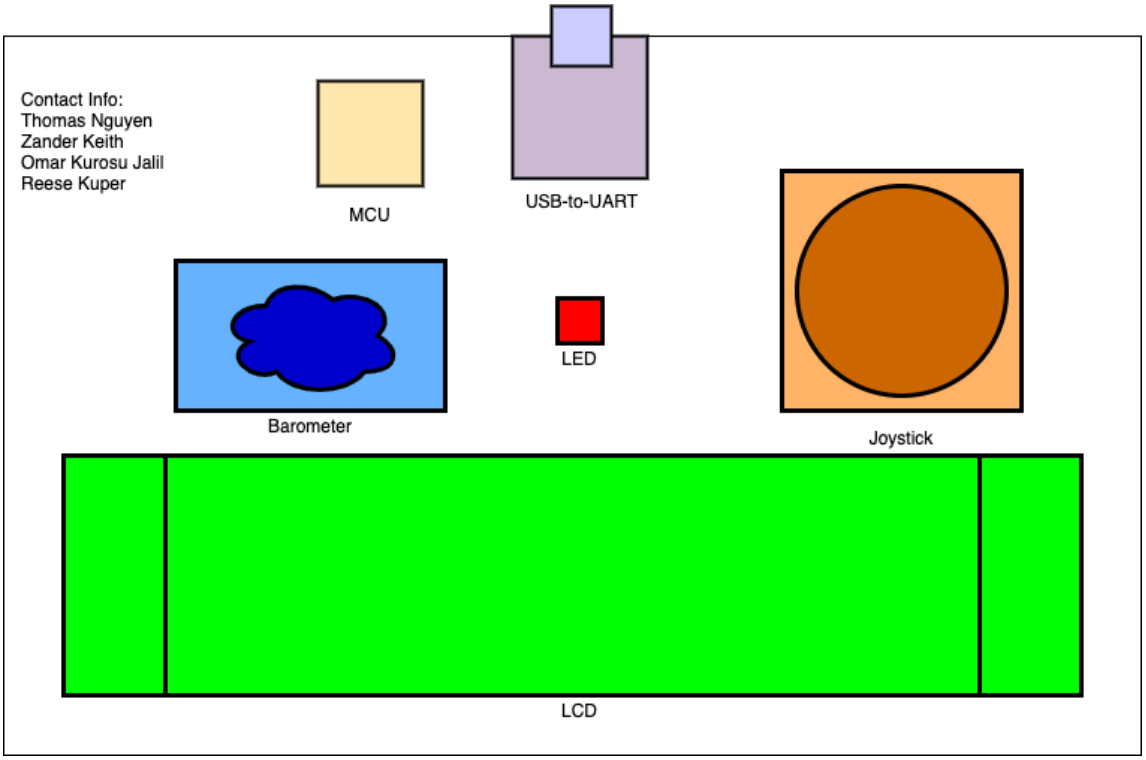
The LCD Display will be connected to one of the MCU's dedicated I2C ports. This peripheral will be used to display data from peripheral sensors as well as other data which can be programmed into board logic with C (e.g. a timer).

Block Diagram:

draw.io



PCB Visualization:



JOBS:

1. LCD: Zander

2. Joystick: Thomas

3. Barometer: Omar and Reese

4. LEDs, Power, Fixing already completed modules (MCU/USB-UART): Omar and Reese

Before you commit, please do the following checks:

- All GPIO pins , including serial interfaces, that are utilized must have a test point
- All integrated circuits MUST have one (1) 10uF capacitor for each power pin (VCC)
- All nets are required to have net names.
- All resistor, capacitor, and inductor values must be visible.
- All sensors that you will utilize must be found in the schematics themselves and not just a connector that interfaces with a module designed by someone else. If you were planning on using a sensor provided by a site like SparkFun, you can use their schematics as a reference to determine which parts will be needed for your schematics.

As a group, we must do the following checks:

- Schematics must be annotated
- Your design needs to supply the processor with 3.3V.
- Modify the Title Page of your project to include the names of everyone on the team.
- Modify the text block on each page of the document to indicate with team member was primarily responsible for that page.