CODE DOCUMENTATION

Project Name: Aquatic Monitoring System
Project Duration: 09/13 - 11/30
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PROCEDURES FOR TESTING

For this project 'Aquatic Monitoring system', we used the Beaglebone black, and we employed the Putty software for interacting. Our sensor-related code, which is written in the C programming language, underwent testing to ensure its robustness and correctness.

TESTING SCENARIOS

During the testing process, we created various scenarios to cover different aspects of the code,

1. Nominal Scenarios:
    - Make sure the sensors give us the right temperature and water quality readings. Verify that our temperature and water quality sensors are telling us the correct information.
    - See the data show up in real-time on the terminal.
    - Check if the values of the sensors are popping up on the terminal immediately.
    - Make sure the LED blinks when the sensor's values exceed the threshold.

2. Off-Nominal Scenarios:
    - Pretend the sensors are broken and see what happens.
    - Try to make the sensors give wrong information on purpose.
    - Check if our sensor values stay the same even when there is a sudden change in water conditions.

We were able to come up with the code for all sensors including LCD but, we weren't able to achieve the results on the LCD as expected. So we can say about 90% of our code was working and the tests were performed for the same.

PSEUDO CODE

Temperature Sensor DSB1820:

```
function convertToTemperature(temperatureReading):
  voltage = A2D_VOLTAGE_REF_V * (temperatureReading / A2D_MAX_READING)
  // Calculate the voltage using the provided formula
  temperature = (1000 * voltage - 500) / 10.0  // Convert the voltage to temperature using
  the linear scaling formula
  return temperature
```

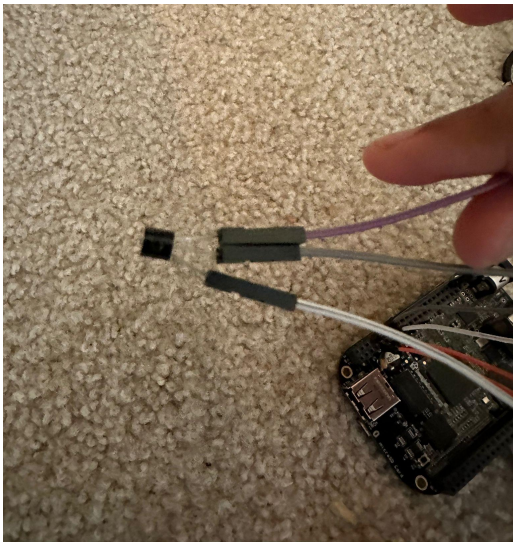

Fig 1. Temperature Sensor

TDS Water Quality Sensor:

```
function convertToPPM(waterQualityReading):
    calibratedTDS = waterQualityReading * TDS_CALIBRATION_FACTOR +
    TDS_OFFSET   // Apply calibration to the water quality reading
    calibratedTDS = (calibratedTDS < 0.0) ? 0.0 : calibratedTDS   // Ensure the result is
    non-negative
    return calibratedTDS
```

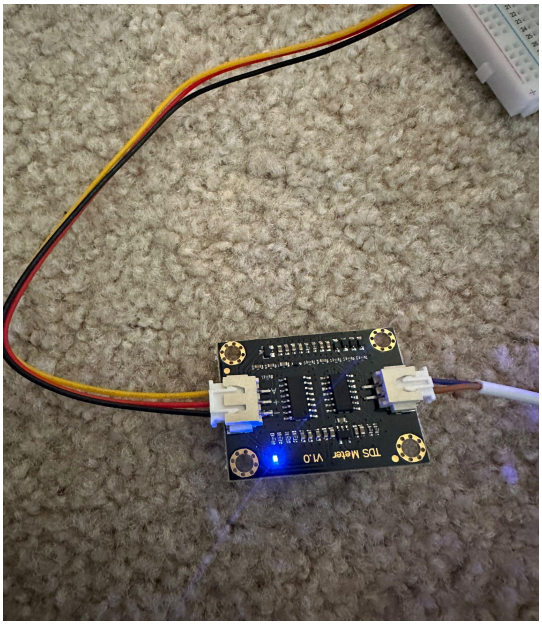

Fig 2. TDS Sensor

EXECUTION INSTRUCTIONS

1. Hardware Setup: Enumerate the connections for the DSB1820, TDS sensor, LCD screen, and LEDs.
2. Code Compilation:

   Using the URL below we were able to open a workspace where we wrote the code for the sensors

   https://192.168.7.2:3000/?workspace=/home/debian/examples/BeagleBoard.code-workspace

   We compiled the C code using the GCC Compiler(gcc). The command **gcc temp.c -o temp -pthread** (temp.c is the file name) was utilized to convert our human-readable code into machine executable format. This step was crucial in preparing the code for execution on the Beaglebone.

   After compilation, we executed the executable using the **./temp** command. This allowed us to observe the actual behavior of our code on the Beaglebone black. We paid close attention to the interactions between the code and the sensors, ensuring that the expected data was collected accurately.

VERIFYING SENSORS IN TWO CONDITIONS

1. Normal water:
   When the temperature sensor reads 36 degree celsius and the TDS sensor reads values in between 100-500 ppm then the water is in good condition and no need to take any extra care.
2. Hot water or More saltiness in water:
   In this scenario, the water temperature has exceeded a critical threshold(greater than 40 degrees in our case), and the TDS level (greater than 400 ppm) indicates increased salinity. These conditions can be stressful and harmful to the fish and extra care needs to be taken.

TEST DATA OUTPUT

LED state: 0
Water Quality Sensor PPM: 380.45 ppm
Temperature Sensor Temperature: 36.59 °C
LED state: 0
Water Quality Sensor PPM: 385.87 ppm
Temperature Sensor Temperature: 36.83 °C

LED state: 0
Water Quality Sensor PPM: 385.90 ppm
Temperature Sensor Temperature: 38.01 °C
LED state: 0
Water Quality Sensor PPM: 389.89 ppm
Temperature Sensor Temperature: 37.50 °C
LED state: 0
Water Quality Sensor PPM: 389.49 ppm
Temperature Sensor Temperature: 37.80 °C
LED state: 1
Water Quality Sensor PPM: 400.09 ppm
Temperature Sensor Temperature: 40.45 °C
LED state: 1
Water Quality Sensor PPM: 401.80 ppm
Temperature Sensor Temperature: 41.78 °C
LED state: 1
Water Quality Sensor PPM: 400.46 ppm
Temperature Sensor Temperature: 41.01 °C