PROJECT PROPOSAL

ECE-445 SENIOR DESIGN LABORATORY

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1. Introduction

1.1.Title

Data collection, GPS monitoring and power management of pollution measurement system on a boat.

1.2. Objective and Background

The USGS (U.S Geological Survey) has estimated that each person uses up to 130,000 liters of water every year. A big part of this consumption is for drinking and hygiene. Water companies, consumers and environmental scientists need to know the condition of water resources in order to take action if the pollution levels of water raise unexpectedly, given the importance of drinkable water.

That is why the company CERSE thinks that we should make sure that this water is not polluted. This led them to come up with an idea: a boat that could be deployed in lakes and rivers in order to analyze the water pollution, and make sure that the water we are drinking is safe to consume.

Our duty in this project is to provide this boat a GPS system, a data transmission system, an app to get this data in real time and the electric system to power this boat in order to ensure that consumers get water with the appropriate quality.

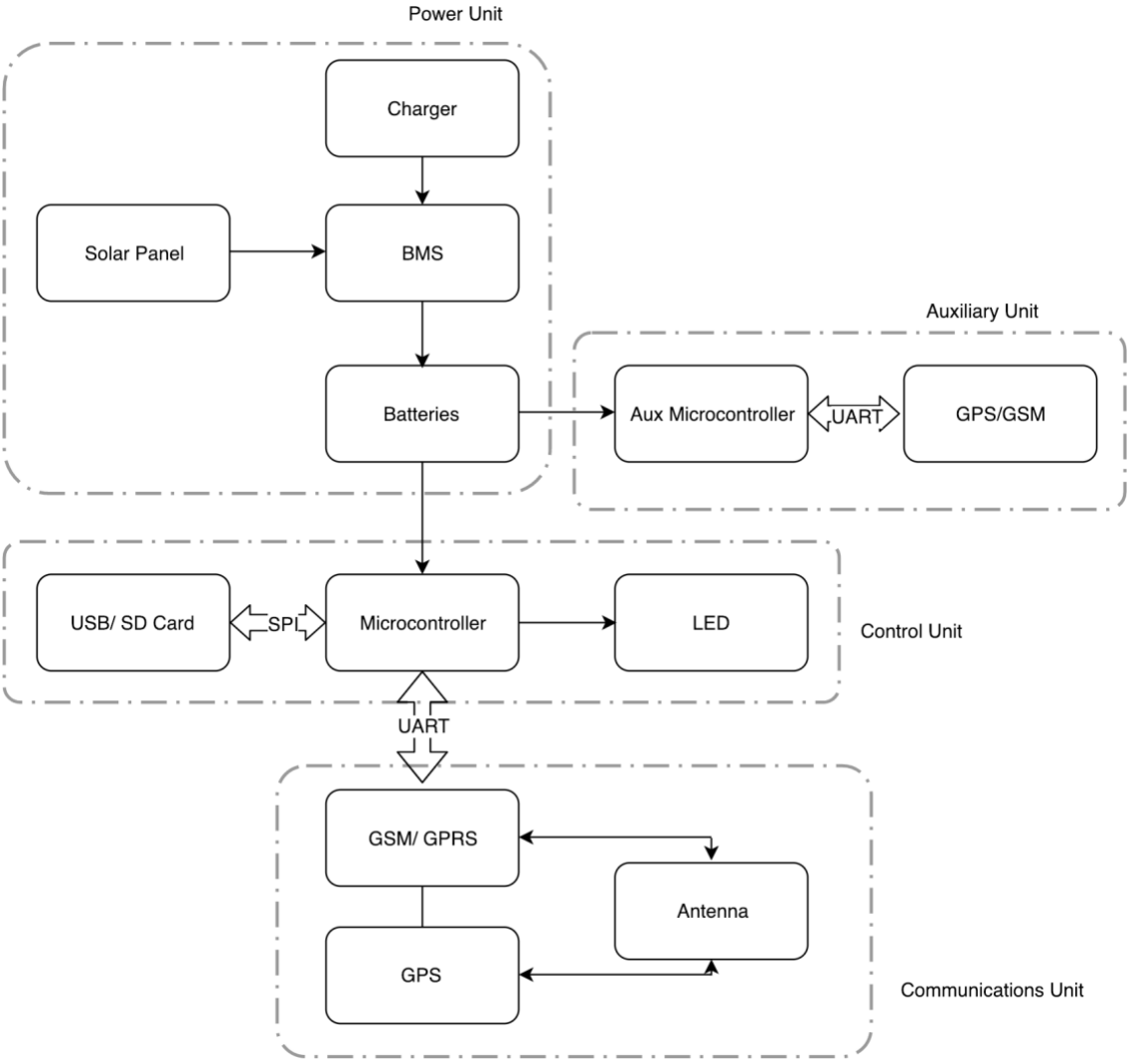
1.3. High-Level Requirement List

CERSE's main requirement for this projects are the following:

- Data transfer system in order to analyze and monitor the pollution levels in real time with desktop and android applications to access the data.
- Solar panel utilization in order to give a greater autonomy.
- GPS control to broaden the applications of the boat.

2. Design

2.1. Block Diagram



2.2. Components

2.2.1. Power Management Unit

- **Solar panel:** a solar panel is required in order to give the boat the sufficient power to stay in a desired position in a lake or river during various days. The power requirement is yet to be specified by the company.
- **Batteries:** a set of batteries is needed in order to store the energy received by the sunlight, and be able to power the boat. Total power needed is still to be specified by the company
- **Charger:** yet to be specified by company if needed or not.
- **BMS:** Battery Management System to control the state of charge of the batteries and check that all of them are working properly. Also to start/stop getting energy from the solar panels depending on the battery charge

2.2.2. Control Unit

The control unit manages every other module of the system. Receives the data from the sensors installed on the boat and prepares the information to be sent over the GSM module, as well as stored in an SD. It also provides feedback or alarms over the LED module.

- **Microcontroller:** The microcontroller handles all the data. First, it collects the data from the sensors via its connection pins. Then it stores the data in the SD/ USB module via SPI connection and sends the data to the GSM module via UART. We will work with PIC32, a model that must be able to process the great quantity of data that would be generated by the sensors.
    - Requirements:
        - Simultaneous UART and SPI.
        - Pins with 3.3V output.
        - High data processing.
- **LED:** We will install LEDs in the PCB board in order to see if the module is transmitting and receiving data correctly or something is wrong with the system.

- **USB/ SD Module:** The SD Card module will be connected to the microcontroller via SPI. This is necessary because given the case were data connection is lost, the GSM module won't be able to send the data, and we need it to be stored in a SD module to avoid losing the data.

2.2.3. Communications Unit

- **GSM/ GPRS:** The GSM/ GPRS module will be in charge of sending data to the cloud in order for it to be accessible to the users from a computer or android device.
    - Requirements
        - 2G/ 3G data connection.
        - Send alarms via SMS to a designed number.
- **GPS:** The GPS module has two main functions. First of all, data must be classified according to the geographical coordinates and the date in order to keep a clean record. Second, in case data connection is lost, an SMS alarm must be sent with the current GPS coordinates of the device.
- **Antenna:** An antenna module is necessary in order to increase precision of the GSM and GPS modules, and increase connectivity as well.

2.3. Risk Analysis

We need to take into account many factors that can influence the performance of our system.

- Climatological conditions can be a factor to take into account given that various components (such as the GPS sensor or the solar panels) can be affected by this. We must guarantee that our system keeps working even on non favorable conditions.
- Remote location can also affect performance. GPS monitoring and data transfer can be affected if the boat final destination is an isolated point. We must guarantee that the GSM/GPRS system provides either 3G or 2G connectivity in order to transfer the data in real time or with the minimum latency possible.

3. Ethics and Safety

This system should entail no risk to the environment, or to the animals living in or around the lakes or rivers that are being analyzed. Also, if the water being analyzed is polluted, the consumers of this water should be alerted instantly.

In addition, when designing this project we need to keep in mind the environmental impacts that it could have and also guarantee a sustainable system given CERSE's commitment to sustainable practices and its commitment to the environment.

According to the IEEE Code of Ethics, the project we need to agree "to be honest and realistic in stating claims or estimates based on available data". This point has great importance to our project given that the data collected must be analyzed by not biased algorithms and keep people's interests and not companies first, given that drinkable water is a priority in our society.