KCG VERGHESE SATELLITE PROGRAM

Report for Payload Determination of Ground-Based Water Condition Monitoring Buoy System

Submitted by:

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The ground-based water condition monitoring buoy system is designed as a buoy which floats over the water at fixed distances in the target water bodies which operates such that the intended parameters of water as well as the surrounding environment are monitored continuously and transmitted to the ground station over satellite communication. The data acquired from various parameters are processed, so that data is clean and in a useful format fit for transmission and interpretation at the ground station for which various signal conditioning will be incorporated in the design. The sensor output values would be tabulated based on experimental analysis carried out in the laboratories and a lookup table would be made which would be the basis of the program fed into the microcontroller. For the experimental setup, prototype model is to be built which consist of the following as mentioned in table 1.

Table 1 Components details in the buoy

S. No.	Measured Parameter	Proposed Sensor	Cost Per Sensor Module	Cost for 4 Sensor Modules
1.	pH value of water	DFRobot Gravity Analog pH sensor	Rs. 3000 x 4	Rs. 12000
2.	Water Temperature	DS18B20 Temperature Sensor	Rs. 300 x 4	Rs, 1200
3.	Water Turbidity	DFRobot Gravity Analog Turbidity Sensor	Rs. 1000 x 4	Rs. 4000
4.	TDS level	SeeedStudio Grove TDS Sensor	Rs. 1400 x 4	Rs, 5600
5.	Wind Speed	Anemometer	Rs. 5200 x 4	Rs. 20800
Other Components				
6.	Arduino Mega 2560 Rev3		Rs.4000 x 4	Rs. 16000
7.	ESP8266		Rs. 600 x 4	Rs. 1200

8.	3D Printed Structures)		Rs.2500 x 4	Rs. 10000
9.	Others (Misc..)		Rs. 5200	Rs. 5200
		Total	Rs. 76000	

Parameters Measured:

1. pH Value of the water

2. Turbidity of the water

3. Temperature of the water

4. TDS (Total Dissolved Solids) of the water
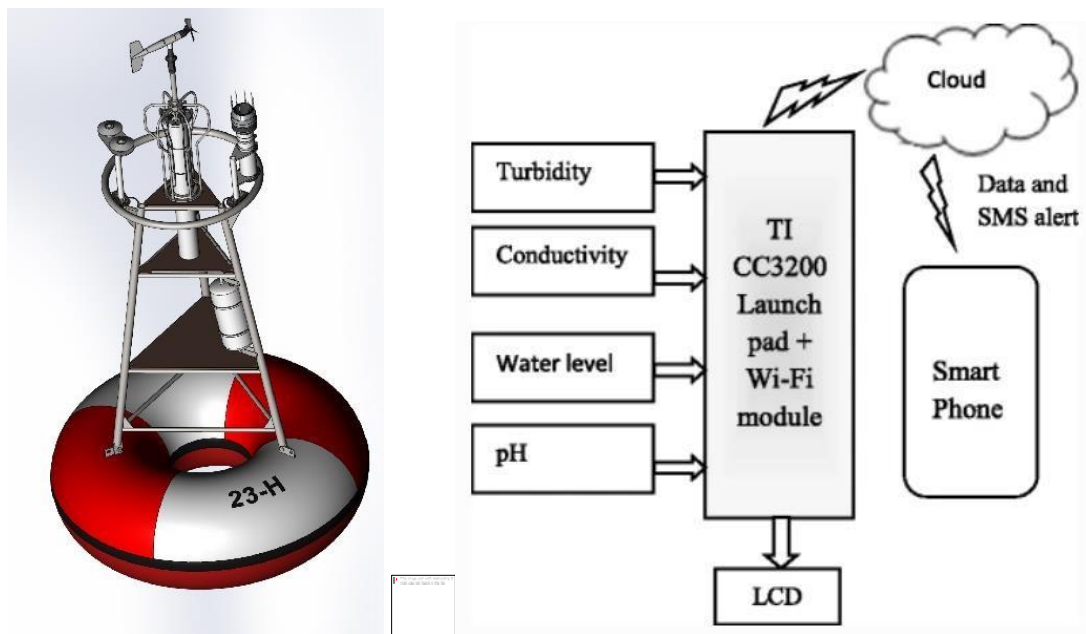5. Speed and Direction of Wind

Proposed Buoy Design:

Fig.1 Proposed Buoy Model

Specifications:

Buoy Length: 1.7m

Float Diameter: 3.6m

Focal Diameter: 1.1m

Buoy (without Float): 1.2m

Weight: 3-5 kg

Specifications:

Buoy Length: 1.7 m scaled it down to 65%
New Buoy length: 0.565 m = 50.6 cm

Float Diameter: 3.6 m scaled it down to 40%
New Float Diameter: 1.44 m = 144 cm

Focal Diameter: 0.86 m

Buoy (Without Float): 0.51m

S. No.	Measured Parameter	Proposed Sensor	Dimensions	Voltage
1.	pH value of water	DFRobot Gravity Analog pH sensor	42mm x 32mm	3.3 – 5.5 V
2.	Water Temperature	DS18B20 Temperature Sensor	Probe – 45mm Wire – 100mm	3.0 – 5.5 V
3.	Water Turbidity	DFRobot Gravity Analog Turbidity Sensor	38 x 28 x 10 mm	5V
4.	TDS level	SeeedStudio Grove TDS Sensor	20 x 40 mm	3.3 – 5.5 V
5.	Wind Speed	Anemometer	105 x 60 x20 mm	3.0 – 5.5 V

Selection of Microcontroller:

Parameters	Arduino Mega 2560 Rev3
Operating Voltage	5V
Software	IDE
Digital I/O pins	54 (of which 15 provide PWM output)
Analog I/O pins	16
Input voltage	7-12
Cost	Rs 4000
Flash Memory (KB)	256 KB of which 8 KB used by bootloader
SRAM (KB)	8 KB

Dimensions of Microcontroller

LENGTH	101.52 mm
WIDTH	53.3 mm
WEIGHT	37 g

Power: -

The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may become unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the GND and Vin pin headers of the POWER connector.

If more than 500 mA is applied to the USB port, the fuse will automatically break the connection until the short or overload is removed.

Links for Buying the components Online:-

- DFRobot Gravity AnalogpH sensor

  https://robu.in/product/dfrobot-gravity-analog-ph-sensor-for-arduino/?gclid=CjwKCAjwo_KXBhAaEiwA2RZ8hIJiFFv57PRO4oEf-oDnB0YKtP4YW5xC28_iChTVNFqMCKHFyG_VChoCa0UQAvD_BwE

- DS18B20 Temperature Sensor

  https://www.evelta.com/ds18b20-waterproof-temperature-sensor-probe/?gclid=CjwKCAjwo_KXBhAaEiwA2RZ8hK0FLfZvdXuniF8dgF4rI71-JadaoNL28o8Q7JltKu6-9XQMWpTCBBoCg4QQAvD_BwE

- DFRobot Gravity Analog Turbidity Sensor

  https://robu.in/product/dfrobot-gravity-analog-turbidity-sensor-for-arduino/?gclid=CjwKCAjwo_KXBhAaEiwA2RZ8hHUZMUnRt112RY0RSLBpCUqtPef_uo3gCRIMjUTcDdvWzKSK5jPePRoCxEkQAvD_BwE

- SeeedStudio Grove TDS Sensor

  https://robu.in/product/grove-tds-sensor-meter-for-water-quality/

- https://robu.in/product/wind-speed-sensor-current-type4-to-20ma-anemometer-kit-waterproof-industrial/?gclid=CjwKCAjwo_KXBhAaEiwA2RZ8hLfbiW5SJdhjC1HLcMYq1obx6VZzh3nuyFFgovBFGyb4YjEQMkX4NRoCIWUQAvD_BwE

- Arduino Mega 2560 Rev 3

  https://store-usa.arduino.cc/products/arduino-mega-2560-rev3?selectedStore=us

- ESP8266 Wifi Module

  https://www.electronicscomp.com/nodemcu-esp8266-development-board-cp2102-ic-based-india?gclid=CjwKCAjwo_KXBhAaEiwA2RZ8hCuYKFZC_P2ApBD5hqUo-oaEK45RlZwmh60rIaZUD8a3_dYMe6EH6RoCnMgQAvD_BwE

References:

1. Sandra Sendra, Lorena Parra, Jaime Lloret, José Miguel Jiménez, "Oceanographic Multisensor Buoy Based on Low-Cost Sensors for Posidonia Meadows Monitoring in Mediterranean Sea", Journal of Sensors, vol. 2015, Article ID 920168

2. Geetha and Gouthami, Internet of things enabled real time water quality monitoring system, Smart Water (2017) 2:1