Monitoring remote tidal based on web

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Abstract. Currently oceanographic data can be obtained through overseas websites that provide online and costless, but these online data generally have rough resolution with global or regional space coverage. The purpose of this study is to apply tidal measurements in three different waters (Surabaya, Gresik and Lamongan, East Java-Indonesia) that can transmit data via SMS gateway and store data on the web server to be accessible by people. The first step is to combine the electronic and mechanical circuits and then it was followed by experimental tools and data retrieval conducted in the laboratory. After the trial is successful, it was followed by the actual data retrieval that it tested the transmission of data from the observer station to the data center via modem that uses AT Command, a computer language program. Data will be received and stored in a web server, and then the data can be accessed via internet. The results showed that tidal instrument can work well and gave an estimated error of 3-4%. The choice of location of instrument placement was very important. The most important in this research was to avoid the crowded boat traffic and under the bridge.

1. Introduction
Indonesia as a maritime country is a country that most of its territory is the sea should make marine sector development as the main priority. The development in the marine sector can run well if all aspects related to the development is prepared. One important aspect in development in the marine sector is the existence of oceanographic data. Some of parameters such as tides, waves, currents, and temperatures can be measured directly using measurement tools [1]. We have designed tidal and current tools [2]. The oceanographic data observed are the speed data, the direction of currents data and the tidal data. The oceanographic data obtained directly from the observed area uses the sensors that are connected to the microcontroller and sent via a modem. In the real time, these data submitted by the microcontroller via the modem which also serves as a gateway SMS, directly to the server. From the server, the community can access those online data using the internet.

The purpose of this study is to apply tidal measurements in three different waters (Surabaya, Gresik and Lamongan, East Java-Indonesia) that can transmit data via SMS gateway and store data on the web server to be accessible by the people wherever they are as long as they have media connected to the internet network.
2. Methods
In this research, we built an oceanographic data processing system using internet network [2], so the person who takes the data no longer has to be at the location during the data retrieval process, whereas in manual usage, the person must be always at the location for a long time. This tool can also send data from several locations at once, so it is very effective and efficient in the process of taking oceanographic data in various places (Figure 1 and 2).

![Figure 1. Oceanographic data processing system using internet network.](image)

- Tidal
- The tidal mechanic circuit
- Web server
- GSM Modem
- Sensor
- Microcontroller

- Laboratory of Electrical Engineering, University of Hang Tuah Surabaya
- The waters near the Port of Cement, Gresik
- The waters near Paciran Port
- Surabaya waters (around the Suramadu bridge)

![Figure 2. Schematic Diagram](image)
2.1. Location of Research
The research location is in Laboratory of Electrical Engineering, University of Hang Tuah Surabaya, the waters near the Port of cement, Gresik, the waters near Port of Paciran and Surabaya waters (around the Suramadu Bridge).

2.2. Electronic Network Planning
At the stage of designing this electronic circuit and mechanical design is done with steps such as the flow chart in Figure 3 and 4.

![Flow chart of electronic circuit design stage](image)

**Figure 3.** Flow chart of electronic circuit design stage
2.3. Testing Instrument and Data Retrieval

Testing instrument and data retrieval will be done first in the laboratory, and then the instrument will be displayed to the actual location of the waters to measure tides of sea water. The measurement method is a direct measurement method that uses tidal measuring instrument [3]. Then, it tested to send data from observer station to data center through SMS gateway. The data will be received and stored in a web server so that data can be accessed via internet.

3. Results and Discussion

3.1. Wavecom Modem Testing

Before using wavecom modem, the users must prepare power supply first. The required voltage for the modem to work is 5.5-12 Volt DC. The voltage is taken from a power bank with a capacity of 1,500 mAh that can last about 2 days. To be able to make this tool work on a longer time, just replace the power bank with a larger capacity. The modem uses AT Command program, so it can receive and sends the data in the form of SMS, or this process can be called as ‘SMS Gateway’. The trial needs two different places to prove that the sending-receiving method works well. The first trial was conducted in the laboratory, but the second was undergone in the field.

3.2. Tidal Device Testing

To test the strength and magnitude of errors of the tidal set, tidal tools are placed in three waters location, i.e. the water near Port of Paciran, Lamongan, the water near Port of Cement, Gresik and the waters around Surabaya Bridge. The laying of the tidal appliance is in a conventional way (using human’s palm) to determine the magnitude of errors of this tool. To test the robustness of the tool, this tidal set of devices is used for 15 days (half a month cycle around the earth).

To finding out the result of the new tool, the installation of this tidal set is displayed next to the installation of a conventional (human palm), so the observer directly know the efficacy of both tools. The first set of tidal appliances is placed in Lamongan waters, near the Fish Auction Place Dock, Paciran as in Figure 5. The second set of tools is placed in Gresik waters, close to the Semen Gresik Pier (Figure 6). The third set of tidal tools is placed under the Surabaya-Madura Bridge (Figure 7.).
Figure 5. The first set of tidal appliances in Lamongan waters, near the Fish Auction Place Dock, Paciran

Figure 6. Setting location of tidal set circuit in Gresik
After the tool circuit was installed in the determined location, then the data will be sent using a modem that was equipped with a power supply first. The required voltage for the modem to work is 5.5 - 12 Volt DC. Once the modem was ready, the next equipment that needs to be prepared is the server. The server used in this circuit testing tool was located in University of Hang Tuah, at the Electrical Laboratory.

The three series of devices installed in three locations (Lamongan, Gresik and Surabaya) will transmit data, received and stored into the database from existing sensors. This software was made using the basic programming language of compiler Delphi 7. Delphi 7 software that had been made received SMS and saved SMS data into MySQL database that had been provided.

Data from the set of tidal tools that had been sent in the software were combined and processed with tidal observation data manually to determine the magnitude of errors of each device placed in the waters.

The results of manual measurements and using a set of installed tidal instrument in Lamongan can be seen in Figure 8. The result of the graph in red was the result of measurement using the conventional tide sign (palm), while green color was the result of tidal measurement using the tidal circuit. From both tools, it gives an approximately error of 3%. At this location, there was hardly any problem in sending data from the device to the server that was placed in the Laboratory of Electrical, University of Hang Tuah Surabaya. This was because the location of the placement of the tool was in open water with traffic that was not too crowded.

Figure 7. Setting location of tidal set circuit in Surabaya
Figure 8. Graph of tidal observation using conventional and automatic in Lamongan

Figure 9. Graph of tidal observation using conventional and automatic in Gresik
The results of manual measurements and using tidal set of instrument in Gresik can be seen in Figure 9. Graph with red is the result of measurement using conventional tide sign (palm), while green color is result of tidal measurement by using tidal circuit. From both these tools, gives a big error of 4%. At this location, there is little problem in the placement of tidal circuit sets. This happens, because the location of the waters is too crowded by boats that go back and forth and is often used by small children to play water. Conditions of water that are only about 50 cm from the surface of the water, causing the device exposed to water splashes, causing some components to be replaced. Meanwhile, the transmission of data from the device to the server placed at the Laboratory of Electrical, University of Hang Tuah, Surabaya, did not experience any problems.

Figure 10. Graph of tidal observation using conventional and automatic in Surabaya

The results of manual measurements and using tidal set of instrument in Surabaya can be seen in Figure 10. Graph with red is the result of measurement using conventional tide sign (palm), while green color is result of tidal measurement by using tidal circuit. From both these tools, gives an approximately error of 3%. Consideration instrument placed under the bridge Suramadu Surabaya for tools protected from rain. However, the problem then arises, namely in the delivery of data from the device to the server that is placed in the University Laboratory Hang Tuah Surabaya. This is possible because Suramadu bridge structure interferes with signal delivery from the device to the server.

4. Conclusions
The conclusion of this research is tidal instrument can work well and give error of 3-4%. The choice of location of instrument placement is very important. Therefore, the research must avoid the crowded boat traffic and under the structure of the building or bridge to get accurate data.

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