



PORTABLE MICROCONTROLLER-BASED TURBIDITY MEASURING KIT

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ABSTRACT

This project entitled Portable Microcontroller-based Turbidity Measuring Kit was conducted to design a device that can measure the amount of turbidity (based on the amount of intensity of the portion of the liquid) using an Infrared LED as the light source and a photodiode as the light detector using an attenuated detection method.

The device has four (4) major parts: (1) Infrared LED (light source), (2) Photodiode (detector), (3) Microcontroller, and (4) LCD interface. The testing of the device is made to happen using standard Formazin solutions, primarily with measurements of 2 NTU, 10 NTU, 20 NTU, 100 NTU, and 4000 NTU.

The result showed that the prototype was able to give precise yet limited range of measurement. The device can only be able to measure with a minimum measurement of 50 NTU to 4000 NTU which is a high turbid range specifically applicable to farm lakes and waste water samples. In terms of the accuracy of the prototype, the standard solutions were measured and gave a relatively small number of percent error ranging from 1 – 4 percent.

To further improve the device, a higher sensitivity light detector is recommended. A PIC microcontroller is also well recommended to use for the device because of its reliability since the PIC controlled system often resides machines that are expected to run continuously for many years without any error and in some cases, recover by themselves if an error occurs. The PIC



microcontroller is well trusted based on its performance, power consumption, and its expandable memory. The use of lens is also recommended to limit the direction of the light emitted by the Infrared LED. Scattered light can cause lesser intensity detection for the light sensor.



CHAPTER I

THE PROBLEM AND ITS SETTING

Introduction

One of the global problems being experienced in the present time is having a very poor water quality due to water pollution that could lead to serious environmental problems. When industrialization has spread throughout the globe, different kinds of pollution problems have also spread with it, including water pollution. Water pollution has various contributors that affect the quality of water, such as eutrophication, microbial pollution, chemical and oil pollution, solid waste, etc. An individual has the ability to identify whether the quality of water is good or bad by using his keen eye to observe its physical appearance or property. However, there are fine suspended particles in water that may include sediments like clay, silt, fine organic and inorganic matter, colored soluble organic compounds, plankton, algae, and other microorganisms. The enumerated sediments are the substances or pollutants that cause turbidity.

According to U.S. Geological Survey (USGS), "Turbidity is the measure of the relative clarity of a liquid. It is an optical characteristic of water and is an expression of the amount of light that is scattered by material in the water when a light is shined through the water sample." Flooding and spring runoff due to heavy rains, landslides and bank erosion, algae blooms, person, animals or boats disturbing the waterbed, human activities that disturb land like construction,



mining and agriculture, and storm water pollution from urban areas are some of the following contributing factors that causes turbidity in surface water bodies. If there is the high turbidity level of rivers, lakes, and streams, it can reduce their aesthetic quality and the amount of sunlight that reaches the lower depth of bodies of water, which can cause negative effects on aquatic species. High level turbidity can lower the dissolved oxygen in bodies of water which can also lower the absorption of dissolved oxygen by the aquatic organisms.

With the above-mentioned situations, the researchers designed a locally-made Portable Microcontroller-based Turbidity Measuring Kit to be used to determine the amount of turbidity to correlate to the concentration of suspended particles in a sample of water. It will also feature analytical sensor which is discussed in the field of Analytical Instrumentation.

Generally, the Portable Microcontroller-based Turbidity Measuring Kit can help the beneficiaries of the study to become aware of the importance of turbidity measurement and how analytical sensor to be used will function.

Objectives of the Study

A. General Objective

To design and construct a low-cost Portable Microcontroller-based Turbidity Measuring Kit



B. Specific Objectives

1. To provide an instrument that can measure the turbidity of a liquid sample
2. To develop an Arduino C Program for the function specified for the kit
3. To create a user interface using Liquid Crystal Display (LCD) that will show the parameters measured
4. To test if the device can measure efficient water turbidity
5. To measure the contamination in the liquid sample taken from ponds, rivers, fish pens, wastewater etc.
6. To provide a user's manual for the kit

Significance of the Study

The project aims to enrich the knowledge of each individual in understanding the importance of measuring turbidity in water. The project is considered another breakthrough in the field of Analytical Instrumentation here in the Philippines since there is no existing locally-made turbidity meter yet. Turbidity has been marked as a huge help in means of water quality monitoring parameter to assess the quality of environmental water sources. As to industrial fields, water-based processes are used in a variety of applications including filling, heating, cooling, processing, cleaning or rinsing. Most industries use water treatment to improve process efficiency and reduce operating costs and risks.