# SmartPhone Turbidimeter

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**Abstract**

Turbidity measurements are the single most important parameter guiding operation of a flocculation/sedimentation/filtration facility. Routine turbidity measurements are required by regulators. A requirement of regular turbidity reporting can provide another incentive for plant operators to do their best to keep the treated water turbidity as low as possible. Our goal is to integrate the turbidity measurement with the reporting function by coupling a turbidity sensor with a SmartPhone.

- Skills: Computer science, electrical and computer engineering

## 1 Introduction

AguaClara water treatment plant operators use a small hand held turbidimeter to measure the turbidity of the raw water, settled water, and filtered water. They record the data in a log book. Four of the AguaClara water treatment plants are also texting the turbidity readings to The WashMap Project. The goal would be to simultaneously reduce the cost of the turbidimeters by using a SmartPhone with a turbidity meter app and a plug in sensor. A blue tooth connection to the sensor would also be possible, but that would require that the sensor has a battery. It is possible that the turbidity sensor could run off of the phone power if it plugs into the phone. However, it appears that Smart Phones are designed to be USB devices and not USB hosts and thus as a device (that expects to connect to a host) it can't connect to another device such as an external sensor. Tethering a SmartPhone to a USB device

The turbidity sensor would need to have the turbidity sample cell, infrared LED, two light detectors, analog to digital converter, and communications hardware and software for interfacing with the SmartPhone Turbidimeter app. The Turbidimeter app would need to handle the calibration process for the turbidimeter, sample reading, data recording to the phone, and an interface for easily sending the plant operating data to The WashMap Project.

Explore options for creating a hand held turbidimeter with phone text capabilities or a SmartPhone with Turbidimeter capabilities. In the first case a portable turbidimeter might have buttons to transmit raw water turbidity, settled water turbidity, or filtered water turbidity. When the operator takes

a turbidity measurement they would then press the correct button and a text message would be sent to the server. The turbidimeter would have software that allows setting up plant information and the server phone number. The other option would be to create a turbidimeter sample cell and optics and analog to digital converter and interface system that could connect to a smart phone. A smart phone app would include all of the software capabilities necessary to calibrate the meter using standards, read sample data, and transmit the data to the server.

The calibration information should be stored in stable memory in the sensor so that the SmartPhone can be swapped without having to recalibrate the sensor.

## 2 Strategies

It is possible that a turbidimeter company is already considering this option. We could contact HFScientific or HACH to see if they are interested. It would also be reasonable to work with a small firm to make the sensors. The sensor will be the most expensive component and if we can produce a sensor for less than the cost of a commercial turbidimeter, then we would have a viable commercial product because the SmartPhone will give the turbidimeter new features that current models don't have. Commercial hand held turbidimeters are expensive because there isn't a large market and turbidimeters are expensive. The goal would be to overcome that price barrier and produce turbidimeters sensors that cost less than $100.