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IOT BASED WATER QUALITY MONITORING SYSTEM

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ABSTRACT

Water pollution is one amongst the largest fears for the green globalization. So as to confirm the safe supply of the drinking water the quality needs to be monitor. The system consist of several sensors is used to measure physical and chemical parameters of the water. The parameters such as temperature, PH, turbidity of the water can be measured. The measured values from the sensors can be processed by the core controller which is Arduino model. Finally, the sensor data can be viewed on android using WI-FI system. If the water parameters are abnormal buzzer gives the signal and the water pumps out.

I. INTRODUCTION

Our body is consists of about 60% water. During this 21st period untidy or polluted water is taken for the drinking requirements that's nonetheless there's no assortment or purifying in numerous evolving countries. People are been effected by several diseases through this polluted water like cholera, typhoid, polio and guinea worm disease. Many of the water quality monitoring devices and automatic water saving devices face lots of problems. The fresh water can be appraised through the advantage of pH sensor. All the sensors are connected to the microcontroller Arduino Uno board which is more adaptable, the real time data is collected, processed and stored within the database and these specified data can be continuously monitored. Data are collected through the sensors that are been used and then these data are sent to the server and displayed on android application through the Wi-Fi module. The LCD screen is to observe and monitor the standard drinking water, mobile phones using a application and if it there is any abnormalities in water, the motor pumps out the water.

II. LITERATURE REVIEW

Water Quality Monitoring for Rural Areas-A Sensor Cloud Based Economical Project." Published in 2015 1st International Conference on Next Generation Computing Technologies (NGCT-2015) Dehradun, India. This paper highlights the entire water quality monitoring methods, sensors, embedded design, and information dissipation procedure. It also explores the Sensor Cloud domain. While automatically improving the water quality is not feasible at this point, efficient use of technology and economic practices can help improve water quality and awareness among people.In this paper, we present the design of IOT based water quality monitoring system that monitor the quality of water in real time. This system consists some sensors which measure the water quality parameter such as pH, turbidity, temperature. The measured values from the sensors are processed by microcontroller and this processed values are transmitted remotely to the core controller that is Aurdino Uno. Finally, sensors data can view on Wi-Fi controller application.

III. METHODOLOGY

Install any WiFi Application for Arduino. Pair wifi controller module with the mobile Default password is "1234" or "0000".Click on the referesh icon. After the device is connected to mobile application the parameters values are shown on the screen. We can monitor the values and sense of quality of water.

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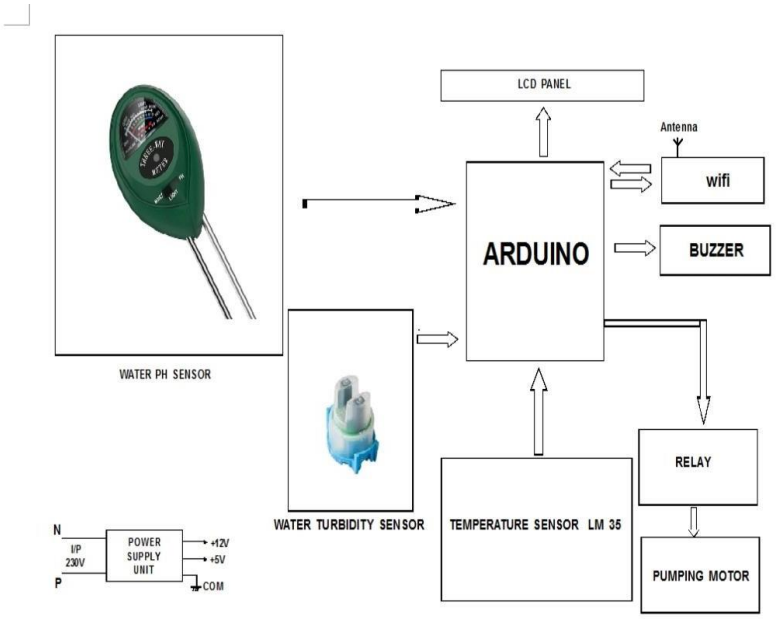

Figure 1: Block Diagram Of Water Quality Monitoring System

IV. THE HARDWARE

ARDUINO UNO

The Arduino Uno is an open-source microcontroller board dependent on the Microchip ATmega328P microcontroller and created by Arduino.cc. It is programmable with the Arduino IDE through a kind B USB cable. It can be controlled by the USB link or by an outside 9-volt battery, however it acknowledges voltages between 7 and 20 volts. Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. It is similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available.The word "uno" means "one" in Italian and was chosen to mark the initial release of Arduino Software. The Uno board is the first in a series of USB-based Arduino boards; it and version 1.0 of the Arduino IDE were the reference versions of Arduino, which have now evolved to newer releases. The ATmega328 on the board comes preprogrammed with a bootloader that allows uploading new code to it without the use of an external hardware programmer.

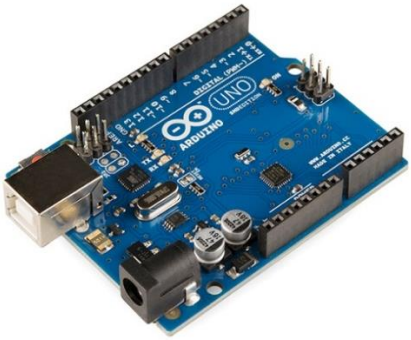

Figure 2: Arduino Uno

Wi-Fi MODULE ESP8266

The ESP8266 WiFi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application or

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offloading all WiFi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much WiFi-ability as a WiFi Shield offers (and that's just out of the box)! The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community.

This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area. The ESP8266 supports APSD for VoIP applications and Bluetooth co-existance interfaces, it contains a self-calibrated RF allowing it to work under all operating conditions, and requires no external RF parts.

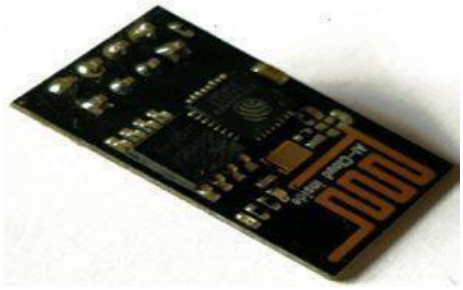

Figure 3: Wi-Fi Module

TEMPERATURE SENSOR

A temperature sensor is a device, typically, a thermocouple or resistance temperature detector, that provides temperature measurement in a readable form through an electrical signal. LM35 is a temperature measuring device having an analog output voltage proportional to the temperature. It provides output voltage in Centigrade (Celsius). It does not require any external calibration circuitry. The sensitivity of LM35 is 10 mV/degree Celsius. As temperature increases, output voltage also increases. E.g. 250 mV means 25°C. It is a 3-terminal sensor used to measure surrounding temperature ranging from -55 °C to 150 °C. LM35 gives temperature output which is more precise than thermistor output.

Figure 4: LM35 Temperature sensor

TEMPERATURE SENSOR

The Turbidity sensor detects the water quality by measuring the levels of turbidity, or the opaqueness. It uses light to detect suspended particles in water by measuring the light transmittance and scattering rate, which changes with the amount of total suspended solids (TSS) in water. As the TTS increases, the liquid turbidity level increases. Turbidity sensors are used to measure water quality in rivers and streams, wastewater and effluent measurements, control instrumentation for settling ponds, sediment transport research and laboratory measurements. This liquid sensor provides analog and digital signal output modes. It is very efficient, the Arduino Turbidity Sensor is able to detect and verify the quality of the water, making the turbidity measurement, where it is possible to verify the results by means of digital or analog signal next to the corresponding pins in the accompanying electronic module. In general, the Arduino Turbidity Sensor is applied in projects involving the monitoring of water turbidity in , and so on. This Turbidity Sensor has an end specially prepared for direct contact, having an electronic module to amplify and send the received data to the microcontroller of the project.

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Figure 5: Turbidity sensor

PH Sensor

The pH value of a water source is a measure of its acidity or alkalinity. The pH level is a measurement of the activity of the hydrogen atom, because the hydrogen activity is a good representation of the acidity or alkalinity of the water. The pH scale, as shown below, ranges from 0 to 14, with 7.0 being neutral. Water with a low pH is said to be acidic, and water with a high pH is basic, or alkaline. Pure water would have a pH of 7.0, but water sources and precipitation tends to be slightly acidic, due to contaminants that are in the water. Surface water typically has a pH value between 6.5 and 8.5 and groundwater tends to have a pH between 6.0 and 8.5. The pH of a water source can vary naturally. Some types of rock and soil, such as limestone, can neutralize acid more effectively than other types of rock and soil, such as granite. Or, when there are a large number of plants growing in a lake or river, they release carbon dioxide when they die and decompose. When the carbon dioxide mixes with the water, a weak carbonic acid is formed; this can then cause the pH of the water body to decrease.

Figure 6: PH sensor

16x2 LCD DISPLAY

The term LCD stands for liquid crystal display. It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly preferred for multisegment light-emitting diodes and seven segments. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc.

Figure 7: 16x2 LCD Display

RELAY

The Single Channel Relay Module is a convenient board which can be used to control high voltage, high current load such as motor, solenoid valves, lamps and AC load. It is designed to interface with microcontroller such as Arduino, PIC and etc. The relays terminal (COM, NO and NC) is being brought out with screw terminal. It also comes with a LED to indicate the status of relay. At the heart of the module is a 5V relay covered in blue color

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plastic. Maximum operating current and voltage for both AC and DC load are also mentioned at the top of the relay cover. SRD-05VDC-SL-C is part number and it shows the operating voltage. It is known as a 5V relay module. Because the relay operates at 5V DC. In other words, a 5V active high or low signal activates the relay by energizing its coil. As mentioned earlier, internally a 5V relay consists of a NC, NO, COM terminals and a coil.

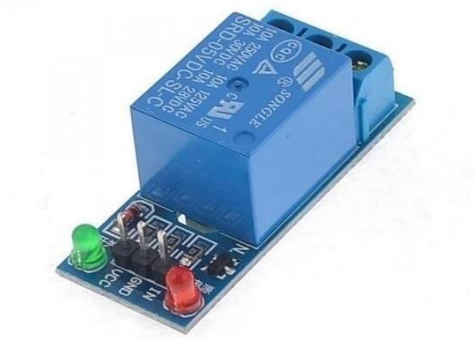

Figure 8: Relay

MINI WATER PUMP

This is a low cost mini submersible type water pump that works on 3-6V DC. It is extremely simple and easy to use. Just immerse the pump in water, connect a suitable pipe to the outlet and power the motor with 3-6V to start pumping water. Great for building science projects, fire- extinguishers, fire fighting robots, fountains, waterfalls, plant watering systems etc.

This motor is small, compact and light. It can be controlled from a micro controller/Arduino using our DC Motor Drivers or one of our Relay Boards. You may use our 5V SMPS Power Supply Adapter to run this pump. You may also use our 6V Solar Panel to run the pump with appropriate a 6V voltage regulator.

Figure 9: Mini Water Pump

BUZZER

An audio signaling device like a beeper or buzzer may be electromechanical or piezoelectric or mechanical type. The main function of this is to convert the signal from audio to sound. Generally, it is powered through DC voltage and used in timers, alarm devices, printers, alarms, computers, etc. Based on the various designs, it can generate different sounds like alarm, music, bell & siren. It includes two pins namely positive and negative. The positive terminal of this is represented with the '+' symbol or a longer terminal. This terminal is powered through 6Volts whereas the negative terminal is represented with the '-'symbol or short terminal and it is connected to the GND terminal.

Figure 10: Buzzer

V. SOFTWARE

ARDUINO IDE SOFTWARE

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them. Programs

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written using Arduino Software (IDE) are called **sketches**. These sketches are written in the text editor and are saved with the file extension .ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom righthand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

Installation

The steps to get started with Arduino UNO are listed below:

- **Install the drivers of the board.**

As soon we connect the board to the computer, Windows from XP to 10 will automatically install the board drivers. But, if you have expanded or downloaded the zip package, follow the below steps:

1. Click on Start -> Control Panel -> System and Security.
2. Click on System -> Device Manager -> Ports (COM &LPT) -> Arduino UNO (COMxx). If the COM &LPT is absent, look Other Devices -> Unknown Device.
3. Right-click to Arduino UNO (COmxx) -> Update Driver Software -> Browse my computer for driver software.
4. Select the file "inf" to navigate else, select "ArduinoUNO.inf" Installation Finished.

VI. RESULTS AND DISCUSSION

DEVICE:

The pictures below are to represent the result of this work.

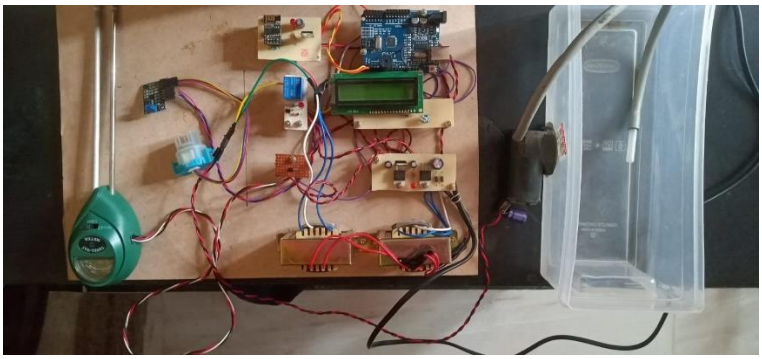

Figure 11: Without power supply

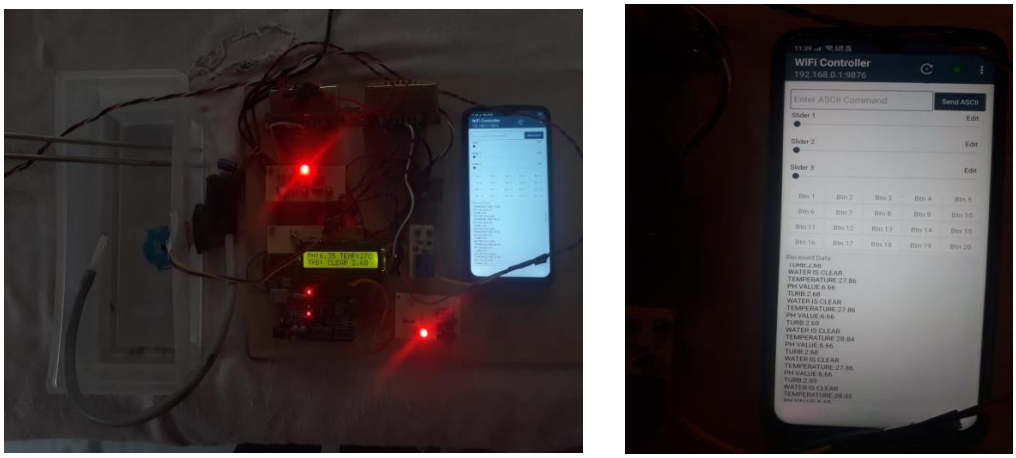

Figure 12: Parameters values of clear water

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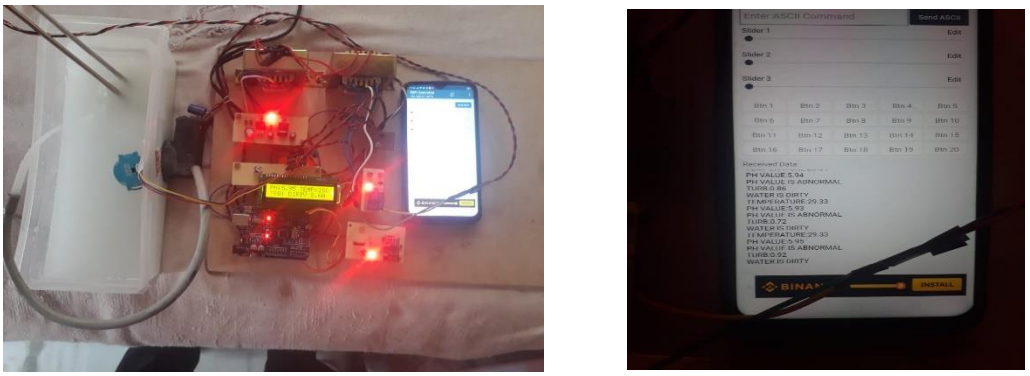

Figure 13: Parameters values of unclear water

APPPLICATION:

Figure 14: APPLICATION

The pictures abo Wi-Fi Controller is used to send and receive messages to Arduino with ESP8266 Wi-Fi module using TCP/IP Protocol. To connect with device you have to add IP & PORT of device and select it.

VII. CONCLUSION

Measuring of Turbidity, PH & Temperature of Water makes use of water detection sensor with unique advantage. The system can monitor water quality automatically, it's low in cost . The water quality testing is probably going to be more economical, convenient and fast. Only by replacing the corresponding sensors and changing the relevant software programs, this kit can be used to monitor other water quality parameters. The system can be expanded to observe hydrologic, air pollution, industrial and agricultural production and then on. To implement this need to involve the sensor devices within the environment for collecting the information and analysis. Then the collected data and analysis results are available to the end user through the Wi-Fi module.

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