BRAINY BOTTLE

(PROJECT REPORT)

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ABSTRACT:

Getting clean water every day is important for your health. Drinking polluted water exposes people to specific water contaminants that could lead to certain waterborne diseases. Water-related illnesses include waterborne diseases that are caused by pathogens such as viruses, bacteria, and protozoa. Some of these sicknesses also arise from the toxins produced by harmful algae and cyanobacteria. Other primary sources include chemicals from industrial and manufacturing facilities, agricultural and farming practices, human activities, and many more. Contaminated water transmits diseases such as cholera, diarrhea, dysentery, hepatitis A, typhoid and polio, CKD. Absent, inadequate, or inappropriately managed water services expose individuals to preventable health risks.

Our idea is a simple bottle with some intelligent can monitor the water filled in bottle from various sources with some parameters and it will monitor whether water is suitable to drink or not it will clean the water instantly with UV C spectrum and with filter tube in bottle

INTRODUCTION:

Generally, whenever we travel somewhere or in a routine carrying a water bottle is common when a bottle is empty, we fill the water nearby like in a bus stand, railway station, hotels, schools, public places but we know what quality of water they have? are they clean to drink or not? Any method which instantly filters water in our hands? These are the main reasons for causes of diseases like cholera, diarrhea, dysentery, hepatitis A, typhoid and polio and chronic kidney diseases. industrial exposure, air or water pollution, foods, medicines, improperly coated food containers, or the ingestion of lead-based paints are reasons for heavy metal in water. Types of heavy metals commonly found in water include manganese, lead, arsenic, chromium and copper. Several acute and chronic toxic effects of heavy metals affect different body organs. Gastrointestinal and kidney dysfunction, nervous system disorders, skin lesions, vascular damage, immune system dysfunction, birth defects, and cancer are examples of the complications of heavy metals toxic effects. Sustainable Development Goal target 6.1 calls for universal and equitable access to safe and affordable drinking water. The target is tracked with the indicator of “safely managed drinking water services” – drinking water from an improved water source that is located on premises, available when needed, and free from fecal and priority chemical contamination. Our idea is a simple bottle with some intelligent can monitor the water filled in bottle from various sources with some parameters and it will monitor whether water is suitable to drink or not it will clean the water instantly with UV C spectrum and with filter tube in bottle. additional features in future include monitor water level, no. of liter we intake per day, indicate if bottle is empty (IOT based) and display the whole information in small display on bottle two different metal layer like copper and aluminum outer body with stainless steel make it as thermos flask also.

The bottle contains features like:

*Instant cleaning with UV C and filter tube in bottle.

*Monitoring water parameters and conclude whether water is safe to drink or not (IOT based or Bluetooth based)

*Thermos flask feature also. Built in active carbon and water filter core to block and filter impurity in water. It can remove harmful bacteria in water, effectively filter out parasites and other plankton in the water; remove heavy metals and prevent heavy metal poisoning. Long last effective filtration.

**Indicate water level (if bottle is empty) or water consumption per day to day (everything is record IOT, Bluetooth based) additional feature in future.

DESCRIPTION:

- **PH SENSOR:**

A pH sensor/meter is used in pharmaceuticals to determine the pH of various solutions. It is a more accurate method than the pH probe, which sends electrical signals to the pH meter, which displays the solution’s pH value.

A sensor electrode and a reference electrode are located on the glass pH probe. These electrodes are made of glass tubes, one of which contains a pH 7 buffer and the other a saturated potassium chloride solution. The sensor electrode bulb is made of porous glass or a permeable glass membrane that has been coated with silica and metal salts.

In the bulb, a silver wire coated with silver chloride is immersed in the pH7 buffer. As shown in the figure below, another silver wire coated with silver chloride is immersed in the saturated potassium chloride solution in the reference electrode.

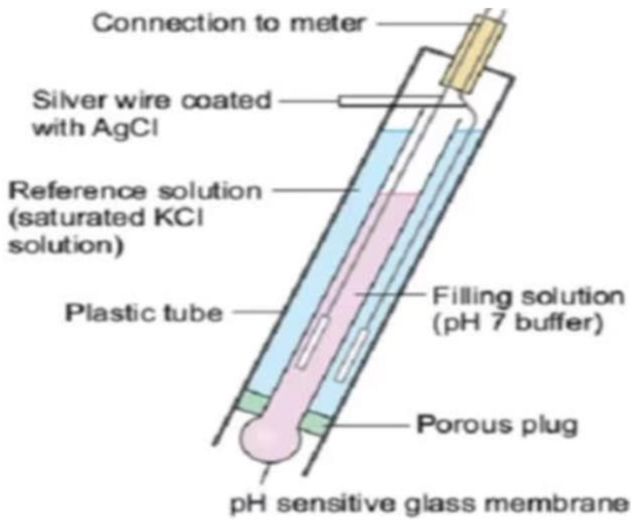
When the pH probe is immersed in a solution, hydrogen ions accumulate around the bulb and replace the metal ions in the bulb. This ion exchange produces some electric flow, which is captured by the silver wire.

The voltage of this electric flow is measured by the pH meter by converting it into pH value by comparing the generated voltage with the reference electrode.

As the acidity of the solution increases, so does the concentration of hydrogen ions, which raises the voltage. The increased voltage lowers the pH reading on the pH meter.

Similarly, an increase in alkalinity decreases the concentration of hydrogen ions or increases the concentration of hydroxyl ions, which decreases the voltage and increases the pH value in a pH meter.

The overall operation of the pH sensor and pH meter is based on the exchange of ions from the sample solution to the inner solution (pH 7 buffer) of the glass electrode via the glass membrane. The porosity of the glass membrane decreases with continued use, lowering the probe’s performance.

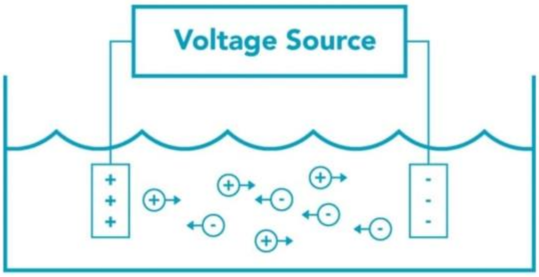


Working of pH Sensor

- **TDS SENSOR:**

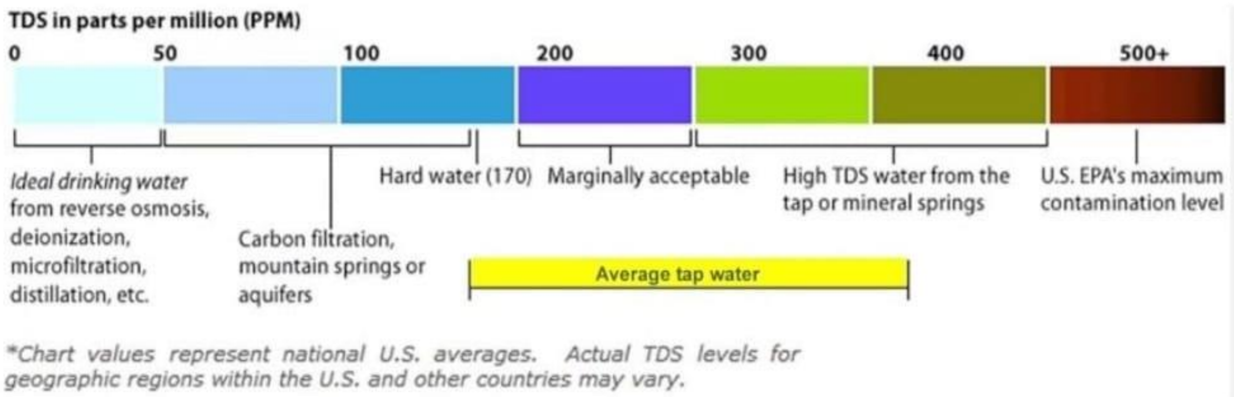
TDS is an abbreviation for Total Dissolved Solids in a liquid, including organic and inorganic substances in a molecular, ionic, or micro-granular suspended form. TDS is generally expressed in parts per million (ppm) or as milligrams per liter (mg/L). TDS is directly related to the quality of water i.e., the lower a TDS figure, the purer the water. As an example, reverse osmosis purified water will have a TDS between 0 and 10, whereas tap water will vary between 20 and 300, depending on where you live in the world.

The materials that constitute dissolved solids in water include materials such as minerals, salts, anionic and cationic substances. They can also include pollutants such as heavy metals, and other substances such as organic materials that may have leaked into your water supply system.



A TDS meter is basically an electrical charge (EC) meter whereby two electrodes equally spaced apart are inserted into water and used to measure charge. The result is interpreted by the TDS meter and converted into a ppm figure.

If the water contains no soluble materials and is pure, it will not conduct a charge and will, therefore, have a 0-ppm figure. Conversely, if the water is full of dissolved materials, it will conduct a charge, with the resulting ppm figure being proportional to the number of dissolved solids. This is because all dissolved solids have an electrical charge, which allows conduction of electrical charge between the electrodes.



- **TURBIDITY SENSOR:**

Turbidity is the cloudiness or haziness of a fluid caused by large numbers of individual particles that are generally invisible to the naked eye, similar to smoke in the air. The measurement of turbidity is a key test of water quality.

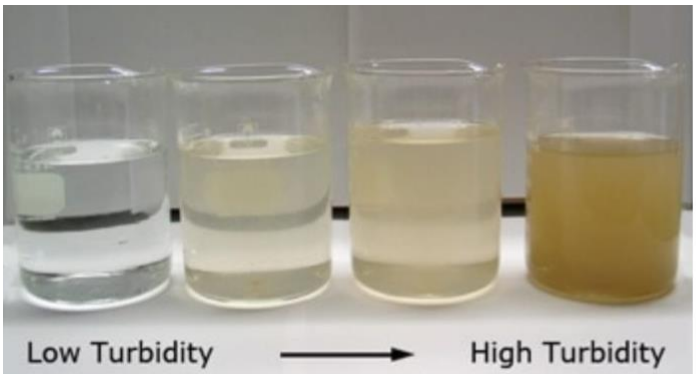
Turbidity is caused by particles suspended or dissolved in water that scatter light making the water appear cloudy or murky. Particulate matter can include sediment, especially clay and silt, fine organic and inorganic matter, soluble colored organic compounds, algae, and other microscopic organisms.

High turbidity can significantly reduce the aesthetic quality of lakes and streams. It can increase the cost of water treatment for drinking and food processing. It can harm fish and other aquatic life by reducing food supplies, degrading spawning beds, and affecting gill function.

Sediment often tops the list of substances or pollutants causing turbidity. Natural sources can include erosion from upland, riparian, stream bank, and stream channel areas. Algae that grow with nourishment from nutrients entering the stream through leaf decomposition or other naturally occurring decomposition processes can also be a source of turbidity.

Stream channel movement can also release sediment. Organic matter from sewage discharges, especially during treatment plant bypasses, can contribute to turbidity. Human activities that disturb the land, such as construction, mining, and agriculture, can lead to high sediment levels entering water bodies during rainstorms due to stormwater runoff.

Turbidity is measured using specialized optical equipment in a laboratory or in the field. Light is directed through a water sample, and the amount of light scattered is measured. The unit of measurement is called a Nephelometric Turbidity Unit (NTU), which comes in several variations. The greater the scattering of light, the higher the turbidity. Low turbidity values indicate high water clarity; high values indicate low water clarity.



- **WATER TEMPERATURE SENSOR:**

Temperature testing is the process of measuring temperature levels in water. Temperature is a key factor in water chemistry. Temperature affects the dissolved oxygen levels in water, the rate of photosynthesis, metabolic rates of organisms. DS18B20 is a 1-wire digital thermometer from Dallas Semiconductor Corp. It is based on a 1-wire interface that requires only one pin for circuit connections. The sensor has a 64-bit unique serial code for addressing a 1-wire interface. It has multi-drop capability enabling interfacing of many DS18B20 sensors on a single data line as a distributed network. It is even possible to power the sensor from the data line itself.

The sensor outputs a temperature measurement with scales from 9-bit to 12-bit resolution. The operating temperature range of DS18B20 is -55˚C to 125˚C with an accuracy of +/-0.5˚C. The default resolution of the sensor is 12-bit which lets it measure temperature with a precision of 0.0625˚C. This temperature sensor takes less than 750 ms for converting a reading. Therefore, it is easily possible to fetch temperature measurements at an interval of 1 second from the sensor network.

- **UV C LED:**

Water purification remains a prevalent issue in the world today. In many third world countries, drinking water is easily polluted and can lead to the mass infestation of various pathogenic microorganisms in vital water sources. The consequences of polluted drinking water could be catastrophic and lead to global viral pandemics'-C presents an innovative solution for providing clean and effective water purification. UV-C (ultraviolet) light is a type of radiation that can be found on the electromagnetic spectrum and is measured in Nano-meters (nm). Invisible to the human eye, UV-C is an effective disinfectant due to the density of its wavelength.

There are three ranges to UV light – UV-A, UV-B, UV-C and Vacuum-UV:

• UV-A – otherwise known as black light, it has the longest wavelength, ranging between 315nm to 400nm.

• UV-B – known as the medium wavelength, it ranges between 280nm and 315nm.

• UV-C – the shortest wavelength, it ranges between 200nm and 280nm. UV-C is germicidal, meaning it can be used effectively as a disinfectant to kill microorganisms, such as bacteria and viruses. When the DNA of microorganisms absorbs UV light, it stops them from being able to reproduce and duplicate, thereby preventing their growth.

Disinfection of drinking water

One area where UV-C LEDs are proving to be successful is in the disinfection of drinking water. UV-C LEDs are being to disinfect drinking water at various points in the treatment cycle, from source to consumption. It can take a few seconds for the water to become clean in a UV-C model, and the new technology allows for LEDs to place at a different point to ensure decontamination. It works initially when a water reservoir is exposed to a number of high-powered LEDs that disinfect the water. They emit powerful UV-C photons in the range of 200 – 280nm that pass through the water, stopping the bacteria in the water from being able to reproduce. Many newer systems have taken advantage of the compact size of the LEDs and can disinfect at the end stage of the drinking water journey – ensuring complete disinfection.

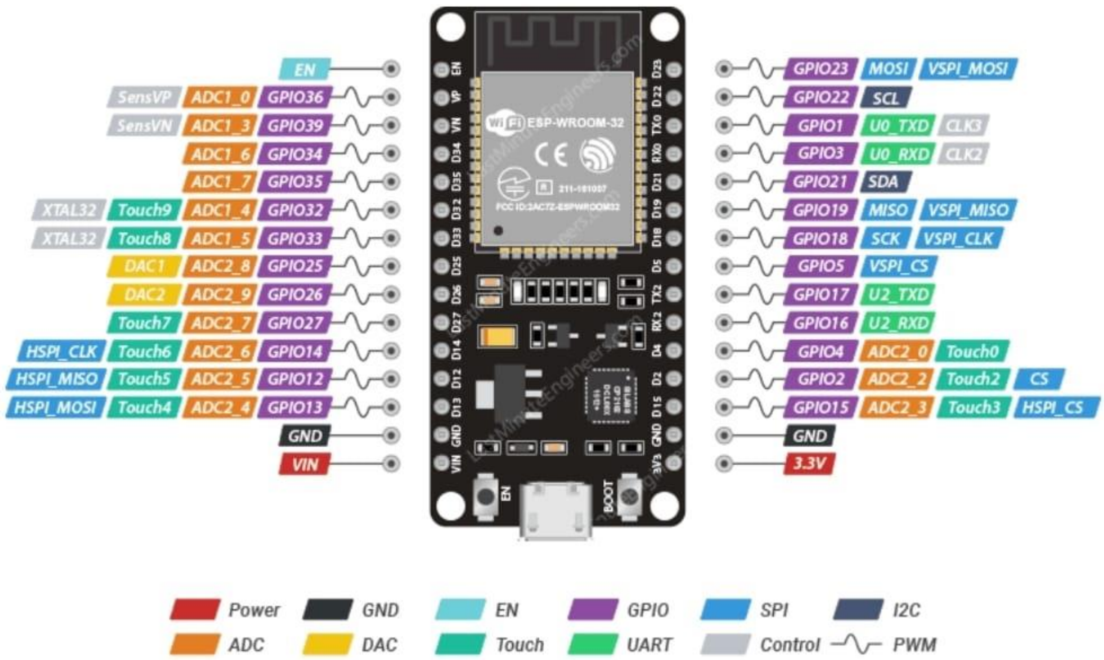
- **FILTER TUBE:**

Straw based water filtration and purification devices. It filters a maximum of 300 litres of water, enough for one person for 3 months. It removes almost all waterborne bacteria, microplastics and parasites. The filters can provide clean water without the need for batteries or chemical treatment. They are made using hollow fiber membrane technology; some of them also incorporate an activated carbon component. LifeStraw is a plastic tube 22 centimetres long and 0.7 centimetres in diameter. Water that is drawn up through the straw first passes through hollow fibres that filter water particles down to 5 µm across, using only physical filtration methods and no chemicals. remove a minimum of 99.999% of waterborne protozoan. capable of removing chemicals and heavy metals including lead, chemicals, salt water.

- **ESP32:**

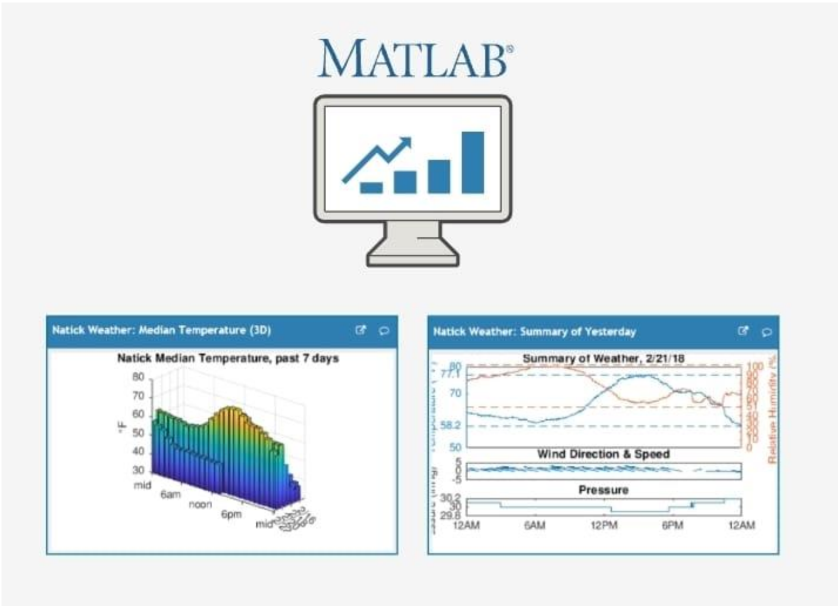
ESP32 is a series of low-cost, low-power system on a chip microcontrollers with integrated Wi-Fi and dual-mode Bluetooth. The ESP32 series employs either a Ten silica Xtensa LX6 microprocessor in both dual-core and single-core variations, Xtensa LX7 dual-core microprocessor or a single-core RISC-V microprocessor and includes built-in antenna switches, RF balun, power amplifier, low-noise receive amplifier, filters, and power-management modules. ESP32 is created and developed by Espressif Systems, a Shanghai-based Chinese company, and is manufactured by TSMC using their 40 nm process.[2] It is a successor to the ESP8266 microcontroller.

- Peripheral interfaces:
- 34 × programmable GPIOs
- 12-bit SAR ADC up to 18 channels
- 2 × 8-bit DACs
- 10 × touch sensors (capacitive sensing GPIOs)
- 4 × SPI
- 2 × I²S interfaces
- 2 × I²C interfaces
- 3 × UART



- **THINGSPEAK IOT PLATFORM:**

ThingSpeak™ is an IoT analytics service that allows you to aggregate, visualize, and analyze live data streams in the cloud. ThingSpeak provides instant visualizations of data posted by your devices to ThingSpeak. With the ability to execute MATLAB® code in ThingSpeak, you can perform online analysis and process data as it comes in. ThingSpeak is often used for prototyping and proof-of-concept IoT systems that require analytics.

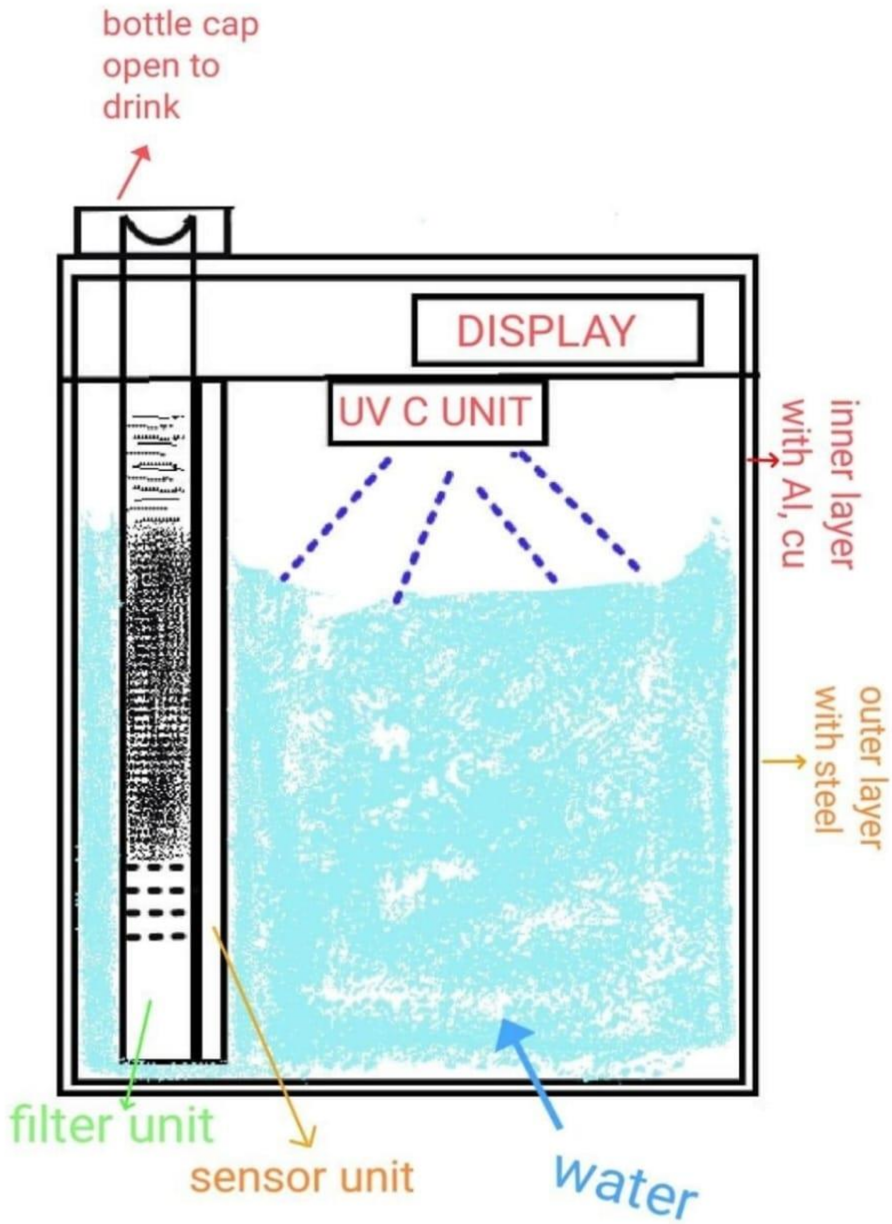


IMPLEMENTATION:

The bottle is made up of three units

- **Sensor unit**
- **Filter unit**
- **UV C unit**

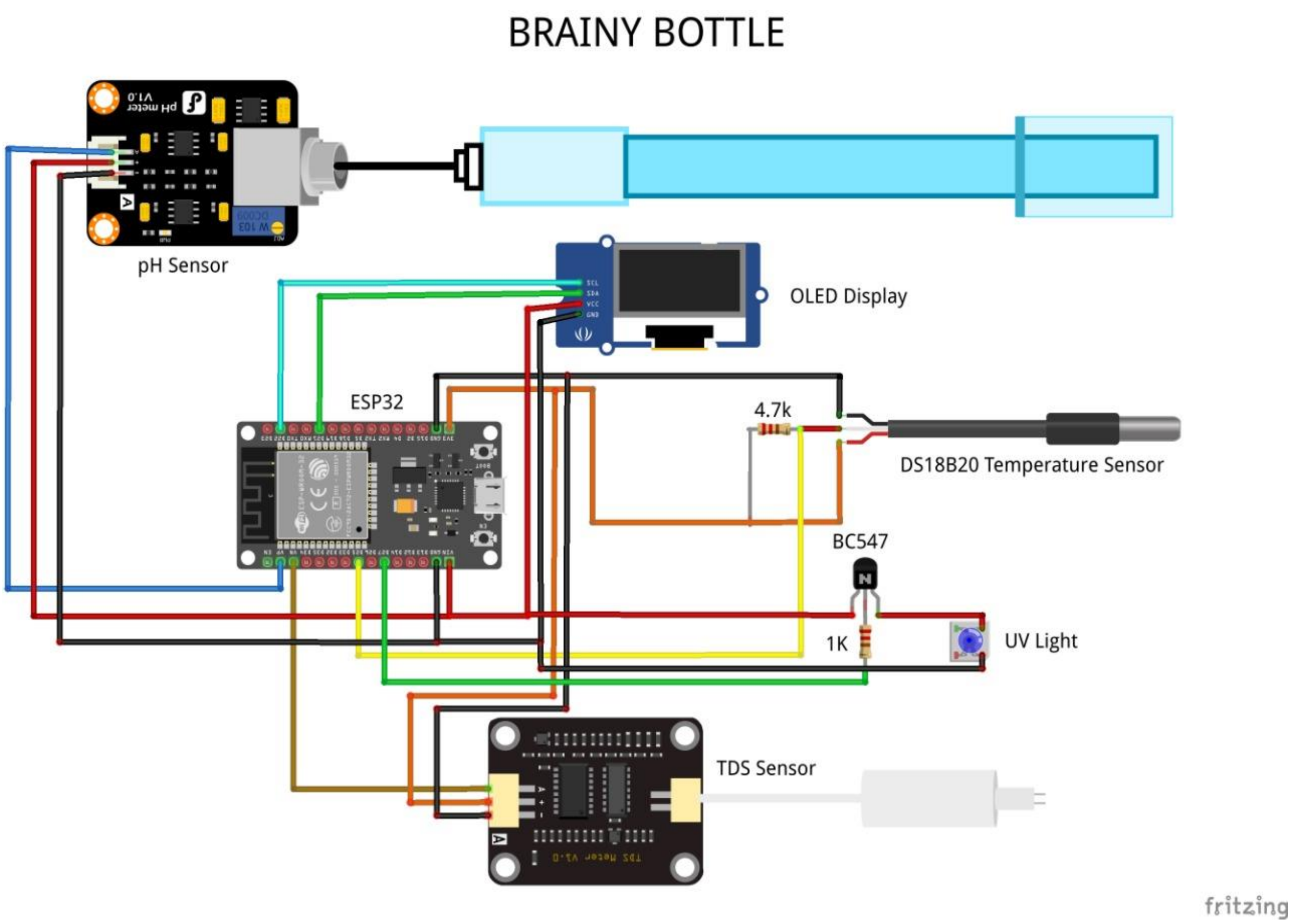
BLOCK DIAGRAM:



- **UV C UNIT:**

Bottle cap is equipped with UV C emitting unit. UV range of 200-250nm will start emitting when we press button on cap of bottle UV C frequency will pass through water in bottle, It instantly cleans water with in 2 min UV C will destroy bacteria, fungi, microbes in water .As outer surface is coated with aluminum UV C frequency does not emit out (safe to carry).

- **CIRCUIT DIAGRAM:**

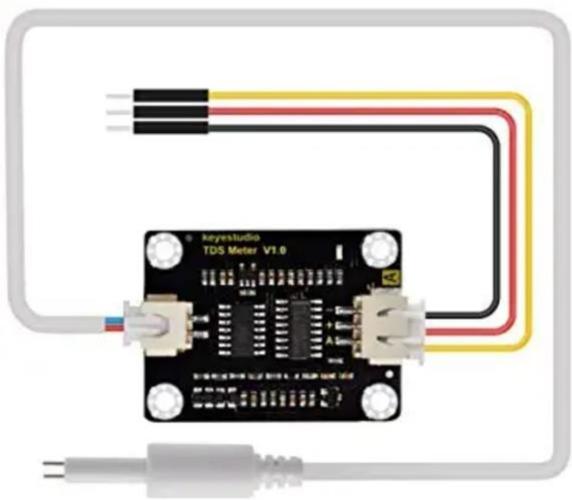


- **SENSOR UNIT:**

By monitoring the above parameters of water in bottle and conclude water is clean or not then it will display this data on small screen on bottle update the same data to ThingSpeak server with IOT by Nodemcu, sensors are equipped to filter tube:

- PH value of water
- TDS
- Turbidity
- Temperature



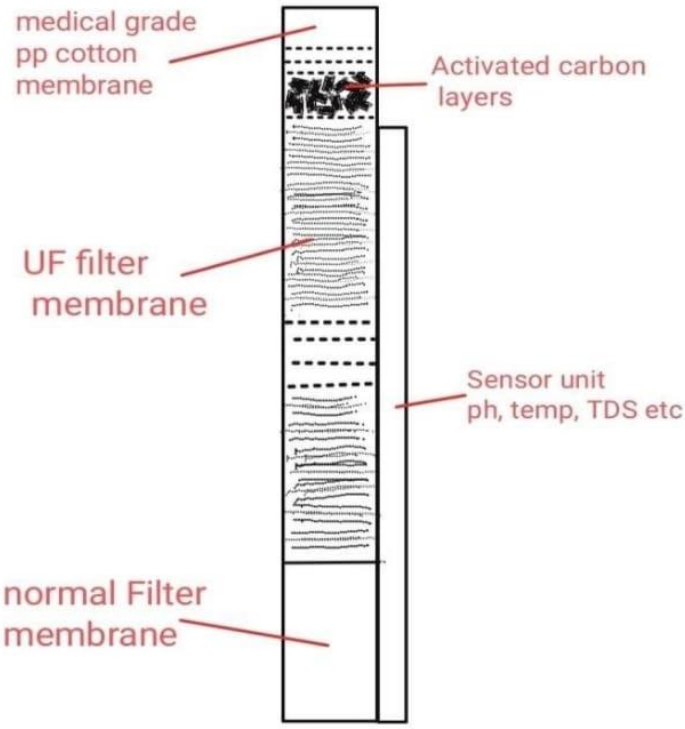



Display on the cap of water bottle is used to display water parameters and they are saved to drink or not OLED display SSD1306 controller is so versatile, the module comes in different sizes and colors, such as 128×64, 128×32, with white OLEDs, blue OLEDs, and dual-color OLEDs. The good news is that these displays are all interchangeable.

- **FILTER UNIT:**

Filter unit tube is also equipped with sensor unit which consist of Ph, TDS, temperature, turbidity sensors. Filter tube consist of activated carbon layers, UF Filter membrane (5 micron), medical grade pp cotton membrane which are used to filtration of water.

Built in active carbon and water filter core to block and filter impurity in water. It can remove harmful bacteria in water, effectively filter out parasites and other plankton in the water; remove heavy metals and prevent heavy metal poisoning. Long last effective filtration.

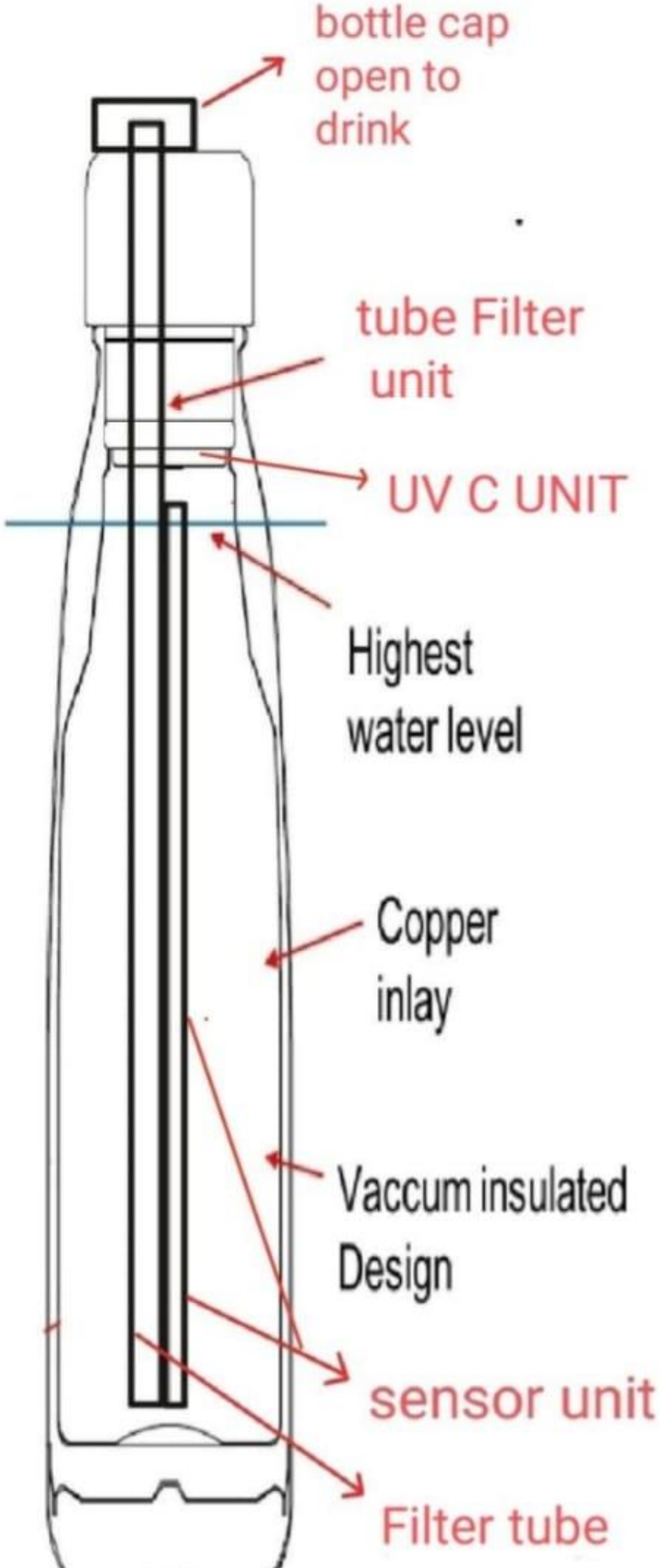


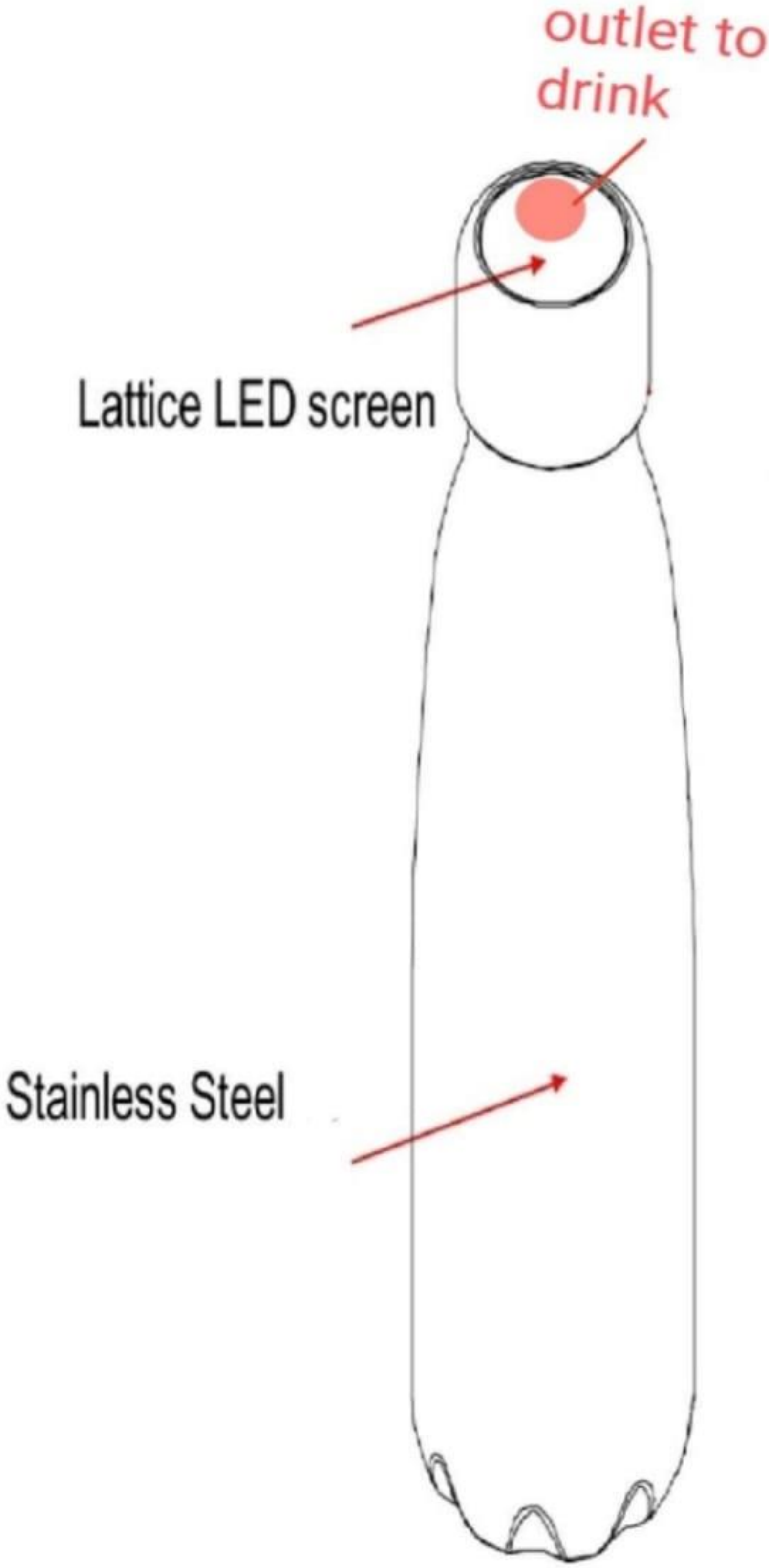
RESULT AND DISCUSSION:

No.of sample of water is tested successfully bottle is identifying the water quality(no as exact)and it will display water is safe to drink or not the same data is updated to ThingSpeak server IOT based UV C and filter tube are successfully working.

In product level design the sensors are micro sensors there is no change in bottle dimensions, volume.

PRODUCT LEVEL DESIGN:




outlet to drink
Lattice LED screen
Stainless Steel

CONCLUSION:

By this I conclude that this bottle ensures save drinking water by monitoring the water petameters & instant filtration methods in the bottle with advanced IOT features and ensure safe & clean water for healthy life.

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