SMART WATER FOUNTAINS

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Project objectives:

- Improve Hydration: Ensure that people have easy access to clean and safe drinking water by installing smart water fountains in public areas, with the aim of increasing overall hydration rates.
- Water Quality Monitoring: Implement sensors and monitoring systems to continually assess and maintain the quality of the water in the fountains, ensuring it meets safety and health standards.
- Reduce Plastic Waste: Encourage the use of refillable water bottles by providing convenient and free access to water, thereby contributing to a reduction in single-use plastic bottle consumption.
- Accessibility: Ensure that smart water fountains are accessible to people of all abilities, including individuals with disabilities, by incorporating inclusive design principles.
- Data Analysis: Collect and analyze data on water consumption patterns, fountain usage, and user feedback to optimize fountain placement and operations.
- Sustainability: Implement eco-friendly and energy-efficient features in the design and construction of smart water fountains to reduce environmental impact.

- Remote Monitoring and Maintenance: Enable remote monitoring and maintenance of the fountains to minimize downtime and ensure they are always in working order.
- User Engagement: Develop a mobile app or other engagement strategies to promote the use of smart water fountains and educate the public about the importance of hydration and reducing plastic waste.
- Cost-effectiveness: Ensure that the project is cost-effective and that the benefits of reduced plastic waste and increased hydration outweigh the initial investment.
- Public Health Promotion: Collaborate with public health agencies and organizations to promote the health benefits of staying hydrated and make the project a part of broader public health initiatives.
- Expansion and Scaling: Plan for the expansion of smart water fountains to more locations, both regionally and nationally, to maximize their impact.
- Water Conservation: Implement features to track and promote water conservation, such as low-flow dispensers and automatic shut-off mechanisms.

These objectives should provide a solid foundation for your "Smart Water Fountains" project, helping to address hydration, sustainability, and public health concerns. Be sure to tailor them to the specific needs and goals of your project and stakeholders.

Components Selection for Project Enhancement:

- ❖ Wokwi-Buzzer Reference
- ❖ ESP32
- ❖ Connecting wires
- ❖ Ultra sonic sensor HC-SR04

- ❖ LED lights
- ❖ Triggers

Wokwi-Buzzer Reference

The buzzer can operate in two modes: "smooth" (the default) and "accurate".

"smooth" sounds better and is suitable for simple, single-frequency tones. Use it when playing a melody or playing tones with Arduino's `tone()` function. Complex and polyphonic sounds may not play correctly (or not play at all) in "smooth mode"

Use the "accurate" mode when you need to play complex sounds. It will accurately play the sound you feed in. However, it'll add audible click noises to your sound. These noises are due to fluctuations in the simulation speed - it's not always able to provide the complete sound buffer in real time.

ESP32

- **Water Level Sensing**: The ESP32 can interface with water level sensors to monitor the water level in the fountain. This data can be used to determine when the fountain needs refilling or to adjust water flow.
- **Water Quality Monitoring**: You can connect water quality sensors to the ESP32 to measure parameters like pH, turbidity, or chlorine levels. This data helps ensure the water quality is safe.
- **Remote Control**: With Wi-Fi capabilities, you can remotely control the water fountain. This can be used to turn the fountain on or off, adjust water flow, or change the fountain's lighting.
- **Smart Scheduling**: The ESP32 can be programmed to follow a schedule for the fountain operation. For example, it can turn on the fountain at certain times of the day or in response to specific events.
- **Leak Detection**: The ESP32 can be connected to water leak sensors. If a leak is detected, it can send alerts or shut off the water supply to prevent damage.
- **Data Logging**: The ESP32 can log data from various sensors and send it to a cloud service or store it locally. This data can be used for analysis and maintenance.
- **User Interface**: Create a user-friendly interface for controlling the fountain using a web page or a mobile app. Users can adjust settings, check water quality, and receive alerts.

- **Integration with Other Smart Systems**: Integrate the fountain with other smart home or building systems. For example, it can turn on when someone enters a specific area.
- **Energy Efficiency**: Implement power-saving features to ensure the ESP32 consumes minimal energy, especially if your fountain is solar-powered or needs to operate in a remote area.
- **Security**: Ensure that your ESP32 is secured against unauthorized access and hacking, especially when it's connected to the internet.
- **Maintenance Alerts**: Set up the ESP32 to send maintenance alerts when components like filters or pumps need replacement or servicing.
- **Customizations**: The ESP32 allows for a high degree of customization, so you can adapt it to the specific needs and features of your smart water fountain project.

Connecting wires

- **Power Distribution**: Connection wires are used to distribute power from a power source (e.g., a battery or power supply) to the various components of the water fountain system, including pumps, sensors, and controllers.
- **Sensor Interfacing**: Wires connect sensors (e.g., water level sensors, water quality sensors) to the central microcontroller (e.g., an ESP32). These connections allow the microcontroller to receive data from the sensors and make decisions based on that data.
- **Control Signals**: Wires transmit control signals from the microcontroller to actuator components like pumps, valves, and solenoids. For example, a wire can carry a signal to turn the fountain pump on or off.
- **Data Communication**: In a networked smart system, connection wires or communication buses (e.g., I2C, SPI, UART) are used to exchange data between microcontrollers, sensors, and other devices. This enables data sharing and coordination between different parts of the system.
- **Remote Control**: Wires or wireless modules (like RF transceivers or Wi-Fi modules) can be used to establish communication between the water fountain system and a remote control interface, such as a mobile app or a web-based dashboard.
- **Power Management**: Some components may require different voltage levels, so voltage regulators and wires are used to manage and step down power to the appropriate levels for those components.
- **Safety Features**: Wires can connect safety features like emergency shutoff switches, which can quickly disconnect power in case of an issue.
- **LED Lighting**: If your fountain includes LED lighting, connection wires are used to power and control the LEDs, allowing you to change colors, patterns, or brightness.

- **Weatherproofing**: In outdoor installations, waterproof and weather-resistant wires may be necessary to ensure the system's reliability in various weather conditions.
- **Circuit Assembly**: During the construction of the electrical circuit, wires are used to connect components on a circuit board or within the system's enclosure.

Ultra sonic sensor HC-SR04

- **Water Level Monitoring**: Use the ultrasonic sensor to measure the water level in the fountain's reservoir. This information can be crucial for determining when the fountain needs refilling and preventing the pump from running dry.
- **Water Depth Control**: By continuously monitoring water levels, the sensor can help control the depth of the water in the fountain. You can program the system to maintain a certain water level for aesthetic and functional purposes.
- **Overflow Prevention**: Set up the ultrasonic sensor to detect when the water level is approaching overflow conditions. If the water level rises too high, the system can trigger an alert or automatically shut off the water source to prevent overflowing.
- **Leak Detection**: Ultrasonic sensors can also be used to detect water leaks. If the sensor detects a sudden drop in the water level that is not in line with normal operation, it can trigger a leak alert.
- **Energy Efficiency**: Implement energy-saving features by using the ultrasonic sensor to adjust the water flow rate or turn off the fountain when the water level is sufficient, reducing energy consumption.
- **Water Quality Control**: Monitor the water quality by placing the ultrasonic sensor at a specific depth in the fountain. If the sensor detects that the water quality has deteriorated, it can trigger an alert or water treatment process.
- **Obstacle Avoidance**: In interactive fountains, ultrasonic sensors can detect the presence of people or objects near the fountain, allowing it to react accordingly. For instance, it can change its water display or turn off temporarily to avoid collisions.
- **User Interaction**: Use the ultrasonic sensor for user interaction. When a person approaches the fountain, the sensor can trigger a responsive action, such as activating a light show or specific water patterns.
- **Aesthetic Adjustments**: Depending on the distance measured by the ultrasonic sensor, you can change the water display to create different water patterns and visual effects.
- **Water Conservation**: Control water usage based on the water level. The fountain can adjust water flow rates or even turn off during periods of low water availability.
- **Data Logging**: Record water level data over time, allowing you to analyze water consumption patterns and optimize the operation of the fountain.
- **Integration with Control Systems**: Integrate the ultrasonic sensor data with the central control system, which can include microcontrollers like an ESP32, to make real-time decisions about water flow and operation.

LED light

- **Illumination**: LEDs provide various lighting options to enhance the visual appeal of the water fountain. They can be programmed to create colorful, dynamic lighting effects, making the fountain more attractive, especially during nighttime.
- **Color Changing**: RGB LEDs can change colors, creating vibrant and eye-catching displays. You can synchronize the LED colors with music or set them to change gradually for a mesmerizing effect.
- **Water Patterns**: LEDs can be synchronized with the water display to create harmonious patterns and effects. For example, they can change colors in coordination with different water jets or patterns.
- **Mood Enhancement**: Adjustable LED lighting allows you to set the ambiance of the surrounding area, making it suitable for different events, moods, or occasions.
- **Energy Efficiency**: LEDs are energy-efficient and have a longer lifespan than traditional lighting, contributing to lower energy costs and reduced maintenance.
- **Automation**: Integrate LEDs with sensors and triggers to adjust lighting based on factors such as user presence or ambient light conditions.
- **Visual Feedback**: Use LEDs to provide visual feedback to users or operators, such as indicating the fountain's operational status, water quality, or maintenance needs.
- **Weather Resistant**: Waterproof or weather-resistant LED fixtures are suitable for outdoor fountains, ensuring durability in various weather conditions.
- **Customization**: LEDs offer flexibility in terms of color, intensity, and patterns, allowing for customization to match the fountain's design and the overall ambiance.
- **Safety**: Illuminating pathways or steps around the fountain enhances safety during nighttime, preventing accidents.
- **Attractiveness**: LED lighting can make the fountain a focal point, attracting attention and creating a captivating visual experience.
- **Remote Control**: LEDs can be controlled remotely, allowing you to adjust lighting from a mobile app or a centralized control system, adding convenience and versatility.

Triggers

Water Level Triggers:

Low Water Level: Triggers can be set to activate when the water level in the fountain is low, signaling the need for refilling.

High Water Level: Triggers can activate when the water level is too high to prevent overflow.

Water Quality Triggers:

Poor Water Quality: Triggers can be set to respond to deteriorating water quality by activating a water treatment system or sending alerts.

Optimal Water Quality: Triggers can deactivate water treatment systems when the water quality meets the desired standards.

User Interaction Triggers:

Proximity Sensors: Triggers can be used to respond to the presence of users or objects near the fountain. For example, the fountain can start a light show or water display when someone approaches.

User Input: Buttons or touchscreens can serve as triggers, allowing users to control the fountain's operation or change its patterns.

Scheduled Operation:

Set time-based triggers to control when the fountain should be active, such as turning on at specific times of the day or for special events.

Create seasonal triggers to adapt the fountain's operation to changing weather conditions.

Weather Triggers:

Connect weather sensors to triggers to respond to weather conditions. For example, the fountain can be turned off during rain or high winds to conserve water and protect the equipment.

Energy Efficiency:

Set triggers to activate energy-saving modes when certain conditions are met. For instance, the fountain could reduce water flow or turn off during off-peak hours.

Emergency Triggers:

Use emergency triggers for immediate fountain shutdown in the event of a safety concern or system malfunction.

Leak Detection:

Triggers can activate in response to water level drops that exceed normal operational fluctuations, signaling a potential leak in the system.

Data Logging and Reporting:

Triggers can initiate data logging and reporting processes, recording specific events or conditions for analysis and maintenance records.

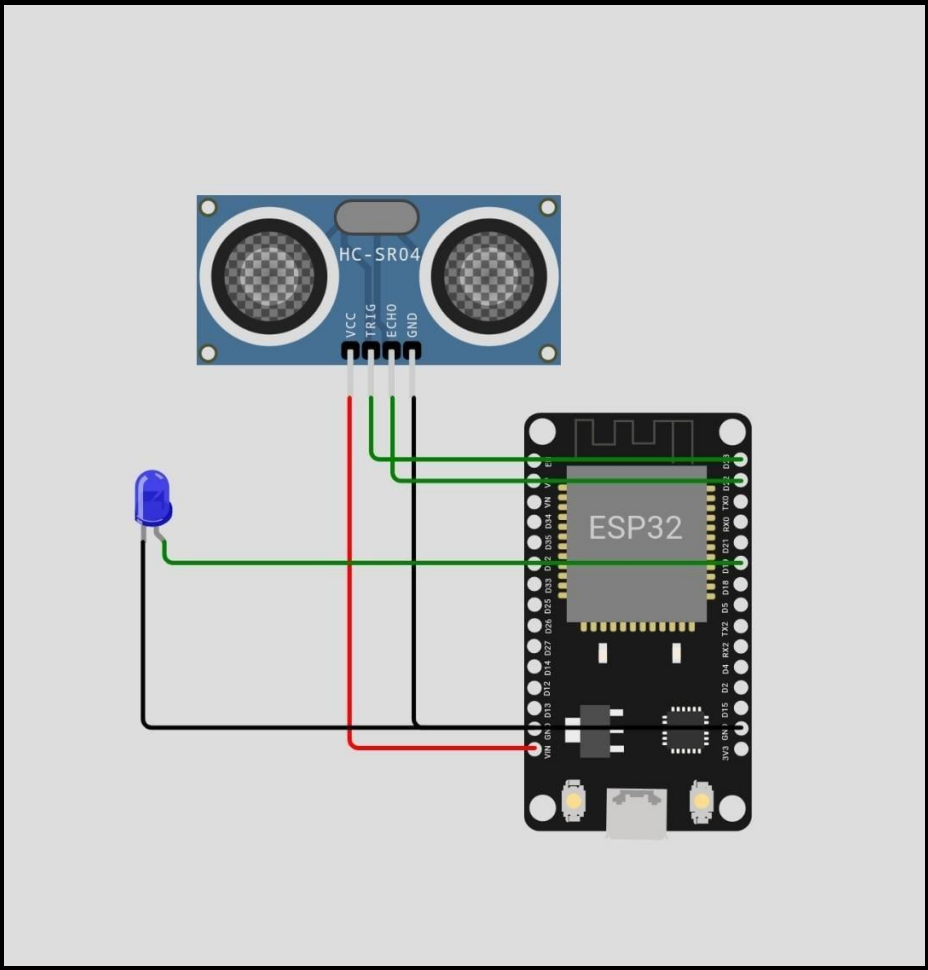
Cloud server

For sending the parking place status data to mobile app we use cloud server. For our project we choose Think speak cloud to send the information which is free for use

For using Thinkspeak we must first have a account in the server to have the cloud server for use.We can setup our channel in cloud as public to update the details about the parking spaces .

Now people can use the data about parking slot in the public tab using Thinkspeak cloud server.

Circuit diagram



Python code

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Smart water fountains

Designed by Tharshini.S

```
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\*
  import time   # Import the time module for
  time delays

  # Define GPIO pin numbers
  TRIG_PIN = 2  # GPIO pin number for the
  ultrasonic sensor's trigger
  ECHO_PIN = 3  # GPIO pin number for the
  ultrasonic sensor's echo
  PUMP_PIN = 4  # GPIO pin number for the
  water pump
  LED_PIN = 5   # GPIO pin number for the
  LED


  # Initialize components (virtual
  components for Wokwi)
  ultrasonic_sensor = Ultrasonic(TRIG_PIN,
  ECHO_PIN) # Create an ultrasonic sensor
  pump = Motor(PUMP_PIN)  # Create a water
  pump
  led = LED(LED_PIN)  # Create an LED


  while True:
      # Measure distance
    distance = ultrasonic_sensor.distance_cm
  # Measure distance in centimeters


      if distance > 200:  # Water level is
  above 200 cm
```

```
        # Make the LED blink
        led.blink(on_time=0.5,
off_time=0.5)  # LED blinks with 0.5
seconds on and off time
        pump.on()  # Water pump is turned
on
    else:
        # Water level is below 200 cm
        # Turn off the LED and the pump
        led.off()
        pump.off()


    # Introduce a small delay to control
the loop rate
    time.sleep(0.1)  # Sleep for 0.1
seconds
```