Juni Khyat
(UGC Care Group I Listed Journal) ISSN: 2278-4632
Vol-14 Issue-02 Aug 2024

IOT BASED SMART WATER BOTTLE

Gummula Ravi[1], Kasanagottu Srinivas[2] ,V.Santhosh Kumar[3] Santosh Kumar Kulkarni[4].

[1, 2, 3, 4] Assistant Professor, Department of Electronics and Communication Engineering, St. Peters Engineering College, Hyderabad, India

Abstract: *Water is the essence of life, and maintaining adequate hydration is crucial for the proper functioning of the human body. However, with busy schedules and numerous distractions, it can be challenging for people to remember to drink enough water. To foster a healthy hydration habit, it is important to monitor daily water intake. The Smart Interactive Water Bottle concept merges technology with the fundamental health need of proper hydration. By utilizing sensors and IoT capabilities, this device provides users with valuable insights into their water consumption patterns and reminds them to drink water. Such a tool is especially beneficial for individuals with busy lifestyles who need assistance in staying hydrated. The device tracks daily water intake, the average amount consumed, the last time water was consumed, and sends reminders to the user. Additionally, the Adafruit IO platform, an IoT-based solution, is employed to monitor and help users analyse their hydration habits.*

Keywords: Hydration Tracking, Level Detection Monitoring, Temperature Monitoring, Water Quality Sensors, Solar Charging Technology, Bottle Locator, Mobile App Integration.

I. INTRODUCTION

Water is essential for life, playing a vital role in the proper functioning of human organs. Despite its importance, busy schedules and constant distractions often lead people to forget to drink enough water. Research involving professionals and university students under 50 years old indicates that over 70% of participants frequently forget to stay hydrated due to their busy lifestyles [1]. To foster healthy hydration habits, it is essential to track daily water intake. The IoT-based Smart Water Bottle addresses this need by helping users maintain adequate and controlled water consumption.

The IoT-enabled Smart Water Bottle allows users to monitor their daily water intake and keep track of the time since their last drink. It also sends reminders to drink water and prompts users to refill the bottle when necessary. This smart bottle is designed to assist users in analysing and improving their hydration habits.

An IoT-based smart water bottle incorporates advanced technology to provide various features and functionalities for better water intake monitoring. These smart bottles help individuals stay hydrated and effectively manage their daily water consumption. Key features and components commonly found in IoT-based smart water bottles include:

1. **Water Intake Monitoring**: These bottles have sensors that track the amount of water consumed by the user, transmitting this data to a mobile app or cloud-based platform for real-time monitoring [2].
2. **Mobile App Integration**: A dedicated mobile app allows users to set hydration goals, view their water intake history, and receive regular reminders to drink water. The app may also offer insights and recommendations based on the user's hydration patterns [3].
3. **Hydration Reminders**: The smart water bottle can be programmed to send notifications to the user's smartphone or smartwatch, reminding them when it's time to drink more water [4].
4. **Leak Detection**: Some smart bottles feature leak detection sensors that alert users if the bottle is not properly sealed, helping to prevent spills and water wastage [5].
5. **Temperature Control**: Certain smart bottles can maintain the desired temperature of the water, keeping it cold or hot for extended periods, ensuring the user enjoys their preferred water temperature [6].
6. **UV-C Sterilization**: Equipped with UV-C light technology, some smart bottles can sterilize the water, ensuring it is safe to drink.

7. **Connectivity**: These bottles connect to the user's smartphone via Bluetooth or Wi-Fi, allowing for real-time data synchronization and remote control through a mobile app.
8. **Battery and Charging**: Smart water bottles typically come with rechargeable batteries that can be charged via USB or wireless charging.
9. **Material and Design**: Designed for durability and eco-friendliness, smart bottles are often made from materials like stainless steel or BPA-free plastic. They may also feature a smart cap or lid with a display for easy access to information.
10. **Social and Gamification Features**: Some smart bottles include social elements, enabling users to share hydration progress with friends, participate in hydration challenges, and gamify the hydration process to make it more engaging.
11. **Integration with Health and Fitness Apps**: These bottles may sync with health and fitness tracking apps like Fitbit, Apple Health, or Google Fit, providing a comprehensive view of the user's overall well-being.
12. **Water Quality Monitoring**: In addition to tracking water consumption, some smart bottles can monitor water quality, checking for impurities and notifying users if the water is unsafe to drink.

IoT-based smart water bottles represent a growing trend in smart devices designed to improve various aspects of daily life through data collection, connectivity, and automation. These bottles can be particularly useful for health-conscious individuals.

II. LITERATURE SURVEY

1. **Hydration Reminding Smart Bottle: IoT Experimentation** Dr. P.B. Pankajavalli, Mr. R. Saikumar, and Mr. R. Maheswaran proposed a smart water bottle that reminds users to drink water at regular intervals, preventing dehydration. The bottle features a Water Float Sensor that detects water levels as low or high. An RS232 chip determines the type of communication and instructs the GSM modem, which provides voice and data services to communicate with a mobile device. Users receive SMS notifications reminding them to drink water. The proposed model operates on 5V power.
2. **IoT-Based Smart Water Bottle** J Laxmi Lahari proposed a smart water bottle that helps users track their water consumption. The bottle reminds users to refill it and assists them in improving their hydration habits. An ultrasonic detector inside the leak-proof cap measures water levels, with the data displayed on Adafruit IO feeds. The buzzer rings when the bottle is empty and stops once refilled. It also reminds users to drink water if they haven't for over two hours, promoting a healthy lifestyle.
3. **A Self-Monitoring Water Bottle for Tracking Liquid Intake** Bo Dong, Ryan Gallant, and Subir Biswas developed a water bottle that emphasizes regular water intake, crucial for the normal functioning of the human body. They designed a band and attachment that can be affixed to any standard water bottle, converting it into a smart bottle capable of tracking the user’s fluid intake. This Bluetooth-based device transmits data about the user’s drinking habits to their smartphones and sends reminders if the intake is low.
4. **GROW: A Water Bottle that Uses its Surface as a Display to Motivate Water Intake** Gul Kaner, Deniz Erdogan, and Huseyin Ugur Genc created a smart water bottle called "GROW" to encourage users to drink water. Recognizing that water is essential for the human body, they developed this bottle to help people meet their daily hydration needs despite their busy schedules. The bottle features a liquid level sensor and uses its surface as an ambient display to monitor daily water consumption.
5. **Accuracy of Daily Fluid Intake Measurements Using a “Smart” Water Bottle** Borofsky MS and colleagues developed a water bottle that measures fluid intake, particularly beneficial for individuals prone to kidney stones, who require high fluid intake. This bottle uses touch sensors to measure water levels and allows users to view their daily intake data via a smartphone app. A two-week survey was conducted to evaluate the bottle's effectiveness, showing it to be accurate within a 3% range.

6. **Healthcare Services and a Water Bottle for Senior Citizens** Nam Eui Lee, Tae Hwa Lee, Seo Dong Heui, and Sung Yeon Kim designed a smart water bottle aimed at providing healthcare services to the elderly. Older adults often experience a slowdown in central nervous functions, leading to inadequate water intake. Their study revealed that 75% of respondents did not feel thirsty regularly, and 47% drank water intentionally for health reasons even when not thirsty.

III. COMPONENTS DESCRIPTION

A. NodeMCU – ESP8266: NodeMCU is an IoT-focused open-source Lua-based firmware and development board. It includes software for the ESP8266 Wi-Fi SoC from Espressif Systems and hardware for the ESP-12 board. The firmware is based on the eLua project and built with the Espressif Non-OS SDK for ESP8266.

B. Water-Resistant Ultrasonic Sensor: Ultrasonic sensors measure distances by calculating the time interval between sending and receiving ultrasonic pulses. The ME007YS is a water-resistant ultrasonic sensor module with a range of up to 4.5 meters, operating on a 5V power supply and communicating via UART.

C. Adafruit IO: Adafruit IO is a cloud service provided by Adafruit Industries Ltd, designed for storing data and controlling devices via commands sent over the internet. It offers real-time data visualization and integration with other online services.

D. Piezo Buzzer: A piezo buzzer is an electronic device that produces tones, alarms, or sounds. It is a cost-effective, lightweight component used for generating alerts and providing audible feedback.

E. Power Supply: The NodeMCU can be powered via USB or an external source. External power should range from 6 to 20 volts, with a recommended range of 7 to 12 volts.

IV. WORKING

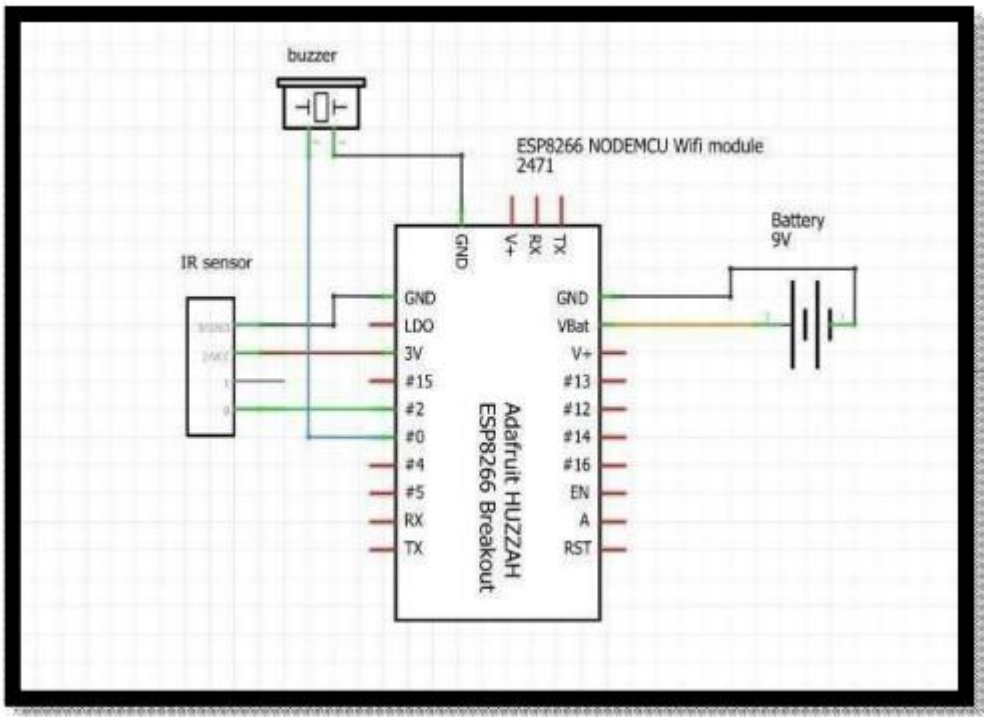

Fig.4.1 Circuit Diagram.

In Figure 4.1 the NodeMCU is connected to the waterproof ultrasonic sensor, which has four pins: VCC, Trig (signal output pin), Echo (signal input pin), and GND. The GND pin of the Ultrasonic Sensor is connected to the

GND of the NodeMCU, and the VCC pin is connected to the Vin of the NodeMCU. The data pins, Echo and Trig, are connected to D1 and D2 (digital pins) of the NodeMCU, respectively.

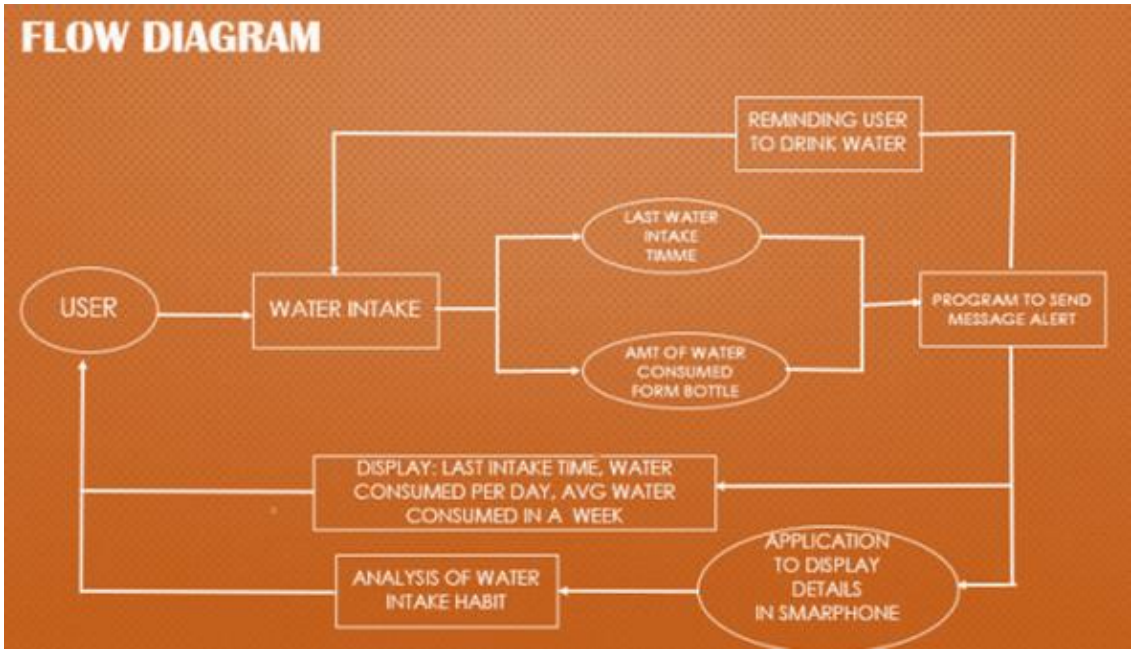

Fig.4.2 Flow Diagram

The piezo buzzer has two pins: positive and negative. The positive pin is connected to the D5 pin of the NodeMCU, and the negative pin is connected to the GND pin of the NodeMCU. A 9V battery provides power, with its positive and negative terminals connected to the Vin (Vbat) and GND of the NodeMCU, respectively. The software code is uploaded to the NodeMCU using the Arduino IDE.

The waterproof ultrasonic sensor is installed into the bottle cap using a cement gun. Once the cap is secured to the bottle, the setup is complete. The bottle begins reading the water level inside using the ultrasonic sensor. These values are processed by the program uploaded to the NodeMCU, and the relevant data is displayed on the serial monitor in the Arduino IDE. The project outcomes are then reflected in the Adafruit IO feeds. The Flow Diagram of smart water bottle shown in Figure 4.2.

Whenever the water level in the bottle changes, the data is updated in real-time on the Adafruit IO dashboard using graphs and values. When the water level drops to zero, the buzzer activates, alerting the user to refill the bottle. The buzzer will continue to sound until the bottle is refilled. Additionally, if the user does not consume water for an extended period (set to 2 hours in the program), the buzzer will remind the user to drink water. The Adafruit IO Dashboard is shown in Figure 4.3.

Fig 4.3 Adafruit IO Dashboard

V. CONCLUSION

The smart water bottle offers a practical solution for tracking water consumption and ensuring proper hydration. It provides users with valuable insights into their water intake habits and offers reminders and alerts to maintain healthy hydration levels. This innovative concept combines technology with health management, addressing the social need for better hydration practices. Such a product can significantly benefit individuals committed to leading a healthier lifestyle by promoting balanced water consumption.

VI. FUTURE SCOPE

The smart water bottle could be integrated with other health management apps to utilize the collected data for a comprehensive health assessment. Future enhancements could include incorporating user-specific inputs such as age, weight, and gender, as well as monitoring environmental factors like temperature and humidity. This would enable the system to provide personalized hydration recommendations and set daily water consumption goals, further improving the user's overall health and wellness.

References

1. Pankajavalli, P. B., Saikumar, R., & Maheswaran, R. (Year). Hydration reminding smart bottle: IoT experimentation.
2. Lahari, J. L. (Year). IoT-based smart water bottle.
3. Dong, B., Gallant, R., & Biswas, S. (Year). A self-monitoring water bottle for tracking liquid intake.
4. Kaner, G., Erdogan, D., & Genc, H. U. (Year). GROW: A water bottle that uses its surface as a display to motivate water intake.
5. Borofsky, M. S., et al. (Year). Accuracy of daily fluid intake measurements using a “smart” water bottle.
6. Lee, N. E., Lee, T. H., Heui, S. D., & Kim, S. Y. (Year). Healthcare services and a water bottle for senior citizens.