2022 13th International Conference on Computing Communication and Networking Technologies (ICCCNT) | 978-1-6654-5262-5/22/$31.00 ©2022 IEEE | DOI: 10.1109/ICCCNT54827.2022.9984544

HydrationCheck : An IOT based smart water bottle

Rahulkrishnan Ravindran[1], Radhika Ravindran[2] and Anjali T[3]

[1,3] Department of Computer Science and Engineering, Amrita School of Engineering,
Amrita Vishwa Vidyapeetham, Amritapuri, India.

[2] Department of Engineering Science (Data Science), State University of New York,
University at Buffalo, USA

***Abstract* — Water is the driving force of all nature, it accounts for about one half to two thirds of an average person's weight thereby making it essential for a human being to maintain the right amount of water intake throughout the day to protect oneself from dehydration. In the post-pandemic period, everyone has accustomed themselves to the work from home culture which keeps one occupied, and the heavy workload makes it difficult to prioritize health. Hence, it becomes tough for an individual to keep track of one's daily fluid intake. To serve this purpose, HyderationCheck, an IoT based smart water bottle will come to the rescue. This smart water bottle will allow the user to track their daily amount of fluid intake, average amount of fluid consumption in a day, last time of fluid intake and also notify the user reminding them to fulfill their daily fluid consumption goal, the user will be reminded to drink water every two hours by a notification message, which will be sent over email utilizing the SMTP protocol, which enables free email delivery.**

Index Terms*—Ultrasonic range sensor, ESP-32 wifi and bluetooth enabled Module, DS 1307 RTC (Real-Time Clock) Chip, IoT Cloud, SMTP(Simple Mail Transfer Protocol).

I. INTRODUCTION

"Drink your way to better health, Drink water!" goes the quote. The mental and physical disruption caused by the covid pandemic is devastating. It has caused a lot of disruption to people's health in the current setup involving work from home. This has contributed to the deprioritization of an individual's health, as a consequence of which numerous people have unfortunately got myriad ailments. It is likely that due to this post-pandemic culture there will be more such cases in the days to come. Hence, keeping a regular track of our health by improving our eating habits along with regular fluid intake has become all the more crucial in the current situation.

For this project the components used will enable to make this build a sophisticated yet a feasible one, the IoT based smart water [1] bottle uses an ESP-32 module which is a series of low-cost, low-power system on a chip microcontrollers with integrated Wi-Fi and dual-mode Bluetooth which allows the smart water bottle to collect raw information in the form of data and send it to the arduino based IoT cloud dashboard which allows the user to look at the processed information, the ultrasonic range sensor or displacement sensor calculates and measures the amount of fluid that the smart water bottle holds and also the amount of water that has been consumed by the user, and the DS 1307 RTC (Real-Time Clock) chip is a battery-powered clock that is included in a microchip which uses minimal amount of power from the Li ion battery to gather and tabulate the time of water intake [2], it also has the ability to collect this information when the device is in sleep mode, the device is also set up with SMTP protocol which is programmed to notify the user when it is time to consume water. The principal objective of this smart water bottle is that it allows the user to monitor the amount of water consumed by them, it reminds the user by notifying them timely to drink water, and it calculates the average intake of water in a day, week and month.

II. RELATED WORKS

The idea of monitoring devices and applications have been around for decades, but the incorporation of personal health with such monitoring devices has made it easier for oneself to take care of their own health. "Smart water level monitoring and management system using IoT", [3] have developed a similar system which uses the waterproof ultrasonic sensor module[4][5]. This device works in a similar fashion and also helps in keeping track of the daily, weekly and monthly water intake values and their averages via the various graphs and widgets on the IoT cloud platform. In the IoT based smart connected campus model developed with the paper titled "Smart connected campus" which used microcontroller such as ESP or Arduino has appended controls and monitoring functions to it, the application also used in their project uses an IoT specific platform to create a mobile application with widgets like gauges, percentage meters, on and off switches etc which allows it to be easier for the user to access [6]. A similar project, "Iot based water parameter monitoring system", with an outdated and bulkier microcontroller module GSM (Global System for Mobile communication) which allows transcending data in the form of messages to a mobile phone whereas the main application processor's communication stack overhead is decreased by the ability of the ESP32 to operate as a fully independent system or as a slave device to a host MCU. Wi-Fi and Bluetooth capability can be provided by ESP32 by interacting with other systems; this integration of WIFI and Bluetooth enables the device to communicate with the application at a better and faster pace [7].

III. METHODOLOGY

- This Iot based Smart Water Bottle pops in notifications as reminders to the user for the consumption of water in order to fulfill their daily water intake.
- There is a mobile based application's dashboard that provides the user to access all the information they require with a clear and straightforward view of all the functionalities in one location.
- The user is required to charge the bottle and fill it with water after which the smart water bottle will keep track over the amount of water intake.
- The user can go through all the information not only via the screen that is provided on the bottle but also through the mobile phone based application that will allow them to keep track of all their information.
- The user may add/remove the notification option which reminds them to consume water and their medicines.
- There is also an inbuilt DS 1307 RTC module provided so that it is easier for the user to check everything from their last water consumption time and date in a day to their monthly average water intake, Thereby making this smart water bottle a one-stop solution that caters for all of the user's needs.

IV. PROPOSED SYSTEM

Water consumption in the right amount is vital for any individual. Due to the busy and stressful lifestyle, one tends to neglect their health and fluid intake which is one of criterias affecting the health of an individual. This Smart water bottle gives timely reminders to the user every 2 hours to consume water and also provides them with statistics in the form of a message consisting of the user's daily water intake, daily average, and also alerts the user in case the water level goes below a specific set threshold. The functioning can be seen via the flowchart in Fig.1. Other than monitoring the level of water the bottle holds the water bottle also does a broad category of functions such as:

- Monitoring of water intake by the user.
- Average water consumption in a day, week and a month.
- Tracking the previous time of water consumption.

The above mentioned functions are incorporated and implemented in the smart water bottle using the DS 1307 RTC module which consolidates with the programed code to keep track of all the details such as the last time of water intake, the no of times the user has consumed water in a day, Unlike the other components used for building the smart water bottle the DS 1307 RTC does not require a battery backup as it already is incorporated with a 3v battery backup which allows it to function even without a secondary power source.

The power button has been coded with a one button library which allows the user to access the different information the smart water bottle provides, just with the help of a single button where a long press is used to wake the device from sleep mode and two clicks is to find the daily average water consumption.

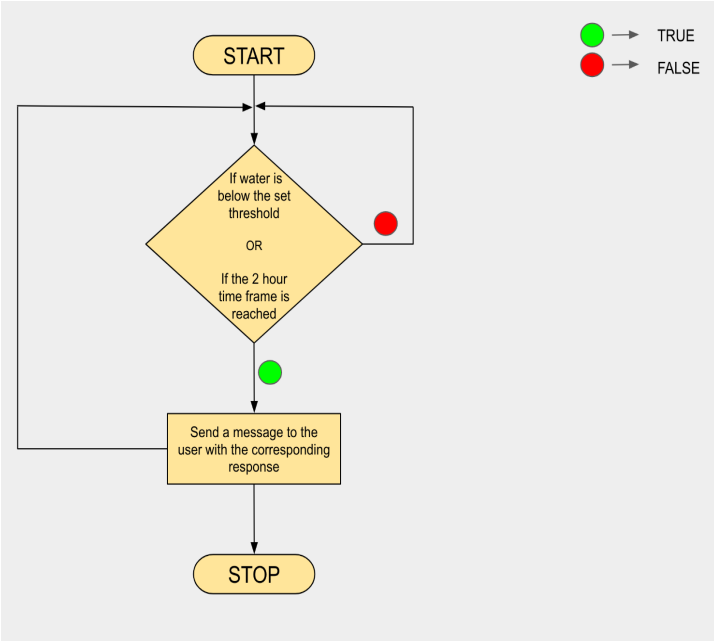

Fig.1. The flow of logic

Once the smart water bottle is refilled with water the ultrasonic range sensor[8][9] will calculate the level of water that is filled in the water bottle and will send a signal to the DS 1307 RTC module which will then store the date and time when the bottle was refilled, when the water in the smart water bottle depletes then a signal will be again sent from the ultrasonic range sensor to the ESP32 WiFi and Bluetooth enabled module which will then trigger a message using the SMTP [10] (simple mail transfer protocol) to the users mobile device which will pop as a notification on the users phone reminding them to refill water along with giving the user the vital information such as the amount of water that is left back in the smart water bottle and also the reminder to drink water every two hours.

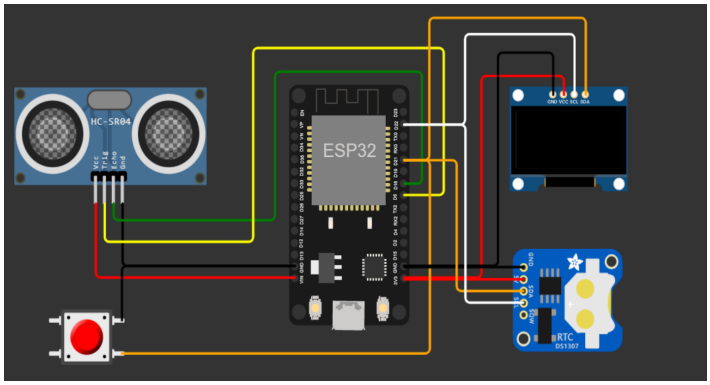

Fig.2. Circuit diagram

In the following arrangement, we have a collection of input, output, and processing components that work well together to make the smart water bottle function effectively. In the above circuit diagram we can see the precise layout of the components with the ESP 32 WiFi and Bluetooth enabled module.

Ultrasonic range sensor and push button make up the input components, while a 0.96-inch OLED display and the DS 1307 RTC module, which saves the information about the water intake time, make up the output components.

V. ADVANTAGES

- This smart bottle allows the user to record their daily water intake.
- It also helps to keep track of an individual's health by giving timely reminders for the intake of water.
- Users can easily carry it around since it is lightweight and very much affordable.
- Users can get statistics of their daily water intake, alongside their average water intake during the day.
- This smart water bottle also alerts the users to refill the water bottle in case the set minimal threshold is reached.

VI. RESULTS AND OUTCOME

This IoT based smart water bottle makes it a lot easier for the user to track one's daily water intake and to ensure we have sufficient water that is required for an individual. A striking feature of this product is that it provides the user with a message containing the amount of water consumed by them alongside their daily average and the water left in the bottle. Apart from providing statistics it also proves to be a vital tool by giving the user a reminder every two hours for water intake. It is a very compact, user friendly and cost efficient product and proves to be an asset when it comes to taking care of an individual's health.

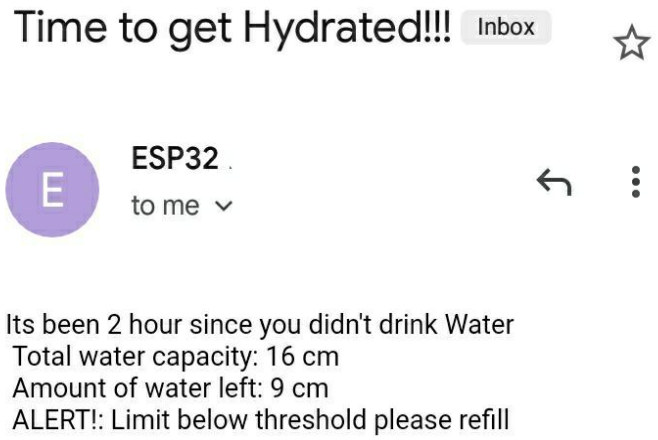

Fig.3. Email notification

In this figure we see that an alert is given to the user either as a reminder to drink water every two hours or in the event that the bottle has to be refilled when the water level drops below a predetermined level. Since it had been more than two hours and the container had a total capacity of 16 cm, an automated email message flashed up with the necessary details like the container's total capacity, present capacity, and whether or not the water bottle needed to be replenished.

When the water in the bottle has gone below a certain set threshold which in this case is "10 cm" the ESP32 module automatically triggers an alert message by sending an email to the user notifying them to refill the water bottle, Other than this the microcontroller (ESP32) also notifies the user by sending an email every 2 hours to drink water.

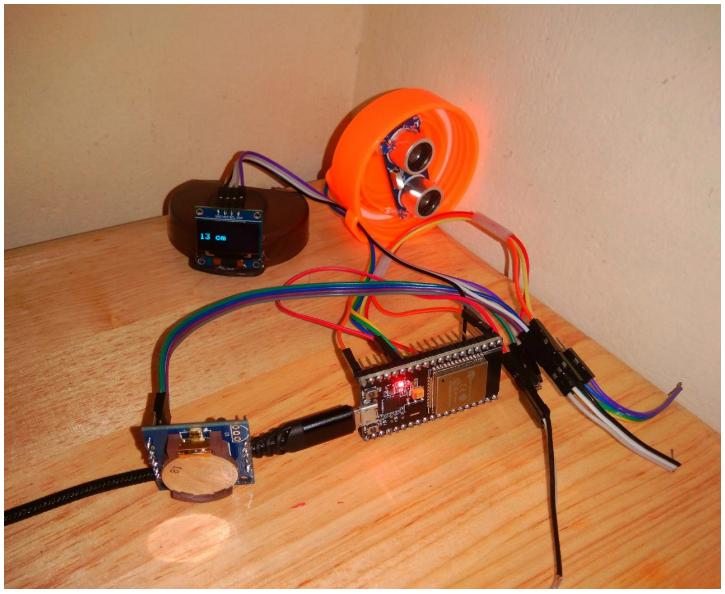

Fig.4. Hardware setup

The above figure shows the hardware components which are ESP32 microcontroller module, DS 1307 RTC module, the ultrasonic range sensor, oled display-0.96 inch I2C interface, and a multipurpose push button or a power button that enables user access to the data on the Oled screen. These are the hardware elements utilized to make this smart water bottle.

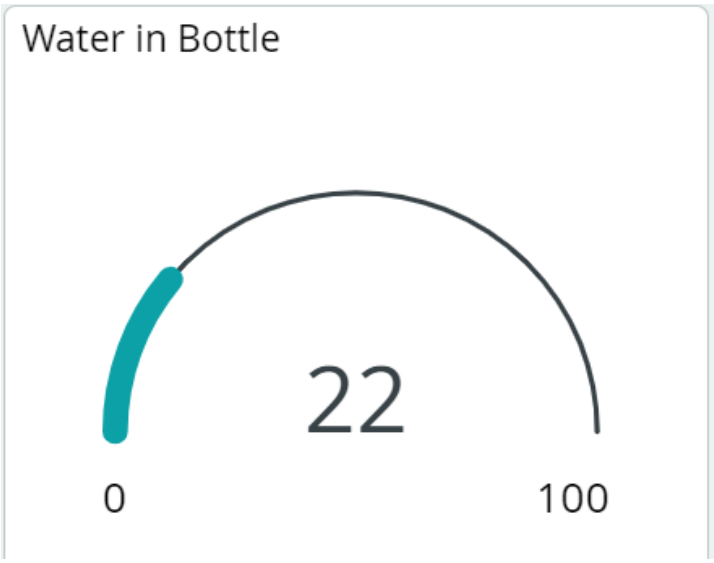

Fig.5. Meter gauge representing the water quantity in terms of percentage.

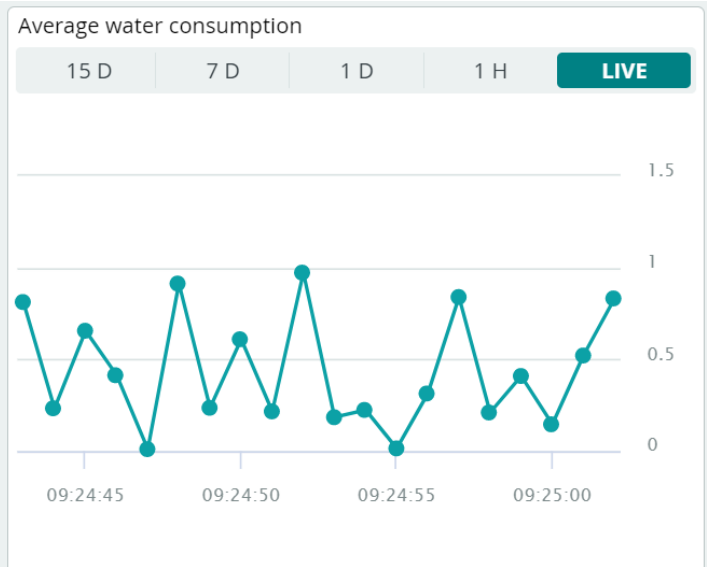

Fig.6. Graph showing average water consumption across the timeline

The average amount of fluid intake or consumption is depicted in the data graph above by adding up the number of times the user has replenished their smart water bottle with water and the remaining volume.The fluid intake rate for each day is also taken into account for a week and a month, and then the week's number of days is divided by seven, respectively for the month.

VII. CONCLUSION

“Health is Wealth”, As the saying goes very well, one must take their health as a matter of principal importance. Due to the new norms of work from home culture being introduced post covid, people have less exposure to sunlight, their movements have minimized and needless to say about the water intake which has reduced drastically. To monitor their water intake so as to keep them away from various deficiencies or diseases like kidney stones due to the presence of uremic toxins which could occur otherwise[11], our product - “HyderationCheck” comes to the rescue. It not only provides the user with the statistics of their daily amount of water intake and daily average, but also nudges the user with reminders on drinking water every 2 hours. Thus, this product provides the user with a meticulous way of managing their water intake which one tends to forget.

This smart bottle is IOT enabled thanks to the esp32 module, which also permits the user to view the information related to fluid consumption on the 0.96 inch OLED display on his mobile handset. In earlier renderings of the same project, a microprocessor module based on Arduino was used to collect the raw data and process it before projecting it on the cathode 4 digit 7 segment display.

VIII. FUTURE SCOPE

The Microcontroller(ESP32) receives the sensor information and displays it. The future scope of this endeavor will also include water quality analysis [12] using components and modules like the TDS (Total Dissolved Solids) meter which allows to check the hardness level of the water in the form of ppm(parts per million, a Ph sensor could also be incorporated in the smart water bottle making it easier to assess the acidic or alkaline properties of the water[13].Water analysis can calculate the water quality index based on the existing criteria [14] for the water. Communication technologies may see improvements in the future. As a software interface, several communication technologies can be implemented, and the application can choose from the communication channels based on specific situations[15].

IX. REFERENCE

[1] Perera, C., and C. Harold. "Member, L., Jayawardena, S.: The emerging internet of things marketplace from an industrial perspective: a survey." *IEEE Trans. Emerg. Top. Comput* 3, no. 4: 585-598.

[2] World Health Organization. "Maldives green climate-smart hospitals: hospital vulnerability analysis and report." (2018).

[3] Praveen, Anagha, R. Radhika, D. Sidharth, Sreehari Ambat, and T. Anjali. "Smart water level monitoring and management system using IoT." In *2021 6th International Conference on Communication and Electronics Systems (ICCES)*, pp. 482-487. IEEE, 2021.

[4] Narendran, Sreekanth, Preeja Pradeep, and Maneesha Vinodini Ramesh. "An Internet of Things (IoT) based sustainable water management." In *2017 IEEE global humanitarian technology conference (GHTC)*, pp. 1-6. IEEE, 2017.

[5] Praveen, Anagha, R. Radhika, M. U. Rammohan, D. Sidharth, Sreehari Ambat, and T. Anjali. "IoT based Smart Bin: A Swachh-Bharat Initiative." In *2020 International Conference on Electronics and Sustainable Communication Systems (ICESC)*, pp. 783-786. IEEE, 2020.

[6] Narendrakumar, Thota, and Anju S. Pillai. "Smart connected campus." In *2017 International Conference on Intelligent Computing, Instrumentation and Control Technologies (ICICICT)*, pp. 1591-1596. IEEE, 2017.

[7] Krishna, S., T. V. Sarath, M. S. Kumaraswamy, and Vishnu Nair. "Iot based water parameter monitoring system." In *2020 5th International Conference on Communication and Electronics Systems (ICCES)*, pp. 1299-1303. IEEE, 2020.

[8] Khan, Sadeque Reza, Alvir Kabir, and Dilshad Ara Hossain. "Designing smart multipurpose digital clock using real time clock (RTC) and PIC microcontroller." *International Journal of Computer Applications* 41, no. 9 (2012): 40-42.

[9] Reddy, V. Sai Nikhil, S. Pavan Kumar, B. Venkat, and J. Swetha Priyanka. "IoT based social distance checking robot using Esp32-Cam." In *AIP Conference Proceedings*, vol. 2407, no. 1, p. 020011. AIP Publishing LLC, 2021.

[10] Sureswaran, R., Hussein Al Bazar, O. Abouabdalla, Ahmad M. Manasrah, and Homam El-Taj. "Active e-mail system SMTP protocol monitoring algorithm." In *2009 2nd IEEE International Conference on Broadband Network & Multimedia Technology*, pp. 257-260. IEEE, 2009.

[11] Suresh, Sruthi, and Udaya Bhaskar Reddy Ragula. "A regenerative adsorption technique for removal of uremic toxins: An alternative to conventional haemodialysis." *Materials Today: Proceedings* 24 (2020): 714-723.

[12] Vijayakumar, N., and and R. Ramya. "The real time monitoring of water quality in IoT environment." In *2015 International Conference on Innovations in Information, Embedded and Communication Systems (ICIIECS)*, pp. 1-5. IEEE, 2015

[13] Myint, Cho Zin, Lenin Gopal, and Yan Lin Aung. "Reconfigurable smart water quality monitoring system in IoT environment." In *2017 IEEE/ACIS 16th international conference on computer and information science (ICIS)*, pp. 435-440. IEEE, 2017.

[14] Shahanas, K. Mohammed, and P. Bagavathi Sivakumar. "Framework for a smart water management system in the context of smart city initiatives in India." *Procedia Computer Science* 92 (2016): 142-147.

[15] Ramesh, ManeeshaVinodini, Renjith Mohan, M. Nitin Kumar, Deepak Brahmanandan, C. Prakash, Prakash Lalith, M. Ananth Kumar, and R. Ramkrishnan. "Micro water distribution networks: A participatory method of sustainable water distribution in rural communities." In *2016 IEEE Global Humanitarian Technology Conference (GHTC)*, pp. 797-804. IEEE, 2016.