International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 03 | Mar 2021 www.irjet.net p-ISSN: 2395-0072

SMART WATER MANAGEMENT SYSTEM FOR APARTMENTS USING IOT

Ms.B.Suganya[1], G.Goutham[2], K.L.Subhiksha[3], N.Abilashsriram[4]

[1]Assistant Professor, Department of Computer Science and Engineering, Dr.Mahalingam College of Engineering and Technology, Tamilnadu

[234]Department of Computer Science and Engineering, Dr. Mahalingam College of Engineering and Technology, Tamilnadu

---

Abstract: *Water is essential for human survival as well as the survival of the whole natural world. The government has made attempts through numerous initiatives to save water and better use it in the future. Apartments may use a smart water control system that uses an IoT computer to monitor and schedule their water usage. With the assistance of an internet-based computer, the sensor mounted in the apartment's tank continuously monitors the amount of water used. The traditional approach of water analysis takes more time and effort. Using a pH, flow rate, and ultrasonic sensor, the IoT-based water control device tests the consistency and quantity of water supplied to each household. Consequently, everybody is very aware of their water use and the water's consistency. The proposed IoT-based framework effectively controls water use, thus improving efficiency.*

Keywords:IOT, ArduinoUNO, LED, Smart Water

1 INTRODUCTION

Humans have long struggled with water shortages. As cities' population grows, there is a greater need for water than usable, resulting in the resource's depletion. As a result, the system aims to use the Internet of Things to improve water control in multi-story buildings. In apartments, each household will be informed in real-time about how much water they drink through a mobile app.

An IoT architecture for water resources relies on real-time data collection through the internet [1]. The machine compiles a comprehensive report on each home's or unit's water use. It uses a flow rate sensor to calculate the water level to minimise water waste with a solenoid valve.

The Internet of Things provides new ways to improve water resources and make the most effective usage of this rapidly depleting resource. Comprehensive water storage systems will save up to 20% on water costs.

1.1 Objectives

- To perform efficient water management with information about individual household consumption of water.
- To check the quality of water using pH value and inform the user for effective water usage.

2 LITERATURE SURVEY

2.1Measure the Value of the Water

According to the author of [2,] contains an ultrasonic transmitter, receiver, and control circuit. Ultrasound is a kind of high-pitched sound wave with frequencies greater than the human hearing maximum. On the other hand, ultrasound has a level of about 20,000 Hz, making it inaudible to humans. The HCSR04 Ultrasonic Distance Sensor is made up of two ultrasonic transducers at its centre. The one serves as a converter, converting electrical signals into ultrasonic sound waves at a frequency of 40 kHz.

Figure1. Graph ofvarious sound waves

The ATmega328 microcontroller is built into the Arduino UNO. There are 14 digital I/O pins on the board, six of which have PWR output. It is equipped with a 16MHX crystal oscillator. It also has a USB port, a power socket, an ICSP, a header, and a reset button in addition to the above functions. It has all of the required components to support a microcontroller. It is powered by a battery or linked to a device by a USB cable. SENSOR ULTRASONIC It is essentially a distance sensor that is used to determine the distance between two points. The receiver and the control circuit are also ultrasonic transmitters. The transmitter sends out a high-frequency ultrasonic sound wave that bounces off stationary objects and is picked up by the receiver as an echo. The control circuit then analyses the echo to determine the time and difference between the transmitter and receiver signals. It's used to figure out how far away the sensor is from the reflected object. Wires are the conductive contacts between the components in contact in some electrical circuitry. To display the results, an LED is inserted into the circuit and attached to the Arduino board. The ultrasonic sensor will measure the water level and show the effects on the LED screen.

2.2 Measure the pH content of the water

The ATmega328 microcontroller is built into the Arduino UNO. There are 14 digital I/O pins on the board, six of which have PWR output. It is equipped with a 16MHX crystal oscillator. It also has a USB port, a power socket, an ICSP, a header, and a reset button in addition to the above functions. It has all of the required components to support a microcontroller. It is powered by a battery or linked to a device by a USB cable. SENSOR ULTRASONIC It is essentially a distance sensor that is used to determine the distance between two points. The receiver and the control circuit are also ultrasonic transmitters. The transmitter sends out a high-frequency ultrasonic sound wave that bounces off stationary objects and is picked up by the receiver as an echo. The control circuit then analyses the echo to determine the time and difference between the transmitter and receiver signals. It's used to figure out how far away the sensor is from the reflected object. Wires are the conductive contacts between the components in contact in some electrical circuitry. To display the results, an LED is inserted into the circuit and attached to the Arduino board. The ultrasonic sensor will measure the water level and show the effects on the LED screen.

2.3 User Interaction

The internet of things (IoT) is gaining popularity on the internet [4]. In the Internet of Things, the word "Things" refers to ordinary items wired to the internet. It, the Internet of Things, has created a connection between the physical and virtual worlds. The IoT principle is simple: Through the integration of IoT, networking creates a need for web design. The Graphical User Interface (GUI) encompasses all aspects of a website that can be used on a laptop, smartphone app, or any device [9]. When watching, the template layout is speared through these. Every computer has its collection of commands, capabilities, and functionalities for receiving and transmitting information so that communication techniques can vary from device to device. Node.js is one of the most widely used software development platforms for interaction. An IoT application's web-based user interface must be simple, intuitive, and fast.

2.4 Upload Program on the Arduino Board

Install the Arduino Desktop IDE first before programming the Arduino. The Arduino Software (IDE) is used to programme the Uno, and it is the same with all the boards

[5]. The Uno board is then connected to a computer with a USB cable. The Uno can immediately pull input from the USB port or an external power source. Using the USB cord, connect the board to your device. The renewable power LED (labelled PWR) should be turned on, or the Zip kit should be downloaded and extended. After that, disconnect the board and choose the serial port you want to use. Now, in the environment, press the "Upload" icon. Wait a couple of seconds; the RX and TX LEDs on the board should be blinking. The message "Finished uploading." would show in the status bar if the upload is good.

2.5 GSM/GPRS module

A cell phone and a GSM modem make up the architecture. In the suggested scheme, incoming SMS messages are transmitted as text messages from the user phone to the GSM modem through the cellular network [6]. Using an RS232 interface, the GSM modem sends the commands to the PIC microcontroller in text format. The system's incoming alert, which contains the home appliances' status, is sent to the cell phone via a GSM modem. Timers, Analog to Digital Converters (ADCs), and Universal Synchronous Asynchronous Receiver Transmitters are all part of the 8-bit PIC16F887 microcontroller (USART). The PIC16F887 and GSM modem were physically connected using the RS232 protocol, which was installed on Max232. Due to the lack of a battery in the device architecture, an external power source is used to push adequate current through the circuit connections. The "COMPIM" clock physically checks the GSM modem's reactionby attaching it to a physical port on the PC when simulating it. The planned GSM-based home automation framework is simulated.

The first message would be deleted from the SIM card memory with this instruction. The software enters a sleep condition when waiting for new incoming text messages, in which it compares the text message to the previously stored commands. To observe the answer when interacting with the GSM modem, a simulation result was performed. As the software starts up, the AT command is transmitted from the PIC16F887 to the GSM modem. The answer is obtained from the GSM modem after a very short period (less than 500 microseconds), quick enough to detect the modem's incoming message. The monitor was used to indicate when the PIC was transmitting the signal; the PIC16F887 initially acts as a transmitter before receiving the modem's answer. The time between sending the text and receiving the answer is less than 500 microseconds. Furthermore, the pause that must be monitored for this project is for GSM contact, which is mostly regulated by the SMS protocol and does not surpass 2 or 3 seconds, as checked in practice. The notification warning text shows that the message was successfully obtained and saved in the SIM card's memory position.

3 METHODOLOGY

The Tank Water Level Monitoring device detects the level of water in the tank, preventing leakage. The current automatic level detection system is defined as something that can be used to switch the motor unit on/off to start the feed pump at a low level and enable it to operate until the water tank's water level rises to a higher level. This contributes to the improvement of the water supply scheme. The project aims to use the Internet of Things to improve water quality in multi-story building complexes. Everyone would be able to use this to analyse, test, and calibrate the data collected to monitor the motor's on/off switching based on utilisation, tank power, and water quality calculated in the tank [10]. The machine is set up in such a manner that it can constantly regulate the available water volume. The device was built with an embedded system, and communication would be done through IoT.

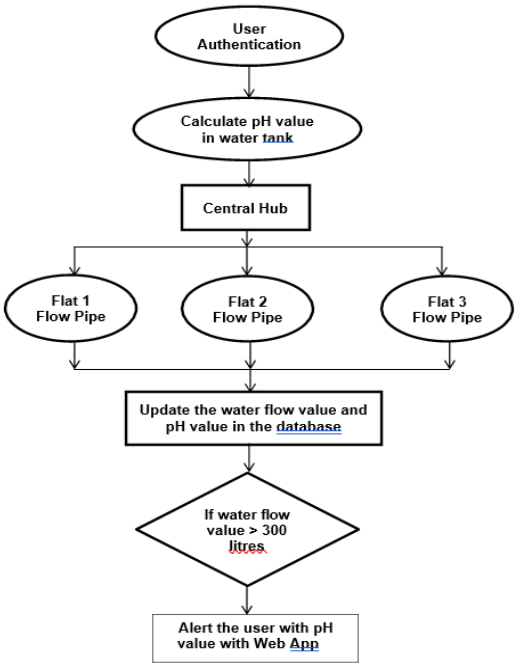


Figure – 2. Flow chart of the system

IoT is being used in a water management system. Water level detection, automated water pump on/off, and other tasks are completed. The planned device would track, maintain, and regulate the apartment's water source and use. The motor's operation is automatically monitored by the amount of water in the tank. When the water level drops below the mark, the engine can immediately switch back on.

To achieve the above goal, the following steps are followed:

Measurement - Measuring the water flow from the tank to the individual unit/house.

Update - It is used to update the current usage details of the user.

Alert - For giving alert/command for the activity given at a periodic time by the user.

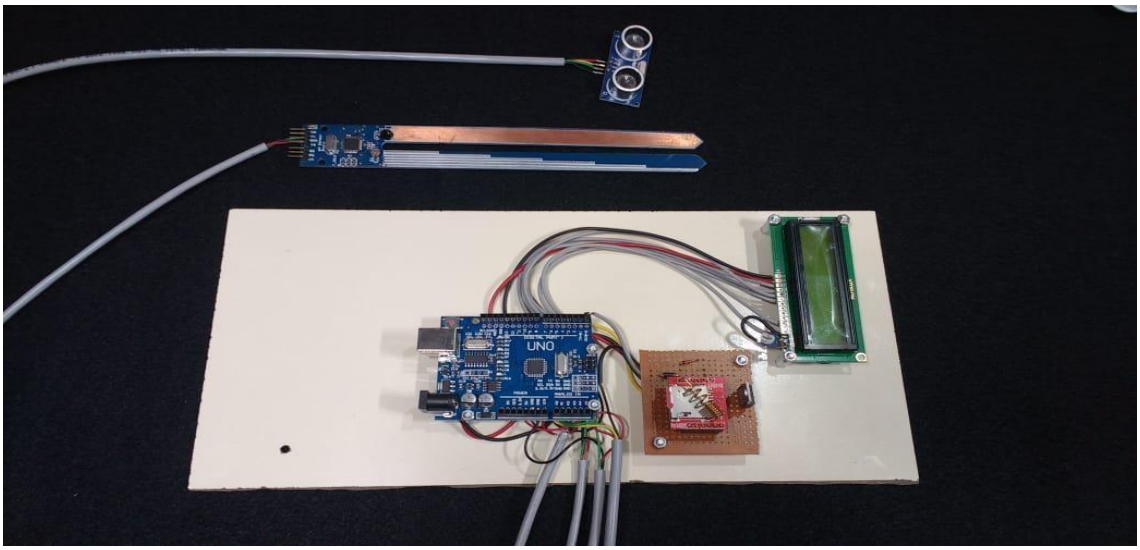


Figure3(a). Pictureof the workingdevice (part 1)

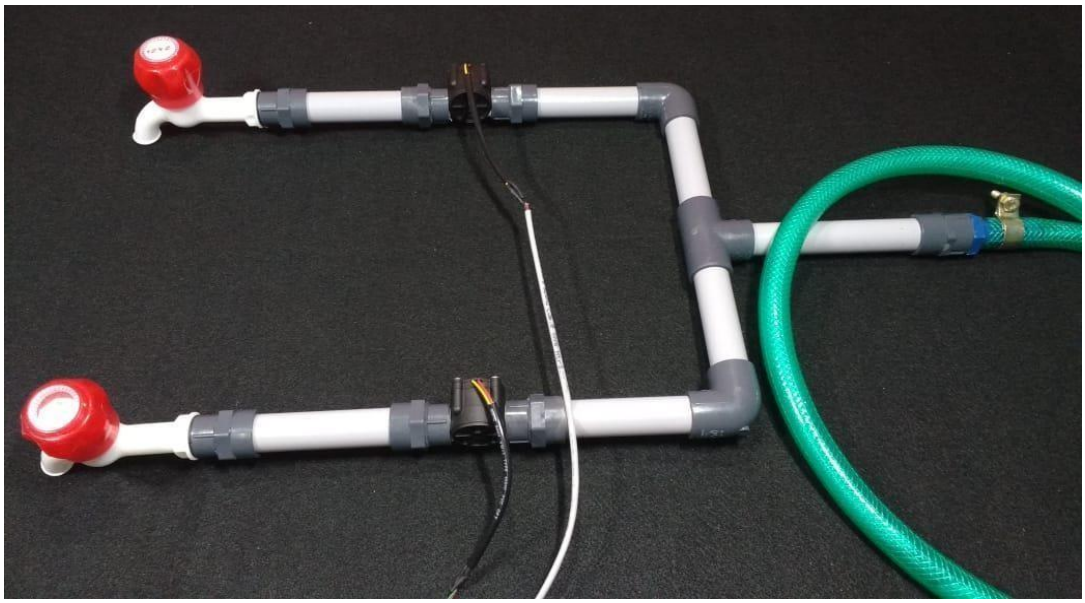


Figure3(b). Pictureofthe workingdevice (part 2)

3.1 USER AUTHENTICATION

The system's goal is to demonstrate water use to include an idea for analysing consumer thoughts in a real-time application [6]. As a result, the programme would display to the consumer the volume used and other information such as the pH content of the water and the quantity of water remaining in the tank. To address this problem, a website has been created that displays the appropriate content to the consumer [9]. The customer must have a username and password to enter the webpage, and the site even has an admin tab. The admin will control the water level cap, add and uninstall users, monitor passwords and users, and monitor operation such as monitoring the amount of water consumed by every person, pH values of water to track the quality of water being issued or received from the source, i.e., groundwater or any other type of supply in the admin tab.

3.2 UPDATED THE DATA TO THE SERVER

The link to the GSM module (SIM800L GSM/GPRS module) was built from the hardware, i.e. the Arduino board [7]. This involves the pins required for UART contact with a microcontroller. With Auto-Baud detection, the module supports baud rates ranging from 1200bps to 115200bps. To link to a network, the module needs an external antenna. The Helical Antenna is normally included with the module and solders directly to the NET pin on the PCB. If you choose to keep the antenna away from the frame, the board even has a U.FL connector. The GSM module has a SIM port on the backside. Any 2G micro-SIM card that has been activated would function fine. The correct way for inserting a SIM card is usually etched on the SIM socket's back. The communication between the GSM and the server would be used to transmit data. The GSM network is connected to the internet. The AT commands are used to link the GSM and the server through the UART. It communicates with the server using commands. The GSM module would first include a SIM card and internet activation, after which data will be transferred via webpages in bytes, equivalent to baud rate synchronisation. Commands like getting and post can help you update and store data on the page. The data will then be modified on the server and stored in the archive using the commands.

3.3 DATABASE CONNECTIVITY WITH WEBPAGE

The data in this programme is stored in an MYSQL database. To store the data on the internet and display it, you'll need a database link "[7] s to the consumer. To submit commands and receive responses, normally in the form of a result collection, you'll need a link. In data-

centric programming, connections are a crucial principle. Link pooling was created to increase efficiency since certain DBMS engines take a long time to communicate. Without "free and accessible" access to a database, no command can be run against it. Connections are established by passing a link string to an underlying driver or provider, which addresses a certain database, server, case, and user authentication credentials. A link may be opened and closed at will, and properties can be set once established. The Link String comprises key/value pairs determined by the data access device and data provider [11]. The data is sent to the webpage after the link is established "s stored in the database are immediately retrieved and shown on the webpage.

3.4 ALERTS TO THE USER

The programme will submit an SMS to the consumer using the GSM module [8]. The device sends an SMS warning in this application. Call warning may be achieved with the GSM module if required, using the SIM card installed in the GSM module. The android can help with texting and calling via AT commands and a linked internet connection [12]. The warning notification may be transmitted via SMS or phone call, depending on the consumer and the creator's needs. The consumer receives an SMS warning response from this device.

4 RESULTS AND DISCUSSION

The proposed system is installed in a residential building's water tank, 500 metres away from the motor pump. The water level is automatically monitored and controlled. Wireless sensors, devices, and actuators are used in this framework. These sensors are connected to a specific object that communicates through the internet, allowing for the automated transmission of data between artefacts or persons without the need for human interaction and alerting the consumer regularly. Using metres, the suggested device monitors the water quality and quantity absorbed. The consumer can access the created data on water usage through a web interface. The outcome is more successful than the traditional approach.

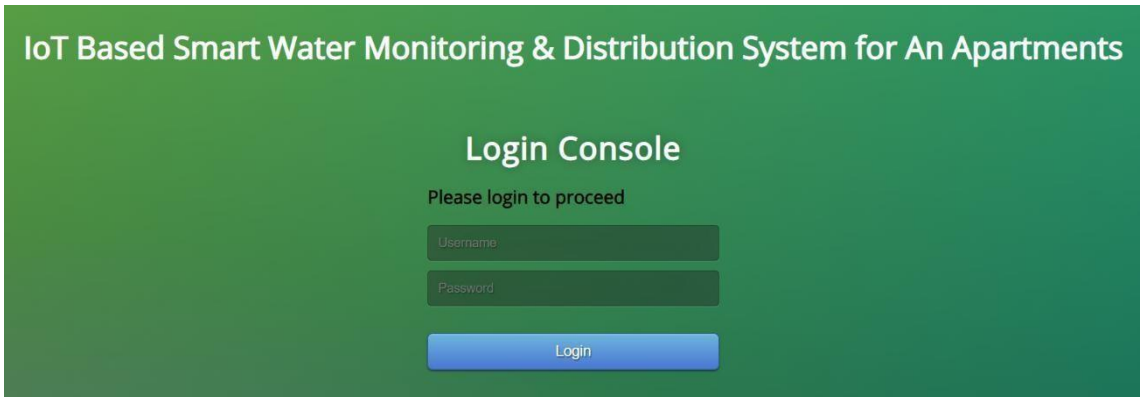


Figure4. Screenshot ofthe Login page

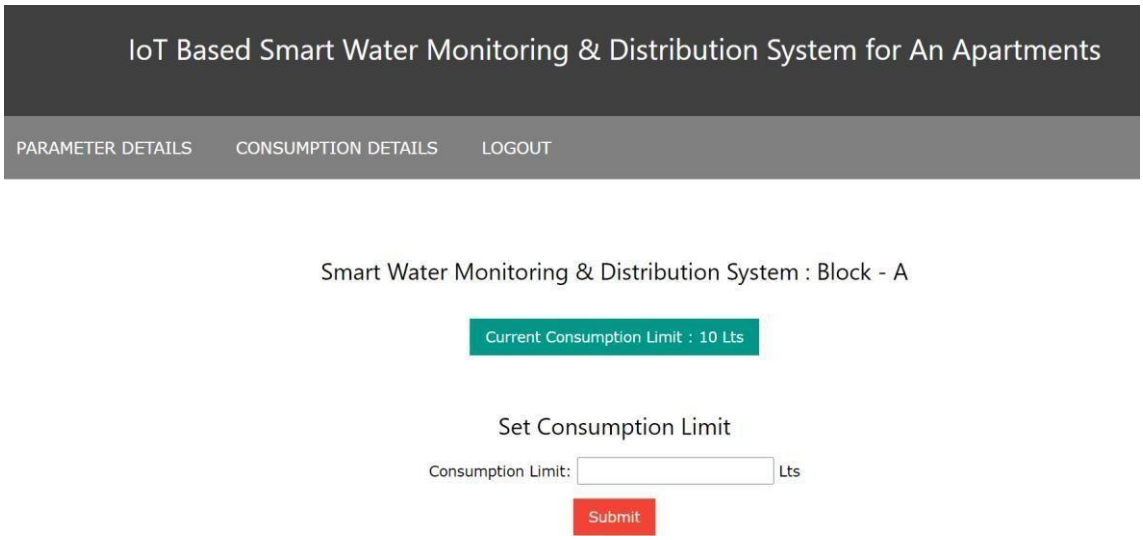
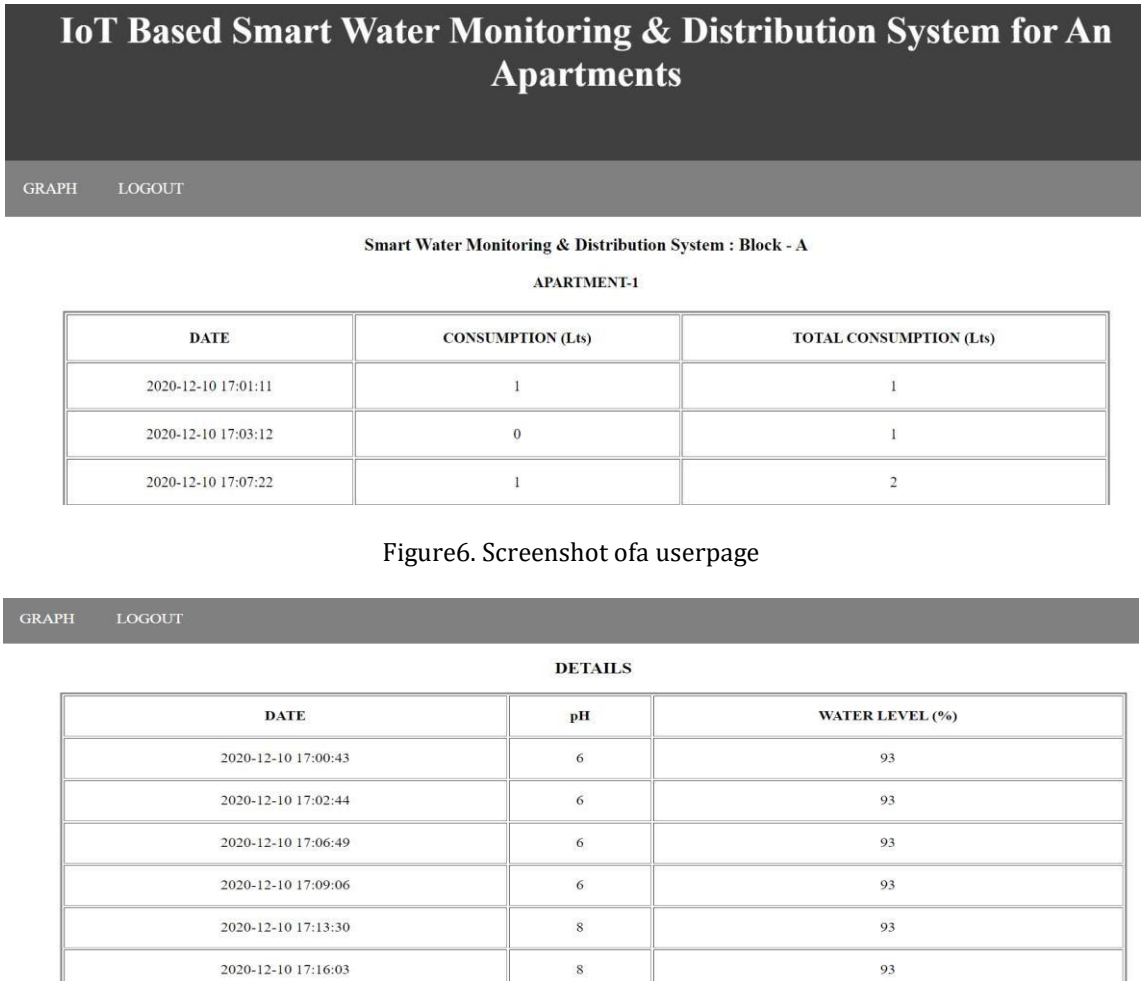


Figure5. Screenshot ofthe admin page



DATE	CONSUMPTION (Lts)	TOTAL CONSUMPTION (Lts)
2020-12-10 17:01:11	1	1
2020-12-10 17:03:12	0	1
2020-12-10 17:07:22	1	2

Figure6. Screenshot ofa userpage

DATE	pH	WATER LEVEL (%)
2020-12-10 17:00:43	6	93
2020-12-10 17:02:44	6	93
2020-12-10 17:06:49	6	93
2020-12-10 17:09:06	6	93
2020-12-10 17:13:30	8	93
2020-12-10 17:16:03	8	93

Figure7. Screenshot of pH value and waterlevel

5 CONCLUSION

The proposed system provides an efficient water level monitoring of the individual units and the water qualityby checking its pH value. It is planned to implement the alert system to maintain the pH value for quality purpose and alert according to the percentage of usage.

6 REFERENCES

1. Ms. A. Madhuraveni, G. Athithan, S. Thilagavathi, R. Vignesh," Smart WaterManagement using IOT Environment," ICONNECT – 2018 (Volume 6 – Issue07), IJERTCONV6IS07106, 24-04-2018, IJERT.
2. Ms. Pooja K1, Ms. Kusumavathi 2, Ms. Pavithra3, Ms. Nishmitha4, Prof.Aishwarya D Shetty, "Automatic Water Level Indicator And Controller UsingArduino", Volume: 07 Issue: 05, e-ISSN: 2395-0056, p-ISSN: 2395-0072, May2020, IRJET.
3. Asma Fatani; Afnan Kanawi; HedaihAlshami; Ahmed Bensenouci; TayebBrahimi; Mohamed-Amine Bensenouci, "Dual pH Level Monitoring and Control using IoT Application", 10.1109/LT.2018.8368502, 17805856, 31 May2018, IEEE 4. Web Reference :https://readwrite.com/2019/04/26/how-website- esignintegrates-with-the-internet-of-things-iot/
4. Web Reference : https://www.arduino.cc/en/Guide/ArduinoUno/
5. NavinRapelli; AshishMyakal; Vyankatesh Kota; Prachi R Rajarapollu, "IOT Based Smart Water Management, Monitoring and Distribution System for an Apartment", 2019 International Conference on Intelligent Computing and Control Systems (ICCS)(ieee.org), IEEE
6. Salah Addin Ahmed, Kok Wai Chan, and Mok Vee Hoong," Smart GSM Based Home Automation System", CEng , : 10.1109/SPC.2013.6735152, CSPC2013, December 2013, IEEE
7. Niel Andre Cloete, Reza Malekian, Lakshmi Nair "Design of smart sensors for real-time water quality monitoring". Department of electrical, Electronic and Computer Engineering, pp. 1-16, University of Pretoria, Pretoria, South Africa13 (2018), IEEE
8. Edward Curry, Souleiman Hasan, Christos Kouroupetroglou, Willem Fabritius,Umair ul Hassan and Wassim Derguech"Internet of Things Enhanced User Experience for Smart Water and Energy Management" - IEEE Internet Computing, Volume: 22, Issue: 1, Jan./Feb. 2018
9. F. Viani, M. Bertolli, M. Salucci, and A. Polo "Low-Cost Wireless Monitoring and Decision Support for Water Saving in Agriculture" - IEEE Sensors Journal, Volume: 17, Issue: 13, July1, 2017
10. Joseph Siryani, Bereket Tanju and Timothy Eveleigh "A Machine Learning Decision-Support System Improves the Internet of Things Smart Meter Operations" - IEEE Internet of Things Journal, Volume: 4, Issue: 4, Aug. 2017
1. 12. A.N. Prasad, K. A. Mamun, F. R. Islam and H. Haqva"Smart water quality monitoring system" - Second Asia-Pacific World Congress on Computer Science and Engineering, Dec 2015