Automatic Water Conservation System

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***Abstract*-**This present study involves the application of variable orifices devices to control the flow rate of water, flexible apertures, and allow modulation of the flow rate and influence of water conservation. IoT- enabled flow sensor work synergistically with the variable orifice, orifice sensor monitors real-time flow rates, expedite the orifice aperture's adjustment, and optimizes water usage this mortar is attached to the orifice to maintain the flow rate of water. In addition, this sensor provides granular data collection, and continuous monitoring and is essential for subsequent data analysis. Flow sensor data is uploaded to the cloud with a time stamp. The designed prototype was installed in both public washrooms and home-use situations to take measurements of washing hands, vegetables, etc., and determine the most appropriate flow rates for specific household tasks. This prototype's data was evaluated based on flow control accuracy, data transmission reliability, efficiency in conservation, and waste reductions. During the present study, data from daily household activities to evaluate the efficiency of the variable orifice system in conjunction with two different modes: Mode 1 and Mode 2. For handwashing the traditional taps distributed approximately 10 liters of water with Mode1, the usage decreased to 7 liters, and with Mode2 it further dropped to 5 litres. In dishwashing activities, the tap distributed 15 litres as compared to 10 litres in Mode1 in 10 liters and 5 liters in Mode2.

***Keywords*-** Water Conservation, ESP-8266, Wi-Fi Technology, Internet of Things (IoT)

I. INTRODUCTION

Water shortages are a growing concern worldwide, with many regions experiencing water shortages due to Saving water in cities will be crucial and therefore studying the usage pattern becomes important factors such as climate change and population growth. To address this issue, water conservation, and monitoring systems are becoming increasingly important [1]. In this paper, Wi-Fi technology is used to monitor water usage and implement conservation measures. Our proposed system uses water flow sensors to measure the amount of water being used and the ESP 8266 microcontroller to collect and analyze this data.

By using a Solenoid valve water flow automatically shut down after a predetermined length of time or offering real-time feedback on water consumption through a mobile app, can also be used to manage water flow. This proposed method might significantly reduce the consumption of water while encouraging conservation efforts. Users may become more aware of how much water they are using and change their behaviour by receiving real- time feedback on their water usage. In addition, this system is adaptable to each user are unique requirements and may be employed in a range of environments, including private residences, commercial buildings, and public areas.

We provide an in-depth description of the proposed system, including its components, design, and implementation. Water conservation is becoming an increasingly important issue worldwide due to the impact of climate change and the growing demand for limited freshwater resources. One area where technology can help in monitoring and managing water usage by sensors and smart devices.

Development of a new measure to check attitudes toward water conservation providing baseline data on Indian attitudes, behaviour, and behavioral intentions about water conservation. In this study a scale was designed to measure Indians' attitudes toward water conservation; the scale has 20 components broken down into 5 subscales and examined around 430 participants around the country by Reddy et al. [2].

Trottier et al. [3] studied the relationship between consumption and effects while concentrating on the water footprint of families in 14 Canadian cities and examined home water usage trends and related environmental effects in several Canadian urban locations. Sharma et al. [4] developed a technique for residential buildings' sustainable water management; in which water audits are used to spot patterns in water use, spot water area, and increase water efficiency in residential settings.

Arbues et al. [5] examined the patterns of domestic water use in several nations and analyzed the variations in consumption levels and patterns in various homes and the factors affecting water usage. Saranya et al. [6] presented the concept of IOT for automatic water conservation and designed a water monitoring and control system with real-time databases. It is useful in many areas like apartments, colleges, hostels, shopping malls, etc. The concept is to inform the user about the excess flow of water through the mail and control the overflow of water using a solenoid valve. Therefore, water conservation and management can be done simultaneously. With the help of Proteus Software, simulation of the monitoring and controlling system.

Vatsala Sharma et al. [7] developed an Arduino- based smart water management system that is used with an ultrasonic sensor to sense the level of water in the ground tank. The sensed information is updated on an Android application through which the user can visualize the water level on a smartphone. According to the level of water in the tank, the motor functioning is controlled, When the water reaches the high level of the underground tank, the motor will be turned on through the Blynk application on the smartphone to transfer the water in the ground tank to the main tank, and when the main tank is about to fill up, it will turn off automatically. When the soil in the garden is dry, the soil moisture sensor senses the dryness in the soil and automatically starts the water pump. When water flows through the main tank and reaches the soil of the garden, the motor is automatically switched off.

Development and extension of a real-time water eminence computing structure at a compact cost using the Internet of Things (IoT) developed by Bharath et al. [8]. The centralized arrangement obtains the monitored standards from several devices over a period. Through the Wi-Fi structure, the sensor output data is sent to the concerned authority for additional stages to advance the water quality.

Installing low flow tap faucets and showerheads can save up to 30-50% of the water usage as well as 5- 10% of water can also prevent leaks wastage and save up to 5-10%

Trigger nozzles or watering cans for indoor plant watering can save up to 50-70% of water compared to uncontrolled or excessive watering. Brooms or water-efficient cleaning tools instead of hoses for cleaning tasks can save around 80-90% of water. Adding water-efficient appliances and fixtures for sprinkle-related activities saves approximately 10- 20% of water.

II. MOTIVATION AND NOVELTY OF THE PRESENT STUDY

Due to the misuse and squandering of water, numerous regions across the globe are presently grappling with a water crisis. In India, 85% of water requirements are fulfilled through rainfall, while the remaining 15% is sourced from the melting of snow. As a part of an overall water regeneration plan, the Indian government launched the "Namami Ganges" initiative aimed at the Ganges River basin.

The annual water requirement for India amounts to 1100 billion cubic meters. The agricultural sector accounts for 80% of the country's overall water usage. Insufficient water availability also leads to wage loss due to the 150 million workdays per year that women spend on water transportation and collection. These motivate the author to do research in water conservation systems to save water by using the Iot based Wi-Fi system. This system collects behavioural data from households on a typical day as well as measures the flow rate with respect to time according to the use of water. There are 2 modes: mode 1 and mode 2. This product used a sharp sensor to monitor mode 1 and mode 2; by swiping the hand above it changes the water flow rate according to usage, saving water. this is the novelty of the present study.

III. METHODOLOGY

This product is based on an IoT-integrated device for regulating the water flow through taps. This innovative device modulates the water flow; fitting this device to any existing tap to optimize the flow of water besides measuring water consumption and water saving. This product can help with water control, measurement, and conservation.

By utilizing gesture-based control, this product allows users to adjust the speed at which water is dispensed simply by swiping near a sharp sensor. In the present health crisis, a digital, touch-free experience for switching the mode and turning on/off the tap is highly relevant. In addition, it also monitors the amount of water consumed and provides hourly data by using a Wi-Fi module.

A. Block Diagram

Developed simple and portable water monitoring and control system using ESP 8266. This module design is easily accessible and economically available on the market.

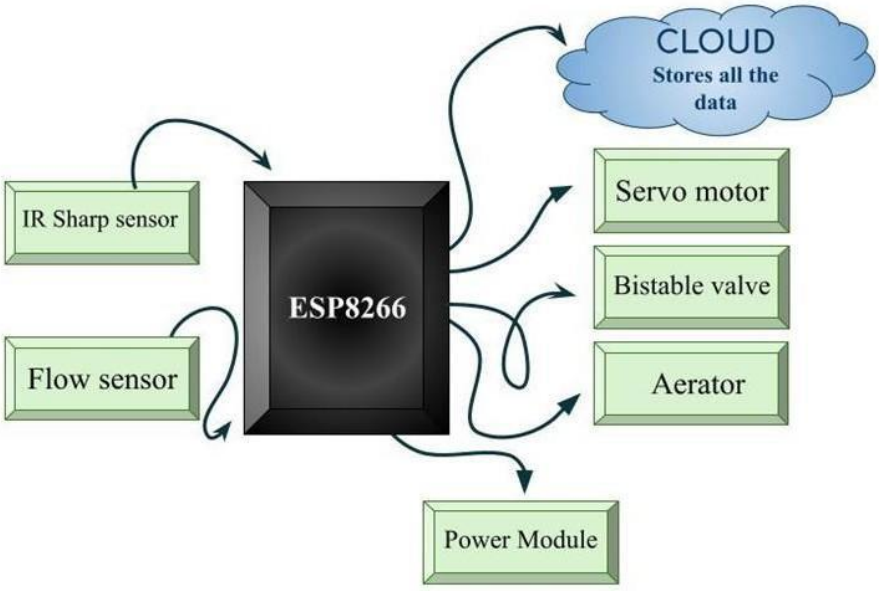


Fig. 1 Block diagram

This block diagram includes the server stations, sensor network, and Esp8266 microcontroller.
The circuit is interconnected with two IR sensors:
one sensor is utilized to change the modes, while the other sensor is employed to detect the movement of hands. The water flow sensor is used to detect the flow of water via pipes.
A solenoid is used to switch on and off the water supply. The system can be easily identified and automated using the Internet of Things (IoT). Esp8266 generated data all are stored on the cloud with the help of Wi-Fi.

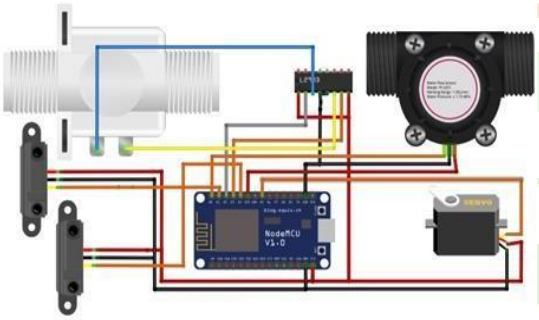
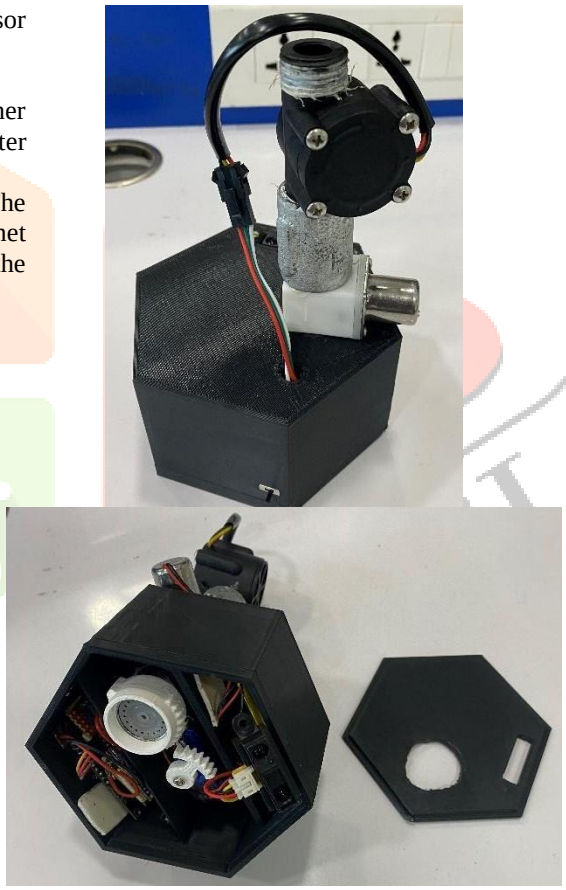


Fig. 2 Circuit diagram



(b)

Fig. 3 (a) and (b) Prototype of water conservation system

Sr. No	Name of Components	Quality
1	ESP 8266	1
2	IR Sensor	2
3	Water Flow Sensor	1
4	Bistable Value	1
5	Servo Moter	1
6	Aerator	1
7	5V Step-Up Booster	1
8	Battery	1

TABLE I. THE FOLLOWING COMPONENTS, WE HAVE USED IN THE CIRCUIT

Fusion 360 is a 3D CAD, CAM, CAE, and PCB tool of its kind that connects your complete product development process into one cloud-based software. A Prototype is designed to test the system performance by using PVC pipe and connected to the existing pipe with faucets. we performed various tasks, such as washing our hands and utensils, etc.

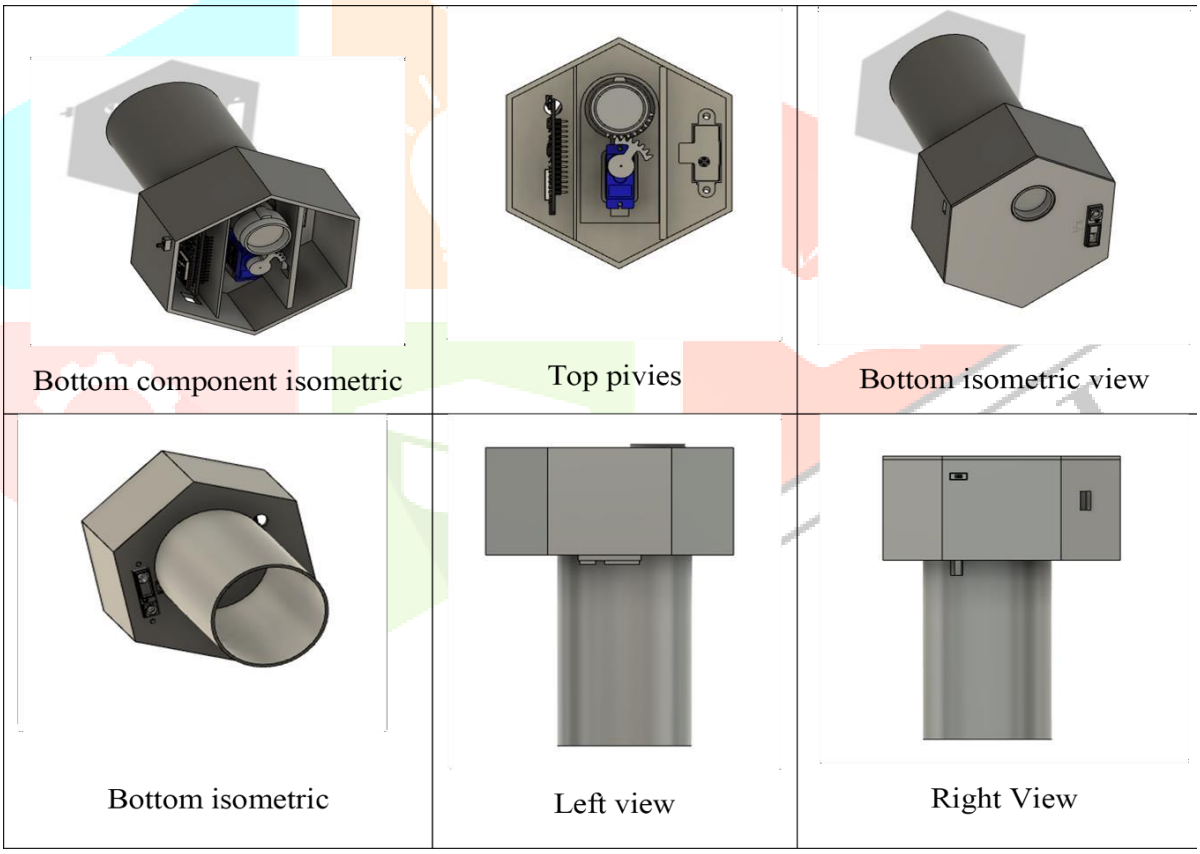


Fig. 4 3D Design of the prototype

Fusion 360 software is used to create the prototype design. From an electronics perspective, this device used two sharp sensors to operate automatically. The primary actuator responsible for the aerator's mode is a servo motor, while another actuator known as the Bistable valve is utilized to control the water flow, enabling it to switch between the "on" and "off" states Furthermore, all data related to the water flow rate and duration are instantly displayed on cloud platforms.

IV. RESULT AND DISCUSSIONS

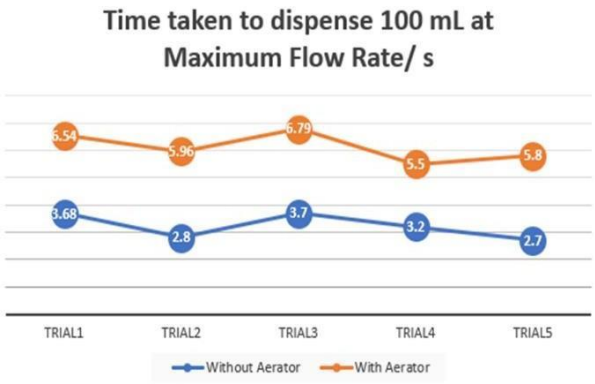


Fig. 5 Comparison of maximum flow rates with and without aerators without an aerator, which helps in saving water.

Furthermore, the system's reliability will be validated via data transmission between the hardware and the IOT platform.

Utilizing the Thing Speak mobile application for water quality monitoring would prove highly beneficial for the authorities responsible for overseeing water quality standards.

After installation, authorized users can access this information using a user identification ID and password to view Thing Speak data in their accounts.

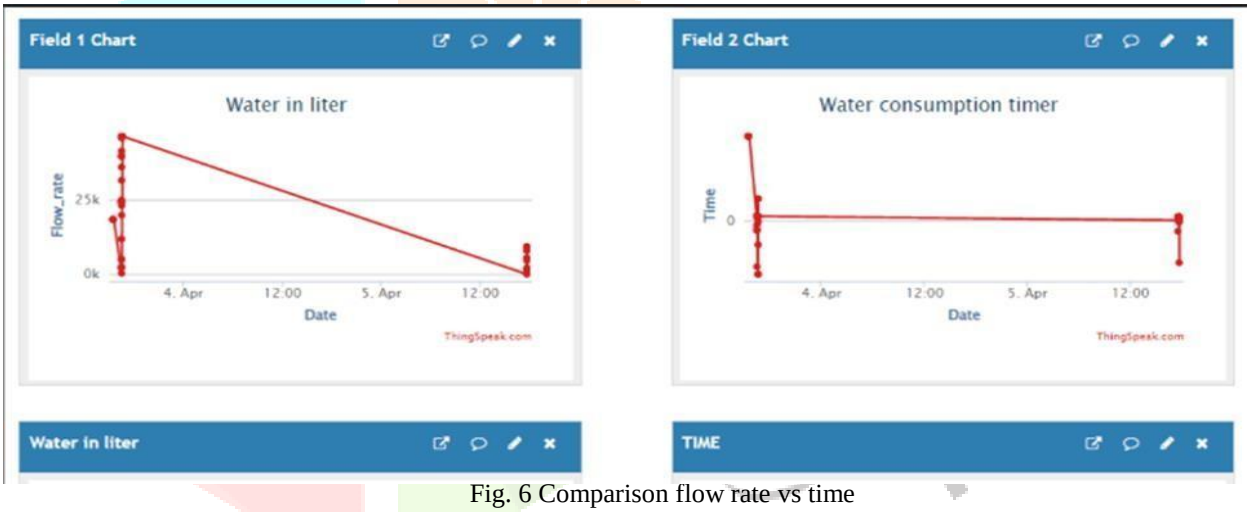


Fig. 6 Comparison flow rate vs time

conservation system; using the implementation of

Activities	Tap (Liters)	Sprinkle (Liters)
Handwashing	10	0
Dishwashing	15	5
Teeth Brushing	5	0
Cooking and Food Preparation	10	2
Cleaning Tasks	5	0
Face Washing	3	2
Body Cleansing	3	0
Indoor Plant Watering	15	2

TABLE II. ESTIMATED WATER FOR TAP AND SPRINKLE- RELATED ACTIVITIES PER DAY. behaviors aspects observed in a household on a typical day.

Tables II. show the estimated water required for handwashing, dishwashing teeth brushing, cooking and food preparation, cleaning task, face washing, body cleansing, indoor plant watering, etc. through tap and sprinkles in liters.

TABLE III. SAVING WATER AFTER IMPLEMENTATION OF WATER CONSERVATION SYSTEM.

Activities	Tap % Saved	Sprinkle (%) Saved
Handwashing	20	10
Dishwashing	25	5
Teeth Brushing	50	10
Cooking and Food Preparation	15	5
Cleaning Tasks	10	0
Face Washing	5	5
Body Cleansing	5	0
Indoor Plant Watering	0	50

Table III. represents percentages of the estimated water saving for taps and sprinkles based on the calculated water conservation system. These percentages indicate that the reduction in water usage is achieved after the installation of a water

CONCLUSION

This paper developed a prototype for a water conservation system using ESP8266.

Real-time monitoring and control of water usage through sensors and smart devices present a viable solution for tracking water consumption patterns and gaining valuable insights, ultimately more effective in water management practices.

The utilization of this prototype effectively minimizes water wastage and ensures the sustainable utilization of limited freshwater resources. These systems hold significant improvements to bring about substantial advancements in global water conservation endeavours.

There are ongoing challenges that are still to be solved, the need for more precisely accurate, and dependable sensors, enhanced methodologies for data processing, and improved user interfaces to enhance user acceptance better user interfaces for increasing user acceptance.

In future studies expect even more innovative water- saving ESP8266 solutions will be developed on water conservation. These developments will play a crucial role in mitigating the impacts of climate change and securing a sustainable future for future generations.

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