INTERNET OF THINGS GROUP 4

IOT-SMART WATER MANAGEMENT

PHASE 3

NAME : **J.MOHAMED JASSUR**

REGISTER NO : **822621106009**

NM ID : **au822621106009**

DEPARTMENT : **Electronics&Communication Engineering**

COLLEGE CODE : **8226**

COLLEGE NAME : **Arifa Institute Of Technology- Nagappattinam**

EMAIL ID : **mdjassur17122003@gmail.com**

DEFINATION AND OBJECTIVES

Smart Water Management (SWM) refers to the use of technology, such as sensors, data analytics, and automation, to improve the efficiency, reliability, and sustainability of water systems.

Smart Water Management can include monitoring and managing water resources, distribution networks, and infrastructure, as well as reducing water waste and improving water quality. The goal of smart water management is to optimize the use of water resources and improve the overall performance of water systems.

Governments worldwide are incorporating smart concepts into their urban, regional, and national agendas, causing SWM to gain ever more attention.

Smart Water Management systems has many possible applications in water management, including solutions for floods, droughts, pressure and flow issues, leaks, efficient irrigation, water quality, quantity, and many other problems.

Data collection and Sensors

Sensors are usually named after the physical parameter they measure. The following is a list of sensor types and how they work.

Temperature sensors include thermocouples that indicate temperature measuring a change in voltage; infrared sensors that detect emitted infrared energy and infer temperature based on intensity; and semiconductors that detect temperature based on the conductivity of a semiconductor.

Proximity sensors detect either the presence or absence of a nearby object or material. Inductive proximity sensors sense the presence of a metallic object using an electromagnetic field. Photoelectric ones use a beam of light to detect objects. Ultrasonic sensors use sound to detect the presence of objects.

Gas sensors, like carbon dioxide sensors, detect the amount of an element in the air. Other examples of gas sensors are air quality sensors, which detect chemicals that indicate air pollution; breathalyzers that detect alcohol in the air; and humidity sensors that measure the air water content.

Level sensors include point level sensors that measure the level of a liquid or dry material and indicate whether it is above or below what it should be. Continuous level sensors provide a continuous level reading.

Light sensors, such as light-dependent resistors, measure changes in circuit resistance to determine changes in light intensity.

Pressure sensors are devices such as a strain gauge, which has a spring element that changes shape as force is applied, affecting resistance and changing the pressure reading. Differential pressure sensors measure the difference between two pressures connected to each side of the sensor.

Chemical sensors include chlorine residual sensors that measure the amount of chorine in water. PH sensors check the hydrogen-ion activity in a solution to measure its acidity.

Biomedical sensors encompass medical devices, such as optical heart rate sensors, that use light-sensitive diodes to determine volume changes in the capillaries above someone's wrist. They also include pulse oximeters that shine a light-emitting diode light through the finger of a patient, analyze the character of the light and use that data to determine the amount of oxygen in the blood.

Remote Monitoring

The Energy Water Monitoring System gives you the power to monitor your water usage, by combining software, hardware, wireless communications and sensors, Energy industry-leading water monitoring and analytics solutions help industries and hotels to increase productivity, and compliance while enhancing safety, sustainability and service

Energy water monitoring solutions help industries and hotels to meet the wide array of challenges from water monitoring, leakage detection, water pressure management (reducing water pressure from 70 to 50 psi could lower the total water consumption of an industry by 10 to 20%), sewer overflows and flooding to water quality, water meter data collection. Which also enables them to more effectively manage their problems such as water conservation procedures and operations in addition to the installation of water-efficient equipment and accessories

Conservation

Preserving water resources and conservation safeguarding watersheds are important environmental protection priorities. IBM's first water conservation goal was established in 2000 and has evolved over time as our company has transformed into a hybrid cloud and AI platform company.

IBM's water conservation goal is to achieve year-to-year reductions in water withdrawals at larger IBM locations and data centers in water-stressed regions. In 2021, withdrawals at these locations decreased by 1.2% versus 2020. IBM's primary use of water at locations subject to this goal is cooling and humidity control at offices and data centers (40% of total water withdrawals), irrigation (31% of total water withdrawals), and domestic water use in the workplace (29% of total water withdrawals).

Leak Detection

As Smart home technology continues to develop, so do the business opportunities for residential service plumbers and HVAC professionals. Because many smart home products are designed to prevent property damage, it makes sense that water leak detectors were the next evolution in the technology. Smart leak detector systems vary from brand to brand, but it's common for a system to include three main components that are controlled by an app for smartphones or tablets: smart water leak sensors, shutoff valves and a centralized hub.

Sensors are placed where leaks are possible at specific points in a home, such as faucets, appliances and water heaters. This allows you to customize a leak detection solution based on your customers' needs or concerns. Certain sensors not only detect water and potential leaks but can alert for water pressure, humidity and freezing as well.

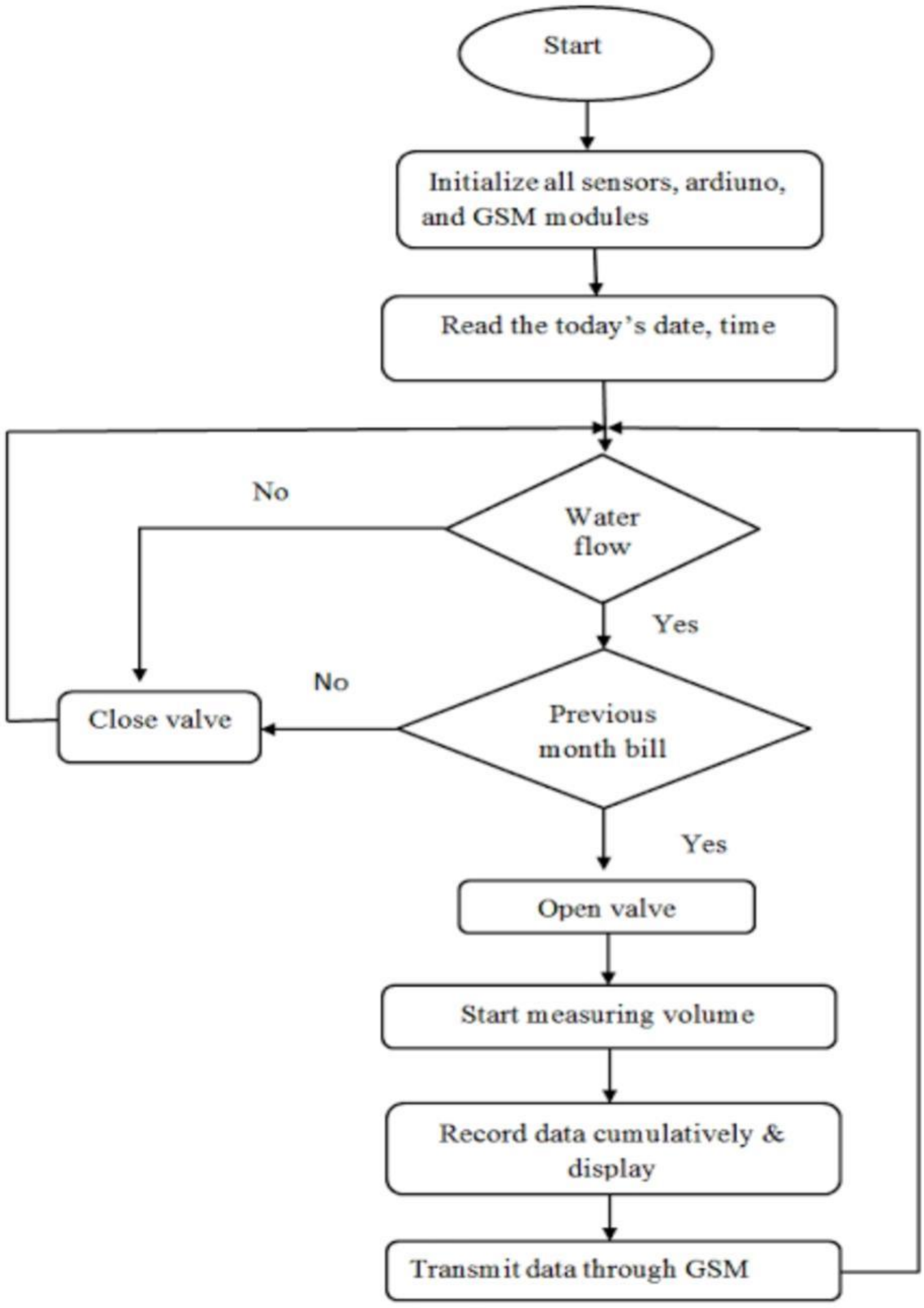
Smart shutoff valves are installed at strategic locations as well. These usually need to be installed by a licensed plumber, since cutting into a water line may be required for certain types of shutoff valves.

A centralized hub seamlessly integrates with the shutoff valves and relays information to the system's app. Once the smart water leak detection system is set up, your customer can get alerts on their app if anything goes wrong and control the system from wherever they are. This could potentially help them save thousands of dollars on repairing water damage while giving them peace of mind.

Three things to know about smart water leak detectors Knowing more about the options available can help you in discussions with your customers about water leak detection. Check out three facts to help you stay on top of this technology.

Select sensors monitor water temperature as well, which can help your customers be aware of and avoid the risks of frozen pipes.
Smart leak detector system installation often involves little time and effort. As mentioned above, if cutting into a water line is required, certain shutoff valves must be installed by a licensed plumber. For plumbing professionals, however, this is no different than installing a standard brass valve. Again, the specific shutoff valves vary from brand, but they are available in standard domestic sizes for easy installation.

Once the shutoff valves and other components are in place, the smart leak detector system setup is often done through the respective app on your customer's smartphone or tablet. This allows your


Start
Initialize all sensors, ardiuno, and GSM modules
Read the today's date, time
Water flow
No
Yes
Previous month bill
No
Close valve
Yes
Open valve
Start measuring volume
Record data cumulatively & display
Transmit data through GSM

Water Quality Monitoring

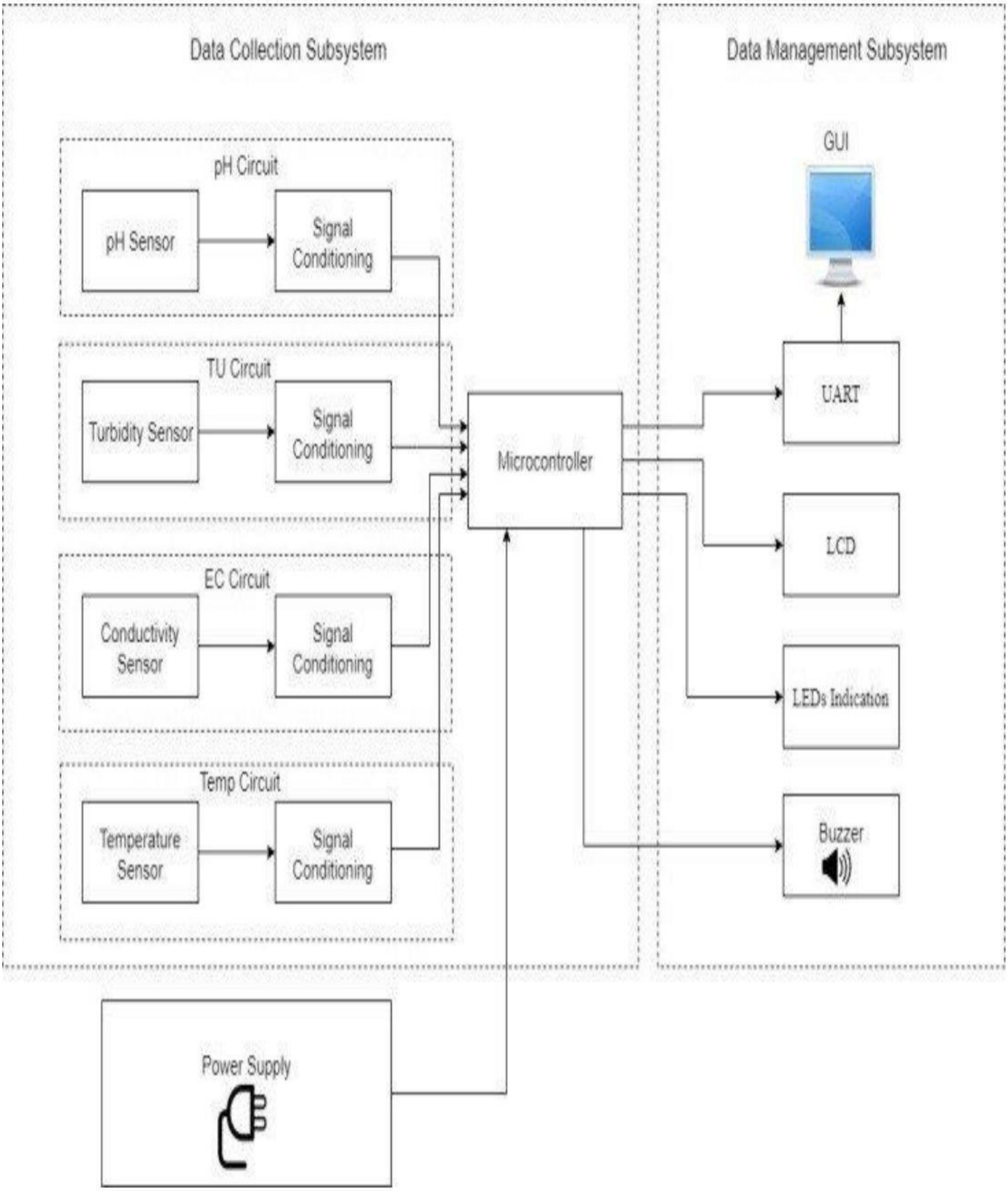
Although there are several parameters for monitoring water quality, only a few are used as key parameters in the monitoring, which can vary according to the location or the purpose of water use Regarding water use, according to Boyd] and Alley when intended for human consumption, such as drinking, for example, the water must not have high concentrations of minerals, taste, or odour, and must be free of toxins or pathogenic organisms; for recreation, despite being unsuitable for consumption, the water must not present risks of contagion or diseases through direct contact; for the environment, the water must not contain pollutants that cause adverse effects on flora and fauna. Rahman and Bakri Mohamed et al.], and et al. , for example, present water quality monitoring studies whose monitoring parameters were established according to the needs of each location.

For monitoring water quality, Boyd Alley , the World Health Organization Spellman and Omer [present a variety of physical, chemical, and biological parameters for drinking water, superficial water (fresh and saltwater) and groundwater, the sources of pollutants, types of speciation, and the main analysis techniques. In this work, the following were considered as physical parameters: (i) colour(ii) temperature, and (iii) turbidity; and as chemicals: (iv) chlorine, (v) fluorine, (vi) phosphorus, (vii) metals, (viii) nitrogen, (ix) dissolved oxygen, (x) pH, and (xi) redox potential or ORP (Oxidation–Reduction Potential).

In biological monitoring, although it is possible to identify numerous pathogenic species in water, the methods of isolation and the enumeration of such micro organism make this a complex and time-consuming task, making it impractical to monitor all microorganisms that may be present in water . To solve this problem, the monitoring of biological contamination is conventionally carried out by the analysis of key microorganisms present in human and warm-blooded animal faces , (xii) total coliforms are Escherichia coli being the most-used parameters to assess the microbiological safety of drinking and surface water supplies

The monitoring of (xiii) algae also important, since in many aquatic ecosystems, including drinking water supplies, there is a proliferation of these microorganisms called Harmful Algal Blooms (HAB)]. As emerging contaminants, the occurrence of HAB depends on several environmental conditions, such as the presence of nutrients and water temperature, and it is responsible for producing a variety of toxins released into water, which are dangerous for public health

Many of the parameters mentioned above make up the water quality index (WQI), such as dissolved oxygen, total coliforms, pH, temperature, nitrogen, phosphorus, and turbidity The WQI appeared in 1960 (Horton Index), being a simple and concise tool that allows the expression of the quality of water bodies and their derivations, such as for recreation, irrigation, and public supply, for example]. Nowadays, there are different numbers of models developed by different international organizations and used for WQI calculation, such as the National Sanitation Foundation Water Quality Index (NSFWQI) and the Weighted Arithmetic Water Quality Index (WAWQI), for example].



Data Collection Subsystem
Data Management Subsystem
pH Circuit
pH Sensor
Signal Conditioning
TU Circuit
Turbidity Sensor
Signal Conditioning
EC Circuit
Conductivity Sensor
Signal Conditioning
Temp Circuit
Temperature Sensor
Signal Conditioning
Microcontroller
GUI
UART
LCD
LEDs Indication
Buzzer
Power Supply

Water Demand Management (WDM):

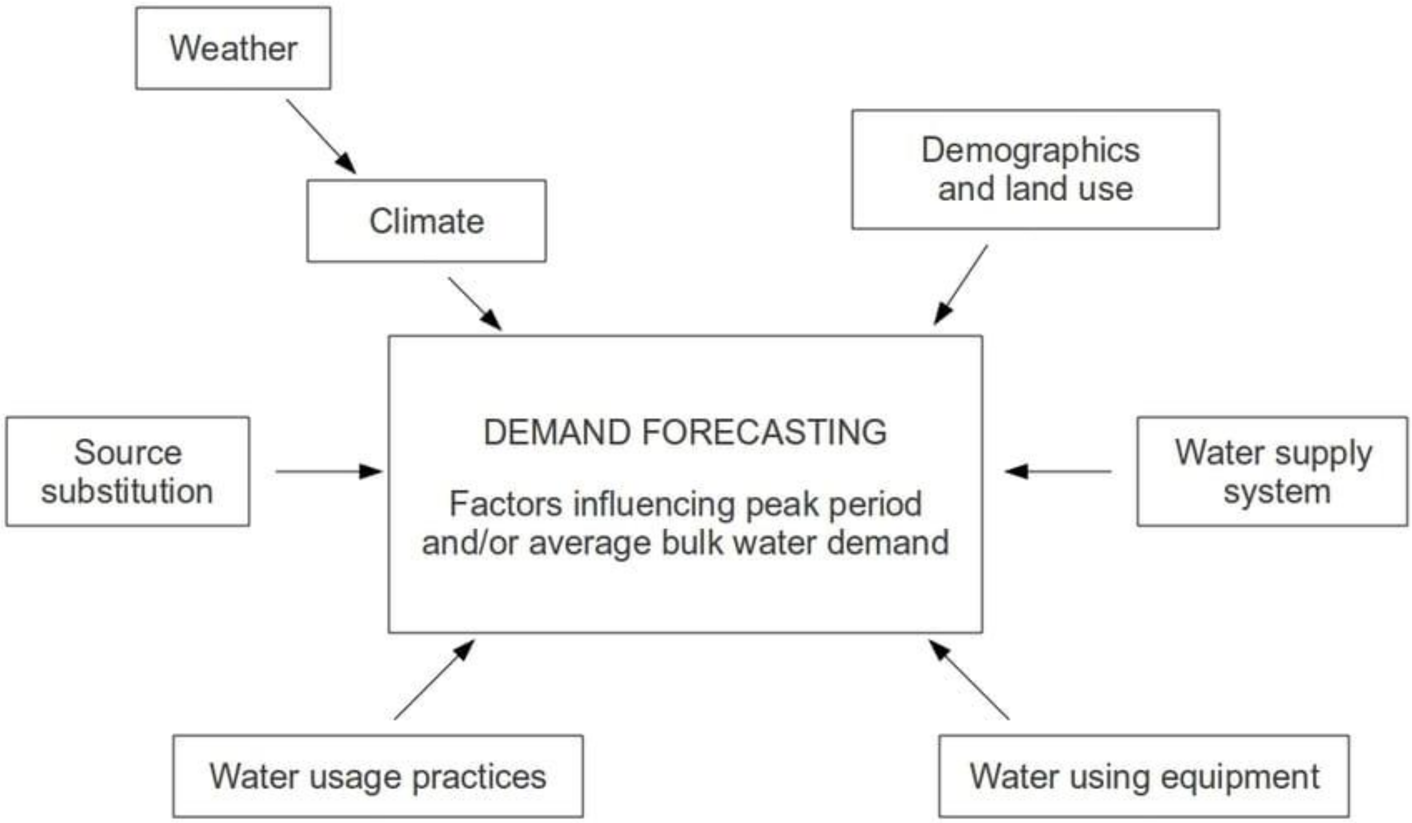
WDM aims to increase water efficiency through both wise use and reduction, which in turn will reduce or postpone the need to build more dams and drill more boreholes

WDM seeks to maximize the usage of a given volume of water by curbing inessential or low-use values through price or nonprice measures

1. WDM is the development and implementation of strategies aimed at influencing water demand in order to achieve water consumption levels that are consistent with equitable, efficient and sustainable use of the finite water resource
2. WDM is a management approach that aims to conserve water by influencing demand. It involves the application of selective incentives to promote efficient and equitable use of water. WDM has the potential to increase water availability through more efficient allocation and use. This is guided by economic efficiency; equity and access; environmental protection and sustainable ecosystems functioning; governance based on maximum participation; responsibility and accountability and political acceptability

Incentives for implementing WDM

- The incentives for implementing WDM in the region and in individual countries are numerous:
- resource protection: Managing demand eases pressure on scarce resources
- increased production: It is more productive to encourage or adopt measures for efficient use of water than to invest in additional sources of supply a sound basis for planning: Estimates of present and future sectoral water use can be made
- water loss reduction: This promotes the sustainability of the resource


Weather
Climate
Demographics and land use
Source substitution
DEMAND FORECASTING
Factors influencing peak period and/or average bulk water demand
Water supply system
Water usage practices
Water using equipment

PROGRAM

```
I=0
While i<6:
X = comm.readline().decode().strip()
If x==”start”:

Run_audio_file(“audio/start.wav”)

# store the start time of motor

Start = datetime.datetime.now().strftime(“X”) mydevice.digitalWrite(4, ‘HIGH’) twilio_alertmoto

Print(“\nMotor on..”)


Elif x==”comm1” or x==”comm2” or x==”comm3” or x==”comm” communication = x

Elif arg==”comm2”:


Msg_string = “Dear user, need your attention here. The water tank \n\nIn the initial phase of the project you chose to \n\nJust click on the Turn Off button to switch off \n\nYou can also choose other 2 options ie Direct Li

Elif arg==”comm3”:

Msg_string = “Dear user, need your attention here. The water tank \n\nIn the initial phase of the project you chose to \n\nLog in and then switch off the motor. You can al

Elif arg==”stopped” or arg==”stop”:


Msg_string = “Congrats user, one cycle of the autonomous project: \n\nWishing you good Luck for the rest of the day. Y


#whatsapp message

Client.messages.create( from_=’whatsapp: +cred. FROM_, body=msg_string, to=’whatsapp: ‘+cred. TO_

#text (normal) message

Client.messages.create(

From_ cred.text_FROM,

Body=msg_string,

To= cred.TO_
```

Common solution

In general, there are several common technologies that are used for water quality estimation. The summarized list includes

Sensors: sensors are used to measure various parameters of water quality, such as

pH, temperature, dissolved oxygen, and the presence of chemicals and microorganisms. These sensors can be placed in rivers, lakes, and other bodies of water, and they can transmit data in real-time to a central monitoring system.

Smart meters: smart meters are used to monitor water usage in homes and businesses, and they can detect leaks and other potential issues. By providing real-time data on water usage, these devices can help water utilities to better manage their systems and respond to potential problems.

Actuators: actuators are devices that can control or manipulate the environment based on data from sensors. In the context of water quality, actuators can be used to

automatically adjust the flow of water, or to dispense chemicals or other substances to improve the quality of the water.

Gateways: gateways are devices that can connect multiple sensors and other devices to the internet, and they can act as intermediaries between the devices and central monitoring system. In the context of water quality, gateways can be used to collect data from multiple sensors and transmit it to a central server for analysis and processing. A table with examples of the shown list is presented in Supplementary Materials

The Raspberry Pi is a popular choice for the use in IoT projects, including those involving water monitoring. The Raspberry Pi is a small, inexpensive computer that iswell-suited for use in applications because of its low power consumption, small size,