# Smart water management using IOT

DHAANISH AHMED COLLEGE OF ENGINEERING.-ECE DEPT
PADAPPAI -601301,CHENNAI

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**Abstract:** Water is the most important need for all living beings. This paper helps to regulate the proper maintenance of water tank using IOT. Water management problems such as water usage, overflow in the water tank.To overcome this problem by implementing proper monitoring and information updation system. Ultrasonic sensor is used to indicate the level of water in real time. When the water level falls below the threshold level the motor will automatically ON. Temperature sensor is used to sense the temperature in the water tank. Water flow sensor is used to know the usage of water liter per hour. By using ESP8266 WI-FI module the data is recorded in real time and updated in cloud.

**Keywords:** Ultrasonic sensor, Temperature sensor, Water flow sensor, ESP8266 WI-FI module, SIM 900 GSM module.

## 1. Introduction

Internet of Things has been associated with cities, smart homes and also to manage traffic system.A unknown fact that about internet of things technology is also application across many other fields in our everyday life. Another such area where the internet of things technology can play a major role in water management. IOT is evolving fast and latest innovation occurring in wireless technology and embedded technology. This work focuses on a solution for water management in colleges, building and commercial area with the help of IOT. Water is precious and supply the needs to be regulated.

To maintain the water in a proper way, should prevent the overflow of water in tanks and usage of the water in proper manner. In traditional days there is no proper maintenance of water. In conventional tanks there is need of human being to ON/OFF the motor. In this paper the automated system is introduced which is used to save the human work and cost. In this system the motor is automatically ON/OFF by using level sensor.

The usage of water is observed by the water flow sensor.

## 2. Related work

Many researches are working in the field of IOT and its application. One such application is Smart Water Management. The researchers are creating a system which can indicate level of water in tanks, usage of water in water,quality monitoring suchas turbidity sensor, PH sensor, salt sensor in the water tanks to know contamination, alkaline nature and salts in the water which causes diseases to living beings. Another work presented an IOT system which is capable of detecting and displaying level of water in the storage tanks and used for managing and planning use of water. Divyapriya et.al in continuously keeps track of the level of the water in water system like overhead water tanks. Proposed the client can send the message to the framework realize the water level subtleties of the tank. This is intended to control the dimensions of water with help of ultrasonic sensor and GSM innovation. Kumar et.al in IOT based water management system for a campus proposed real time monitoring system for campus recommended that work utilized an off /on the track ultrasonic sensor HC-SR04 which is mounted at the highest point of the tank. It sends the ultrasound beats at 40khz towards the water surface and measures the reflected waves backs to the sensor.

## 3. Existing system

This is used for water level detection and automatic ON/OFF the motor for water tanks. By using IOT the data is upload on Ada fruit platform. Laser sensor is placed above the tank toknowthe level of the water in the tank. When water falls below the threshold value the motor is automatically ON.

***Corresponding Author,**
**E-mail address:** sajeeda666@gmail.com



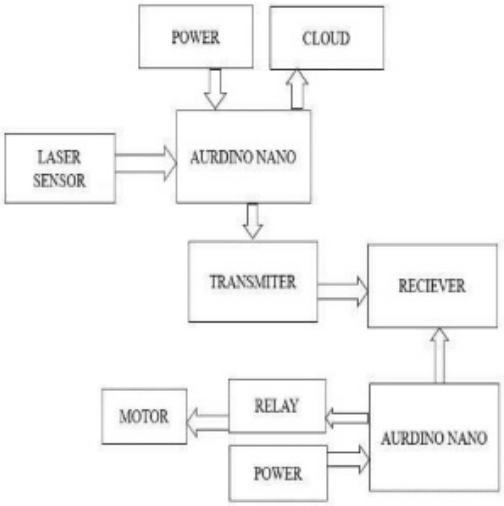


**Fig.1:** Block diagram of existing model **4.**

## Proposed System,

In the proposed system the following parameters can be known

- The level of water in the tank by using the ultrasonic sensor and can reduce overflow of the water.
- The usage of the water in the tank can be used to control the wastage of the water.
- To know the temperature in the water tank in real time

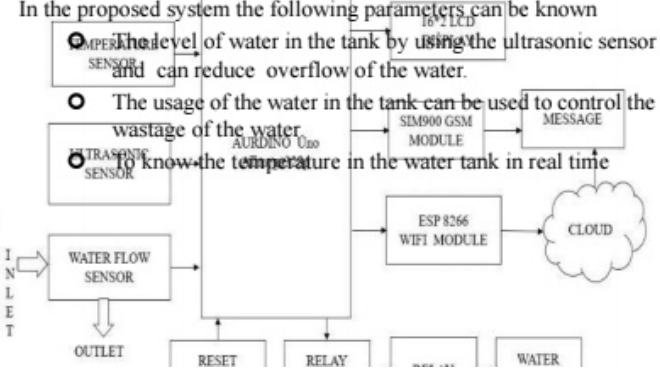


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**Fig. 2:** Block Diagram of Proposed System

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The Arduino UNO has super convenient power management and builtin voltage regulation.The Arduino can be directly powered through USBor external power supply. The external power supply can be given by

 Connecting power source(7-12v DC) to DC power jack  Connecting a battery lead to Vin and Gnd. 5V and 3.3Vare used to provide power to sensors and modules when connecting it to. The temperature sensor LM35IC has been used for sensing the temperature. It is an integrated circuit sensor that can be used to measure temperature with an electrical output proportional to the temperature. The temperature can be measured more accurately with it than using a thermistor. The sensor circuit ryis sealed and not subject to oxidation, etc. It is a three terminal sensor used to measure the surrounding temperature ranging from -55 degree centigrade to 150 degree centigrade.

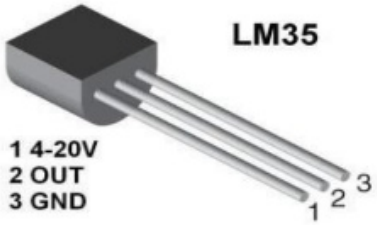


**Fig. 3:** temperature sensor

Water flow sensor are installed at the water sources or pipes to measure the rate of flow of water and calculate the amount of water flowed through the pipe. Rate of flow of water is measured as liter per hour or cubic meters. Water flow sensor consists of plastic valve from which water can pass. A water rotor along with a hall effect sensor is present and measure the water flow. The main working principle behind the working of this sensor is the hall effect. According to this principle , in this sensor , a voltage difference is induced in the conductor due to rotation of the rotor. This induced voltage difference is transverse to the electric current.

**Fig. 4:** water flow sensor The HC-SR04 ultrasonic module is a module that can provide noncontact measurement within the range of 2cm to 400cm with an ranging accuracy that can reach 3mm. It works on the principle of echolocation. The ultrasonic sensor as a trigger and an echo pins. The Arduino provides a high signal of 10microseconds to this pin. The sensor is trigged, it send out a 840khz to the surface of the water. On getting to the surface of the water, the wave is echoed back to the sensor and the Arduino reads the echo pin to determine the time spent between the triggering and receiving of the echo.

**Fig. 5:** Ultrasonic sensor

The Arduino Uno is used as microcontroller in this structure , it has 14 propelled data/yield pins of which the user are using 6 pins for interfacing sensors-waterflow , Ultrasonic and temperature. Interfacing the wi-Fi module ESP8266 with Arduino for giving an electronic system. Arduino is a microcontroller board subject to the Atmega328p. A 16 MHz quartz valuable stone, a USB affiliation, a power jack, a reset.


**Fig. 6:** Arduino uno

The ESP8266 can do either offloading wi-fi frameworks organization limits from another application processor or encouraging an application. The ESP8266 wi-fi module is a free SOC with facilitated TCP/IP show stack that can giveany microcontroller to access to the wi-fi range. This module has an earth shattering enough prepared getting ready and limit capacity that empowers it to be composed with the sensors.

**Fig. 7:**ESP 8266 WI-FI module The SIM900 is a quad-band GSM/GPRS solution is a SMT module which can be embedded in the customer applications. Featuring an industry standard , interface the SIM900 delivers GSM/GPRS 850/900/1800/1900MHz performance for the voice, sms , data with small power consumption.

A 16*2 LCD has two registers namely, command and the data. The register select is used to switch from one register to other.

RS=0 for command register and RS=1 for data register.

## 5. Results

This paper gives efficient usage and level detection of water in the water tank in effective manner by using the IOT.


**Fig. 8:** temperature in water tank

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**Fig. 9:** Water level sensor

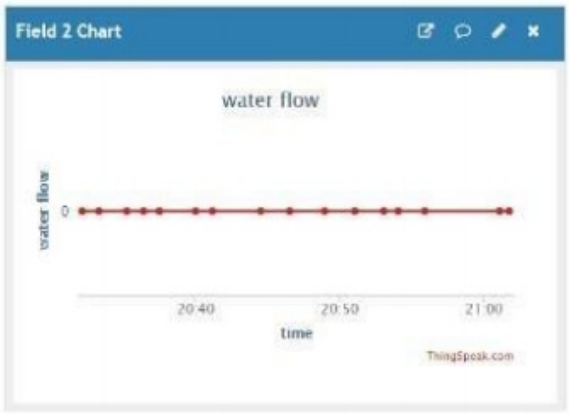



**Fig.10:** Water is not in usage

## 6. Conclusions

According to this system, proposed architecture becomes more autonomous with quick transmission of data by using IOT. The main advantage in IOT is, even when clients are not in the node network, data will be sent, whenever a client is connected with that node, they can able to see the data which has been sent already.

Smart water management can reduce the overflow of water in tanks and provide the usage of water in liter per hour in real time. This system is cost effective. This enables the efficient use of water.Thus

it reduces the wastage of water. This project can be further enhanced by using the results of this present project. The turbidity sensor is placed in the water tank to know quality of water which is helpful to know that chemicals in the water. The PH sensor is also placed in

water tank to know the nature of water in tanks in which is suitable for drinking or not for living beings in real time by using IOT.

A smart water management system offers several benefits, including:

1. Conservation: It helps in monitoring and optimizing water usage, reducing wastage, and conserving water resources.

2. Efficiency: Smart systems can detect leaks and inefficiencies, allowing for prompt repairs and cost savings.

3. Data Insights: They provide real-time data

And analytics for better decision-making,

Enabling more efficient water distribution.

4. Cost Savings: By reducing water loss, energy consumption, and maintenance costs, smart systems can save money for both utilities and consumers.

5. Sustainability: These systems contribute to sustainable water management, helping to ensure a stable supply of clean water for the future.

6. Environmental Impact: They reduce the environmental impact by water management system

7. Environmental Impact: They reduce the environmental impact by minimizing water wastage and energy use in water treatment.

8. Remote Monitoring: Smart systems enable remote monitoring and control, making it easier to manage water infrastructure.

9. Improved Quality: They can enhance water quality through better monitoring and treatment adjustments.

10. Consumer Engagement: Users can track their water consumption, leading to more conscious water use.

11. Resilience: Smart systems are better equipped to handle emergencies and unexpected events, ensuring continuity in water

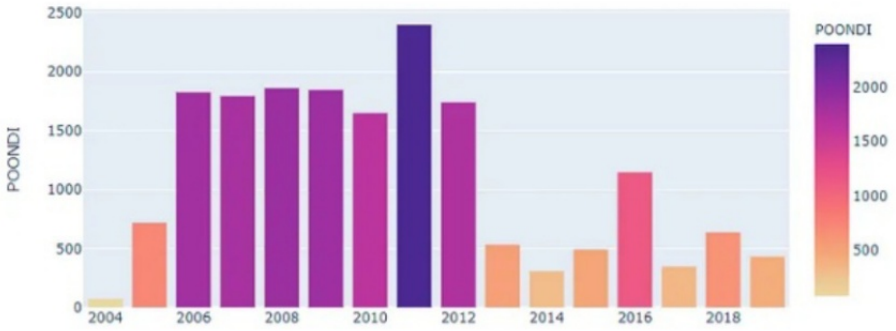
Overall, smart water management systems promote efficient, sustainable, and cost- effective water use while reducing the environmental footprint.

**Sma**

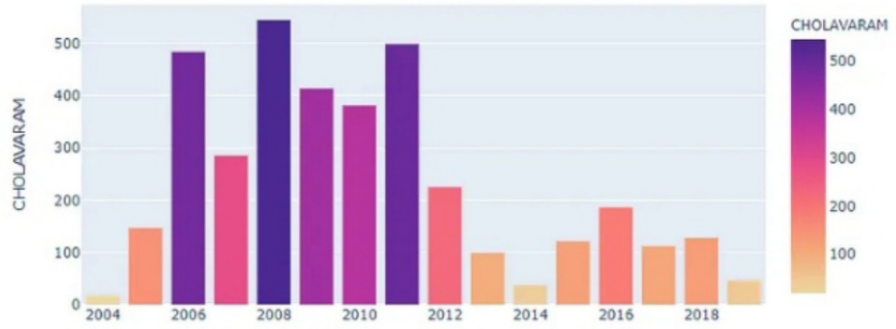
*A smart water management system figure shown*

## 2.1 Individual Water Levels

```
# Individual Water Level
Graph

water_levels =
reservoir_time.groupby([(rese
rvoir_time.index.year)]).mean
()
water_levels.index.names =
['Year']
water_levels =
water_levels.reset_index()
water_levels =
water_levels.set_index("Year"
)
years =
sorted(list(set(water_levels.
index)))
reservoirs =
list(water_levels.columns)

for res in reservoirs:
fig = px.bar(water_levels,
x=water_levels.index, y=res,
color=res, width=800,
height=400,
color_continuous_scale=
px.colors.sequential.Agsunset
_r)

fig.show(renderer="colab")
```




NOTE: This is an interactive plot and values can be seen by hovering over it in python.

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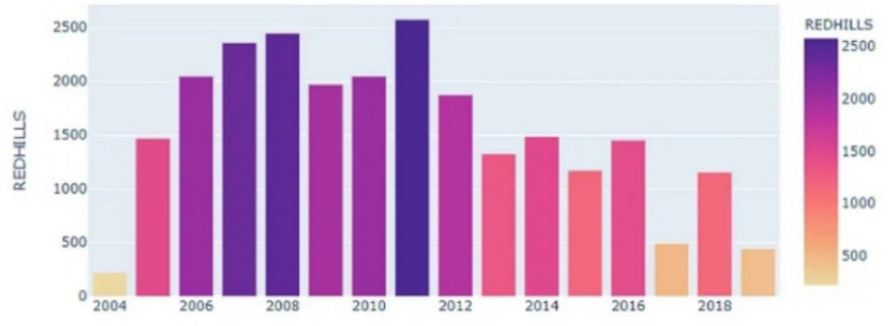


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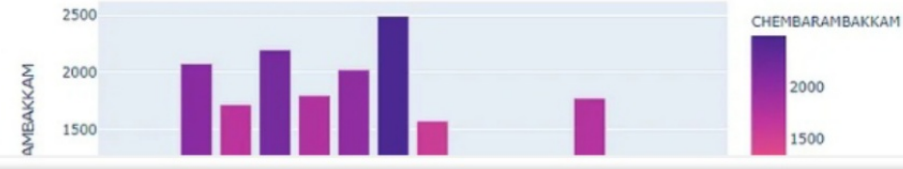
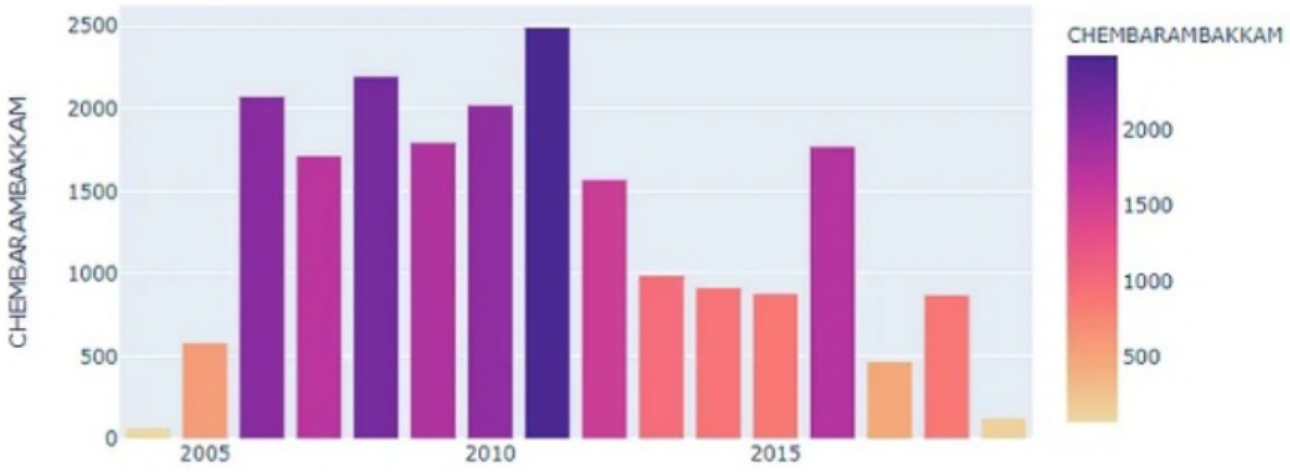
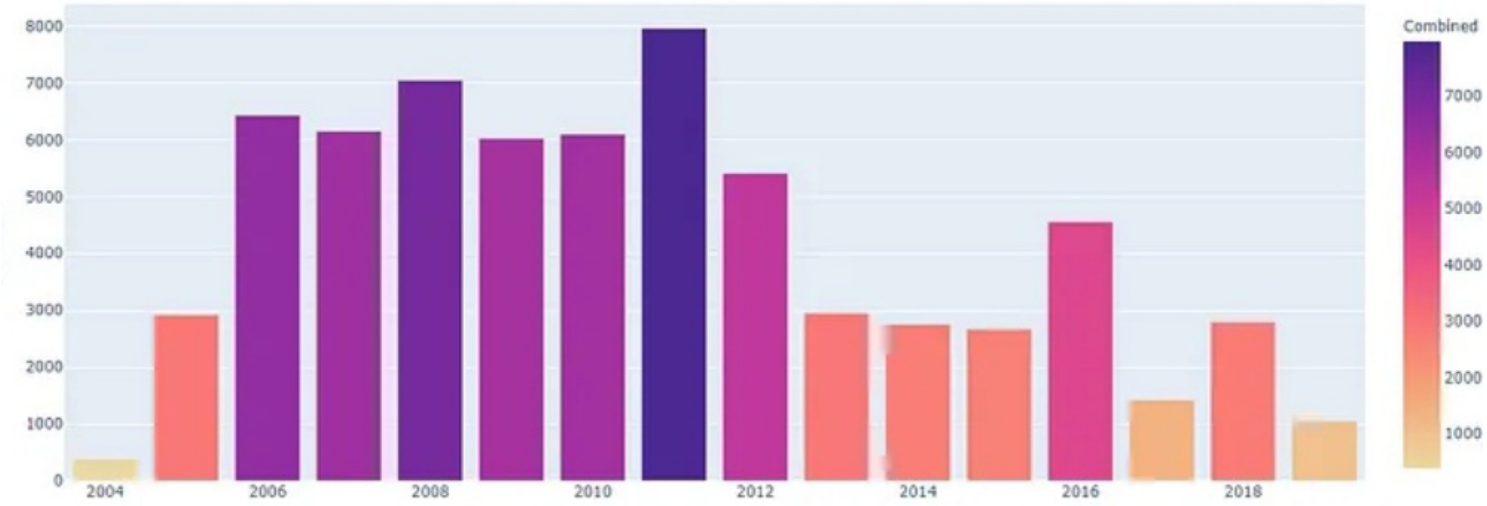





NOTE: This is an interactive plot and values can be seen by hovering over it in python.

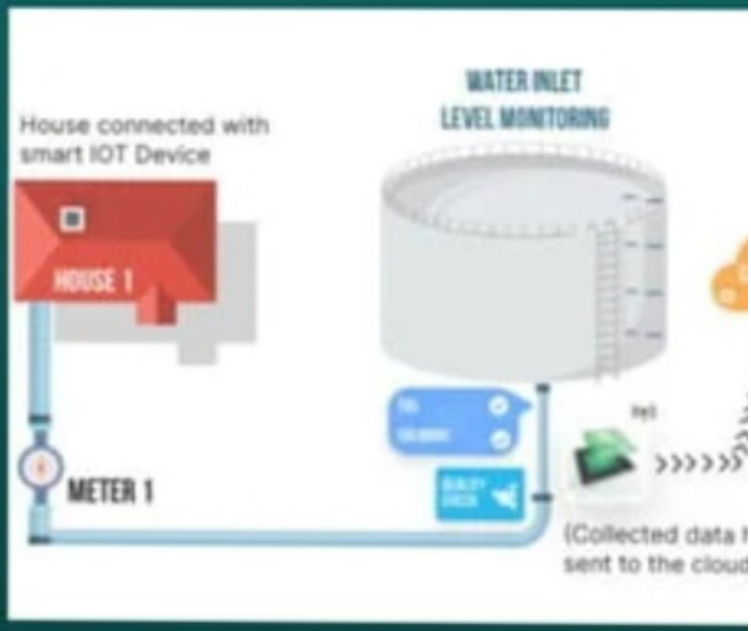
```
# Combined water Level graph

water_levels_com =
reservoir_time.groupby([(rese
rvoir_time.index.year)]).mean
()
water_levels_com.index.names
= ['Year']
water_levels_com =
water_levels_com.reset_index(
)
water_levels_com =
water_levels_com.set_index("Y
ear")
years =
sorted(list(set(water_levels_
com.index)))

water_levels_com["Combined"]
=
water_levels_com[reservoirs[0
]] +
water_levels_com[reservoirs[1
]] +
water_levels_com[reservoirs[2
]] +
water_levels_com[reservoirs[3
]]

fig =
px.bar(water_levels_com,
x=water_levels_com.index,
y="Combined",
color="Combined",
```

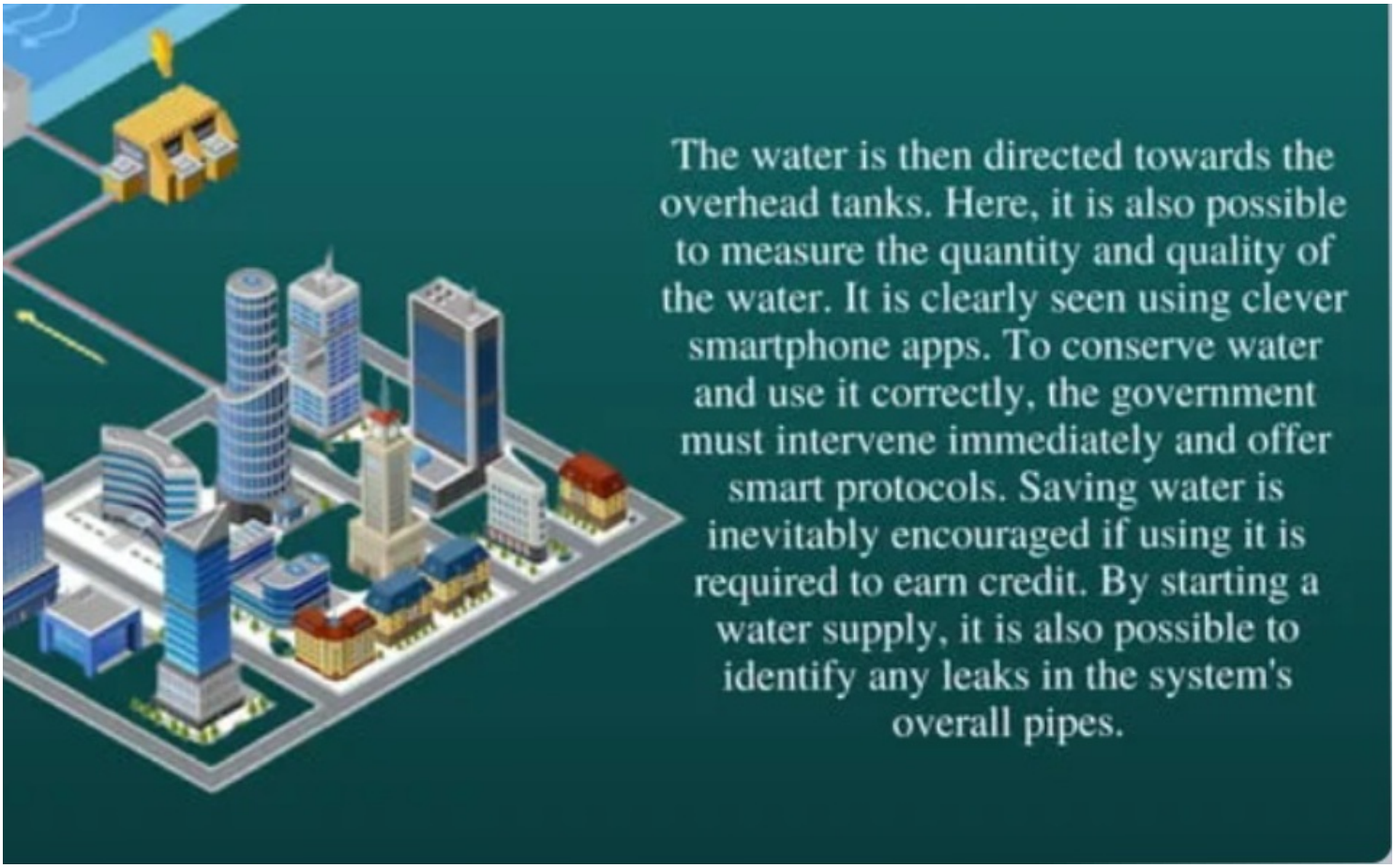



NOTE: This is an interactive plot and values can be seen by hovering over it in python.

IoT has had a significant impact on everyone's lives in this technology age. Smart houses, smart traffic management systems, and other smart infrastructure are present in our cities. IoT is currently heavily used in the water management strategies. It guarantees the precise use of water, protecting our priceless resources and enhancing overall convenience. The majority of nations lack effective resource management. It always causes a shortage of water. According to a recent study, water scarcity would affect 50% of the world's population within the next four years. These facts make it very evident that water will be a valuable resource in the coming years.

The IoT-integrated smart water management system is currently the greatest method for effectively saving water. The smart IoT water measuring devices are used to measure the water supply in both industrial and commercial settings. A number of sensors, including those for pressure, volume, pH, and turbidity, are mounted throughout the pipelines to collect data and send it to cloud storage. The sensors described above are mostly used to test the water's quality in a specific way.




The water is then directed towards the overhead tanks. Here, it is also possible to measure the quantity and quality of the water. It is clearly seen using clever smartphone apps. To conserve water and use it correctly, the government must intervene immediately and offer smart protocols. Saving water is inevitably encouraged if using it is required to earn credit. By starting a water supply, it is also possible to identify any leaks in the system's overall pipes.

- Water Preservation
- Smart Irrigation
- Smart Water Management
- Systematic Smart Water Units

While discussing in detail, most of the houses in our country especially in the southern part, the people have constructed large wells where the water is pumped easily to fulfill our daily needs.

## Evolution of smart water management for the metropolitan city

Smart showers are known to have a control point at the output source. Today, it is possible to control the entire household's water system. Either a utility company or a relevant government is in charge of the whole water delivery. The monthly bills go to both the household and the industrial sectors. Usually, it is calculated using water metre measurements. The majority of people wonder how smart water metres are introduced. It is merely a typical question and not a major concern; it is not a big hypothetical one. It is simple to create smart water metres by adding sensors to conventional metres. Massive data collections have been analysed by intelligent systems, even when the distance factor is taken into account.


According to a statistics report, agriculture uses around 70% of the water that is used globally. This one automatically applies to improving roughly 90% of the Asian nations in the southern region. It is possible to drastically remove by utilising more modern IoT & AI technology. The irrigation procedure often follows an infinite strategy. An enormous plant's water needs are triggered by a number of variables. Practically speaking, it is impossible to quantify every issue. But as of right now, everything has changed and is moving in the right direction.

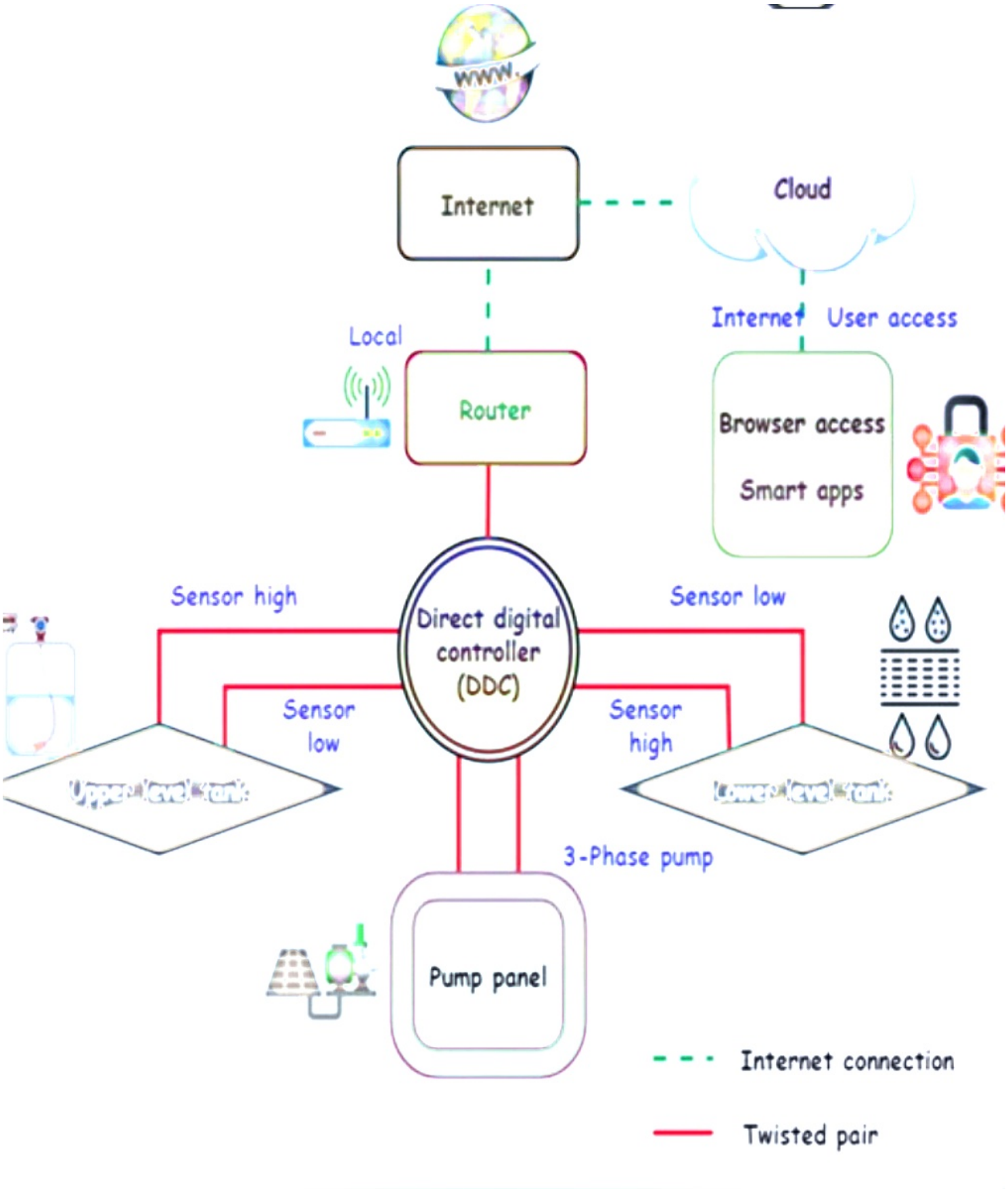
The management of water resources, conservation efforts, and waste prevention have all been made possible by IoT, as is evident from the aforementioned facts. The optimization of automated concerns is what the Internet of Things is all about. IoT had a significant impact across all industries, excluding water management. It plays a crucial part in everything from beehive monitoring systems to smart cities. There is no doubt that everything will be automated in the future, and this is only possible with the help of IoT coupled with its array of sensors. Be prepared to use IoT technology in every industry by making the proper system choice and being wise enough to do so! In search of any IoT project development or other services like app or web development. For your project's launch, you can find top web development companies nearby.

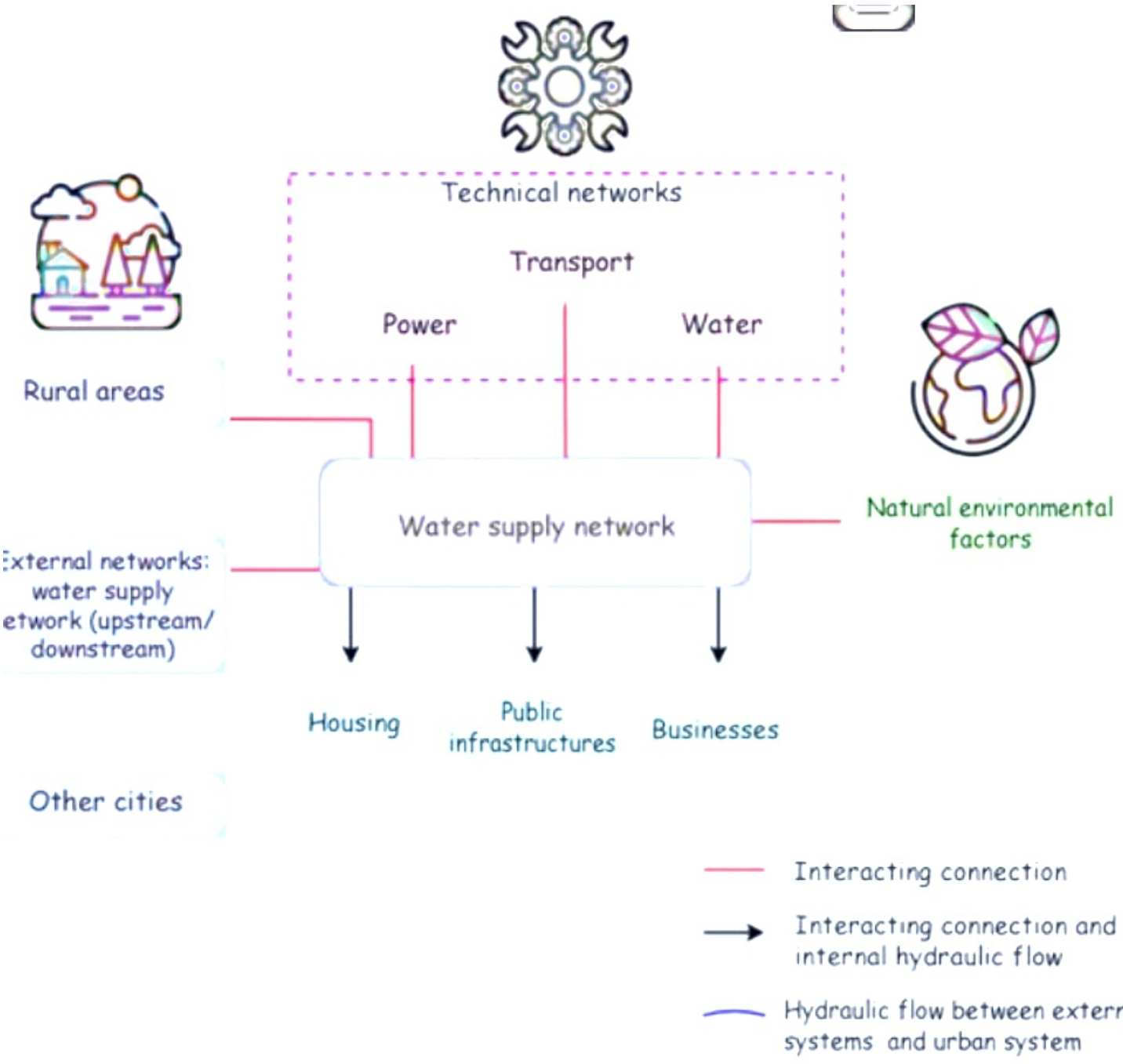
Water is one of the fundamental resources that aid life and there are speculations that estimate at 2025 almost half of the urban population will live under short supply and water stress. With the usage of new technological advancements in IoT (Internet of Things) powered smart devices for water management, it can become a worthy implementation towards avoiding the predicted water depletion. In the past years up until recently, water monitoring and management were manually carried out with intensive power requirements and high capital expense with low efficiency recorded. Overflow of water overhead tanks in residential, commercial, cooperate and educational settings, as well as broken pipes resulting in spillage, contribute to wastage at large. Regular reservoirs for water cannot monitor nor give analytics and automated water level detection in the tank. Vandalization or transmission blockages on distributions pipes may take so long to discover. The proposed model addresses problems mentioned above by the application of portable smart systems with interoperability and easily configurable to handle automated management of water supply with energy efficiency and a reduction in power cost in both homes and enterprise environment within smart cities as well as reduction of the rate of building degradation as a result of overflow from overhead tanks. Our model also integrates the application of Natural Language Processing for speech recognition as an alternate medium useful

- Smart water management gives a greater understanding of the water system, including flaw detection, preservation, and water management.
- A comprehensive database of regions with water losses or unlawful connections can be built with the introduction of smart water system technology by public service corporations.
- Smart water grids can save costs by conserving water and energy while improving the quality of service to consumers. Wireless data transfer allows consumers to assess their water use to reduce water costs in other circumstances.

## 3. Proposed Method: IoT-Based Smart Water Management Systems

In Saudi Arabia, water supply and sanitation are marked by problems and successes. Water shortage is a major issue [30]. Water desalination, water distribution, sewerage, and wastewater treatment have received significant investments to combat water shortages [37]. Today, desalination provides roughly half of the country's drinking water, groundwater mining provides 40%, and surface water supplies in the mountainous southwest account for 10% [38]. A desalinated water pipeline runs from the Arabian Gulf to Riyadh, Saudi Arabia's capital and largest city. Consumers get water nearly at no cost. Despite these advances, the quality of service remains low, for instance, in terms of supply continuity. The public sector in Saudi Arabia is characterized by a widespread lack of institutional capability and governance. The Saudi vision 2030 addresses this challenge to be resolved [39]. Among the successes is expanding wastewater treatment and processed sewage to irrigate urban green spaces and farmland.


www.
Internet
Cloud
Internet
User access
Local
Router
Browser access
Smart apps
Sensor high
Direct digital controller (DDC)
Sensor low
Sensor low
Sensor high
Upper level tank
Lower level tank
3-Phase pump
Pump panel
Internet connection
Twisted pair


Technical networks
Transport
Power
Water
Rural areas
Natural environmental factors
Water supply network
External networks: water supply network (upstream/ downstream)
Housing
Public infrastructures
Businesses
Other cities
Interacting connection
Interacting connection and internal hydraulic flow
Hydraulic flow between external systems and urban system

*TEAM MEMBERS NAME:*

- *Thirushul yadav*
- *Syed imran sathik*
- *Surya Kumar*
- *Ameen*
- *Mohamed Riyash khan*