SMART WATER MANAGEMENT

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ABSTRACT:

The project involves implementing IoT sensors to monitor water consumption in public place such as parks and gardens. The objective is to promote water conservation by making real-time water consumption data publicly available. This project includes defining objectives, designing the IoT sensor system, developing the data-sharing platform, and intergrating them using IoT technology and python. Water is a precious resource that can be intelligently managed. Effective water usage demands computerized home water supply management in a culture where water tanks, motors, and pumps are ubiquitous. Water management is crucial for the government and the citizens in countries like Saudi Arabia. The issue is providing a constant, high-quality, low-cost water supply. This study introduces a smart water management (IoT-SWM) system that may be used in structures that do not have access to a constant water supply but instead have water stored in enormous tanks underneath. The GSM module collects water use data from each home in a community and transmits it to the cloud, where it is analyzed. A smart water grid is a hybrid application that uses an inspection mode to identify leaks and measure the resulting height differences to keep track of the tank's water level. The system automatically deactivates the affected section after detecting any water shortage or malfunction in the system mechanism, such as broken valves, pumps, or pipes. It sends an emergency signal to building managers. It monitors essential water quality elements regularly, and if they fall below acceptable levels, it sends warning signals to the building management, who can take action. Over an extended period, the system monitored and recorded all water quality metrics. The system restarts when the water pump has been reconnected and sends an emergency alert. As a result, the suggested system has been an excellent replacement for Saudi Arabia's mechanically operated system.

OBJECTIVE:

The main objective of smart water management is sustainable and reasonable usage as well as recycling of the water resources. Check out the main objectives of Smart water management using the IoT technology. Smart water management helps to minimize usage of water usually utilized in higher amounts for manufacturing, agriculture, and power production. It reflects the introduction of advanced practices like smart irrigation, precision farming, real-time water metering, crop water management, and various other applications of IoT in agriculture. Nowadays everyone is implementing agriculture software development services to simplify the tasks. Enhancing the quality of water and preventing contamination due to the wastage of chemicals and natural pollution like acidification. In order to maintain and improve the quality of water, many reputed organizations are using IoT technology and sensors in order to monitor and control in real-time monitoring. Smart water management using the IoT technology will help in enhancing the efficiency of the water systems like treatment plants, water collectors, waste water recycling centers, and distribution mains. By implementing the data solutions and IoT for asset management, many organizations can keep essential measurements like temperature, water pressure, flow, and many more. Integrating predictive maintenance helps in avoiding downtime and breakage of the equipment. You can attain leakage control by implementing smart water management devices that are equipped with moisture and leak sensors. Around $3 billion will be spent in order to fix the damage that has been caused by having leakage yearly. Leakage control is very important to keep budget and water resources safe. Implement consumption monitoring using the IoT-powered water management systems. It assists in optimizing and keeping under control the utilization of water resources at various levels including communities, households, countries as well as the entire planet. There are various advantages of implementing Smart water management using the IoT technologies. Let's discuss how exactly smart water management systems influence the conservation, consumption, as well as quality of the water resources on our planet. IoT water management solutions enable managers to fully or partially automate all the processes as well as optimize the usage of human power. The scope and depth of the automation will differ based on the sector and particular business requirements. For example, utility networks as well as smart water supply companies will automate the complete lifecycle of offering water to customers by making use of the connected meters, dynamic pricing models, as well as real-time monitoring systems. Sustainability goals are the basis of many innovation and retrofit projects for the smart water industry but across all other sectors like logistics, construction, energy, etc. Technologies that are implemented for smart water will no longer be considered as a source of higher efficiency and savings but also as the medium for reaching various environmental goals that includes reduced pollution, carbon footprint, and water preservation.

INTRODUCTION:

One of the essential elements in the universe is water. Nowadays, consumers continuously seek methods to simplify their lives.Monitoring water quality is critical to ensuring the planet's health and long-term viability. Water is the source of many infectious illnesses, and garbage thrown by residents and environmental disasters from industrial enterprises pollute most of the nearby freshwater supplies in SA . Drinking water can be stored in an overhead tank. The principal causes of water quality deterioration in residential buildings are the development of microbes in overhead tanks and distribution networks, corrosion of pipe material, and the non-replacement of existing pipes. To avoid catastrophic health implications, it is necessary to continuously and remotely check the quality parameters of the water system in real-time.

Traditional water quality monitoring in South Africa (SA) is expensive and does not allow continuous and timely monitoring of water quality from various sources. Sustainable water management strives to combine many water management areas and optimize advantages in SA. This can be accomplished in various ways, including water reuse, collecting, and conservation techniques.The delicate balance of nature is maintained through ecosystem processes, whereas human consumption leads to an imbalance.Sustainable water management can reduce water use by changing consumer habits and implementing water efficiency measures.

A key goal of sustainable and self-sufficient water management is to maximize water use at the regional or municipal level. Information and control methods and monitoring leverage this resource.Leakage can be reduced, quality assured, customer experience improved, and operations optimized through water management. IoT can promote sustainable economic development and improved water resources and energy management in SA, which invests in citizens' well-being by supporting IoT adoption. Additionally, water systems should be equipped with technology to create smart procedures. In many water systems with weak infrastructure, uncertain supply, and customer satisfaction, or significant discrepancies between proportional bills and actual consumption or use, smart water systems can help improve the situation . There are several benefits to adopting a smart water system, including minimizing financial losses, and creating new business models better to serve urban and rural populations . The benefits of IoT technology in our smart water system project are well-known to us at this point. As a result, we will be able to control our energy consumption better and manage our resources. This project's primary objective is to design a novel, trustworthy, and adaptable water quality monitoring system for real-time monitoring of a remote water level throughout an IoT zone. Wireless sensor networks offer a novel framework for gathering and relaying data from various sources . Extensive testing is performed on an Internet of Things system designed specifically for this network. The Internet of Things network's end goal is to allow for the monitoring and management of water supplies, distribution systems, and reservoirs. There has been extensive testing and analysis of this.

In this paper, hybrid applications and IoT devices are given prominence. Water is more commonly squandered at residences, and the major supply source is wasted. GPRS and GSM modules are the two IoT devices: a water tank level sensor that sends data to the cloud for analysis and a motor that turns on and off automatically. Using an IoT-SWM system, the water level can be monitored and controlled while leaks in the tank are detected and an estimated measurement is provided.

Smart water management system Architecture:

The smart water management system is built on an IoT platform that consists of various components. The system's architecture is designed to collect, process, and analyze data from various sources, including sensors, databases, and other connected devices.The first component of the system is the water sensors that are installed in various locations to monitor water usage and quality. These sensors collect data on water flow, pressure, and temperature, among other parameters. The data collected by the sensors is transmitted to a cloud-based database for storage and analysis.The second component of the system is the IoT gateway, which acts as a bridge between the sensors and the cloud-based database. The gateway is responsible for collecting data from the sensors and transmitting it to the cloud-based database. It also provides security features to ensure that the data transmitted is secure.The third component of the system is the cloud-based database, which stores the data collected by the sensors. The database is designed to handle large amounts of data and is scalable to accommodate future growth. The database also provides real-time data analytics capabilities to enable quick decision-making.The final component of the system is the user interface, which provides access to the data collected by the sensors. The user interface is designed to be user-friendly and can be accessed from any device with an internet connection. The interface provides real-time data on water usage and quality, enabling better decision-making for water management.

Benefits of a smart water management:

A smart water management system using IoT technology offers several benefits over traditional water management systems. The system provides real-time monitoring of water usage and quality, enabling better management of water resources. It can also help identify leaks or wastage in the system, reducing water losses and conserving water resources. The system can also provide insights into water usage patterns, enabling better decision-making for water conservation and management. The data collected by the sensors can be used to identify trends in water usage, enabling the implementation of targeted water conservation programs.The system can also be used to manage the quality of water, ensuring that it meets the required standards for consumption. The sensors can detect changes in water quality and alert the authorities to take corrective action.The smart water management system is designed to provide several benefits. Firstly, it helps to conserve water resources by identifying areas of high consumption and wastage. This information can be used to develop targeted conservation measures such as leak detection and repair. Secondly, it helps to ensure water quality by monitoring the quality of water at various stages of the distribution network. Thirdly, it helps to reduce operational costs by optimizing the water distribution network and reducing wastage. Fourthly,its provided real time information on water availability, which can be used to manage the water supply during periods of high demand or low availability.The proposed smart water management system has several challenges that need to be addressed. Firstly, the system requires a reliable and robust communication network to transmit data from sensors to the central server. Secondly, the system requires a high level of data processing and analytics capabilities to provide real-time information on water usage, quality, and availability. Thirdly, the system requires a high level of security to prevent unauthorized access and tampering of data.

DESING OF THINKING:

1. The proposed smart water management system under the West Bengal Drinking Water Sector Improvement Project has two main objectives.

(i) The first objective is to facilitate the management of customer service at a locallevel, thereby greatly increasing customer and community engagement with thenew system, which will lead to greater sustainability of the system through.

(a) increased ownership and valuing of the new piped water supply system.

(b) better revenue collection.

(c) responsible use of water.

(ii) The second objective of the smart water management system is to increase theresilience and efficiency of the O&M of the entire system, which will also lead togreater sustainability of the system through:

(a) reduced risk of system failure.

(b) improved compliance with social and environmental requirements.

(c) the development of new and necessary skills within the Public Health

Engineering Department (PHED).

IOT SENSOR DESING:

What sensors are used in smart water treatment?

The smart water sensor can monitor the pressure, temperature and quality of water present in tanks as well as running in the supply lines. This sensor can also come handy in keeping track of the pH level in water in order to offer pure and safe water.that is called the smart water management.its mostly used for the water treatment.

What are the IoT sensors used for water quality monitoring?

IoT 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.

REAL –TIME TRANSIT INFORMATION PLATFROM:

City administrators need to keep a close eye on water supply, consumption, and equipment. With IoT, the whole water supply chain can become more transparent and easier to control.

What technology is used in smart water management?

Smart water systems use equipment and technology like sensors, control panels and wireless communication to detect and relay information about leaks and changes in water pressure.

How is AI used in water management?

One of the ways in which AI is being used in water management is to monitor and analyze water cycle data. This includes checking water quality, tracking water use, and identifying potential problems in water supply infrastructure.

Integration Approach:

Across the globe, the integration of AI and the IoT in water management is revolutionizing how we monitor, distribute, and conserve water. These technologies enable real-time data collection and analysis, facilitating predictive maintenance, leak detection, and efficient water distribution.

What is the integrated water management approach?

Integrated Water Resources Management (IWRM) is a process that promotes the coordinated development and management of water, land and related resources in order to maximize economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.

What are the approaches to water management?

The techniques include water harvesting, desalination with renewable energy, water reuse, smart water management, and BGI, each of which has the potential to transform the way we manage water.

Sensors Deployment:

Sensors have broad applications in smart water management due to their great diversity and purposes. In a very basic water supply chain, sensors measure.

The quality of raw catchment water, the chemical composition in the water after treatment and wastewater, etc.

changing quantity in the storage reservoir,

pressure on the pipes in the distribution pipeline,wear of the equipment and machinery that process and distribute water to end-users, and more.

Using the data collected by IoT water sensors, managers at different points of the water supply chain receive key insights into the changing conditions of water resources and equipment and can take data-driven corrective measures on demand.

Smart water and monitoring systems:

Reduce wasting water used in high volumes for agriculture, manufacturing, power production. It implies the introduction of high-tech practices like precision farming, smart irrigation, crop water management, real-time water metering and other applications of Internet of Things in agriculture. Learn about our agriculture software development services.

Improve water quality and prevent contamination by chemical waste and natural pollution such as acidification. In order to improve and maintain the quality of water, companies use sensors and IoT technology for real-time monitoring and control.

Enhance the efficiency of water systems such as water collectors, treatment plants, distribution mains and wastewater recycling centers. Using IoT and data solutions for asset management, companies can keep important measurements such as water pressure, temperature, flow, etc. at hand, integrate predictive maintenance and avoid breakage and downtime of equipment.

Implement leakage control by using smart water management devices equipped with leak and moisture sensors. Given that almost $3 billion are spent on fixing the damage caused by leakage yearly, leakage control is essential to keep water resources and budgets safe.

Practice consumption monitoring via IoT-based water management systems. It helps to optimize and keep under control the usage of water resources at different levels — households, communities, countries and the whole planet.

INNOVATION :

Data collection :

Set up IoT devices like smart water meters or sensors inresidential or commercial properties to collect water consumption data.Collect additional relevent data, such as weather conditions, property size, and occupancy.

Data preprossing:

Clean and preprocess the collected data to handlemissing values and outliers.Normalize or scale the data for better algorithm performance.

Feature engineering:

Create relevant features, such as daily, weekly, orseasonal consumtion patterns.Incorporate external data sources like local waterusage statistics or drought indicators.

Machine Learning Model Selection:

Choose appropriate machine learning algorithmsfor your ask. Time series forcasting models, regression, or clusteringalgorithms may be relevant.Train models on historical data to learnconsumption patterns.
Reducing waste of water-intensive industries
Agriculture, manufacturing or power production use very high volumes of water. Farming alone accounts for 70% of all water consumption. The same sector is liable for wasting approximately 60% of that water according to the UN's Food and Agriculture Organization.
Producers have to contend with increasingly erratic weather patterns which result in hotter and drier growing seasons.

Real-time water metering and other applications such as smart irrigation systems or crop water management systems can help farmers reduce waste while maintaining soil health, improving water conservation, and increasing crop yield:

- Water flows, humidity, and temperature data collected by IoT devices, can be used to train machines to trace treatment processes.

- It can be used to evaluate the impact of an individual treatment process.
- The data collected using soil and light sensors can be analyzed to recommend the quantity of water and fertilizers required in a field.

These installations are designed to measure the essential aspects of a plantation, reducing the environmental impact thanks to responsible use of energy and natural resources, and by improving soil fertility and maintaining water quality. Libelium have calculated that overall, their solutions could help reduce the water consumption per capita by 10%, reduce leakage by 20%, reduce billings accordingly, predict potential failures and diminish the maintenance costs, while helping better manage water pressure and consumption. All of which allowed their clients to augment their revenue.

Monitoring water quality to fight pollution and diseases:

Manufacturing and other human activities can be responsible for polluting rivers and the groundwater table. Sensors and IoT technology for real-time monitoring and control can help monitor and prevent pollution and even improve the water quality.

To do so, IoT systems connected with AI-based software are deployed to capture standard parameters for monitoring the water quality: pH, Total dissolved solids (TDS)—including Oxygen, the Oxidation reduction potential (ORP) or the Temperature of different types of water. Using machine learning algorithms, the devices can be trained to predict the quality of water, monitor the effectiveness of a sanitizing agent or adjust the water treatment plan accordingly.

In the UK for example, outbreaks of the Legionnaires' disease have been reported over the past few years. It is caused by Legionella, a bacteria that develops in uncontrolled soil and water environments. It infects the body through inhalation of contaminated water droplets and can cause a potentially fatal form of pneumonia. To combat this illness, Wavetrend, created legionella detecting sensors that use Saft batteries. The IoT actively monitors hot and cold outflow, and will activate an alert on high-risk temperatures that could lead to spread of the bacterium, enabling quick action to be taken. Read the complete case study here: Helping to protect UK's water from Legionella with their temperature sensors.

Improving the efficiency of water systems:

Smart water systems allow the collection, treatment, distribution and recycling of water. These systems, often deployed underground, can leak, freeze, or breakdown. These systems are widely deployed on infrastructures nowadays. By monitoring the pressure, flow, moisture, temperature, time difference between points and other parameters directly within the systems, the IoT can facilitate maintenance prediction and avoid breakage, leakage, and equipment downtime.

One such example is Fuji Tecom's "Quatro Core" LC-5000, a system powered by Saft batteries, that can automatically pinpoint the location of a leak by calculating the time difference of the detected noise caused by the water leakage between sensors. A combination of 4 sensors allows for complete accuracy of the system and distance calculation from the measuring point. The sensors are also used as a radio repeater, extending the wireless communication, and avoiding poor connections due to obstacles. The solution can record up to 6 routes simultaneously and display the data on one screen, which expedites maintenance operations. Find out more about their product in our case study: Fuji Tecom is offering more efficient operation thanks to an innovative water leakage detector.

CREATING AWARNESS OF HOUSEHOLD WATER USE THANKS TO SMART METERS:

Many households are guilty of wasting water, without really knowing how or how much a change of behavior could benefit them. Most utility providers have now deployed smart meters to easily and remotely monitor and bill consumption. The information is also readily available to final users, which is a real incentive. Individual consumers can now make savings by lowering their water bill while preserving water supplies on a daily basis.

Techem, is the European leader in individual water and heating metering in collective housing. The company created an innovative smart reading system for utility meters connected to end devices wirelessly per OMS throughout a building. These smart readers send consumption and status info per mobile communication via cloud to the Techem data center which then automatically creates billing and energy reports for the properties. Not only does the system offer precise and automatic monitoring and billing, but the residents are informed of their exact consumption and are subsequently incentivized to reduce consumption. The combination of billing and consumption monitoring verifiably reduces heating and water consumption by about approximately 20%. Read the article “Techem- providing value to residents with smart metering” and the case study and the case study “Battery solutions for smart utility metering systems - Techem case study”.

Similarly, in Saudi Arabia where drinking water is a scarce resource, IoTSens developed a network of Watchmeter data loggers. The system monitors consumption patterns, without having to break into water mains to install an inline-meter, thanks to the detection of high-frequency vibrations in the water distribution network. The result is that customers can monitor, control — and reduce!—their own consumption. Find out more in our case study: Battery solutions for smart water networks - IoTsens use case We discussed further how the IoT can be used in Smart Cities to help us solve our ecological issues.

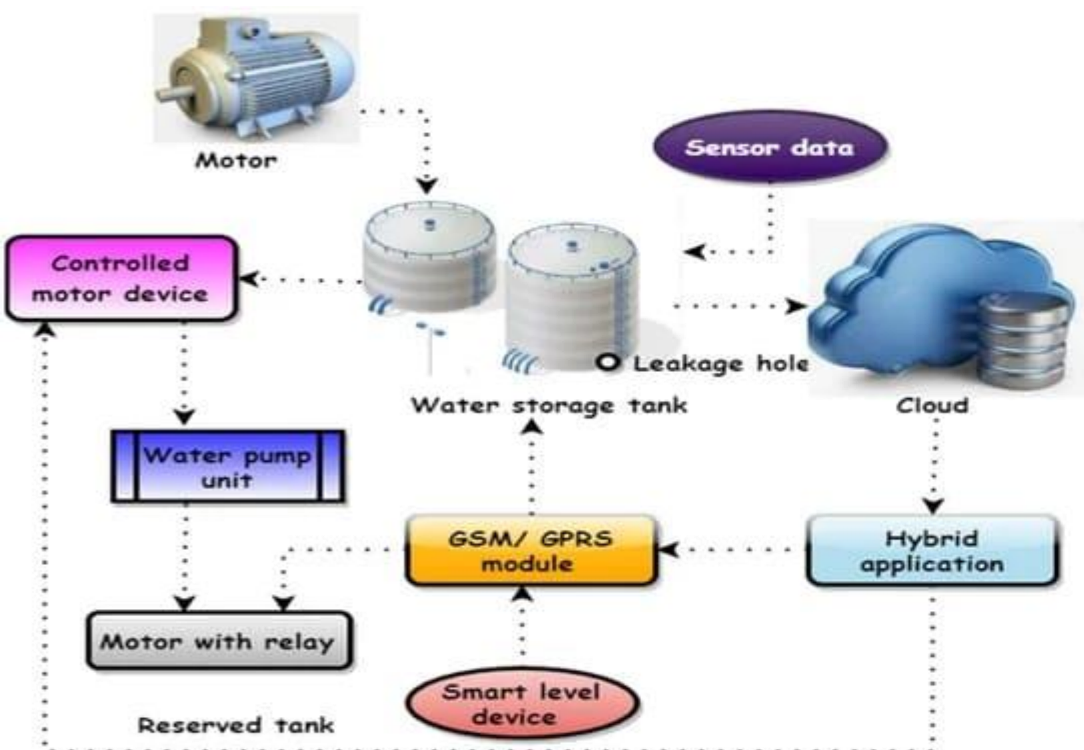
PROVIDING RUNNING WATER THROUGH INNOVATION SOLUTIONS ALL AROUND THE WORLD:

Managing water is not just about delivering it efficiently. Sometimes it is about delivering it to all. In many developing countries, many people do not have easy access to running water. Water utility infrastructures suffer from lack of investment, lack of public water points, irregular delivery services. Chlorine pills are expensive and unreliable. As a result, people with irregular or low incomes are faced with daily hardships in procuring water.

CityTaps have developed an innovative solution to address the problem: the first prepaid water service, CTSuite. The software and pay-by-phone solution relies on a smart and prepaid water meter. Customers can pay money with their phone on their water account using Mobile Money. When the account is charged, water becomes automatically available until the money runs out. The Smart Prepaid Water Meter measures and sends water usage data in near real-time. It also provides the water utility with live key hydraulic and commercial indicators and identifies thefts and leaks to reduce Non-Revenue Water (NRW) Find out more about this project we proudly contributed to “CityTaps: when IoT empowers people with a fundamental human need – access.

Smart water technology brings transparency and improved control to the whole water supply chain, from freshwater reservoirs to wastewater collecting and recycling. By allowing a better management of the production, distribution and consumption of water and enabling smart water treatment practices, the IoT is widely contributing to preserving our scarce resources. Over the years, Saft has become the go-to brand to power multi-technology meters for the water industries.

BLOCK DIAGRAM:



Relay-connected motors control the water pump, the second controlled motor device. The GSM module controls the motor and relay to respond to a signal and turn the motor on or off. A hybrid app must create both web-based and native hybrid applications. The cloud serves as a repository for the data collected, and it is this data that is analyzed and shown. The software will automatically check the water tank's current level since it regularly pulls data from the cloud. The application will signal the motor to turn the motor controller on or off. The app can remotely turn the motor on or off by sending a text message to the GSM network in the motor control device. If there is a leak in the water tank, the consumer can switch on the application's inspection mode at night to see any damage. Accordingly, it has been proposed as upcoming work to create a framework based on the Internet of Things for an efficient water management system that considers all these crucial characteristics and uses machine learning-based predictions to boost the smart management system's efficacy. Future works can additionally integrate the IoT coverage element while assessing measurement uncertainty.

COMPONENT:

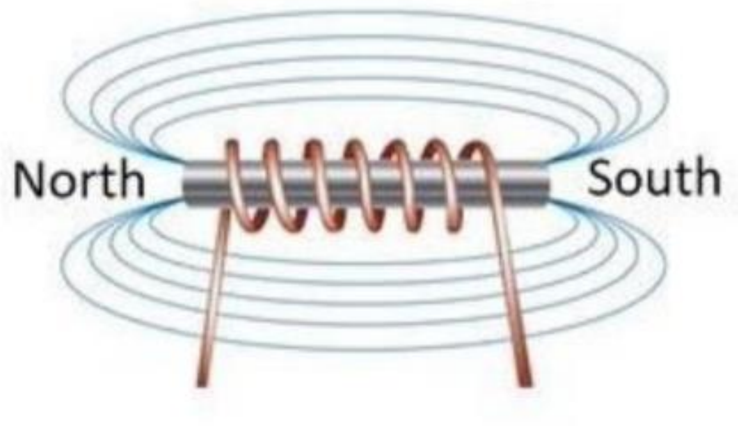
- Motors
- Water storage tank
- Controlled motor device
- GSM (Global System for Mobile) module
- GPRS (General Packet Radio Service) module
- Sensor Data Analysis
- Remote Monitoring and Alerts
- Hybrid application

MOTORS:

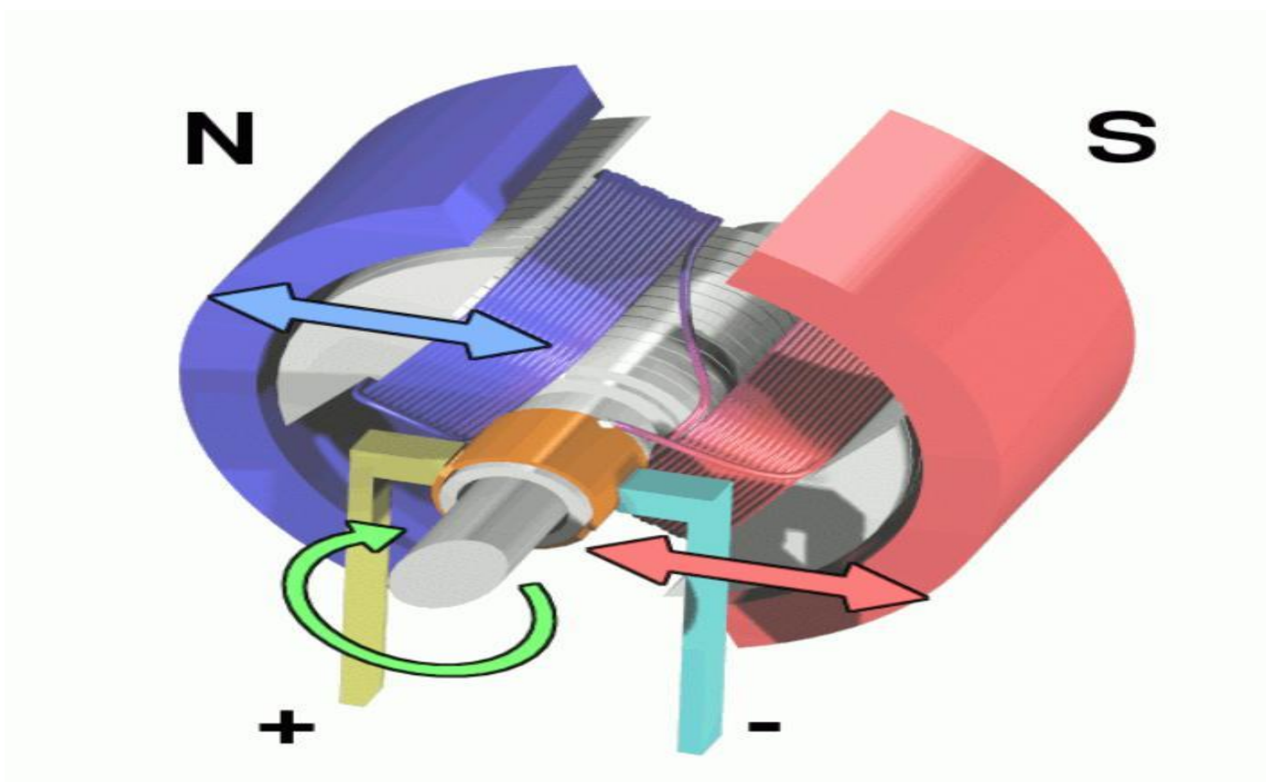
Before we dive into the different motor types you may see as an operator, let's discuss basic motor principles. Motors use magnetism to generate the rotational force required to power a pump. An electromagnet is created by wrapping wire around a rod and flowing current through it. North and south poles are created by this flow current.

(Electrical engineering: Electrical power, Motor or generator) An electric motor is a device for converting electrical energy into mechanical energy in the form of rotation. In an electric motor, the moving part is called the rotor and the stationary part is called the stator.

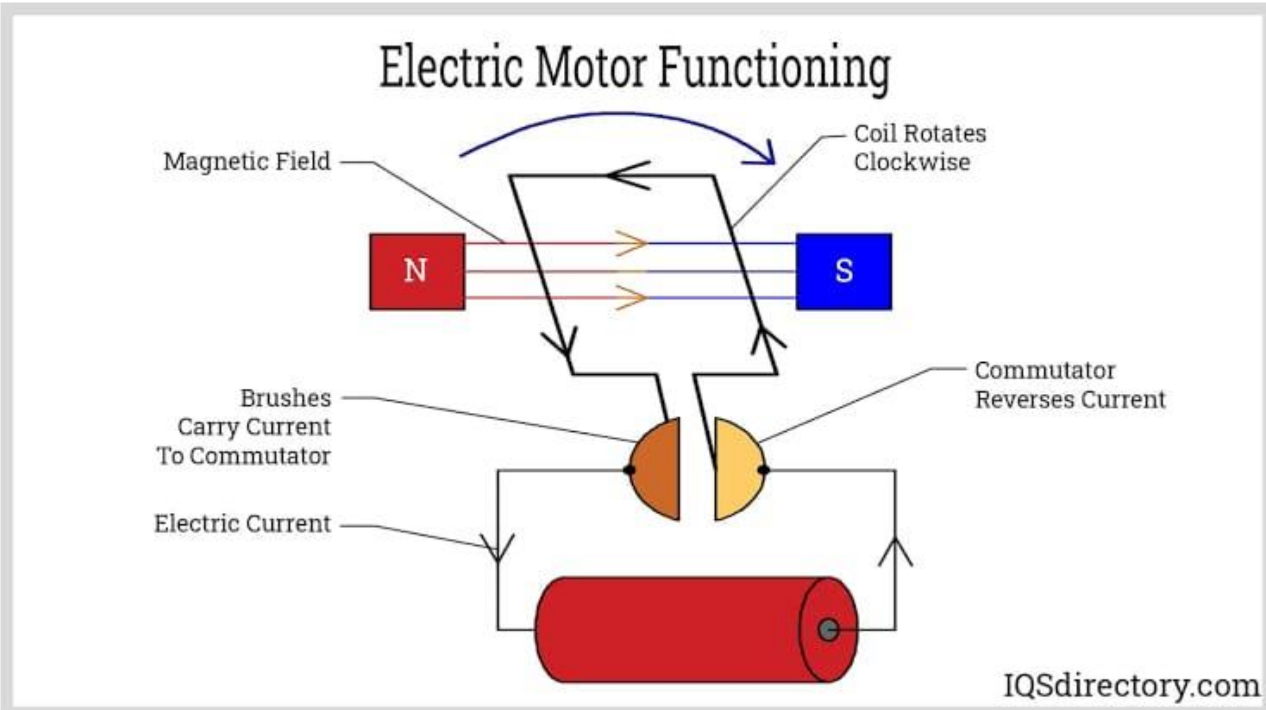
Motors can be easily controlled using electrical signals, such as voltage and current. This allows for precise control over the speed and torque of the motor.



As current flow direction changes, so does the polarity of the magnet. A simple motor can be created by placing a rotating magnet near an electromagnet. As current flows through the electromagnet (stator windings) it creates a magnetic pole, which attracts the opposite pole of the magnet (rotor). A magnetic field is created in the stator, which rotates the magnet attached to the rotar, following the rotating magnetic field.



A voltage is produced, in the form of a sine wave, by rotating a conductor through a magnetic field. As this voltage produces current, flow strength increases amperage from zero to a positive peak and then back down towards zero, with a negative amperage. This is a complete cycle. There are 60 cycle frequencies every second on the US electrical system, expressed as 60 Hertz (Hz).



Ohm's law shows the relationship between voltage, current flow, and the conductor's resistance, in an electrical system:

Volts (E) = Amps (I) x Ohms (R)

A volt is a measure of electrical pressure, comparable to water pressure measurement.

An ampere (amp) is a measure of electrical flow through a conductor, simiar to flow through a pipe.

An ohm is a measure of the conductor's resistance to current flow, comparable to pipe head loss.

SPEED MOTORS:

The speed at which this magnetic field rotates around the stator is called synchronous speed, expressed in revolutions per minute (rpm). Motors have a maxiumum rpm of 3,600 (since the electrical system operates at 60 Hz):60 cycles/second x 60 sec/min = 3,600 rpm.

A two pole motor can achieve 3,600 rpm, while motors with more poles will operate at fractions of 3,600 rpm:

- ✓ 4 pole = 1,800 rpm
- ✓ 6 pole = 1,200 rpm

Synchronous motors operate at the speeds mentioned above, while induction motors operate at a speed somewhat.

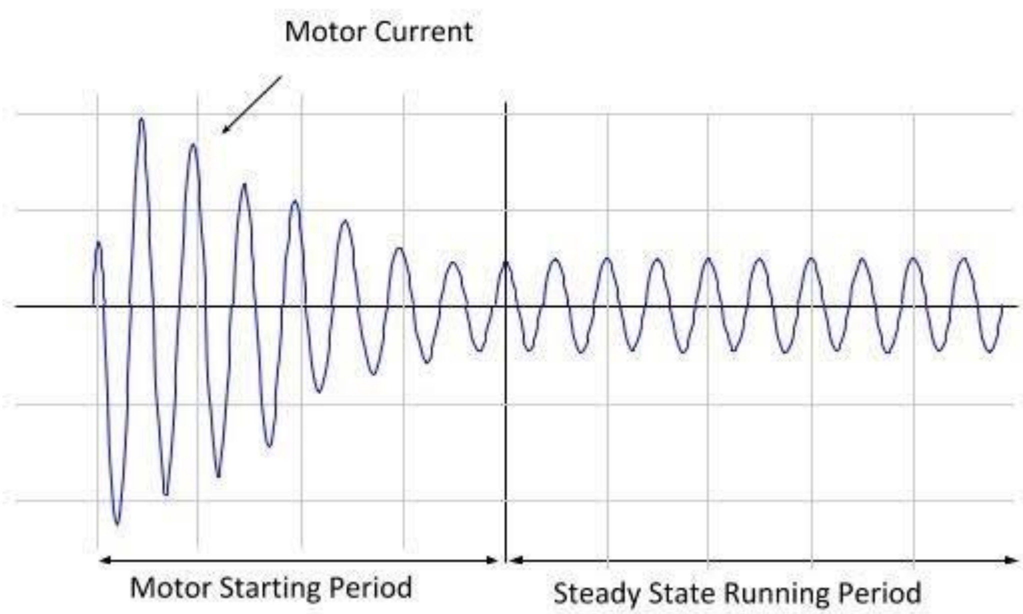
lower than synchronous speed:

- ✓ 2 pole = 3,450 rpm
- ✓ 4 pole = 1,750 rpm
- ✓ 6 pole = 1,150 rpm

Motor speed can be controlled by electronic motor controllers, allowing a single motor to operate over a wide range of speeds.

STARTING CURRENT:

Most motors draw more current during startup than during normal operation. The instant a motor is powered on, before the rotor begins to move, a locked-rotor-current (LRC), or starting current, is created. This initial power surge is typically 5 to 10 times the normal operating current for most motors, and is at its maximum before lowering to normal operating levels.



WATER STORAGE TANK:

Water storage tanks serve a critical role in ensuring the reliable supply of high-pressure potable water to communities. They are also financially beneficial as they decrease the size of required pumping facilities and reduce energy consumption. Water storage tanks are located in nearly every water distribution system around the world. It is important that engineers understand the different functions of water storage tanks. This course focuses on water storage tanks that hold “finished water”. Finished water means water that has been treated and disinfected and is ready for distribution to the community as potable water.

The most common type of water tank is the ground storage tank. This is a tank with the floor at ground level. Ground storage tanks are also called ground level reservoirs. However, the term reservoir implies that the tank may not be covered, and for finished water tanks, a watertight roof is required per Section 7.0.2.b of the Ten States Standards. Therefore, the term ground storage tank is more commonly used.

ELEVATED STORAGE TANKS:

Elevated storage tanks have the floor of the tank above ground. They are often called water towers. Examples of different types of elevated storage tanks. The highest water pressure is experienced in the lowest elevation building when the elevated storage tank is at the high water level. It should be confirmed that the piping system is designed to withstand the high water pressure. Note that water distribution pipes are typically 3 to 5 feet below ground, so the pressure in the pipes should be calculated at the lowest elevation of the piping. A pressure reducing valve can be installed in the piping system to keep pressures below the design maximum. The lowest water pressure is experienced in the highest elevation building when the elevated storage tank is at the low water level. It should be confirmed that this pressure exceeds the minimum acceptable water pressure. When calculating the lowest pressure, pipe friction and fitting losses at maximum flow should be calculated and subtracted.

GSM (GLOBAL SYSTEM FOR MOBILE) MODULE:

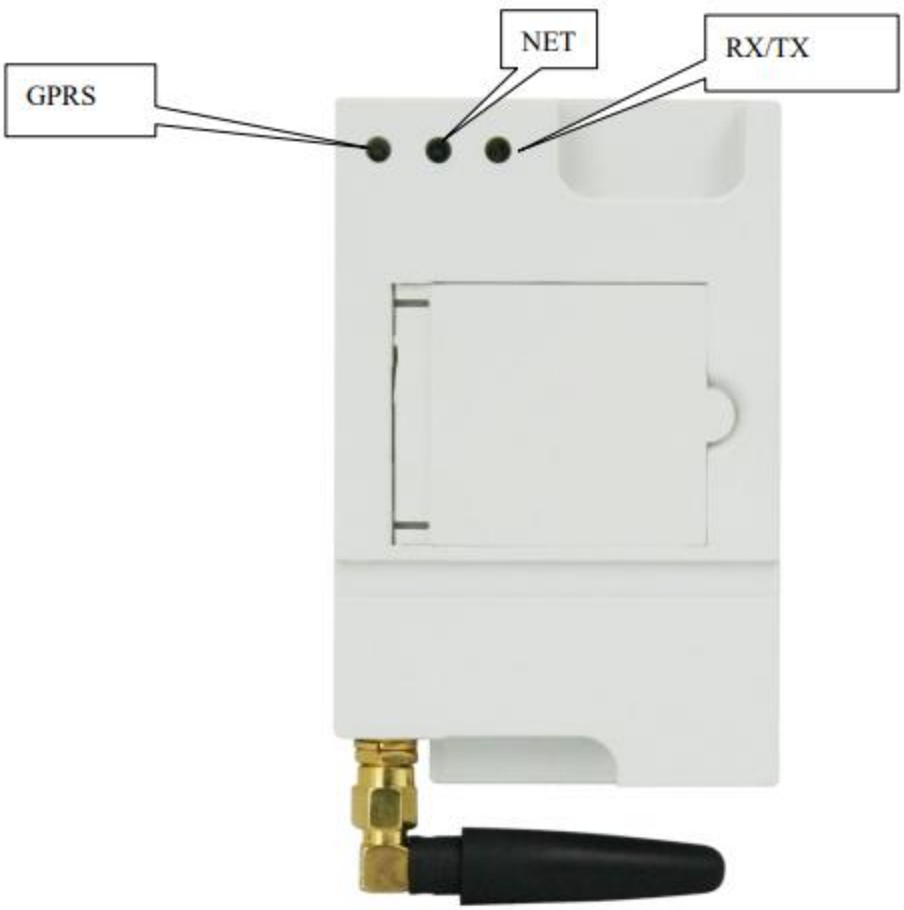
The GSM module is an optional add-on module for the Secvest 2WAY. It sends voice texts, control center protocols and SMS messages via the mobile wireless network. In addition to the analog integrated dialling unit, a Secvest with GSM module has a secondway of sending alarm messages. The GSM module is a small, powerful board. It can be quickly and easily plugged into the Secvest 868. In order for voice texts (control center) protocols or SMS messages to reach a control center or private connection via the module, the GSM module needs access to the mobile wireless network. To achieve this, you simply insert a mobile telephone card into the module and fasten the antenna provided on the board. The code of the SIM card must be deactivated or set to "0000." In the event of an alarm, the call for a Secvest with a GSM module can be made via PSTN (analog) and via the mobile wireless network. The GSM module is therefore also suitable for buildings without a telephone connection.

PRODUCT HIGHLIGHTS:

- Transfers voice texts and protocols
- Redundant transfer if PSTN fails
- Ideal for buildings without a telephone connection (vacation homes, etc.)
- Easy to install
- Antenna is cancealed inside the Secvest housing

GPRS (GENERAL PACKET RADIO SERVICES) MODULE:

G610 type GSM/GPRS communication module is applicable for the HXET100 data concentrator, which realizes the remote communication function of AMI concentrator.



BASIC SPECIFICATION:

Operating voltage:

DC 3.3v-4.5v

Operating Parameters:

- Operating temperature -40°C to +85°C
- Storage temperature -40°C to +85°C
- Operating humidity 5% ~ 100%
- Frequency range 4 frequency bands 850/900/1800/1900MHZ
- Internal protocol stack
- Current in Sleep mode: 1.6mA
- High sensitivity: -108dBm
- Dimension 92.00 x 60.00 x 23.64mm

Indigator Lights:

- GPRS: green, this light is for local communication, if the light is alwarsy on, it means the communication status between the module and concentrator is normal. Vice versa.
- NET: when the light is blinking very fast, it means it has successfully registered the GSM network; when it is blinking very slowly, it means it is making the communication connection.
- RX/TX: it is data communication light. When the module is communicating with the external equipment via SMS or GPRS, the light will blink at a regular frequency.

SIM Card Loading and Replacing:

When the concentrator is running normally, pls open the SIM card slot cover and change the SIM card.

Serial Port:

GPRS module communicates with the meter by serial port, the relative information about output is as following.

- Signal electrical level range 3.3V TTL level
- Local serial port baud rate 57600bps
- Data bits 8 bit
- Odd-even check even check
- Stop bit 1 bit

IMPORTANT NOTES:

Do not place it within the airtight metal box, otherwise you should lead the antenna out of the metal box Please set up the lightning rod when it is used in a high place out door. The product is not water-proof. Please do not place it in the open air and humid place without any shelter. Please protect it against electrostatic discharge.

HYBRID APPLICATION:

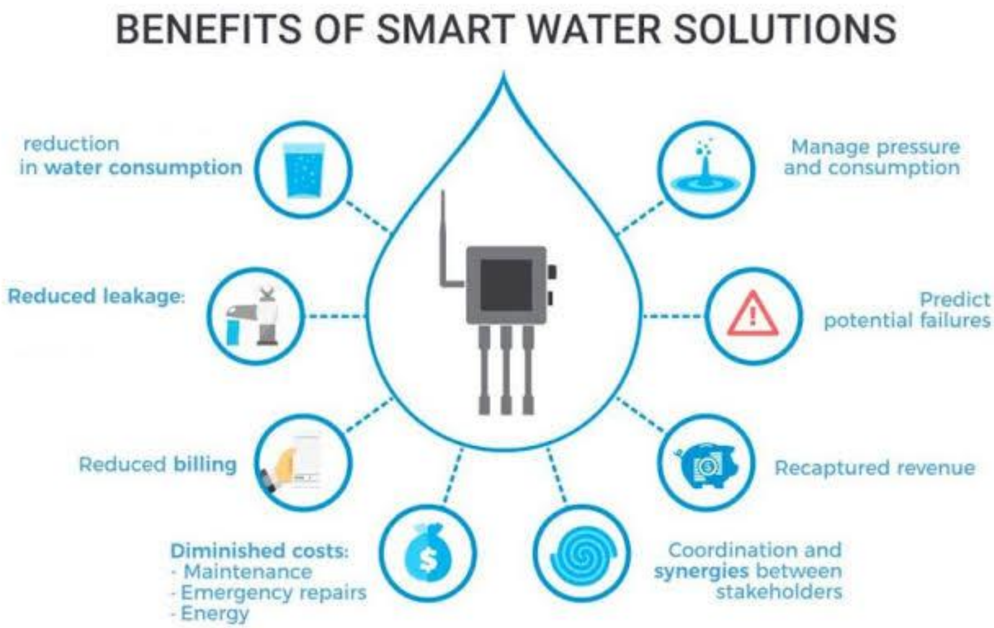
Water Quality Parameters:

This study measures key water quality parameters. The following sentence is a comprehensive overview of the key water quality parameters that are measured, including temperature, dissolved oxygen (DO), pH, conductivity, oxidation–reduction potential (ORP), total dissolved solids (TDS), and turbidity. Among all these parameters, pH measurement is particularly crucial as it is used to indicate hydrogen concentrations, ranging from 0 to 14 g-equivalents per liter in fields like chemistry, biology.

METHODOLOGY:

In this section, we explain how we designed and built our Hybrid IoT-based Water Quality Monitoring System. The system collects water data from sensors, which is then trained using machine learning algorithms SVM and ANN. We deploy the most accurate model to Google Cloud, where it can predict water quality values in real time. The ESP8266 Wi-Fi module sends the data wirelessly to the Cloud. Our system also has a control mechanism that treats the water if the ORP, pH, or both are extremely low.

Water is supplied via a centralised water supply system in combination with decentralised water supply options such as rainwater-storm water harvesting & waste water reuse.

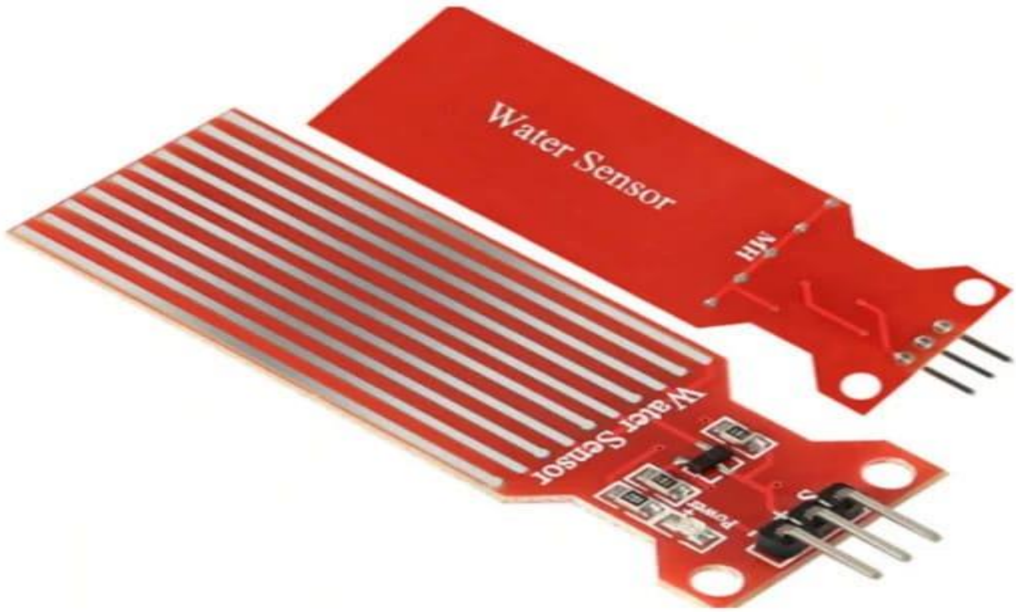


EXPERIMENTAL SETUP AND EVALUATION:

The sensors amplifier boards, Arduino, and ESP8266 modules were assembled inside a plastic box measuring 4 cm x 4 cm x 2 cm. To prevent the sensors from sinking into the water, the sensor probes were attached to a floating material because the upper part of these sensors is not water-resistant. A waterproof junction box was used to protect all electronics from water damage caused by rainfall and water splashing around the prototype.

SENSOR DATA ANALYSIS:

IoT-based water management system to reduce water wastage in residential buildings. The authors considered monitoring water level, leakage control, and auto refilling tank. It is centered around the Raspberry Pi 3 Model B+ kit [87]. This kit is based on a 64-bit Quad-core processor, @ 1.2 GHz. In addition, it is also abundant in peripherals such as HDMI port, CSI camera port, USB ports, 40 I/O pins, Wi-Fi/Bluetooth/ethernet, 1GB memory, and more. However, it does not offer any on-chip ADC unit; due to this reason, the authors used an eight-channel, 10-bit ADC chip (MCP3008) while acquiring the relevant sensors data. To monitor water levels, the authors used a water sensor (Figure 4). It has two types of metallic layers, i.e., power and sensors layers, isolated from each other and exposed to water. Touching these layers by the water body completes the circuit, and then voltage develops across a high ohmic resistor on this card. This change is read by Raspberry Pi via ADC chip to predict the water level in the tank. Data is then sent to a cloud server, not specified. However, to monitor water leakage in the tank, the authors installed two water flow sensors in the supply pipes of the water tank. The output of these sensors is read via an ADC by Raspberry Pi, and an alert is also generated if there is any significant difference. Though the block diagram of this system tips about the end-user interface module, it is not detailed explicitly.



IoT-based water management system targeting water regulation in offices and buildings. In this study, both water level and tank auto refilling are monitored. This design is based on Arduino Uno, which works as follows: Arduino Uno measures the water level in the target tank using an ultrasonic sensor; after local processing, data is sent to an ESP8266 transceiver being interfaced with Arduino Uno. The ESP8266 is an SoC (System-on-Chip) having an embedded TCP/IP protocol stack necessary for an MCU while accessing Wi-Fi. In addition, it has four general-purpose I/O pins as well. It sends data to the webserver via a Wi-Fi router

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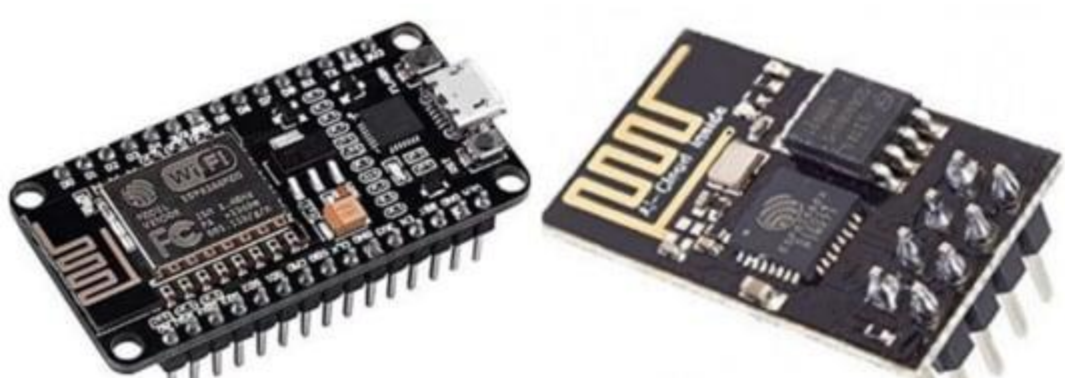


NodeMCU(ESP8266) ESP8266 Transceiver module

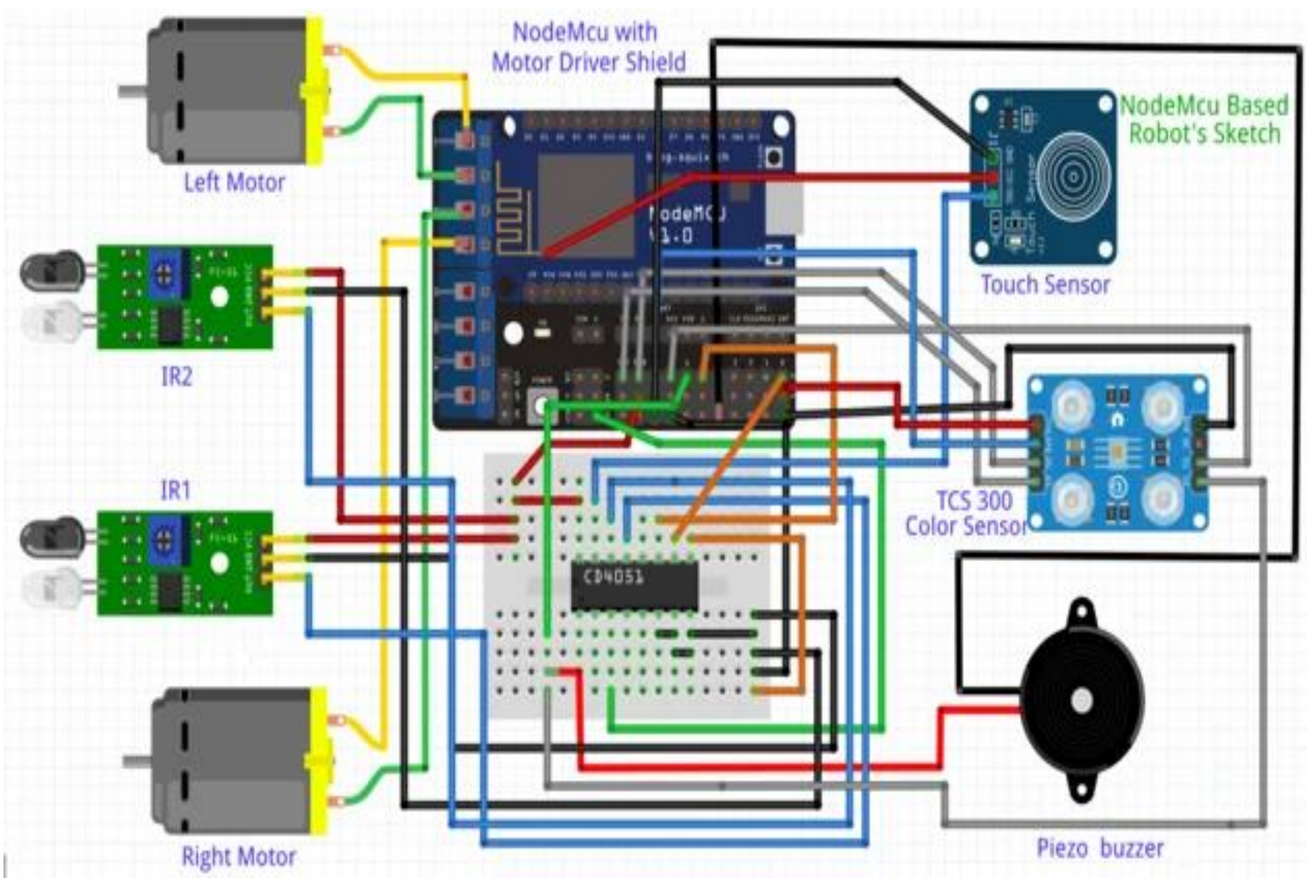
The cloud server compares this data with the preset tank's levels. If the water level is found below a lower threshold, the motor pump is turned on via Arduino Uno; otherwise, no action is taken. In case the motor is already on, the data is checked against an upper threshold. If it is found above the preset threshold, the motor is immediately turned off. Though the hardware used here is quite optimized, it has offered nothing to detect water leakage.

RECENT TECHNOLOGIES AND TECHNIQUES:

This section presents several well-known technologies and techniques commonly used in the IoT–WST.

Monitoring the water level in the tank is considered an essential parameter in smart monitoring of water storage tanks. As both cemented and portable tanks exist in different capacities and heights, precise water level measurement may be challenging due to the sensors' range limitations.

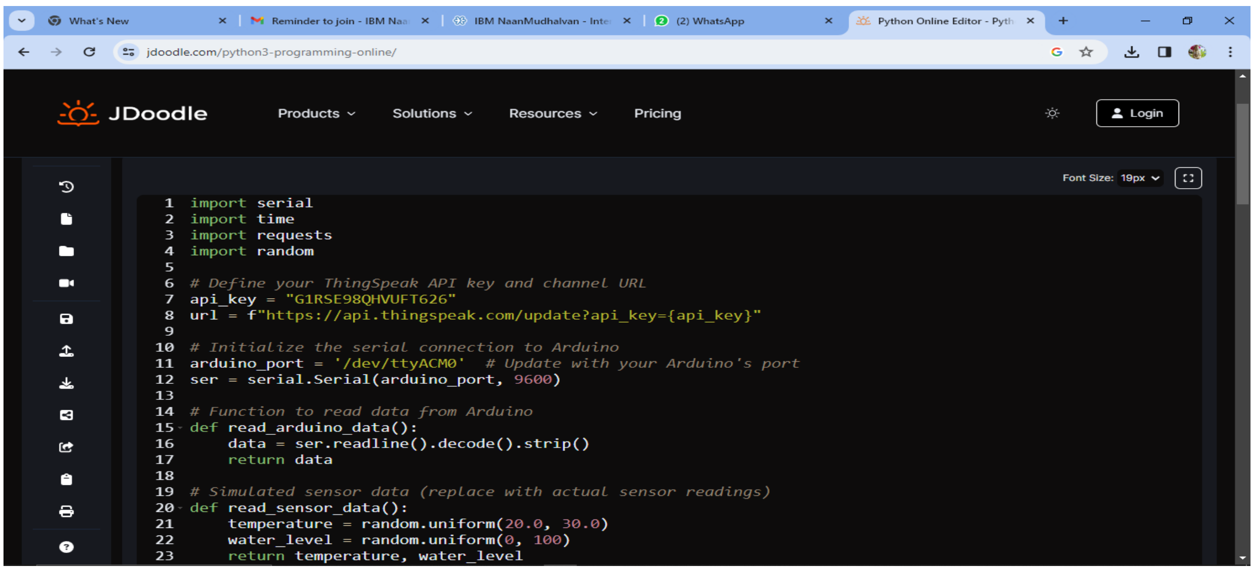
INTERNAL DIAGRAM:

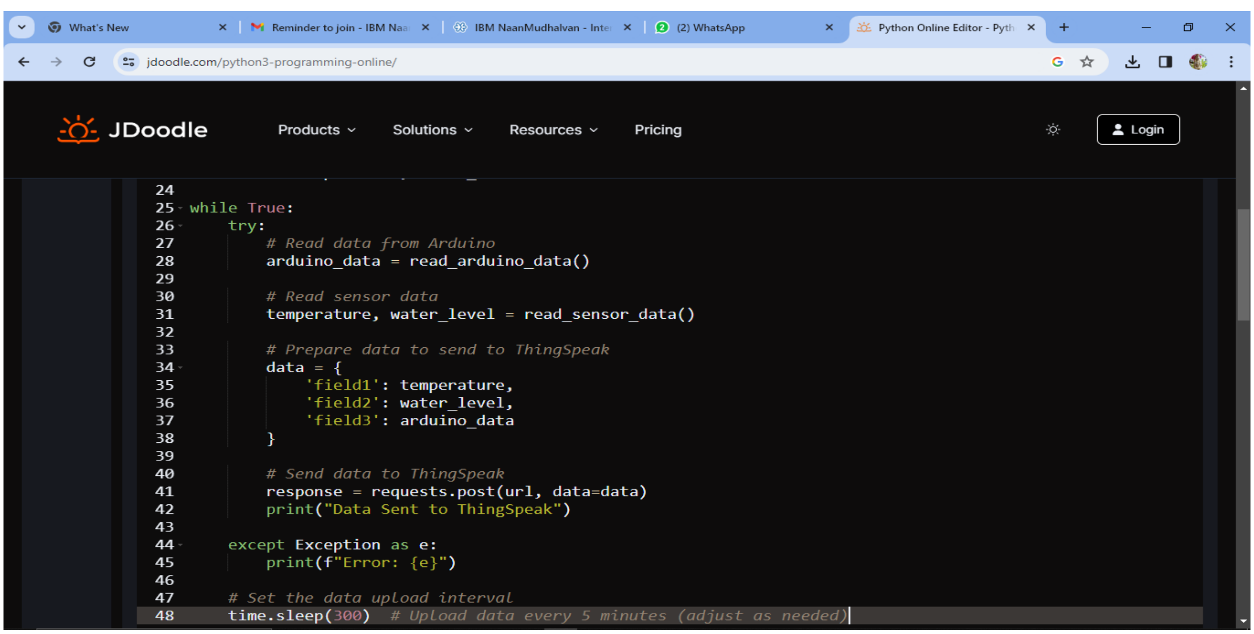


PROGRAM PYTHON SCRIPT:

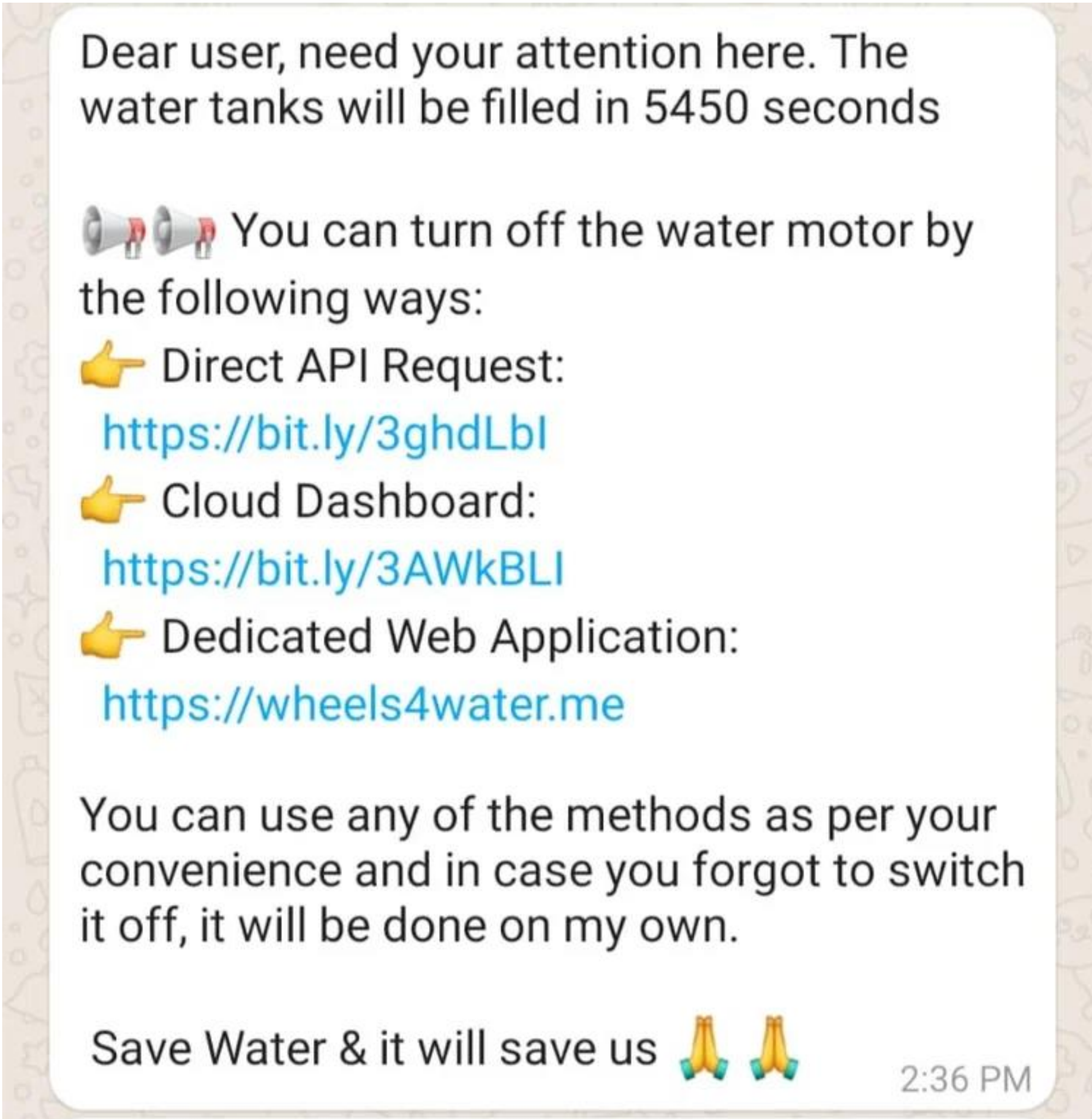
```
import serial
import time
import requests
import random

# Define your ThingSpeak API key and channel URL
api_key = "G1RSE98QHVUFT626"
url = f"https://api.thingspeak.com/update?api_key={api_key}"

# Initialize the serial connection to Arduino
arduino_port = '/dev/ttyACM0'  # Update with your Arduino's port
ser = serial.Serial(arduino_port, 9600)

# Function to read data from Arduino
def read_arduino_data():
   data = ser.readline().decode().strip()
   return data

# Simulated sensor data (replace with actual sensor readings)
def read_sensor_data():
   temperature = random.uniform(20.0, 30.0)
   water_level = random.uniform(0, 100)
   return temperature, water_level

while True:
   try:
      # Read data from Arduino
      arduino_data = read_arduino_data()

      # Read sensor data
      temperature, water_level = read_sensor_data()

      # Prepare data to send to ThingSpeak
      data = {
         'field1': temperature,
         'field2': water_level,
         'field3': arduino_data
  }
```

```
# Send data to ThingSpeak
      response = requests.post(url, data=data)
      print("Data Sent to ThingSpeak")

   except Exception as e:
      print(f"Error: {e}")

   # Set the data upload interval
 time.sleep(300)  # Upload data every 5 minutes (adjust as needed)
```





OUTPUT:


Dear user, need your attention here. The water tanks will be filled in 5450 seconds
📢📢 You can turn off the water motor by the following ways:
👉 Direct API Request:
https://bit.ly/3ghdLbl
👉 Cloud Dashboard:
https://bit.ly/3AWkBLI
👉 Dedicated Web Application:
https://wheels4water.me
You can use any of the methods as per your convenience and in case you forgot to switch it off, it will be done on my own.
Save Water & it will save us 🙏🙏
2:36 PM

CONCLUTION:

The development of a smart water management system using IoT technology has the potential to revolutionize the water management sector. The proposed system can help to conserve water resources, ensure water quality, reduce operational costs, and provide real-time information on water availability. However, the system faces several challenges such as the need for a reliable communication network, data processing and analytics capabilities, and security. These challenges need to be addressed to ensure the successful implementation of the system. A smart water management system using IoT technology offers a significant opportunity for efficient management of water resources. The system provides real-time monitoring of water usage and quality, enabling better decision-making for water conservation and management. The system can also help identify leaks or wastage in the system, reducing water losses and conserving water resources. The system's scalability ensures that it can handle future growth, making it an ideal solution for water management in both urban and rural areas. Overall, the development of a smart water management system using IoT technology is an essential step towards sustainable management of water resources.