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IoT BASED ANTI-THEFT WATER SUPPLY SYSTEM WITH WATER QUALITY MONITORIZATION

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***Abstract*—Water pollution is one of the biggest fear of green globalization. The quality needs to be monitor in real-time to ensure the safe supply of drinking water. In time paper, presenting a design and development of a low-cost system for real-time monitoring of the water quality in IoT(Internet of Things). The system consists of several sensors is used to measuring the physical and chemical parameters of the water. The parameters such as Temperature, P.H., turbidity, flow sensor of the water can be measured. The core controller can process the measured values from the sensors. The Arduino model can be used as a core controller. Finally, the sensor data can be viewed on the internet using a WI-FI system.**

Keywords—pH sensor,Turbidity sensor,Temperature sensor,Flow sensor,PPM sensor, Arduino module,WI-FI module,Thingspeak server

I. INTRODUCTION

The water distribution system (WDS) is a significant research area that affects our country's economic growth. WDS mainly has two issues: the water loss due to leakage, and the second is that it is prone to contamination. So there is a need to ensure the water quality and control the wastage of water. There is a tremendous need for water and water distribution networks to deliver water for individuals in urban areas. Efficient water delivery depends on the water flow rate, pressure of water, and purity of water. But sometimes it is found that some individuals run motors to suck more water from the pipeline. There must be some system that will ensure a steady flow of water for all individuals in that area to avoid water theft.

This project deals with the automation in water distribution and management with a technical device. The water levelsensor will sense the water level, and depending on the reading,the water's speed will be varied. Wastewater is water that has been used and must be treated before it is released. The ppm is used to detect chemicals n water.If any particles in the water, the water will not be an outlet.The supply of water from different area is automated through the use of IoT. The flow meter is placed in the pipe at particular intervals. If the flow rate decreases from the designed level, the motor speed is automatically, and the required water quality will be supplied in a specific time interval. Automatically the valve will be locked.

II. LITERATURE REVIEW

This paper has given a short conversation about ready water supply across a specific region by tackling the mechanical use of IoT idea, all the while improving the water nature of the drinking water. Different governments could carry out this thought worldwide to save water bodies from evaporating brought about by overabundance of water use. This framework could likewise be executed to reuse the water and forestall water wastage. Contamination and conductivity trial of water also assumed an enormous part in the government assistance, which could lessen the general sickness caused because of insufficiency, consequently making a better society of individuals. This framework was likewise upgraded by including modules that further improved the provided circumstance to forestall the overabundance utilization of water and save underground water. Water conductivity sensors were utilized in water-quality applications to quantify how well an answer leads to an electrical flow. This kind of estimation surveys the centralization of particles in the arrangement. The more particles that are in agreement, the higher the conductivity, henceforth higher the debasements. The creator also utilized a mineral cartridge to recharge the cleaned water's mineral substance from the substation. Be that as it may, the mineral cartridge terminates because of the utilization of minerals present. They took an overview dependent on the mineral substance force present in the water tank. They noticed a consistent reduction in mineral substance over the long run, and the mineral substance drained to zero following four months. Henceforth an implication was shipped off the U.I., which cautioned the client to supplant the mineral cartridge.[1]

This paper has introduced the plan and improvement of IoT based water observing and control framework.For this, a few sensors are utilized. The gathered information from every sensor is used to examinethe reason for a better water issue arrangement. The data is shipped off the cloud worker employing Wi-Fi module ESP8266. So this application will be the best challenger, continuously checking and control the framework and use it to settle all the water-related problems.This paper proposes more effective water, observing and maintaining a water utility framework to reduce water wastage. This methodology will help utility administrators improve ease water the board frameworks, uncommonly by utilizing rising innovations, and IoT is one of them. The Web of Things (IoT) could end up being perhaps the main strategies for growing utility-appropriate frameworks and for making the utilization of water assets more effective. This examination talks about the plan and current improvement of a framework with minimal effort to screen consistent qualities and control the framework utilizing IoT. An exhibit of sensors is remembered for the framework to quantify the different boundaries of the water. The edges which can be estimated resemble Temperature, P.H., turbidity of the water. Center regulator can deal with the worth estimated from the sensors. The Arduino Uno model can be utilized to control the framework. conclusion, to get to the sensor information on the web,

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In this paper, water progression through the homegrown pipeline can be checked, anticipated and envision from anyplace on the planet utilizing the web through P.C. or cell phone. The gathered information can be examined to make expectations to the clients, request the board, resource the executives, and spillage them. With the water as a streaming fluid, the framework was tried effectively. The work can be stretched out to estimate information for more extensive networks with consumer loyalty, including ease and better Execution of the general framework. As per the paper's creator, the proposed model to estimate and screen water utilization fundamentally comprises stream meter, miniature regulator and cloud framework. Corridor impact-based stream meter was utilized to quantify the water's stream pace, and Arduino UNO and Raspberry Pi went about as microcontroller-based devices.In a request to handle the solicitation from an enormous number of clients, cloud interfacing was introduced. The end clients,usingthe web interface, had the option to envision the information. The information from the data set would then be used by information expectation calculation for making forecasts according to the clients. The solicitation for the projection comes from the clients through the web interface.So this paper gave us the outcome showing that the alarm message would be sent after being perceived at a certain level, and afterwards, the client would recognize the letter and act with activities. An examination testing was led to see how the geophone sensor functioned, set up at the line's edge point associated with the circuit.[3]

This paper presents an IoT gadget that assists with overseeing and plan the utilization of water. This framework can be effortlessly introduced and kept up for since quite a while ago run. The Laser sensor is put on the tank, which persistently screens the water level progressively. This data will be refreshed in the cloud, and the client can break down the measure of water. As per the degree of water in the tank, the engine working is consequently controlled. When the water level falls beneath the limit level, the engine will be again turned on naturally. Flooding water tanks in home, schools, universities, City overhead tanks, Clinics and so forth can add to the gigantic measure of water wastage. On the off chance that one can handle this save a lot of water. Ordinary water tanks can neither screen nor control the water level in the tank. As of now, the water level must be physically checked and topped off as per the prerequisites. So in this paper, the above notice issues are addressed with programmed water level identification and topping off of water stockpiling framework with Web of Things (IoT). Introduced here is a Water The board Framework utilizing IoT. In the programmed water level recognition and topping off of water stockpiling framework, the sensor used is the Laser sensor, a substitution of the ultrasonic sensor due to its precision and diminutive size. The sensor is set on top of the tank confronting downwards. The Laser sensor is utilized to identify the water level. These days fluid level observing is imperative in numerous enterprises, like oil, auto,etc. Utilizing our savvy framework, one can investigate the use and identify the spillage in these businesses' tanks.[4]

This paper will show the fruitful Execution of a web-based way to deal with estimating water quality and use consistently. A stream sensor for estimating the amount metering frameworks. Future improvements can incorporate prepaid charging and programmed treatment of water-dependent on the idea of tainting. Water metering framework will be utilized for mechanized charging, killing the disadvantages of conventional water metering frameworks. This original thought can be additionally reached out to different territories like oil and flammable gas checking systems.The framework tends to new difficulties in the water area - stream rate estimating and the requirement to investigatewater stock to control water wastage and support its preservation. Likewise,measure the nature of water disseminated to each family by conveying pH and conductivity sensors. The customary water metering frameworks require intermittent human intercession for upkeep, making it poorly designed and frequently least potent. For inadequacy of the current models for universal use of remote frameworks for quality observing and impart information wirelessly.This framework can be carried out on water tanks for protected and squander less utilization. Water, when provided from the repository to tanks, then the pH level of water will be checked; if it comes in required reach, the water's conductivity will be reviewed. On the off chance that pH or conductivity of water won't be ata safe distance than the water won't be provided to family tanks, and valves will be shut. A similar strategy will be followed till water doesn't come in safe reach. During appropriation of water pace of the stream is estimated so that equivalent dissemination is finished. This entire information is sent from Wi-Fi to the Site page so the framework can be gotten to distantly from a P.C.(5)

In this paper,the authors propose a plan that utilizes Arduino as the handling unit for the interfaced parts, for example, water stream rate sensors, stream meter and solenoid valves. They use a fixed set estimation of stream rate and contrast it. The got esteem perused by the Arduino microcontroller from the stream rate sensor to recognize burglary once the water stream rate surpasses the set worth. They likewise utilize the Cayenne application that sudden spikes in demand for a cell phone and gets to the framework's cloud information through an Ethernet safeguard W5100 for the prepaid water acquisition. The Ethernet safeguard W5100 relies upon the WizNet W5100 Ethernet chip datasheet that presents a framework (I.P.) stack utilized for taking care of TCP and UDP bundles. In their plan, the issues of flood and over usage are dealt with by the monitor. In their decision, they suggest utilizing SCADA and PLC for future work. The limit of far off admittance to the observing framework using the Ethernet Safeguard W5100 has been tended. With their Execution, it is likewise conceivable to get the organization by utilizing theapplicable Ethernet conventions.[6]

III. PROPOSED SYSTEM

A. ARCHITECTURE OF PROPOSED SYSTEM

In this paper, the theory of real-time water quality monitoring in an IoT environment is explained. The proposed method's overall block diagram is explained. Every part of the system is thoroughly explained.Several sensors (Temperature, pH, turbidity, and flow) are linked to the core controller in this proposed block diagram. The sensor values are accessed by the core controller, which processes them before transmitting the data over the internet. On the internet, the sensor data can be accessed by Wi-Fi Module. Below, Fig. 1. Specifies the architecture of the IoT anti-theft water supply system.

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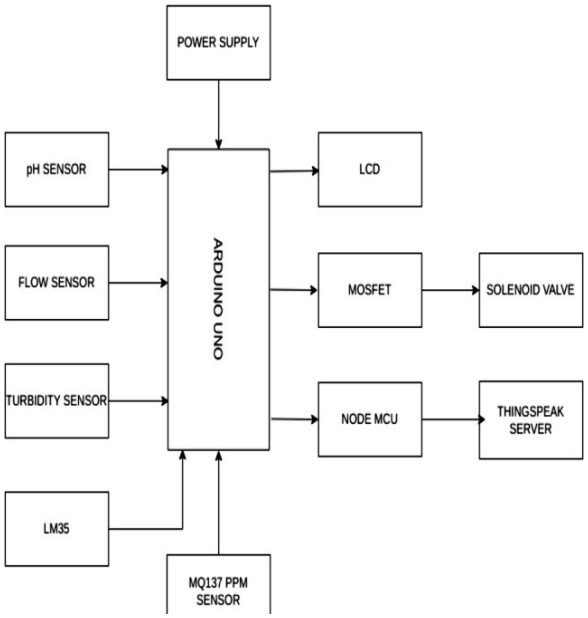

Fig. 1. Architecture of the proposed system

This proposed system consists of several sensors, including LM35, pH sensor, turbidity, Flow and PPM sensors are linked to the core controller.The core controller accesses the sensor values and processes them to transmit the data across the internet. The data will be displayed on the LCD. The core controller is an Arduino Uno, and the sensor data is collected by the Arduino Uno and transferred to NodeMCU. NodeMCU can automatically send data from the Arduino Uno to the Thingspeak platform once it receives it.

B. CIRCUIT DIAGRAM OF PROPOSED SYSTEM

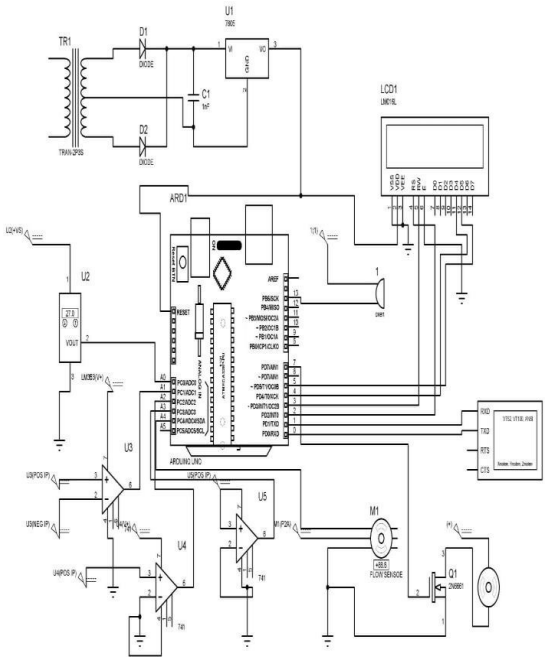

Fig. 2.Circuit Diagram

Arduino Uno is used as a central controller in this circuit diagram. The Arduino Uno transforms analogue to digital values. Turbidity,Flow, Temperature and ppm sensors are connected as an input to the controller.The output elements linked to the NodeMCU are the LCD and think to speak server, which provides a connection between hardware and software. If the water flow is surpassed, the water will not be discharged. The solenoid valve gets automatically closed.

C. FLOW CHART OF PROPOSED SYSTEM

Below, Fig. 3. depicts the flow chart for the IoT-based anti-theft water supply system. The supply of water in this proposed system is controlled by flow rate, temperature, turbidity, PPM, and pH level. A constant flow rate of water is fixed. Flow measurement on each channel can be easily determined by employing flow sensors.As the water flow rate reaches the set rate, the solenoid valve closes automatically, and water theft is detected. The mechanism usually continues until the water flow rate is under control.

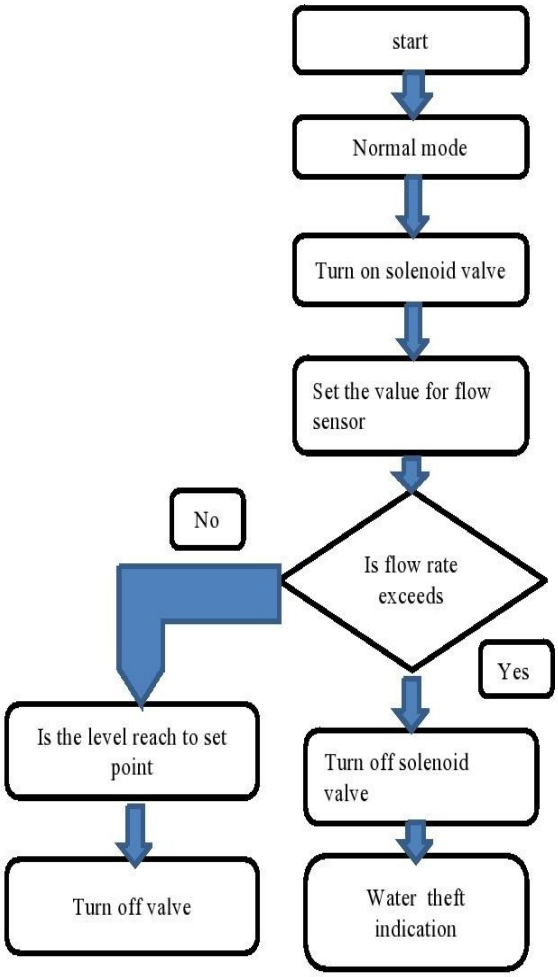

Fig. 3.Flow Chart

D. SYSTEM COMPONENTS

1) Arduino Uno(Microcontroller)

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc.The board is equipped with sets of

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to various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. Schematic representation of Arduino Uno is shown in below Fig. 4.

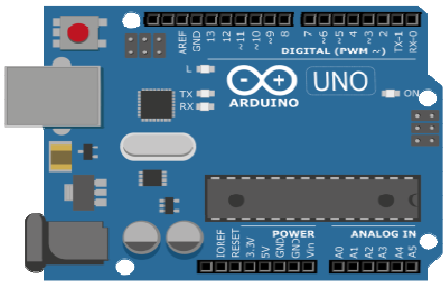

Fig. 4.Arduino Uno

2) NODEMCU ESP8266

The NodeMCU ESP8266 is a low cost Wi-Fi microchip which has a full TCP/IP stack and microcontroller capability produced by Espressif Systems in Shanghai, China.This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands. Fig. 5 shows the NodeMCU ESP8266.To upload sensor readings from DHT11 to the open-source cloud ThingSpeak, Arduino Uno interfaces at the output with WiFi module ESP8266. It is a low-cost Wi-Fi microchip with a full TCP/IP stack. It works on the 3.3V that Arduino Uno in proposed system provides.

Fig. 5. NodeMCU ESP8266

3) LIQUID CRYSTAL DISPLAY(LCD)

The term LCD stands for liquid crystal display. It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. The LCD module is shown in Fig. 6.These displays are mainly preferred for multi-segment light-emitting diodes and seven segments. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc.

Fig. 6.LCD Module

4) LM35 TEMPERATURE SENSOR

LM35 is a precession Integrated circuit Temperature sensor whose output voltage varies based on its temperature. LM35 Temperature Sensor is shown in Fig. 7. It is a small and cheap IC that can measure temperature anywhere between -55°C to 150°C. It can easily be interfaced with any Microcontroller that has ADC function or any development platform like Arduino.

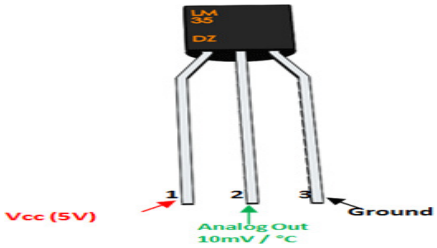

Fig. 7. LM35 temperature sensor

5) MQ137 PPM SENSOR

The MQ137 sensor is a gas sensor module is specially designed to detect and sense gases like ammonia (NH3) and carbon monoxide (CO). MQ137 PPM sensor is shown in below Fig. 8.The MQ137 gas sensor module comes with digital pins connected to a microcontroller like Arduino boards and comes in handy when you are only trying to detect one particular gas.

Fig. 8. MQ137 PPM sensor

6) TURBIDITY SENSOR

The Turbidity sensor detects water quality by measuring the levels of turbidity. The turbidity sensor is shown in Fig. 9. It uses light to detect suspended particles in water by measuring the light transmittance and scattering rate, which changes with total suspended solids (TSS) in water. As the TTS increases, the liquid turbidity level increases.This fluid sensor provides analogue and digital signal output modes. The threshold is adjustable when in digital signal mode.

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Fig. 9 Turbidity sensor

7) FLOW SENSOR

The flow sensor sits in line with your water line and contains a pinwheel sensor to measure how much liquid has moved through it. There's an integrated magnetic hall effect sensor that outputs an electrical pulse with every revolution. The hall effect sensor is sealed from the water pipe and allows the sensor to stay safe and dry.Water flow sensor is shown in Fig. 10.The sensor comes with three wires: red (5-24VDC power), black (ground) and yellow (Hall effect pulse output).

Fig. 10. Flow sensor

8) pH SENSOR

A pH sensor is a scientific instrument that measures the hydrogen-ion activity in water-based solutions, indicating its acidity or alkalinity expressed as pH. The pH sensor is shown in below Fig.11.The pH sensor measures the difference in electrical potential between a pH electrode and a reference electrode. So the pH meter is sometimes referred to as a "potentiometric pH meter".

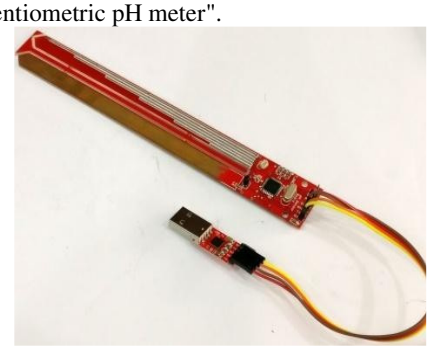

Fig. 11. pH sensor

9) SOLENOID VALVE

Solenoids are very commonly used actuators in many process automation systems. There are many types of the solenoid; for instance, there are solenoid valves that can be used to open or close water or gas pipelines, and there are solenoid plungers used to produce linear motion. Solenoid valve is shown in below Fig. 12. One widespread application of solenoid that most of us would have come across is the ding-dong doorbell.

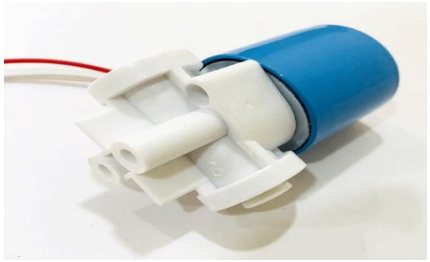

Fig. 12. Solenoid Valve

E. WORKING PROCEDURE

In this method, two parts includedthe first one are hardware & the second one is software.The hardware part has sensors that help measure the real-time values. Turbidity sensors measure the turbidity level of water. The PPM sensor measures the PPM level of water;a pH sensor detects the pH level.The flow sensor detects the flow of water level. The lm35 sensor detects the temperature of the water.Arduino Uno Atmega328 converts the analogue values to digital values, & LCD shows the displays output from sensors. NodeMCU gives the connection between hardware and software.The data retrieved from the sensor is sent as input to the Arduino Uno.LCD is connected to the Arduino Uno, showing the turbidity, PPM, flow rate, pH level, and water temperature on display.

Thinkspeak is a cloud platform to store data. This proposed system is connected to the think speak server by using the Wi-Fi NodeMCU ESP8266. Whenever NodeMCU gets data from the Arduino through the sensors,it will be automatically sent to the thinkspeak platform. Suppose the water consumption and the speed of the valve are high, and the condition for the flow of water is not satisfied with the limitations. In that case, the controller invokes, and the water outlet will be stopped by closing the solenoid valve automatically. These data are visually seen in the thinkspeak server in graphic format.

IV. RESULT

In this study, water theft is detected, and water quality parameters such as pH, turbidity, PPM, Temperature, and water flow are measured using an IoT-based anti-theft water supply system.Table 1 represents the LCD output, and Fig 13 illustrates the think speak server output. The module was successfully designed and implemented. The project's hardware component The PPM level of water is measured using the MQ-137 PPM sensor. A pH sensor is used to determine how acidic water is. The flow of water is calculated using a flow sensor. Water turbidity is measured using a turbidity sensor (several particles suspended in water).It continually sends data to the NodeMCU, which is regularly updated in the Thingspeak server. The LCD and the Thingspeak server web page will show the Ph value, turbidity value, flow rate, PPM value, and water theft indication simultaneously. As a result, this system is straightforward and cost-effective. It's beneficial for maintaining a reliable water supply system

A. LCD OUTPUT

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Table 1 LCD OUTPUT

FIELD	LCD OUTPUT
THEFT INDICATION	
FLOW RATE OF WATER	
TEMPERATURE AND pH VALUE	
PPM AND TURBIDITY VALUE	

B. THINGSPEAK SERVER OUTPUT

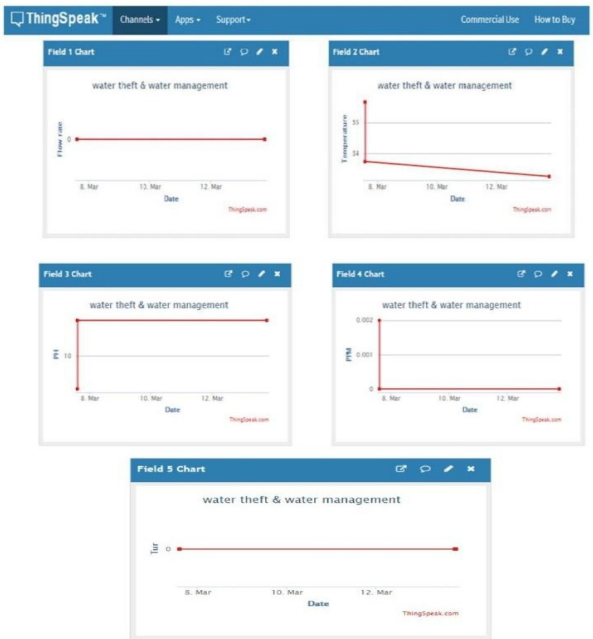

Fig. 13. Thinkspeak web monitor of a system

CONCLUSION

The proposed automated system, which will be integrated into the water distribution network, would ensure that the refurbished water supply urban utilities are kept up to date and provide new monitoring options. Measurement data reliability is guaranteed by the central dispatching unit's global network monitoring andwater distribution continuity, and water theft prevention.One can eliminate water theft in government pipelines with this project so that everyone has an equal share of water. This system is excellent and cost-effective in preventing the theft of drinking water.This proposed work is suitable for water supply.

In the future, government will use pipelines to supply liquid petroleum gas and other fuels. This proposed work can also be implemented in the future by using SCADA and PLC.Future work will identify water tanks with low water levels by integrating GSM modules into the system. The system can also pinpoint the exact location of a pressure drop in a water distribution system. Monitor and control the whole system from the central control units. The unskilled operators can also understand the SCADA graphical interface and storing data for future use. Future work can identify water tanks with less water quantity by incorporating GSM modules in the system. The system can also be extended to detect the accurate location of pressure drop in the water distribution system.

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