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Implementation of Optimal Modeling for Water Supply Pipe Network

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ABSTRACT: Water is one of the essential parts of life. Wastage of water is one of the main problem in the present scenario where there is scarcity of water.. In order for provide water to all needy consumer a model is proposed so that users will get limited amount of water and hence they use it wisely so this will result in less wastage of water. The Proposed model included several sensors to monitor the volume of water reached to each and every individual house. Finally displaying of sensor data has been shown on internet through Wi-Fi. The data between water municipality and user can be used in future research and development for avoid wastage.

KEYWORDS: Dynamic Tariff, Urban water management, water pricing, marginal value of water, hydro economic modeling

I. INTRODUCTION.

In the Proposed model "**Optimal design of urban water supply pipe networks**", per user water volume is limited by the water municipal corporation regardless whether the user uses high power water sucking system. This system is connected to internet through Wi-Fi.

If the user get water according to the limit mentioned by municipality, water valve will automatically turn to off position. The data collected from users volume sensor can further be used by water municipality for future like user can select the required water volume and if volume is available to give that user municipality will give it to user. So this system helps to fulfill the water demand of everyone .The propose model aims to supply the fixed quantity of water to urban houses so that water is available to each and every house-hold of that particular area. As water scarcity is the major problem now-a-days. Therefore suitable measures are taken by government for fulfilling water demand so that water reaches to each and every house. Our proposed model put a limit on water supply for limited required usage for better availability and avoids wastage

II. LITERATURE REVIEW

Around 2.2 million die of basic hygiene related diseases, like diarrhea every year. The great majority are children in developing countries. Interventions in hygiene, sanitation and water supply make proven contributors to controlling this disease burden. For decades, universal access to safe water and sanitation has been promoted as an essential step in reducing this preventable disease burden. The purpose of this report is to critically review the various candidate technologies and systems for providing microbiologically improved household water and to identify the most promising ones based on their technical characteristics and performance criteria. The characteristics and performance criteria for these are: effectiveness in improving and maintaining microbial water quality, reducing waterborne infectious disease, technical difficulty or simplicity, accessibility, cost, socio-cultural acceptability, sustainability and potential for dissemination. This critical review considers methods and systems to protect water during storage, collection and use that improve microbial quality and thereby reduce pathogen exposure and risks of diarrheal and other waterborne diseases. Because it has been repeatedly demonstrated and is generally accepted that the most important and immediate risks to human health from using contaminated drinking water are those from enteric microbes of fecal origin or other sources, this review focuses on strategies and systems to protect and improve the microbiological quality of household water to prevent and control waterborne microbial diseases.[1]

Water shortages and threats of water shortages have induced the development of innovative demand management and supply enhancement measures. Demand management

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measures have relied on modifying consumption patterns and decreasing demand by means of education, low volume water fixtures, water rationing, and tiered water pricing, and controlling landscaping. Supply enhancement measures have included new water supplies from new facilities reclamation and desalinization plants, water transfers, improving existing system operations, and increased use of groundwater. This paper describes the use of two stage linear programming to integrate long-term and short-term supply enhancement and demand management options for least-cost shortage management, considering yield reliability (Lund 1995; Lund and Israel 1995; Lund et al. 1995). The effects of hydrology uncertainty, availability of resources, water uses, and costs are incorporated into the model. A wide range of available demand management and supply enhancement measures can be considered in devising a management plan to increase supply system reliability and to respond to shortage events. Ideally, in developing demand management and supply enhancement practices, the effects of uncertainties associated with hydrology, water demands, environmental requirements and regulations, and availability of resources should be examined.[2]

Home automation refers to remotely monitoring the conditions of home and performing the required actuation. Through home automation, household devices such as TV, light bulb, fan, etc. are assigned a unique address and are connected through a common home gateway. These can be remotely accessed and controlled from any PC, mobile or laptop. This can drastically reduce energy wastage and improve the living conditions besides enhancing the indoor security. Owing to the rapid growth in technology, the devices in the recent past are becoming smart. The real world devices are being equipped with intelligence and computing ability so that they can configure themselves accordingly. Sensors connected to embedded devices along with the low power wireless connectivity is facilitates to remotely monitor and control the devices. This forms an integral component of Internet of Things (IoT) network. Internet of Things can be considered as a network of devices that are wirelessly connected so that they communicate and organize themselves based on the predefined rules. Organization of the paper is as follows: A brief overview about the MQTT protocol is presented in section II. The related work that has already been done in this area is discussed in section III. In section IV the implementation details about the network setup, hardware and software used is briefed. Results from developed prototype are discussed in section VI. Section VII presents the conclusions and future scope of work.[3]

The present invention achieves the above objects among others by providing in a preferred embodiment, linear Stepper motor comprising, an annular Stator Structure, an axially extending, cylindrical, permanent magnet shaft extending coaxially through Said annular Stator Structure; and Said axially extending cylindrical, permanent magnet shaft having a Smooth external Surface along a portion thereof with axially alternating N and S poles defined circumferentially in an outer periphery of Said portion of Said axially extending, cylindrical, permanent magnet Shaft. The present invention also provides a method of magnetizing the Shaft of Such a motor and a fixture and method of manufacturing the fixture therefore. Micro-stepping of stepper motors improves the positioning resolution and disturbance torque in any control application. In most of the applications it is seen that micro-stepping is carried out at fixed stepping rate or Pulses per Second (PPS) only. The basic stepping frequency or the full step pulse width remains fixed and the same is converted into discrete sine and cosine phase waveforms to actuate the motor. But several applications like antenna tracking a ground station in Low Earth Orbit (LEO) imaging spacecraft, medical instrumentation, robotics, industrial automations etc., where stringent position tracking in real time is must.[4]

Water quality management at all different scales requires a decision making process to prevent pollution from progressing. Thoreson et al. [14] mention that periodic maintenance is required in irrigation-water delivery and distribution systems. Irrigation system managers such as farmers, government agencies, and companies conduct maintenance activities correctively or preventively. Examples of corrective, periodic maintenance include desalting and cleaning weeds and grass from a canal. This paper proposes a novel methodology to approach universal optimization, which is in contrast with particular optimization for each decision making as mentioned above. A universal optimization scheme establishes a reasonable water quality management strategy to judge whether the pollution reaches the level that requires any decision. Conventionally, agreement of a community or formation of public opinion has been bearing a role of such universal optimization. In this sense, universal optimization scheme having rational mathematical background has never yet been developed. Here, the mass balance model for a water quality index is expanded as a stochastic

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ordinary differential equation to be incorporated in the framework of the linear control theory. Operation of such a decision making model allocates allowable level of pollutant discharge to each source but governmental legislation is necessary for actual implementation of such a decision. [5]

III. METHODOLOGY

In this project we have an adapter of 24V rating which is connected with a DC-DC buck boost converter. We have LM2596 DC to DC buck boost converter having 4 pins including input/output and on/off pins. The converter is used to step down the 24V DC into 5V DC then we are using node MCU ESP8266 microcontroller which operates on 5V supply so buck boost converter is connected with the microcontroller and 5V supply is given to the microcontroller.

It is a miniature Wi-Fi module which is used to establish a wireless connection between the microcontroller and server. By using web services sending and receiving of data has been done. Programming of MCU has been done by using Arduino IDE. The main purpose is to receive power supply from the converter via analog pins and compute power to the water flow sensor. Calibration factor is set in the programming. Second part of program is controlled by relay by using IF ELSE loop and the water volume limit is set. Third part of program is connected to Wi-Fi and finally data will be send to thinger.io server where data is collected and can be extracted in MS excel for statistics purpose so that DEMAND FORCASTING can be done.

There is a turbine sensor which rotates as the water flow through and it works on Hall Effect and delivers generated pulses to the microcontroller. Programming of water flow sensor has been done by the node MCU. Then a 5V DC Relay connected with the MCU works as a switch to open or close the circuit after getting response by the MCU. Normally closed configuration of relay is used.

Solenoid valve is connected through the relay which operates in both directions. It is a control unit which electrically energized or de-energized to either shut off or allow water to flow.

The proposed model work in order to provide limited water to users. The water volume consumption limit has been done by Municipality .When the limit of volume reaches, the valve get automatically closed. In starting the volume sensor measures the volume of water given to user and then sends measured data to Microcontroller. Now monitoring of data can be done on the server. When limit reaches to set volume MCU triggers the relay so that the circuit get opened and the valve start moving until the valve gets off and supply stops. The data now therefore stores in the system servers for future research and development. Hence water is not wasted and reaches to all users in the limited amount.

INTERFACING OLED DISPLAY TO MCU

Interfacing of OLED with MCU has been done for displaying parameters like total volume and water flow rate. To write data to OLED display coding has been done.

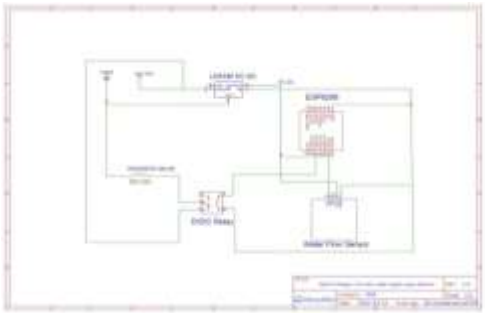

Figure 1 Simulation Model of proposed system

IV. SYSTEM DESCRIPTION

In the proposed model the rating of component like relay is set to 5V. DC-DC Buck Converter stepped down the 24V DC supply to 5V. The microcontroller works with an objective of establishing a wireless connection between the microcontroller and the server. It can sends and received data from any website. The model contains a water measurement sensor which measures the quantity of water passing through it. In the proposed design main aim is to limit the water by controlling flow of water so that water reaches to every house in desired quantity. There is an arrangement of automatic valve which is used to turn on and off the water Depending upon the short circuit and open circuit condition of the relay supply this valve gets automatically open and closed. Relay conditions of being short or open is controlled by microcontroller ESP-8266.

When the water flow spins the turbine of measurement sensor then a pulse is generated and sends to microcontroller which have keeps all calculation of each pulse. Then the data is being recorded of each user in a particular area.

The website is developed by the government to keep an eye on when and how much the water is to be send. Various interfaces like statistics and charts have been added to this site that records the data for future use in global welfare.

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V. STRENGTH

In addition to a network of interconnecting mains or pipes, water distribution systems normally include storage facilities, valves service connection to user facilities. The function of water distribution system is to deliver water to all customers of the system is sufficient quantity for potable drinking water and fire protection purposes, at the appropriate pressure with minimal loss, safe and acceptable quality and as economically as possible. The data is recorded on the server for the future purpose so it can be use by the government also. The system reduces problem of water quality deterioration through the distribution mains.

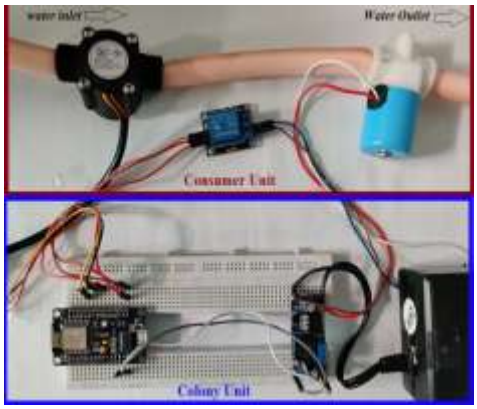

Figure 2 Hardware implementation of proposed mode

VI. EXPERIMENTAL RESULTS AND ANALYSIS

The implementation of proposed model "Optimal design of urban water pipe supply networks" has been done successfully using real time limiting the water to avoid wastage are shown in the following Figures.

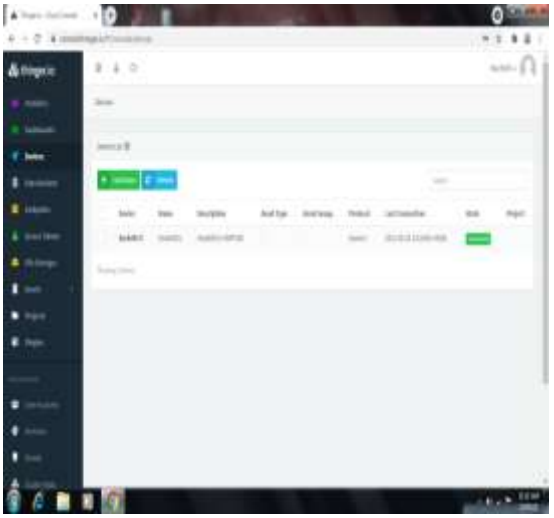

Figure 3 Device Status

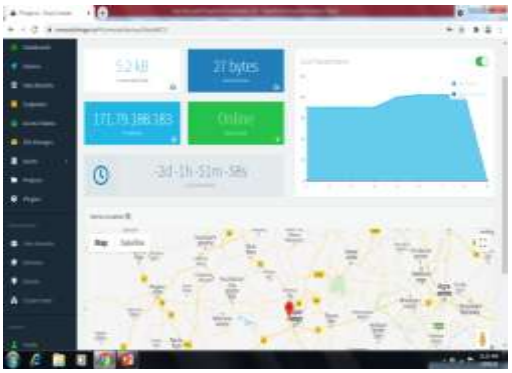

Figure 4 IP Address of system for location

Figure 3 shows the device status that it is whether connected or disconnected .Here only one device is shown as we have considered only one consumer. Figure 4 shows the IP Address of proposed system for location purpose.

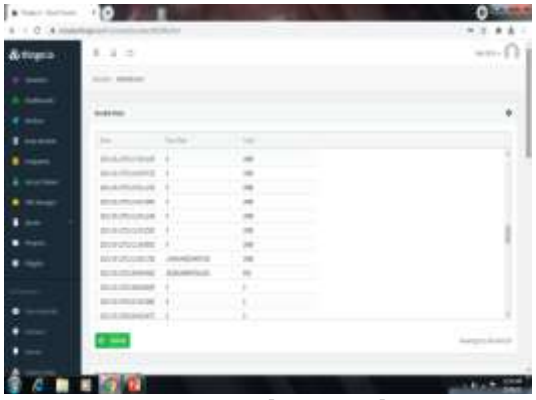

Figure 5 Data Bucket recording user consumption.

Here figure 5 shows data recording of user consumption. Green round dots in figure 6 describe

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about the exact location of device. If consumer migrate from one place to another then they will go under different Municipal Corporation.

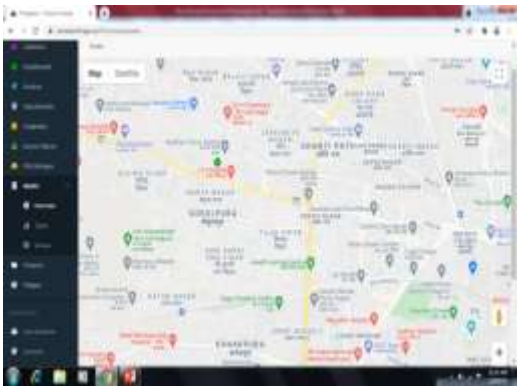

Figure 6 Exact Location of device

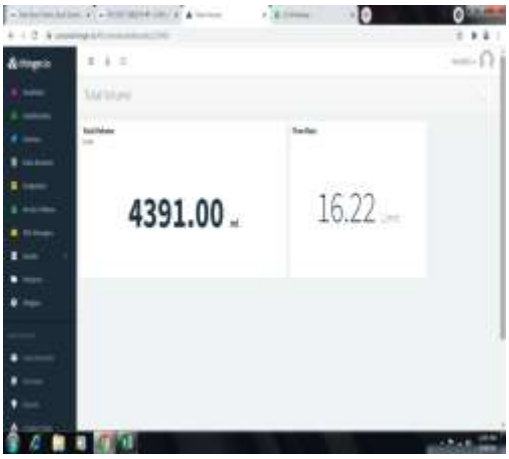

Figure 7 Real time monitoring

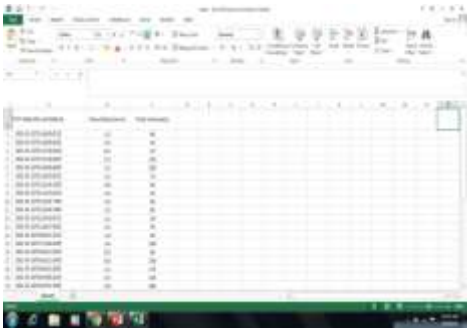

Figure 8 Data in Excel Format

Figure 7 shows the real time monitoring of water consumption. Now further as for keep an eye on water demand and forecasting municipality should have the recorded data in form of excel sheet. Excel sheet is formed through data recorded automatically through the design server as shown in Figure 8. This figure shows data saved in the excel sheet can be extracted from for Statistics and demand forecasting purpose.

Figure 9 shows the code running in ARDUINO IDE to check whether the system is working properly or not. Figure 10 describes the data recorded in Microcontroller ESP8266 and sending it to server.

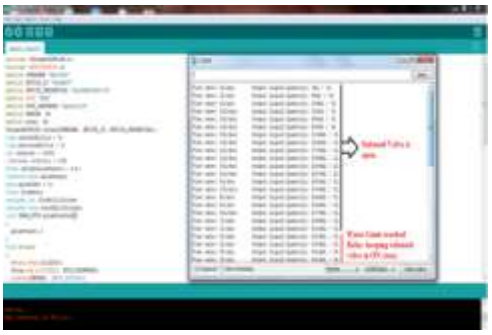

Figure 9 Arduino Code

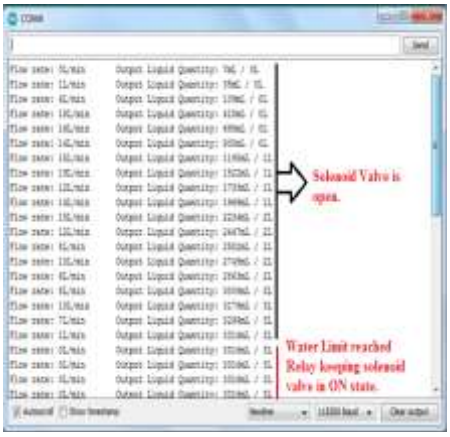

Figure 10 Microcontroller Data

We create a Gerber file as shown in Figure 11 for our printed circuit board design that contain information on each of physical board layer of our PCB design. For example circuit board like copper traces, solder mask and silkscreen images and all they are defined in a series of vector coordinates. This file shows the physical assembly and interconnection platform for various electronic components schematically. The schematically capture program provides all the information in detail about completion of board design in series of data. The Gerber file is the most important file for fabricating a circuit board.Figure12 shows the 2D view of designed PCB.

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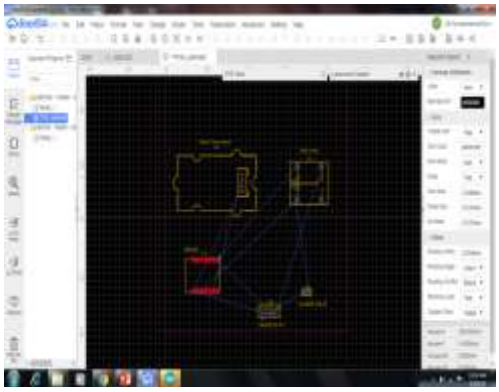

Figure 11 Gerber File

Figure 12 2 D View of designed PCB

VII CONCLUSION

Based on the analysis of the result of the studies, the following conclusion and statements have been observed:

The water supply network passes through the areas of increasing population which enable the participation of external factors in the water supply failure constantly increased. Based on observation by this proposed model the water is saved in large amount in this water scarcity era. Due to limiting water, the wastage is avoidable and the tariff is applied based on the amount of water is being used. User also can apply for more amounts when needed and water is sent to user based on the quantity they have and according to record of user. This provides transparency between user and government. Our proposed model is user friendly and helps the municipality to keep an eye on water demand and forecasting. Our proposed model main aim is to avoid unnecessary water usage because water is very essential for living and to supply water to each and every house.

SAVE WATER SAVE LIFE!

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