Journal for Educators, Teachers and Trainers
The PROFESIOLab electronic, peer-reviewed, open-access Magazine

ISSN 1989-9572

DOI: 10.47750/jett.2023.14.04.38

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Journal for Educators, Teachers and Trainers, Vol. 14 (4)

https://jett.labosfor.com/

Date of reception: 15 June 2023

Date of revision: 04 July 2023

Date of acceptance: 05 Aug 2023

S. Sreedhar Babu1, Dr P Rama Koteswara Rao1, M. Suneel1 **(2023).** IOT-ENABLED SMART WATER DISTRIBUTION SYSTEM WITH RTC-BASED AUTOMATED SCHEDULING**. Journal for Educators, Teachers and Trainers, Vol. 14(4)458-467**

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IOT-ENABLED SMART WATER DISTRIBUTION SYSTEM WITH RTC-BASED AUTOMATED SCHEDULING

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ABSTRACT

This project presents a functional model of a Municipal Watering System and dispenser setup designed to provide a time-based drinking water supply. The system utilizes a Real-Time Clock (RTC) to regulate the scheduled activation and deactivation of the water pump. Users can set the timing remotely via an IoT-based mobile application, ensuring efficient and automated water distribution. At each scheduled interval, the corresponding water pump is turned ON or OFF accordingly. The entire system's status is displayed in real time on a 16×2 LCD module, allowing for easy monitoring. The proposed system is implemented using an Arduino microcontroller programmed through the Arduino IDE, with a 5V regulated power supply ensuring stable operation. The integration of IoT technology allows for seamless user control, enabling adjustments to be made remotely via the mobile application. This smart watering solution enhances municipal water management, reducing manual intervention and ensuring a consistent water supply at predefined times. The automation of the water distribution process optimizes resource utilization and minimizes water wastage.

Keywords: Smart Water Distribution System, IoT (Internet of Things), Municipal Watering System, Water Dispenser, Time-based Control, Mobile Application Interface, Arduino Microcontroller, LCD Display (16x2), Power Supply Regulation

1. INTRODUCTION

With rapid urban development, the demand for an efficient water distribution system has increased. However, traditional water distribution methods remain largely manual and outdated. As population growth continues, ensuring a reliable water supply has become a challenge. Existing systems face critical issues such as water theft, leakage, and wastage, leading to inefficiencies. To address these challenges, an advanced automated system is proposed for more effective and convenient water distribution. This system integrates a microcontroller with solenoid valves, flow sensors, and relays to ensure precise monitoring and control. The microcontroller oversees the entire process, enabling automation that reduces operational time, prevents theft, minimizes water wastage, and eliminates the need for manual intervention. By leveraging these advanced components, the system enhances efficiency, optimizes resource utilization, and ensures a sustainable water distribution approach.Every year on 22nd march world WATER DAY is celebrated. This is to take actions about the water crises and to prepare ourselves in managing the future. The theme of 2022 for water day is “GROUND WATER MAKING THE

INVISIBLE VISIBLE". In India the water characteristics are changing day by day due to the development pressure and rise in demand. The ground water is more depleted and less available and surface water is getting more polluted and unsuitable for human use. Good water quality is essential for human health as well as for the ecosystem. One of the big challenges is to ensure sufficient water to everyone. About 70% of surface water resources are polluted. The major contribution factor for water pollution is wastewater from different sources, intensive agriculture, industrial production, infrastructure development and untreated urban runoff. According to WHO, half of the India's morbidity is of water related. Waste management is not as efficient as required to manage increasing volume of waste generated daily in India, especially in cities. Because of this water crisis drinking water is not available sufficiently and hence distribution and management of water is one of the important issues. Automation is about the advanced technology used for proper water distribution by eliminating human intervention. It includes the use of various equipment and control system. The biggest benefit of automation is that it saves labor, energy, and precision. Automation provides optimized solution to all the problems of water distribution system. The conventional water distribution system is facing many problems which includes water leakage, improper supply of water, water theft etc. Due to these issues, consumers get less amount of water. By, considering above scenario the problems of water distribution need to be minimized. The main objective of this system is to providesufficient water to every consumer in an effective manner. And therefore, Arduino based control system from which solenoid valves are controlled is implemented making the distribution system automatic.

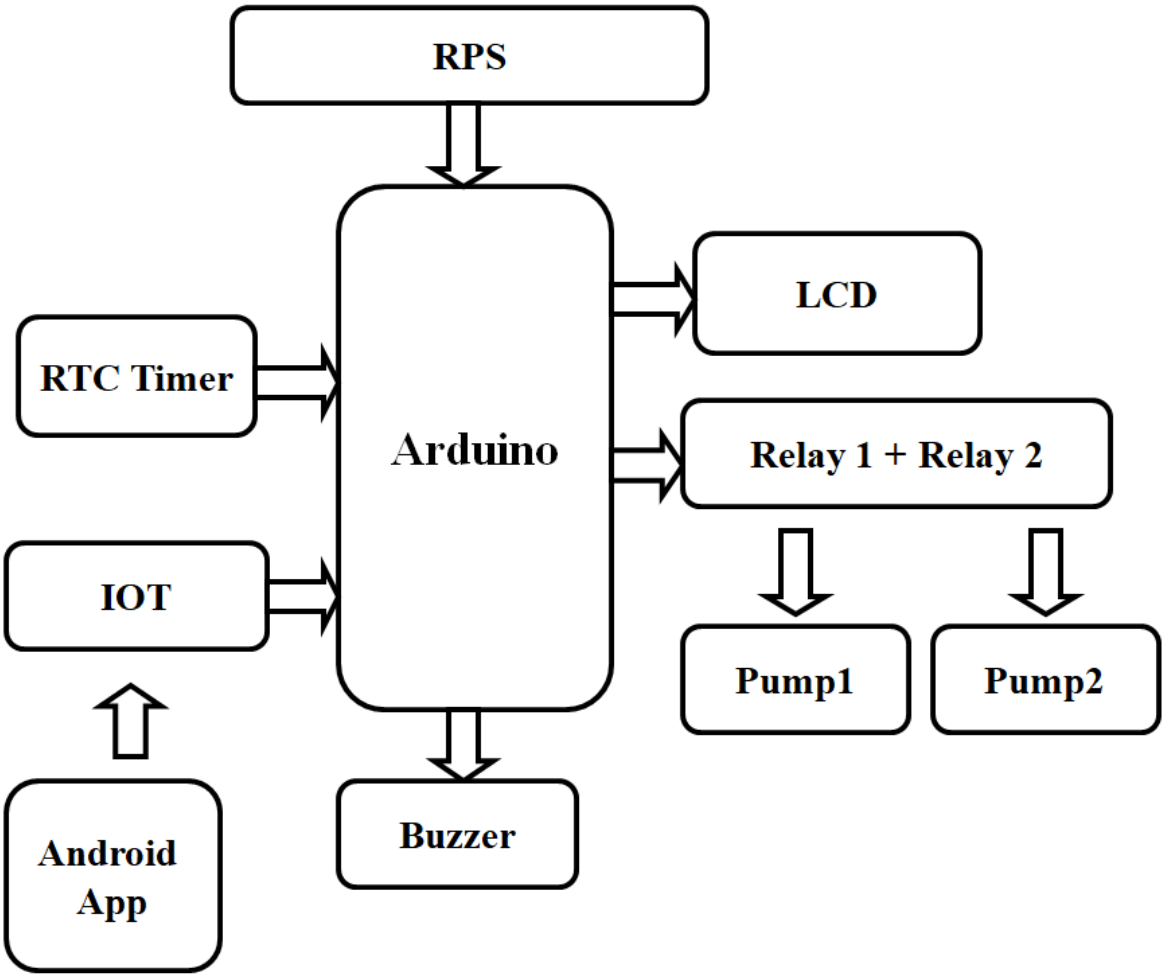
2. LITERATURE RESEARCH

Based on authors in [1], the Internet of Things (IoT) is one of the field study that has advantages of Wireless Sensor and Actuator Networks (WSAN) and Pervasive Computing domains. The security challenges are rooted in the technology and how information is acquired and manipulated by this technology [2]. IoT is very important to face a problem in accessibility in both physical and environments every day. The IoT offers a method for potentially removing these obstructions [3]. IoT holds promise benefits to emerging and developing economies such as in sustainable agriculture, water quality and usage, healthcare, industrialization, and environmental management [4]. ITU (International Telecommunication Union), proved the main vision of IoT, where an environment things are able to talk while their data can be processed by machines to do desired tasks [5]. Enabling technologies for the IoT can be divided into three categories which are technologies that enable "things" to get the information, to process information and technologies to improve security and privacy [6]. Many challenges faced to make IoT as stated from research in [7], if devices from different manufacturers do not use the same standards, interoperability will be more difficult, requiring extra gateways to translate from one standard to another. The implementation of an IoT application requires the integration of a range of information and communication technologies in the form of hardware and software [8]. For information that will be created, should have the capacity to reach some generalizable conclusion from the interpreted sensor information [9]. In terms of investment, IoT has mostly been in the development of software for smart homes and buildings by private investor [10]. B. pH for Water Health Regarding research in [11], for establishing water quality criteria on fisheries, the acidity or alkalinity of the water is an important factor to be considered support for a good fishery. The same of the impacts of the pH and carbon IV oxide (CO2) strain on the oxygen-conveying limit of the blood has additionally been noted [12][13].

3.PROPOSED SYSTEM

Block Diagram of System In this system the main objective of the project is to setup an auto municipal water system which can be monitored using sensors via the internet. RTC timer for feed with manual turn on/off option to be controlled at specific time. The proposed automated urban water supply system consists of Arduino uno based Microcontroller is the heart of automated water supply system. It helps in controlling the solenoid valve. The general layout of the proposed system is shown in Fig. 1. It mainly consists of microcontroller and solenoid

valves. Here we have used 4 solenoid valves. The microcontrollers programmed in such a way that the valves are operated for a pre-set period of time. One solenoid value is used for each distribution pipe at every area. And similarly every house is installed with one solenoid valve.



Whenever the water is supplied from the main overhead tank, it is not distributed until the main solenoid valve which is placed at the distribution pipe of each area is opened. The main solenoid valve operates for a pre-set time and water is distributed. For ex: if the microcontroller is programmed for a pre-set time of 6pm-8pm on daily basis then everyday exactly at 6pm the main solenoid valve is opened and the water is distributed up to 8pm. Similarly each house is provided with a solenoid valve which operates based on the water level in the storage tank.

The block diagram of automated water distribution system is as shown in above figure. It mainly consists of an Arduino uno based microcontroller, solenoid valves, relay, flow sensors, float switch and a real time clock. Basically, Arduino controls the overall operation of the system. Real time clock is set for a particular time of water distribution on daily basis. Every day at the set time arduino sends signals to the solenoid valves to operate and the water is distributed to the solenoid valve of each house accordingly. Later on, depending upon the level of the water in the tank at each house the solenoids valves operate and thus the water is supplied. Here, flow sensors are used to measure the rate of flow of water in the pipelines. By which, water theft can be detected and also can be prevented by sending signals to microcontroller, so that further actions can be taken.

Project Working :

There are five modules in the project they are:

1)REGULATED POWER SUPPLY

2)INPUT SECTION

RTC Timer

IOT

3)OUTPUT SECTION

LCD

Relay1,Relay2

Pump1,Pump2

REGULATED POWER SUPPLY: This module ensures that the entire system receives stable and regulated power, which is crucial for the proper functioning of electronic components. It typically takes in an unregulated voltage (such as from a wall outlet or battery) and converts it into a stable voltage output. This regulated voltage is then distributed to all the other modules in the system.

INPUT SECTION: This module consists of two primary components: the RTC Timer and IoT (Internet of Things) device.

RTC Timer: This is a Real-Time Clock module that keeps track of the current time and date. It is often used in projects that require actions to be performed at specific times.

IoT: This stands for the Internet of Things, which refers to a network of interconnected devices that can communicate with each other and send/receive data over the internet. In this project, the IoT component could be used for remote monitoring and control, allowing you to access and control the system from a distance using a smartphone or computer.

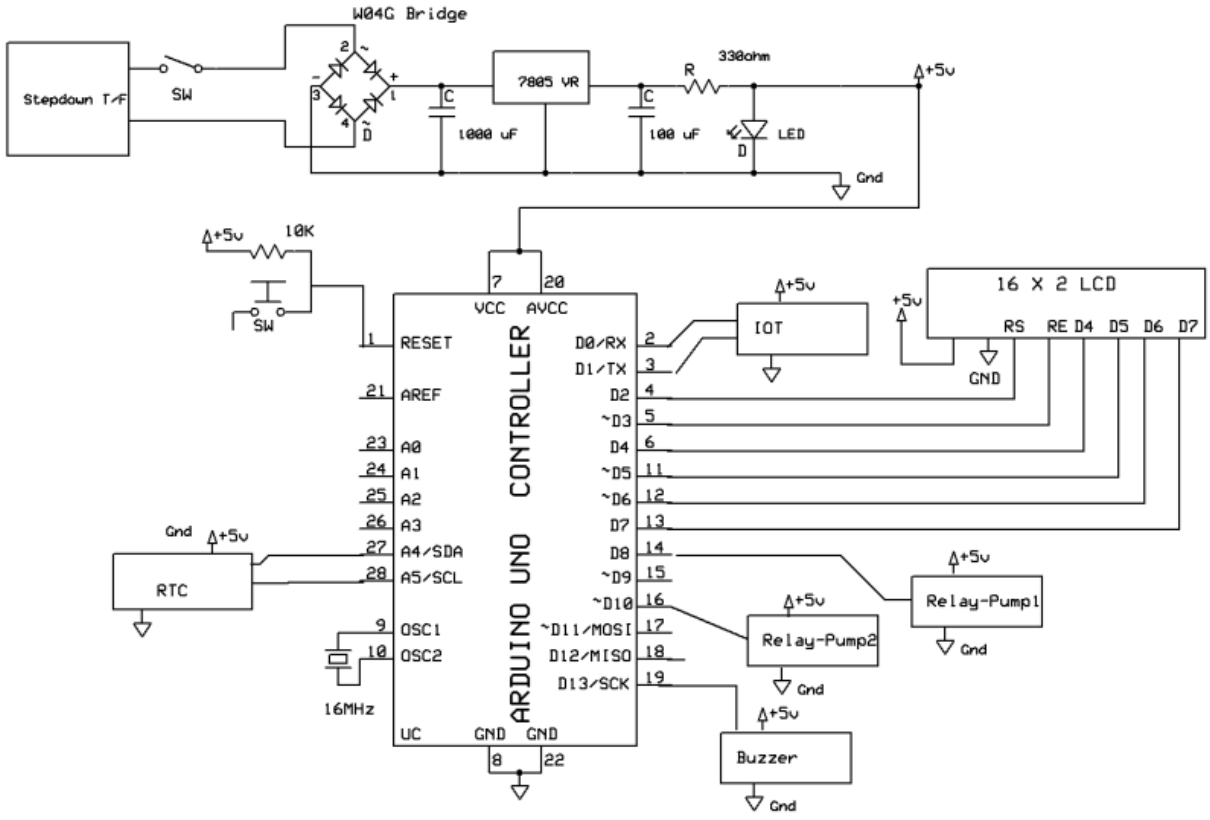
OUTPUT SECTION: This module is responsible for displaying information and controlling the actuators (relay and pumps) based on the input signals from the RTC Timer and IoT devices.

LCD: This stands for Liquid Crystal Display, which is a type of screen used to display text and simple graphics. The LCD in this project would likely show the current time and date from the RTC Timer, as well as any relevant data from the IoT device.

Relays: These are electronic switches that can be controlled by the microcontroller. They are used to control high-power or high-voltage devices, such as pumps or motors. In this project, the relays could be used to turn the pumps on and off based on input signals.

Pumps: These are devices used to move liquids or gases. In this project, they could be used for tasks such as pumping water from a reservoir or filling a tank.

Overall, the system works by receiving input signals from the RTC Timer and IoT device, processing these signals using a microcontroller or similar device, and then using the output signals to control the LCD display and the various actuators (relays and pumps) in the system.



This is the pin diagram where all the hardware components are been connected components. this ARDUINO microcontroller having 28 pins. In which 14 GPIO pins as digital pins and 6 GPIO pins. 16MHz crystal oscillator connected internally. The step down transformer, Bridge rectifier capacitor with 1000f Resisters and led are connected in Regulated power supply which provide the 5v to the Arduino and all input/output modules.

16*2 LCD Monitor has connected with the Digital pins 2, 3, 4,5,6,7.

WIFI has connected to Digital Pins D0,D1 internal Transmitter and receiver pins.

Buzzer connected to 13 pin of the Arduino micro controller.

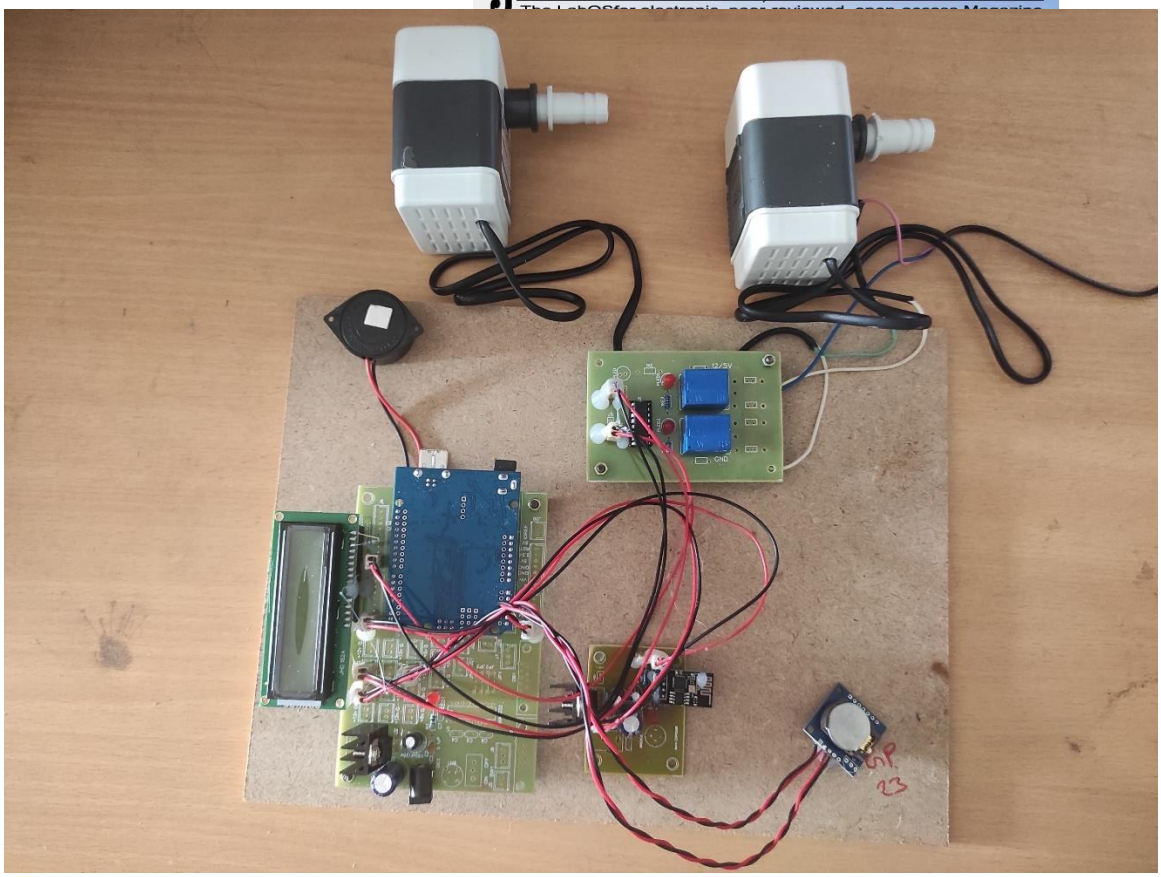
RTC connected to digital pin A4,A5

Relay-Pump1 connected to digital pin 8

Relay-Pump2 connected to digital pin 10

Buzzer alarm connected to digital pin 13

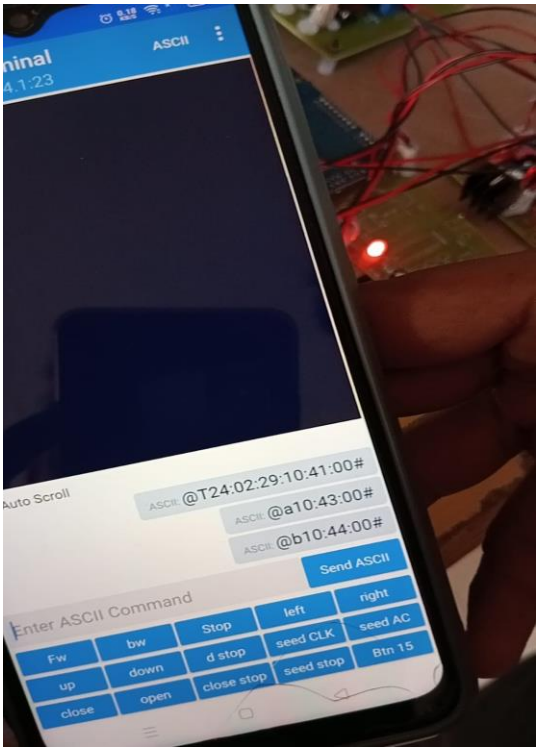
4.RESULTS



The above image shows the hardware equipment of the project. The kit is turned ON by giving the regulated power supply of 12v which is then converted to 5v dc current. The LED is the indication for 5v current so, if there is 5v current then automatically the LED glows. The generated 5v dc current

passes to every hardware co component in the circuit.

When we hit the reset button after providing the regulated power supply, the LCD displayed the RTC Water Distribution System.The output is seen in the following image after we have connected the IoT module.



- The first command sets the current date and time. The subsequent commands are as follows:
- Command 'a' specifies the time for turning on pump 1 followed by activating the buzzer alarm.
- Command 'b' indicates the time for turning off pump 1 followed by activating the buzzer alarm.

- Command 'c' denotes the time for turning on pump 2 followed by activating the buzzer alarm.
- Command 'd' designates the time for turning off pump 2 followed by activating the buzzer alarm.

5.CONCLUSION

"Arduino Based Automatic Municipal Watering System" has been designed and tested successfully. It has been developed by integrated features of all the hardware components used. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Thus, the Arduino Based Automatic Plant Watering System has been designed and tested successfully. The automated water distribution system is the best solution for all the problems faced by the existing system. This system is most effective for water distribution as it reduces operating time, eliminates manual operation completely and avoids leakage of water which in turn reduces the wastage of water. This system also prevents the water theft at the pipelines due to which people get equal quantity of water. The RTC Based Pump switching system proves to be a real time feedback control system which monitors and controls all the activities of system efficiently. Arduino based Public Garden Automation system is simple and easy. In this system various applications like gate, water pump, light etc are turned ON and OFF for the predefined time. The present proposal is a model to modernize and automated the day today life gadgets with optimum expenditure. Using this system, one can save manpower, water to improve production and ultimately high profit.

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