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IOT Based Digital Water Meter

S. R. Khot[1], Sejal Patil[2], Tohid Pakhali[3], Vedant Yadav[4], Prajakta Hogade[5], Harshada Bachate[6]

D.Y. Patil College of Engineering and Technology, Kasaba Bawada, Kolhapur[1-6]

Abstract: The paper examine through the present panorama of smart water purposes, spotlighting on utilizing IoT technologies to upgrade water systems management. It highlights the importance of various parts like microcontrollers, sensors, and modules in evolving IoT-based answers. A principal conflict underscored is the disjointed essence of current systems, which obstructs the smooth incorporation of IoT technologies. Nevertheless, the entry of 5G networks emerge as a bright solution, providing swift data transmission and backing numerous simultaneous associations. In contrast to 4G/LTE, the enhanced bandwidth of 5G allows quicker data processing, overriding delays that have troubled IoT resolutions. This converting connection empowers the instant data transmission across broad distances, aiding remote surveillance and handling of water systems. In general, the papers emphasize the vital role of 5G technology in unleashing the filled latent of IoT applications for smart water management.

Keywords: IOT, Digital Water Meter, Water Management and Billing System, IOT Based Digital Water Meter

I. INTRODUCTION

In the modern world of city infrastructure maintenance, the combining innovative technologies has become fundamental to tackle the challenges presented by limited resources and environmental worries. Among these advancements, the Internet of Things (IoT) stands out as a transformative power, changing the way utilities are watched and controlled. Especially, the merging of IoT with 5G technology provides uncommon opportunities for increasing the productivity and sustainability of essential services such as water management. This article investigates the change in approach brought about by the execution of IoT-driven digital water meters fueled by 5G connectivity. Water deficiency has risen as a pressing global problem, intensified by fast urbanization and climate change. In this context, conventional water measuring schemes have shown to be insufficient in offering real-time information and awareness necessary for proactive control and preservation attempts. The arrival of IoT proposes a viable answer by enabling the deployment of interconnected sensors and gadgets that continuously monitor water use, identify leaks, and optimize distribution networks. Yet, the full capability of IoT in water management can only be realized with high-speed, low-latency connections, which is exactly where 5G technology gets involved.

5G technology, the fifth generation of mobile networks, offers incomparable bandwidth and responsiveness, opening the path for many groundbreaking applications across different sectors. When used to water measuring systems, 5G supports smooth communication among IoT devices and central control platforms, allowing real-time data transmission and analysis. This empowers water utilities to promptly identify irregularities, control valves remotely, and optimize resource allocation, thereby reducing waste and maximizing productivity.

Further, the integration of 5G technology with IoT-based water meters enhances scalability and reliability, ensuring powerful performance even in populated urban zones. With its ability to back up a vast number of connected devices at the same time, 5G enables comprehensive coverage and data collection, promoting a holistic approach to water control. Additionally, the low latency feature of 5G ensures quick response times, crucial for time-sensitive tasks such as leak detection and emergency control.

In conclusion, the fusion of IoT-driven digital water meters with 5G technology heralds a new period in water control, offering unparalleled capabilities in terms of productivity, sustainability, and strength. Through empirical research and case studies, this article aims to shed light on the transformative potential of this innovative approach and offer insights into its implications for city infrastructure and environmental sustainability.

II. METHODOLOGY

Developing a IoT-based intelligent water meter leveraging 5G technology involves a strategized approach. To start, defining a project's objectives and requirements sets a foundation for following steps. Selecting hardware is vital, including sensors for water usage measurement, flow meters, and microcontrollers compatible with 5G communication modules. Designing the system's architecture is paramount, ensuring scalability, reliability, and security.

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Developing firmware and software proceeds, integrating data collection, processing, and communication functionalities, while emphasizing security measures against unauthorized access and cyber threats! Rigorous testing validates system performance, including accuracy, reliability, and analytics efficacy. Integration with cloud services facilitates data storage, analysis, and visualization, leveraging 5G connectivity for efficient data transmission.

Compliance with regulations ensures adherence to standards for water metering, data privacy, and telecommunications. Deployment involves careful monitoring and maintenance, ensuring optimal performance through periodic updates and emerging needs addressing. This methodology ensures a creation of a robust IoT-based intelligent water meter system, capable of accurate measurement, real-time monitoring, and proactive water management enabled by 5G technology

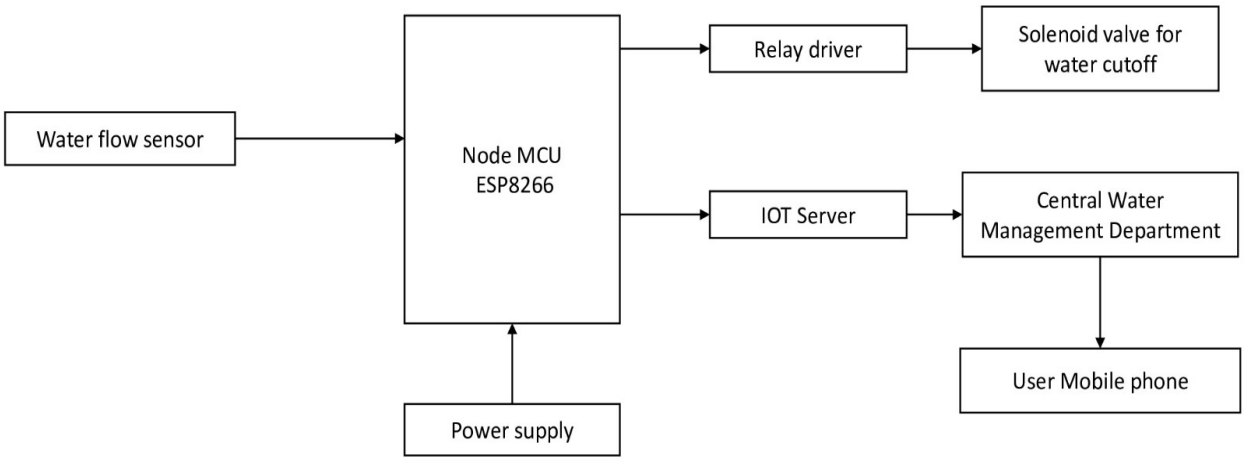

Fig:1 Block Diagram

1.NodeMCU:
An IoT-smart water meter with Node-MCU board can be built by collecting parts like the Node-MCU board and sensor for water flow. Connecting sensor to Node-MCU requires writing firmware for communication to get water flow data. Enable IoT connectivity for sending data to cloud server to monitor from afar. Advance functions like leak detection or valve management can be included if required. Test system rigorously before installing it in desired area for correct functioning. Ongoing care maintains operation. Node-MCU simplifies making a small, effective smart water meter, providing immediate information on water use.

2.Water flow Sensor (YF S201):
The H2O Flow Sensa (YF-S201) operates basing it on the Hall Effect theory and is commonly put to use for size and H2O Speed measurement, mainly in combination with Arduino arrangements. Presenting a disposable rotor with a pinwheel shape, it is put inside the H2O stream to evaluate the size of H2O traversing through. As H2O streams opposite the rotor, it makes a twist that an incorporated magnetic Hall Effect sensor discovers. This sensa logs each revolution, creating an electric pulse outcome proportional to the Speed. By recording these pulses, the H2O flow can be specifically calculated.

3.Solenoid valve:
The Solenoid Regulator functions as an electromechanical device for controlling H2O flow by electrical mechanisms. Obtainable in two main settings, in the main open (NO) and usually fastened (NC), these regulators are in general put together from copper. In this setting, a DC solenoid is utilized, reinforced by resisters and an RC net within parallel to moderate voltage spurts. The continuous electric current consumption of the DC solenoid supports seamless transitions, presenting a noticeable benefit for its use.

4.Relay 5V-2A:
The research involves integrating a 5V-2A relay into the IoT-based digital water metering system, powered by 5G technology. This relay facilitates the control of water flow based on data collected by the meter, ensuring efficient management. Through careful implementation and testing, the relay's performance in regulating water flow is evaluated, aiming to enhance system functionality and reliability for optimized water resource management.

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5.Adapter 12V-2A:
It is used to provide the power supply to Node MCU.

6.Regulators:

1. 7805:
By integrating the 7805 regulator, the system's power supply is effectively managed, enhancing reliability and performance. Through thorough testing and evaluation, the effectiveness of the regulator in sustaining the required voltage levels is assessed, contributing to the system's overall efficiency and functionality.

2. 7809:
This regulator 7809 ensures a stable 9V supply, vital for the operation of various components within the system, including sensors and microcontrollers. Through meticulous testing and calibration, the regulator's efficiency and reliability in maintaining the required voltage levels are assessed, ensuring consistent and accurate performance of the water metering system.

III. WORK FLOW OF PROJECT

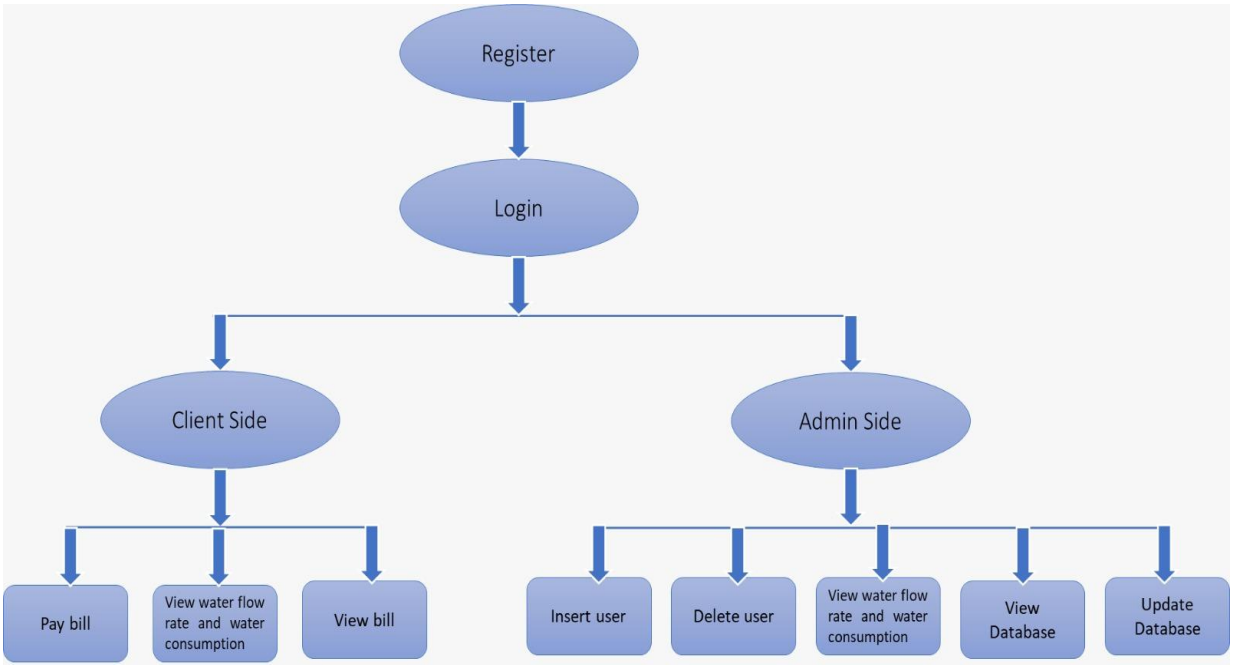

Fig:2. Procedure for registration and Bill payment, Database creation

A smart water meter is a modern device designed for measuring water consumption in a super precise, really efficient, and intelligent manner compared to the super old-fashioned traditional water meters.

It's like high-tech and stuff. Incorporating amazing technology to automatically communicate usage data to both consumers and utility providers, making everything super easy to manage. Here's a detailed breakdown:

1. Data Collection :
The smart water meter totally measures water flow, like, using these really cool sensors that are all fancy and advanced. It records the volume of water passing through the meter in real-time.

2.Data Storage (Local):
So, like, initially, the data can be, you know, temporarily stored in the Node-MCU's like, super small and stuff onboard memory if they don't need to transmit it right away or to batch data to reduce network traffic.

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3.Data Processing with Node-MCU:

Local Processing: Before transmitting the data, the Node-MCU can, you know, perform some initial data processing. This might include some filtering, timestamping, and formatting the data for transmission. They might even do some advanced stuff like complex calculations or preliminary analysis at this stage to minimize the data sent over the network, which is smart, I guess.

Edge Computing: The Node-MCU can also, like, do some edge computing tasks such as monitoring for anomalies in water usage patterns and stuff, or they can quickly adjust to predefined conditions without even talking to a central server.

4.Enhanced Data Storage and Transmission:

Intermediate Storage: For applications that need data logging over time, they can use an external SD card connected to the Node-MCU just for the added data

Transmission: Using its amazing Wi-Fi capabilities, the Node-MCU transmits the processed data to the utility provider or to some cloud-based server using some fancy acronyms like MQTT, HTTP(S), or other IoT protocols for efficient and secure data transmission, which is totally cool, right?

5. Data Reception :
The data is magically received by the utility provider's data center or some cloud-based server that's floating in the sky or something. A network gateway or hub often, like, helps to collect data from lots of different meters. It's all about that teamwork, you know?.

6. Data Analysis :
Software at the utility provider's end, like, does some serious analysis on the received data. They look for trends, detect leaks, predict peak demand, and all that jazz.

7. Billing and Reporting :
The analyzed data is used to, like, generate accurate billing based on actual consumption, which is super important, obviously .Reports can be created for consumers and for internal use by the utility to, you know, improve water resource management or something like that.

8. User Interface Interaction :
Consumers can, like, super easily access their consumption data through a web portal or some mobile app. It's like magic! This interface allows users to really closely monitor their water usage, view bills, get some cool alerts (for leaks or abnormal usage), and manage their accounts, which is pretty sweet.

9. Feedback Loop :
Users can, you know, adjust their consumption based on the insights gained from the data provided. It's like learning from the water, man.Utilities may, like, totally adjust pricing, issue water-saving recommendations, or make policy changes based on the data, which is just brilliant..

This flow chart represents a comprehensive view of how smart water meters function within a larger water management system, offering benefits like enhanced efficiency, improved water conservation, and better customer service.

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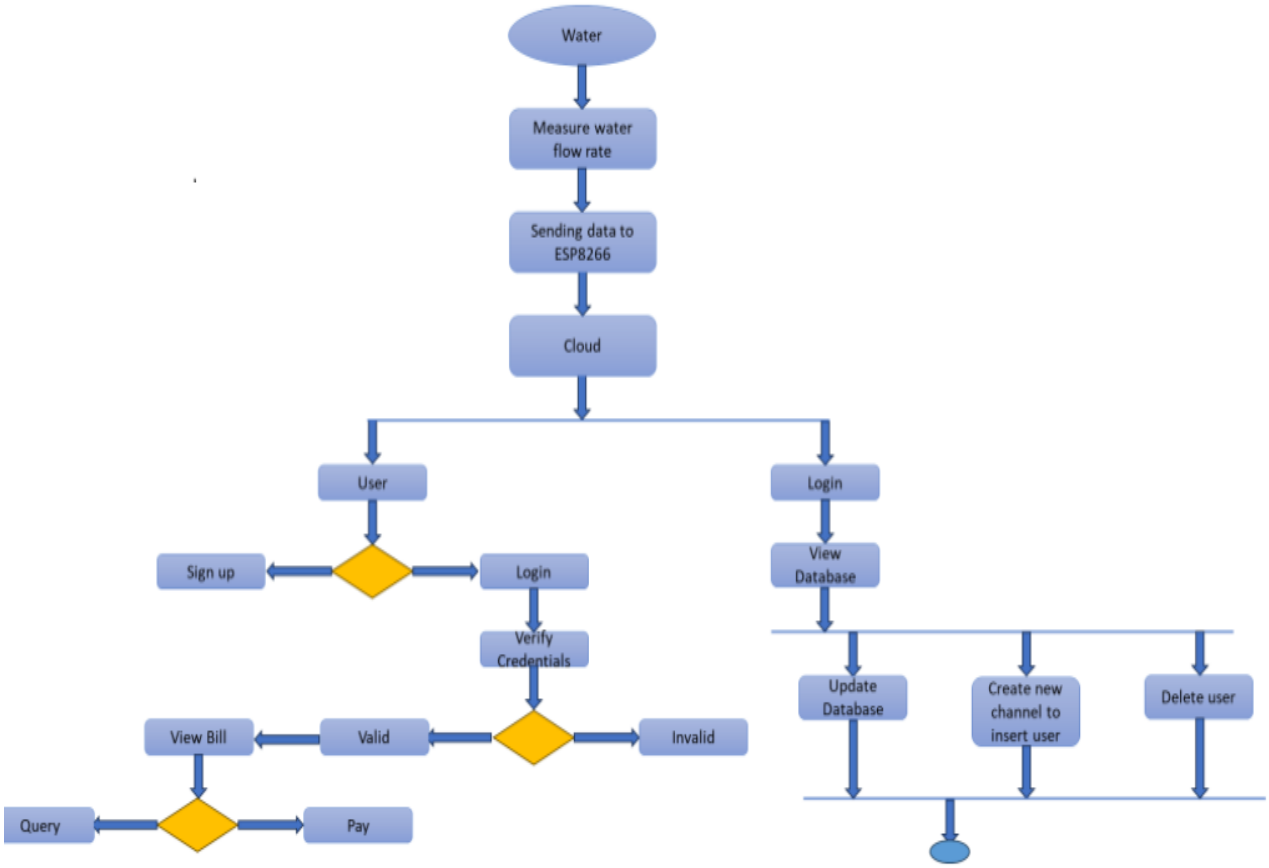

IV. CONCLUSION

So yeah, in conclusions and stuff, like the integration of IoT with digital water meters, leveraging that 5G technology, it presents a transformative solution for, you know, efficient water management. Through like - real-time data collection, and analysis, and communication, this like super cool system, it optimizes water usage like a pro, enhances leak detection, and enables proactive maintenance, like wow! The synergy between IoT sensors and 5G networks offers unprecedented scalability, reliability, and like low-latency communication, ensuring like seamless connectivity and actionable insights for both consumers and utility providers, you know? As we embrace this paradigm shift like towards smart water management, the IoT-based digital water meter, empowered by 5G stands poised to revolutionize resource conservation and sustainability efforts, heralding a new era of intelligent infrastructure, like totally!

REFERENCES

[1]. Jiwa Abdullah , “An Efficient IoT-based Smart Water Meter System of Smart City Environment.” Faculty of Electrical and Electronic Engineering, University Tun Hussein Onn Malaysia, Johor, Malaysia. August 2021

[2]. M Suresh, “A Novel Smart Water-Meter based on IoT and Smartphone App for City Distribution Management” . IEEE region 10 symposium . Feb 2018

[3]. Adnan M, “Smart Water Meter System for User-Centric Consumption Measurement.” Meraka Institute, Council For Scientific & Industrial Research , May 2015.

[4]. Marais, J., Malekian, “A review of the topologies used in smart water meter networks: A wireless sensor network application”. Journal of Sensors, 2016.

[5]. M. H. Yaghmaee and H. Hejazi, “Design and Implementation of an Internet of Things Based Smart Energy Metering,” Conf. Smart Energy Grid Eng, 2018.

[6]. M. Kaur, L. Mathew, A. Alokdeep, and A. Kumar, “Implementation of Smart Metering based on Internet of Things,” IOP Conf. Ser. Mater. Sci. Eng ,2018.

[7]. Sundresh, H. D., & Priya, D. “Design and Integrate IoT Sensors to RO Water Purifiers for Remote Monitoring and Allowing Users to Pay Per Usage on the Rented RO System”. In Inventive Communication and Computational Technologies. Springer, Singapore 2020.