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Smart Water Monitoring and Billing System Using IOT

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Abstract : ***Water is a vital natural resource that is necessary for all living things, including humans.It is essential to our survival. The government has made great efforts to preserve it, but it is getting harder and harder to preserve water and use it properly in the future. The goal of this study is to create a system that uses water resources effectively by distributing them properly and installing monitoring equipment. The design of the system will allow it to continuously track the flow of water through tanks or pipelines and alert the user.It is put into practice with the aid of embedded systems and IOT. Real-time data is collected by monitoring the continuous flow using an ultrasonic sensor and a water flow sensor. The precise level of water that has been utilised is displayed by the digital metre. The cloud is used to gather and store the real-time data. The real-time data gathered by the system may be viewed by the user on a smartphone anywhere there is an Internet connection by utilising an Android application.***

Keywords - Sensor,IOT,Internet,NodeMCU Microcontroller, Ultrasonic Sensor,WI-FI Module.

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I. INTRODUCTION

In urban environments, one of the issues that gets less attention is water delivery. A lack of water can occur in some areas as a result of drought, excessive use of available water supplies, or population growth. Inadequate water supply for homes, farms, and businesses may result from this.Because of this problem, it is imperative that water be continuously monitored. The mechanism that will channel water to each block in order of user order will be described in this article. An embedded system has been built using an Arduino controller, which is one of the readily available solutions to keep the overall concept affordable. Arduino will regulate the required amount of water at the appropriate time.Water has been delivered for the required amount of time and at the required flow rate. The quantity of water utilised will determine how much is billed. Water conservation results in financial savings. It's also possible that folks occasionally require more water. It is practical to utilise in these circumstances.It is put into practice with the aid of embedded systems and IOT. Real-time data is collected by monitoring the continuous flow using an ultrasonic sensor and a water flow sensor. The precise level of water that has been utilised is displayed by the digital metre.The cloud is used to gather and store the real-time data. The real-time data gathered by the system may be viewed by the user on a smartphone anywhere there is an Internet connection by utilising an Android application.

Motivation: Freshwater is a limited resource that is getting harder to find in many areas as a result of urbanisation, population increase, and climate change. Water conservation measures are one way to increase the amount of this valuable resource that is available. Overuse of water can be detrimental to ecosystems, particularly when it takes water away from places like wetlands and rivers. Systems for conserving water can lessen the effects of water extraction and use on the environment. Large energy inputs needed for the distribution and treatment of water. Water conservation can help cut greenhouse gas emissions because it requires less energy to pump, clean, and distribute water to households and businesses.Governments, corporations, and people may all save money by conserving water. People can lower their utility rates and communities can postpone or avoid expensive investments in water infrastructure expansion by conserving water.

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LITERATURE REVIEW

As per literature survey Smart Water Monitoring [1] Hrithik Yadav,Navya Kola,Ashritha Reddy,Kiran Kumar. "Smart Water Quality Monitoring System is necessary now a days due to increase in pollution and other industrial waste which is being dumped in the water bodies, which makes water polluted even after purifying it., [2]Omkar Pharande,Sanket Patil."Real Time Water Quality Monitoring and Management System".Water pollution has been an increasing problem over the decade. The conventional method of testing water quality is to assemble samples of water physically and send them to the lab to test and analyze.As per literature survey water management systems [3] L. Zhenhua, "Supervision and Management Information System for Rural Drinking Water Project Construction," had been already implemented and invented by various researches. In the implemented system various features has been working together like uniform water distribution, monitoring of water level available in a tank, supply on demand, [5] Ting Wang, Jian Zhong Hao, Li Zhuo, Qing Zhang and Yan Wei, Online billing and payment of the water utilized. Using existing IoT (mobile network) these data could be sent to the remote server for billing from each flat and accepting request, monitoring and getting notifications are also done in this project. In this paper author has implemented a system which is monitoring the water utilization and preparing a bill as per utilization of water also water monitoring has been done remotely.

OBJECTIVE :

The purpose of this action is to manage, monitor, and distribute water in a way that conserves it, makes good use of it, and gains the trust of others. The system is designed to continuously track the quantity of water that is available and used.

- To keep an eye on tank levels.
- To determine how much water each flat Consumes.

PROPOSED METHOD :

The IOT environment methodology is used in the smart water monitoring and conservation system, which includes the block diagram and hardware/software needs.
An example of a possible block diagram

The project has been divided into four separate modules, the first of which is the real-time water level monitoring module. Ensuring that each block receives the same amount of water is the responsibility of the second module. Using a mobile IOT application, the third module can be used for demand-based water delivery and water usage. Calculate the total bill of water distribution in the fourth module.
The block diagram for the smart water monitoring and conservation system is shown in the image below.

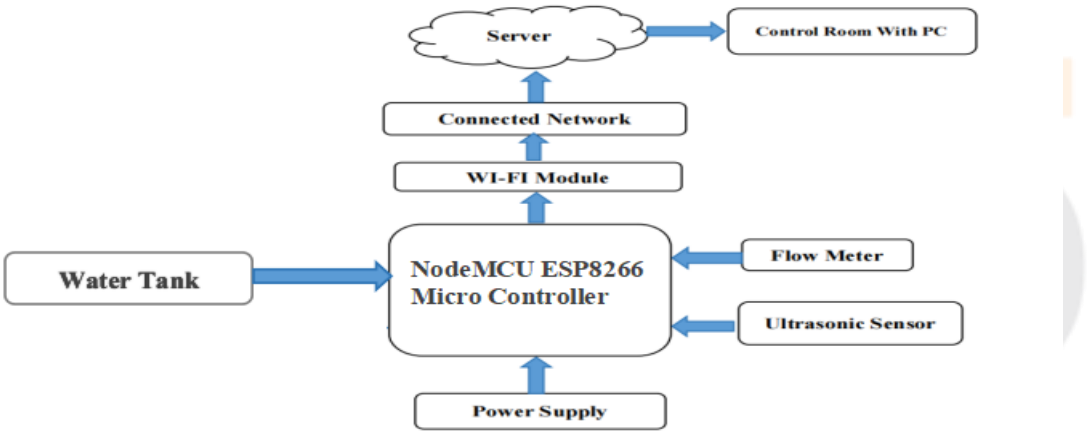


Fig.Block Diagram of Smart Water Monitoring and Conservation System using IOT

Installing a monitoring system begins with measuring the water level in the main tank using an ultrasonic sensor. This measurement will demonstrate the exact amount of storage that is accessible. This level can be translated to a volume for distribution needs. Next, distribute the water in each flat using IOT based on the needs of each individual or as needed. (Portable). Every flat has a flow metre that gauges the available water flow. Arduino will automatically stop the water flow after a preset amount of time.

A)Node MCU:

One flexible and affordable platform for creating a water monitoring system is the NodeMCU microcontroller. It is perfect for Internet of Things applications since it combines a microcontroller with integrated Wi-Fi capabilities, based on the ESP8266 Wi-Fi module. NodeMCU can interact with different sensors in a water monitoring system to measure characteristics including flow rate, quality, and level of water. For instance, flow sensors track the rate at which water is consumed, while ultrasonic sensors can detect the water level. Turbidity and pH sensors can be used to evaluate the quality of water. Remote monitoring and control are made possible via the NodeMCU's Wi-Fi functionality, which enables real-time data transmission to cloud platforms. The visualisation of this data via mobile applications or web dashboards enables effective water management and prompt responses.

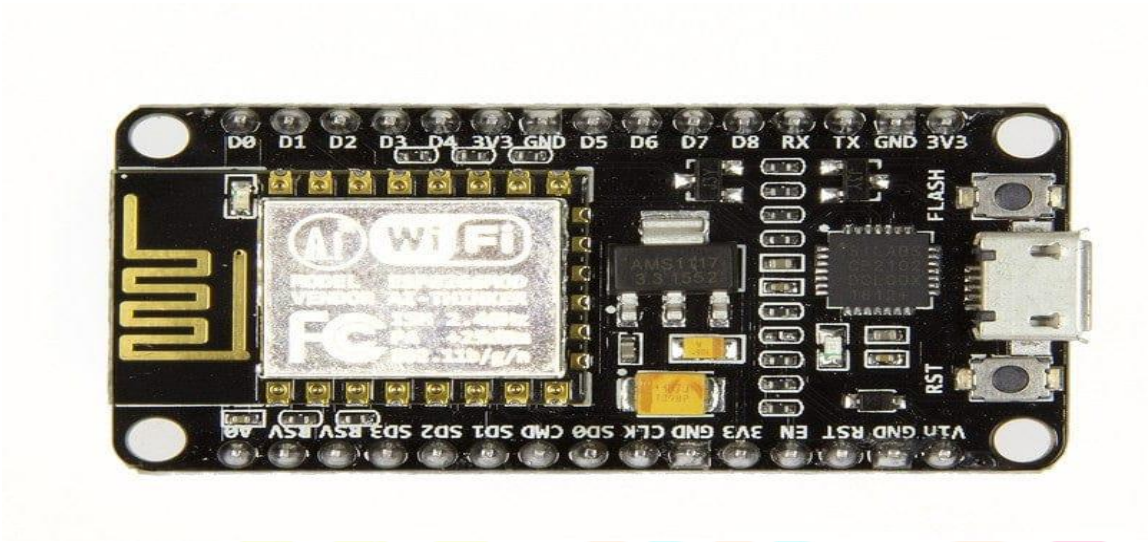


Fig: Node MCU

A) Flow sensor:

Water flow through a flow sensor is measured using a flow sensor. The essential components of this sensor are a rotor, a Hall Effect sensor, and a plastic valve body. When liquid or water runs through the pinwheel, the pinwheel rotor revolves. The flow rate and the valve's speed will be inversely correlated. With each rotation of the pinwheel rotor, the Hall Effect sensor will deliver an electrical pulse.

Fig: Flow sensor

B) Ultrasonic Sensor:

Water monitoring systems frequently use ultrasonic sensors to assess water levels because of their excellent accuracy and dependability. These sensors detect the amount of time it takes for an echo to return after reflecting off the water's surface by emitting ultrasonic vibrations. After then, the time delay is transformed into a distance measurement, giving real-time water level information. Because ultrasonic sensors provide non-contact measurements, they can be used in a range of water bodies, such as natural water sources, tanks, and reservoirs. Their long-term durability is guaranteed by their resistance to water and environmental conditions. Wireless data transmission is made possible by integration with microcontrollers such as NodeMCU, allowing for effective water management and monitoring.

Fig: Ultrasonic Sensor

FUTURE SCOPE:

The Internet of Things, artificial intelligence, and data analytics are driving exciting developments in smart water monitoring and billing systems. These systems provide effective water usage management and real-time monitoring. The usage of smart water technology is anticipated to soar as urbanisation increases and water shortage becomes a pressing concern. Integration with smart city infrastructure, which facilitates easy data sharing and resource optimisation, is one of the main areas for future growth. Predictive analytics driven by AI will improve conservation and preventative maintenance techniques. Furthermore, blockchain technology might guarantee safe and open billing procedures.

Due to smart systems' promotion of sustainable water usage, reduction of waste, and decreased operating costs, there are substantial environmental benefits. Government rules and incentives will probably hasten adoption, improving the effectiveness and environmental friendliness of water management. All things considered, the development of intelligent water billing and monitoring systems has enormous potential to change how we handle one of our most important resources.

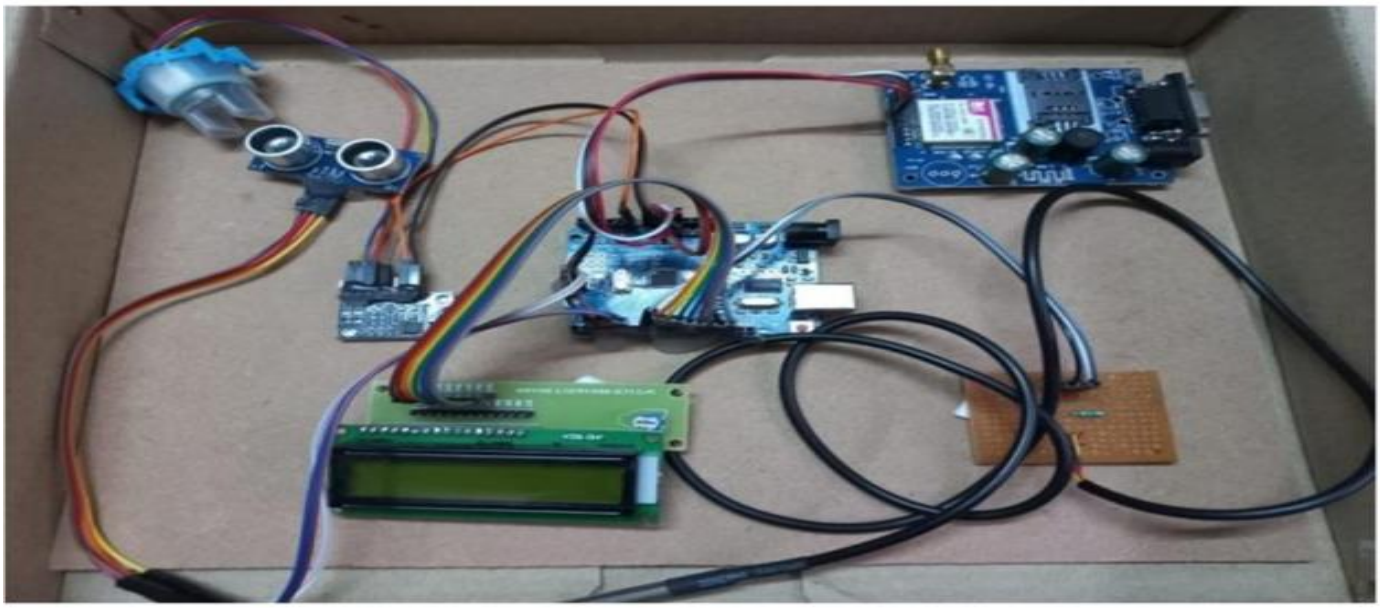
RESULT:

For thorough monitoring and invoicing, the Smart Water Monitoring and invoicing System uses flow metres, ultrasonic sensors, and the flexible microcontroller NodeMCU. The central processing unit, NodeMCU, is Wi-Fi enabled. It collects data from the ultrasonic sensor to determine tank levels and the flow metre to measure water usage.

After that, this data is sent to a specified server or cloud platform for analysis. Through the integration of these components, the system can monitor water consumption in real time, identify abnormalities like leaks or overflows, and enable automated payment based on usage statistics. This technology empowers customers with insights into their consumption habits, which not only improves operational efficiency and billing accuracy but also encourages water conservation.

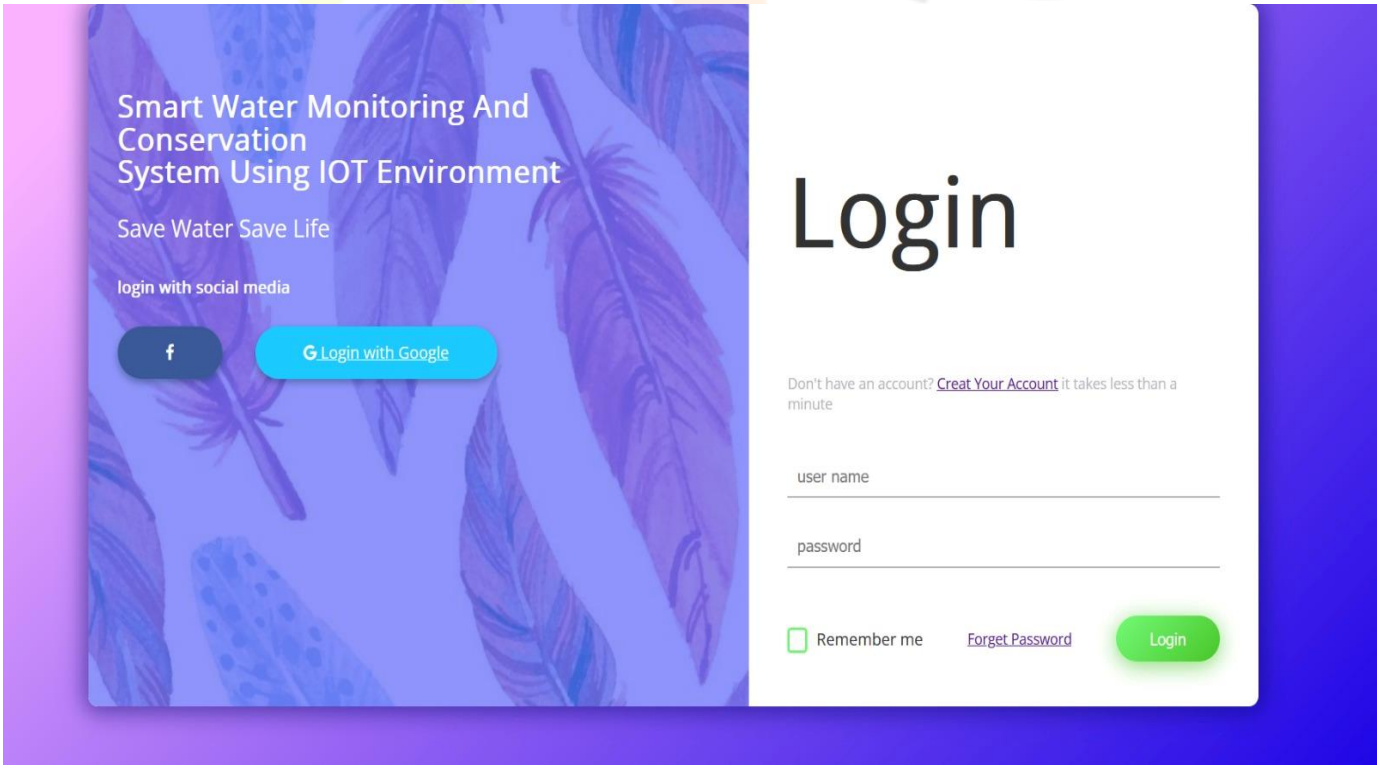
Additionally, the system encourages sustainable water use by raising consumer knowledge of their consumption patterns. The Smart Water Monitoring and Billing System provides a scalable and flexible solution for both residential and commercial applications thanks to its affordable implementation and user-friendly interface. All things considered, this system provides a major improvement in water management, conservation, and billing efficiency by utilising NodeMCU, flow metres, and ultrasonic sensors.

HARDWARE DESIGN:

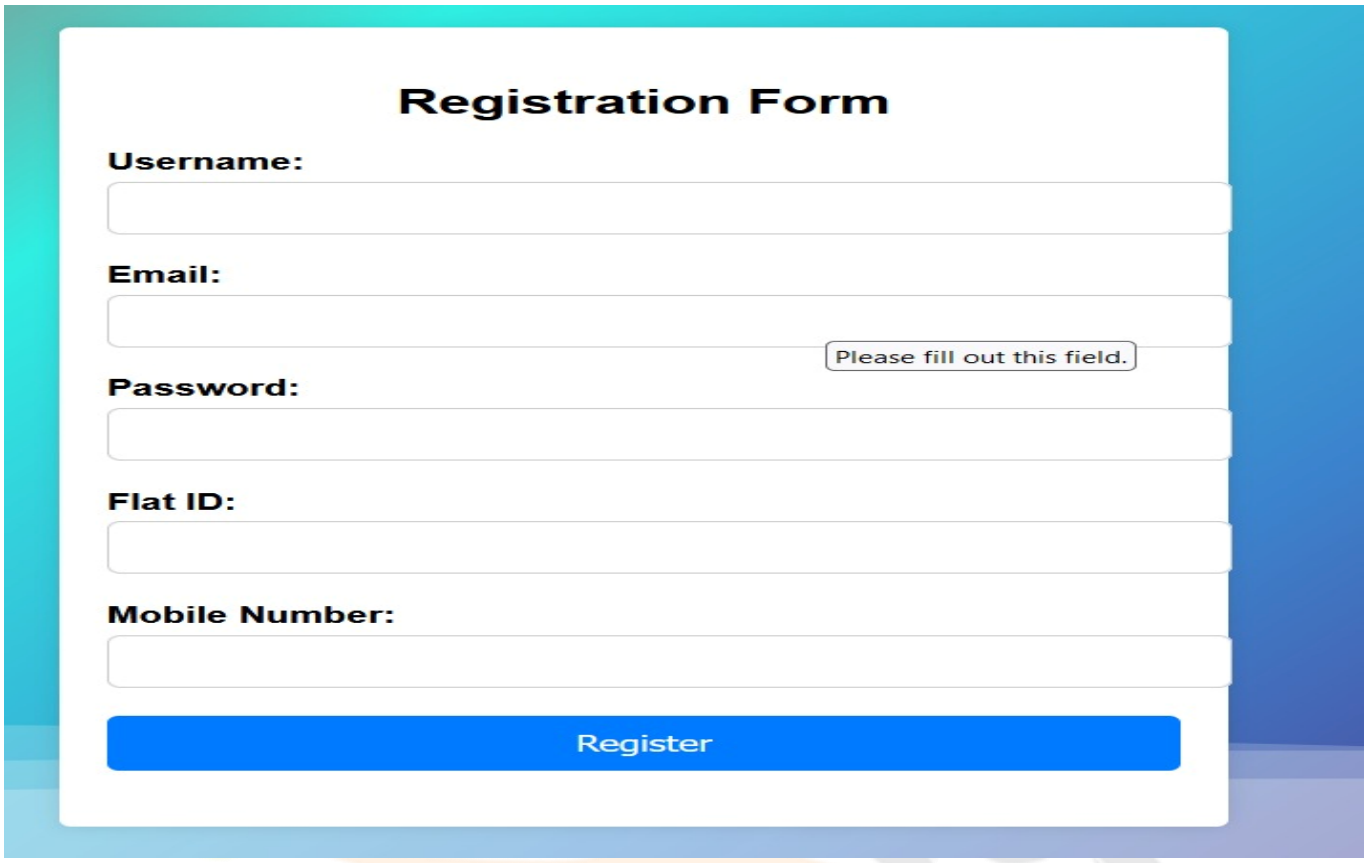


SOFTWARE DESIGN:

1. **LOGIN PAGE**

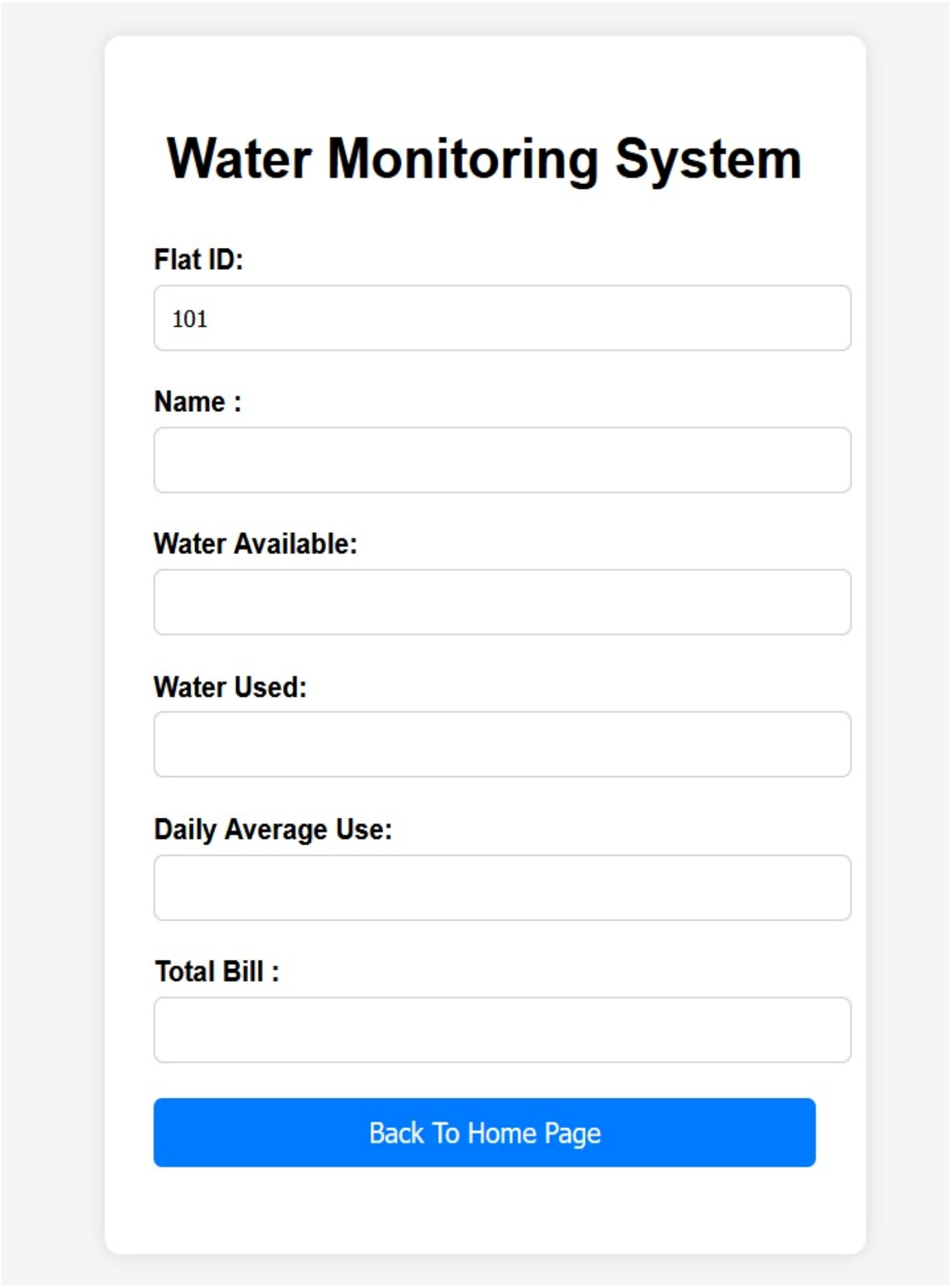


2. REGISTRATION PAGE



2. FORGET PASSWORD

3. WATER MONITORING MAIN PAGE


Water Monitoring System
Flat ID:
101
Name :
Water Available:
Water Used:
Daily Average Use:
Total Bill :
Back To Home Page

4. MYSQL DATABASE

```
sql> select * FROM LOGIN;
+-----+-------------+
| id  | password    |
+-----+-------------+
|  71 | hjk         |
|  38 | tyu         |
|  17 | jkl         |
|  98 | yui         |
|  81 | fgh         |
|  88 | swami       |
|  73 | 455         |
|  81 | fgh         |
|  39 | sataras     |
|  12 | bhavesh     |
|  12 | asdfg       |
|  24 | Suraj@12345 |
|  12 | gulzar      |
|  17 | Satara@12   |
|  17 | Satara@12   |
|  26 | oby         |
+-----+-------------+
 rows in set (0.02 sec)

sql> SELECT*FROM REGISTER;
+-----+-------------------------+----------------------------+-------------+--------+------------+
| id  | uname                   | Myemail                    | Mypassword  | FlatId | MobilNum   |
+-----+-------------------------+----------------------------+-------------+--------+------------+
|  58 | Swami                   | Swami@gamil                | asdf        | 100    | 8999787209 |
|  86 | hjjj                    | jkk@hj                     | dfgdh       | 45     | 899        |
|   8 | bhavesh                 | bhavesh@gmail              | Swam        | 414    | 5689       |
|  73 | get                     | dbgh@gghj                  | swe         | 456    | 756        |
|  34 | ghjkt                   | bhl@gamil                  | satara      | 52     | 5689       |
|  12 | dfg                     | dfdf@gh                    | gulzar      | 548    | 789456     |
|  88 | Santosh                 | sttt@gmk                   | swami       | 45     | 789        |
|  27 | fghh                    | hkll@ghj                   | wer         | 46     | 235        |
|  71 | fghj                    | ser@er                     | hjk         | 789    | 3256       |
|  38 | kliu                    | bhj@gjfjg                  | tyu         | 456    | 798        |
|  17 | fgh                     | rree@g                     | jkl         | 45     | 256        |
|  98 | ddrt                    | deer@ghy                   | yui         | 789    | 256        |
|  81 | BHavesh                 | ghh@fgf                    | fgh         | 101    | 546        |
|  39 | Gulzar                  | gulzar@gmail.com           | sataras     | 101    | 8999787209 |
|  24 | surajkamble             | suraj@gmail.com            | Suraj@12345 | 411    | 9359093875 |
|  17 | Dipesh Santosh Kumbhar  | dipeshkumbhar14@gmail.com  | Satara@12   | 105    | 98658475   |
|  85 | Dipe                    | bhj@123                    | asd         | 568    | 2589       |
|  26 | Diraj                   | diraj@ghj                  | oby         | 457    | 8978458    |
+-----+-------------------------+----------------------------+-------------+--------+------------+
 rows in set (0.01 sec)
```

CONCLUSION:

In conclusion, a major development in water management technology is represented by the Smart Water Monitoring and Billing System, which makes use of NodeMCU, flow metres, and ultrasonic sensors. The system monitors water usage and storage levels precisely and in real time by integrating various Internet of Things components. NodeMCU functions as an efficient central hub, enabling smooth data gathering and transfer to cloud platforms for in-depth analysis thanks to its strong processing and Wi-Fi capabilities.

By automating the invoicing process based on precise water use statistics, this solution improves operational efficiency and lowers errors and administrative cost. Furthermore, it provides users with comprehensive insights on their water usage trends, encouraging more sustainable and conscientious water consumption practices. Early leak and anomaly detection reduces water waste, which helps save money and conserve resources.

The system is appropriate for a wide range of applications, from large-scale commercial and municipal water management to individual households, due to its scalability and versatility. Its usefulness and worth are further demonstrated by how affordable and simple to implement it is.

All things considered, the Smart Water Monitoring and Billing System helps environmental sustainability initiatives while also streamlining water management and billing procedures. It is an innovative response to the growing demand for sustainable, open, and effective management of water resources.

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