



Project Documentation: Water Billing System Program

1. Research


The problem of manual water billing processes, especially differentiating between customer categories (residential and industrial), was identified through feedback from utility management systems and customer complaints about inefficiencies and errors.

Research from credible sources, such as local government utility boards and water management agencies, revealed that current billing systems struggle with precision and scalability. The need for an automated, user-friendly solution was clear to ensure:

- **Accurate calculation of water consumption charges**
- **Ease of billing for different customer types with distinct pricing tiers**
- **Reduction of human error in manual input** This solution is critical for water management in residential areas, small-scale industries, and municipalities, where water conservation and correct billing are increasingly important.

2. Analyze

The proposed solution addresses the problem by automating the billing process, reducing human error, and providing a more reliable and scalable system. By using validated inputs and a tiered pricing structure, the program:

- **Provides accurate billing based on customer type and water consumption**
 - **Simplifies the process, ensuring quick generation of bills**
 - **Enhances transparency for both consumers and utility companies** The value and impact are significant for municipalities and companies involved in water distribution, where accurate billing can increase customer satisfaction and optimize resource management. The automation of this process reduces administrative overhead and ensures timely billing.
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3. Ideate

The program works by allowing users to input customer details (e.g., ID, telephone number, type, units of water consumed). Based on the customer type (residential or industrial) and water usage, the program calculates the bill using a tiered pricing model. Here's how it works in different cases:

- **Residential Case:**
 - For 50 or fewer units, the rate is **₹2 per unit**.
 - For 51–150 units, the rate is **₹3 per unit beyond the first 50**.
 - For more than 150 units, the rate is **₹5 per unit beyond the first 150**.
 - **Industrial Case:**
 - For 50 or fewer units, the rate is **₹4 per unit**.
 - For 51–150 units, the rate is **₹6 per unit beyond the first 50**.
 - For more than 150 units, the rate is **₹8 per unit beyond the first 150**.
- Each case is processed differently based on the input, and the system validates data to prevent incorrect entries. Error messages guide users when invalid inputs are provided, ensuring robust handling of different scenarios.

4. Build

The program was developed to ensure seamless functioning by integrating error-handling mechanisms. Key aspects include:

- **Input Validation:**
 - Customer ID must be exactly 13 digits long and only contain numeric values.
 - Telephone numbers must be exactly 10 digits.
 - Customer type is restricted to either "residential" or "industrial."
 - Water units consumed must be a non-negative integer.
 - **Error Handling:**
 - If any of these conditions are not met, appropriate error messages are shown to the user, prompting correct inputs. This ensures the program handles all edge cases, preventing crashes or invalid output.
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5. Test

The program was thoroughly tested using several cases to ensure it met expectations:

- **Test Case 1 (Residential, 40 units):** The bill was calculated correctly as ₹80 (40 units * ₹2).
- **Test Case 2 (Industrial, 200 units):** The bill was calculated as ₹1,200 (50 units * ₹4 + 100 units * ₹6 + 50 units * ₹8).
- **Test Case 3 (Invalid ID):** The system prompted an error for incorrect customer ID length.
- **Test Case 4 (Invalid Phone Number):** The system flagged the error for non-numeric or incorrect phone number length. These tests confirm that the program operates correctly under different conditions, handling input validation and correct bill calculation for both customer types.

```
Enter phone number (10 digits): 356456835967356
Invalid phone number. Please enter exactly 10 digits.
Enter phone number (10 digits): 8492057395
Enter customer type (residential/industrial): sdfjigidk
Invalid customer type. Please enter 'residential' or 'industrial'.
Enter customer type (residential/industrial): industrial
Enter units of water consumed (in cubic meters): -29
Invalid number of units. Please enter a non-negative integer.
Enter units of water consumed (in cubic meters): 252
Enter customer name: xyzwattd
Enter customer ID (13 digits): 9472940583914

Water Bill
-----
Customer Name: xyzwattd
Customer ID: 9472940583914
Phone Number: 8492057395
Customer Type: industrial
Units of Water Consumed (cubic meters): 252
-----
Amount to be Paid: 1110.00
Make payment at this Gpay ID: paymentpunecorporation@axisbank
Your payment slip will be sent on your E-mail
-----
Process exited after 50.1 seconds with return value 0
Press any key to continue . . . |
```



6. Implement

This program can be deployed in various sectors for water billing purposes, including:

- **Municipal Water Departments:** For managing water billing across residential neighborhoods and industries.
- **Private Utility Companies:** For water management and billing in housing societies or industrial complexes.
- **Smart City Projects:** Where automation of billing processes is crucial for improving efficiency and resource management.
- **Water Conservation Programs:** To track usage more effectively and encourage responsible water use with transparent billing.

7. References

- <https://www.pmc.gov.in/en/water#:~:text=OVERVIEW%20&%20FUNCTIONING&text=Water%20Supply%20Department%20is%20one,Implement%20best%20management%20practices>
- <https://pune.cantt.gov.in/water-supply/>
- <https://urbanwaters.in/cities/pune/>
- <https://raleighnc.gov/water-and-sewer/where-does-my-drinking-water-come#:~:text=Sources%20of%20Drinking%20Water,-In%20most%20cases&text=Water%20is%20collected%20from%20surface,water%20up%20to%20the%20surface.>
- https://en.wikipedia.org/wiki/Water_tariff





8. Conclusion and Future Scope

This program solves a critical issue in water billing by automating the process, reducing errors, and providing a scalable solution for both residential and industrial consumers. In the future, the program can be enhanced with additional features like:

- **Integration with Payment Gateways:** To allow customers to pay bills online.
- **Smart Meter Connectivity:** Direct connection to digital water meters for real-time consumption tracking.
- **Consumption Trends Analysis:** Data analysis to offer insights into water usage trends, enabling better conservation efforts.

This program is positioned to benefit a wide range of sectors where accurate, efficient water billing is essential.

9. Team Cast:

- Parth R. Chaudhari (Lead Developer & Presentation)
- Anurag Patil (Conceptualization & Alternate Code Developer & Presentation)
- Rohan H. Mali (Conceptualization & Preparation)
- Isha S. Patil (Publisher & Assistant Developer & Presentation)

Thank You!

