

# Design and Implementation of Any Time Electricity Bill Payment(ATP) Machine Controller

## Introduction:

The Any Time Electricity Bill Payment (ATP) Machine Controller is a system designed to facilitate convenient and secure payment of electricity bills. This controller allows users to make bill payments at any time, eliminating the need to visit physical payment centers during working hours. The design and implementation of the ATP machine controller involve several components, including hardware, software, and security features. Let's discuss each component in detail:

## 1. Block Diagram



## **2. Identify Proper Inputs and Outputs**

### **Inputs:**

- 1. User identification:** User ID or account number to identify the electricity bill payer.
- 2. Bill details:** Information about the electricity bill, such as the bill amount, due date, and billing period.
- 3. Payment method:** Selection of the desired payment method, such as credit card, debit card, net banking, or mobile wallets.
- 4. Payment amount:** The amount the user wants to pay towards their electricity bill.
- 5. Confirmation:** User's confirmation to proceed with the payment.

### **Outputs:**

- 1. Payment confirmation:** A confirmation message indicating that the payment has been successful.
- 2. Transaction receipt:** A digital receipt or acknowledgment of the payment, including details like the payment amount, date, and transaction ID.
- 3. Bill payment status:** Information on the status of the electricity bill payment, whether it has been processed, pending, or completed.
- 4. Error messages:** In case of any issues or errors during the payment process, appropriate error messages are generated to provide feedback to the user.
- 5. Payment history:** A record of the user's past electricity bill payments, including the date, amount, and payment method used.

These inputs and outputs may vary depending on the specific implementation and features of the Anytime Electricity Bill Payment Controller. The system's goal is to streamline and automate the bill payment process, ensuring a seamless experience for users while managing their electricity bills.

### 3. FSM(MEALY/MOORE)OF THE ATP DESIGN

#### Functionality:

The anytime electricity bill payment system allows customers to pay their electricity bills at any time. The system should be able to handle bill payment requests, verify payment details, process payments, and provide confirmation to the customers.

#### Requirements:

**1. User Interaction:** The system should interact with the user to collect necessary information, such as customer ID, bill amount, and payment method.

**2. Payment Verification:** The system should verify the payment details, such as customer ID and bill amount, to ensure accuracy and prevent fraudulent payments.

**3. Payment Processing:** Once the payment details are verified, the system should initiate the payment process and complete the transaction.

**4. Confirmation:** The system should provide confirmation to the user after a successful payment or notify them about any errors or issues during the payment process.

Based on these requirements, we can design an FSM using either the Mealy or Moore model. Let's go with the Mealy model for this example.

#### Mealy FSM for Anytime Electricity Bill Payment System:

**1. State:** Idle

- Outputs: None

- Actions: Wait for user input (customer ID, bill amount, payment method)

**2. State:** Verify

- Inputs: User input (customer ID, bill amount, payment method)
- Outputs: None
- Actions: Verify payment details
- Transition (On user input): Idle -> Verify

### **3. State:** Process

- Inputs: Payment details verification
- Outputs: None
- Actions: Process payment
- Transition (On successful verification): Verify -> Process
- Transition (On failed verification): Verify -> Error

### **4. State:** Complete

- Inputs: Payment processing result
- Outputs: Confirmation message
- Actions: Provide confirmation to the user
- Transition (On successful payment): Process -> Complete
- Transition (On payment error): Process -> Error

### **5. State:** Error

- Outputs: Error message
- Actions: Notify user about the error
- Transition: Error -> Idle

This is a simplified representation of the FSM for the anytime electricity bill payment system. Depending on the complexity and additional requirements of the system, you may need to add more states and transitions.

## 4. VALID TEST CASES

1.     **Valid payment:** Submit a payment with a valid amount for a specific electricity bill. Verify that the payment is processed successfully and the bill status is updated accordingly.
2.     **Invalid payment amount:** Attempt to submit a payment with an invalid amount (e.g., negative value, zero, non-numeric input). Verify that the controller rejects the payment and provides an appropriate error message.
3.     **Late payment:** Submit a payment for an overdue electricity bill. Verify that the controller applies any late payment fees or penalties and updates the bill status accordingly.
4.     **Multiple bill payments:** Submit payments for multiple electricity bills simultaneously. Verify that all payments are processed correctly and the corresponding bill statuses are updated.
5.     **Bill payment confirmation:** After submitting a payment, verify that the controller sends a payment confirmation to the customer via email or SMS.
6.     **Partial payment:** Submit a payment for an electricity bill with an amount lower than the total due. Verify that the controller updates the bill status to reflect the partial payment and provides the remaining balance.
7.     **Payment failure:** Simulate a payment failure scenario (e.g., network error, invalid credit card information). Verify that the controller handles the failure gracefully, provides an appropriate error message, and does not update the bill status.
8.     **Bill retrieval:** Retrieve a specific electricity bill using its unique identifier. Verify that the controller returns the correct bill details and payment history.

**9. Payment history:** Retrieve the payment history for a specific customer. Verify that the controller returns a list of all payments made by the customer, including the bill details and payment dates.

**10. Payment refund:** Initiate a refund for a previous payment. Verify that the controller updates the bill status accordingly, processes the refund correctly, and sends a refund confirmation to the customer.

**11. Integration testing:** Test the integration of the payment controller with other systems or services, such as payment gateways or customer management systems. Verify that the data exchange and communication between systems are functioning properly.

These test cases cover various scenarios and help ensure that the "Anytime Electricity Bill Payment" controller handles different situations accurately and provides the expected functionality to users.