

Module 6: Assignment

Matlab Fundamentals

Submitted by:

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Problem Statement 1:

With the increasing prevalence of electric vehicles (EVs), there's a demand for efficient power management systems. Developing a MATLAB program to accurately calculate the power delivered from the battery to the electric motor is crucial for performance evaluation and optimization.

Objective:

The objective is to create a MATLAB program that prompts users for vehicles. name, battery voltage, and current drawn from the battery. It should validate inputs (ensuring positive values for voltage and current), calculate the power delivered to the motor and display the result.

Formula: $P = V * I$

Task to be performed:

- 1.Design a MATLAB script for user input and execution initiation.
2. Implement input validation to accept only positive values for voltage and current.
3. Develop the power calculation formula using the accepted inputs.
4. Incorporate error handling for invalid inputs or unexpected errors.
5. Test the program with various scenarios for accuracy and robustness.
6. Enhance user experience with clear messages and interfaces.
7. Thoroughly document the program for future reference and maintenance.

MATLAB coding program for power calculation:

% MATLAB Script to calculate power delivered from battery to EV motor

% Step 1: Prompt user for input

```
disp('Electric Vehicle Power Management System');  
vehicle_name = input('Enter the vehicle name: ', 's'); % Vehicle name as a string  
while true  
    voltage = input('Enter the battery voltage (V): ');  
    current = input('Enter the current drawn by the battery (A): ');
```

% Step 2: Validate inputs

```
if voltage <= 0  
    disp('Error: Voltage must be a positive value.');
```

elseif current <= 0
 disp('Error: Current must be a positive value.');

else
 break; % Exit the loop if both inputs are valid
end
end

% Step 3: Calculate power delivered to the motor ($P = V * I$)

power = voltage * current; % Power in Watts (W)

% Step 4: Display results

fprintf ('\nVehicle: %s\n', vehicle_name);

fprintf ('Battery Voltage: %.2f V\n', voltage);

fprintf ('Current Drawn: %.2f A\n', current);

fprintf ('Power Delivered to Motor: %.2f W\n', power);

% Step 5: Error handling (in case of unexpected errors)

try

 % Additional code logic if needed

catch ME

 disp(['Unexpected error occurred: ', ME.message]);

end

Result:

Electric Vehicle Power Management System

Enter the vehicle name:

Tata Curve EV

Enter the battery voltage (V):

400

Enter the current drawn by the battery (A):

150

Vehicle: Tata

Battery Voltage: 400.00 V

Current Drawn: 150.00 A

Power Delivered to Motor: 60000.00 W

Test the program with various scenarios for accuracy and robustness

Example1:

Electric Vehicle Power Management System

Enter the vehicle name:

BYD

Enter the battery voltage (V):

-450

Enter the current drawn by the battery (A):

-150

Error: Voltage must be a positive value.

Example2:

Electric Vehicle Power Management System

Enter the vehicle name:

Citroen

Enter the battery voltage (V):

350

Enter the current drawn by the battery (A):

-250

Error: Current must be a positive value.

Example3:

Electric Vehicle Power Management System

Enter the vehicle name:

MG

Enter the battery voltage (V):

650

Enter the current drawn by the battery (A):

400

Vehicle: MG

Battery Voltage: 650.00 V

Current Drawn: 400.00 A

Power Delivered to Motor: 260000.00 W

Example4:

Electric Vehicle Power Management System

Enter the vehicle name:

TESLA

Enter the battery voltage (V):

ABC

Error using input

Unrecognized function or variable 'ABC'

Enhance user experience with clear messages and interfaces. Thoroughly document the program for future reference and maintenance.

Explanation of the program:

1. **Input for Vehicle Name:** The program first asks the user to input the vehicle name using the `input ()` function with the 's' option to accept a string.
2. **Input for Battery Voltage:** The script uses a while loop to repeatedly ask the user for the battery voltage until a valid (positive) number is provided. The try-catch block ensures that if an invalid input (e.g., a negative value or a non-numeric entry) is given, an error message is displayed, and the user is prompted again.
3. **Input for Current:** Similarly, the program validates the input for the current drawn from the battery. The user must enter a positive value for the current.
4. **Power Calculation:** After receiving valid inputs, the power delivered to the motor is calculated using the formula $P = V * I$.
5. **Result Display:** The result is displayed using `fprintf` for formatted output, showing the calculated power and vehicle name.
6. **Error Handling:** The try-catch mechanism ensures that invalid inputs (e.g., non-numeric values or negative values) are handled appropriately with error messages prompting the user to re-enter the data.
7. **User Experience:** Clear and informative messages are provided to the user for each input prompt and result, ensuring a smooth interaction.

Problem Statement 2:

Alice, an environmentalist, needs to calculate the energy requirement for a 2-hour journey to ensure her chosen electric vehicle (EV) has a sufficient battery capacity.

Objective:

Develop a MATLAB program that prompts Alice to input the journey's power requirement (in kW) and duration (in hours), calculates the energy requirement and displays the result. Ensure inputs are non-negative, displaying an error message if they are negative.

Formula Used: $\text{Energy} = \text{Power} * \text{Time}$

Tasks to be Performed

1. Prompt input for power and duration of the journey.
2. Implement control statements to ensure non-negative inputs.
3. Calculate energy requirement using $\text{energy} = \text{power} * \text{time}$.
4. Display the calculated energy requirement.
5. Provide error handling for negative inputs.

Matlab Code Program:

% Electric Vehicle Energy Requirement Calculation for Alice's Journey

% Clear the workspace and command window

clear;

clc;

% Display a welcome message

disp('Welcome, Alice! This program will help you calculate the energy requirement for your journey.');

% Prompt the user for the power requirement of the journey in kW

while true

try

power = input('Enter the power requirement for the journey (in kW): ');

if power < 0

error('Power must be a non-negative value');

end

break; % Exit the loop if valid input

catch

disp('Error: Power must be a non-negative value. Please try again.');

end

end

```

% Prompt the user for the duration of the journey in hours
while true
    try
        duration = input ('Enter the duration of the journey (in hours): ');
        if duration < 0
            error ('Duration must be a non-negative value');
        end
        break; % Exit the loop if valid input
    catch
        disp ('Error: Duration must be a non-negative value. Please try again. ');
    end
end

% Calculate the energy requirement (Energy = Power * Time)
energy = power * duration;

% Display the calculated energy requirement
fprintf ('\nEnergy required for the journey: %.2f kWh\n', energy);

% End of the script
disp ('Thank you, Alice, for using the Energy Requirement Calculation Program!');

```

Result:

Example 1:

Enter the power requirement for the journey (in kW):

40

Enter the duration of the journey (in hours):

2

Energy required for the journey: 80.00 kWh

Thank you, Alice, for using the Energy Requirement Calculation Program!

Provide error handling for negative inputs:

Example 2:

Enter the duration of the journey (in hours):

-2

Error: Duration must be a non-negative value. Please try again.

This MATLAB two programs is designed to be easy to use and robust, ensuring to calculate power delivered from battery to EV motor and to calculate the energy requirement for alice journey while handling incorrect inputs gracefully.