COLLEGE CODE:2124

COLLEGE NAME:SREE SASTHA INSTITUTE OF ENGINEERING AND TECHNOLOGY

DEPARTMENT:COMPUTER SCIENCE AND BUSINESS SYSTEM

STUDENT NM-ID:aut8667245077

ROLL NO:212423244006

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TECHNOLOGY-PROJECT NAME:COST ESTIMATION AND BUDGET ANALYSIS

SUBMITTED BY:NANDHINI.K

Phase 5: Project Demonstration & Documentation

Title: Cost Estimation and Budget Analysis

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Abstract:

The Cost Estimation and Budget Analysis project aims to streamline financial planning and improve the accuracy of cost forecasting within projects. By leveraging historical financial data, statistical models, and budgetary control frameworks, this system provides a comprehensive toolset for estimating costs, tracking expenses, and optimizing resource allocation. The final project phase includes a live system demonstration, complete technical and financial documentation, performance analysis, and detailed reporting mechanisms. The system is engineered for scalability and practical integration into enterprise-level project management environments. It supports stakeholders in making informed decisions by offering predictive insights, automated calculations, real-time dashboards, and deviation alerts. Screenshots of working modules, cost models, sample outputs, and user interfaces will be included to validate functionality.

1. Project Demonstration:

Overview:

The demonstration focuses on how the Cost Estimation and Budget Analysis system supports project teams in managing financial resources effectively, projecting future costs, and maintaining control over budgetary allocations.

Demonstration Details:

Interactive System Walkthrough:

- Real-time input of project parameters including labor, materials, equipment, and overheads.
- Step-by-step demonstration of how the system generates initial cost estimates and allocates funds across phases.

Dynamic Cost Modeling:

Utilization of parametric and analogous estimation models.

Presentation of variable cost calculations, inflation adjustments, and contingency reserves.

Analytical Dashboards:

- Display of data visualizations such as cost variance charts, expenditure trends, forecast vs. actual comparisons.
- Custom filters to analyze costs by category, department, or timeframe.

Forecast Accuracy Validation:

- Comparison of generated estimates with actual historical costs to demonstrate system precision.
- Highlighting error margins, sensitivity analysis, and risk projections.

ERP Integration Demonstration:

- Showcasing data exchange between the system and external platforms like SAP or QuickBooks.
- Simulated import/export of budget reports and project financial summaries.

Key component Demonstration:

```
# Cost Estimation Function
def estimate_total_cost(material_cost, labor_cost, overhead_cost, contingency_percent):
    contingency = (material_cost + labor_cost + overhead_cost) * (contingency_percent / 100)
    return material_cost + labor_cost + overhead_cost + contingency
# Example Use
total_cost = estimate_total_cost(10000, 5000, 2000, 10)
print(f"Estimated Total Project Cost: ${total_cost}")
# Budget Variance Analysis
def calculate_variance(estimated, actual):
    variance = actual - estimated
    percentage = (variance / estimated) * 100
    return variance, percentage
variance, percentage = calculate_variance(15000, 16000)
print(f"Budget Overrun: ${variance} ({percentage:.2f}%)")
```

OUTPUT:

Estimated Total Project Cost: $18700.0

Budget Overrun: $1000 (6.67%)

Outcome:

Stakeholders will witness how the tool supports financial control from project initiation through execution, demonstrating its value in reducing cost overruns, increasing planning precision, and enhancing accountability.

2. Project Documentation

Overview:

This section provides an in-depth explanation of all components and processes in the Cost Estimation and Budget Analysis project, structured to guide future users, administrators, and developers.

Documentation Sections:

System Architecture:

- Technical diagrams illustrating modular structure including user interface layer, logic layer (estimation engine), data repository, and integration modules.
- Overview of system interactions, calculation workflows, and storage processes.

Estimation Models and Algorithms:

- Explanation of cost estimation techniques used: bottom-up estimation, three-point estimation, and Monte Carlo simulations.
- Description of logic used to handle fixed vs. variable costs, indirect cost allocation, and financial indexing.

Budget Planning and Adjustment Mechanism:

- Methodology for tracking allocated vs. actual expenses.
- Rebudgeting logic based on phase completion rates and milestone adjustments.

User Guide:

- Step-by-step instructions for using each feature—from entering project data to generating detailed reports.
- User roles and permissions, walkthrough for exporting reports, and customization settings.

Administrator Guide:

- Instructions for system configuration, database management, and threshold updates.
- Guide to setting alert systems for cost overruns and generating compliance reports.

Testing Reports:

- Documentation of system validation processes, including unit testing, regression testing, and performance testing.
- Detailed case studies of simulated projects with test results for accuracy, speed, and usability.

Input module:

```
# Collecting project inputs
project_data = {
    "project_name": "IT Infrastructure",
    "material_cost": 12000,
    "labor_cost": 8000,
    "overhead": 3000,
    "contingency_percent": 15
}
```

Estimation Engine:

```
def compute_project_budget(data):
    return estimate_total_cost(
        data['material_cost'],
        data['labor_cost'],
        data['overhead'],
        data['contingency_percent']
    )
```

Report Generator:

```
# Generating budget report
def generate_report(data, total_cost):
    return f"""
    Project: {data['project_name']}
    Estimated Budget: ${total_cost}
    Material: ${data['material_cost']}
    Labor: ${data['labor_cost']}
    Overhead: ${data['overhead']}
    Contingency: {data['contingency_percent']}%
     “‘”
```

Outcome:

Comprehensive documentation ensures the project is maintainable and scalable, with clear instructions for stakeholders at every level, from system operators to decision-makers.

3. Feedback and Final Adjustments

Overview:

This phase focuses on collecting and implementing feedback to fine-tune the project prior to deployment. Special emphasis is placed on user experience, system accuracy, and financial reporting clarity.

Steps:

Feedback Collection:

- Structured collection from academic mentors, finance professionals, and target users through live sessions, surveys, and feedback forms.
- Evaluation metrics include ease of use, accuracy of forecasts, report clarity, and overall satisfaction.

System Enhancements:

- ❖ Improvements to the interface based on usability feedback (e.g., clearer graphs, faster load times).
- ❖ Algorithm refinements to address any inconsistencies or edge case failures identified during demonstration.

Final Testing:

- ❖ Verification of enhancements through additional user testing sessions.
- ❖ Real-world testing simulations using various project case studies from construction, software development, and research grants.

```
# Real-Time Graph (using Streamlit)
import streamlit as st
import matplotlib.pyplot as plt

estimated = [10000, 12000, 14000]
actual = [11000, 11500, 15000]
st.line_chart({"Estimated": estimated, "Actual": actual})
```

OUTPUT:

```
2025-05-15 14:42:54.680 Thread 'MainThread': missing ScriptRunContext! This warning can be ignored when running in bare mode.
2025-05-15 14:42:54.681 Thread 'MainThread': missing ScriptRunContext! This warning can be ignored when running in bare mode.

DeltaGenerator()
```

Outcome:

The system will be polished and validated, achieving high usability standards and delivering consistent performance in practical applications.

4. Project Handover and Future Work

Overview:

This section outlines the formal handover of the project along with documentations.

Handover Details:

Deployment Strategy:

- Instructions for deploying the system within a local network or cloud-based environment.
- Backup and recovery procedures included.

Future Development Suggestions:

- AI-based cost prediction improvements using machine learning.
- Integration with tax calculators and regional regulatory compliance engines.
- Support for multilingual interfaces and cross-currency estimation features.

Training Materials:

- Tutorials, presentation decks, and training scripts to assist new users during onboarding.
- A sample project library for practice and demonstration purposes.

```
# Simple AI Estimation Example (Linear Regression)
from sklearn.linear_model import LinearRegression
import numpy as np
# Historical data
X = np.array([[100], [200], [300]])  # Hours worked
y = np.array([1000, 1800, 2500])     # Cost
model = LinearRegression().fit(X, y)
future_cost = model.predict(np.array([[400]]))
print(f"Predicted cost for 400 hours: ${future_cost[0]:.2f}")
```

OUTPUT:

```
Predicted cost for 400 hours: $3266.67
```

Outcome:

The Cost Estimation and Budget Analysis system will be officially transferred with full documentation and a roadmap for future development, ensuring continued value in academic, governmental, or enterprise project settings.

SOURCE CODE:

```
import pandas as pd

# Load the dataset

df = pd.read_csv('/content/large_budget_data.csv')

# Calculate variance

df['Cost_Variance'] = df['Actual_Cost'] - df['Estimated_Cost']

df['Status'] = df['Cost_Variance'].apply(lambda x: 'Under Budget' if x <= 0 else 'Over Budget')

# Total Estimation vs Actual

total_estimated = df['Estimated_Cost'].sum()

total_actual = df['Actual_Cost'].sum()

total_variance = total_actual - total_estimated

# Display results

print("=== Cost Estimation and Budget Analysis ===")

print(df)

print("\nTotal Estimated Cost:", total_estimated)

print("Total Actual Cost:", total_actual)

print("Total Variance:", total_variance)

print("Project Status:", "Under Budget" if total_variance <= 0 else "Over Budget")
```

OUTPUT:

```
=== Cost Estimation and Budget Analysis ===
              Item  Estimated_Cost  Actual_Cost  Budget  Cost_Variance
\
0        Packaging            8577         1019   50000          -7558
1        Transport            4711         9132   50000           4421
2      Maintenance            3960         9126   50000           5166
3        Packaging            5830         8481   50000           2651
4        Marketing            6458         6540   50000             82
...            ...             ...          ...     ...            ...
49995    Logistics            9661         2148   50000          -7513
49996    Logistics            1522         3237   50000           1715
49997    Marketing            4355         6835   50000           2480
49998        Labor            9172         8319   50000           -853
49999    Marketing            1743         2023   50000            280

             Status
0      Under Budget
1       Over Budget
2       Over Budget
3       Over Budget
4       Over Budget
...             ...
49995  Under Budget
49996   Over Budget
49997   Over Budget
49998  Under Budget
49999   Over Budget

[50000 rows x 6 columns]
```

```
Total Estimated Cost: 275462034
Total Actual Cost: 275693848
Total Variance: 231814
Project Status: Over Budget
```

Conclusion:

The Cost Estimation and Budget Analysis project successfully demonstrates the development and implementation of a functional budgeting tool using Python. Through detailed cost modeling, variance analysis, and visualization, the system provides valuable insights for planning and managing project expenses.

The integration of code-based automation improves accuracy, reduces manual errors, and enhances decision-making. With scope for future enhancements such as AI-based forecasting and API integration, this project lays a solid foundation for advanced financial planning tools.