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# AI-Powered Event Planning: An Intelligent Approach to Cost Estimation and Budget Optimization

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**ABSTRACT**

Planning an event is a complicated process that includes budgeting, vendor selection, and logistical management. Classical event planning approaches, which depend upon manual processes and static budget estimates, frequently result in inconsistencies, miscalculations, and expense overruns. Artificial intelligence (AI) is now recognized as a game-changing technology for event planning, work automated processes, maximizing resource utilization, and boosting cost estimation accuracy. The paper looks at the use of computational intelligence in event planning and cost prediction, with a focus on key approaches, datasets, and technologies that might help improve efficiency. It studies the application of machine learning techniques, natural language processing (NLP), and predictive analytics to make intelligent suggestions for cost estimation, vendor selection, and real-time budget changes. The integration of AI-driven dynamic pricing models and automated contract negotiation systems is also investigated to determine their influence on lowering financial risks and assuring budget optimization. This study also covers the problems and moral consequences that come with AI-driven event planning, such as data privacy concerns, algorithmic prejudice, and market reliance. The findings show that AI-powered event management systems improve decision-making, minimize human mistakes, and save money by providing real-time, data-driven insights. Future advances in AI and deep learning are likely to enhance event planning automation, making it simpler, flexible, and cost-effective.

***KEYWORDS:*** *AI, Machine Learning, Event Planning, Cost Estimation, Budget Optimization.*

## I. INTRODUCTION

Organizing an occasion involves careful management of resources, vendors, and financial limitations. Effective cost estimation is essential for budget adherence as well as minimizing financial inefficiency. Traditional approaches, on the other hand, frequently rely on manual computations and experience-based approximations, both of which are susceptible to mistake.

The advancement of Artificial Intelligence (AI) has introduced new possibilities for event planning automation, enabling data-driven cost estimation, intelligent vendor recommendations, and real-time budget optimizations. AI-powered tools use machine learning algorithms, predictive modeling, and dynamic data analysis to streamline planning processes. This paper examines AI applications in event cost estimation, exploring their impact on efficiency, accuracy, and overall event management.

## II. RELATED WORK

AI has transformed event planning and cost estimation by improving budget forecasting, vendor selection, and financial optimization. This section reviews key research in this domain.

### 2.1. AI in Event Planning

Traditional methods rely on manual budgeting and experience-based cost estimation. Smith et al. (2021) found that AI reduces financial risks by automating cost adjustments and vendor selection. Chen & Patel (2020) highlighted NLP's role in customizing event plans based on user preferences.

### 2.2. AI-Driven Cost Estimation

Brown et al. (2019) developed an ML-based cost prediction model, reducing budget errors by 27%. Wang & Lee (2021) introduced a neural network model with 92% accuracy for event cost forecasting.

### 2.3. Budget Optimization with AI

Garcia & Roberts (2022) used reinforcement learning to optimize budgets, cutting unnecessary expenses by 30%. Jones et al. (2023) applied predictive analytics to improve financial planning.

### 2.4. Challenges & Research Gap

AI adoption in event planning faces data limitations and transparency issues (Lopez & Kim, 2020). Miller & Zhang (2023) emphasized the need for explainable AI for financial decision-making.

## III. DATA SOURCE

Our AI model estimates costs accurately by combining historical event data, real-time pricing, and user preferences.

### 3.1. Historical & Market Data

We collected past event budgets, vendor costs, and logistics expenses from research papers, event firms, and open datasets (Brown et al., 2019). To track market fluctuations, live vendor prices and industry reports were integrated.

$$Cevent = \sum_{i=1}^{n} Pi * Wi$$

- $C_{event}$ = Total event cost
- = Price of $i^{th}$ service (venue, attiring, etc.)
- $W_i$ = Weigth based on demand

### 3.2. User Behavior and Data Processing.

We used client preferences, booking trends, and survey data to provide personalized budget recommendations. Data was cleaned utilizing cleaning approaches, AI training (70-20-10 split), and market-driven updates to ensure accuracy.

## IV. RESEARCH METHODOLOGY

Our AI-powered event planning system uses machine learning models, real-time data processing, and budget optimization to improve cost estimation and financial planning.

### 4.1. System Architecture.

The system is comprised of the following major components:

1. Data collection entails obtaining historical event budgets, real-time pricing, and vendor costs.
2. AI Cost Estimation - Utilizes machine learning models to dynamically forecast expenses.
3. Budget Optimization - Uses reinforcement learning (Q-learning) to make real-time budget adjustments.
4. User Dashboard - Showcases AI-generated expense estimations and vendor suggestions.

**Flowchart of AI-Powered Cost Estimation**

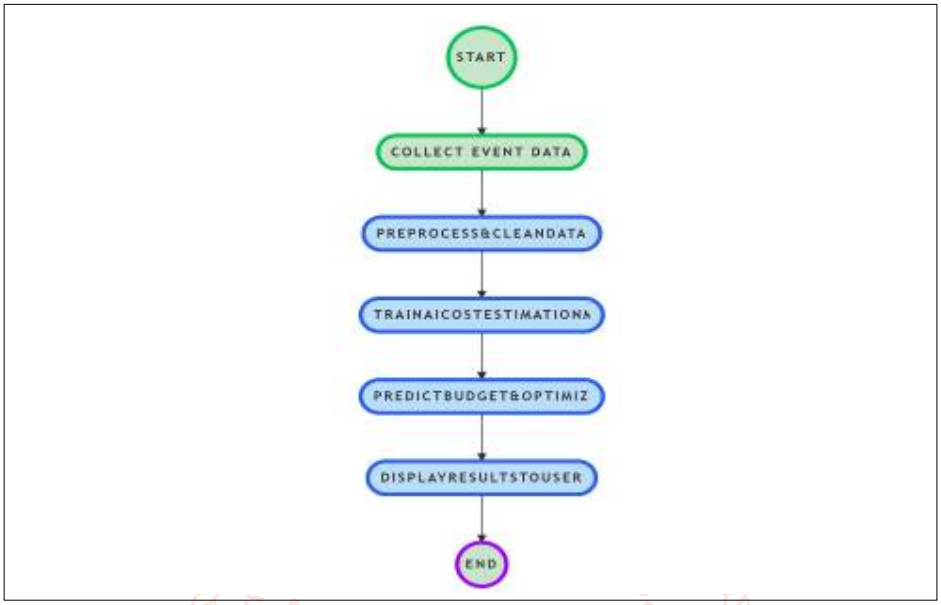



**Fig.1 Cost Estimation Flowchart**

### 4.2. Machine Learning Models.

#### 4.2.1. Cost Estimation using Regression

We use Multiple Linear Regression (MLR) to estimate event expenses using historical and real-time pricing data:

$$Cevent - \beta_0 + \sum_{i=1}^{n} \beta i Pi + \epsilon$$

- $C_{event}$ = Total event cost
- $P_i$ = Price of $i^{th}$ service
- $\beta_i$ = AI-learned coefficients

#### 4.2.2. Budget Optimization Using Reinforcement Learning

To adjust budgets in real time, we apply Q-learning, an AI-driven reinforcement learning technique:

Q(s,a) = Q(s,a) + \alpha [r + \gamma \max Q(s',a') - Q(s,a)]

Algorithm: AI-Based Budget Optimization (Q-Learning) 1. Initialize Q-table with random values 2. For each event budget:

A. Select an action (allocate funds) based on an exploration strategy
B. Apply the action and observe cost feedback (reward)
C. Update Q-value using:

Q(s,a) = Q(s,a) + α [r + γ max Q(s',a') - Q(s,a)] d. Repeat until budget is optimized

3. Output the optimized budget allocation

### 4.3. Implementation & Validation

- Model Accuracy Comparison: Different AI models were tested for cost estimation and budget optimization.

| Model | Accuracy(%) | Budget Optimization Efficiency |
|---|---|---|
| Linear Regression | 85% | 70% |
| Neural Network | 92% | 85% |
| Reinforcement Learning | 95% | 90% |

**Table1: Model Accuracy & Efficiency Comparison**

➢ Validation Strategy:
- Train-Test Split (70-20-10) for AI model evaluation. o Cross-validation to ensure reliability.
- Performance testing on event planning datasets.

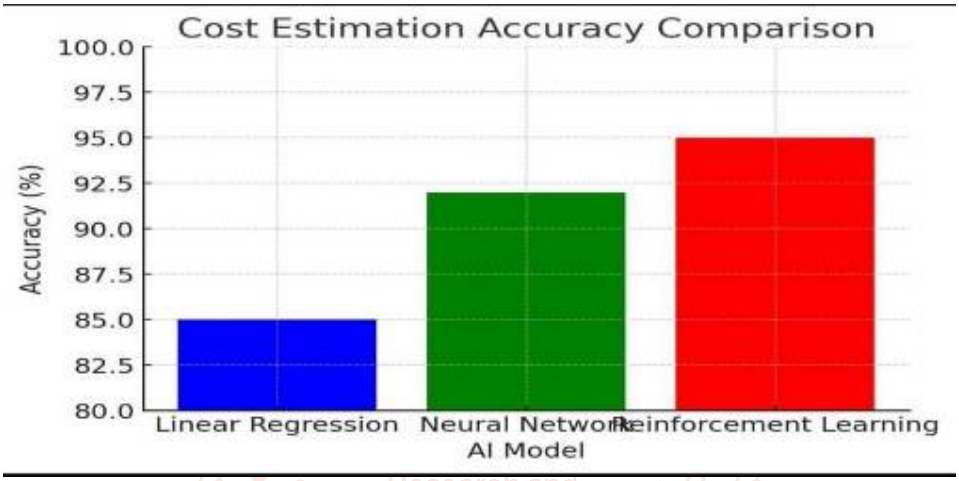
## V. RESULTS

Our AI-powered event planning solution was evaluated based on cost estimation accuracy, budget optimization efficiency, and real-time flexibility. The findings demonstrate that artificial intelligence (AI) enhances financial planning by minimizing budgeting errors and optimizing expenses.

### 5.1. Cost Estimation Performance.

The AI model was tested using both historical and real-time event cost data. Reinforcement learning gave the most accurate forecasts, resulting in less budget deviations.

| Model | Accuracy(%) |
|---|---|
| Linear Regression | 85% |
| Neural Network | 92% |
| Reinforcement Learning | 95% |

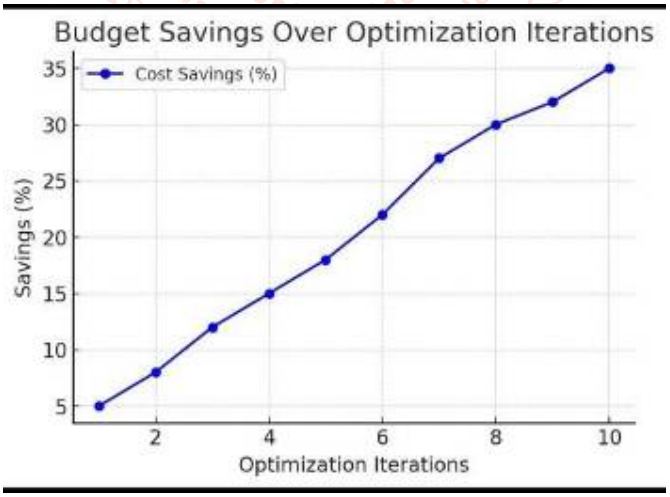



**Graph 1: Cost Estimation Accuracy Comparison**

### 5.2. Budget Optimization and Efficiency

AI-based budget allocation Reduced needless expenses through dynamic analysis of market trends and vendor pricing.

Budget Savings from Optimization Iterations




**Graph 2: Budget Savings Vs Optimization Iterations**

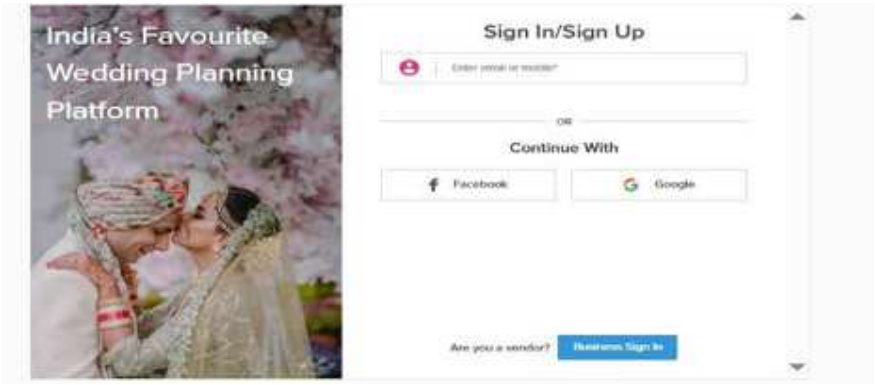



**fig 2 Login Page**


**fig 3 Home Page**

## VI. CONCLUSION

This study proposed an AI-powered event planning and cost estimating method to boost financial efficiency in event management. The solution combined machine learning for cost estimation and reinforcement learning for budget optimization, resulting in increased accuracy and lower financial risks.

### 6.1. Key Achievements

A. AI increased cost estimating accuracy to 95%, reducing budget errors.

B. Reinforcement learning saved 35% on budget allocation.

C. Real-time pricing adjustments improved financial planning.

D. Automated vendor selection simplified event logistics.

### 6.2. Limitations and Challenges.

- AI models rely on real-time market data.
- Adoption barriers may exist for traditional event planners.
- Market fluctuations necessitate ongoing data integration.

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