

INTELLIGENT WEBSITE GENERATION FRAMEWORK USING ARTIFICIAL INTELLIGENCE AND DATA MINING

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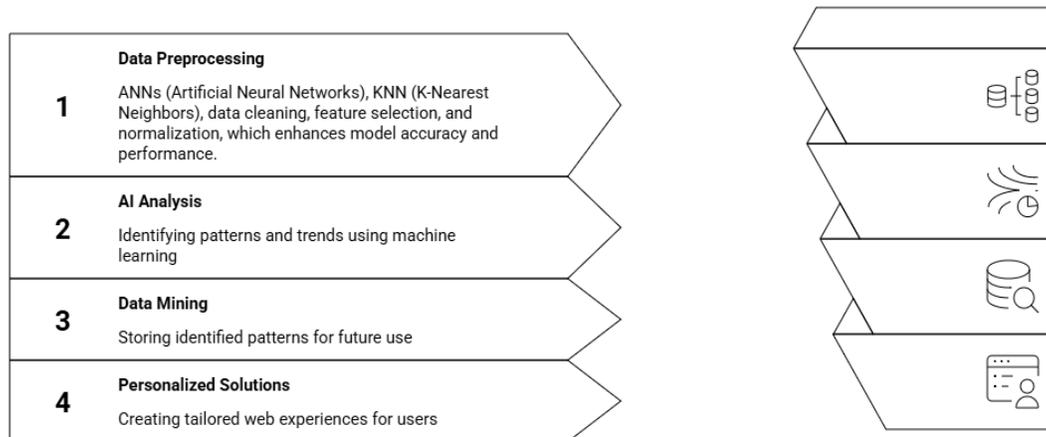
Waqas Tariq Paracha

Abstract

This study presents the design and development of an intelligent web-based system that integrates Artificial Intelligence (AI) and data mining techniques to analyze user behavior and improve web-based services. The proposed system identifies patterns and trends in user interactions by examining system usage, user inputs, and behavioral data. Machine learning approaches, including unsupervised learning, reinforcement learning, and neural networks, are employed to interpret user needs and adapt system responses accordingly. The system is capable of operating autonomously and continuously improving its performance over time with minimal human intervention.

Data preprocessing plays a vital role in enhancing model effectiveness and accuracy. Techniques such as data cleaning, normalization, feature selection, Artificial Neural Networks (ANNs), and K-Nearest Neighbors (KNN) are applied to prepare and optimize the dataset before analysis. Through data mining, meaningful patterns are extracted and stored, enabling the system to generate personalized web solutions and recommendations for future users. Compared with traditional web development approaches, the proposed AI-driven system provides improved efficiency, higher automation, and the ability to process large-scale datasets. This enables faster analysis and more informed decision-making. The integration of advanced preprocessing and data mining methods ensures robust system performance and reliable results. The findings highlight the significant potential of AI-driven data mining in modern web applications, particularly in predictive analytics, recommendation systems, and user-centered design. The proposed framework contributes to the development of intelligent, adaptive, and reliable digital systems that can enhance user experience and support future web technologies.

Artificial Intelligence (AI) and Data Mining



1. Introduction / Background

Web development today increasingly relies on modern technologies to build websites that are interactive, user-centric, and capable of handling large volumes of traffic. Developers aim to create websites that provide seamless user experiences, and for this purpose, web development systems play a crucial role. These systems, along with frameworks and tools, help streamline the process of building, maintaining, and updating websites. However, most current web development systems face limitations. They are often optimized for specific browsers or devices and struggle to perform efficiently when scaled across multiple platforms. Additionally, there is often a lack of integration between the information architecture and functional architecture, while the existing tools and frameworks offer limited flexibility for maintenance and evolution. These challenges not only affect the overall user experience but also impact the long-term sustainability of web systems. To address these issues, this Web Development System leverages Artificial Intelligence (AI) and data mining techniques to analyze and predict data across multiple domains, rather than being confined to a single domain. By employing hybrid AI architectures that combine classical machine learning with deep learning, the system automates code generation, optimizes UI/UX design, performs testing, generates dynamic content, and provides personalized user experiences. This enables the development of

scalable, intelligent.

Literature Review

Kumar and Thakur (2012), explain that Artificial Intelligence (AI), Artificial Neural Networks (ANNs), and data mining are important parts of AI-driven website generators. AI models support pattern recognition, decision-making, and analysis of user behavior. Neural networks and machine learning allow web systems to adapt and learn from data. Data mining finds useful insights from large datasets, improving website features, customization, and recommendations.

In the *European Journal of Advances in Engineering and Technology*, Madupati (2022) in the European Journal of Advances in Engineering and Technology explains how Artificial Intelligence (AI) and Data Science are changing modern web development. The study shows that AI helps automate coding, improve website performance through smart caching, make websites more personal, and enhance web security through machine learning. The paper also examines ethical issues, including data privacy and regulatory compliance. Overall, the article gives a clear summary of how AI-driven technologies are shaping the future of web development.

Trigka and Dritsas (2025) Generative artificial intelligence (AI) helps computers create high-quality text, images, audio, and structured data. In their survey, **Trigka and Dritsas** examine key architectures, recent progress, practical applications, and ethical issues in this field.

Early generative methods relied on chance-based models, but these were soon replaced by deep learning methods such as VAEs, GANs, Transformers, and Diffusion Models. VAEs enabled the creation of new data with clear patterns. GANs made results look more realistic by having two networks compete, though they sometimes produced duplicate results or became unstable. Transformer models changed how computers understand language by focusing on important words in sentences, which led to large models like GPT and BERT. More recently, diffusion models have produced clearer, more stable images by gradually removing noise from the data.

Waqas Tariq Paracha et al. (2025) Recent studies show that combining different learning methods is making generative AI easier to control, faster, and more capable. Generative AI is now used in healthcare, language, climate science, finance, cybersecurity, aerospace, and creative fields. Still, there are problems such as bias, the spread of false information, fake news, high computer costs, insufficient transparency, and unclear rules. Future research aims to make AI decisions easier to understand, set clear rules for AI use, reduce energy use through better design, and ensure AI is used safely and responsibly by managing risks.

Recent advances in Artificial Intelligence (AI) and Machine Learning (ML) have enhanced disease prediction in healthcare. Rajkomar et al. (2019) and Miotto et al. (2018) highlight that ML and deep learning models can accurately analyze clinical data. Esteva et al. (2021) demonstrate that deep learning is effective for medical imaging tasks.

Most current models prioritize predicting individual diseases, and multi-disease systems remain limited. **Waqas**

Tariq Paracha et al. (2025) reported improvement in heart disease prediction using advanced feature

selection methods. The present research investigates hybrid AI models for multi-disease prediction and focuses on improving interpretability.

Statement of problem

AI code-generation tools (like Codex) make coding easier for beginners, but can make people pay less attention to solving problems. When programmers know the basics and how to think through problems, they use AI as a helpful **assistant**: they explain what they want to do, and AI gives them quick, improved code. My research in AI and Data Mining uses machine learning to study how students think and write code, and **data mining gives** feedback on how they learn and the mistakes they often make. This makes AI-assisted coding more personal and helpful, so beginners can work faster while getting better at solving problems and thinking things through. Using AI and Data Mining together also makes learning more data-based and easier to expand to more people.

Personalizing websites by finding patterns in data is helpful, but many systems still struggle to grow and adapt, especially when they use different methods together. It is also challenging to combine various types of data for automatic personalization. As a result, AI website builders need to create systems that can easily adapt and scale to deliver smart, personalized content to users quickly.

The aim of study

This study aims to develop a website builder that leverages AI and data analysis to automatically create websites tailored to each user's needs. By looking at how users behave and what the data shows, the system will create web content that adapts to improve the user experience and handle more users.

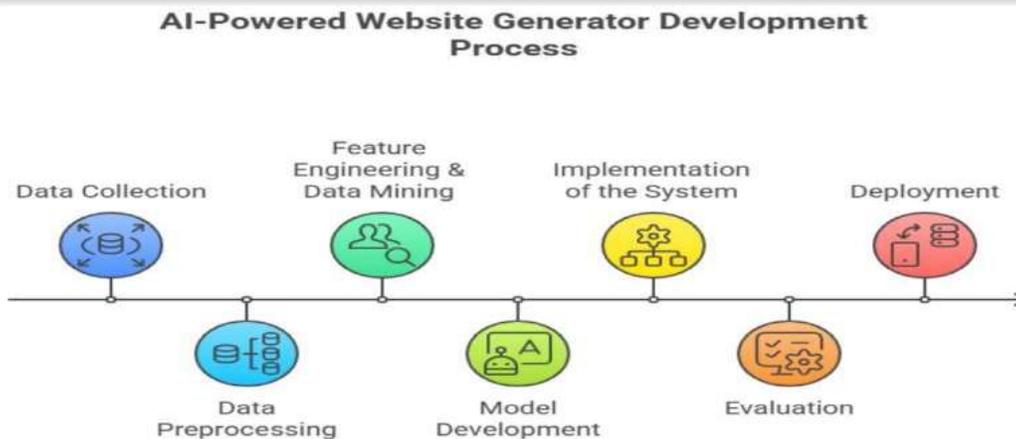


Figure 1 Projected flow of the system.

Major Findings

1. Imagine creating a powerful website with just one click, thanks to a smart AI-powered platform.
2. Furthermore, seamless integration of cutting-edge language processing tools, from entity recognition to deep learning embeddings, ensures content is both clean and context-aware.
3. In addition, harnessing data mining uncovers user habits and reveals hidden patterns that drive smarter website experiences.
4. Moreover, deploying machine learning models that continuously learn and adapt makes the system smarter with every interaction.
5. As a result, tailored experiences are delivered through automated personalization and intelligent AI-powered recommendations. Simultaneously, a robust, scalable framework is built to effortlessly manage vast amounts of data. Ultimately, these innovations pave the way for smarter, data-driven, and truly user-focused web development solutions.

Motivation

Websites have become essential for both businesses and individuals. However, creating a professional site still demands technical skills in development, design, and maintenance. Traditional approaches are often slow, expensive, and depend on skilled developers. As a result, small businesses and people without technical backgrounds often find it difficult to build and manage websites.

Modern websites collect a lot of user data, such as clicks and browsing habits. Traditional development rarely uses this information. By applying data mining, it is possible to find hidden patterns and better understand user behavior. Using these insights can improve personalization, usability, and user engagement.

Recent advances in AI and machine learning offer new ways to automate web development. AI systems can study user needs, learn from data, and create layouts and content. This automation reduces development time and enables the creation of personalized websites.

This research focuses on creating an AI-based website generator that uses data mining and AI to automate building websites. By using user data and smart models, the system can produce responsive, personalized, and scalable websites with little human effort. This approach makes modern web development more efficient.

2. Research Objectives

1. To develop and deploy an AI-assisted web generator based on data mining techniques used to automate web development.
2. To analyze the behavior and interaction information of the user so as to design personalized websites.
3. To apply machine learning and deep learning hybrid AI models (RL), (NLP) in smart layout, content, and functionality design decision-making.
4. To make systems scale and perform

better through efficient feature choice and data pre-processing.

5. To draw parallels between the performance of the proposed system and more traditional procedures of web development.

3. Methodology

The research will apply experimental and data-driven research using Narrow AI.

1. Data Collection

• Web logs, forms, navigation, and events will be used to gather information about user interaction with the site.

• Public datasets and simulated data may also be used for training and evaluation.

2. Data Preprocessing

• Collected data will be processed through noise elimination, normalization, and feature selection to ensure accuracy and reliability.

3. Feature Engineering & Data Mining

• Data mining techniques will identify trends in user navigation, content preferences, and functional use.

• Clustering and association rule mining will group users with similar behavior.

4. Model Development

• The system will combine unsupervised learning, reinforcement learning, and neural networks, Narrow AI.

• Hybrid ML and deep learning models will ensure robust and intelligent decision-making.

5. Implementation of the System

AI frameworks and modern web technologies will be used to implement the AI-based website generator. The system will automatically produce:

- Website layouts
- UI elements
- Content structure

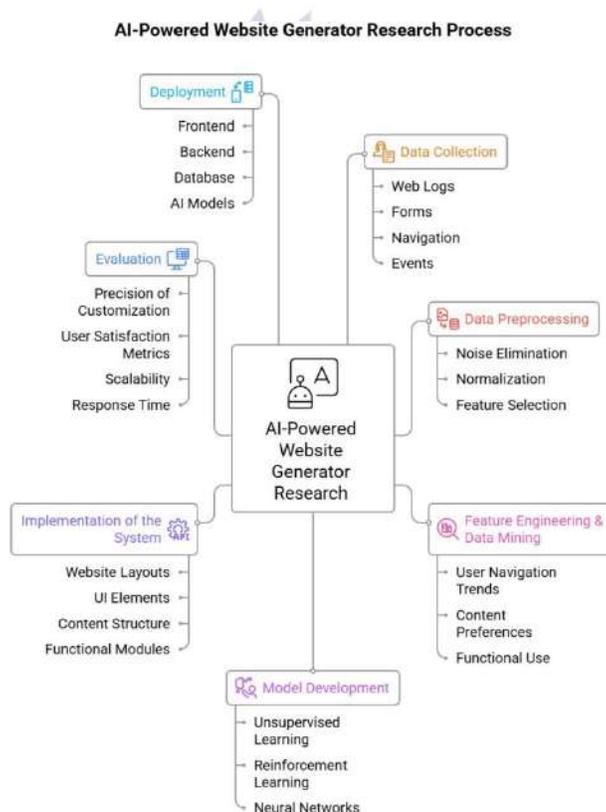


Figure 1.1(AI-Powered Generator Process)

6. Evaluation

We will evaluate the AI website builder’s performance by looking at data and listening to user feedback. This helps us see if the results are accurate, meet user needs, and work quickly.

6.1 Personalization Accuracy

To measure how well the system suggests content for each user, standard machine learning evaluation metrics will be used

- **Precision (P):** Measures how well the suggested content matches what the user wants.

$$Precision = \frac{True\ Positives}{True\ Positives + False\ Positives}$$

- **Recall (R):** Tells us how much of the user’s needs were actually suggested.

$$Recall = \frac{True\ Positives}{True\ Positives + False\ Negatives}$$

- **F1-Score:** Combines precision and recall into a single score.

$$F1 = \frac{2 \times Precision \times Recall}{Precision + Recall}$$

System efficiency will be evaluated by measuring page load times and server response speeds, which are standard ways to assess website performance (Dina I. Zahran et al., 2014).

Goal: An F1-score above 0.85 means the system is personalizing and recommending well.

6.2 Page Load Time Reduction:

These checks whether pages created by AI load faster than those made with older website tools.

Example comparison:

Traditional CMS	3.2 seconds
AI-Based Generator	1.8 seconds

Improvement:

Approximately **44% faster page loading**. **Server Response Time:**

Measures the aver Shows how long it takes, on average, for the system to create and send personalized content. Each request should be processed within **2 seconds**.

6.3 System Efficiency

- Page Load Time Reduction: Checks if pages open more quickly after using AI.
 - **Example Metric:**
 - Traditional CMS: 3.2 sec average
 - AI-Based Generator: 1.8 sec average

- Improvement: ~ 44% faster page load
- Server Response Time: The average time it takes for the system to create and display new content with AI.
-
- Goal: Each standard content request should take less than 2 seconds.

6.4 User Engagement Metrics

- Click-through Rate (CTR): The percentage of users who click on items suggested by the AI.
- Time-on-Page: The average time users spend reading content created for them.
- Bounce Rate Reduction: The decrease in the percentage of users who leave right after opening the page

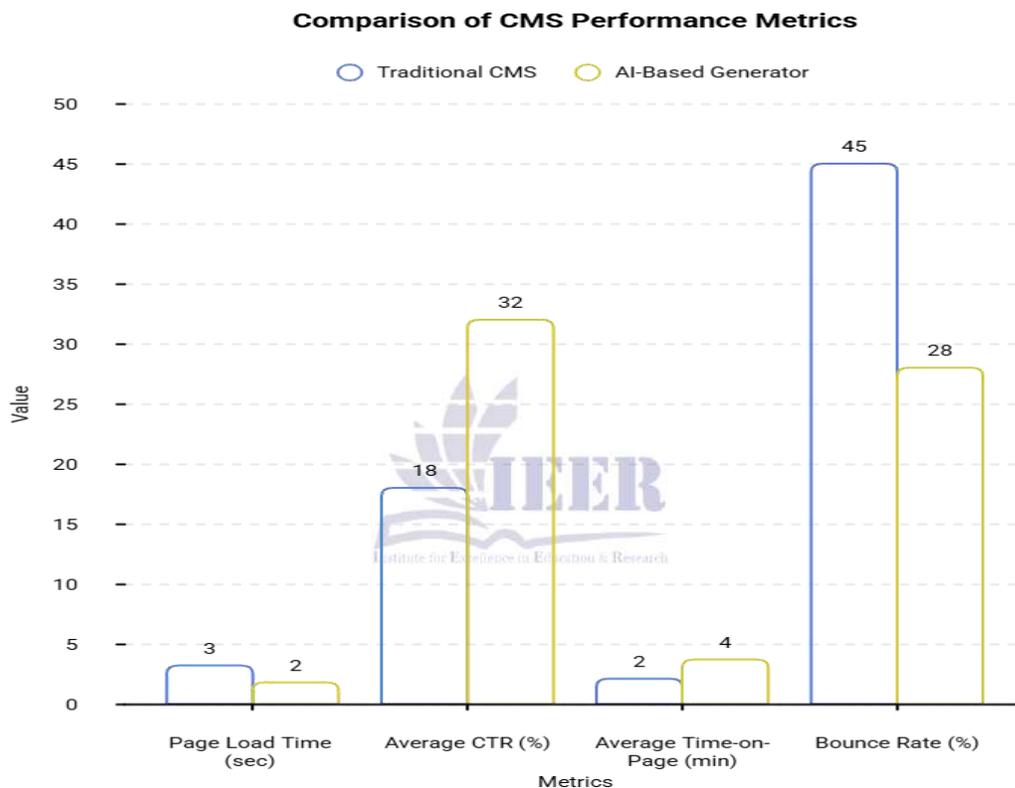


Figure 1.2 Martics performance

6. Deployment Frontend

The front-end allows users to interact directly with the web application. In this research, the design provides users with an easy, fast, and effective experience. **React.js and Next.js build a component-based user interface, with separate components for the navigation bar, content sections, forms, and preview panels.** This approach simplifies maintenance and enables the team to add new features in the future. (Lazuardy & Anggraini, 2022). The front-end architecture communicates with the back-end through REST

APIs. When users enter input or make design changes, the front-end sends requests to the server through the API. The server processes the request and returns the data, which the user interface displays. This process enables **real-time system interaction**. In addition, the front-end applies **responsive design principles to ensure** the web application works properly on devices such as mobile phones, tablets, and desktop computers. **Tailwind CSS** creates flexible layouts and modern UI components, thereby improving the overall user experience.

To improve performance, techniques such as **dynamic rendering** and **optimized component loading** are used in the front-end. With **Next.js**, web pages load faster and provide a better user experience. Furthermore, integrating an **AI**

assistant helps users by providing automated suggestions for website content, design, and layout, making the website creation process easier and more efficient. (Lazuardy & Anggraini, 2022).

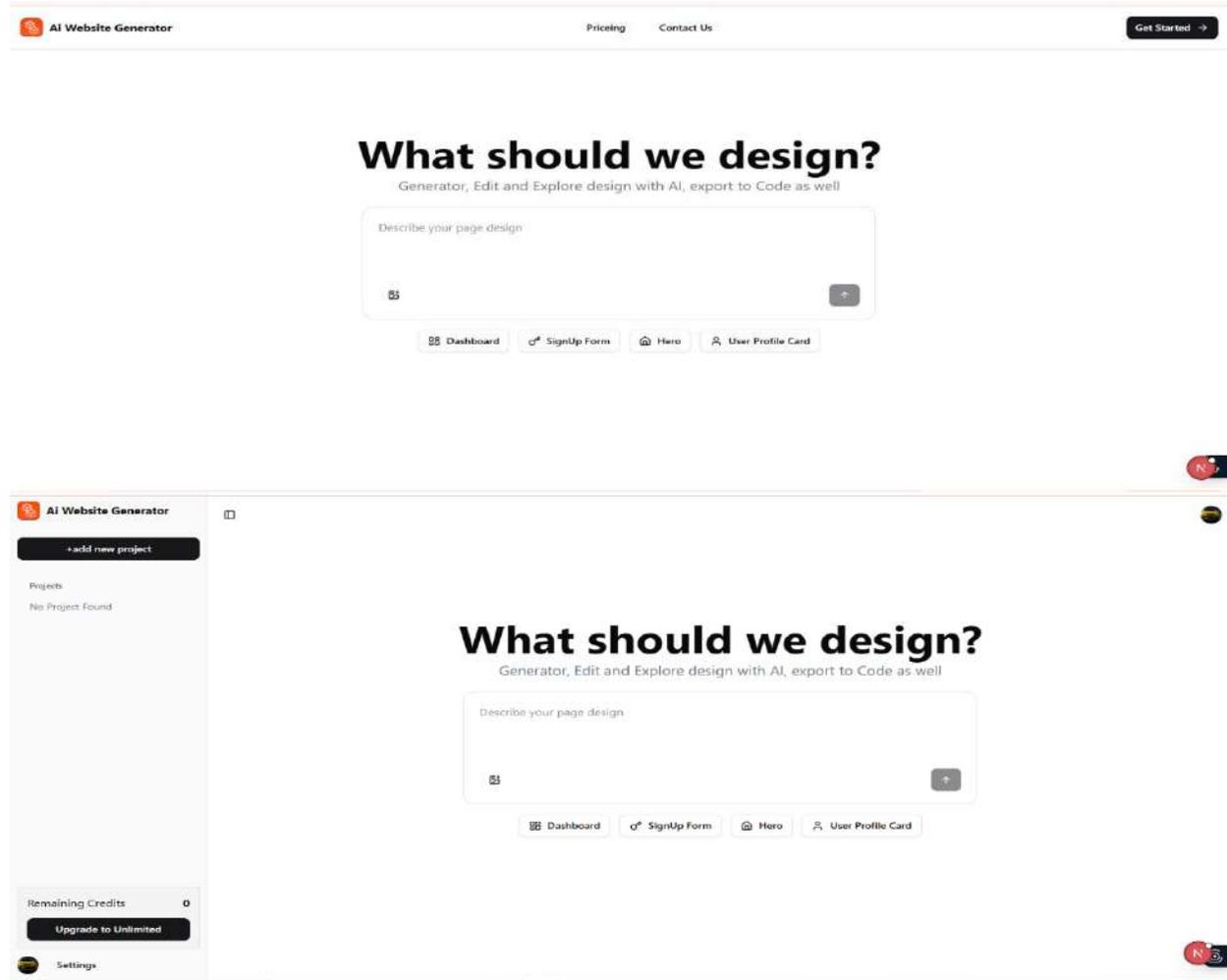


Figure 1.3 frontend deployment demo

Backend

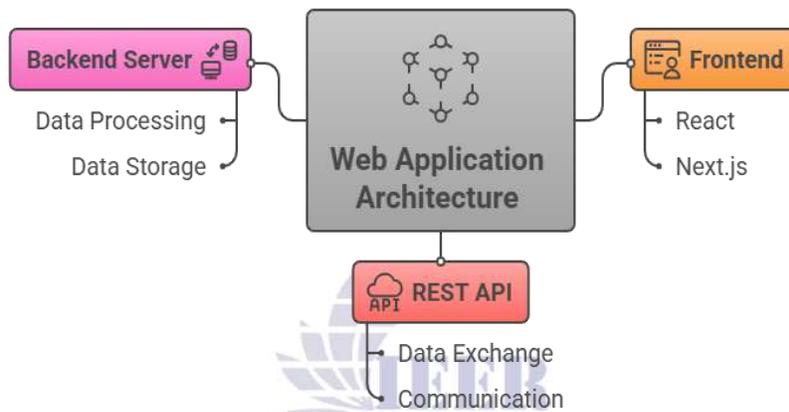
The backend of the AI Website Generator is developed with Node.js and Express.js, widely used technologies for building RESTful APIs. According to the study by Shkodra, Jajaga, and Shala (2021), Express provides an efficient environment for developing REST APIs and easily integrates with non-relational databases such as MongoDB. In this system, the backend handles API requests, manages application logic, and supports

communication between the frontend and the database. The backend manages user sessions, project creation, and AI processing required for generating websites. For authentication and session management, the system uses Clerk, which provides secure user authentication and session handling through middleware integration. This allows the backend to securely identify users and manage their sessions as they interact with the system. Additionally, the backend processes AI-generated outputs and

converts them into React component code, which the frontend uses to dynamically build the website interface. It also supports website deployment and integration with hosting services, enabling users to publish their generated websites online. The use of Node.js and Express ensures scalability and efficient request handling, which makes the system suitable for modern web application development (Shkodra et al., 2021). Reference: Shkodra, E.,

Jajaga, E., & Shala, M. (2021). Development and Performance Analysis of RESTful APIs in Core and Node.js using MongoDB Database. Proceedings of the 17th International Conference on Web Information Systems and Technologies (WEBIST 2021).

Web Application Architecture



```

    Explorer:
    - AI GENERATOR WEBSITE
    - .next
    - app
    - _components
    - (auth)
    - api
    - playground
    - workspace
    - _components
    - AppHeader.tsx
    - AppSidebar.tsx
    - layout.tsx
    - page.tsx
    - favicon.ico
    - global.css
    - layout.tsx
    - page.tsx
    - components
    - config
    - context
    - drizzle
    - hooks
    - lib
    - node_modules
    - public
    - .env
    - .gitignore
    - components.json
    - drizzle.config.ts
    - middleware.ts
    - next-env.d.ts
    - OUTLINE
    - TIMELINE

    AppHeader.tsx:
    1 import { SidebarTrigger } from "@components/ui/sidebar";
    2 import { UserButton } from "@clerk/nextjs";
    3 import React from "react";
    4
    5 function AppHeader() {
    6   return (
    7     <div className="flex justify-between items-center p-4 shadow">
    8       <SidebarTrigger />
    9       <UserButton />
    10     </div>
    11   );
    12 }
    13
    14 export default AppHeader;

    Terminal:
    PS C:\Users\Lenovo\Desktop\AI_Generator_website\ai-website-generator> npm run dev
    ✓ compiled /api/users in 6s (1475 modules)
    POST / 200 in 7841ms
    o compiling /workspace ...
    POST /api/users 200 in 11252ms
    ✓ compiled /workspace in 4.1s (1694 modules)
    GET /workspace 200 in 7822ms
    POST /workspace 200 in 79ms
    POST /api/users 200 in 3351ms
    GET /workspace 200 in 2003ms
    POST /workspace 200 in 267ms
    POST /api/users 200 in 3794ms
  
```

Figure 1.4 Backend code deployment demo structure

Database

- Uses **MongoDB** to store:
- User and authentication data
- Website project details and generated content
- AI usage logs and feedback data

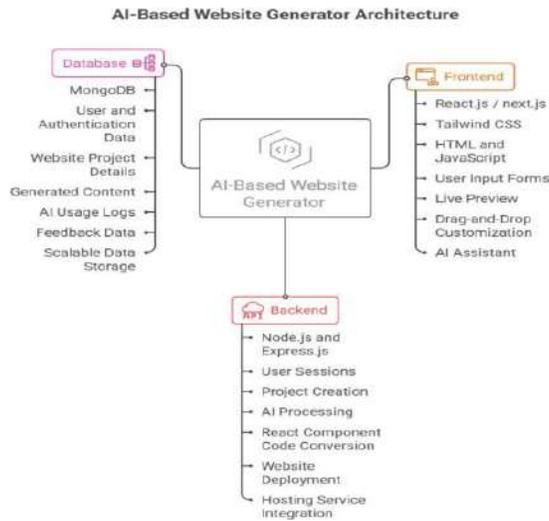


Figure 1.3 (AI Based website Generator Architecture)

- Provides scalable and flexible data storage

AI Models

- Uses **Machine Learning and Deep Learning** models for:
 - **NLP** to understand user input and generate content
 - **User intent analysis and personalization**
- The complete system is **developed, tested, and debugged using Visual Studio Code (VS Code)** as the primary development environment.

6. **Expected Outcomes and Impact**

- Creation of a **framework for intelligent** and self-sufficient AI-based web development
- Improved customization and flexible user experiences via data-driven intelligence
- Considerable decrease in the amount of **time and effort** required for manual development
- A versatile and scalable web development solution that can be used **in several domains**
- Significant contribution to the study of intelligent web systems and **AI-**

driven web engineering

Conclusion

AI-based website generators can automatically build websites that fit each user and work well on different devices by using artificial intelligence (AI) methods such as machine learning, which trains computers on example data, and neural networks, which are computer models inspired by how the human brain works. These systems also use data mining, which means finding useful patterns in large amounts of data, to study how people use websites and what they like. This helps them guess what users want and show better content. Using AI and data mining together makes website development faster, saves time, and lets websites handle many users at once. These systems can also get better over time as people use them. AI helps developers by automatically generating code, designing page layouts, and writing website copy. With these improvements, it is important to think about how future research could make these systems

even smarter and more flexible. As a result, several new research areas could shape the future of AI-powered website building.

Future research should focus on self-learning, adaptive websites, optimization across multiple platforms such as mobile, AR/VR, IoT, and wearables, predictive personalization that anticipates user needs, privacy-aware AI to protect user data, automated content generation, and AI tools that assist developers in website creation and maintenance.

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