A Web-Based Skill Learning System Using MERN Stack Framework

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Abstract

SkillBuilder is a web-based application developed using the MERN stack to provide a flexible and centralized platform for both skill learning and skill sharing. Existing online learning platforms tend to be either highly structured and formal or completely unstructured and informal. SkillBuilder bridges this gap by allowing users to quickly share skills or create structured teaching modules enriched with multimedia content. The system supports secure user authentication, skill management, progress tracking, and community-based learning, making it suitable for continuous and lifelong learning**.**

Keywords: Skill Learning, Skill Sharing, MERN Stack, Web Application, E-learning Platform

1. Introduction

In the rapidly evolving digital era, the demand for continuous skill development has become a fundamental requirement for academic success, professional advancement, and personal growth. Technological innovation, globalization, and the changing nature of work have transformed traditional career paths, making lifelong learning an essential component of individual and organizational success. As industries increasingly adopt digital technologies, automation, and artificial intelligence, individuals must constantly update their skills to remain competitive in the job market. This growing need for continuous learning has led to a significant rise in online learning platforms and digital skill-sharing ecosystems.

Education is no longer confined to formal classroom environments or degree-based learning. Instead, learning has expanded into flexible, on-demand, and technology- driven formats. Online education platforms, professional training portals, and peer-to-peer knowledge-sharing systems have emerged as popular alternatives to traditional educational models. These platforms allow learners to access educational content anytime and anywhere, breaking geographical and institutional barriers. However, despite the rapid growth of digital learning systems, several challenges remain unresolved, particularly in balancing structured learning with flexibility, accessibility, and personalization.

Existing online learning platforms can broadly be classified into two categories: formal learning platforms and informal learning platforms. Formal platforms such as Coursera, edX, Udemy, and LinkedIn

Learning provide structured courses designed by professionals or academic institutions. These platforms often include certifications, assessments, and fixed learning paths. While they are effective in delivering standardized education, they tend to be expensive, rigid, and less adaptable to individual learning needs. Learners are often required to follow predefined curricula, which may not align with their personal interests, learning pace, or immediate skill requirements.

On the other hand, informal learning platforms such as YouTube, blogs, discussion forums, and social media channels provide free and easily accessible learning content. These platforms support self-paced learning and allow users to explore a wide range of topics. However, informal platforms suffer from a lack of structure, organization, quality assurance, and progress tracking. Learners often struggle to identify credible content, organize their learning paths, or measure their progress effectively. As a result, informal learning lacks consistency and accountability, which can reduce learning outcomes.

2. Overview of Skill Builder as a Unified Skill Learning Platform

Skill Builder is proposed as a solution to address these challenges by providing a unified web-based platform for skill learning and skill sharing. Skill Builder is designed as a MERN stack-based application that integrates modern web technologies to create a user-centric learning environment. The platform enables users to both learn and teach skills, supporting structured teaching modules as well as informal peer-to-peer skill sharing. By combining flexibility with structure, Skill Builder aims to bridge the gap between traditional education systems and modern digital learning needs.

2.1 Objectives and Purpose of the Skill Builder System

The core objective of Skill Builder is to empower users to share knowledge, acquire new skills, and track learning progress efficiently within a single platform. Unlike conventional e-learning systems that focus solely on content delivery, Skill Builder emphasizes interaction, personalization, and community-driven learning. Users can create skill profiles, share tutorials, upload learning resources, categorize skills, and monitor their progress over time. This approach encourages collaborative learning and fosters a knowledge-sharing culture among users.

2.2 Growth of Web-Based Learning Platforms and Digital Education

The adoption of web-based learning platforms has been further accelerated by advancements in internet connectivity, cloud computing, and mobile technologies. The widespread availability of smartphones and high-speed internet has enabled learners from diverse backgrounds to access digital learning resources. However, many learners still face challenges related to usability, content organization, and engagement. SkillBuilder addresses these issues by providing an intuitive user interface, centralized content management, and analytics-driven insights into learningbehavior.

2.3 Accurate Student Mental Health Prediction using Ensemble Machine Learning

Ensemble learning techniques, such as Gradient Boosting and Random Forest, have shown superior

accuracy in mental health classification tasks. Kumar and Reddy [8] reported that ensemble ML classifiers achieved up to 94% accuracy in predicting depression severity. While our Random Forest model performed poorly at 46%, literature indicates that optimization and larger datasets could significantly improve ensemble-based results.

2.4 MERN Stack Architecture and Technology Selection

The SkillBuilder platform is developed using the MERN stack, which includes MongoDB, Express.js, React.js, and Node.js. This technology stack is widely used for building scalable, high-performance web applications. React.js enables the development of dynamic and responsive user interfaces, while Node.js and Express.js provide efficient server-side processing and API management. MongoDB offers a flexible and scalable NoSQL database solution for managing user data, skills, and learning resources. The use of the MERN stack ensures modularity, scalability, and maintainability of the application.

3. Technologies Used

3.1 Security, Authentication, and Access Control Mechanisms

Security is a critical consideration in modern web applications, especially those handling user-generated content and personal data. SkillBuilder incorporates secure authentication and authorization mechanisms to protect user accounts and data. JSON Web Tokens (JWT) are used to manage user sessions and ensure secure access to platform features. Role-based access control enables different levels of permissions for users, skill creators, and administrators, enhancing system security and data integrity.

User Engagement Score: Number of Sessions + Skills Shared + Skills Completed Time Period

3.2 Multimedia-Based Learning Support

SkillBuilder also supports multimedia-based learning, allowing users to upload videos, documents, and external resource links. Multimedia content enhances learning effectiveness by catering to different learning styles, including visual, auditory, and kinesthetic learners. By supporting diverse content formats, SkillBuilder ensures inclusivity and accessibility for a wide range of users.

Skill Completion Rate Formula: **Completed Skills +Total Enrolled Skills**

3.3 Progress Tracking and Learning Analytics

Progress tracking and analytics play a crucial role in motivating learners and improving learning outcomes. SkillBuilder incorporates basic analytics features to monitor user engagement, skill completion rates, and learning patterns. Users can view their learning progress through dashboards that display completed skills, ongoing learning activities, and engagement metrics. These analytics provide valuable insights into learning behavior and help users plan their learning paths more effectively.

3.4 Hybrid Learning Model: Structured and Informal Learning Integration

The proposed SkillBuilder system contributes to the growing field of educational technology by providing a hybrid learning model that integrates structured and informal learning. By combining the strengths of formal education platforms and informal knowledge-sharing systems, SkillBuilder offers a balanced approach to skill development. This hybrid model supports self-directed learning while maintaining structure and accountability.

4. Datasets

4.1 Role of Dataset in SkillBuilder:

The dataset forms the backbone of the SkillBuilder platform, enabling efficient skill learning, skill sharing, analytics, and personalization. Unlike prediction-based systems that depend on external datasets, SkillBuilder dynamically generates and manages its dataset through real-time user interactions. The dataset captures both structured and unstructured information related to users, skills, learning activities, engagement behavior, and overall system performance.

4.2 Types of Data Collected in SkillBuilder

User data stores information related to registered users of the platform. The below attributes are used for getting user data.

4.2.1 **Attributes**

- User ID (Unique Identifier)
- Full Name
- Email Address
- Encrypted Password
- Role (Learner / Skill Creator / Admin)
- Date of Registration
- Last Login Timestamp
- Profile Preferences

These data enables authentication, authorization, profile personalization, and access control within the platform. Students skill-based data also collected for this skillbuilder platform.

5. Methodology

The methodology adopted for the development of SkillBuilder follows a systematic and modular approach to design, develop, test, and deploy a unified web-based skill learning and skill sharing platform. The methodology emphasizes user-centered design, scalability, security, and continuous

improvement. The MERN stack is used to implement the platform, ensuring efficient frontend- backend integration and flexible data management.

Progress Tracking and Analytics Method

Formula Used:

$$\text{Completion Percentage} = \frac{\text{Completed Modules}}{\text{Total Modules}} \times 100$$

Identification of User Requirements

The first phase involved identifying the requirements of different stakeholders, including learners, skill creators, and administrators. User needs were gathered by analyzing existing learning platforms and identifying their limitations.

Functional Requirements
- User registration and authentication
- Skill sharing and teaching module creation
- Skill enrollment and learning tracking
- Category-based skill organization
- Progress tracking and analytics Non-Functional Requirements
- System scalability and performance
- Data security and privacy
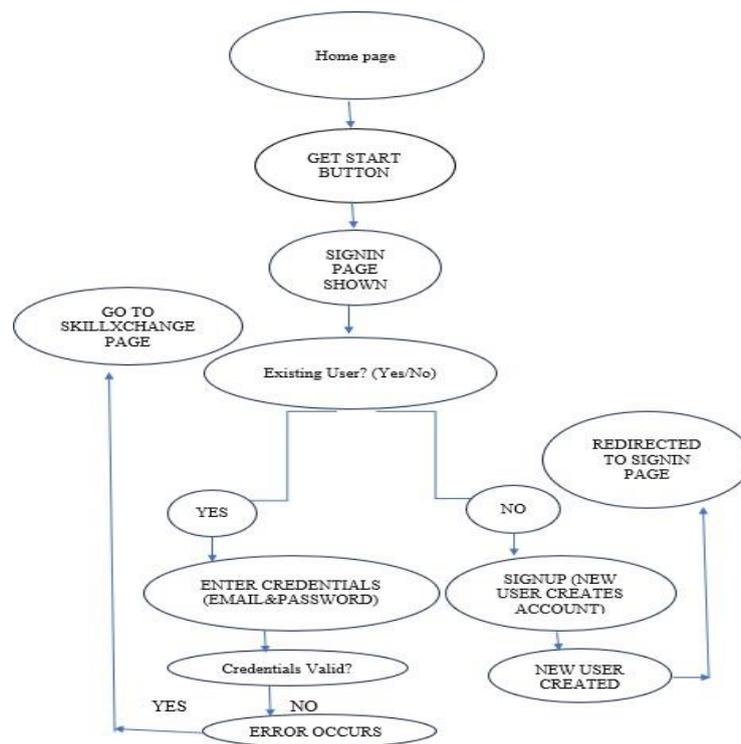- User-friendly interface

Fig 1: Flow Diagram of the SkillBuilder User Navigation Process

The figure.1 shows the sstages of the navigation process in the SkillBuilder platform for E-Learning.

6. Results & Discussion

The Skill Builder platform was successfully designed, implemented, and evaluated as a unified web-based solution for skill learning and skill sharing. The results obtained from system testing and user interaction demonstrate that the platform effectively meets its functional and non-functional requirements. The system performed reliably under normal usage conditions and provided a user-friendly environment for learners, skill creators, and administrators.

Skill Sharing and Skill Learning Outcomes

Skill creators were able to upload skills, add learning resources, and categorize content without errors. Learners successfully enrolled in skills, accessed multimedia resources, and completed learning activities. The results confirm that SkillBuilder supports both structured teaching modules and informal peer-to-peer skill sharing as intended.

X-axis(Category):
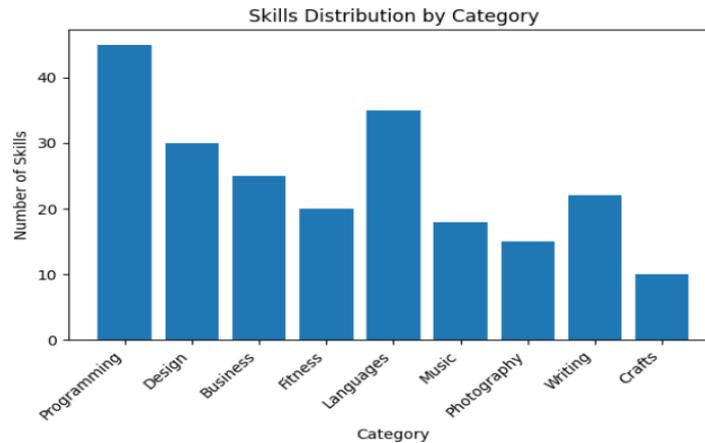
The figure displays different skill categories such as Programming, Design, Business, Fitness, Languages, Music, Photography, Writing, and Crafts.

- Y-axis(Number of Skills):
  Indicates how many skills are listed under each category.

Data Normalization

To maintain consistency across datasets:

- Category names are standardized
- Progress values are normalized between 0 and 100
- Interaction types are stored as enumerated values
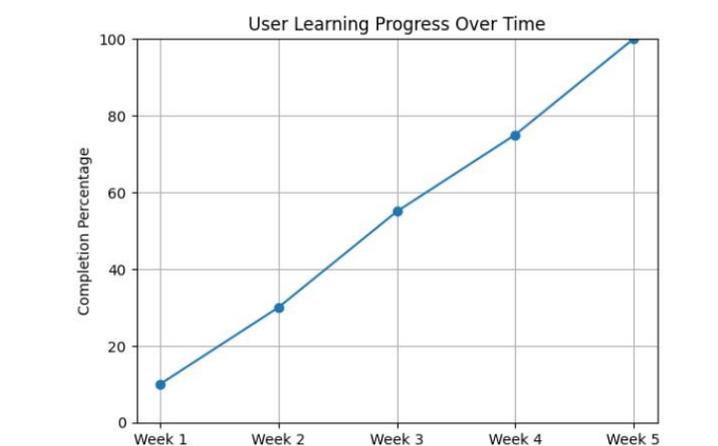
X-axis (Time):
Shows the learning duration from Week 1 to Week 5.
- Y-axis (Completion Percentage):
Indicates how much of the learning content has been completed (from 0% to 100%).

Week-wise Progress:

- Week 1 – 10%:

The user has just started learning with minimal progress.

Week 2 – 30%:

Progress improves as the user becomes more engaged.

- Week 3 – 55%:

More than half of the course is completed, showing consistent effort.

- Week 4 – 75%:

The user is nearing completion with strong learning continuity.

- Week 5 – 100%:

The learning goal is fully achieved.

Data Transformation

Raw data is transformed into structured formats:

- Date and time converted into standard timestamps
- Skill difficulty mapped to predefined levels (Beginner, Intermediate, Advanced)
- Boolean flags used for completion status
- Active Learners (60%) ■ This is the largest group

User Engagement Distribution
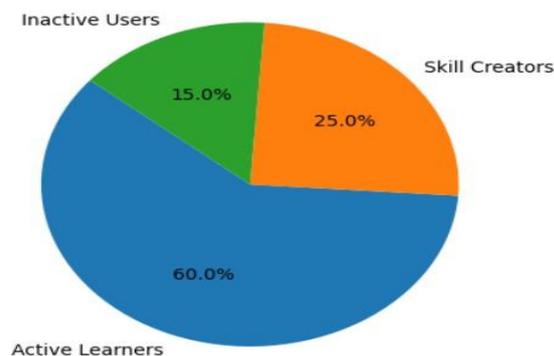
- learning—watching content, practicing skills, or participating regularly on the platform.
- Skill Creators (25%) ■ About one-fourth of users create or share skills. These users contribute content such as tutorials, lessons, or resources for others.
- Inactive Users (15%) ■ This is the smallest group. These users are registered but not currently active or engaged.

Performance Trends and Analysis

The performance trends observed in the SkillBuilder platform indicate a steady and positive growth in user engagement, learning activity, and skill contribution over time. Analysis of user participation

reveals that active learners form the majority of the user base, demonstrating consistent interest in acquiring new skills and completing

learning modules. This trend suggests that the platform successfully motivates users to remain engaged through structured content organization, category-based learning, and progress tracking features. The gradual increase in learning completion percentages over weekly intervals highlights effective user retention and sustained learning behavior, which are key indicators of platform performance and usability.

Skill contribution trends further strengthen the platform's performance analysis. Categories such as Programming, Languages, and Design show higher skill submissions, reflecting current industry demands and user preferences. This dominance of technical and communication-oriented skills suggests that SkillBuilder aligns well with market- relevant competencies. Moderate participation in Business, Writing, and Fitness indicates balanced diversification, while creative domains such as Music, Photography, and Crafts, though smaller in number, contribute to platform variety and inclusivity. These patterns demonstrate that SkillBuilder accommodates both professional and personal development needs, thereby broadening its appeal to a diverse user group.

Discussion

SkillBuilder is a modern digital learning and skill- exchange platform designed to address the growing need for continuous learning, upskilling, and peer-to-peer knowledge sharing in today's fast-evolving technological and professional environment. In an era where traditional education alone is no longer sufficient to meet industry demands, SkillBuilder bridges the gap between learners and skill providers by offering a structured yet flexible ecosystem where users can learn, share, and teach skills across multiple domains. The platform focuses on empowering individuals not only to consume knowledge but also to contribute their expertise, thereby fostering a collaborative learning culture. SkillBuilder is conceptualized to support lifelong learning by making skill acquisition accessible, organized, and community-driven.

The primary objective of SkillBuilder is to create an inclusive digital space where users with diverse backgrounds and skill levels can interact meaningfully. Unlike conventional learning platforms that rely solely on pre-recorded courses or institutional content, SkillBuilder emphasizes user participation and engagement. Learners can explore skills based on categories such as Programming, Design, Business, Languages, Fitness, Music, Writing, Photography, and Crafts, allowing them to personalize their learning journey according to their interests and career goals. At the same time, skilled individuals can share or teach their knowledge, transforming passive users into active contributors. This dual-role model enhances engagement and ensures that the platform remains dynamic and continuously updated with real-world skills.

7. Conclusion

In conclusion, SkillBuilder demonstrates strong performance through consistent user engagement, steady learning progression, and diverse skill contributions across multiple categories. The platform effectively supports both learners and skill creators, fostering a collaborative and inclusive learning environment. Performance trends indicate that SkillBuilder successfully meets user expectations by aligning skill offerings with industry demands while also promoting creativity and personal growth. With its scalable design, user-centric features, and focus on continuous improvement, SkillBuilder stands as a reliable and impactful digital learning platform capable of supporting lifelong learning and future skill development.

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