KalaHeart - A Marketplace for Local Artisans

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Abstract:

This paper presents KalaHeart,an AI-enabled multilingual digital marketplace designed to support local artisans by improving the visibility and accessibility of the product in the digital market.This platform has features such as personalized recommendations,automated content generation, and multilingual interaction. These features simplify the adoption of technology for craftsmen and also improve the customer experience. The system uses artificial intelligence to understand user's preferences, generate structured product content, and enable voice and image-based interactions. KalaHeart is designed to improve usability and scalability and also provides role-based access for artisans, customers, and administrators. The platform has been implemented and tested at the prototype level. The results show that product descriptions became clearer,interactions felt more seamless, and users were able to find relevant products more easily.The results show that the quality of content has improved. The interactions have become more efficient, and the product discovery has improved. KalaHeart shows how AI-driven solutions can make marketplaces more inclusive and can help to support the growth of the cultural and creative economy.

Keywords: Local artisans · Digital Marketplace · Artificial Intelligence · Personalized Recommendations · E-commerce .

1 Introduction

Local artisans are important in keeping the cultural heritage alive, in a country such as India,where handicrafts highlight traditional skills.Although they are important to the economy,many artisans face difficult times in reaching larger markets due to limited digital skills,language barriers, and lack of technological support [4, 12].

As technology has grew rapidly,E-commerce platforms have created with new opportunities for artisans to connect directly with customers and expand

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their business[11].Currently the existing platforms mainly focus on product listings and transactions and not on offering help with multilingual communication,automated content creation or tools that allow artisans to effectively showcase their products.

This highlights a significant gap in current systems.There are no integrated solutions that bring together artificial intelligence, multilingual support and various interaction ways dedicated to artisan focused marketplaces.Most existing systems are not easy to use for people who have limited digital skills. They also do not offer assistance or personalized suggestions to help users discover products more easily.

To address this issue,this article proposes *KalaHeart*,an AI enabled multilingual marketplace that aims to make it easier for artisans to participate digitally while enhancing the customer experience. The system combines AI driven content creation,speech and image processing and personalized recommendation thus allowing easy interaction through text,voice and images.

This research aims to design,implement and evaluate a scalable and accessible platform that improves artisan registration,product visibility and customer engagement. The study focuses on creating a prototype with limited language support,while in future it will explore larger scale deployment,integrating support for more languages and better features like payments.

2 Literature review

The handicraft sector is important not only for the economy but also for preserving cultural heritage.However,artisans often face challenges in reaching bigger markets due to low digital literacy and lack of access to technology. E-commerce platforms have the potential to connect artisans directly with consumers and reduce the need for middlemen [7],but many existing systems are still difficult to use and don't have enough automation or proper multilingual support.

Previous research shows that storytelling, artisan identity, and product stories plays an important role in building customer trust.However, most platforms assume that artisans already have some level of digital skills, as they need to create and manage their product content on their own. Even though recent AI advancements like automated content generation, image-based search, and multilingual interaction have made mainstream e-commerce more accessible, these features are still rarely used in platforms designed for artisans [3].

Existing marketplaces such as Craftsvilla and Amazon Karigar have improved product visibility, but still provide limited personalization, flexibility, and analytical support tailored to artisans [1].

In general, existing solutions don't have a single proper system that brings together AI-based help, multilingual interaction, and support specifically designed for artisans.

3 Proposed Approach

The proposed KalaHeart system is an AI-enabled multilingual marketplace which is designed to improve accessibility and usability for local artisans. The system is designed using user cantered principle with artificial intelligence to address challenges such as limited digital literacy, language barriers, and low product visibility.

This platform follows a modular three-tier architecture which consists of a presentation layer, application layer, and data/AI layer, this enables scalability and efficiency of intelligent services for integration.

3.1 System Architecture

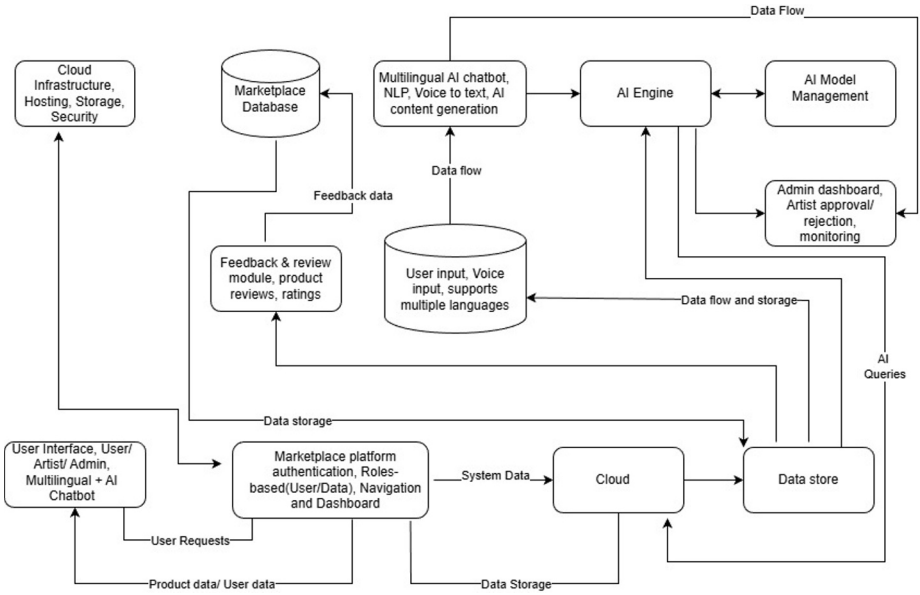

Fig. 1. Overall System Architecture and Data Flow of KalaHeart.

As shown in Fig. 1, the system consists of the following components:

- **User Interface Layer:** Supports multilingual interaction using text, voice, and image inputs.
- **Application Layer:** Handles authentication, role-based access control, and marketplace operations.
- **AI Engine:** Performs content generation, speech-to-text processing, image classification, and recommendation modeling.
- **Data Layer:** Stores user data, product information, and interaction logs.

– **Cloud Infrastructure:** Provides scalable storage, hosting, and secure communication.

Table 1 summarizes the core system modules and their responsibilities.

Table 1. Core System Modules and Technical Responsibilities

Layer	Module	Functionality
Presentation Layer	Multilingual UI	Text, voice, image interaction
Application Layer	Role Management	Authentication and authorization
AI Layer	Content Generation	Transformer-based text refinement
AI Layer	Recommendation Engine	Hybrid ranking
AI Layer	Image Categorization	CNN-based classification
Data Layer	Database	User and product storage
Cloud Layer	Infrastructure	Scalable deployment

3.2 System Workflow

The system follows a role-based workflow in which firstly artisans register on the platform and then the administrator verifies them. After approval from the administrator, artisans gain access to features such as product listing, order management, and analytics. Customers can browse products, search in multiple languages, and receive personalized recommendations. This structured workflow ensures authenticity, controlled access, and improves user's experience.

3.3 AI Integration

The AI module improves usability and automation within the platform. It includes:

– Speech-to-text conversion for voice input processing
– Natural language processing for refining product descriptions
– Automated content generation for structured listings
– Multilingual translation support
– Hybrid recommendation system based on user interaction
– Image-based categorization using computer vision

3.4 Security and Deployment

The system implements role-based access and secure communication using HTTPS protocols. KalaHeart is deployed in a cloud infrastructure with modular services, this enables horizontal scalability and efficient resource utilization. To ensure low latency and high availability of data storage and retrieval are optimized.

4 Methodology

In the development of KalaHeart a structured methodology is followed integrating system design, AI model development, implementation, and validation. The goal is to build a scalable and multilingual marketplace for artisans with low digital literacy.

4.1 Problem Formulation and Requirement Modeling

The system is formulated as a multimodal marketplace optimization problem that involves:

- Automated content generation
- Multilingual interaction processing
- Personalized recommendation
- Role-based governance

Let $U = \{u_1, u_2, ..., u_n\}$ represent users and $P = \{p_1, p_2, ..., p_m\}$ represent products. The objective is to learn a ranking function:

$$R(u_i, p_j) \rightarrow relevancescore$$

that maximizes recommendation accuracy while maintaining low latency.

4.2 System Architecture Design

KalaHeart follows a three-tier architecture:

Presentation Layer: Multilingual UI that supports text, voice, and image inputs.

Application Layer: Handles business logic, authentication, and API communication using the Django REST Framework.

Data and AI Layer: Includes database storage and AI modules for processing and recommendation.

The architecture supports scalability through modular services and load-balanced APIs.

4.3 AI Pipeline and Model Specifications

KalaHeart integrates a multimodal AI pipeline for text, speech, image, and behavioral data.

Table 2 summarizes the AI techniques used.

Content Generation Model A transformer-based model generates structured product descriptions:

$$y = f_\theta(x)$$

where x is the input and y is the generated output.

Table 2. AI Techniques Implemented in KalaHeart

Component	Algorithm / Model	Purpose
Content Generation	Transformer-based Model	Product descriptions
Speech Processing	Speech Recognition Model	Voice-to-text
Image Categorization	CNN (Transfer Learning)	Category detection
Recommendation	TF-IDF + Cosine Similarity	Content-based ranking
Recommendation	Interaction Matrix	Collaborative filtering

Speech-to-Text Processing Voice input $a(t)$ is converted into text:

$$T = g_\phi(a(t))$$

where T is the transcription.

Image-Based Categorization Images are classified using CNN-based feature extraction:

$$z = h_\psi(I)$$

Recommendation Engine A hybrid recommendation approach combines content-based and collaborative filtering.

$$R(u, p) = \alpha \cdot ContentScore + (1 - \alpha) \cdot CollaborativeScore$$

4.4 Implementation Framework

The frontend is developed using React.js, while backend services use Django REST Framework with JWT-based authentication and role-based access control.

4.5 Experimental Setup

The data set includes product records, simulated users, interaction logs, multilingual voice inputs, and labeled images. The load testing is performed using concurrent user simulation.

4.6 Evaluation Metrics

The performance of the system is evaluated using the metrics summarized in Table 3.

4.7 Validation Procedure

Validation includes functional testing, load testing, and user interaction scenarios to verify system performance and stability.

Table 3. Planned Quantitative Evaluation Metrics

Module	Metric
Recommendation Engine	Precision@K, Recall@K, MRR
Content Generation	Human Rating Score
System Performance	API Response Time
Scalability	Throughput

4.8 Security and Deployment

The system uses HTTPS-based communication, JWT authentication, and role-based access control. It is deployed on a scalable cloud infrastructure with optimized data handling.

5 Prototype Evaluation and Results

The KalaHeart platform was evaluated at the prototype level through functional testing, controlled scenario validation, and user interaction simulations. Prototype driven validation is commonly used in early-stage AI system development to verify architectural feasibility and module integration before large scale deployment. The objective of the evaluation was to verify the operational precision of AI modules, role-based access mechanisms, and multilingual interaction capabilities.

5.1 Functional Validation

Each core module of the system was independently tested to ensure correct integration and execution, following modular validation practices in software system engineering [8]:

Table 4. Prototype Validation Scenarios and Outcomes

Scenario	Expected Behavior	Outcome
Artisan Registration	Admin verification triggered	Successful
Voice Product Upload	Speech converted to text	Successful
Image Upload	Category auto-assigned	Successful
Multilingual Search	Relevant products retrieved	Successful
Recommendation	Ranked products displayed	Successful

Table 4 summarizes the prototype validation scenarios and their observed outcomes.

– The AI-assisted content generation module successfully transformed the text and voice input provided by artisans into structured product descriptions.

- The speech-to-text component correctly transcribed multilingual voice inputs under controlled testing conditions.
- The image-based categorization module was able to assign craft categories to uploaded product images.
- The hybrid recommendation module generated ranked product suggestions based on user interaction patterns, consistent with evaluation practices in the investigation of the recommendation system [9].

All modules functioned as expected within the integrated system pipeline.

5.2 User Interaction Scenarios

The prototype was tested using predefined usage scenarios including artisan registration, administrative approval, multilingual search, and recommendation workflows. Scenario-based usability evaluation is widely adopted in early-stage interactive system validation [6].

The system successfully handled all test scenarios without functional failure, validating the correctness of the workflow execution.

5.3 AI-Assisted Content Support Observations

Preliminary interaction tests indicated that AI-generated product descriptions were more structured and descriptive compared to raw artisan input. Human-in-the-loop evaluation for AI-generated content is considered an appropriate validation approach in the early stages of deployment [2].

Multilingual processing allowed artisans to interact with the system using regional languages, supporting inclusive AI principles discussed in recent human-centered AI literature [10].

5.4 System Performance Observations

During controlled testing, the platform maintained stable API responses under moderate simulated user activity. Although large-scale benchmarking was not conducted, early-stage system validation focusing on architectural stability is common in prototype AI systems.

5.5 Limitations of Current Evaluation

The present evaluation is limited to prototype-level validation and controlled simulations. Large-scale quantitative benchmarking and statistically significant experimental validation remain part of future work, as recommended in AI system lifecycle frameworks [5].

5.6 Summary of Findings

The prototype evaluation demonstrates that:

- The multimodal integration of AI is technically feasible within an artisanal marketplace.
- Role-based governance and approval workflows work correctly.
- Multilingual and AI-assisted features enhance usability at the conceptual level.

These results validate the architectural and algorithmic design of KalaHeart, while a comprehensive quantitative performance evaluation is reserved for subsequent large-scale deployment.

6 Conclusion

This paper presents KalaHeart, an AI-powered multilingual marketplace designed to help local artisans through different types of interaction, automated content support, and smart product recommendations. The system combines transformer-based content generation, speech-to-text processing, image-based categorization, and a hybrid recommendation system within a role-based marketplace setup.

Prototype-level testing shows that it is possible to integrate different types of AI into a digital marketplace. The system follows known recommendation approaches [9] and also considers human-centered AI principles. It also follows human-centered AI ideas[10], while using human-in-the-loop methods to reduce technological barriers [2]. The role-based governance model also helps in making the system more transparent and supports responsible AI practices [5].

Although the evaluation is limited to controlled prototype testing, the system shows potential to scale and work accurately in real scenarios. In future, the work will focus on large-scale deployment, proper evaluation using metrics like Precision@K and MRR, and also looking into possible bias in multilingual content generation.

Overall, KalaHeart shows how an AI-based design can help create more inclusive digital marketplaces while still preserving cultural craftsmanship.

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