|| Volume 9 || Issue 1 || January 2025 || ISSN (Online) 2456-0774
INTERNATIONAL JOURNAL OF ADVANCE SCIENTIFIC RESEARCH AND ENGINEERING TRENDS

A REVIEW OF AI-BASED CHAT-BOT KIOSKS: ARCHITECTURE, APPLICATIONS, AND FUTURE DIRECTIONS

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Abstract: This review examines the development and implementation of AI-based chatbot kiosks, a system that combines the power of high-order natural language processing (NLP) and conversational AI with physical self-service devices. Based on UK Patent 6380713, in which a strong kiosk framework with dual-mode interaction, backend integration, and embedded recommendation engines were described, and with the help of recent research on chatbot strategies and conversational commerce, the paper discusses the technical design, AI, and layering of these systems. It also shows multiple uses in retail, banking, healthcare, and government services, showing an increase in automation rates, customer satisfaction, and productivity. It also examines key user experience (UX) motivators including simplicity and speed of response as well as implementation issues including compatibility with legacy systems, computing requirements, and data security. Lastly, it addresses the new trends such as emotion-aware AI, edge computing, and smart city integration that places AI-powered kiosks at the center of managing future service delivery in a seamless, personalized, and scalable manner.

Keywords: *AI Chatbot Kiosks, Natural Language Processing (NLP), Conversational AI, User Experience (UX), Patent 6380713.*

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I.INTRODUCTION:

Artificial intelligence (AI) and natural language processing (NLP) have been integrated in a way that has greatly changed the manner in which businesses and institutions relate with the users. Conversational AI has taken many forms, including smartphone digital assistants and voice-activated customer support agents, and is now a pillar of user engagement in the modern world[1]. Historically, such AI-based interactions have been limited to the web or mobile channels. Nevertheless, due to the improvement in hardware design and edge computing, there has been a significant trend to have intelligent conversational agents embedded in the physical interface- especially in the kiosk systems[2].

Chatbot kiosks are a combination of physical computing framework and AI-driven software that allows real-time, autonomous, and human-like communication in a semi-public or public setting. Such systems provide services including information dissemination, transaction processing, customer support and individual recommendation[3,4]. They are a solution that is interesting in numerous industries, including retail, banking, healthcare, and public administration due to their capability to operate 24/7, cut staffing requirements, and provide multi-language support. By relying on the patent and additional research studies dedicated to the deployment of chatbots in various industries and conversational commerce frameworks, this review paper summarizes the technological aspects and industry implications of such kiosks[5].

This study attempts to provide an in-depth description of AI chatbot kiosks in terms of technical and practical perspectives. It analyses their architectural design, core AI building blocks, NLP mechanisms, industry-specific use cases, and user experience as well as future trends. In this review, the review aims at equipping AI industry leaders and technology architects with quality information on the expanding opportunities and challenges of implementing intelligent kiosk-based systems in real-life settings[6].

OVERVIEW OF PATENT 6380713 AND ITS UNIQUENESS

UK Patent 6380713 is a crucial innovation in the field of the combination of conversational AI and physical kiosk systems. The patent presents the innovative AI-based chatbot kiosk that not only can accept the natural language inputs through voice and text but is also intended to perform the backend data access and transactional operations in their entirety a part of a physical standalone system[7].

The patented system has a few major innovations that help it to stand out among the currently present chatbots implementations:

- **NLP-based Conversational Engine:** A strong natural language processing component allows extraction of the intent in real-time, dynamic management of the dialogue flow, and contextual awareness across several conversational turns.
- **Dual-Mode Interaction:** The kiosk has been designed to support both speech-to-text and text-to-speech interaction that can provide users with an intuitive voice-first experience as well as the more familiar text entry features[8].
- **Backend System Integration:** The kiosk can be connected to CRM databases, inventory management systems and payment gateways through secure APIs and data bridges, providing possibilities to deliver services in real-time and personalize them.
- **Included Recommendation System:** The built-in recommendation logic is driven by AI, enabling more intelligent suggestions in an interaction by considering both a historical behaviour as well as the session-specific context.

In contrast to traditional chatbots implemented in web or mobile applications, this AI kiosk introduces the digital intelligence into the real world, flowing in the areas of high traffic, like retail stores, bank lobbies, hospitals, airports, and government service centres. The kiosk is a next generation self-service paradigm combining conversational intelligence with touch and voice interface in a secure, movable hardware platform.

Figure 1: Front View of AI Chatbot Kiosk - Patent 6380713

This image shows the front elevation of the kiosk, with the principal interactive elements being the centre touchscreen display[9], the camera facing forward, and the pair of stereo loudspeaker enclosures. The design focuses on user accessibility and instant interaction, which facilitates a wide range of demographic use in semi-public and public places.

TECHNICAL ARCHITECTURE AND DESIGN

The AI chatbot kiosk system is designed on a multi-layered platform that allows flawless integration of hardware with conversational AI allowing intelligent and user-friendly real-time physical interactions.

1.1. Layered Architecture

The system architecture suggested is based on a multi-level architecture pattern that is usually cited in the current literature on AI chatbots. This tiered approach has the functional areas of the kiosk divided into six combined levels, each one of which performs a particular aspect of the user interface, processing, or backend connection:

Table 1: Architecture Layer Summary[10]

Layer	Description
User Interaction Layer	Interfaces with users through touchscreen, microphone, and speakers; handles real-time voice and text input/output.
Conversational Engine & NLP Layer	Performs natural language processing, identifies user intent, tracks dialogue context, and generates intelligent responses.
Business Logic Layer	Applies transaction rules, eligibility checks, and recommendation logic; supports service workflows.
Backend Integration Layer	Connects with external systems (e.g., CRM, inventory, banking APIs) to retrieve or submit real-time data.
Analytics & Monitoring Layer	Logs interactions, user behaviour, and feedback; supports usage tracking and system performance evaluation.
Security Layer	Enforces access control (e.g., OAuth 2.0), encrypts user data, and ensures compliance with regulations such as GDPR.

This architecture increases modularity, which enables separate updates of NLP engines, logic rules or hardware layers. It is particularly applicable in multi-location and large-scale deployment.

1.2. Comparison to the Existing Chatbot Architectures

Traditional chatbot systems are usually optimized on the digital platforms like websites, mobile apps and messaging tools[11]. Such systems usually include:

- Omnichannel input (voice, text, gesture),
- RESTful APIs integration (backend),
- NLP modules such as intent classifier and entity extractor,
- And conversational engines hosted on the cloud.

Patent 6380713, on the contrary, stands out because it integrates these features into a physical kiosk device. The change brings new challenges and considerations, such as how to support voice interfaces in busy outdoor contexts, how to secure embedded systems and how to do on-premise data processing. Such disparities necessitate the need to consider a more responsive and situational architectural concept to guarantee dependability and user interaction in real-life and high-traffic sites.

Table 2: Comparison Between Web-Based Chatbots and Kiosk-Based Systems[12]

Aspect	Web/Mobile Chatbots	AI Chatbot Kiosk
Deployment	Web/Mobile Apps	Standalone Physical Kiosk
Input Modalities	Text, limited voice	Text + Advanced Voice Interaction
Use Environments	Remote (Online)	On-site (Retail, Banks, Hospitals)
Hardware Dependency	None	Requires dedicated I/O and processing unit

Personalization	App-based	Embedded Recommendations + Local Sensors
Backend Access	Cloud APIs	API + Direct hardware control modules

1.3. Hardware Design Considerations from Patent 6380713

Besides its software design, the physical design of the kiosk enables its conversational abilities by modularity and ergonomic position of components.

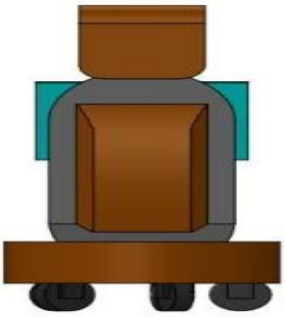

Figure 2: Rear design layout with access panels for service and hardware modules

The rear panel has modular slots where hardware may be serviced such as access to battery banks, motherboard trays and ventilation modules[13]. Maintenance and upgrades are easily done on this design, without affecting the operations of the kiosks.

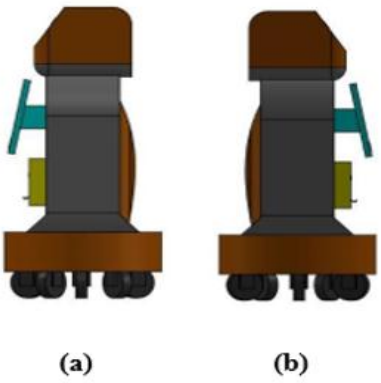

Figure 3: Side elevation showing touchscreen and speaker placement

In this side view, the location of the display panel at ergonomic height and directional speakers that are aligned to provide the best audio to the users facing the device in front are brought out[14].

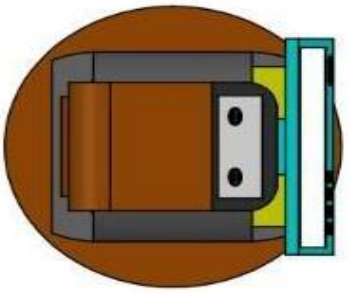

Figure 4: Top-down layout with embedded sensors and microphon**es**

Embedded microphones and ambient light sensors can be found on the top layout and this assists the system in processing directional voice input and adjusting the screen brightness depending on the different environments (e.g. malls, hospitals) [15].

II.AI AND NLP TECHNIQUES USED

Chatbot kiosks are only effective when they have capable AI and NLP to make natural and responsive user interactions in various service situations.

NLP and Dialogue Management

The deep learning intelligence of the AI chatbot kiosk that is mentioned in the Patent is enabled with a powerful Natural Language Processing (NLP) engine that enables natural and effective human-machine communication. Good NLP design allows not only simple question-answer but also facilitates more complex, multi-turned conversation that is associated with business reality[16]. Among the important elements are:

- **Intent Detection and Entity Recognition:** With the help of machine learning classifiers, the kiosk will be able to determine the intent of the user (e.g., "check the availability of products") and extract the relevant information like the names of products, dates and account numbers. Domain-based classifier enhances the performance of different fields such as retail industry, banking, and healthcare, and the interaction is more accurate and effective.
- **Contextual Dialogue Management:** Session memory, discourse state monitoring, and context awareness keep the dialogue going between turns. Filling forms, reserving services, and customizing product recommendations require back-and-forth contact. Keeping things in context boosts user pleasure and task completion.
- **Deep Learning Methods:** Rule-based NLP systems have been replaced by innovative NLP systems like RNNs and BERT. Because BERT is pre-trained in transformer layers, it can interpret delicate and unclear requests, making the kiosk more flexible and wiser at natural language interpretation[17]

Such combined technologies enable chatbot kiosk to provide dynamic, context-sensitive, and personalized interaction with users-making it a powerful substitute to both digital and face-to-face interfaces of services.

Table 3: Reference Table

Author(s)	Year	Focus Area	Methodology	Key Findings	Contribution
Kusal et al.[18]	2022	Conversational Agents	Systematic literature review of 60+ academic sources	Identified trend toward multimodal and emotion-aware systems	Reviews technologies, applications, and future directions of conversational AI
Lin et al.[19]	2023	Chatbot Implementation Methodology	Meta-review of frameworks from 1999 to 2022	Found hybrid models (rule-based + AI) yield better accuracy and user retention	Discusses implementation strategies, evolution, and architecture of chatbot deployment
Inavolu[20]	2024	AI in Customer Service	Survey-based evaluation across 120 businesses	Found 67% adoption rate of chatbots among customer-	Evaluates architectures, industry adoption, and business-level implementation challenges

1.4. Voice Processing

The patent is heavily focused on the bi-directional voice communication, which makes it inclusive to the users with different levels of digital literacy. The kiosk incorporates unlike most web-based systems that are essentially text-driven:

- **Speech-to-Text (STT):** Records and transcribes the speech of the user in real-time.
- **Text-to-Speech (TTS):** This converts the system responses to sounding voice.

Such two-way communication is necessary in a high-traffic and multilingual and accessibility-sensitive place like airports, railway stations, and hospitals[22].

1.5. Embedded Recommendation Systems

The patent includes a real-time recommendation engine that personalizes the interaction with the use of past history, session behaviour and context. The system of the kiosk capitalizes on:

- History tracking of the user
- Content-based logic/ collaborative filtering
- Suggestions adjustment in real-time

The ability to make offers that are relevant to the individual, or to dynamically match the products to the individuals is especially useful in retail and banking environments where conversion and cross-sell opportunities can be increased.

II.APPLICATIONS ACROSS INDUSTRIES

The modular software architecture and hardware-software interconnection make AI-based chatbot kiosks extremely versatile and adaptable in the broad spectrum of industries[23]. Their applicability in the following areas is evidenced by the insights gathered in recent studies in the following areas:

Retail

Chatbot kiosks are used in retail stores as smart customer service assistants, to assist users with: Real time inventory checks; Individual product suggestions; Touchless buying and checkout assistance

Such features lead to a decrease in shopping cart abandonment and customer conversion rates, which goes between 17% and 22%. These kiosks serve to fill the divide between online and in-store shopping by taking the capabilities of intelligent commerce out into the store.

Banking

Chatbot kiosks are useful solutions to banks as they automate the most commonly demanded services which include:

- Inquiries of balance and transactions
- Submissions of forms
- The creation of service tickets
- The statement is issued on print basis

They are especially useful in branch offices that have fewer employees, e.g. in the rural or semi-urban setting, where they can easily process routine transactions and enhance the overall quality of service.

Public Services and Healthcare

In government buildings and hospitals, chatbots terminals can make simple things like [24]:

- Scheduling of appointment
- Queue and flow control
- Payments of bills
- Reservation of tickets to the public services

Such kiosks enhance throughput, reduce human error and are operational 24/7 even in unmanned or after-hours operations. This independence renders them best suited to be used in busy locations like outpatient departments, transport terminals, and the centres of public utilities.

Quantitative performance measures in terms of effectiveness of such chatbot systems in practical application are summarized in the table below:

Table 4: Chatbot Performance Metrics in Service Sectors[25]

Metric	Value	Implication
Average Response Time	4.4 seconds	Enables quick user interactions, critical in high-throughput environments
Customer Satisfaction	86.6%	Reflects high acceptance and trust among users
Task Automation Rate	79%	Highlights the kiosk's ability to handle service tasks with minimal human input

Such measures highlight the stability and expandability of chatbot kiosks in front-end industries, which have great advantages in terms of service and convenience of use.

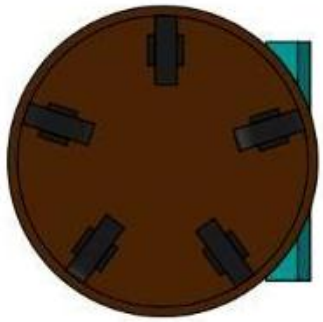

Figure 5: Close-up of Omni-Directional Wheel Base for 360° Mobility

This mechanical addition, illustrated allows the kiosk to spin on its axis and change position in indoor premises[26]. This is essential in intelligent deployment in dynamic places such as banking halls, shopping malls, events, and service counters, where the pattern of traffic is not always the same. The 360-degree movement guarantees best positioning and re-positioning without lifting and re-setting by the hands.

III.USER INTERACTION AND UX DESIGN

The main factor in the success of AI chatbot kiosks is user interaction and experience, the design decisions of which affect usability, engagement, and overall satisfaction with different user groups directly[27].

UX Drivers

The success of any AI-driven kiosk is mostly dependent on its user interface and the general quality of interaction it provides. Three major aspects have been continuously cited as influencing user acceptance:

- **Ease of Use:** 85 percent of respondents preferred systems that are user-friendly, not too complicated and need little learning. A simplified interface is a direct factor to user confidence and involvement.
- **Fast and Timely Response:** 78 percent of the respondents indicated that fast and quick response is very essential in sustaining satisfaction when talking to one another particularly when getting transactions done or when seeking assistance.
- **Hybrid Support Systems:** The hybrid solutions that incorporate AI automation and optional human fall back were also found to be consistently higher on user satisfaction, at an average of 4.5 out of 5. This versatility is particularly relevant in complicated or emotionally sensitive situations[28].

In addition, further technical reviews also focus on:

- **NLP Accuracy:** NLP accuracy was rated at 4.6 to 4.8 out of 5 by users in the banking, retail, and healthcare industries, which indicates such a high level of trust in the system.
- **Multilingual Abilities:** The multilanguage support is very important in enhancing accessibility and inclusivity, especially in multilingual communities. It enables users to communicate with ease using their local languages, improving usage among demographics.

These conclusions support the need to create kiosk systems with responsive, intelligent, and context-aware interactions, so that the user does not only finish their task in an efficient manner, but also has a positive experience of the service they were provided with[29].

Figure 6: Rotating Camera Mechanism for Face/User Detection

Such patented feature demonstrates how a servo-assisted camera mount with the ability to track a face in real-time can be incorporated. The design increases:

- **Personalization:** Kiosk greets the user by recognizing the face orientation.
- **Authentication:** Allows secure access or initiation of transactions using face ID.
- **Dynamic Interaction:** Modifies the inter-action view or voice output direction depending on the physical position of the user.

The kiosk increases the bar of multimodal user interaction in physical service systems by incorporating visual intelligence to the voice/text modalities[30].

Implications for Kiosk Design

Based on the user studies, the UX design recommendations to be implemented in order to deploy effective AI chatbot kiosks are as follows[31]:

- **Multimodal Interface:** A mix of a touchscreen, voice input/output, and visual tracking makes the experience smooth and accessible to different users such as differently-abled or elderly.
- **Conversational Responsiveness:** Use low-latency AI models (e.g., fine-tuned BERT or T5) to respond quickly.
- **Human Escalation:** Provide fall-back to live agent through voice/video bridge when complex or sensitive queries.
- **Adaptive Layouts:** Employ responsive UI designs using the user behaviour metrics which can be received through the current log and the previous session analytics.

IV.BUSINESS VALUE AND MARKET TRENDS

The implementation of AI-enabled chatbot kiosk has significant strategic and operational advantages to industries:

- **Operational Efficiency:** Chatbot-based kiosks have shown automation levels of up to 79 percent, which has significantly lowered the need to use human staff[32]. This allows 24-hour, 7-day a week service delivery even at off-peak hours or at stations with few staffs.
- **Customer Loyalty & Satisfaction:** Customer satisfaction rates are reported to be high even surpassing 86% where the kiosks provide timely and personalized responses. The ease of use, fast and smooth interactions are some of the factors that users value and which help build repeat use and brand trust.
- **Data-Driven Insights:** Each voice, text or touch interaction with the kiosk provides useful data[33]. This data is input into analytics systems that assist organizations in making more accurate inventory planning, customer service plans, and promotional campaigns.

Such benefits are consistent with wider market forces as companies are looking to integrate physical and digital touchpoints into a seamless omnichannel experience. Kiosks powered by AI are the critical enablers of this transition, particularly as customers require smart and self-service alternatives that replicate online comfort in the real world.

Market Evolution & Trends

The transition to the physical implementation of kiosks with chatbots points to the future of mixed reality of the physical and the digital world[34]:

- **Retail Transformation:** The in-store kiosks are now turning into digital assistants- they assist in product discovery, transact, and gather feedback.
- **Smart Cities & Public Infrastructure:** Urban implementations are using kiosks in parking, transit, civic information and e-governance.
- **Healthcare Access Points:** In hospitals and clinics, automated kiosks are making it easier to triage patients, make appointments and ask wellness questions.

Moreover, the latest tendencies show that the emotionally intelligent AI, on-device federated learning, and 5G-powered real-time cloud synchronization are gaining momentum, all of which will improve the next-generation chatbot kiosk.

IMPLEMENTATION CHALLENGES AND SCALABILITY

AI-powered chatbot kiosks are beneficial and interesting, but real-world deployment is difficult. These technical, operational, and organizational constraints affect deployment success and scalability in the short and long term[35].

→ **Integration complexity:** Integrating kiosk systems with existing infrastructures is challenging. Banking, healthcare, and government use non-API-based legacy databases. Special middleware and extensive testing are needed to connect them to AI-driven kiosks, increasing costs, implementation time, and reliability.

→ **Measures of Success:** Kiosk performance demands broader measurements than standard digital platforms. Organizations must track conversation accuracy, user happiness, session abandonment, hardware availability, and ROI. Without adequate AI operations (AIOps) frameworks, tuning these KPIs is resource-intensive and challenging[36].

→ **Requirements and Safety Calculation:** Real-time NLP engines, voice modules, and recommendation systems require significant computation. Security is crucial since kiosks handle sensitive data like IDs and payments. Voice spoofing, hardware hacking, and data leaking are risks. Anti-tampering, multi-factor authentication, and encryption are mitigation methods.

→ **Scalability and Physical Maintenance:** Kiosks need ongoing hardware maintenance, including repairs, component replacement, and firmware updates, unlike digital systems[37]. Facilities, IT, and local service teams must collaborate to implement such units. Scalability requires a well-managed backend and local technical support.

V.FUTURE DIRECTIONS

With the development of AI and edge computing, chatbot kiosks will only be more intelligent and flexible. Emotion and sentiment-sensitive AI is one of the directions which allows kiosks to recognize frustration, confusion, or satisfaction through the analysis of voice, facial expression, and language[38]. This allows the system to adapt its responses on the fly-providing more human-like responses or passing on to human assistance when necessary. These abilities are particularly useful in such sensitive sectors as healthcare or financial services.

The other significant trend is the integration of Edge AI and federated learning, which will enable kiosks to handle data and individualize interactions at the local level without necessarily referring to the cloud[39]. This decreases latency, enhances resilience in areas of poor connectivity and protects user privacy

better, which is critical in industries such as banking and healthcare. In the future, chatbot kiosks will also become more integrated into smart cities and will not only be used as customer assistants but also as a source of general information, transport service, paying bills, and seeking emergency assistance[40]. They are highly flexible in their design and AI-powered backend, which enables them to personalize services to time, location or user requirements, making them central to the delivery of smooth, real-time experiences in the city.

VI.CONCLUSION

The AI-powered chatbot kiosks are an interesting combination of modern conversational AI, powerful NLP systems, and smart hardware, introducing personalized, real-time interactions into the physical service world. With the guidance of UK Patent 6380713 and backed by empirical evidence in the retail, banking, healthcare and public sectors, this review describes how these kiosks are used to promote efficiency in operations, customer satisfaction and the provision of services to a wider base. Nevertheless, despite the issues that surround the concept of integration, scalability, and data security, the future of emotion-aware NLP, edge computing, and federated learning is a bright one. With the increasing demand of seamless omnichannel interaction between businesses and the general population, AI-based chatbot kiosks are also emerging as revolutionary platforms that combine digital AI intelligence with the physical experience of users, making them a key element of the smart service delivery of the future.

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