

Artificial Intelligence-Based Solution Model for Real Estate Business and Entrepreneurial Operations: Case Study

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Abstract: Artificial Intelligence (AI) is a collection of algorithms, tools and solution models that offer entrepreneurs a platform for managing and systemising their SMEs and business operations. Recently, AI opened new venues for smart activities and cost-effective solutions, saving time and money for start-ups and established enterprises. Advanced AI tools use high-efficiency algorithms such as machine learning to assess markets, evaluate product and service prices, and reduce maintenance costs. AI has radically disturbed many industries and sectors, offering opportunities to and allowing entrepreneurs to innovate and develop smart solutions in a competitive market. However, this disruption presents new challenges for entrepreneurs in dealing with AI technologies and establishing their 'smart' businesses. Investing in AI requires proper planning and understanding of the risks and challenges of applying new technologies and tools. Therefore, entrepreneurs must acquire the necessary skills and build competent teams of talents or experts to support them in maximising their returns and minimising risks. This paper presents a real-life scenario about some of the challenges faced by business enterprises in general and property businesses in particular. An AI-based innovation model for a real estate business comprising six primary services: Data analysis and strategy, Finance, Legal, Property Development, Property management, and Facility management has been introduced. This paper covers some of the entrepreneurial activities and AI-based solutions developed to improve the quality of their operations, manage their business processes, and maintain effective service delivery. Generative AI or Gen AI has significantly impacted many impressive real-life applications, delivering real value to many sectors, including finance, real estate, business management, research and development (R&D) projects, and entrepreneurial operations. Gen AI uses machine learning and neural network algorithms trained using big data text, images, audio and video. This paper introduces the main Gen AI types and covers real-life examples of applying Gen AI techniques to property business problems. It presents our GPT-based AI-powered property consultant application that uses GPT to help property developers, investors, and professionals, offering them solutions to business challenges such as property design and conversion options. If necessary, the user prompts the application, which responds with options for possible solutions like design solutions or converting office buildings or commercial properties to multiple residential flats and houses.

Keywords: AI-based models for businesses and entrepreneurial operations, Gen AI, Automated services, Optimisation of business systems and processes

1. Introduction

AI is becoming essential for innovation and analysing extensive data from across areas of sectors, offering compelling predictive insights and developing efficient, cost-effective solutions for many industries; it undoubtedly will transform our lives. AI tools have been instrumental in business operations, enabling new developments in finance, market predictions, property development and investment, and forecasting. With the support of machine learning techniques and predictive analytics, AI technologies can gather and analyse large amounts of data, like market conditions and sales data, to predict prices, allowing businesses and professionals to make informed decisions and minimise risks. AI has revolutionised how we perform many activities, manage business operations, predict and detect disease, develop marketing and sales strategies, etc.; the possibilities are endless (Mollick, 2024). Figure 1 shows what the author believes the main features offered by AI solutions, as follows:

- Data Analytics: ability to analyse big data and learn of that data to perform exciting tasks
- Effectiveness: improve the quality of business operations
- Cost Reduction: keep business costs and expenses as minimal as possible
- Efficiency: ability to reduce the time required to complete business tasks and operational activities



Figure 1: Artificial Intelligence Features

Advanced AI models like Gen AI, a subset of Artificial Neural Networks (ANNs), can process and analyse data to generate new content or data such as natural language or video. This newly generated content is based on patterns Gen AI recognised and similar to the data they were trained on; hence, the name Generative AI. Gen AI tools use high-efficiency algorithms like machine learning to evaluate product and service prices and reduce maintenance costs. For example, ChatGPT can initiate communication with potential clients, start the negotiation process to learn about their needs, get basic information about their situation based on their prompts, and then assess the available resources and offer them cost-effective solutions (Erne, 2023).

According to Forbes, AI is expected to grow 37.3% from 2023 to 2030, reflecting the rising impact of AI technologies in optimising business operations. About 25% of businesses adopt AI to address labour shortages and offer compensation for the lack of qualified employees. Furthermore, 77% of employees are concerned about losing their jobs because of the introduction of AI in 2024, showing a widespread concern among the majority of the workforce. However, AI is projected to introduce about 97 million new job opportunities, countering the job loss concerns. The impact of AI could reach 400 million workers worldwide, affecting around 15% of the global workforce.

2. Literature Review

Although Gen AI is considered by many as a game changer that is capable of showing interesting creativity and the ability to deliver real value in research and development (R&D), entrepreneurial operations and innovation, there is potential for more impressive content generation, design works, and scientific research. This offers good support to entrepreneurs and various enterprises across various industries to gain significant operational support; however, Gen AI needs to catch up in producing original ideas and content that human creative authors can make. Gen AI models are large algorithms trained on human intelligence using massive datasets, growing Internet content, and its expansion. These intelligent models can be tailored to specific sectors like education, finance, real estate, etc., offering disruptive applications across many industries.

Gen AI tools allow companies to provide high-quality services or develop enhanced products, opening new markets and clients. However, businesses must build pilot projects and plan for testing Gen AI tools and their

impact, which implies a lot of learning and education and making informed decisions. This should help them gain the necessary knowledge and build their understanding of how to deal with this extraordinary technology. It should also equip them with the right skills that will support them in achieving their business goals and objectives. Gen AI focuses on two major categories, Generative AI and Discriminative AI, as follows:

- Generative AI models analyse data to learn probability distributions of sub-categories within a dataset, which makes them capable of generating content similar to the training data. They offer content generation, create personalised content such as text, images, sound, and videos, and transform text into images or video, making Gen AI a significant model for producing creative content such as ChatGPT.
- Discriminative AI models are about summarisation and predictive analytics. They are based on ANN models that can classify data by identifying features. They offer exciting applications like speech recognition and analytics, AI-powered applications, document summarisation, chatbots, etc. Such smart tools can be trained on previous customer communications and interactions, creating exciting applications that support many businesses and organisations and offer quality customer service.

2.1 Gen AI Types

Gen AI has become an attractive tool for business intelligence, market assessment, and property legal matters, using online accessible data repository platforms to extract valuable information. For instance, property investors and developers became aware of the power of Gen AI and started using it to analyse the real estate market and for evaluation and assessment purposes. OpenAI tools such as ChatGPT use a large language model (LLM) designed to respond to user questions efficiently. LLM is an AI algorithm that uses deep neural network (DNN) learning techniques to process and summarise big data and predict new content. It is closely connected to Gen AI and designed to help generate content. This makes LLM capable of predicting the best output response textually or verbally to text-based queries or input questions. Different types of Gen AI (Abdullahi, 2024) (Almeida, 2024) can be distinguished based on the input and output content type, as shown in Figure 2 below.

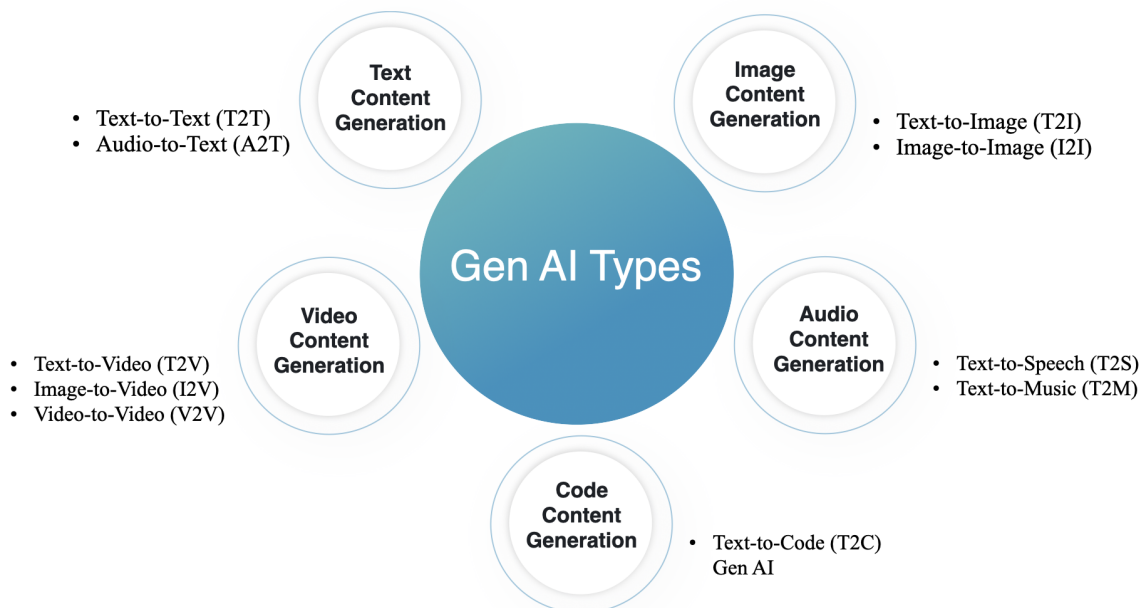


Figure 2: Gen AI Types

- Text Content Generation: Text AI generators are trained on large amounts of text from different sources, such as websites, e-books, and publications, to identify patterns and relationships between features in natural language. This makes them capable of generating new text such as reports, blogs, poetry, etc. There are two categories of text content generation, as follows:
 - Text-to-Text (T2T) Gen AI
 - Audio-to-Text (A2T) Gen AI
- Image Content Generation: This type of Gen AI analyses image datasets and their text descriptions and learns their features and concepts to create new images. There are two categories of image content generation, as follows:

- *Text-to-Image (T2I) Gen AI*
- *Image-to-Image (I2I) Gen AI*
- **Audio Content Generation:** Audio AI generators can analyse sounds and their metadata from different audio genres and associated text or song lyrics to learn features and patterns. There are two categories of audio content generation, as follows:
 - *Text-to-Speech (T2S) Gen AI*
 - *Text-to-Music (T2M) Gen AI*
- **Video Content Generation:** These generators can analyse visual, sound, and text content to learn how to generate new videos and apply effects if necessary. There are three categories of video content generation, as follows:
 - *Text-to-Video (T2V) Gen AI*
 - *Image-to-Video (I2V) Gen AI*
 - *Video-to-Video (V2V) Gen AI*
- **Code Content Generation:** These AI generators are trained from large, accessible code datasets for different programming languages. This helps identify patterns and language structure and then write or develop program code to perform various tasks, whether for producing new programs or debugging purposes. There is only one category of code content generation, as follows:
 - *Text-to-Code (T2C) Gen AI*

2.2 Gen AI Tools

Many Gen AI tools are currently available for businesses to help them with their operations and business challenges. These tools use LLM models trained on extensive data to learn how to generate human-like content, such as predicting the highly likely word to follow a previous one in T2T Gen AI. Figure 3 shows six tools: OpenAI's ChatGPT, Google's Gemini, Inflection's Pi, Anthropic's Claude, Microsoft's Copilot, and Adobe's Firefly (Kothari, 2024); Table 6.1 shows a brief comparison between all these tools (Kothari, 2024), (Abdullahi, 2024) (Almeida, 2024).

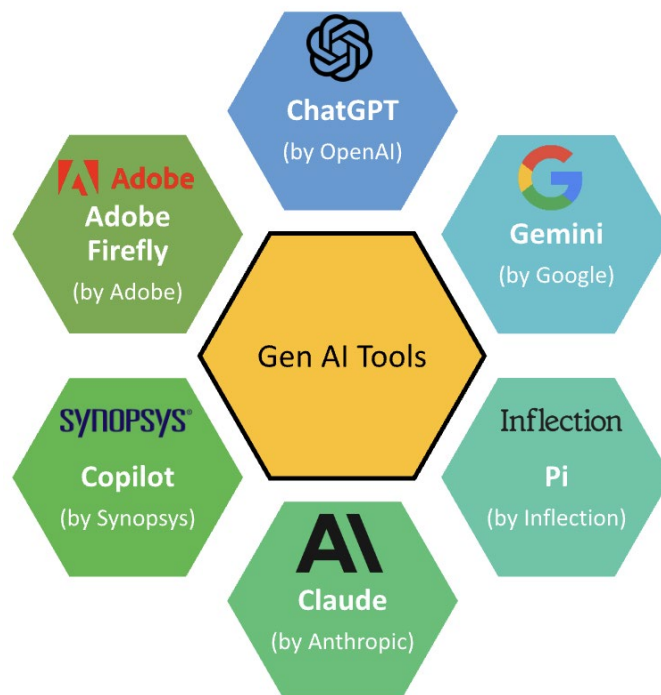


Figure 3: Gen AI Tools

Table 1: A Brief Comparison Between Gen AI Tools

Tool	Model	Code generation	Context window	Message limit
ChatGPT	GPT 4+ & Turbo	Yes	32k & 128k	40-80 per 3h
Gemini	Gemini Ultra	Yes	1 m	~ Limitless
Pi	Inflection-2.5	No	?	?
Claude	Claude 3 Opus	Yes	200k	100 per 8h
Copilot	GPT 4+	Yes	?	100 per day
Adobe Firtofly	Diffusion	Yes	1k	?

These tools use a large language model (LLM) to respond efficiently to user questions and use many resources to gather information, such as published research papers and articles, technical reports, social media, programming code, and online communications. These resources and LLM allow these tools to respond to users and offer helpful content using human-like smart AI functionalities. Therefore, communicating with Gen AI tools is essential to getting a helpful output or response to your query, such as an exciting image, useful video, or article. However, you must provide the Gen AI tool with the correct input or prompt, use the right words, structure requests correctly, and communicate clearly to receive the perfect response and desired information (Patel, 2024). For example, prompts instruct or ask ChatGPT or Google Gemini a question to generate a response in text, images, or both. ChatGPT can respond to customers' questions or queries, providing helpful information and efficient support, offering customers a superior experience and satisfaction. ChatGPT is a large AI-based natural language processing model, and its name ChatGPT combines 'Chat', which uses the AI chat feature used by chatbots, and 'GPT', which stands for Generative Pre-trained Transformer, an LLM.

Getting the best of Gen AI tools requires a proper understanding of how to instruct "prompt" those innovative tools to generate the results you are aiming for. It is not always guaranteed to receive the desired output; it is just about increasing the opportunity to get the desired results. Regardless of the content of your prompt, the way you structure and frame it would significantly improve the generated response and results. In other words, the quality of your prompt determines the quality of the tool's response. The better you write and frame your prompt, the better the output. Examples of valuable prompts will be introduced in the following sections, illustrating some techniques you must be aware of to produce well-framed prompts for Gen AIs.

With its intelligent features, the Internet has improved the real estate business regarding property market assessment, valuation, conveyancing, etc., but it has brought benefits and limitations. Bringing real estate businesses online helped interested customers check property prices, locations, and neighbourhoods. However, the Internet has limitations and cyber security challenges, threats, risks, and vulnerabilities. Many Internet and AI tools have become available to property businesses to speed up and simplify previously paid services that are often costly. Those tools cooperate to create an ecosystem that offers efficient and effective services to their customers. AI tools can help property investors and professionals like estate agents, letting agents assess the property market and improve their customers' experience (Fielden, 2024).

Many of these features and services were not possible ten years ago and were time-consuming and intensive. Today, we can look for a property and view it virtually; if we like it, we can offer our price, apply for a mortgage on the same website, and start purchasing the property on the same day. With such innovative online services, advertising and selling a property has become much easier and faster. They simplify and expedite the communication between buyers and sellers or tenants and landlords, thus saving time for all parties involved

(Mather, 2019). AI technology and online services resolve many complex problems and challenges impacting businesses, as follows:

- Keep them operating effectively and productively, delivering their services to their customers.
- Monitor operations and more measurability of results and completed tasks.
- Ensure agility and accountability to minimise errors
- Speed up activities and workflow and improve service support
- Minimise wastage in effort and time and avoid the use of ad hoc measures
- Develop a dynamic and efficient business that is capable of resolving its problems and challenges and able to change
- Better satisfaction of business members and employees
- Minimise the risks of human errors and make informed decisions

3. Methodology

AI has radically disturbed many industries and sectors, and the real estate sector is not an exception, offering opportunities to and allowing property business entrepreneurs and start-ups to innovate and develop intelligent solutions in a competitive market. However, this disruption presents new challenges for entrepreneurs in dealing with AI technologies and establishing their 'smart' businesses. AI tools such as machine learning can assess the property market, evaluate prices, and improve the customer experience. With the introduction of such tools, the role of real estate businesses such as asset management, buy-to-let companies, and letting agents or estate agents will develop and change. Figure 4 shows our AI-based innovation model for a real estate business comprising six primary services, as follows:

- **Data Analysis and Strategy:** Analysing the current property markets at different geographical locations and the demand and supply levels is essential in the real estate business. Applying AI mechanisms and its learning models can help predict future changes to market behaviour.
- **Finance:** Offer digital mortgage brokering, providing online access to capital and proposing different types of loans. Moreover, auto search tools for the best suitable mortgage products offer a comparison platform and options for borrowing beyond banks, providing an efficient, transparent mortgage/loan application process that speeds up lending. Furthermore, it helps find and close the best deals faster, eliminating intermediaries and reducing costs.
- **Legal:** Blockchain technology is a platform capable of processing smart contracts and managing and electronically signing property-related legal documents. It is a decentralised system capable of verifying identities using the personal digital key to authenticate and authorise a smart contract or transaction (Wu, B. and Wu, B., 2023). Using the blockchain and smart contracts can improve the contract management process, speed up a transaction process, ensure transparency and avoid extra costs. The blockchain can transfer and record transactions and real estate titles and makes background checks on all entities involved.
- **Property Development:** Digitally manage the development planning stage and develop the project life-cycle using smart tools such as Building Information Modelling (BIM). BIM can simulate the planning and development process, visualise all the milestones of construction projects, design buildings, estimate costs, and analyse them before construction.
- **Asset Management:** It is about ensuring the growth and success of the investment through the property's income generation and capital appreciation. AI tools can be used to monitor the property's performance, stay current with market trends, make critical decisions, and mitigate risk on behalf of the investors. This includes two main activities.
- *Property Management: Online marketplaces are used to find potential tenants; chatbots filter unqualified applicants, assess those qualified ones, select successful applicants, and use auto-filling tools to prepare tenancy agreements. This helps property managers properly manage their property's occupancy using cost-effective solutions and supports potential tenants in overcoming geographical barriers.*
- *Facility Management: The facility manager can use smart tools and applications to monitor and optimise efficiency, control costs, regulate property usage, and report to the property owner in real-time. This helps to optimise regular checks and routine maintenance, anticipate repairs, and respond to problems and breakdowns in the property.*



Figure 4: AI-based Real Estate Innovation Model

A Gen AI application using a feed-forward ANN model has been developed to help property investors and professionals develop appropriate real estate projects such as market analysis, commercial conversions, etc. The application has multiple built-in features using ChatGPT to interact with the backend model to analyse the user's input(s) and provide the necessary output(s). The following section details the application prototype and its main features.

We developed a Gen AI application prototype using a GPT, an ANN model that uses the Transformer Gen AI model, which can learn the context of the input data using feed-forward NNs, deciding the weights of the input data to determine the relationships between different parts of the input content. It is commonly used in natural language processing and AI applications like ChatGPT. The developed application is a GPT-based AI-powered property Consultant using ChatGPT to support property investors and professionals. Figure 5 shows four prompt options and an input field, allowing property developers, investors and professionals to use the application for various services. The application is designed to help them analyse properties, property locations and markets and obtain information about converting large properties into multiple flats and houses, as follows:

- Analyse any property market using SWOT (Strengths, Weaknesses, Opportunities, and Threats) and PESTEL (Political, Economic, Social, Technological, Environmental, and Legal) analysis.
- Identify supply and demand for residential properties in any city or country.
- Get information about a property use class and building conversion options.
- Design options for property conversion, such as commercial-to-residential conversion projects.

- Evaluate and optimise the property conversion design process to efficiently use a space, offering cost-effective solutions.

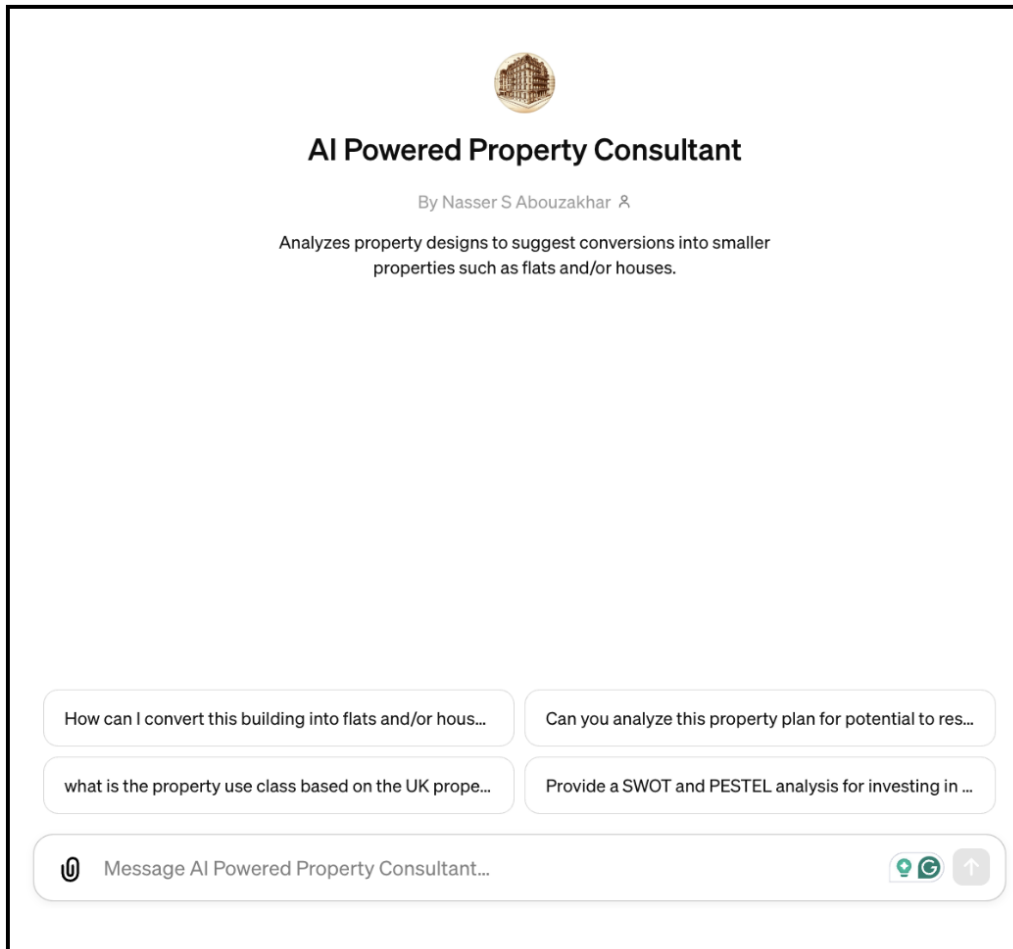
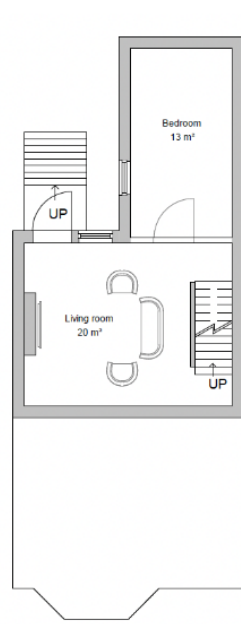


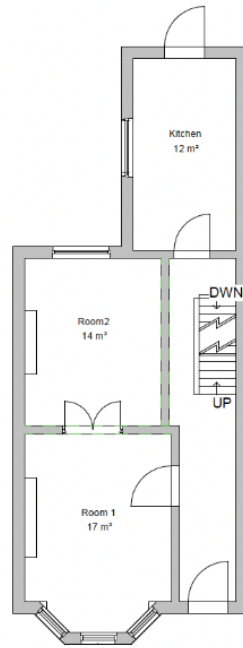
Figure 5: AI-Powered Property Consultant

Gen AI transforms how planners and developers approach business activities, offering practical tools to explore, experiment, and create innovative solutions. The application uses input parameters to offer its users innovative solutions and optimises the property conversion and design process regarding development time and renovation works. This makes the application capable of analysing each scenario option against the user's predefined criteria. The AI-powered property Consultant uses an iterative process supported by powerful Gen AI algorithms operating in the background, capable of proposing helpful solutions. Each suggested solution is analysed against predefined criteria such as building design, number of floors, area of the building or floor, etc., considering the building requirements and regulations.

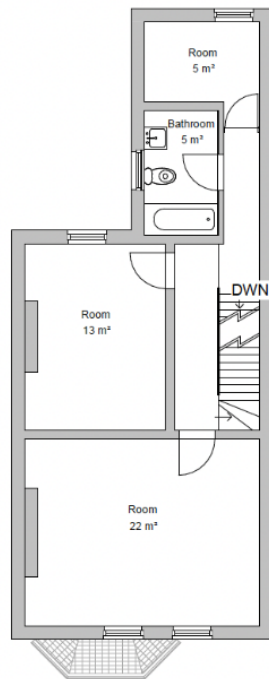
The application offers the user an incredible way to explore various design and property conversion possibilities, ensuring efficient use of the available resources and space and allowing the user to compare and contrast multiple designs and select the best option based on the desired output. This app can accept a property design plan, such as Figure 6, which shows a four-story residential building with a basement used as input to the application to provide a conversion option for this property into multiple flats. The application's proposed solution output is shown in Figure 7 (a), offering detailed design options for all the apartments at each property level. Figure 7 (b) shows the remaining part of the output, which includes extra suggestions from the application.



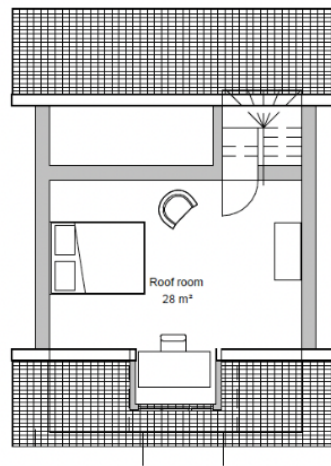
Prop. Basement
1 : 100



Ex. Level 0
1 : 100



Ex. Level 1
1 : 100



Ex. Roof room
1 : 100

Figure 6: Property plan



AI Powered Property Consultant

Thank you for providing the floor plans. Based on the layout provided, here are some suggestions for converting this building into flats:

Proposed Basement:

- The existing living room can be converted into an open-plan living/kitchen/dining area.
- The current bedroom could be maintained as is, or if there's enough natural light, potentially split into two smaller bedrooms.

Existing Level 0:

- Room 1 can be an open-plan living/kitchen/dining area.
- Room 2 can remain as a bedroom.
- The kitchen area could be converted into a bathroom if the existing one isn't sufficient.

Existing Level 1:

- The largest room (22 sqm) can be converted into an open-plan living/kitchen/dining area.
- The 13 sqm room can be kept as a bedroom, or if there's another space for a kitchen, it could be split into two smaller rooms.
- The smallest room can be an office or a small bedroom.

Existing Roof Room:

- This could make a spacious studio flat with an open-plan living/kitchen/dining area and a separated sleeping area.

Figure 7 (a): The generated output

General Suggestions:

- Ensure each flat has at least one source of natural light and ventilation.
- All flats should have a bathroom with a toilet, sink, and bath or shower.
- Kitchens should be designed with efficiency in mind, possibly with integrated appliances to save space.
- Consider soundproofing between floors to improve the quality of living for residents.
- Compliance with fire safety regulations is critical; ensure there are sufficient escape routes and fire-resistant materials.
- Check if a change of use permission is required from residential to multiple dwellings.
- Make sure to comply with the minimum space standards and natural light requirements for new dwellings.
- Consider the accessibility requirements for all residents, including those with mobility issues.

These are preliminary suggestions and would need to be reviewed by an architect and in accordance with local building regulations and planning permissions. Always consult with a professional to ensure all conversions are legal and safe.

Figure 7 (b): The generated output

4. Discussion

AI has disturbed the real estate industry, providing opportunities for investors and entrepreneurs to develop smart systems that help them deal with various business challenges, such as market analysis, cost management, customer experience, etc. The role of the developed AI-Powered Property Consultant application prototype is to support its users in terms of analysing property markets at different geographical areas including the demand and supply levels and offering business opportunities for development strategies such as commercial conversions. Such support is essential for various property businesses to find the best deals and minimising costs. The application prototype can play a major role in business growth and investment success, staying with market trends, mitigating risks and making informed decisions about property development and significant conversion projects.

The developed application prototype can support property developers, investors and professionals in developing successful property projects using ChatGPT features. The application analyses the users' prompts and provides the results as requested according to relevant property markets, locations and local situations, providing SWOT and PESTEL analysis. The necessary details for property conversions, such as use classes, design and conversion options, can also be offered. The application can provide cost-effective development projects and evaluate the process effectively.

5. Conclusion

AI has radically disturbed many industries and sectors, offering opportunities to and allowing entrepreneurs to innovate and develop intelligent solutions in a competitive market. AI opened new venues for smart activities and cost-effective solutions, saving time and money for start-ups and established enterprises. Advanced AI tools use high-efficiency algorithms such as machine learning to assess markets, filter unqualified clients/applicants, evaluate product and service prices, and reduce maintenance costs. An AI-based innovation model for a real estate business comprising six primary services: Data analysis and strategy, Finance, Legal, Property Development, Property management, and Facility management has been introduced. This paper introduced a real-life scenario about some challenges and the ongoing change in the property business landscape and operations. It also covers some of the entrepreneurial activities and AI-based solutions implemented to improve the quality of its operations, manage property business processes, and maintain effective service delivery.

Gen AI has significantly impacted many real-life applications, such as content generation, design works, scientific research, and experimentation. It uses machine learning and ANN algorithms trained using big data text, images, audio and video. This paper covered the main Gen AI types, including the main tools of Gen AI, and presented some real-life scenarios of applying Gen AI techniques to property business problems. A GPT-based AI-powered property Consultant application has been introduced. This application can support property developers, investors, and professionals by offering solutions to various design and property conversion problems. It can analyse user prompts and property plans and provide options for converting office buildings or commercial properties to multiple flats and houses.

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