Digital Government Authority
هيئة الحكومة الرقمية

Artificial Intelligence Agents & Large Action Models in Digital Government

13 January, 2025
Document Type: Brief Study
Document Classification: Public
Issue No.: 1.0

Contents

1. Introduction

Artificial Intelligence (AI) has advanced significantly in recent years, transforming our interactions with technology and capturing global attention with its capabilities and potential. A particularly exciting development in this field is Generative AI, a branch that enables machines to create new content—such as text and images—based on patterns and data they have learned. Central to this advancement are Large Language Models (LLMs), which are sophisticated systems that allow AI to comprehend user prompts and generate human-like text by processing vast amounts of data.

Generative AI, especially through LLMs, has introduced new possibilities, making AI more adaptable and capable of handling a broader range of tasks. However, these models have primarily been used for generating content like text, images, videos, and sounds, along with processing and understanding language. To move beyond these limitations, researchers have developed Advanced AI Agents powered by Generative AI, also known as Large Action Models (LAMs). These AI Agents not only generate text but also execute complex actions, enabling AI systems to autonomously perform tasks in both digital and physical environments.

> **This study explores cutting-edge Advanced AI Agents, specifically Large Action Models (LAMs), and their potential to transform the delivery of digital government services in Saudi Arabia.**

What are Large Action Models (LAMs)?

While current AI systems excel at processing various data types—such as text, images, video, and audio—Large Action Models (LAMs), which are advanced AI agents, are designed to respond to human commands by acting upon them directly within computer applications. This capability allows LAMs not only to process information but also to mimic human actions and execute complex tasks, making them highly versatile tools for both digital and real-world applications.

Advanced AI agents like LAMs bridge the gap between existing AI systems, which require significant supervision and are limited to specific tasks, and future systems that can operate autonomously, manage complex goals, communicate with one another, and adapt to changing conditions. By understanding and replicating human actions, LAMs can significantly enhance user experiences, making interactions more intuitive and efficient.

In essence, LAMs and other advanced AI agents enable AI not just to think and understand but to act—transforming user prompts into actions and integrating AI more deeply into our daily lives.

Achieving this level of innovation has required several breakthroughs and groundbreaking developments throughout AI's rich history, and the emergence of LAMs represents a significant step in a new direction. As this is an emerging field, it presents a unique opportunity for the Kingdom of Saudi Arabia (KSA) to encourage and enable the adoption of Large Action Models (LAMs) and position itself as a leader in leveraging advanced AI technologies to transform government services and drive innovation.

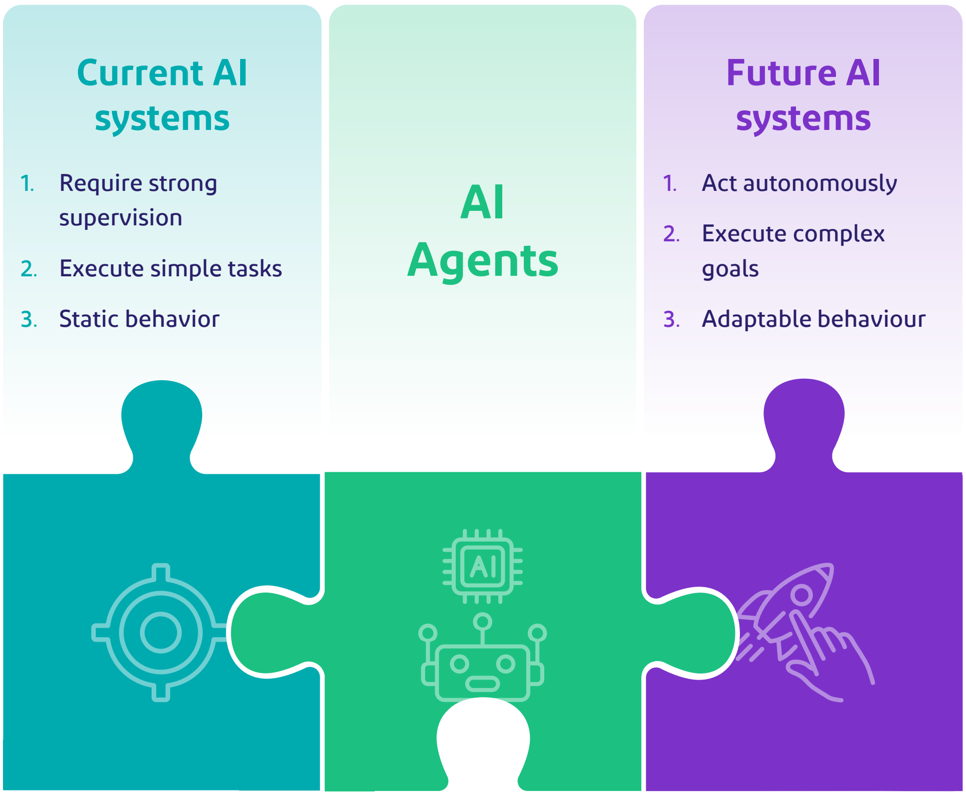


Figure 1: Closing the AI Agency Gap [1]

2. History of AI Leading to Large Action Models

The origins of Large Action Models (LAMs) can be traced back to foundational concepts in decision theory, game theory, and early developments in Artificial Intelligence (AI). Decision theory focuses on making optimal choices under uncertainty based on probability[2], while game theory studies strategic planning in competitive environments by considering the actions and decisions of others[3]. As AI evolved, these principles were integrated into more sophisticated models capable of understanding and predicting human behavior.

Over time, advancements in algorithms and machine learning techniques led to the development of Large Action Models, which can model complex user interactions with high accuracy and interpretability. This represents a significant evolution in AI capabilities.

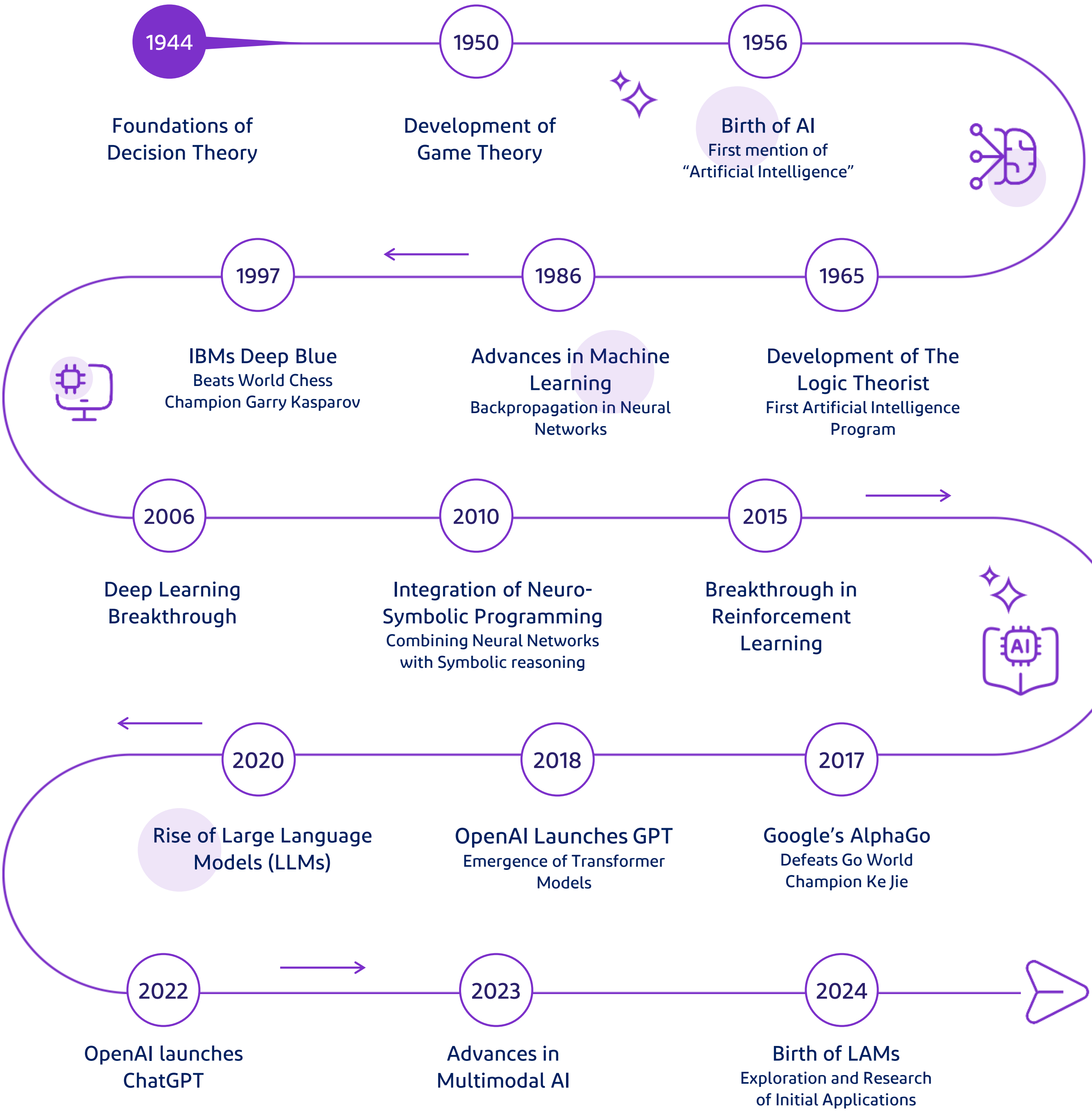


Figure 2: History of AI Agents (Timeline)

Since its inception, Artificial Intelligence (AI) has undergone remarkable advancements, evolving from a theoretical concept into a transformative technology shaping various aspects of modern life. The term "Artificial Intelligence" was first introduced during the 1956 Dartmouth Summer Research Project[4], officially marking the establishment of AI as a distinct field of study. This foundational moment paved the way for significant milestones: the creation of ELIZA[5], one of the earliest chatbots simulating human-like conversation; The Logic Theorist[6], the first AI program; IBM's Deep Blue[7], which made history in 1997 by defeating world chess champion Garry Kasparov; and Google's AlphaGo, which surpassed world Go champion Ke Jie in 2017[8].

In the 21st century, AI has evolved from narrow, task-specific capabilities to more advanced systems that can understand and respond in natural language. OpenAI's launch of the GPT model in 2018 led to the development of Large Language Models (LLMs) like ChatGPT, enabling users to have sophisticated conversations with AI. As of 2024, advancements in multimodal AI have enhanced AI's understanding and interaction capabilities.

To provide a comprehensive analysis, it is essential to distinguish between Large Language Models (LLMs) and Large Action Models (LAMs). LLMs are distinguished by their extensive training on diverse datasets, allowing for nuanced and context-aware responses across a wide range of topics. In contrast, task-specific models are designed and optimized for particular functions or domains. This differentiation will be further examined in the subsequent section to clarify their respective applications and strengths.

KAUST's groundbreaking 2023 research, published at NeurIPS, introduced the CAMEL project, where multiple AI agents collaborate autonomously to solve tasks, highlighting Saudi Arabia's active contribution to global AI advancements.[9]

3. The Difference Between LLMs & LAMs

This section provides a detailed comparison between Large Language Models (LLMs) and Large Action Models (LAMs), highlighting their key capabilities. It contrasts these advanced models with conventional AI systems and examines their roles in advancing toward Artificial General Intelligence (AGI).

Conventional AI focuses on task-specific solutions built on predefined rules and algorithms. While it excels at solving specific problems within well-defined parameters, it lacks adaptability and general problem-solving abilities.

Large Language Models (LLMs) leverage advanced linguistic capabilities to generate coherent and contextually relevant text by recognizing patterns in vast datasets. However, its reasoning is typically limited to single-step processes based on language patterns, and it may not be optimized for task execution.

In contrast, Large Action Models (LAMs), also known as advanced AI agents, represent a significant advancement in AI. They combine linguistic understanding with functional capabilities, enabling complex reasoning, strategic planning, and autonomous task execution. By integrating neural networks with symbolic reasoning—a way of solving problems by using symbols, like numbers or words, and following set rules to find answers or make decisions—LAMs apply both textual and external contexts, making them ideal for autonomous applications requiring strategic planning and bringing us closer to AGI.

Large Action Models (LAMs) represent a significant advancement in AI. They combine linguistic understanding with functional capabilities, enabling complex reasoning, strategic planning, and autonomous task execution.

The differences between conventional AI, LLMs, and LAMs are detailed in the table below.

Dimension	Conventional AI	LLMs	LAMs
Core Function	Task-specific solutions based on pre-defined rules and algorithms	Language understanding and generation	Language understanding, generation, complex reasoning and actions
Primary Strength	Efficiency in solving specific problems within well-defined parameters	Formal linguistic capabilities, generating coherent and contextually relevant text	Advanced linguistic capabilities (Formal + Functional) with multi-hop thinking and generating actionable outputs
Reasoning Ability	Limited reasoning, operates based on programmed logic without adaptability	Limited to single-step reasoning based on language patterns	Advanced multi-step reasoning, capable of handling complex, interconnected tasks & goals
Contextual Understand -ing	Limited contextual understanding, relies on pre-defined data and scenarios	Good at understanding context within text, but limited in applying external knowledge	Superior in understanding and applying both textual and external context
Problem-Solving	Effective in specific, narrow domains but lacks general problem-solving capability	Can provide information and answer questions based on existing data	Can propose solutions, strategic planning, make reasoned decisions and provide act autonomously
Learning Approach	Based on fixed algorithms and rules, limited learning capabilities	Primarily based on pattern recognition from large datasets	Integrates pattern recognition, self-assessment & improving with advanced learning algorithms
Application Scope	Ideal for repetitive tasks, automation in manufacturing, data analysis in constrained environments	Suitable for tasks like content creation, simple Q&A, translations, chatbots etc.	Building autonomous applications that require strategic planning, advanced research, and specialized task execution

Conventional AI, LLMs, and LAMs mark sequential steps toward Artificial General Intelligence (AGI), which is considered the pinnacle of AI Technology. As AI evolves from Simple Reflex Agents to Learning Agents, including Large Action Models, its capabilities expand significantly. The next section will explore these advancements in AI agents, highlighting their increasing complexity and functionality.

4. LAMs and the Advancement of AI Agents

It is important to recognize that while basic AI agents have been in use for many years, the advent of Generative AI with natural-language capabilities has opened up new possibilities. AI agents vary in their levels of sophistication, and for straightforward objectives, simpler agents may be preferable to avoid unnecessary computational complexity. Currently, there are five main types of AI agents, ranging from the simplest to the most advanced, which will be detailed below in order of increasing complexity. [10]

1. Simple reflex agents

Simple reflex agents are the most basic form of agents, they act based solely on their current perceptions and predefined rules, without memory or learning capabilities. For instance, a thermostat adjusting temperature based on current room readings exemplifies a simple reflex agent. These agents work well in predictable and fully observable environments but struggle in complex or unfamiliar situations.

2. Model-based reflex agents

Model-based reflex agents use their current perceptions and an internal memory to maintain a model of the world, enabling them to make decisions even in partially observable environments. For example, a robotic vacuum cleaner that remembers obstacles and adjusts its cleaning path demonstrates this type of agent. While more versatile than simple reflex agents, they still rely on predefined rules.

3. Goal-based agents

Goal-based agents operate with a defined objective and plan actions to achieve it. For instance, a GPS navigation system that calculates routes to a destination showcases a goal-based agent. These agents are more effective than reflex agents in dynamic environments as they consider future actions to reach their goals.

4. Utility-based agents

Utility-based agents go beyond achieving goals by optimizing the overall utility, such as time efficiency or resource usage. For example, a ride-sharing app that balances passenger pickup time and driver availability embodies this agent type. These agents are ideal for scenarios requiring trade-offs and prioritization of optimal outcomes.

5. Learning agents

Learning agents improve over time by adapting based on experience. They have four components:

Learning Element:

Enhances knowledge through interaction with the environment.

Critic:

Evaluates performance to provide feedback.

Performance Element:

Executes actions.

Problem Generator:

Suggests exploratory actions to discover new strategies.

An example is a personal assistant app that learns user preferences over time to provide better recommendations. These agents can function as utility-based or goal-based agents while continuously evolving in diverse environments.

Large Action Models (LAMs)

Integrates the advanced reasoning, planning, and execution capabilities previously discussed, positioning it to become the most advanced form of AI Agent in the future. For more details on the existing types of AI Agents, refer to Appendix 2.

With advancements in AI agents, AI capabilities have expanded significantly. This sets the stage for exploring the significance of Large Action Models (LAMs) in specific contexts. In Saudi Arabia, LAMs are pivotal for driving innovation and meeting strategic objectives. The following section will examine their impact on various sectors and their alignment with national goals.

5. Significance of Large Action Models in Saudi Arabia

As outlined in the previous section, AI agents go beyond simple text generation by incorporating advanced reasoning and action capabilities. They can plan solutions for complex problems, evaluate their effectiveness, and execute them accordingly. The key benefits of Large Action Models (LAMs) lie in their ability to autonomously manage tasks, seamlessly interact with applications and other AI agents, and adapt to diverse scenarios—all while providing a simple, intuitive interface that allows users to engage via natural language prompts.

In the context of Saudi Arabia, deploying LAMs and other advanced AI agents can significantly impact various sectors. Broadly, the application of LAMs has the potential to support and advance all pillars of the National Digital Government Strategy (NDGS).

National Digital Government Strategy (NDGS) Pillars

Satisfied Citizens

Provide seamless and effective government services to all beneficiaries.

Enabled Business

Improve ease of doing business within Saudi Arabia

Effective Government

Empower the government by adopting unified business models

Efficient Investment

Optimize ICT investments for efficiency, compliance, and sustainability

Regulated Ecosystem

Provide policy and legislation guidance and review

Expedited Transformation

Enable the entire digital government transformation strategy

For citizens

LAMS can offer 24/7 personalized support for government services, handling high volumes of citizen interactions. By scaling up as needed, these systems can manage tasks such as renewing licenses through predictive automation. This approach reduces wait times, minimizes errors, and simplifies processes, ultimately creating a more seamless and efficient experience for citizens.

For businesses

LAMs can automate tasks like regulatory compliance, supply chain management, and customer service, reducing manual effort and errors. By integrating with business systems, they provide real-time insights that enhance operational efficiency, market responsiveness, and decision-making, giving businesses a competitive edge.

For governance

LAMs can streamline key internal processes like procurement, infrastructure maintenance, public healthcare management, and audit by automating tasks, predicting needs, and optimizing resource allocation. This enhances transparency, reduces errors, and ensures regulatory compliance, leading to more efficient public administration and improved service delivery.

For investment

LAMs can provide data-driven insights to optimize ROI, reduce costs, and manage risks. By analyzing trends and resource allocation, they help governments focus on high-impact projects and make informed decisions, resulting in more efficient financial management and sustainable public sector investments.

For regulation

LAMs can streamline policy and legislative reviews by automating the analysis of regulations, ensuring alignment with national goals, and maintaining compliance with international standards. This speeds up legislative updates, improves accuracy in policy decisions, and fosters a more responsive regulatory environment.

For expedited transformation

Overall, these advancements can expedite Saudi's digital transformation. By leveraging LAMs, Saudi Arabia's government can create a more connected, regulated, efficient, and innovative ecosystem. This acceleration supports the implementation of the NDGS, enhances collaboration between the public and private sectors, and drives economic growth through better digital infrastructure and services.

What roles can Advanced AI Agents like LAMs take in Saudi Arabia’s Digital Government?

01 Customer Service Officer

Large Action Models (LAMs) and other advanced AI agents, serving as virtual customer service officers, can significantly enhance the efficiency of Saudi government portals such as Absher and Tawakkalna. For example, instead of citizens navigating multiple menus to upload a document manually, the LAM agent could prompt the user directly, asking, “Would you like to upload your ID now?” and guide them step-by-step to complete the process seamlessly. This innovation reduces wait times and improves the overall citizen experience by offering prompt and personalized assistance.

02 Regulatory Compliance Officer

LAMs and other advanced AI agents can automate the monitoring of regulatory compliance across various sectors, including financial services, healthcare, and energy. These agents can review regulatory submissions, detect discrepancies, and flag non-compliance issues in real-time. They can also assist in drafting compliance reports, helping businesses align more efficiently with Saudi regulations. By reducing bureaucratic inefficiencies, this automation supports Effective Government and Enabled Business pillars, leading to a more streamlined and responsive regulatory environment.

03 Education and Training Coordinator

LAMs and other advanced AI agents can enhance personalized learning by tailoring educational content to meet students' specific needs. For example, students complete a short quiz, and the AI generates a custom learning path. On a broader scale, citizens can input career goals or skills they'd like to improve, allowing the system to recommend training programs aligned with labor market needs. This supports Vision 2030’s human capital development goals by fostering continuous learning and upskilling, ultimately contributing to economic growth and competitiveness.

04 Judicial Assistant or Legal Advisor

Large Action Models (LAMs) and other advanced AI agents can significantly enhance judicial processes by automating routine legal tasks such as reviewing case files, conducting legal research, and preparing initial drafts of legal documents. In the Saudi judicial system, the implementation of these agents could reduce the workload of legal professionals and improve case management efficiency. This advancement aligns with ongoing e-Government initiatives and legal digitalization efforts, supporting the broader legal reforms underway in Saudi Arabia.

05 Infrastructure Maintenance Officer

LAMs can predict, monitor, and initiate maintenance as needed for critical infrastructure such as roads and bridges by analyzing sensor data. This proactive approach to maintenance reduces downtime and optimizes government spending by addressing issues before they escalate into major problems.

06 Public Financial Manager

Large Action Models and other advanced AI agents can manage government budgets more effectively by providing predictive analytics on spending patterns, revenue forecasts, and potential cost overruns. They can optimize resource allocation in real-time, ensuring that government projects and public services remain on budget and on schedule. This capability supports the Enabled Business and Effective Government pillars of national strategic frameworks.

07 Environmental Protection Officer

Advanced AI agents can monitor air and water quality, detect pollution levels, and ensure compliance with environmental regulations. By performing these functions, they contribute to the objectives of the Saudi Green Initiative and NEOM's sustainable development goals, playing a crucial role in promoting environmental sustainability.

08 Smart City Manager

LAMs and other advanced AI agents could serve as the backbone for smart city initiatives by coordinating traffic management systems, energy consumption, waste management, and public safety. In cities like NEOM and Riyadh, AI systems can assist in optimizing resource distribution, ensuring the smooth operation of smart infrastructure, and providing predictive analytics to city planners for informed decision-making. This role also facilitates environmental sustainability, a critical objective within Vision 2030.

While the preceding examples highlight some of the roles that Large Action Models (LAMs) can perform, their potential applications are expected to expand considerably as the technology matures and facilitates seamless communication among multiple AI agents. These advancements also bring several opportunities, which are explored in greater detail in the following section.

6. Recommendations for Government Entities to Adopt LAMs

Large Action Models (LAMs) offer transformative capabilities that can greatly enhance the efficiency and effectiveness of public sector operations in Saudi Arabia. By leveraging advanced AI, LAMs automate complex tasks, improve decision-making processes, and deliver personalized public services.

> These models support the Kingdom's strategic goals under Vision 2030, fostering a more innovative, efficient, and citizen-centric governance framework. They streamline government operations, reduce operational costs, and improve responsiveness to citizen needs, contributing to a thriving economy and vibrant society.

While is it true that adoption of Large Action Models (LAMs) in the public sector is still in its early stages, there are several recommendations for government entities to explore and implement this technology:

Research and Development

As LAMs are still emerging, fostering local and international research collaborations will accelerate their development through shared knowledge, standards, and innovations. Highlighting efforts like KAUST's CAMEL project, which led to a successful startup[11], demonstrates how academic research can directly drive industry growth, reinforcing the importance of investing in LAM research.

Impact
Positions Saudi Arabia as a global leader in AI, benefiting from international knowledge exchange while promoting success stories such as CAMEL, setting global benchmarks for AI deployment.

Rationale
Combining international cooperation with local successes like the CAMEL project strengthens Saudi Arabia's technological capabilities and aligns with strategic goals by fostering innovation and attracting investment.

Strategic Partnerships

The Kingdom should encourage collaboration between government entities and private sector companies to leverage shared expertise and resources, which can also accelerate the adoption of LAMs

Impact

Accelerates the development and deployment of LAMs through shared knowledge and innovation, driving technological advancements and economic growth.

Rationale

Collaborative efforts with technology leaders can provide access to cutting-edge resources and expertise, facilitating the efficient implementation and scaling of LAMs.

Training and Education

As LAMs are still emerging, there is a shortage of skilled professionals who can develop and implement this technology. Public sector organizations can help by investing in training and education programs for employees and fostering the development of LAM skills more broadly.

Impact

Enhances the workforce’s ability to utilize LAM technologies efficiently, fostering innovation and improving service delivery.

Rationale

Educating government personnel is vital for the successful adoption and utilization of advanced technologies, ensuring that investments in AI yield the intended improvements in service quality and governance.

Proof of Concept Projects

Public sector organizations can implement proof of concept projects to test LAMs in specific applications. Such prototypes or pilot projects help identify the potential benefits and limitations of LAMs in real-world scenarios, guiding the development of more advanced applications.

Impact

Validates the capabilities of LAMs in practical applications, mitigating risks before full-scale deployment and providing insights for refinement.

Rationale

Proof of concept projects allow for the identification of strengths and weaknesses, offering critical insights that inform better decision-making and further development.

Increase Investment

Allocate significant funding to develop and deploy LAMs across government sectors, ensuring strong infrastructure, research support, and scalability for future needs.

Impact

Secures the financial backing necessary for widespread adoption and innovation in LAMs, enabling Saudi Arabia to build robust infrastructure and stay ahead in the AI domain.

Rationale

Investment is critical to scaling LAMs, ensuring that the technology is deployed effectively and continues
to evolve with growing needs and challenges.

Regulatory Frameworks

With few regulatory frameworks currently governing LAMs, public sector organizations can lead efforts to establish ethical and responsible use regulations, while also promoting innovation and development.

Impact

Ensures LAMs operate within a secure and ethical environment, mitigating risks related to autonomy, liability, & data privacy, enhancing public trust and compliance with international standards.

Rationale

A clear legal structure is essential for navigating the complex ethical landscape of autonomous systems, ensuring safe and responsible AI use, and fostering an environment of trust & safety around AI technologies.

Enhance Data Security Protocols

By implementing state-of-the-art security measures, including advanced encryption methods and strict access controls, the Kingdom can protect sensitive information processed by LAMs.

Impact

Safeguards against data breaches and unauthorized access, maintaining the integrity and confidentiality
of government and citizen data.

Rationale

As LAMs handle large volumes of sensitive data, robust security protocols are crucial to prevent vulnerabilities and maintain public confidence in government digital services.

By adopting these recommendations, Saudi Arabia can effectively integrate Large Action Models into its digital government strategy, driving significant advancements towards the goals outlined in Vision 2030.

Overall, while Large Action Models have the potential to transform many areas of the public sector, significant challenges must be addressed before they can be widely adopted. Overcoming these challenges will require collaboration between researchers, industry partners, and policymakers, with a focus on advancing research, building infrastructure, and fostering education that prepares society for an AI-driven future. The following section explores the future developments and possibilities of LAMs, highlighting how these efforts could shape their adoption and impact.

7. Future Outlook of LAMs and AI Agents

As Large Action Models (LAMs) evolve, they hold the potential to revolutionize industries by autonomously executing complex actions across digital platforms, applications, and the physical world. This marks a significant shift in AI technology—from merely providing guidance to actively performing tasks.

Currently, AI agents can attend meetings, transcribe conversations, take notes, and summarize key points. While useful, these functions primarily generate task lists, leaving execution to humans. With the advent of LAMs, these agents could take on more proactive roles, such as scheduling follow-up sessions, sending emails to absent participants, or even arranging refreshments if a meeting runs longer than planned. This evolution could lead to fully integrated digital colleagues who participate in meetings, process information, and contribute in real-time.

Envision scenarios where digital colleagues from different vendors collaborate in the same meeting, offering diverse perspectives. Even in less ideal circumstances, this integration would still provide valuable insights into digital interaction. Developing these systems will require collaboration among AI, robotics, control systems, and various application domains. Interdisciplinary teams will need to integrate components, refine system architectures, and develop practical solutions that leverage LAMs' unique capabilities.

The emergence of Large Action Models (LAMs) is likely to drive advancements in related fields such as computer vision, sensor technology, and materials science, due to the growing demand for versatile hardware. Despite the challenges and uncertainties ahead, the potential benefits of LAMs—including increased productivity, improved quality of life, and the ability to tackle complex tasks—make this an exciting area of research.

Large Action Models (LAMs) represent a pivotal advancement in artificial intelligence, bridging the gap between virtual knowledge and physical action. By combining the reasoning capabilities of large language models with the ability to interact with the physical world, LAMs unlock a wide array of potential applications across numerous industries. The development of LAMs underscores the rapid progress in AI and its immense potential for transformative change.

Looking ahead, human interactions with generative AI are expected to evolve from simple prompts to engaging with autonomous, goal-driven agents. This shift will allow for greater autonomy and better alignment with human intent. Powered by the advancement of LAMs—which can operate independently, learn from their environments, and perform complex tasks—this evolution requires building architectures that integrate essential tools, provide access to vast knowledge repositories, and support both short-term and long-term memory. These enhancements will elevate the agents' reasoning and expertise.

By 2027, over 50% of development asset selections in technology marketplaces are expected to be driven by generative AI orchestration. This shift will allow humans to focus more on design and specification rather than lower-level development tasks, leading to more efficient and innovative workflows. As these technologies advance, they will bring transformative changes, empowering organizations to leverage the full potential of LAMs for operational efficiency and enhanced service delivery.

By 2028, approximately 33% of interactions with generative AI services are projected to involve action models and autonomous agents. These agents will use advanced AI techniques to identify patterns, make decisions, and execute actions without human intervention. Numerous AI research labs and startups are already developing action transformer models capable of automating repetitive and low-value tasks. Autonomous agents are poised to significantly impact sectors such as healthcare, education, gaming, and insurance by offering tailored solutions, personalized experiences, and efficient customer service interactions.

8. Associated Risks and Considerations

1. Decision-Making and Accountability in Government Services

Key Concern

As LAMs are integrated into government decision-making, especially in high-impact areas like public services and regulatory enforcement, errors in output could result in inefficient governance or non-compliance with national regulations.

Mitigation

Establish robust oversight mechanisms to ensure that LAM-driven decisions align with Saudi regulations and public policies. Implement cross-AI agent validation processes to prevent errors. Government accountability frameworks, guided by the DGA, should clearly outline liability in case of suboptimal decisions.

2. Management of Intellectual Property and National Sovereignty

Key Concern

LAMs handling sensitive governmental and private sector data in Saudi Arabia could inadvertently misuse or disclose national intellectual property, creating risks around sovereignty and economic security.

Mitigation

Strict guidelines must be enforced by the DGA for managing data linked to national security or economic sectors. AI systems should adhere to IP and sovereignty laws, ensuring the data they handle and process are protected in line with Saudi law, with continuous audits and monitoring.

3. Data Privacy and Compliance with Saudi Regulations

Key Concern

LAMs will process significant amounts of personal and governmental data, and ensuring compliance with Saudi's Personal Data Protection Law (PDPL) and other regional regulations is crucial to maintaining trust in digital services.

Mitigation

Enforce strict data protection measures, including adherence to PDPL, end-to-end encryption, and the DGA's security protocols. Conduct regular audits and privacy impact assessments to ensure compliance with Saudi data privacy laws, especially in citizen-facing services.

4. Consumer Protection and Citizen Safety

Key Concern

As LAMs engage directly with Saudi citizens and businesses, there is a risk of delivering misleading or incorrect information that could negatively impact public trust or safety.

Mitigation

Establish ethical guidelines and validation processes within government systems to ensure that LAMs deliver accurate and culturally appropriate information. Continuous reviews, aligned with DGA's mandates, will ensure that LAM interactions protect consumer rights and are culturally sensitive.

5. Security of AI Systems in the Public Sector

Key Concern

The susceptibility of LAMs to adversarial attacks poses a risk to national security, especially within the context of critical digital government services, public infrastructure, and the economic sector.

Mitigation

Adhere to the DGA's cybersecurity frameworks and protocols, focusing on robust anomaly detection and encryption tailored for government use. Establish security standards that prevent malicious attacks and ensure the integrity of digital public services. Monitor continuously for threats, particularly in high-risk areas like national databases.

6. Transparency and Public Trust in Government AI

Key Concern

The complexity of LAM decision-making could lead to a lack of transparency in how government decisions are made, potentially eroding public trust in digital services.

Mitigation

Ensure transparency in LAM systems by making AI processes explainable, auditable, and compliant with public governance standards, in line with DGA's vision to enhance public trust and accountability.

9. Definitions and Acronyms

Term	Definition
Authority	Digital Government Authority
Government Entities	Ministries, authorities, public institutions, councils, national centers, including any additional form of a public entity
Digital Government	The use of digital technologies to transform government services, making them more accessible and efficient for citizens
Digital Transformation	Digitally and strategically transforming and developing business standards and models that would rely on data, technologies, and ICT.
User / Beneficiary	Citizens, residents, visitors, government entities, private sector, and non-for-profit sector, inside or outside the KSA are required to interact with a government entity to receive any of the services offered in the Kingdom.
Generative Artificial Intelligence (GenAI)	Generative AI, sometimes called gen AI, is artificial intelligence (AI) that can create original content—such as text, images, video, audio or software code—in response to a user's prompt or request.
AI Agents	An artificial intelligence (AI) agent refers to a system or program that is capable of autonomously performing tasks on behalf of a user or another system by designing its workflow and utilizing available tools.
Large Action Models (LAMs)	Large Action Models (LAMs) are the latest development in the world of Artificial Intelligence. LAMs use agents to perform actions. The agents are software entities capable of independently executing tasks, moving beyond merely responding to human queries and actively contributing to the achievement of specific goals.
Large Language Models (LLMs)	Large language models (LLMs) are a category of foundation models trained on immense amounts of data making them capable of understanding and generating natural language and other types of content to perform a wide range of tasks.
Artificial General Intelligence (AGI)	Artificial general intelligence (AGI) is a theoretical AI system with capabilities that rival those of a human.
Neuro-symbolic Programming	Neuro-symbolic programming is an AI approach that combines neural networks (which learn patterns from data) with symbolic reasoning (which applies rules and logic) to enable systems to both learn from examples and make structured, rule-based decisions.
Decision Theory	Decision theory is the study of how choices are made, focusing on finding the best decisions based on probability risks, outcomes, and preferences, especially in uncertain situations.
Game Theory	Game theory is the study of strategic interactions where the outcome for each participant depends on the actions of others. It uses mathematical models to find optimal strategies in competitive or cooperative scenarios.

10. Bibliography

1. Gartner. (n.d.). Gartner Report. Retrieved from https://www.gartner.com/document-reader/document/5332663?ref=sendres_email&refval=78964866

2. Cambridge, & Mouchart, M. (1970). H. Raiffa, Decision analysis: Introductory lectures on choices under uncertainty (XXIII, 309 p.). Reading, MA: Addison-Wesley. Recherches Économiques De Louvain, 36(5), 527–528. https://doi.org/10.1017/s0770451800042238

3. Giocoli, N. (2005). John von Neumann and Oskar Morgenstern: Theory of games and economic behavior (Sixtieth-Anniversary Edition). Pisa. Retrieved from https://www.academia.edu/3868220/John_von_Neumann_and_Oskar_Morgenstern_Theory_of_Games_and_Economic_Behavior_Sixtieth_Anniversary_Edition

4. McCarthy, J., Minsky, M. L., Rochester, N., & Shannon, C. E. (1955). A proposal for the Dartmouth summer research project on artificial intelligence. Retrieved from http://jmc.stanford.edu/articles/dartmouth/dartmouth.pdf

5. Weizenbaum, J. (1966). ELIZA – A computer program for the study of natural language communication between man and machine. Stanford University. Retrieved from https://web.stanford.edu/class/cs124/p36-weizenabaum.pdf

6. Newell, A., & Simon, H. A. (1956). The logic theory machine: A complex information processing system. Retrieved from http://shelf1.library.cmu.edu/IMLS/BACKUP/MindModels.pre_Oct1/logictheorymachine.pdf

7. Nilsson, N. J. (2001). Artificial intelligence: A new synthesis. Artificial Intelligence, 130(1), 1–54. https://doi.org/10.1016/S0004-3702(01)00129-1

8. Google DeepMind. (2024, October 9). AlphaGo. Retrieved from https://deepmind.google/technologies/alphago/

9. Li, G., Hammoud, H. A. A. K., Itani, H., Khizbullin, D., & Ghanem, B. (2023). CAMEL: Communicative Agents for "Mind" Exploration of Large Language Model Society. https://openreview.net/pdf?id=3IyL2XWDkG

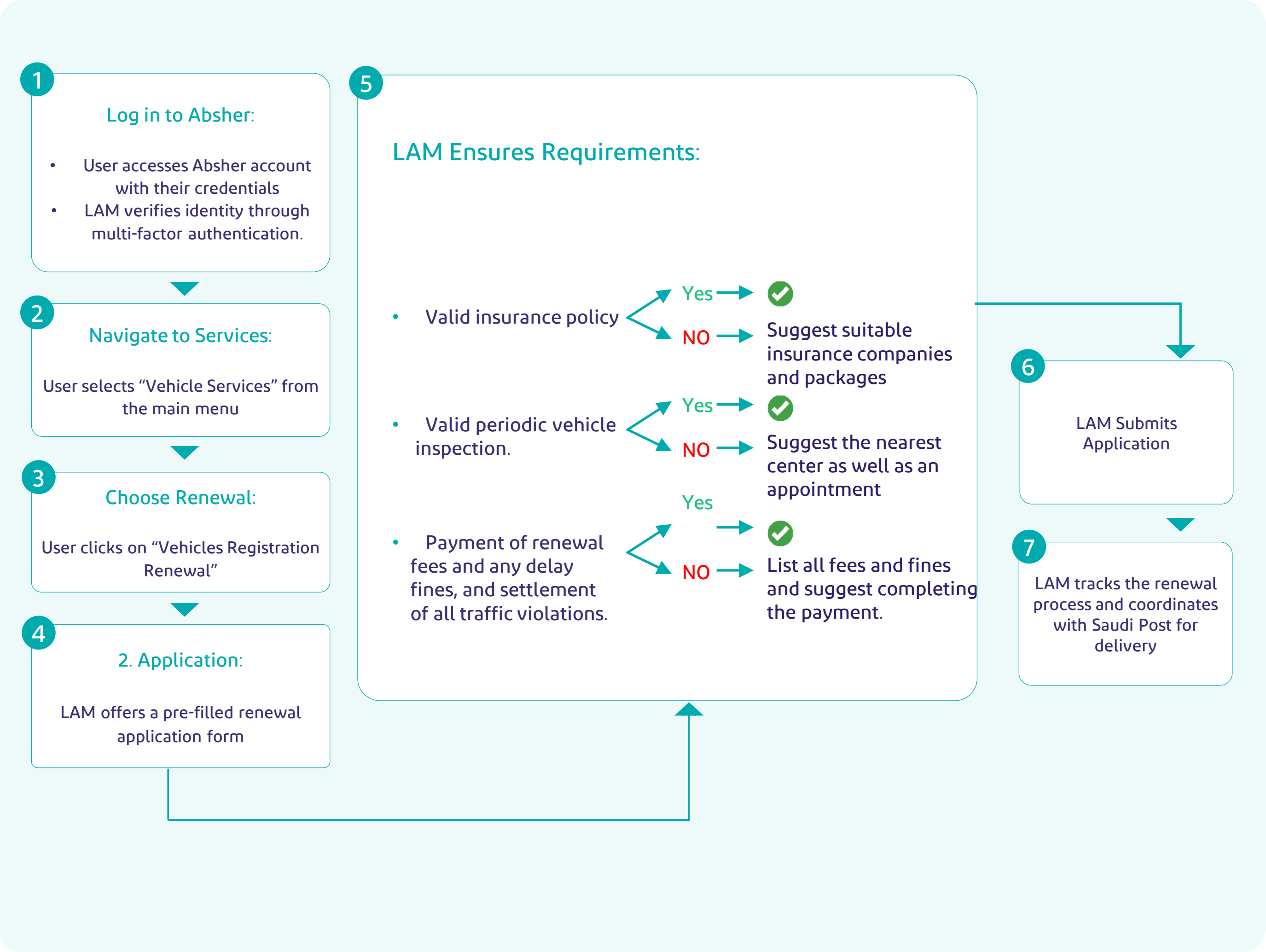
10. IBM. (2024, October 21). AI agents: What are AI agents? Retrieved from https://www.ibm.com/think/topics/ai-agents

11. CAMEL-AI. (n.d.). CAMEL-AI. Retrieved from https://www.camel-ai.org/

Appendix 1

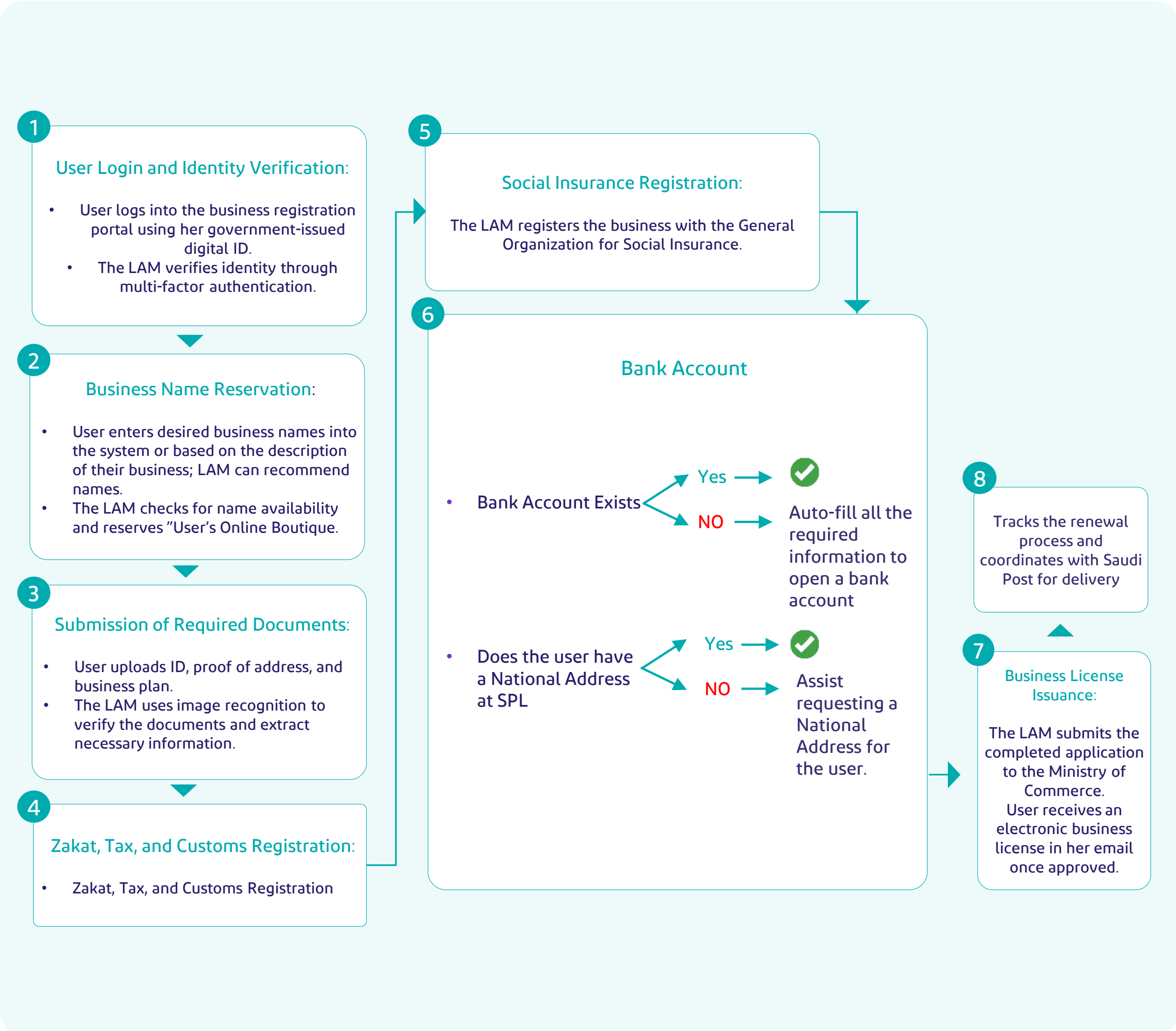
Example 1: Vehicles Registration Renewal

During the vehicle registration renewal process, users are expected to undergo a sequence of steps that involve signing in, selecting the service, filling an application, validating they meet the requirements and paying the fees. LAMs simplifies this process so that the user only provides credentials and approvals.



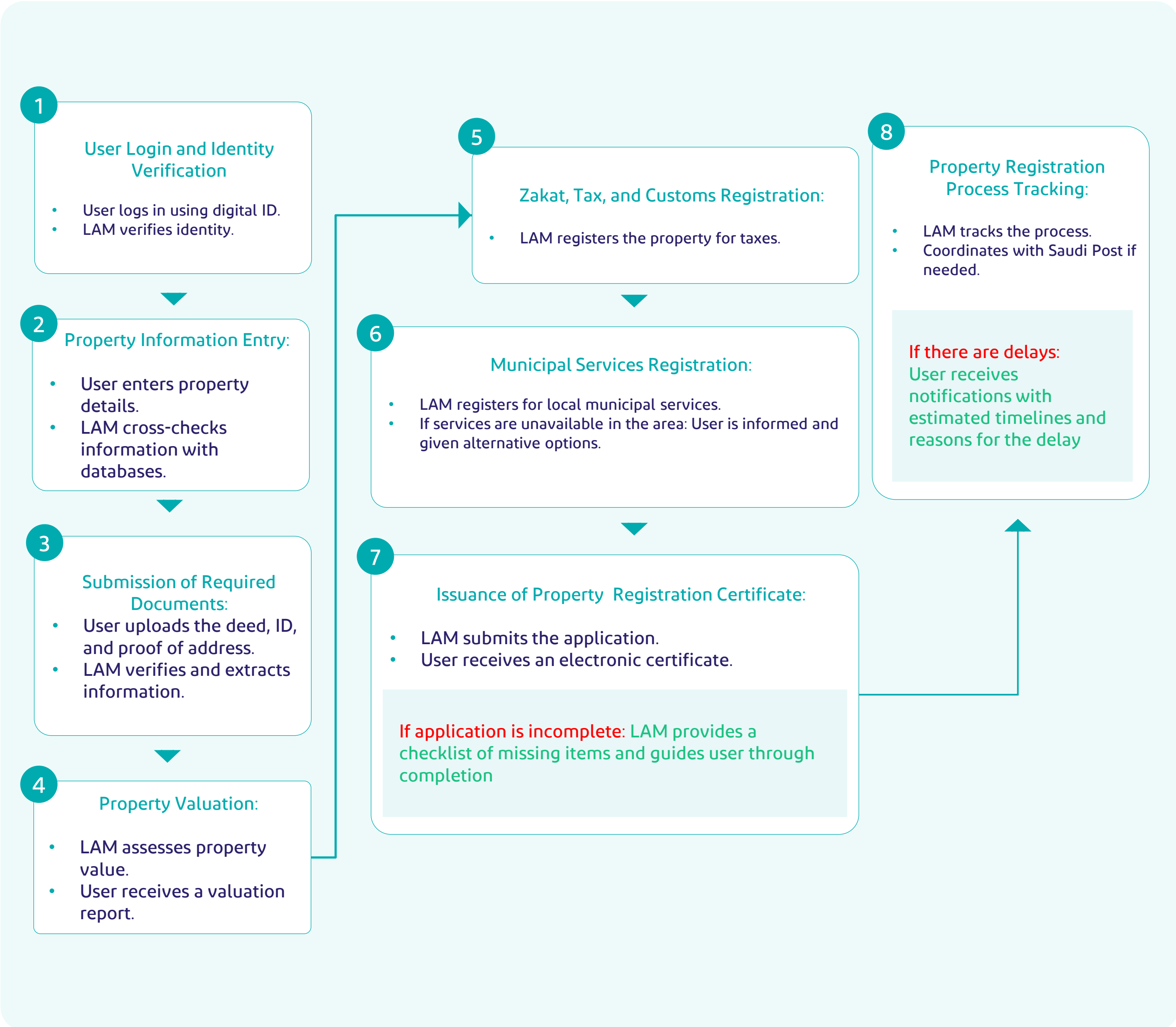
Example 2: Starting a company

During the process of starting a company, users are expected to undergo a sequence of steps that involve signing in, selecting the service, providing several documents, registering with the tax authority and social insurance, setting up a corporate account. LAMs simplifies this process so that the user only provides credentials and approvals.



Example 3: Registering a Property

During the property registration process, users are expected to undergo a sequence of steps that involve signing in, selecting the service, providing several documents, registering with the tax authority and paying the fees. LAMs simplifies this process so that the user only provides credentials and approvals.



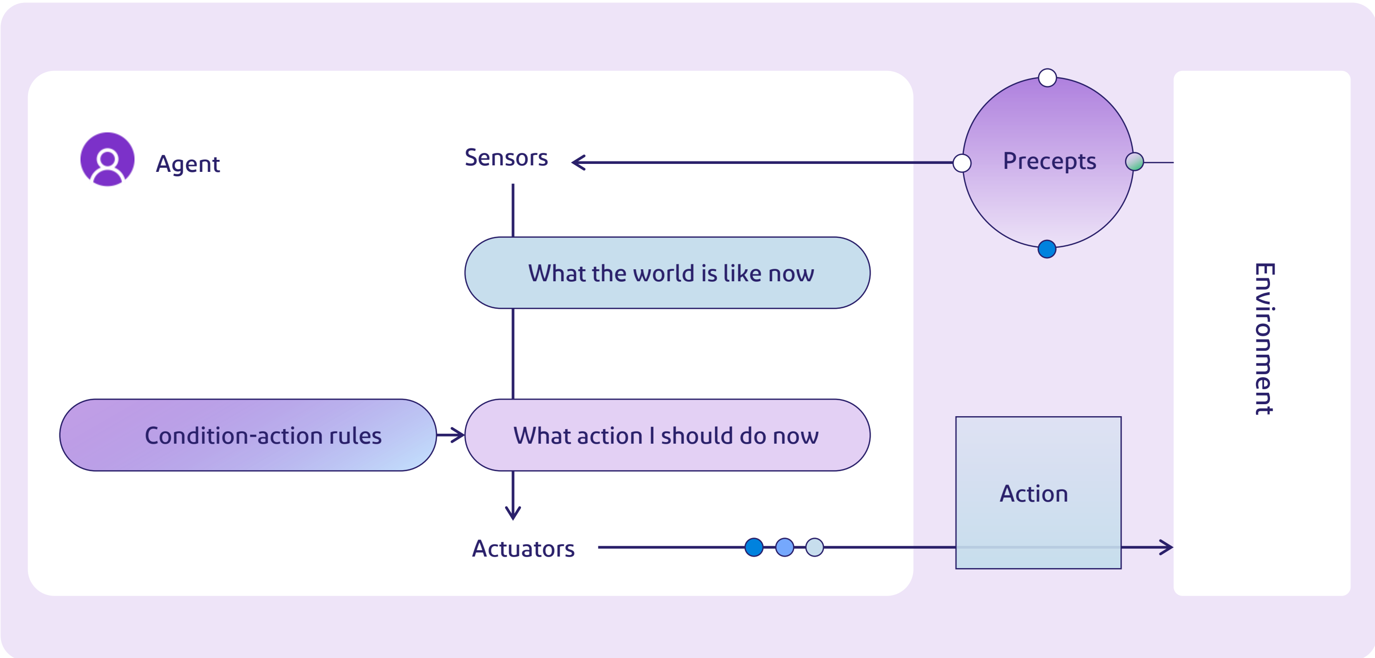
Appendix 2. Types of Existing AI Agents

It’s important to note that while simple versions of AI agents have existed for years, the natural-language capabilities of Generative AI unveil new possibilities. AI Agents generally have varying levels of capabilities. A simple agent may be preferred for straightforward goals to limit unnecessary computational complexity. In order of simplest to most advanced, there are 5 main agent types that currently exist:

1. Simple reflex agents

Simple reflex agents are the simplest agent form that grounds actions on current perception. This agent does not hold any memory, nor does it interact with other agents if it is missing information. These agents function on a set of so-called reflexes or rules. This means that the agent is preprogrammed to perform actions that correspond to certain conditions being met.
If the agent encounters a situation that it is not prepared for, it cannot respond appropriately. The agents are only effective in environments that are fully observable granting access to all necessary information.

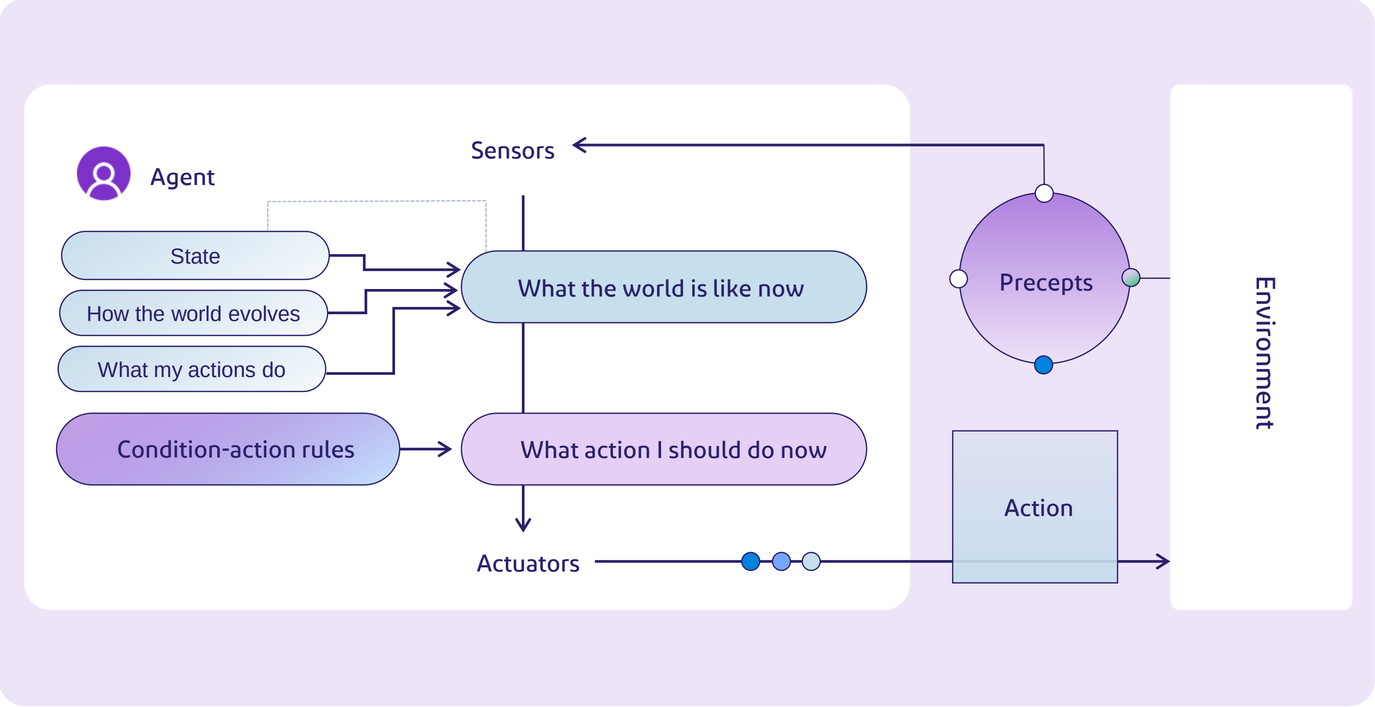
Example: A thermostat that turns on the heating system at a set time every night. The condition-action rule here is, for instance, if it is 8 PM, then the heating is activated.



2. Model-based reflex agents

Model-based reflex agents use both their current perception and memory to maintain an internal model of the world. As the agent continues to receive new information, the model is updated. The agent's actions depend on its model, reflexes, previous precepts and current state.
These agents, unlike simple reflex agents, can store information in memory and can operate in environments that are partially observable and changing. However, they are still limited by their set of rules.

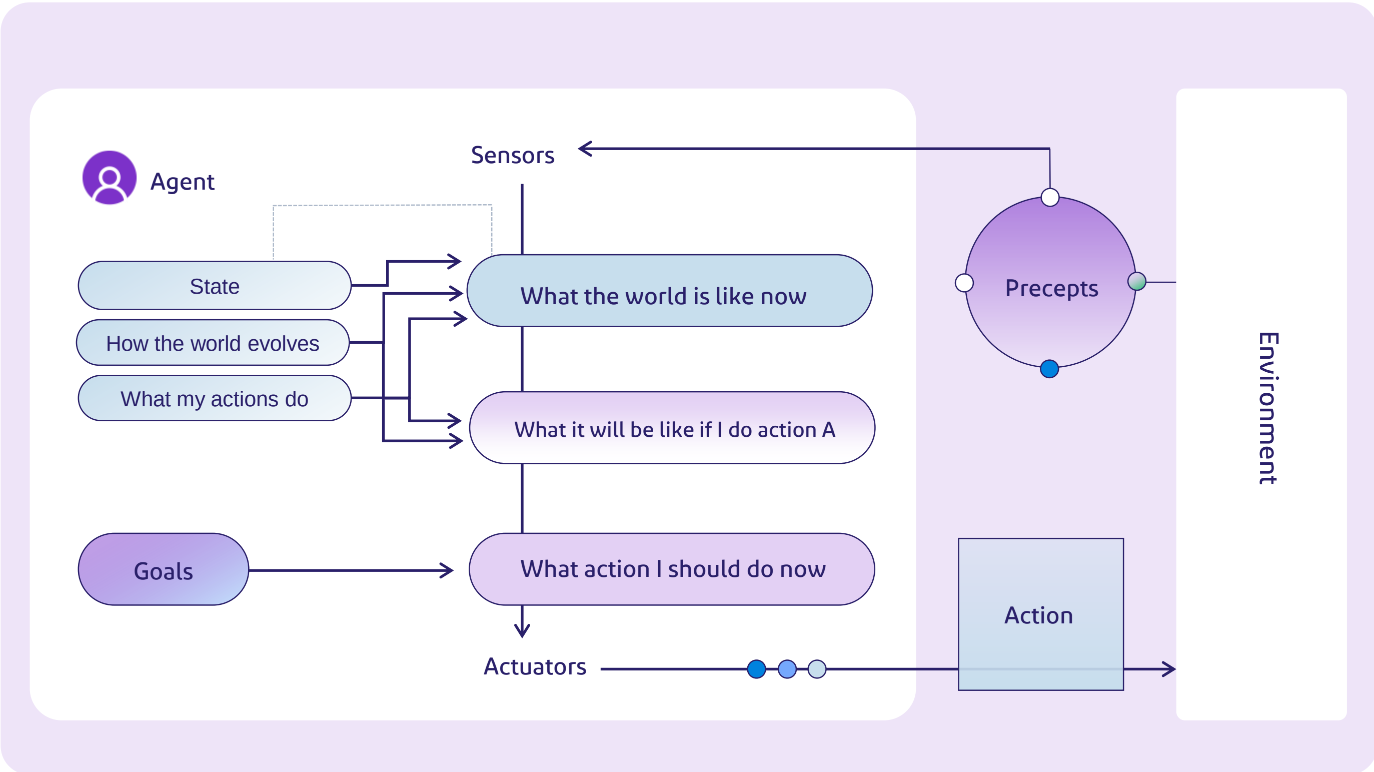
Example: A robot vacuum cleaner. As it cleans a dirty room, it senses obstacles such as furniture and adjusts around them. The robot also stores a model of the areas it has already cleaned to not get stuck in a loop of repeated cleaning.



3. Goal-based agents

Goal-based agents have an internal model of the world and also a goal or set of goals. These agents search for action sequences that reach their goal and plan these actions before acting on them. This search and planning improve their effectiveness when compared to simple and model-based reflex agents.

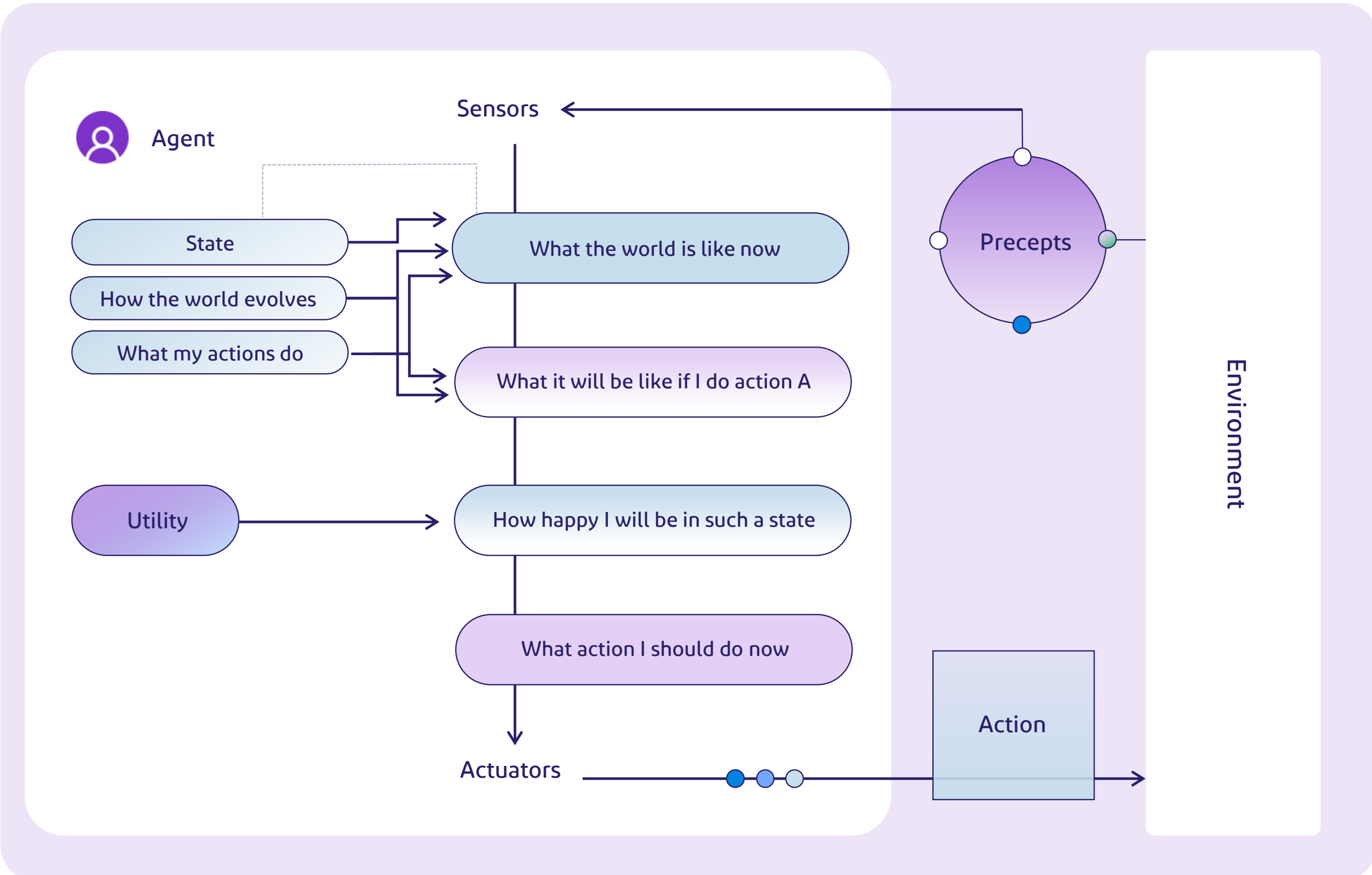
Example: A navigation system that recommends the fastest route to your destination. The model considers various routes that reach your destination, or in other words, your goal. In this example, the agent's condition-action rule states that if a quicker route is found, the agent recommends that one instead.



4. Utility-based agents

Utility-based agents select the sequence of actions that reach the goal and also maximize utility or reward. Utility is calculated using a utility function. This function assigns a utility value, a metric measuring the usefulness of an action or how “happy” it will make the agent, to each scenario based on a set of fixed criteria.
The criteria can include factors such as progression toward the goal, time requirements, or computational complexity. The agent then selects the actions that maximize the expected utility. Hence, these agents are useful in cases where multiple scenarios achieve a desired goal and an optimal one must be selected.

Example: A navigation system that recommends the route to your destination that optimizes fuel efficiency and minimizes the time spent in traffic and the cost of tolls. This agent measures utility through this set of criteria to select the most favorable route.



5. Learning agents

Learning agents hold the same capabilities as the other agent types but are unique in their ability to learn. New experiences are added to their initial knowledge base, which occurs autonomously. This learning enhances the agent's ability to operate in unfamiliar environments. Learning agents may be utility or goal-based in their reasoning and are comprised of four main elements:

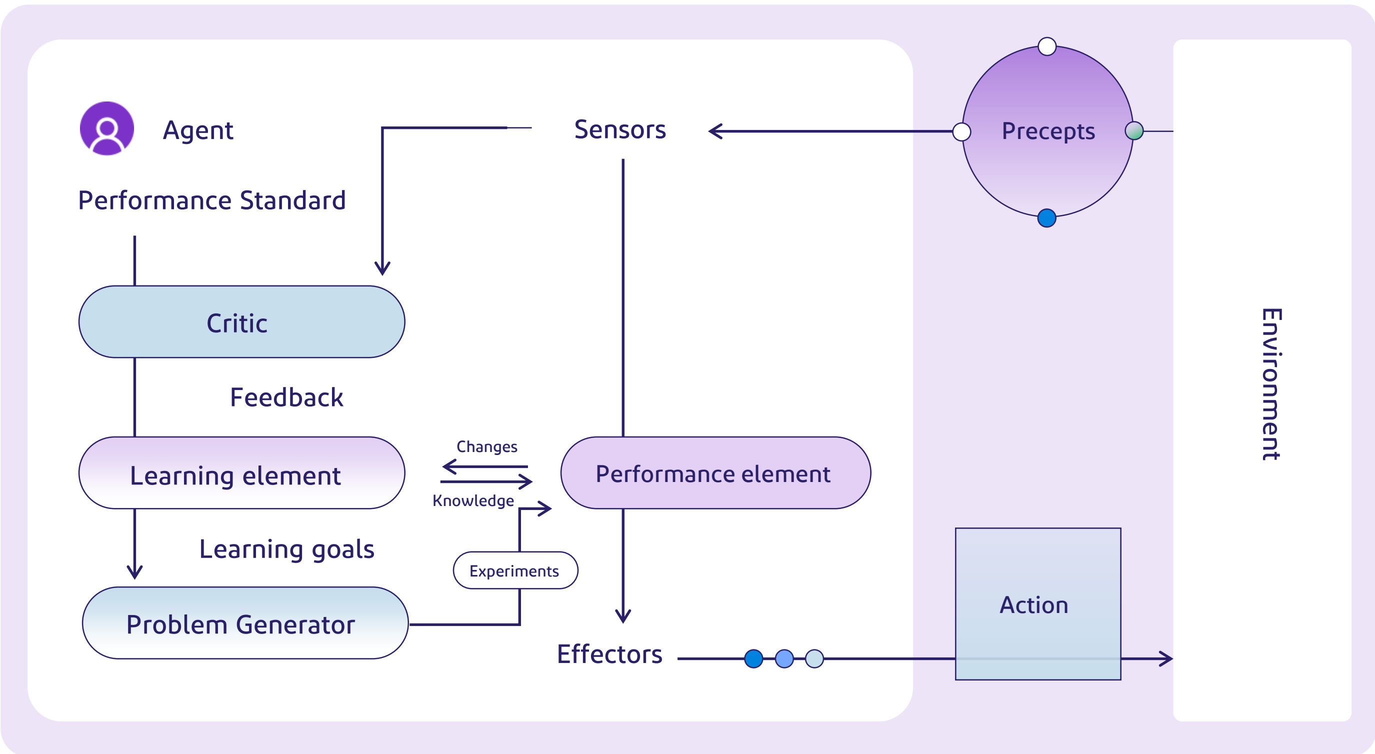
Learning:
This improves the agent's knowledge by learning from the environment through its precepts and sensors.

Critic:
This provides feedback to the agent on whether the quality of its responses meets the performance standard.

Performance:
This element is responsible for selecting actions upon learning.

Problem generator:
This creates various proposals for actions to be taken.

Example: Personalized recommendations on e-commerce sites. These agents track user activity and preferences in their memory. This information is used to recommend certain products and services to the user. The cycle repeats each time new recommendations are made. The user's activity is continuously stored for learning purposes. In doing so, the agent improves its accuracy over time.



For continuous development purposes, please fill out the following survey

Survey

SCAN HERE

For more digital studies, please follow the link below

Digital Studies

SCAN HERE

هيئة الحكومة الرقمية
Digital Government Authority

DGA.GOV.SA