**Frontiers in Computing and Intelligent Systems**
ISSN: 2832-6024 | Vol. 7, No. 1, 2024

# Artificial Intelligence Technology in Mechanical Dogs

**Hui Tan, Shenghong Wu, Yunjie Dai, Yang Li, Youqin Feng**

Geely University of China, Chengdu Sichuan, 641423, China

**Abstract:** Technology is changing day by day, and the products of the times are endless, just as the steam engine in the steam era, the generator in the electrical era, and the computer and the Internet in the information era, artificial intelligence is becoming a decisive force to push mankind into the intelligent era. With this background, this paper discusses the application of artificial intelligence technology in the field of mechanical dogs. Firstly, this paper explains the development status of artificial intelligence technology (AI) at home and abroad, then gives an overview of AI technology and mechanical dogs respectively, then lists the application status of four common types of intelligent mechanical dogs, and finally concludes that AI technology in the field of mechanical dogs still has a better development prospect.

**Keywords:** Robot Dog; AI; Development Status.

## 1. Introduction

China's development in the field of artificial intelligence AI presents a thriving situation. The AI Index report released by Stanford University shows that China already has the world's top AI experts, including nine of the world's top 10 organizations in terms of the total number of published papers. In addition, companies such as Tencent, Alibaba and Huawei have become ranked among the world's top 10 companies in AI research. In terms of infrastructure, China has built a fiber optic and mobile broadband network, which is the largest in the world in terms of 5G autonomous networking. China has paved an "information highway" from cities to vast villages, from base stations to fiber-optic networks, for the development and application of new AI technologies, communications and Internet infrastructure, in depth and breadth. According to statistics, from 2017 to November 2022, China accounted for 63.9% of the total of about 740,000 AI invention patents authorized globally. The investment in AI technology has shown a yearly increasing trend from 2010 to 2023. However, the growth rate has slowed down in the period from 2017 to 2023, but overall, AI technology remains a dynamic and promising field. However, despite China's remarkable progress in AI research and applications, there are still gaps compared to the world's leading countries [1]

Countries in Europe, America, Japan and South Korea have made significant investments and outstanding achievements in the development of AI. The British government released the "AI White Paper" aimed at supporting the development and application of AI technology; the French government also released the "AI strategy", hoping to make France an important force in the field of global AI, through the guidance and support of the policy. The United States has invested even more in the field of artificial intelligence, as a global science and technology power. According to statistics, the share of global private investment in U.S. AI startups increased from 51% ($22.5 billion) in 2020 to 53% ($27 billion) in 2022. In addition, a related AI development strategy has emerged from the active formulation and updating of the U.S. government. Japan's Minister of Science, Technology, Information and Communication, Mr. Lee Sung-ho, reportedly delivered a message on AI development at the "Korea Mega AI (AI) Development Conference" held in Seoul. Both countries are actively formulating and updating their AI development strategies, with a view to making breakthroughs on this technological innovation plateau. Although Europe, the United States, Japan, and South Korea have achieved significant results in the development of AI, they still face a number of regulatory challenges [2].

## 2. Overview of AI Technology and Mechanical Dogs

Artificial Intelligence, abbreviated as AI, is a new technological science for researching and developing human intelligence theories, methods, technologies and application systems for simulating, extending and expanding human intelligence. It is an important driving force of the new round of scientific and technological revolution and industrial change, and is an important part of the discipline of intelligence. Artificial intelligence can learn, reason, judge and make decisions through intelligent behaviors implemented by computer programs just like humans. It is also a modern general-purpose bionic robot, consisting of a "brain".

Mechanical dogs are also known as four-legged robots. The shape is similar to a quadruped, and the biological properties are of a class that can walk autonomously. Most of the mechanical dog belongs to the foot-type robot, because its landing point is a dispersed point with controllability, so this feature will make the mechanical dog more relaxed when dealing with the test of different geographic environments, in addition to this, the bionic leg structure owned by the mechanical dog can make the whole system of the mechanical dog have a greater degree of freedom, so the mechanical dog will appear more robust and flexible when facing the complex road conditions in reality. It is its weight-bearing capacity, when facing the reality of complex road conditions, its load capacity is relatively strong. The development of intelligent mechanical dog control systems that can help people meet their daily needs or can replace human labor in various forms of tasks has been a challenging and interesting problem in the field of mechanical dogs [8]

This excellent adaptability to the surrounding geography and strong material carrying capacity and other advantages all show us its broad application prospects, but with its wider range of applications at the same time on the algorithms for the motion control of the mechanical dog real-time,

robustness, accuracy and other performance needs are also more and more demanding. Especially with the emergence of bionic mechanical dog, its complex mechanical leg structure leads to high production costs and is not easy to control, the impact of the movement and the ground is large, low anti-skid performance and lack of detection of foot force and real-time control and other similar problems, making the mechanical dog in the practical application of the problem.

On the market, we can see different kinds of robotic dogs developed by different companies, each of which has unique features and characteristics. For example, the just released AlphaDogC200, Sony's Aibo robotic dog, Azure Technology, etc., are products that we are more concerned about. Among them, AlphaDog C200 supports face and gesture recognition, text recognition, voice recognition, chatting and dialoguing, and can walk freely without a remote control. In addition, MIT's Min cheetah mechanical dog, on the other hand, each leg is controlled by 3 motors, each motor is controlled by 1 STM32 controller, the motor control algorithm using the FOC algorithm. With the development of technology and technology mechanical dog also officially into the family [3-5].

# 3. Artificial Intelligence Practices in the Field of Mechanical Dogs

## 3.1. Mechanical Dog for Microcontroller

As shown in Figure 1 a mechanical dog modeled on a microcontroller. Requires less driving force and can walk very smoothly, thanks to the smaller mechanical structure to build degrees of freedom to support the overall frame. The application of microcontroller control, by controlling the PID output, increasing the Bluetooth module, real-time monitoring of the robot and cell phone APP interaction, to achieve real-time monitoring of different situations, increase its anti-collision function, to achieve intelligence, temperature collection, change the size of the driving force to cope with the different situations at a later stage [6-7].

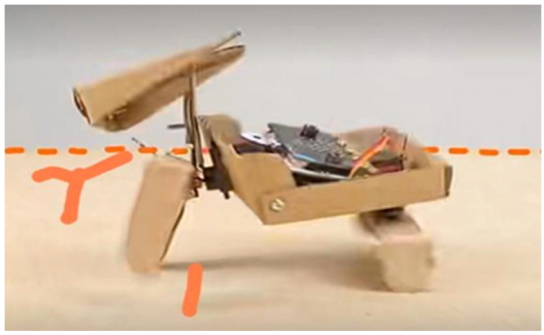

**Figure 1.** Microcontroller based mechanical dog

## 3.2. Intelligent Voice Pet Mechanical Dog

As shown in Figure 2, the software design of the mechanical dog is mainly the preparation of the software program of the Arduino Mega processing control chip and the voice processing module, as well as the preparation of the mechanical dog status display interface and Bluetooth communication program. The designed mechanical dog has the functions of watching the house, accompanying learning, prompting things to be done, etc. The production cost is low and cost-effective. Through the optimization of structure and reasonable design size, the appearance of the mechanical dog is beautiful and reasonable, easy to assemble, superior control performance, reduce the cost of purchase, use and maintenance. The design results can be used as a mechanical pet, but also as a low-cost artificial intelligence research platform for programming enthusiasts, users can program and develop according to their own needs, to achieve openness and co-creation [9].

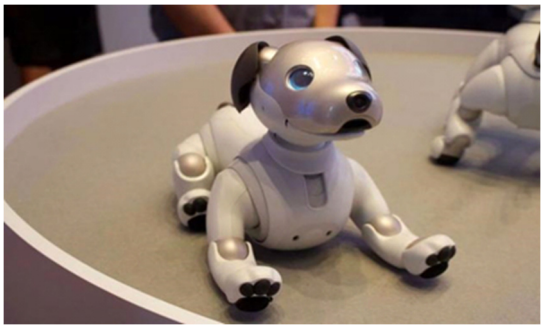

**Figure 2.** Intelligent voice pet mechanical dog

## 3.3. Search and Rescue Mechanical Dog Based on OpenMV Wireless Mapping Technology

As shown in Fig. 3, through the Bluetooth module, it is controlled to send commands in the direction of left, forward, right, left, right and backward. The mechanical dog accepts the instruction to complete the automatic action and detects it. The pictures taken by the camera after opening the APP can be displayed in real time without lag. The design adopts the BUSLINE servo as the basic power source of the mechanical dog, together with the brackets of each joint, so that it has 12 degrees of freedom, and can flexibly cope with various emergencies. The visual part of the picture-less transmission technology uses the TOPENMV camera which has great convenience.

**Figure 3.** Search and Rescue Mechanical Dog

## 3.4. Intelligent Inspection Multi-Legged Robot

As shown in Figure 4, it is an intelligent inspection multi-legged robot based on SLAM compositional navigation, which is able to complete the tasks of autonomous execution of path planning, autonomous exploration, and autonomous navigation in the complex agricultural planting environment by utilizing the LIDAR SLAM technology combined with the millimeter-wave radar mode, and is able to complete the inspection tasks through autonomous navigation in accordance with the established inspection routes. Explore the scenarios of applying intelligent inspection multi-legged robots in agricultural plantation, and utilize the ground remote control to complete crop inspection tasks [10-11].

**Figure 4.** Intelligent inspection multi-legged robot

# 4. Conclusion

This paper summarizes the development status of artificial intelligence at home and abroad and the development and innovation in the field of mechanical dogs. With the argumentative way to elaborate the role of artificial intelligence technology in the mechanical dog to enhance the function of the mechanical dog, and at the same time to promote the development of mechanical dog automation, improve the precision, efficiency and coordination of mechanical work. Finally, they are listed on the current human development of the design of several types of intelligent mechanical dog. Due to the mechanical dog in the past two years less development results and lack of research data, so the content of this paper summarizes the lack of certain graphic data to illustrate. The development of artificial intelligence is a long-term persistent road, not only domestic but also the direction of the world's future competition, especially the main carrier of artificial intelligence mechanical dog, in the future there is a more far-reaching development. But at present, both domestic and foreign countries are increasing research and investment in mechanical dogs, and ultimately, like Musk's "Optimus Prime" or millet's "Iron Egg" will enter thousands of households.

# References


[1] WANG He-Yong,GU Long.Current status of AI development at home and abroad-an analysis and comparison of research hotspots, issuing organizations and geographical cooperation [J]. Modern Information Technology, 2020,4 (4):68-75.

[2] WAN Yan,YANG Yuezhao,LI Minghui. Knowledge Structure, Research Overview and Interdisciplinary Research Implications of Artificial Intelligence Ethics in Foreign Countries [J]. Journal of Beijing University of Posts and Telecommunications: Social Science Edition,2020,22(5):74-86.

[3] Yan H. Reading artificial intelligence [Z]. Windy Generation,2023(12):58-58.

[4] Wu YM. Research on key technology of gait planning for quadruped robot [D].2020.

[5] JIANG Lipeng, WANG Le, SHAO Oli, et al. Research on mechanical structure based on the motion stability of bionic mechanical dog[J]. Automation Application,2022(3):166-168.

[6] Congcong H, Ming Y ,Hengyuan P , et al. About the design of a new bionic robot with four legs for competition [J]. MATEC Web of Conferences, 2021, 336 03003-03003.

[7] ZHENYOU ZHOU, BIN CHEN, WANG YANLIN, YANG ZHAO. Design of quadruped bionic mechanical dog based on microcontroller[J]. Science and Technology Perspectives, 2018 (8):63-64.

[8] Roman M ,Aleš J ,Michal G, et al. Human-Robot Motion Control Application with Artificial Intelligence for a Cooperating YuMi Robot [J]. Electronics, 2021, 10 (16): 1976-1976.

[9] LI Siqin, TONG Xiaoqin, LI Junjie, LI Jianlong, SUN Jingxuan. Design of intelligent voice pet mechanical dog[J]. Internet of Things Technology,2023,13(7):146-147

[10] Ravi R, Andrzej K . A Comprehensive Study of Mobile Robot: History, Developments, Applications, and Future Research Perspectives [J]. Applied Sciences, 2022, 12 (14): 6951-6951.

[11] HUANG Junhui,XIE Wutao. Inspection path planning design of an intelligent inspection multi-legged robot[J]. Journal of Guangdong Agriculture, Industry and Commerce Vocational and Technical College,2022,38(1):83-86.