

# Design and Implementation of a Flexible Raindrop Sensor

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**Abstract:** Hangzhou's "Six Little Dragons" – namely DeepSeek, Unitree Robotics, CloudMinds Robotics, BrainCo, KuaiKe Technology, and Game Science – have created a sensation in the global tech circle, demonstrating the strong strength and great potential of China's technological innovation to the world. These six enterprises cover fields such as artificial intelligence (AI), robotics, brain-computer interface (BCI), cloud-based design software systems, and game development. The rise of the "Six Little Dragons" fully reflects Hangzhou's first-mover advantage in fostering and developing new-quality productive forces. Against the backdrop of accelerating the in-depth integration of technological innovation and industrial innovation, achieving high-level technological self-reliance and self-improvement, and building a world power in science and technology, it is of great significance to study how to replicate Hangzhou's innovative genes in Suzhou. Therefore, combining the innovative practices of the "Six Little Dragons" and related issues, this paper conducts an in-depth analysis from aspects including fostering pioneering technology enterprises, building an open-source innovative industrial ecosystem with full-factor support, creating a relaxed and orderly business environment, stimulating the endogenous driving force of enterprise innovation, promoting the cultivation of new-format industries in emerging fields, and advancing the development of future industries from scattered points to a cohesive force. It is expected to provide theoretical guidance and practical reference for Suzhou's high-quality development.

**Keywords:** New-Quality Productive Forces; Pioneering Technology Enterprises; Hangzhou's "Six Little Dragons".

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## 1. Introduction

Hangzhou's "Six Little Dragons" refer to six emerging enterprises in Hangzhou that stand at the forefront of new technology fields, hold influence in their industries, and focus on areas such as robotics, AI, game development, and BCI. They are Game Science, DeepSeek, Unitree Robotics, CloudMinds Robotics, BrainCo, and KuaiKe Technology, known as the "mysterious oriental power". The common characteristics of these six enterprises are: short establishment time (even KuaiKe Technology, the oldest one, has only been founded for 14 years), cutting-edge technology, rapid valuation growth, and all being rooted in the West Hangzhou Sci-Tech Corridor. The rise of DeepSeek can be called a textbook example of "counterattack". Founded in 2023, this company trained a large model with performance comparable to GPT-4o using only 2,000 GPUs (Graphics Processing Units), at a cost only 1/30 of that of similar models by OpenAI. This "Pinduoduo-style approach in the AI field" has directly shaken the United States' monopoly in the AI sector. Unitree Robotics, on the other hand, occupies 70% of the global market share with its quadruped robot products; even Elon Musk has shared videos of its demonstrations on social media, making it a model of China's high-tech products going global.

Different from leading technology enterprises and traditional "hidden champion" SMEs, the pioneering technology enterprises represented by Hangzhou's "Six Little Dragons" are not only "pathfinders" of cutting-edge disruptive technologies and discontinuous innovation but also "architects" of the innovation ecosystem. They demonstrate systematic innovation capabilities – from revolutionary technological breakthroughs to rapid scenario-based applications, and then to the activation of the industrial ecosystem – effectively promoting the in-depth integration of technological innovation and industrial innovation. Against

the backdrop of the interweaving of a new round of technological revolution and industrial transformation, comprehensively strengthening the dominant position of enterprises in technological innovation, driving the organic integration and mutual promotion of the organized mission-driven innovation ecosystem led by leading technology enterprises and the distributed emergent innovation ecosystem led by pioneering technology enterprises (with scenarios as the driver) has become a key engine for upgrading the national strategic sci-tech strength and comprehensively improving the efficiency of the national innovation system. It injects strong impetus into building a modern industrial system and promoting the development of new-quality productive forces.

## 2. Enlightenment from the Rise of Hangzhou's "Six Little Dragons"

### 2.1. Ecological Cultivation of Innovation Chains and Industrial Chains

The "breakthrough" of Hangzhou's "Six Little Dragons" in innovation is essentially the result of the in-depth coupling of innovation chains and industrial chains. By building a new paradigm driven by both technology and scenarios, Hangzhou has taken enterprises as the main body to create a new innovation ecosystem featuring the "integration of the four chains" – mission-driven, scenario-led, enterprise-dominated, capital-empowered, and policy-supported. This ecosystem realizes the in-depth integration of enterprise-led technological innovation and industrial innovation, stimulates the endogenous growth vitality of technology-based SMEs, and promotes the clustered rise of pioneering technology enterprises and the continuous release of new-quality productive forces. Hangzhou regards the city itself as a "scenario laboratory", seizes the opportunity of scenario-

driven innovation, opens up multi-level strategic scenario resources, builds a collaborative innovation platform integrating industry, university, research, and application, and promotes the wide application and iterative upgrading of innovative technologies in scenarios such as smart cities, intelligent manufacturing, medical and health care, and education, culture, and tourism. For example, the R&D of humanoid robots by CloudMinds Robotics has benefited from the scenario-driven intelligent transformation of Hangzhou's manufacturing industry – the government has accelerated the concept verification and iterative upgrading of new technologies by opening up application scenarios and providing testing platforms. BrainCo's BCI technology is deeply integrated with the clinical scenarios of local medical institutions, achieving technological breakthroughs and product innovation through joint R&D and clinical trials[1-5].

Specifically: Technological breakthroughs create possibilities for scenario innovation; scenario applications verify the feasibility of technologies while feeding back improvement needs and providing high-quality scenario-based datasets; and industrial upgrading provides a broader space for the further development of technologies and scenarios. These three aspects promote each other, forming a spiral upward cycle of "technology-scenario-industry" and accelerating the cultivation and development of new-quality productive forces. Hangzhou has formed a unique cultural atmosphere for innovation and entrepreneurship, characterized by adherence to long-termism and pursuit of product quality. As Feng Ji, the producer of *Black Myth: Wukong*, said, Hangzhou's relatively gentle pace allows entrepreneurs to calm down and polish their products. This cultural atmosphere enables enterprises to focus on technological innovation and product R&D. For instance, Unitree Robotics has gained a good reputation in the capital and industrial circles due to its continuous refinement of products. This cultural trait of focusing on long-term value provides important support for the continuous innovation of enterprises[6-11].

Hangzhou's government has demonstrated unique foresight and pragmatism in supporting innovation and entrepreneurship. It has adopted a precise "one enterprise, one policy" support strategy to provide substantial support for start-ups. This support is not only reflected in capital but also covers multiple dimensions such as R&D support, talent introduction, and office space. Notably, Hangzhou's government provides strong support for micro, small, and medium-sized enterprises, different from the practice of other cities that only focus on leading enterprises. The government's support is manifested in specific aspects. For example, KuaiKe Technology received a 1.5 million yuan subsidy from the government of Shangcheng District, Hangzhou, in its early stage of establishment. The government's forward-looking investment promotion strategy has also significantly enhanced Hangzhou's attractiveness to overseas talents – for example, when officials from the Zhejiang Provincial Government visited the United States for inspection, they successfully attracted the founder of KuaiKe Technology to return to China for entrepreneurship.

## 2.2. Convenient Capital Support System

Hangzhou adheres to proactive services and targeted policies, and tolerates innovation failures. In terms of total capital, Hangzhou's financial investment in science and technology accounts for over 15%, providing continuous

capital support for sci-tech enterprises. In terms of capital supply entities, by the end of 2024, Hangzhou had more than 2,000 financial enterprises of various types and over 300 provincial-level financial institutions. These enterprises and institutions can provide financial products covering the entire life cycle and data-driven risk control services, having served more than 10,000 tech enterprises cumulatively. In terms of policy flexibility, Hangzhou allows high-tech enterprises to undergo trial and error and iteration. For example, Hangzhou's Innovation Guidance Fund provides compensation of 30% to 50% of the actual investment for failed projects, and applications can be processed online, which is both efficient and convenient. Hangzhou adheres to the governance philosophy of "We take charge of providing sunshine and rain; you take charge of thriving and growing". The "Talent Code" launched by Yuhang District integrates 287 services, allowing entrepreneurs to "travel across Hangzhou with one code". Westlake University allows professor teams to hold 70% of the shares in spin-off enterprises, far exceeding the 15%-30% ratio of traditional universities. The creativity released by this institutional breakthrough is amazing – in 2023, 11 professor-founded enterprises of the university had obtained financing, among which 3 had a valuation exceeding 1 billion US dollars.

Hangzhou Bank has been deeply engaged in sci-tech finance for 15 years. From the early stage of "daring not to lend if unable to understand the technology", it has now built a financial ecosystem covering the entire life cycle of enterprises. Its "Tech Innovation 3.0 Model" solves risk control problems through data-driven approaches, with the non-performing loan ratio of sci-tech loans being only 0.76%, far lower than the industry average. More importantly, there is the "bamboo forest effect" in the capital structure – there are not only industrial capitals such as Alibaba Strategic Investment but also funds focusing on high-tech such as Ginkgo Valley Capital, as well as private capitals spilled over from traditional manufacturing, forming a diversified support system. In Future Sci-Tech City, the government has systematically reduced living costs through price-limited housing (with rent being 40% of the market price) and a monthly subsidy of 8,000 yuan for doctors. In Yunqi Town, "Xixi Night Talks" have become an undercurrent channel for technical exchanges. In recent years, Hangzhou has spared no effort in talent introduction: undergraduate graduates can receive a subsidy of 10,000 yuan for working in Hangzhou, master's graduates 30,000 yuan, and doctoral graduates up to 100,000 yuan; some talents can even receive a housing subsidy of 1 million yuan. Hangzhou has established a sound innovative capital support system. The government has set up a fund for the transformation of scientific and technological achievements to help enterprises cross the "valley of death". At the same time, an active venture capital ecosystem provides sufficient capital support for enterprises. For example, DeepSeek has recently attracted the attention of many investment institutions, and its valuation has attracted much market attention.

## 2.3. High-Quality Local Talent Cultivation Base

Hangzhou's talent strategy shows unique advantages. As a key talent cultivation base, Zhejiang University has provided a large number of talents for the "Six Little Dragons". Among them, the founders of DeepSeek, CloudMinds Robotics, and KuaiKe Technology all graduated from Zhejiang University.

With its high entrepreneurship rate and innovative spirit, Zhejiang University injects continuous impetus into Hangzhou's innovation and entrepreneurship ecosystem. Notably, Hangzhou's innovative enterprises show a significant feature of youthfulness. The average age of employees at Unitree Robotics is 30, and the average age of the core creative team at Game Science is only 32. This young talent structure brings innovative vitality and development momentum to enterprises.

Most founders of Hangzhou's "Six Little Dragons" are not from Hangzhou, and many of them did not start their businesses in Hangzhou initially. Attracted by Hangzhou's talent policies, they have successively chosen to settle in Hangzhou. For example, Feng Ji, the founder of Game Science, previously worked at Tencent in Shenzhen and later moved his company to Hangzhou; Wang Xingxing, the founder of Unitree Robotics, is from Ningbo and started his business in Hangzhou after resigning from DJI in Shenzhen. Hangzhou provides five categories, 27 subcategories, and more than 100 talent services for high-level talents through the "Talent Code". For example, engineers from Game Science were seconded to KuaiKe Technology through the "Technical Expert Sharing" module of Hangzhou's "Talent Code" to solve 3D rendering problems. Hangzhou has also innovated the patent income dividend mechanism to encourage talents to actively promote the transformation of scientific and technological innovation achievements and realize sustainable innovation. Hangzhou clearly stipulates that 70% of the income from job-related inventions of university teachers belongs to individuals. An AI team from Zhejiang University developed an industrial AI algorithm that was valued at 120 million yuan and used to acquire shares in an enterprise, providing important basic algorithm support for DeepSeek.

#### **2.4. Collaborative Development of the Industrial Ecosystem**

Hangzhou has built a complete industrial innovation ecosystem. From the establishment of Zhejiang Lab in 2017 to the planning of a 1,000-mu AI Industrial Park in Yuhang District in 2022, Hangzhou has gradually formed a new industrial structure of "computing infrastructure – algorithm R&D – scenario implementation". This systematic industrial layout provides a favorable development environment for innovative enterprises. The presence of Alibaba has had an important impact on Hangzhou's technological innovation ecosystem. Known as the "Whampoa Military Academy of Internet Technology", Alibaba has cultivated a large number of tech talents and also driven the formation of early venture capital teams. This virtuous cycle of the industrial ecosystem provides strong support for the development of the "Six Little Dragons".

### **3. Suggestions for Suzhou's Future Development**

The replication and transfer of the innovation experience behind Hangzhou's phenomenon is by no means a simple transplantation of policy tools, but a deep grasp of the underlying logic of nurturing new-quality productive forces. It requires building a "talent – scenario – capital – system" four-in-one innovation ecosystem in line with local conditions, promoting the integration of the four chains, and providing a "Suzhou Solution" for building enterprises as the

main body to drive technological innovation and lead the development of new-quality productive forces. Through research, this project puts forward the following suggestions.

#### **3.1. Promote the Integration of Industry, University, and Research for Talent Cultivation under the "Integration of the Four Chains" in the In-depth Integration of Industry, University, and Research**

For a long time, there has been a disconnect between science and technology and the economy in China (often described as "two separate skins"), and the innovation chain has also been separated from the industrial chain, capital chain, and talent chain for a long time. With the in-depth operation of the market mechanism in enterprises, universities, research institutes, financial institutions, science and technology intermediaries, and other fields, the competition among enterprises in the market is no longer limited to product competition, but has expanded to the competition of enterprises' innovation capabilities and resource integration capabilities. It is the competition of the ecological chain centered on enterprise groups, and essentially the competition of an innovation consortium with enterprises and research institutions as the core and multi-agent symbiosis. Its healthy operation requires the in-depth integration and balanced development of the innovation chain, industrial chain, capital chain, and talent chain. The market mechanism can play a positive role in information transmission, interest and competition incentives, optimizing the economic structure, promoting technological progress, and improving efficiency in the market economy. The role of the market mechanism in the in-depth integration of industry, university, and research is mainly reflected in the allocation of innovation resources, covering all subjects of industry, university, and research involved in the innovation process, as well as innovation factor markets such as the labor market, technology market, and financial market. With the acceleration of the in-depth integration of industry, university, and research, the market mechanism has an increasingly greater impact on all innovation subjects and supporting subjects of industry, university, and research.

For enterprises, the market is the driving force and destination of their technological innovation. For universities, their funding sources are no longer limited to government appropriations; an increasing proportion comes from enterprises. Therefore, their technology supply capacity will inevitably become more dependent on market demand, and their scientific research strength will also be closely related to the market price of talents and the expected returns of scientific research. On the other hand, scientific research outputs will be tested by the market, leading to the survival of the fittest. This requires universities to judge changes in market demand in the setting of majors and courses and adapt and adjust in a timely manner. Therefore, the market mechanism allocates innovation resources through competition. Global integration integrates all subjects of the technological innovation system into the global industrial chain, realizing the global integration of products and innovation factors. Thus, competition will be all-round – not only do all subjects face competition, but products, innovation factors, and factor markets also face competition. Enterprises face industrial competition at home and abroad, and R&D institutions face technological competition at home and

abroad.

Promoting technological progress and deepening the integration of industry, university, and research are aimed at improving competitiveness and promoting economic growth. Its micro-performance is that enterprises obtain profits due to their advantageous position in market competition, thereby achieving output growth; research institutions gain advantages in technological competition to provide technologies for enterprises' output growth, forming the in-depth integration of the technology chain, innovation chain, talent chain, and industrial chain. This requires the in-depth integration of industry, university, and research to be market-oriented, while the government plays a role in areas where market failure may occur. At present, the extensive cooperation and innovation between industry, university, and research in China are mostly limited to bilateral cooperation between enterprises, universities, and research institutes, with insufficient openness and low efficiency in the allocation and utilization of innovation resources. The failure to give play to the guiding role of the market mechanism is essentially due to the disconnection between the innovation chain and the industrial chain.

### **3.2. Improve the Talent Cultivation Mechanism and Optimize the Talent Development Environment to Build a Multi-Level Innovative Talent Echelon and Talent Ecosystem**

Talents, especially young talents, are the core driving force of innovation. It is necessary to improve the talent cultivation mechanism, optimize the talent development environment, build a multi-level innovative talent echelon and talent ecosystem, and support young talents to take on important responsibilities. Secondly, scenarios are important carriers for technological innovation and industrial transformation. It is necessary to promote technological iteration and product upgrading by opening up application scenarios and building testing and verification platforms. Guide key industrial parks to plan and layout physical bases for the application and transformation of achievements, actively connect with major innovation platforms such as national laboratories and major scientific and technological infrastructure, and guide enterprises in the parks to actively undertake the transformation of scientific and technological achievements. Promote the "incubation along the way" and "hatching along the way" of original achievements.

Second, accelerate the construction of a matrix of high-level sci-tech innovation platforms, actively lay out future tracks, dynamically update the "two lists" of major scientific and technological achievements and enterprise technological needs, and shape new competitive advantages with the "overtaking on a curve" strategy. Focus on industrial chains such as electronic information, equipment manufacturing, advanced materials, and intelligent connected vehicles, and carry out actions to supplement, stabilize, and strengthen the industrial chains. Focus on solving key and bottleneck problems in industries, and encourage innovation entities to conduct collaborative research and promotion of applications. Based on the advantage of abundant scientific and educational resources, increase the layout and construction of concept verification centers and pilot R&D platforms, regularly hold events such as scientific and technological achievement matching meetings, actively develop services such as

technology brokerage, information consulting, and inspection and testing, and promote the efficient flow and optimal allocation of innovation factors.

### **3.3. Establish and Improve a Diversified Investment and Financing System to Connect the Innovation Chain and Capital Chain**

Explore and optimize the fault-tolerance and liability-exemption mechanism for state-owned venture capital. Set more scientific and objective assessment indicators for the investment period and exit period of state-owned angel investment funds and venture capital funds, tolerate the investment failure of a small number of projects, and comprehensively evaluate the overall operation effect of the fund rather than the profit and loss of a single project. Develop and expand patient capital, smooth the exit channels for venture capital, and attract more social capital to participate in venture capital. Make full use of the enterprise innovation scoring system to accurately identify high-tech and promising projects, vigorously promote a series of bank-enterprise docking activities, and increase financial support for seed-stage and start-up enterprise projects.

The government should play a guiding role and introduce targeted policies. On the one hand, set up special guidance funds to provide capital support for innovative enterprises at different stages, reducing their financing thresholds and costs; on the other hand, provide tax incentives, such as tax reductions and exemptions for R&D investment and equity financing of innovative enterprises, to stimulate the enthusiasm of enterprises for innovation and financing. Build a multi-level capital market. In addition to the main board, small and medium-sized board, and ChiNext board, accelerate the development of the Science and Technology Innovation Board (STAR Market) to provide listing and financing platforms for innovative enterprises of different sizes and growth stages. At the same time, encourage the development of the bond market and support innovative enterprises in issuing special bonds. In addition, actively guide social capitals such as private equity investment and venture capital to participate in innovative projects, using their professional advantages to select high-quality projects and inject capital and resources into innovative enterprises.

Financial institutions should innovate financial products and service models. Develop characteristic products such as intellectual property pledge loans and accounts receivable pledge loans to solve the problem of innovative enterprises having light assets and lacking collateral. Use technologies such as big data and AI to establish a credit evaluation system for innovative enterprises, accurately assess the risks and values of enterprises, and improve financing efficiency. Promote the in-depth integration of industrial capital and financial capital. Encourage large enterprises to set up industrial investment funds, layout innovative projects around their own industrial chains, and realize the coordinated development of industrial upgrading and innovation. At the same time, strengthen cooperation between financial institutions, research institutions, and universities, intervene in the incubation of innovative projects in advance, and provide capital support and professional guidance for the transformation of innovative achievements. For sci-tech projects, invest less in each project but more in the number of projects; invest as early as possible rather than later.

### 3.4. Optimize the Innovation Policy System to Provide Institutional Guarantee for Innovation Activities

Systems are the guarantee mechanism for innovation activities. It is necessary to provide institutional guarantee for innovation activities by improving the intellectual property protection system and optimizing the innovation policy system. The core of nurturing pioneering technology enterprises lies in the protection of institutional innovation. At present, the key bottleneck restricting the transformation of SMEs into strategic new tech forces is no longer simply the lack of technical reserves or capital shortage, but the deep-seated contradiction of "institutional fragmentation" between the innovation chain and the industrial chain. This is specifically reflected in structural contradictions such as the impeded flow of innovation factors between regions and departments, hindered transformation of scientific research achievements, imperfect incentive mechanisms for innovation entities, regional market segmentation, local protectionism, and "involutionary" industrial policies. Therefore, it is urgent to comprehensively deepen the reform of the scientific and technological innovation system and mechanism, carry out systematic and operable institutional design, and focus on breaking down the barriers that restrict the free flow of innovation factors. First, comprehensively sort out the current scientific and technological innovation policies at the municipal and district levels, carefully classify and consolidate various subsidies, rewards, and support policies, and establish a clear, concise, and unified policy data framework. Second, promote data and information sharing among multiple departments such as market supervision, taxation, science and technology, economy, and human resources and social security, and establish a "white list" system for policy implementation. Enterprises, talents, and projects that meet the conditions are included in the "white list", and automatic review is conducted based on preset review rules and departmental data to proactively implement policies. Third, regularly monitor and grasp the implementation of policies, and effectively address the demands of innovation entities.

## 4. Conclusion

The rise of Hangzhou's "Six Little Dragons" is by no means accidental, but the inevitable result of the city's long-term accumulation and targeted efforts. The government's forward-looking support, high-quality business environment, sound talent cultivation system, collaborative industrial ecosystem, unique innovation culture, and sound capital support system together constitute the core advantages of Hangzhou's innovation ecosystem. This multi-dimensional innovation ecosystem has not only nurtured the "Six Little Dragons" but also laid a solid foundation for the continuous cultivation of innovative enterprises in the future. Even if the "Six Little Dragons" had not emerged in Hangzhou, other "little dragons" would have appeared, because behind the "Six Little Dragons" there is a large "fish pond" with more than 600 potential "little dragons", and only 6 have emerged so far. Looking to the future, the rise of Hangzhou's "Six Little Dragons" reflects the characteristic of "speed is everything in innovation" in the new round of technological revolution. This also means that a more far-reaching change lies in the paradigm upgrade of the innovation evaluation system – promoting fast innovation, real innovation, and in-depth

innovation through fast decision-making, and stimulating innovation vitality to improve the overall innovation speed of the city. When the value of pioneering technology enterprises is no longer limited to economic indicators but is reflected in the right to set technical standards and the dominance in the industrial ecosystem, the traditional innovation evaluation mechanism that focuses on local gross domestic product (GDP) and the economic benefits of individual enterprises can no longer adapt to the development of new-quality productive forces. Through disruptive technological breakthroughs and the establishment of ecological competition rules, pioneering technology enterprises redefine the global industrial competition rules by means of open-source technology and wide-ranging scenario applications. This transformation also requires the innovation evaluation system to shift from a single economic dimension evaluation to a multi-dimensional comprehensive evaluation. Therefore, it is necessary to establish a multi-dimensional evaluation system covering technological advancement, industrial driving force, and international influence, and match it with differentiated industrial policies. In the future, with the gradual improvement of the innovation evaluation system, the efficiency of the business environment and innovation system will be improved as a whole. Pioneering technology enterprises will also play a more important role in global technological competition, promoting China's transformation from a "technology follower" to a "rule-maker", and finally realizing a historic leap from an "innovation power" to an "innovation giant".

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