

## Artificial Intelligence in Robots: Integration of AI and Robotics for Complete Automatization

Sachin G\* and Nikhil RK\*

Semiconductor and Electronics at MarketsandMarkets, Pune-411013, India

\*Corresponding author: Sachin G, Associate Vice President, Semiconductor and Electronics at Markets and Markets™, Research Private Ltd., Tower B5, Office 101, Magarpatta SEZ, Hadapsar, Pune-411013, India, Tel: +91-9910062353; E-mail: sachin.garg@marketsandmarkets.com

Received date: September 14, 2019; Accepted date: September 24, 2019; Published date: September 27, 2019

### Abstract

This article intends to look into the integration of artificial intelligence (AI) and robotics for process optimization in industries. AI-specific hardware and software are components that can enable the integration of AI and robotics. AI-based robots are finding numerous applications in military and defense, law enforcement, personal assistance and caregiving, warehouse stock management, and factory automation, and hence governments of various countries worldwide have been investing for research on AI and robotics.

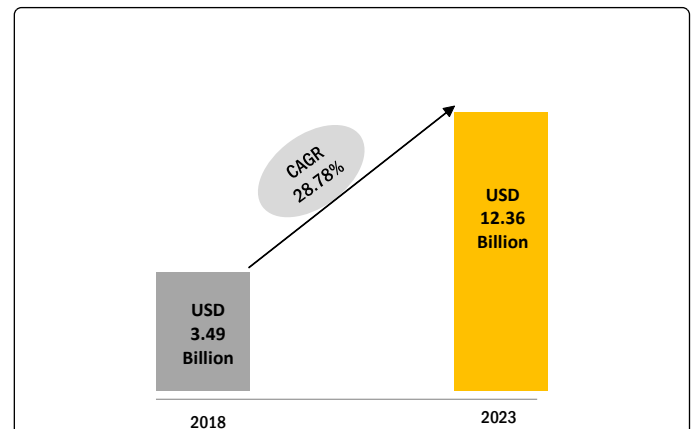
**Keywords:** Artificial intelligence; Robotics; Automation; Cyber security; Cobots, Predictive maintenance; Process optimization

### Abbreviations:

AI: Artificial Intelligence; CAGR: Compounded Annual Growth Rate; Co-bots: Collaborative Robots

### About the Study

Robots have become smarter; from collaboratively working with people in production facilities to helping the elderly with their day-to-day activities, robots have come a long way than just being deployed in assembly lines. The rise of AI in recent years has made this possible. The AI robots considered here refer to service and industrial robots that are integrated with AI technology. 'AI in robots' refers to the AI-specific hardware and software adopted for developing an AI integrated robot or robotic system. The AI integrated robots can learn a few repetitive tasks without any human intervention and can even communicate with humans or, in some cases, with other peer robots. According to our study on AI in robots, the market for these robots is expected to reach USD 12.36 billion by 2023 from USD 3.49 billion in 2018, growing at a CAGR of 28.78% from 2018 to 2023 (Figure 1) [1]. The high adoption of robots for personal use, such as companionship and entertainment; support from governments worldwide to develop modern technologies; and financial assistance through government budgets or subsidies are some of the key factors driving the growth of AI-integrated robots.



**Figure 1:** AI in Robots Market – Forecast to 2023. **Source:** Expert Interview and Markets and Markets Analysis.

The most important difference that AI brings to robots is enabling a move away from automation to true autonomy, which is visible when the robot needs to handle several tasks, or respond to humans or changes in an environment. Due to the various applications of AI-based robots, governments of various countries worldwide are funding companies operating in the AI market. For instance, in 2019, the UK government announced an investment of USD 24.11 million into university research on AI and robotics [2]. Also, there is a growing demand for AI robots for personal assistance of elderly people. These factors are expected to fuel the demand for AI-based robots. With the adoption of technologies such as cloud computing, robots are increasingly being networked. The global military and defense sector has started considering AI-based robots as a vital part of any military fleet. However, researchers and technicians around the world are alerting about the threat AI poses for cyber security as these networked robots can potentially be hacked, and their abilities can be adversely used. In February 2018, study teams from the University of Oxford and University of Cambridge warned that AI could be used as a tool to hack into drones and autonomous vehicles, and turn them into potential weapons [3]. In case the AI-integrated robots being adopted for military and defense applications gather incorrect data, they can be destructive. As AI-integrated robots are user-friendly and the market for these robots is in the introductory stage, there are no regulations regarding the design of these robots, or standardization bodies. This lack of regulatory or standardization bodies is a major factor restraining the growth of the AI-integrated robots sector, especially due to safety and security concerns. Apart from these factors, developing AI to help robots take self-decisions and to make them safe for humans is a major challenge faced by AI-integrated robot manufacturers in the market. In addition, the time taken to commercialize these robots is a matter of concern.

As shown in Figure 2, the components enabling the integration of AI with robots can be categorized into AI-specific hardware and software. Hardware components are broadly segmented into processors, storage devices, and network devices, whereas the software integrated into a robot synthesizes the data received from the hardware and processes it in the AI system to generate an intelligent response. This software is broadly classified into AI solutions and AI platforms.

In most cases, manufacturers of robots partner with AI technology provider companies that develop essential hardware or software for their products. AIBrain (US) is one of the leading software providers for AI-based robots [4]. Nvidia (US), Advanced Micro Devices (US), Intel (US), and Xilinx (US) are the major AI chipset manufacturers present in the market. Processors used in AI-integrated robots include IBM Power System S822LC [5], Nvidia Titan V [6], and Tesla P100 PCI-E 16GB [7]. In case of service robots, AI based robots have found

their application in retail services. For instance, Lowe's (US) have adopted LoweBot NAVii, an autonomous retail service robot built by Fellow Robots (US) to improve customer service at their retail outlets [8]. The robot can recognize voices of the customers visiting the Lowe's retail outlet and also can answer their basic questions through the integrated touchscreen. The robot automates the inventory taking process with the help of computer vision technology enabled due to integration of NVIDIA Jetson platform with the robot.

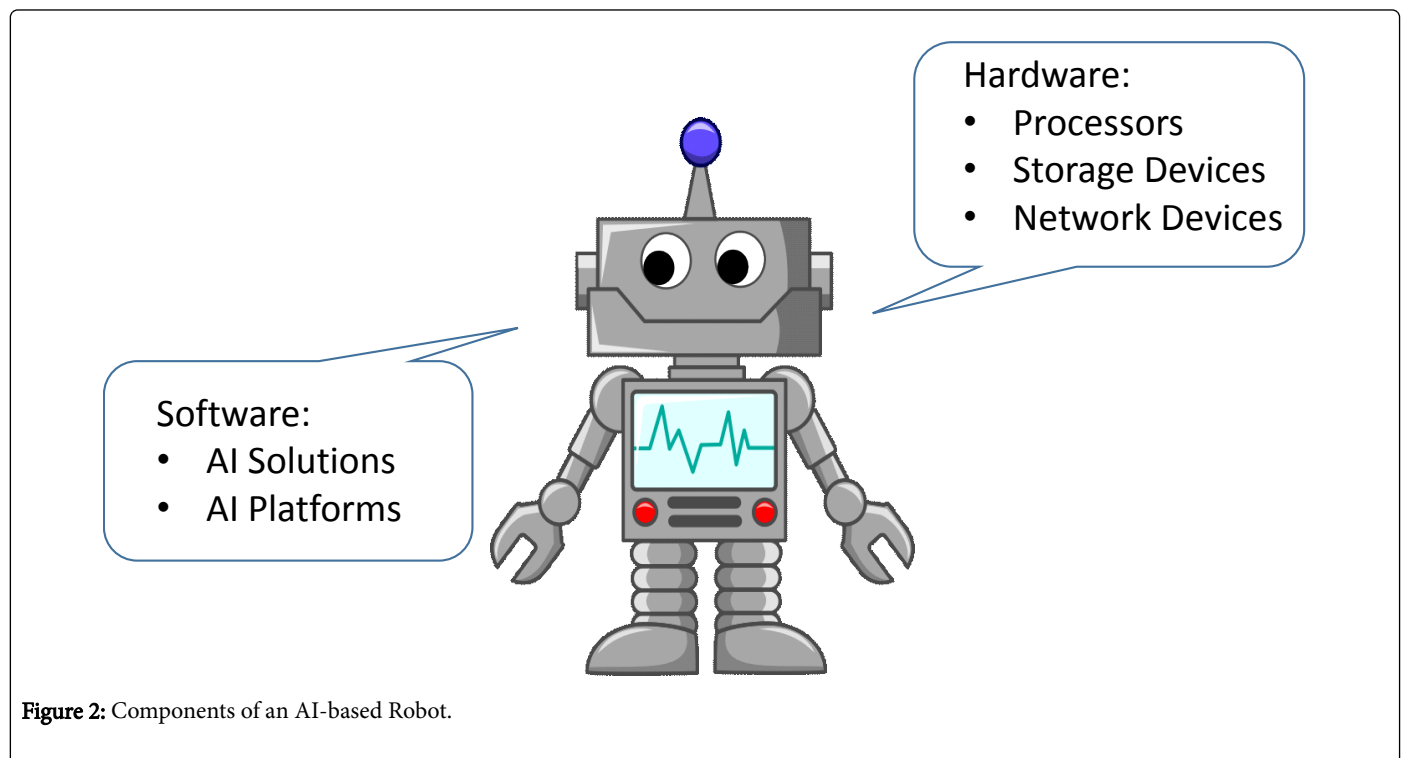


Figure 2: Components of an AI-based Robot.

It has been well recognized that AI in robots augments and amplifies human potential as well as productivity, and this is reflected in the rapid increase of investments across many companies and organizations. It is only because of AI that in manufacturing industries, robots are evolving from potentially dangerous industrial machines to smart “cobots.” AI is used to optimize robot accuracy and reliability. Most industrial robots come with services using AI to analyze data from robots in real-time to predict whether and when a robot is likely to require maintenance, enabling manufacturers to avoid costly machine downtimes and hence optimizes the manufacturing process [9]. AI can improve the speed and accuracy of a robot performing applications such as, pick and place which results into process optimization and cost savings. For instance, in April 2018, FANUC launched an AI based bin picking robotic system [10]. This system adopts NVIDIA GPU and is based on deep learning. The deep learning algorithm allows FANUC Robot Bin Picking system to learn the picking order automatically and hence optimizes the bin picking process and also eases the process of installation resulting into cost savings. AI has continued to beat all records and overcome many challenges that were unthinkable less than a decade ago. The combination of these advances is expected to continue to reshape our understanding of robotic intelligence in many new domains.

### Acknowledgment

We would firstly like to thank the Journal Coordinator of the Journal of Industrial Electronics and Applications and its Editorial Board for the great honor of writing this editorial.

We also would like to cite few of the industry experts such as, Sergii Kornieiev (President, BaltRobotics Sp.z.o.o. (Poland)), James Hodson (Chief Science Officer, Cognism (UK)), and Peter Suma (Co-CEO, Applied Brain Research Inc. (US)) for their help and advice in studying this niche market. We would also like to mention our colleagues at Markets and Markets, Rohit Waghadhare (Assistant Manager) and Anand Shanker (Team Lead) for their help and advice in writing this editorial.

### Quotes from authors

“Increasing adoption of deep learning and NLP technologies for retail stock management and security applications is contributing to the growth of the market in Asia-Pacific region”.

Sachin Garg, Associate Vice President, Semiconductor and Electronics at Markets and Markets.

“Adoption of AI robots for public relations application is expected to grow at a significant rate in next 5–10 years”.

Nikhil R. Kumbhar, Senior Research Analyst, Semiconductors and Electronics at Markets and Markets.

## References

1. Artificial Intelligence (AI) Robots Market: Market Research Report (2019) MarketsandMarkets™. Research Private Ltd.
2. UK Government announces £18.5m investment in AI training: Article published by Education Technology Magazine.
3. Ryan Browne (2018) Weaponized drones. Machines that attack on their own. 'That day is going to come': Article published by CNBC.
4. AIBrain Inc, IRSP (2019) Intelligent Robot Software Platform.
5. Agam Shah (2017) IBM brings Google's AI tools to its Power hardware: Article published by Computerworld.
6. Hassan Mujtaba (2018) NVIDIA's CEO Gives Away Special 32 GB HBM2, Volta Powered, Titan V CEO Edition To 20 AI Researchers: Article published by Wccf (Where Consumers Come First) tech.
7. Agam Shah (2016) Nvidia monstrous Pascal GPU-powered Tesla P100 is getting a PCI-E version, too: Article published by PCWorld.
8. NVIDIA Corporation (2019) NVIDIA Jetson AGXTM systems for robotics.
9. Victoria Lietha (2019) ABB, Predictive maintenance for manufacturing process optimization.
10. FANUC Corporation(2019) FANUC Robot Bin Picking system.