

Overview of Cyber-Physical Systems

Su Peng*

Shenyang University of Chemical Technology, Tiexi, Shenyang, China

DOI: 10.36347/sjet.2019.v07i11.004

| Received: 21.10.2019 | Accepted: 28.10.2019 | Published: 14.11.2019

*Corresponding author: Su Peng

Abstract

Review Article

Cyber-Physical Systems (CPS) integrates the real-time interaction system of communication computing and control capability on the basis of information received by sensors. Since the concept was proposed in the 21st century, theoretical research and application research on CPS have been going on. In order to grasp and study the basic content, the information paper summarizes the physical system, its perception layer, network layer, and control layer three levels analysis summary, to understand the physical information system, the main principle of the future development trend, the safety problem research and safety protection measures, etc. The typical Cyber-Physical Systems structure is summarized to provide reference for future research.

Keywords: Cyber-Physical Systems, architecture, security study, security protection measure.

Copyright © 2019: This is an open-access article distributed under the terms of the Creative Commons Attribution license which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use (NonCommercial, or CC-BY-NC) provided the original author and source are credited.

INTRODUCTION

Cyber-Physical Systems (CPS), found in 2006 by the national foundation for sketching Hell Gill formally, is the collection of computer, communication and control for the integration of the next generation of intelligent control system. The CPS is proposed to change the original content and things, people and things, and even the interaction of the physical world and digital world, promoting the upgrade and optimization of the various industries. The CPS systems supporting two depth fusion systems of an integrated technology can better satisfy the business enterprise's future development. For example: the German Initiative "Industry 4.0" [1], the American "Smart Manufacturing" [2], the Chinese "Made in China 2025" [3], the Japanese IVC (Industrial Value Chain Initiative) [4], the Italian "Industrial National Plan 4.0" [5], etc. In this paper, the concept, basic structure and long-term task of CPS in use were expounded. Through consulting various literatures, the research on CPS was summarized, and the development trend of CPS was finally summarized.

Basic concept and definition of CPS

The meaning of CPS changes along with the development of The Times, so far there is no clear definition. The 2017 whiter Cyber-Physical Systems 2017 was held in Beijing, and the cognition of CPS was updated again. The Cyber-Physical Systems in 2017, the white paper that has carried on the overall positioning to the CPS of CPS is to support two depths

fusion. Set of comprehensive technical system, and at the same time puts forward the CPS new concept :Cyber-Physical Systems by integrating advanced sensing, computing ,communications, control and so on information technology and automatic control technology, build the system space and information space, machine, material, environment, information etc to Somalia's mutual mapping timely interaction and efficient coordination of complex system. The allocation of resources and implement system operate on demand response, fast generation, and dynamic optimization."

CPS Architecture

According to the function, each module is different. The CPS can be divided into controlling module, network module decision module and three big modules; connection between three modules, one module of the output is likely to be another input. Control module and network module and data transmission between the decision module and network module are a two-way street, but the control module cannot communicate directly with the decision module. It needs through the network module data into the into the decision module. The CPS system architecture is shown in Figure-1.

According to the relevant content of the three module of CPS system architecture in literature [6-8], the following is a practical analysis.

Control Module

The control module is mainly composed of physical equipment, which acts as the controlled object and provides the data needed by the decision-making module. In actual industrial research, sensors, control system and other equipment and some information in the control module are usually integrated for modeling. The main task of the control module is to provide information data for the decision module, receive the information processed by the decision module, and control the control object according to the received information.

Network Module

The network module is based on the latest generation of network to collect and transmit data real-

time communication between them. The information transmission of the network module and the control module need data conversion. Another function of the network module is man-machine interaction. When the decision module fails, it can be modified by human input data.

Decision Module

The decision module is mainly composed of a calculation program. According to the data output by the integrated model in the decision module, it analyzes and perceives performance indicators such as robustness, operability and stability of the variable control object, and issues corresponding control instructions through the required method of artificial intelligence.

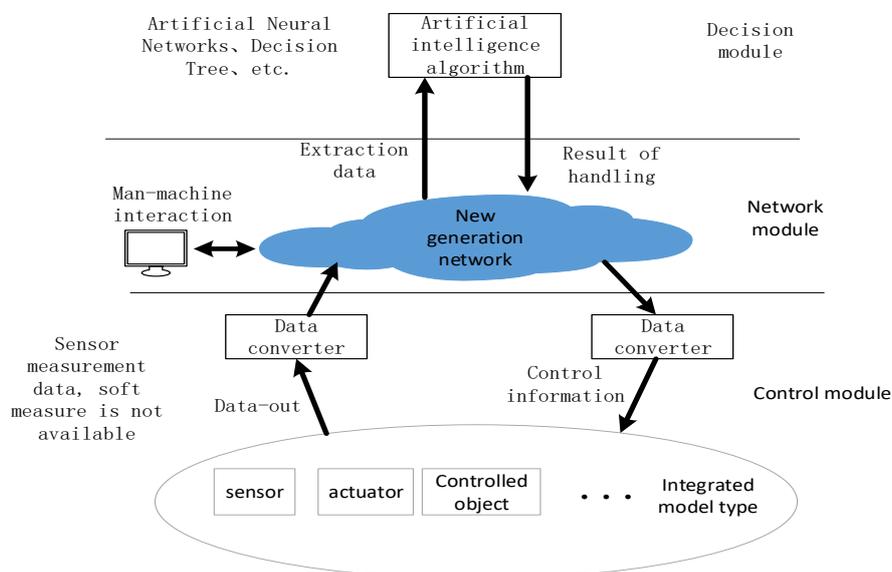


Fig-1: CPS Architecture

Safety Issues and Safety Measure

CPS system not only combines the advantage of the three areas, but also has three areas of security issues. For example, common security threats include privacy disclosure, database attack, illegal login, internet recruitment, routing attack and electromagnetic interference [9].

For CPS security problem, common measure includes establishing an effective fault-tolerant mechanism to reduce the error rate when the physical receiving node is designed. Point-to-point encryption mechanism and secure routing mechanism [6]; Develop new artificial intelligence algorithm and strengthen data protection, etc.

Summarizes

CPS network is a new local operation, global control, and multidisciplinary cross-application of hybrid network as a new way of networking, CPS network in many areas such as personal medical assistance, intelligent transportation, environmental

monitoring and other applications with great potential. Future research direction includes: exploring and supplementing new intelligent algorithms for data and information processing; develop and expand the interactive program of horizontal and vertical integration of CPS system; security and reliability of big data centers.

REFERENCE

1. Kagermann H, Helbig J, Hellinger A, Wahlster W. Recommendations for implementing the strategic initiative INDUSTRIE 4.0: Securing the future of German manufacturing industry; final report of the Industrie 4.0 Working Group. Forschungsunion; 2013.
2. Members of SMLC, Implementing 21st Century Smart Manufacturing, Workshop Summary Report, 24 June, 2011.
3. Shao Y. Strategic Vision and outlook of "Made in China 2025", Industrial and regional policies.

4. Miyazawa A, Usami R. Through IoT - Japanese factories Connected Together, METI Journal, 2015; 5.
5. [5] Ministry of Economic Development, "Industria 4.0" Italy's national plan for industry, February, 2017.
6. Zhiliang S. Research on architecture and security technology of Cyber-Physical Systems [J]. Microcomputer application, 2019; 10.
7. Zhan X. Cyber-Physical Systems in enterprise power management [J]. Integrate circuit application, 2019; 8.
8. Luo S. Architecture of Cyber-Physical fusion system [J]. Computer application and components, 2019; 8.
9. Zhang Y. Quantified risk assessment of distribution network Cyber-Physical Systems against network attack [J]. Power system automation, 2019; 8.