CPS and 5G

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Contents

Abstract: Cyber-Physical Systems (CPS) are integrated systems where physical processes interact closely with computation and communication technologies. As these systems become more prevalent in areas such as autonomous vehicles, smart manufacturing, and healthcare, the demand for fast, reliable, and scalable communication grows. Fifth-generation (5G) mobile networks offer key features like ultra-low latency, high bandwidth, and massive device connectivity, making them a strong enabler for the future of CPS. This research provides an overview of CPS and 5G technologies, explores their integration, highlights the benefits of combining them, and discusses the challenges and future directions. The goal is to clarify how 5G can enhance CPS performance and open new possibilities for real-time, intelligent, and connected systems.

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1 Introduction

With the increasing number of sensors worldwide connected to the Internet,Where it was made possible by the current fast advances of technology. Furthermore, the massive number of physical objects such as embedded devices, smartphones, smart tablets, sensors,and actuators shaped the notion of cyber-physical systems (CPS). CPS is mainly an interconnected physical object and a Cyber system more like a simulation. What facilitates the connection between cyber-physical different systems is the Internet of Things [At17]. One of the greatest challenges of connecting the cyber system with the physical component is the transmission of data and the connection between them. With the recent rise of 5G technology, nearly real-time communication between systems became achievable [Ra23]

2 Background

2.1 Cyber-Physical Systems

CPS is the foundation of Internet of Things and it forms the foundation for Industry 4.0. A real life example for CPS is the mobile phone. With technological advancements, phones offer an extensive set of usages which have completely changed the early principal of mobile phones. [Me19]

CPS has various uses, They are used in transportation for example in public transportation to manage vehicle charging and monitoring traffic. Moreover, it is used in Intelligent buildings to monitor and control HVAC systems, electrical and safety systems. [Me19] In summary, Cyber-Physical systems are complex, physically aware systems that integrates with physical hardware and cyber computing. The system as a whole, observes, communicates and control aspects of the physical system. [Gu14]

2.2 5G Technology

5G is the fifth generation of wireless communications supporting cellular data networks. What makes 5G impactful to many specializations it is its low to moderate latency and the support for huge amounts of data to be transported at high speeds. [Ra20] 5G offers a high speed internet connectivity, a great bandwidth and unlocks the ability to stream UHD media in nearly real-time. There are many services that made use of these features like massive machine-to-machine communications, VR online meeting rooms, smart homes and more [Da22]

3 Benefits of CPS and 5G Integration

4 Ask ChatGPT

4.1 ChatGPT

4.2 Scientific discussion

5 Challenges

6 Future Work

7 Conclusion

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