

Analyzing Theorems and their Applications While Assessing the Concept of "Cyber Physical Frameworks".

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Abstract: - The cyber physical system (CPS) is an intelligent computer system in which compute-based algorithms control the mechanism. In a typical CPS, the computer's software and physical components are interconnected and have the capability of performing multiple different modalities as well as interacting with each other, and the change occurs based on the context being used. It is a combination and collaborative effort of mechatronics, cybernetic theory, and design process. Controlling the mechanism in CPS is also referred to as embedded systems. The responsibility in an embedded system is to manage the computational operations rather than the connection between the system's physical and software components.

Keywords: - Elements of Cyber actual frameworks, Prologue to Cyber actual frameworks CPS Working Instrument, CPS Advantages, CPS Limitations.

Introduction: -

Cyber physical system can be referred to as a complex ecosystem in which various hardware devices are present which interact with each other using digital technology. In simple words, CPS is the system where a number of hardware devices are connected to each other and are operated by computer software by using complex computer algorithms. Any system which is connected digitally and uses computer algorithms to solve a issue comes under the category of cyber physical system. CPS can operate on various modes like spatial mode or like temporal mode due to the fact that the software algorithms and the hardware devices are deeply interconnected with each other in this type of system. They have the capability to describe the behaviour which changes on the basis of the context for which it is used. Examples of a CPS can be a PCI card, a hybrid digital analog computer, a laptop which has Linux operating system etc. It is also observed that a non-typical CPS device can be converted into CPS device by adding more than one CPS controller into it. The thought is intently attached to ideas of mechanical technology and sensor networks with knowledge components legitimate of computational insight driving the pathway. Continuous advances in science and designing work on the connection among computational and actual components through canny instruments, expanding the versatility, independence, effectiveness, usefulness, unwavering quality, security, and ease of use of digital actual frameworks. The other major objective of CPS is to improve the efficiency of traditional physical systems. The requirement for a CPS would be to have three basic elements which are safety, security and sustainability.

Elements/Components of Cyber-physical system: - [1]

Following are the modules or elements in architecture design of Cyber physical system: -

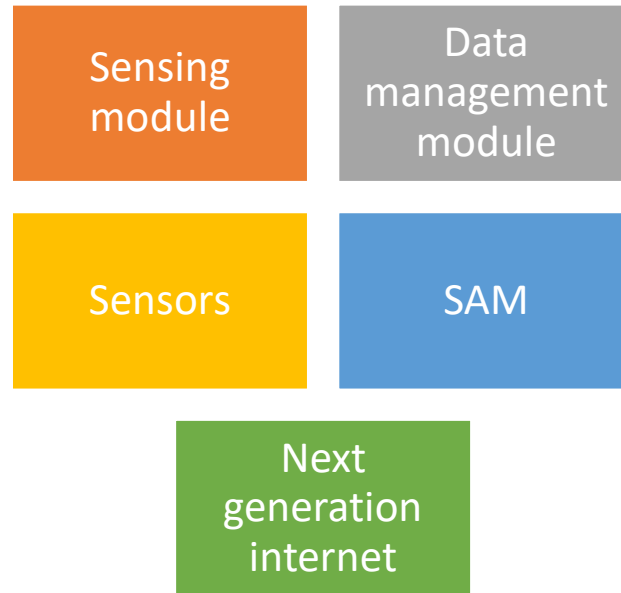


Figure 1 Modules of Cyber physical system.

1. Sensing Module: -

* For information assortment from actual world through sensors, the principal capability of this module works for climate mindfulness which is accomplished by starter information pre-handling. The information is given to the Data Management Module.

* This module helps to support multiple networks which depends upon the type of network it is deployed upon.

2. Data Management Module: -

* This module consists of the elements which are responsible of the management and storage of the data and the information. It also contains devices which are used for the computations as well as for storing the data.

* The major role of this module is to collect data from the sensing module and then pass it on to the service aware modules with the help of the next generation internet.

3. Next generation internet: -

- These are used to select the path which will help to move packets from the source to its destination. The current internet services are able to find the best path that can be used by the data packets to reach to its destination from its source of origin.
- The next generation internet services should be capable of identifying various best possible routes for the data packets to travel from its source to its destination.

4. Service Aware Module: -

* The service aware module is responsible to perform variety of tasks like task scheduling, analysis of task, decision making, etc.

* It will receive the data which is pass on to this module by DMM via internet.

* Once it recognises the data then based upon the type of data it will route these data packets to the services available.

5. Application Module: -

* In this module, various services are deployed. The information and data which comes here will be saved on the servers.

* For the safety of the data, the database on which data is stored will be stored locally as well as on the cloud also for damage control.

* NOSQL can be used to store the data as it has the capability to manage the data which is stored across distributed systems.

6. Sensors and actuators: -

* These both acts like electronic devices which interact with the physical environment. It will receive the instructions from the application module and then executes it.

*The other important part of the CPS is to maintain the security of the system. It is important to maintain all possible security measures like access security, data security, as well as device security.

Advantages of Cyber Physical Systems: - [2]

Following are some of the advantages of Cyber Physical Systems: -

1. Security: -
 - With the latest developments in smart technologies, a number of innovative ways have been developed to provide security measures.
 - CPS have improved the smart security techniques and have taken it to the next level.
2. Health care: -
 - Due to the development of CPS systems, it is made possible to the response to treatment of a cancer patient.
 - CPS have also helped to send the pulse rate, oxygen levels etc from the smart watch to the device it is connected to.
 - This all have been possible due to the availability of CPS systems.
3. Agriculture field: -
 - At times alluded to as brilliant agribusiness or computerized cultivating, CPS-related innovation has brought about progressions that assist with driving efficiencies on ranches: from robots and satellites that hand-off pictures connected with plant wellbeing to savvy sensors on farm haulers or gatherers that give data on soil type and condition.
4. Infrastructure: -
 - The engineers who works with the CPS are capable of improve the declining needs if infrastructure.
 - By using advanced technologies like IoT and video cameras , the planning for smart infrastructure can easily be done using CPS which helps to enhance and improve the quality of living style in these cities which results in enhanced development and infrastructure of the city.
5. Sustainability: -
 - Society keeps on looking for additional answers for the present overpowering requirement for economical practices in business, medical care and endless different enterprises, and CPS innovation frequently makes the headway of these arrangements conceivable — arrangements, for example, public electric vehicle, reasonable energy stockpiling, open sun based power and clean reusing drives are an immediate consequence of IoT and CPS innovation.

Limitations of Cyber Physical Systems: - [3]

Following are few disadvantages of the CPS: -

1. Remote Access: -

The CPS domain is still searching for ways to improve the attacks done by taking remote access into the system by the attackers. These kind of attacks causes disturbances, financial loses etc.
2. Jamming: -

In this type of attack the attackers will launch wireless jamming signals which will result in denial of service which will stop the functioning of the CPS.
3. Wireless Exploitation: -

If the attackers know the structure of the system then they use it to gain unauthorized access to the system which helps them to gain remote access by exploiting the wireless of the system.
4. Information Disclosure: - Programmers can unveil any private/individual data through the interference of correspondence traffic utilizing remote hacking devices, disregarding both security and classification.
5. Vulnerability: -The CPS systems are prone to attacks due to its vulnerable nature. The vulnerable nature of CPS system depends upon many factor like platform management, network vulnerabilities etc.

CPS Models: -

These are divided into following three main categories: -

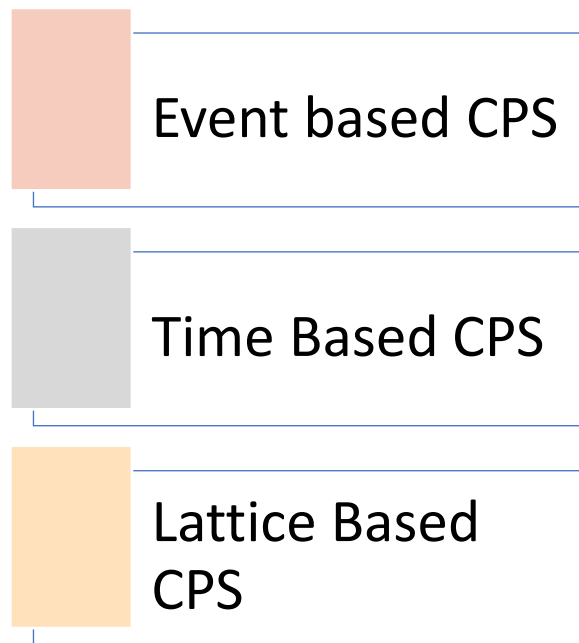


Figure 2 Models of CPS.

1. Event-based CPS: -
In this kind of models, before the actuation process starts the event must be identified by the sensors. Each component timing constraint depends upon the sensing, actuating, computing constraints etc.
2. Time-based CPS: -
This type of model focuses on functional as well as non-functional aspects. The functional aspects includes behaviour and accuracy and non-functional aspects includes performance and timings. These models are capable of identifying the boundaries which helps to prevent it from state explosion issues.
3. Lattice based model: -
The CPS occasions are addressed by the occasion type, alongside the inward and outer occasion credits. Assuming these occasions are consolidated, they can be utilized to characterize a spatio-fleeting property of some random occasion, while likewise distinguishing every one of the parts that were noticing the occasion.

Conclusion: -

Digital actual framework or CPS is the PC framework which is savvy in which figure-based calculations will control the component. In a regular CPS, the product parts of the PC and the actual parts are interconnected to one another and has the capacity to play out various modalities and furthermore can collaborate with one another and the change happens in light of the setting being utilized. It is the mix and joint endeavours of mechatronics, hypothesis of robotics, and configuration process. The most common way of controlling the component in CPS is likewise referred as implanted frameworks. In an implanted framework the obligation is to deal with the computational tasks as opposed to zeroing in on the association between the physical and programming parts of the framework. It tends to be contrasted and IoT with same design yet in CPS the accentuation is more upon the connection between the computational components and physical as well as programming components of the framework.

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