

Advancements in control systems

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Abbreviations: ICS, industrial control systems; SCADA, supervisory control and data acquisition; DCS, distributed control systems; RFID, radio frequency identity; SAS, semi-autonomous systems; ISIS, institute of software integrated systems

Introduction

Control systems are mechanical and/or electronic apparatus that controls other apparatus or systems by way of open or closed control loops. Usually, control systems¹ are automatized. These control systems are one of the major parts in not only in the industry but also in automation. The types of control loops that control this process that include Industrial Control Systems (ICS) for instance as Supervisory Control and Data Acquisition (SCADA) and Distributed Control Systems (DCS). These control systems are used to enrich reproduction, efficiency, adaptability, performance, quality and safety in many areas from Agriculture to Nuclear power plants.

Few of them are discussed from abundant sources of Control system applications which would assist in research and development.

Mathematical proofs, algorithms in control systems

Researchers work in quantifiable realism—An object exists and can be measured. Occasionally, though, the inevitability of the object and how it behaves wavers. In classical mathematic theory, Osinenko said that strength is a significant factor that can miss the point of control theory. Strength in this case refers to the specificity of the information transmitted. Scientist analyzed a hundred year old theorem by mathematician Constantin Carathéodory. This theorem implies that a problem with an unpredictable independent variable such as the trajectory of a thrown ball, that can be solved with weak logical systems. An analysis² of the discrepancy between mathematical proofs, algorithms and their applications in control systems³ with real and measurable outcomes was presented.

“There’s an ocean of mathematical results and theories in control systems that require constructive treatment” was confirmed by Osinenko.

Control systems makes way for large scale universal quantum computing

Scientist from QuTech collaborated by TU Delft and TN, concluded a resolution to the scaling experiment for superconducting qubits. The resolution utilizes control implementations with the amount of a lesser bookcase, to control essential set of eight qubits. By replicating and putting the eight qubits on the chip fragment, the original similar single control system can regulate any figure of qubits independently from eight to eight million or more and accomplish the task of the gates required for quantum error adjustment.⁴ This allows quantum computer programmers to accomplish quantum algorithms on any quantity of qubits. The next task at QuTech is to employ this new

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technique to comprehend a 17 qubit quantum processor with error adjustment in an ongoing activity.

In future quantum computers ensures rapid change in scaling in computing capacity with linearly expanding quantity of qubits. Nevertheless, harnessing this potential is challenging due to the convolution of regulating a large figure of qubits concurrently. The problem to this solution was solved by Richard Versluis, principal scientist at TNO and Leo DiCarlo and their associate professor at TU Delft and postdoc Stefano Poletto with his co-workers from TNO and TU Delft at QuTech and Intel. They designed a new method on control procedure for fault tolerant quantum computing built on a fundamental framework of eight qubits with stable set of control implements. This simple fundamental framework can be imitated to produce large bundle of qubits without any addition or variations to the control systems.⁵

RFID signals for inventory control in drones relay system

Recent retail business activity makes even radio frequency identity (RFID) scanning ineffective. For instance, Wal-Mart stated concern that in the year 2013 it lost \$3 billion in yield because of discrepancies between its stockpile records and its inventory. Even with RFID technology, it can take a particular broad retail store takes three months to perform a comprehensive stockpile review, which describes that it does not matches often and go undetected until discovered by customers inquiry.

Experts at Massachusetts Institute of Technology (MIT) has designed a new method that facilitate tiny in size, (Figure 1) safe and aerial drones to read RFID labels from 10’s meters away approximately, whereas recognizing labels locations with an moderate error of about 19 centimetres. Scientist also predicts that the system can be used in big storage places for both constant controlling to prevent stockpile discrepancies and area of particular items so that staff member can quickly and consistently meet customer’s inquiries. They solved this problem by using drones to relay signals radiated by a standard RFID reader. This only answers the problem but also describes that drones can be extended in conjunction with existing RFID stockpile systems without need of readers, new labels or any other reader application programs.

Smart transportation control systems for US freeways

Firmly integrated computing and networking systems are needed to attain smart transportation.⁷ But they have disadvantages too; they

are susceptible to cyber-attacks and or hostile countries. There was a Hollywood movie that depicted dramatization of risk; when a hacker takes supervision of Los Angeles traffic control guidance to aid his associates in embezzlement load of gold treasure from a heavily cladded car and then ran away.



Figure 1 Illustrates a system that employs safe, small, aerial drones to read RFID tags in large warehouse at better distance of several meters while identifying the tag locations developed by MIT researchers.⁶ Image Credit: © petrovk/Fotolia

The promising value of change nation's freeways into "smart transit control systems" is massive (Figure 2). Providing nation's hardened arteries with nervous system of computers and sensors that directly control on-ramp signs to retain transportation moving efficiently can significantly decrease fuel consumption, reduce movement times and air pollution and not to mention better road safety. In California alone it is estimated that commercial damages of traffic jamming has been at \$400 million approximately and in additional expense and 3.5million approximately in lost earnings every day.



Figure 2 Illustrates potential value of changing nation's freeways into "smart transit systems" is massive. Nervous system of computers and sensors that directly control on ramp signals.⁷ Image Credit: © carloscastilla/Fotolia

This project is an association between team of cyber physical security researchers at Vanderbilt University's Institute of Software Integrated Systems (ISIS) and Scientist at University of California, Berkeley College of Engineering and team collaborators from Advanced Transit Technology's connected corridors task.

Self-driving car and human-machine controlled systems

Hypothetical work, tested with various analysis in driving simulator will help to advance the advancement of safe semi-autonomous systems (SAS) for instance self-driving cars. Such structure or schemes rely on human control and intermittent transmission of control between the human and computerized structure. Expert's highlights considerable challenge that SAS analysis must focus on transfer control quickly, safely and effortlessly between the system and person controlling it. Most systems construct to date do not achieve this. They applied hypothetical framework to semi-autonomous machines using characteristic approach with two levels of reasoning. The high-level program planning takes into account the intermittent need to transmission without devising it in detail. It can manage circumstances by preventing machine, for instance when operator does not respond to the request to take over control. Their experiment and research of the integrated model demonstrates that it implements significant safety guarantees.

University of Massachusetts Amherst computer science graduate Kyle Wray and Luis Pineda with their professor Shlomo Zilberstein illustrated a new and novel method to manage the problem of transferring control between human and autonomous machines.⁸

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Conflicts of interest

The author declares there are no conflicts of interest.

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