Research Paper Draft

On

AUTOMATION AND EXCEPTION HANDLING IN MISSION CRITICAL SYSTEM

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Abstract

In our daily life we come across several mission-critical systems such as banking transactions, power supply and satellite communications. These systems are efficient and critical for individual person to a large organizations. Here, we discuss how to automate these functions or processes and make them enough fault tolerant to prevent any disastrous situation from occurring. Automating a mission critical system might be seen as handing over an important task to a complete stranger but this improves the efficiency and makes it less prone to human error.

Introduction

Mission-Critical System

What is a mission-critical system?

Mission-critical system is generally a system deemed to be a core structure of a firm or organization whose functionality impacts the particular organization greatly. These are present in our day to day life such as, Electricity transmission, aircraft and railway traffic, hospitals and also in advanced scientific technologies such as space crafts, satellites, and nuclear power plants.

What deems a system to be mission critical?

A system that controls the fate of a product's functionality such as production, transaction, output control, quality maintenance are categorized as a Mission-Critical (MC) system. Any negative impact in this system could lead to the disaster of the company. If this system is shutdown or made useless in any means then it will completely break apart the firm or organization to which the system belongs to.

Automation

What is an Automation?

Automation can be defined as performing a task with minimal or no manual interaction. Automation can be done for small tasks such as messaging, ticketing, opening and closing of doors to huge and complex tasks such as driving, air traffic control, piloting, production.

Impacts of Automation

"Automation", this term has seen some ups and downs throughout the world. Automating some complex tasks has led to reduction in time and the cost to produce the product. This is true in case of software engineering tasks such as coding, designing and testing. They also provide consistency in the tasks with less or no errors at all. Automating a complex tasks can be difficult since it needs more training, algorithms and steps to be followed. But, this exposes them to less error prone environment and reduction in human errors.

Automation is viewed as a tool that put humans out of jobs. In many of the domains people are replaced with machines and AI (Artificial Intelligence) systems. This can be argued with cost reduction and human life preservation such as automatic piloting in drones and space crafts.

Exception handling
What is Exception handling?

Handling of events which are unexpected to happen is called exception handling. Exception handling is used most widely in the programming world to prevent any situation that is considered to be bad from happening. They are also a safety mechanism to prevent the system from falling into an irreversible state.

Types of exception handling

Based on the detail of how and where the exception is being handled they can be classified into types. General classification of exception handling is

i. Hardware exception handling
ii. Software exception handling.

Hardware Exception handling

Hardware exceptions can be handled smoothly by halting the tasks and resuming them later. If a product has both the software and hardware then when there is an error that cannot be avoided through software system can be handled through hardware exception handling. Example: A processor in a computer can halt the task if there is an error due to some software.

Software Exception handling

Software exception handling is widely used across several software platforms. While writing a code for the software product there can be many functionalities that needs to be implemented which can lead to different output based on the input and the action performed. Sometimes, the unexpected action can cause crashing of the product and sometime it can even corrupt the file too. This can be prevented by giving some handlers for these unexpected outputs.

Importance of Exception handling

Exception handling is considered as important in the hardware and the software level due to its massive use of preventing system from being pushed into looping or irreversible state. The system or the product may not know how to react when it receives the command which it is not exposed to. During these cases there has to be a failsafe mechanism that takes the state into custody and provide the temporary solution. This can be done with the help of Exception

handling. There is also the method of error checking, a replacement for exception handling is used but sometimes without knowing the type of error this method cannot be implemented. Thus exception handling provides the best case scenario for usage and safety provision.

Overview

Automation in Mission Critical System

Necessity of Automation in Mission Critical System

Automation in mission critical system is required because of the possibility that it can help in prevention of risking the human life. Example: In case of the auto piloted drones, even in the extreme cases where the plane can be shot down by enemy defenses it helps in saving a human life which is priceless when compared to the drone. This can be said for Nuclear reactors as well as other space missions.

Challenges of Implementing Automation

Automating a system is not a simple task that can be achieved overnight. It takes patience and a lot of time to train and test the results of each changes. Automating a simple task itself needs so much time for it to be successful. Consider automating a mission-critical system that a whole organization relies on. It has to be perfect or else it will lead to error and disaster for the company. The cost that it takes to implement an automation for a task should not exceed the limit that it takes for a human labor who works for a certain period of time.

How to calculate the efficiency of automating

The efficiency of automation can be calculated based on its capability to reduce the cost, time taken, error occurrence while performing tasks or operation. It also includes the ability to increase the production rate or producing with consistent results.

Benefits of automating a mission critical system

When the challenges are faced and overcome then the benefits obtained by the automation can be immense. Increase in production efficiency, cost reduction, reduced time consumption, avoids risking human life (auto-pilot drones, nuclear reactors, space missions etc.) There would be consistency in the output when a task is automated by a machine rather by human intervention.

Exception handling in Mission-Critical system

Need for Exception handling in Mission Critical system

Exception handling has proven to be the best method for managing the unexpected events that occur during a task. This needs to be present in the mission-critical system since it has the ability to prevent the MC from crashing or intruded with numerous bugs.

Performance of Exception handling in MC systems

Performance of an exception handling can be measure only by means of testing it by subjecting the system under various conditions. If it is a software then it can be tested with test cases of different inputs which the system might not expect and see how it reacts. If it is a hardware then it has either halt its task when something unexpected happens or it should let know the responsible person to proceed further.

Benefits of Exception handling in automated MC systems.

Benefit of having Exception handling in a MC system can prevent an organization or nation from a creating a disaster based on the task it performs. This can provide fail safe mechanism for the task to be safely executed or to be halted until further notice to proceed is given. This reduces cost of repairing and also reduces the error from happening.

Case Study

The case study for Automating and Exception handling for the Mission-critical System I have taken is **Nuclear reactors and Power plants**. Here we discuss how the various safety and prevention mechanisms provided in the nuclear power plant can be done with less or without the human intervention. We will discuss about the benefits of having automation and exception handling and will justify why it has more pros than the cons.

Conclusion

Based on all the above discussed topic we come to see the advantages of having Automation and the Exception handling and its efficiency. Hence we arrive at the conclusion that these two are required features in any of the mission critical system

Future Scope

The Future of this topic has the enough room for improvement. It can include Artificial Intelligence (AI) and Machine Learning (ML) to be implemented. Once they are done then even if some extreme cases happen then these AI can learn from the tasks performed repeatedly and take necessary measures to avoid any kind of losses. ML can be helped in predicting what can happen if the current state continues and what steps can be helpful in preventing a situation from occurring.

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