International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 06 | June 2020 www.irjet.net p-ISSN: 2395-0072

FAULT TOLERANT SEAMLESS INTEGRATION OF IMA –STUDY AND SIMULATION

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Abstract -*Optimization of hardware and software in 'integrated modular avionics 'by reducing the workload from individual system , dividing equal load to all the systems by means of auto enabling the system when the system gets error the another system will take the authority and do both the works at the same time by not taking extra time for the process . All the systems will have the same hardware, only software will be of multipurpose to complete all the work when it is required. Around the world, aircraft and related systems are undergoing massive innovation and upgrades. The(IMA) architecture these functions are often interconnected with architecture of these systems has developed over the past years to which is known as the integrated modular avionics communication buses. This report presents the review of networks associated with IMA architectures.*

- *Trying to get the more information of avionics hardware and software*
- *Researching on the working principle of applications used for hardware and software working*
- *To optimize the work load from the system and distribute the equal load to every system*
- *Auto enabling system when one system goes fail*

***Key Words*: Communication system, navigation system, hardware and software**

INTRODUCTION

System functions can be advanced improve and certified, volume and weight can be saved. Explaining the IMA model for a new aircraft, however, is complicated.

The aim of this process is to design the IMA architecture optimally for all systems and the underlying aircraft. The architecture rely on the disbursement of sensors and actuators, the aircraft system's essential and the aircraft's model, and also on the accessible information technology.

This procedure is done by allowing rapid re-design of the architecture in case of new and more precise input data or switching the system requirements. Hence, IMA and its development process have to be understood to derive model objects, their attributes, and the relationship Avionics is the cornerstone of modern aircraft. More and more, vital functions on both military and civil aircraft involve electronic devices. After the cost of the airframe and the engines, avionics is the most expensive item on the aircraft, but well worth every cent of the price. Integrated architectures is based upon the IMA concept utilizes configuration to assign the divided computing resources to the hosted functions, the system integrator has the flexibility to actively manage extra resources to each single hosted function. IMA has an extra ability to keep a spare resource pool to be allocated to any hosted function. Therefore, the system integrator is able to change, within the certain limits, the resource allotment for a given function in the upcoming future; or to add up a new hosted functions without the requirement of adding new computing resources. The resource allotment is not made

while the system is used in service because of certification issue. Still, it can be randomly re-allocated by advanced system configuration data, and later it can be certified for use in the service. [12] IMA is a safety critical and complex system which could benefit by adopting MBSE due to the need of early requirements and safety validation, and for system integration.

If MBSE process can be implemented in the whole life cycle of IMA system development, the development process can be more streamlined and efficient, Model-Based System Engineering (MBSE). [14]

The Global Positioning System has enabled satellite-based error-free navigation and landing, and communication satellites are now able to support aviation services. consequently, the aviation world is transforming to satellite-based communications, navigation, and surveillance for air traffic management. Both the aircraft operator and the air traffic services provider are being benefited. This idea of work load optimization will reduces the work load of the pilot in multiple ways as all the works goes automatically and pilot need not to take tension as the systems are designed to take the work load if any system fails. In this hardware's should be same the only change will be in the software depending upon the work and action needs to be taken if the communication command is given then communication software should respond to the pilot with proper output, likewise same work principle will follow for navigation also and all other systems whichever the aircraft is having the systems the working will be same if incase any system has failed then other corresponding system will take up the responsibility and work for the failed system and give the output to the pilot of failed system and also its own output. Further more system has also been considered to show even if the maximum systems fails the corresponding system will take charge of it n give the desired output so there will not be any problem pertaining to communication navigation and detection etc. Considered 3 hardware's if any hardware fails then another hardware will take charge in which hardware is fixed and same 3 software are different for all different works connected to a common bus for 3 different works ,one hardware fails the work load should be shared by other 2 systems which has the lesser work load .The hardware is fixed, It should be able to withstand the lot of load of software. If any system fails then another system should take up charge and work for the failure system to give the output to the pilot it should work in every aircraft. This diagram represents how the workload is evenly distributed to all the systems as it is seamless integration no issue will happen during the flight easily work will be done by the neighboring systems without any hurdle during the flight because even the pilot will not know the issue that much good integration as to be done for tension free and safe flight. The work is automatically get shared as it has the auto enable and auto disable function in built in it, if any system has failed internally, automatically the internally instructions will be given to the neighboring systems by which it will get into action without taking an extra time to give output

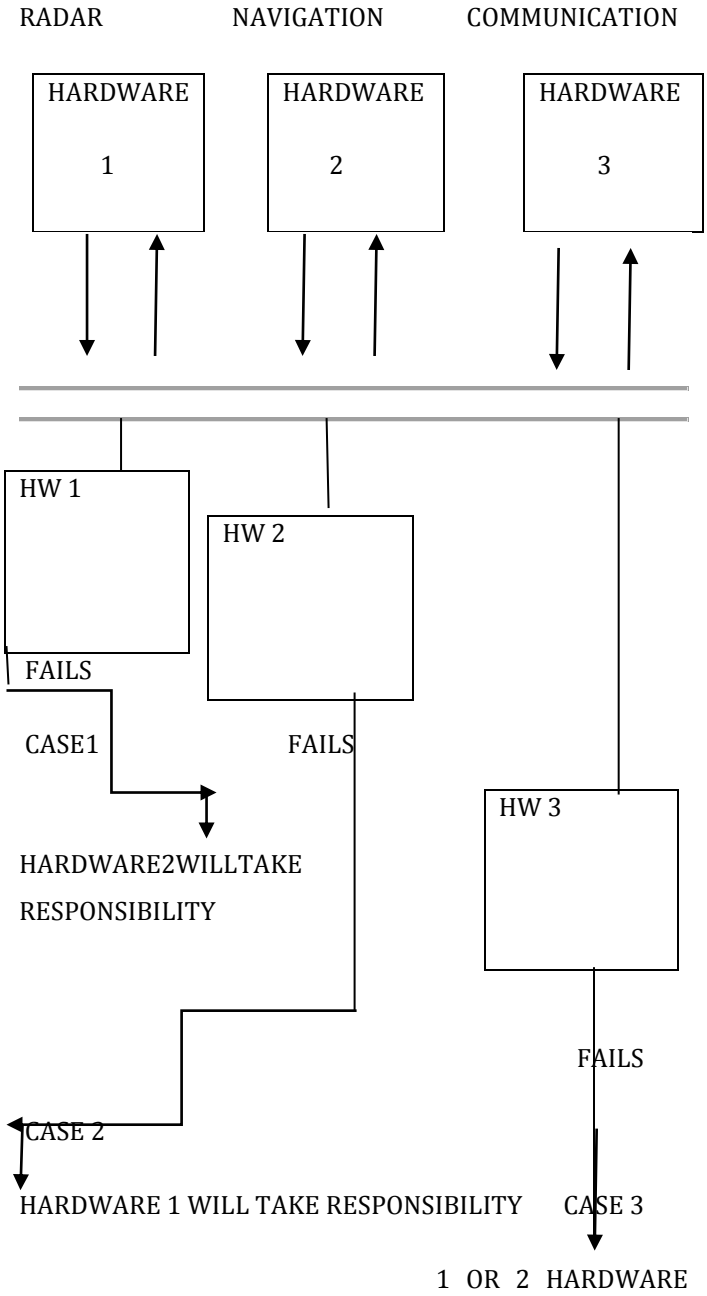

Fig 1. Represents works distribution

Scope of the project and objective

To ease the workload and time taken for every operation specially at the time of error in the system.

The pilot will be tension free if this software is taking the responsibility to do the work at the time of failure of any communication system or navigation system.

The time taken or every action is very short like in second itself the output will be given, because in aircraft operations quick response o mechanism is compulsory in order to avoid any mishap due to system function delay.

This project is igniting the idea of multipurpose generation of software so that cost of production will be less if one software is able to perform more number of works. In this all the system will have the same hardware's but only software's differs respect to its working operations.

The main objective is to optimize the workload from individual system and to distribute the workload to all the systems by advanced using advanced software which can withstand the extra load of work in case of failure of another system than another system should be able to work its work and also the failure system work also, it has to be seamless procedure pilot should not know the system has any problem ,the work process should be free and smooth. Partitioning the software or controlling multiple systems like communication, navigation etc, In this the hard ware will be same only the software is different for all the different works.

Methodology

Considered two and systems one is navigation system and another is communication system in which tried to check the both the systems if it can work automatically if another is fails. Optimizing of hardware /software resources by partitioning of IMA, Distributing the software work and making it quick in response , Here IMA resources are shared like if communication system fails the navigation system is will take the responsibility and give the output and this output will be seamless means the pilot ill not know the error append in the particularly in an system as

the command goes automatically internally to the systems ,This all is possible when partitioning the software for control the multiple systems by keeping the hardware same

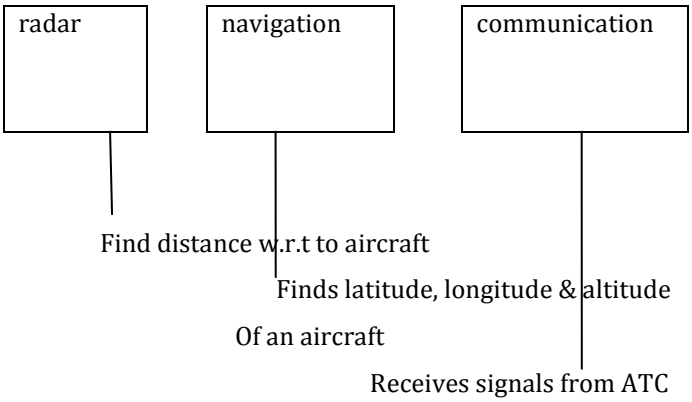

Fig 2. Represents system work representation

Considered 3 hardware's if any hardware fails then another hardware will take charge in which hardware is fixed and same 3 software are different for all different works connected to a common bus for 3 different works ,one hardware fails the work load should be shared by other 2 systems which has the lesser work load.

RESULTS

The result is positive that even one system can complete the work of another failure system if the system is getting failed without any problem the active system auto enables itself below simulation represents complete the working operation of the failure system.

Simulation has been done by using mathlab and simulink to get the working principle of avionics system. Considered 2 systems one is communication system and another is navigation system in which it is shown how another system will take charge of the failure system and still gives the output without taking extra time.

Test conducted on both systems communication and navigation

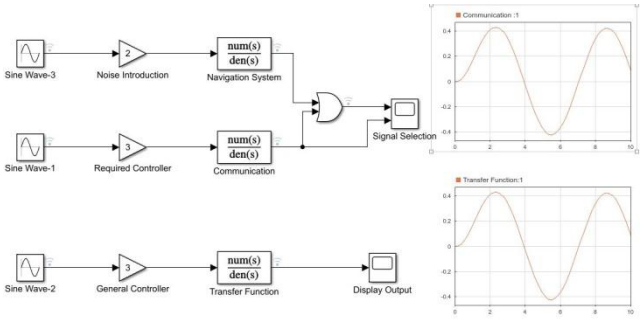

Fig 3. Represents the simulation on simulink

1st simulation we have considered two systems This is the simulation part which is performed on simulink, sine wave is the input signal given to the system which decides where to go then it goes to navigation system and communication system ,further it goes for analyzing part finally the output is given once the operation is completed ,in this result is positive.

communication and navigation passing the input signal and introducing noise into it and leading to respective function here one system got failed which is navigation when it fails then the active system communication system has taken the responsibility and gives the output of both the systems navigation and also communication.

Another system represents no problem in any problem the functioning is happening smooth as all the system working individually on its own.

The 1st simulation explains If navigation system is not working then communication takes charge n complete its both the functions without taking extra time.

2nd simulation explains no problem in any system and is carried out smoothly without error or giving trouble to any other system.

Graphical representation

The graph represents the input signals which is given by sine wave it is wave form it represents the input signals are going into the communication and navigation system.

The representation in the system also has the noise introduced into the system the noise is in the system automatically absorbs the noise and let the system work smoothly.

The error on display this also exist in the aircrafts the error is shown in the cockpit by means of color, for 2 systems fail orange flag, 3 system fail red flag, 3 systems working green flag, 2 systems working pilot will not know and 1 system fails pilot will not know, It represents a system has failed it is just for the pilot information because internally the other software's will take the responsibility of failed system and output is given, it has built in test equipment.

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COMMUUNICATION	T
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Fig 4. Represents display to the pilot

CONCLUSIONS

The optimization of hardware and software is possible when the system has multi-purpose software it can do multiple works at the same time without failing in any operation Software or application with specific hardware with a well-defined set of interfaces that is, when integrated with a platform, it performs a function.

The working system and support software that controls resources to give an environment in which applications can accomplish. The core software is a compulsory component of a platform and is comprised of one or more modules. The IMA concept is most efficient for seamless function it is highly fault tolerated system for multiple functions by the single system the core software is compulsory as it has the quality to withstand multiple functions any hardware. In this concept tried to optimize the workload and has been shared the all the works among all the respective system, even if one system fails another less work loaded system will take the responsibility and complete the failure system work.

It can conclude that at the time of one system failure another system will auto-enabled and do the required work of the failure system, the pilot will not be known for the error of the system.

This idea of **FAULT TOLERANT SEAMLESS INTEGRATIONOF IMA-STUDY & SIMULATION-** This idea has to implemented by all the civil aviation manufacturing industries as it eases the pilot work and also will not have any problem during the flight in case of any system failure as one system fails another will carry its work hassle free without disturbing the pilot, it is recommended to apply this new and advanced technique in order fly a smooth flights.

- More testing is required in order to able it in every aircraft
- Have to work on N systems, to check how many systems may fail and check
  the Threshold.
- software can be improved
- hardware is fixed, It should be able to withstand the lot of load of software
- If any system fails then another system should take up charge and work for the failure system to give the output to the pilot it should work in every aircraft

ACKNOWLEDGEMENT

I, thank to my guide S. Kartikeyan and my friend Vikash Pandey for helping me to complete my research paper.

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