



# STUDY, DESIGN AND STRUCTURAL ANALYSIS OF MULTI TASKING INDUSTRIAL ROBOT WITH TRACKING SENSOR

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**Abstract:** A robot is a multifunctional manipulator that can be reprogrammed to do a variety of tasks by employing programmable motions to move materials, parts, tools, or specialised devices. In precise terms, a robot is a system that consists of software, power supply, manipulators, and control systems that cooperate to complete a task. The inventory control industrial robot is a microcontroller-based mechatronics system that picks objects from their source location and arranges them at the appropriate location. It may execute a variety of mechanical tasks, including the removal of metal. A tracking system is one that is intended to document and report on specific actions taken during a process. In the same process, we have created a robot direction system approach that allows robotics to be controlled and provide precise guidance for a class of non-linear systems in the existence of disruptions and changes in parameters through the use of wireless communication methods. This project is useful in situations when wireless point-to-point communication is desired to control the direction of any automated device. Modelling software such as Catia V5 is used in this project to create a new working module, which is then compared to the previous design. focused around microcontroller, which acts as the control unit for the project. According to this proposal, a smart phone app can be used to control the robot's direction.

## I- INTRODUCTION

An all-purpose industrial robot can do a wide range of jobs. Multitasking industrial robots are primarily used to replace human labour. Because many repetitive tasks are not precisely the same each time and because the professions involved are complex, the industry is lagging behind other related industries in adopting robots. A lot of considerations need to be made before beginning a work, including the size and color to be used. Robots can do additional horticultural tasks including pruning, weeding, spraying, and monitoring. The main benefit of automation is labor savings, but it may also improve quality, accuracy, and precision while conserving energy and resources. The term automation, which is derived from the previous work automatic, which originates from automaton, was not

widely used until 1947, when General Motors established the automation department.

The best use of the Multi-Tasking Industrial Robot throughout the day and year is a crucial component in this situation. We must support many applications, much like the tractor does with various implement combinations, in order to achieve full usage. That plan stipulates that the Multi-Tasking Industrial Robot must be a vehicle with a number of applications and certain basic features. Among the essential elements, a navigation system is definitely required for independent and safe navigation. It can be configured to work with different track widths, row counts, field configurations, sensors, and cultural varieties (e.g., wheat or maize). The navigation system also provides apps.

## II – LITERATURE REVIEW

**Robot with Artificial Intelligence for Multitasking-** Altaf Hussien, Dr. T.C. Manjunath, Suhas M S, Sumanth K, and Chethana P. Using ultrasonic and gas sensors, respectively, the proposed model uses an algorithm to detect and identify things and determines how far away they are from obstacles. According to the objectives, this established model can be effectively applied to the automation of industrial processes, the exploration of challenging environments, and the development of self-driving automobiles. Allocating Tasks to Multiple Robots - Ahmed Elmogy, Ahmed Hussein, and Alaa Khamis the various difficult parts of the multi-robot work allocation problem, the most recent methods for solving it, and the potential paths forward. These well-known, market-based, and meta-heuristic-based methods are often employed to address the issue. Numerous methods that have been studied can manage complicated.

**Creation of a Mobile Multitasking Robot-** Jose Ahirton Batista Lopes Filho, Will Ribamar Mendes Almeida, and Sergio Gomes Martins. Numerous tests involving the performance of multiple tasks have shown that, in addition to doing the duties for which it was designed or other tasks, this robot can also be used as a learning platform for low-cost robotics training at various levels. This is due to a lack of skilled workers as well as the high price of the robotics kits currently on the market. Some research even begin to address educational theories, such as the well-known robotics theory.

**A Robot Arm Motion Planning System with Multitasking Features Scheme** - Chuzhao Liu, Junyao Gao, Yuanzhen Bi, Xuanyang Shi, Dingkui Tian There is room for improvement in the TSC approach presented in this research. The largest alteration is needed to the mechanical structure. The algorithm training would be more effective if the potentiometers were able to track changes in human joint rotation more precisely. The service life of the graphite-based sensors is another area that needs work. It is also possible to enhance the simulation environment. To close the gap between simulation and reality, we might model the humanoid robot we built up in the simulation more precisely. To reduce calculation time, computing power can be increased. Future work will address the aforementioned issues as well as test the scheme's dependability in a real-world setting by applying the simulation's planned actions to a real robot.

**Mobile Manufacturing Robots** - Shneier Michael and Bostelman Roger The field of mobile robotics is substantially bigger than what has been discussed in this document. It includes airborne and water-based mobile robots, autonomous driving on roadways and throughout the nation, and a variety of indoor applications unrelated to manufacturing. Due to the availability of funds, research in the United States has historically concentrated mostly on topics of interest to the emergency services and military.

Recently, there has been an increase in interest in using mobile robots to help people or perform services since it's thought that robotic solutions could be profitable. While Australia has done a lot of work in mining and agriculture, and Japan has, until recently, concentrated on humanoid robots, European research has been more diverse and has addressed more industry demands. Systems with increased mobility and autonomous action capabilities are beginning to integrate all of these research streams.

This chapter's objective is to provide an overview of the state of multi-tasking industrial robot and autonomous system implementation and trends, as well as future application possibilities. Plant care, selective harvesting, and crop establishment have been recognized as the first possible real-world uses of autonomous robotic vehicles. These three main areas of autonomous vehicle applications have been examined and compared with traditional methods. Furthermore, based on a systems analysis and a separate economic feasibility assessment for each application, we will give examples of the economic potential of using these vehicles in different applications in comparison to conventional systems. Potential labor cost reductions, farm sizes and operations implications, daily working hours, possible environmental effect, energy expenses, and safety concerns will all be the main topics of the comparison. Analog techniques were employed by the initial controllers to carry out their computations. Control theory differential equations were also solved using analog techniques. Electronic analog controllers and the electronic analog computer were created to address control-related issues. When digital computers were readily accessible, analog computers were replaced. Feedback control is frequently used to regulate temperature, pressure, flow, and speed.

In certain industries, there may be hundreds or even thousands of relays, cam timers, and drum sequencers in total. To make such systems understandable, early programming languages and techniques were required. One of the first was ladder logic, in which the schematics of the interconnected relays resembled the rungs of a ladder. Later, specialized computers known as programmable logic controllers were created to swap out various hardware sets for a single, simpler-to-reprogramme component.

### III – WORKING DESCRIPTION OF THE PROJECT

#### 3.1 Designed for solution

The greatest way for engineers and researchers to advance autonomous machinery is to create robots that can operate constantly without human supervision.

When used for certain objectives, robots can provide great precision and low prices, and we can see in real time which jobs have already been finished.

Robots could be made to perform a variety of tasks using a small set of tools, taking the place of human workers. A completely autonomous robot should be able to comprehend its surroundings, operate for an indefinite amount of time without the need for operator assistance, adapt to changing conditions, and protect people.

Although there are now only a few commercial robots available, it is anticipated that in the near future

1. Their numbers will rise dramatically in the future.
2. The goal is to create a robot that can operate the ground with great accuracy and perform a variety of moves. They overcome the difficulties caused by irregular and uneven terrain that can alter the course.
3. The autonomous system component consists of a processing unit, sensors to determine position, including a GPS system, and a system to accelerate and steer. The tractor needs more than just sensors and a strong computer to stay on course.
4. The development team develops an application that allows the user to adjust the robot's calibration for each type of terrain.

#### **Benefits**

1. Is made to be replaced by labor.
2. The user has to do very little to operate an autonomous lawn mower.
3. An automated lawnmower doesn't need user assistance.
4. Programming a robotic lawnmower is quite simple.
5. The field of embedded systems is where this application is found.

An embedded system is a mix of computer hardware and software, either fixed in capabilities or programmable, that is specifically designed for a particular use.

Design engineers can tune the embedded system to increase reliability and performance while decreasing product size and cost because it is dedicated to certain functions. One or more primary computing cores, usually a digital signal processor or a microcontroller, govern embedded systems. Nowadays, a lot of everyday gadgets are controlled by embedded systems. An intelligent piece of equipment called a multi-tasking industrial robot was created for purposes and calls for tact, particularly when it comes to robots. Consider a machine that can spin around, move between plant rows, or identify potatoes that don't meet the requirements necessary for commercialization. The pick and place machines need skilled workers to operate efficiently, which directly affects the end product prices. The only option to maintain production costs while increasing output is to use robots. Advanced vision systems were created to identify plants or determine when a fruit is ripe based on colors or forms. The quality of product sorting has significantly improved as a result of all these developments.

## **IV – POWER SUPPLY SYSTEMS**

A variable bench power supply, also known as a variable regulated power supply, lets you continuously modify the output voltage to meet your needs. After confirming the parts arrangement against the circuit designs and the parts placement instructions, it is advised to test the project by adjusting the power supply's output. It's a good control for a basic variable bench power supply. As designing a variable regulated power supply is among the first things a hobbyist should accomplish, this is actually rather important. Even though a dedicated supply, such as 5V or 12V, can be very helpful, having a variable supply on hand is much more convenient, particularly for testing.

The majority of digital logic devices, including CPUs, need a 5-volt power supply. A regulated 5-volt supply must be constructed in order to use these parts. The Beginner Kit and Microcontroller Beginner Kit come with a 12 volt power supply, although typically you begin with an unregulated power source that is between 9 and 24 volts DC. We use the LM7805 voltage regulator integrated circuit to build a 5-volt power supply. The IC is shown below.

#### **Features of the Circuit:**

- Provides a well-controlled +5V output with a 100 Ma output current capacity.
- When the regulator IC becomes too hot, built-in overheating protection cuts off the output.
- Quite straightforward and easy to construct.
- Dependable functioning and a very stable +5V output voltage.
- It is simple to obtain and simply requires very basic, everyday parts.
- A tiny power supply for laboratories and a component of electronics gadgets.
- An uncontrolled 8–18V DC power source.
- The output current required plus 5 mA.
- A few bucks for the cost of the input transformer plus the electrical components.

## **V - DESIGN METHODOLOGY OF MULTI TASKING INDUSTRIAL ROBOT**

#### **Introduction to CATIA**

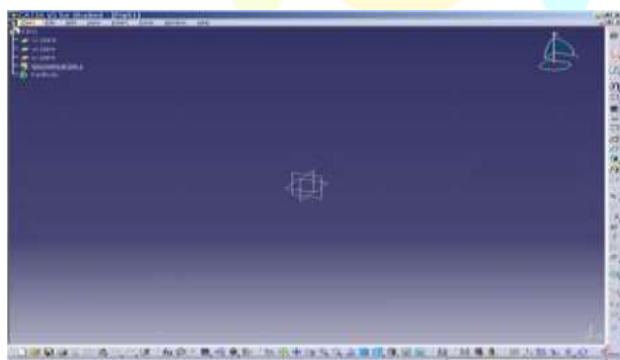
A multi-platform commercial CAD/CAM/CAE software suite called CATIA (Computer Aided Three-dimensional Interactive Application) was created by Dassault Systems, a French company. Dassault Systems' product lifecycle management software package is centred around CATIA, which is integrated into the C++ programming language. CATIA, Cero Elements/Pro, and NX (Unigraphics) are competitors in the high-end CAD/CAM/CAE market. Dassault Systems released CATIA V5, a 3D CAD program, in 1999. This replaced CATIA V4 with a brand-new design tool that was substantially different. Depending on the IT environment, the user interface, which now has

an MS Windows layout, makes it simple to combine standard software packages like SAPR3 products, MS Office, and other graphic applications.

Every stage of the product development process, including the first draft, design, layout, production, and assembly, will be digitally included in CATIA V5. Workbench mechanical design will be covered in this CAE training course.



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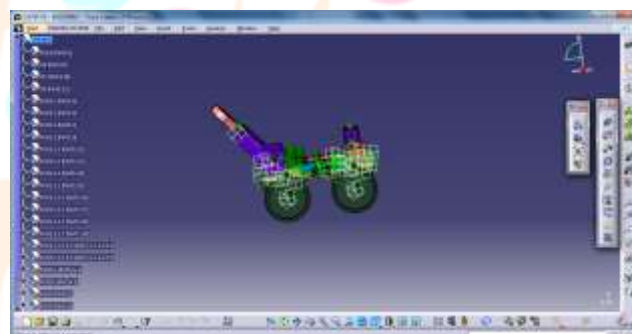


**Fig: 5.1: Home Page of CatiaV5**

**Multitasking Industrial Robot Modeling in CATIA V5**  
 CATIA V5 software was used in the design of this multitasking industrial robot. This software is utilized in heavy engineering, consumer goods, automotive, and aerospace, among other industries. It is an extremely capable program for creating intricate 3D models and CATIA Version 5 applications, such as part and assembly design.

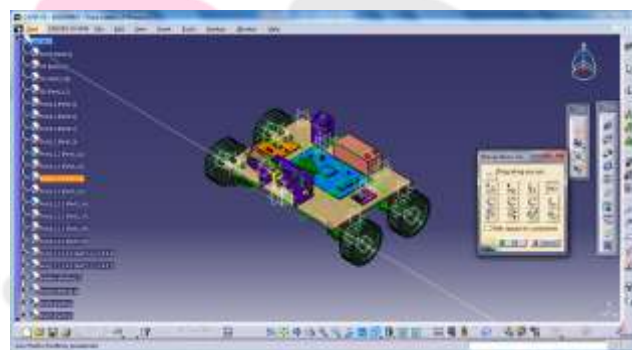


**Figure 5.2: CATIA-V5 model design**



**Figure 5.3: Robotics model setup in CATIA -V5**

**Manipulate:** This command applies the proper constraints and allows the component to be turned, rotated, and manipulated in any direction.



**Figure 5.28 Using the Manipulate Command**

**Multi View:** With this command, all of the component or model's views can be edited under the workbench and seen on the screen simultaneously.

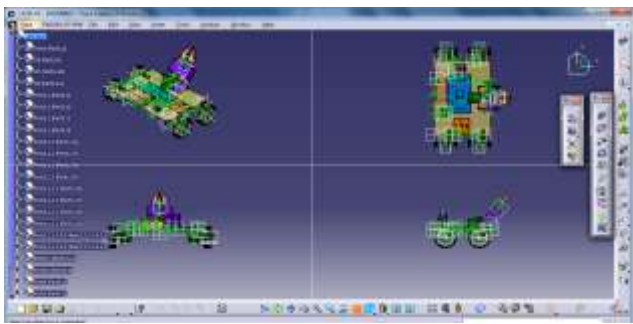


Fig. 5.29: Using Multi View Command

## VI – ANALYSIS OF AUTOMATIC MULTI TASKING INDUSTRIAL ROBOT

### 6.1 Procedure for FE Analysis Using ANSYS:

Both the new and old module component designs are analyzed using ANSYS. Complete assembly is not required; the motor and associated system must be operated by applying moments at the rotation position along which we need to identify the axis.

### 6.2 The preprocessor

The following actions were taken at this stage:

- Use the ANSYS window to import the file.
- STEP > File Menu > Import Select the file saved from CATIAV5R20 by clicking "Browse" after selecting "OK" for the dialog box that appears. To import the file, click "OK."

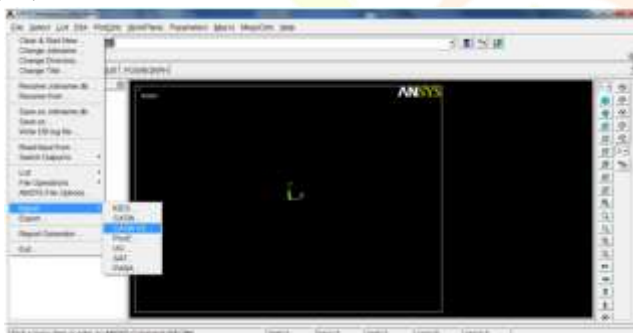


Figure 6.1: Ansys import panel.

### 6.2.1 Mesh:

The process of creating a polygonal or polyhedral mesh that roughly represents a geometric domain is known as mesh generation. The term "grid generation" is often used interchangeably. Applications like computational fluid dynamics and finite element analysis are commonly seen on a computer screen. While the input model form can take many different forms, prominent sources include CAD, NURBS, B-rep, and STL (file format). With contributions from computer science, engineering, and mathematics, the topic is very interdisciplinary.

### 6.3 Multi-Tasking Industrial Analysis Process Robot:

A tetrahedral element that exhibits quadratic displacement behavior is ideal for modelling irregular meshes, as those generated by different CAD/CAM systems. Each of the ten nodes that make up the element has three degrees of freedom and can translate in the nodal x, y, and z

dimensions. Additional properties of the element include significant deflection, high strain, inflammation, creep, stress stiffening, and plasticity.

- Bringing a file into Ansys
- Giving preference to the structurally sound solid component
- Selecting the element type by entering into the preprocessor
- Selecting the Material Model characteristics by entering into the preprocessor
- Getting into the meshing preprocessor
- Entering the preprocessor to move the element
- The component to which loads are applied
- The matrices problem has been resolved.

### 6.4 Components in a Meshed View:

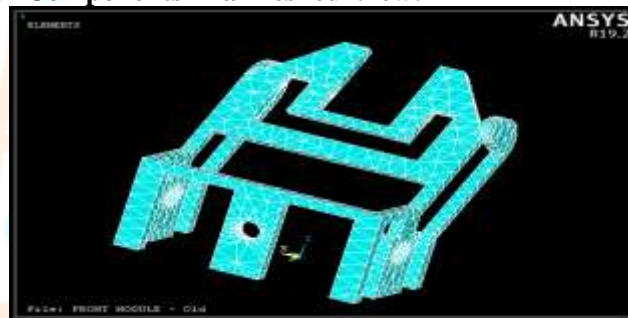


Fig. 6.2 Front Module Old Design Meshing

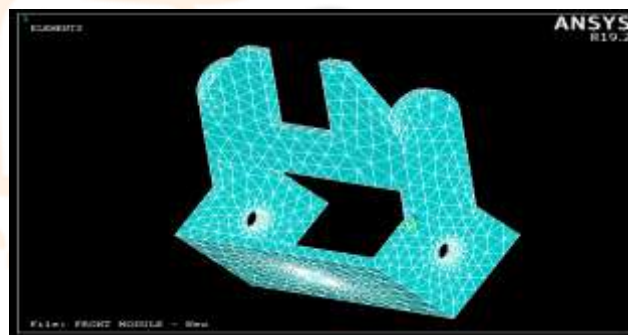


Figure 6.3: New Design Meshing for the Front Module

## VII – DISCUSSION ON ANALYSIS RESULT

### 7.1 Results of Displacement analysis:



Fig. 7.1: Old Front Module Design Displacement

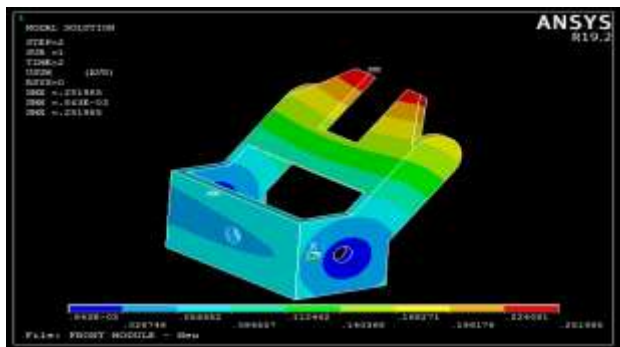


Fig. 7.1: Old Front Module Design Displacement

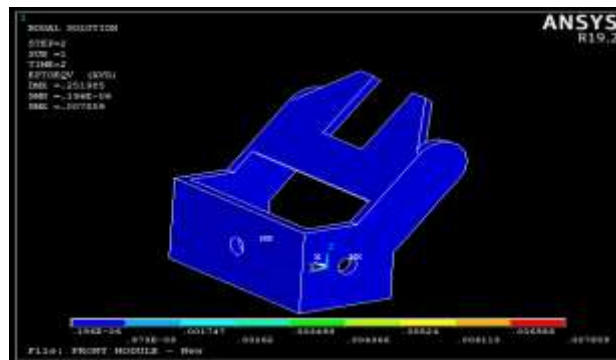


Figure 7.6: Front Module New Design Strain Analysis

7.2 Results of Stress analysis:

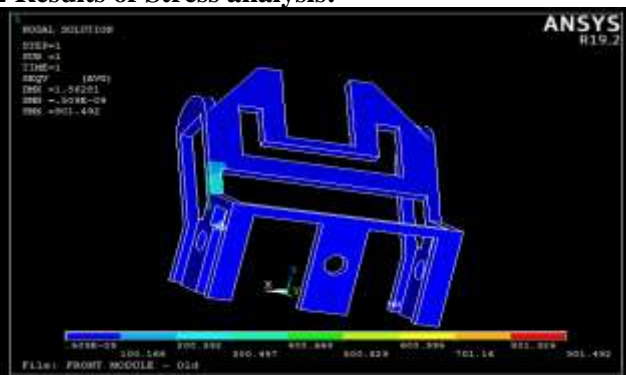


Figure 7.3: Old Front Module Design Stress Analysis

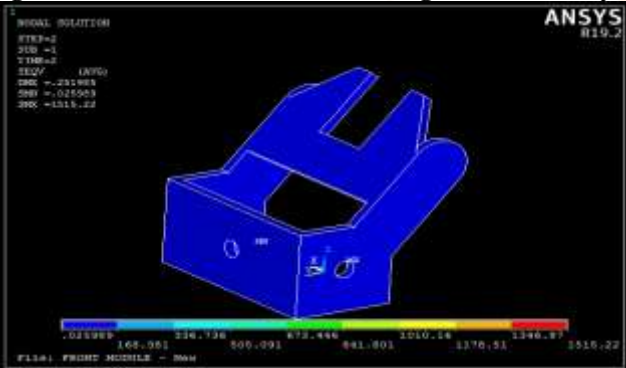


Figure 7.4: New Front Module Design Stress Analysis

7.3 Strain analysis results:

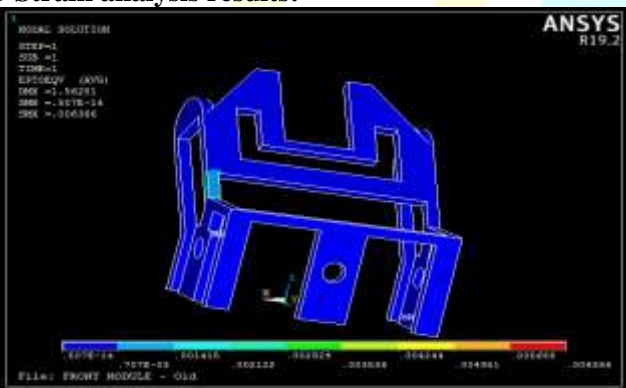


Figure 7.5: Old Front Module Design Strain Analysis

VIII – CONCLUSION

8.1 Conclusion

Both the new and old design modules for the project "Multi-Tasking Industrial Robot" have been successfully created and examined. It was created by combining the capabilities of every piece of gear. Each module's presence has been thoughtfully considered and positioned to maximize the unit's functionality. Second, the capacity and quality of the services are crucial. All of these issues are made worse by the move toward handheld transceivers with limited power. As seen in the above figures, the new design module's displacement is 0.251mm, and the design's displacement is meshed and resolved using Ansys. This demonstrates to us that every part of the assembly is obviously experiencing slight movement. The stress value of the new design module is 1515.22 MPa, and the stress is at the fixed site (minimum stress that is permissible). This value is below the yield point and is significantly lower than the yield value. The maximum strain is 0.0078 MPa, and Ansys software is used to solve this problem. We can therefore conclude that the parameters of our new design module are about accurate. Although the development process may be gradual, the basic idea calls for a different approach to mechanization for autonomous machines, one that is more focused on demands and innovative ways to address them than on changing pre-existing methods.

8.2 Future Enhancement

Nowadays, wireless is the rage in the communication sector. Wireless communication is expanding at an exponential rate every day. Numerous developments in the semiconductor sector have paved the way for ever-greater breakthroughs in wireless technology. Our primary goal in this project is to monitor various data between two microcontrollers that are not wired together. A module encoder that functions as a transmitter will be used to send the data. When the data is being transferred, the emitter gathers it and releases it into the atmosphere, where it is subsequently picked up by the receiver at the opposite end. Design methodologies and problem-solving approaches in mechanization for autonomous robots have enormous room for development and their systems. Satellite communications is seeing significant advancements in wireless communication. The earth stations receive the

signals when they are detected and reflected back. Geological surveys, weather forecasts, and other cosmic developments are all covered by these signals.

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