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DESIGN OPIMIZATION AND STRUCTURAL ANALYSIS OF MULTI TASKING INDUSTRIAL ROBOT

Shaik Faizan, P Rakesh, Pinjari Abbas Vali, Dudekula Basha, P Ashok Kumar, Mr.P.Rakesh Kumar
Dept. of Mechanical Engineering, Brindavan Institute of Technology and Science, Kurnool, Andhra Pradesh, India

Abstract: A Robot is a re-programmable multifunctional manipulator designed to move materials, parts, tools or specialized devices through variable programmed motions for the performance of a variety of tasks. Robot exactly is a system that contains control systems, manipulators, power supplies and software all working together to perform a task. The Inventory control industrial robot perform various kind of mechanical operation such as metal removing process, it is a microcontroller based Mechatronics system that picks the object from source location and places at desired location. A system designed to record and report on discrete activities within a process is called as Tracking System. In the same procedure we have developed a methodology of robot direction system for robotics to control and achieve accurate direction for a class of non-linear systems in the presence of disturbances and parameter variations by using wireless communication technique. This project finds its place in places where one wants to control the direction of any automated device using wireless point to point communication. In this project is the working module is being newly designed by the modeling software like Catia V5 and compared with the old design. Around a Microcontroller which forms the control unit of the project. According to this project, a smart phone based application is used to control the direction of the robot.

I. INTRODUCTION:

A Multi Tasking Industrial Robot is a deployed for many purposes. The main area of application of Multi Tasking Industrial Robot is designed to replace human labor. The industry is behind other complementary industries in using robots because the sort of jobs involved is not straightforward, and many repetitive tasks are not exactly the same every time. In most cases, a lot of factors have to be considered (e.g., the size and color them to be picked) before the commencement of a task. Robots can be used for other horticultural tasks such as pruning, weeding, spraying and monitoring.

The biggest benefit of automation is that it saves labor; however, it is also used to save energy and materials and to improve quality, accuracy and precision. The term automation, inspired by the earlier word automatic (coming from automaton), was not widely used before 1947, when General Motors established the automation department.

It was during this time that industry was rapidly adopting feedback controllers, which were introduced in the 1930s. Automation has been achieved by various means including mechanical, hydraulic, pneumatic, electrical, and electronic and computers, usually in combination. Complicated systems, such as modern factories, airplanes and ships typically use all these combined techniques.

Autonomous Multi Tasking Industrial Robot is an alternative to the tractors found on fields. Today tasks may be performed by fleets of autonomous robots in the future.

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Independent of the actual design a serious agricultural robot will be a complex and expensive vehicle – the challenge is therefore to prove that it is competitive to traditional technology and may even bring a decisive lead. One critical factor here is the optimal utilization of the Multi Tasking Industrial Robot over the day and over the year. To reach a full utilization we need to support multiple applications as the tractor does with different implement combinations. Following that scheme the Multi Tasking Industrial Robot needs to be a vehicle with some basic capabilities and the possibility to support multiple applications. Among the basic capabilities we surely require a navigation system for safe and autonomous navigation. It can be configured to work for different cultures, e.g. maize or wheat, different track widths, number of rows, structure of the field or sensors used. In addition applications are provided by the navigation system.

II - LITERATURE REVIEW

Multi-tasking Robot using Artificial Intelligence

Suhas M S, Sumanth K, Chethana P, Altaf Hussen, Dr.T.C.Manjunath

The developed model detects and identifies the objects using algorithm, which gives distance of obstacles from it using ultrasonic sensors and gas sensors respectively. This developed model can be successfully used in industrial process automation, exploration of complex places and developing self - driving cars as per the set goals.

Multi-robot Task Allocation

Alaa Khamis, Ahmed Hussein, Ahmed Elmogy

The dierent challenging aspects of multi-robot task allocation problem, the recent approaches to tackle this problem and the future directions. These well-known approaches, Meta heuristic based and market-based approaches that are used extensively to solve the problem. Many of the reviewed approaches are capable of handling complex Task-related constraints may tight tasks that cannot be decomposed into single robot tasks or tasks with precedence constraints.

Development of a multitasking mobile robot

Jose Ahirton Batista Lopes Filho, Will Ribamar Mendes Almeida, Sergio Gomes Martins

Several tests were conducted with the implementation of various tasks and has been proven that this robot can be used as a learning platform for low cost robotics education at various levels, as well as for performing those tasks for which it was designed or additional tasks. A fact which occurs by the lack of trained professionals as well as the high cost of existing robotics kits on the market. Some studies even begin to address educational theories such as the famous in Robotics.

A Multitasking-Oriented Robot Arm Motion Planning Scheme

Chuzhao Liu, Junyao Gao, Yuanzhen Bi, Xuanyang Shi, Dingkui Tian

The TSC scheme introduced in this paper needs some improvement. The mechanical structure requires the most modification. More accurate tracking of the changes in human joint rotation by the potentiometers would result in a better effect of the algorithm training. Another area for improvement is the service life of the sensors, which use graphite. The simulation environment can also be improved. The humanoid

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robot we set up in the simulation can be modeled more accurately to reduce the gap between simulation and reality. Computing power can be increased to reduce calculation time. In future work, in addition to solving the above problems, we will apply the actions planned in the simulation to an actual robot to test the reliability of the scheme in an actual environment.

Mobile Robots for Manufacturing

Michael Shneier, Roger Bostelman

The field of mobile robotics is much larger than what has been described in this document. It covers autonomous driving on roads and across country, flying and water-based mobile robots, and a range of indoor applications that are not related to manufacturing. Historically, research in the United States has focused largely on areas of interest to the military and emergency services because that is where funding for research has been available. More recently, interest has been growing in mobile robots to assist people or provide services because there is a perception that robotic solutions might be commercially viable. Research in Europe has been more varied and has addressed more of the manufacturing needs, while Japan has focused, until recently, on humanoid robots and Australia has conducted substantial work in mining and agriculture. All of these strands of research are starting to be combined into systems with greater capabilities both for movement and autonomous action.

The aim of this chapter is to present the status of the current trends and implementation of Multi Tasking Industrial Robot and autonomous systems and outline the potential for future applications. Different applications of autonomous vehicles have been examined and compared with conventional systems, where three main groups of field operations have been identified to be the first potential practical applications: crop establishment, plant care and selective harvesting.

Moreover we will give examples of the economic potential of applying autonomous robotic vehicles compared to conventional systems in different applications. The comparison was based on a systems analysis and an individual economic feasibility study for each of the applications. Focus will be put on potential labor cost savings, farm structure implications and sizes for operation, daily working hours, potential environmental impact, energy costs and safety issues.

The complexities of this are that the quantities involved are all of different physical types; the temperature sensor signal may be electrical or pressure from an enclosed fluid, the controller may employ pneumatic, hydraulic, mechanical or electronic techniques to sense the error and send a signal to adjust the air pressure that moves the valve. The first controllers used analog methods to perform their calculations. Analog methods were also used in solving differential equations of control theory. The electronic analog computer was developed to solve control type problems and electronic analog controllers were also developed. Analog computers were displaced by digital computers when they became widely available. Common applications of feedback control are control of temperature, pressure, flow, and speed.

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III - WORKING DESCRIPTION OF THE PROJECT

3.1 Designed for solution

Engineers and researchers works to increase the level of autonomous machinery in the best solution is to design and build robots capable to work continuously without human guidance.

Robots deployed for purposes can deliver high accuracy and low costs while we can have in real-time a situation of tasks already completed.

The number of commercial robots is still limited for a moment, but there is the assumption that in the near future their number will increase significantly.

The aim is to build a robot able for a wide range of maneuvers and working the ground with high accuracy. They pass the problems with uneven and inconsistent terrain that can change the direction.

The autonomous system component includes a system to act the acceleration and steer, processing unit, and sensors to locate the position including GPS system. Sensors and a powerful computer is not enough to keep the tractor on the right path. The development team creates an application where the user calibrates the robot according to each terrain type.

Advantages

1. Is designed to replace on labor.
2. An autonomous lawn mover requires a minimal intervention from the user.
3. An autonomous lawn mover does not require guidance from the user.
4. It is very easy to program a robotic lawn mower.

This application is in the area of embedded systems. An embedded system is some combination of computer hardware and software, either fixed in capability or programmable, that is specifically designed for a particular function. Since the embedded system is dedicated to specific tasks, design engineers can optimize it reducing the size and cost of the product and increasing the reliability and performance. Embedded systems are controlled by one or more main processing cores that are typically either a microcontroller or a digital signal processor. Embedded systems control many devices in common use today.

A Multi Tasking Industrial Robot is intelligent machinery designed for purposes and requires delicacy especially for robots used. Imagine that can turn around, may go between the plant rows, or a machine that can recognize the potatoes that are not based on standards that allowing the commercialization.

To be used effectively, the pick and place machines require experienced operators, which have a direct impact on the final prices of products. Using robots is the only way to keep production costs down while the productivity is up. Advanced vision systems were designed to recognize based on colors or shapes when a fruit is ripe or to recognize a plant. All these innovations bring substantial improvements in the quality of sorting of products.

IV - POWER SUPPLY SYSTEMS

A variable regulated power supply, also called a variable bench power supply, is one where you can continuously adjust the output voltage to your requirements. Varying the output of the power supply is the recommended way to test a project after having

double checked parts placement against circuit drawings and the parts placement guide. This type of regulation is ideal for having a simple variable bench power supply. Actually this is quite important because one of the first projects a hobbyist should undertake is the construction of a variable regulated power supply. While a dedicated supply is quite handy e.g. 5V or 12V, it's much handier to have a variable supply on hand, especially for testing.

Most digital logic circuits and processors need a 5-volt power supply. To use these parts we need to build a regulated 5-volt source. Usually you start with an unregulated power supply ranging from 9 volts to 24 volts DC (A 12 volt power supply is included with the Beginner Kit and the Microcontroller Beginner Kit.). To make a 5 volt power supply, we use a LM7805 voltage regulator IC (Integrated Circuit). The IC is shown below.

Circuit Features:

- Gives out well regulated +5V output, output current capability of 100 Ma.
- Built-in overheating protection shuts down output when regulator IC gets too hot.
- Very simple and easy to build.
- Very stable +5V output voltage, reliable operation.
- Easy to get, uses only very common basic components.
- Based on datasheet example circuit, I have used this circuit successfully as part of many electronics projects.
- Part of electronics devices, small laboratory power supply.
- Unregulated DC 8-18V power supply.
- Needed output current + 5 mA.
- Few dollars for the electronics components + the input transformer cost.

This 5V dc acts as VCC to the microcontroller. The excess voltage is dissipated as heat via an Aluminum heat sink attached to the voltage regulator.

A diode bridge is an arrangement of four diodes connected in a bridge circuit as shown below, that provides the same polarity of output voltage for any polarity of the input voltage. When used in its most common application, for conversion of alternating current (AC) input into direct current (DC) output, it is known as a bridge rectifier. The diagram describes a diode-bridge design known as a full-wave rectifier. This design can be used to rectify single phase AC when no transformer center tap is available.

A bridge rectifier makes use of four diodes in a bridge arrangement to achieve full-wave rectification. This is a widely used configuration, both with individual diodes wired as shown and with single component bridges where the diode bridge is wired internally. For both positive and negative swings of the transformer, there is a Forward path through the diode bridge. Both conduction paths cause Current to flow in the same direction through the load resistor, accomplishing full-wave rectification. While one set of diodes is forward biased, the other set is reversing biased and effectively eliminated from the circuit.

➢ **Printed Circuit Board**

It is called PCB in short, printed circuit consists of conductive circuit pattern Applied to one or both sides of an insulating base, depending upon that, it is called

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single sided PCB or double-sided PCB. Conductor materials available are silver, brass, aluminum and copper. Copper is most widely used. The thickness of conducting material depends upon the current carrying capacity of circuit. Thus a thicker copper layer will have more current carrying capacity.

The printed circuit boards usually serves three distinct functions.

1) It provides mechanical support for the components mounted on it.
2) It provides necessary electrical interconnections.
3) It acts as heat sink that is provides a conduction path leading to removal of the heat generated in the circuit.

V - DESIGN METHODLOGY OF MULTI TASKING INDUSTRIAL ROBOT

5.1 Introduction to CATIA

CATIA (Computer Aided Three-dimensional Interactive Application) is a multi-platform CAD/CAM/CAE commercial software suite developed by the French company Dassault Systems. Written in the C++ programming language, CATIA is the cornerstone of the Dassault Systems product lifecycle management software suite. CATIA competes in the high-end CAD/CAM/CAE market with Cero Elements/Pro and NX (Unigraphics).

The concept of CATIA V5 is to digitally include the complete process of product development, comprising the first draft, the Design, the layout and at last the production and the assembly. The workbench Mechanical Design is to be addressed in the Context of this CAE training course. CATIA can be applied to a wide variety of industries, from aerospace and defense, automotive, and industrial equipment, to high tech, shipbuilding, consumer goods, plant design, consumer packaged goods, life sciences, architecture and construction, process power and petroleum, and services. CATIA V4, CATIA V5, Pro/ENGINEER, NX (formerly Unigraphics), and Solid Works are the dominant systems.

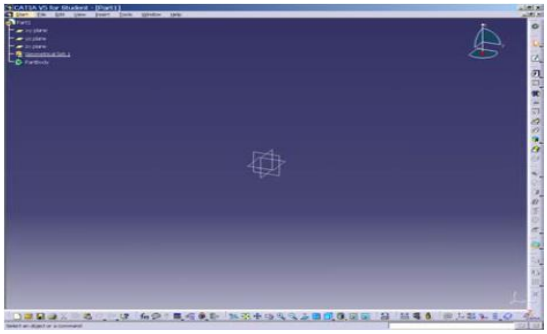

Fig: 5.1: Home Page of CatiaV5

Modeling of MULTI TASKING INDUSTRIAL ROBOT in CATIA V5

This **MULTI TASKING INDUSTRIAL ROBOT** is designed using CATIA V5 software. This software used in automobile, aerospace, consumer goods, heavy engineering etc. it is very powerful software for designing complicated 3d models, applications of CATIA Version 5 like part design, assembly design.

The same CATIA V5 R20 3d model and 2d drawing model is shown below for reference. Dimensions are taken from. The design of 3d model is done in CATIA V5 software, and then to do test we are using below mentioned software's.

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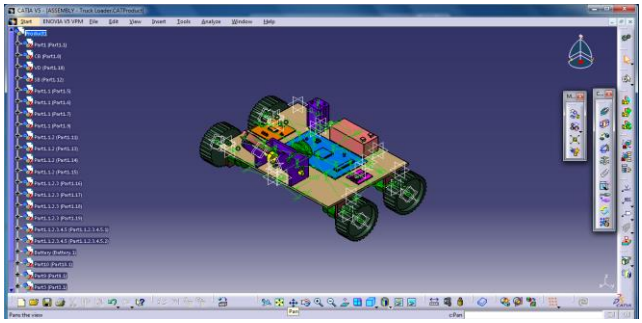

Fig: 5.2: Model design in CATIA-V5

VI - ANALYSIS OF AUTOMATIC MULTI TASKING INDUSTRIAL ROBOT

6.1 Procedure for FE Analysis Using ANSYS:

The analysis of the old design and new design of module component is done using ANSYS. For compete assembly is not required, motor and attached system is to carried out by applying moments at the rotation location along which axis we need to mention.

6.2 Preprocessor

In this stage the following steps were executed:

- **Import file in ANSYS window**

File Menu > Import> STEP > Click ok for the popped up dialog box > Click

Browse" and choose the file saved from CATIAV5R20 > Click ok to import the file

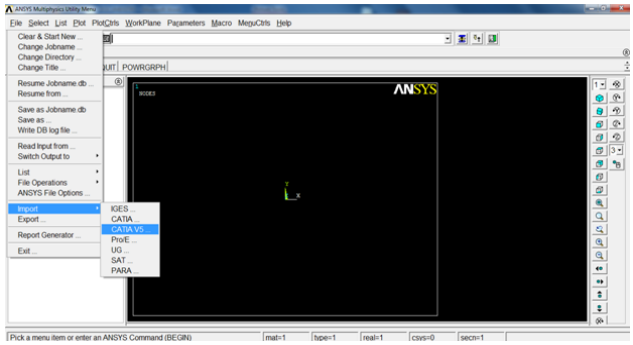

Fig.6.1: Import panel in Ansys.

6.2.1 Meshing:

Mesh generation is the practice of generating a polygonal or polyhedral mesh that approximates a geometric domain. The term "grid generation" is often used interchangeably. Typical uses are for rendering to a computer screen as finite element analysis or computational fluid dynamics. The input model form can vary greatly but common sources are CAD, NURBS, B-rep and STL (file format). The field is highly interdisciplinary, with contributions found in mathematics, computer science, and engineering.

Three-dimensional meshes created for finite element analysis need to consist of tetrahedral, pyramids, prisms or hexahedra. Those used for the finite volume method can consist of arbitrary polyhedral. Those used for finite difference methods usually need to consist of piecewise structured arrays of hexahedra known as multi-block structured meshes.

Meshing is an integral part of the computer-aided engineering (CAE) simulation process. The mesh influences the accuracy, convergence and speed of the solution. Furthermore, the time it takes to create a mesh model is often a significant portion of the time it takes to get results from a CAE solution.

Therefore, the better and more automated the meshing tools, the better the solution. From easy, automatic meshing to a highly crafted mesh, ANSYS provides the ultimate solution. Powerful automation capabilities ease the initial meshing of a new geometry by keying off physics preferences and using smart defaults so that a mesh can be obtained upon first try. It has a range of meshing tools that cater to

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nearly all physics. While the meshing technologies were developed to meet specific needs in the areas of solid, fluid, electromagnetic, shell, 2-D and beam models, access to these technologies is available across all physics.

6.2.2 Finite Element Method:

In mathematics, finite element method (FEM) is a numerical technique for finding approximate solutions to boundary value problems. It uses variation methods (the Calculus of variations) to minimize an error function and produce a stable solution. Analogous to the idea that connecting many tiny straight lines can approximate a larger circle, FEM encompasses all the methods for connecting many simple element equations over many small sub-domains, named finite elements, to approximate a more complex equation over a larger domain. Finite element method (FEM) is a numerical method for solving a differential or integral equation. It has been applied to a number of physical problems, where the governing differential equations are available. The method essentially consists of assuming the piecewise continuous function for the solution and obtaining the parameters of the functions in a manner that reduces the error in the solution. In this article, a brief introduction to finite element method is provided. The method is illustrated with the help of the plane stress and plane strain formulation.

VII - DISCUSSION ON ANALYSIS RESULT

7.1 Results of Displacement analysis:

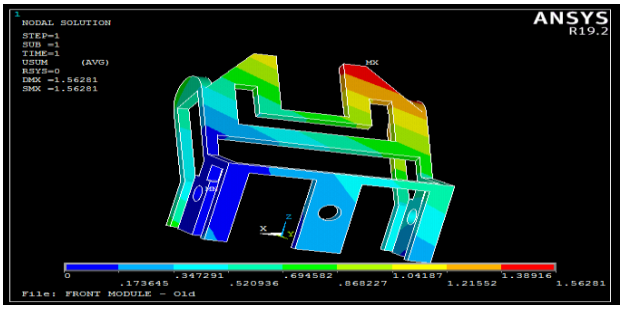

Fig: 7.1: Displacement of Front Module Old Design

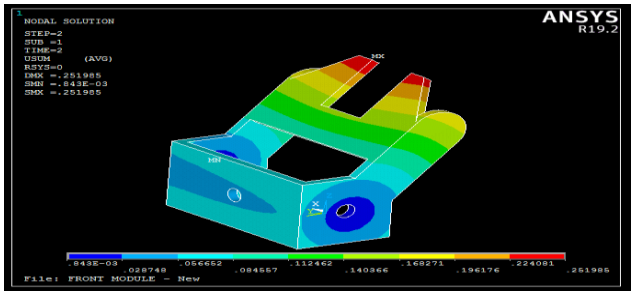

Fig: 7.2: Displacement of Front Module New Design

7.2 Results of Stress analysis:

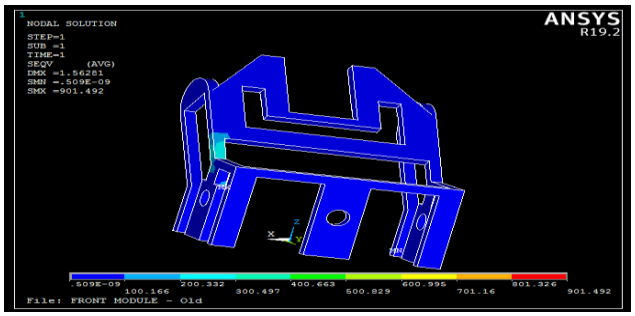

Fig: 7.3: Stress Analysis of Front Module Old Design

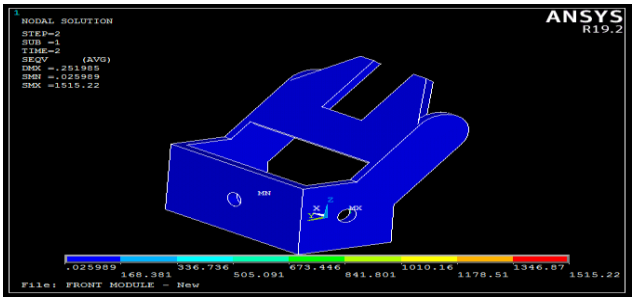

Fig: 7.4: Stress Analysis of Front Module New Design

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7.3 Results of Strain analysis:

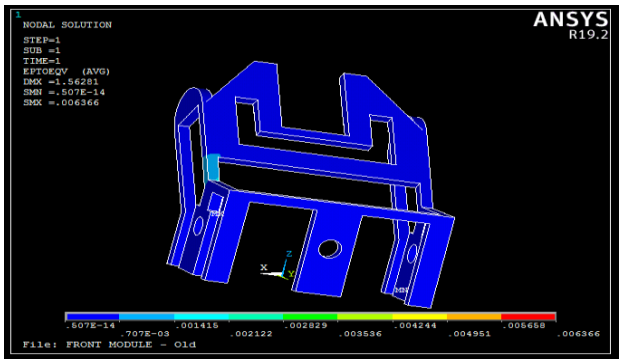

Fig: 7.5: Strain Analysis of Front Module Old Design

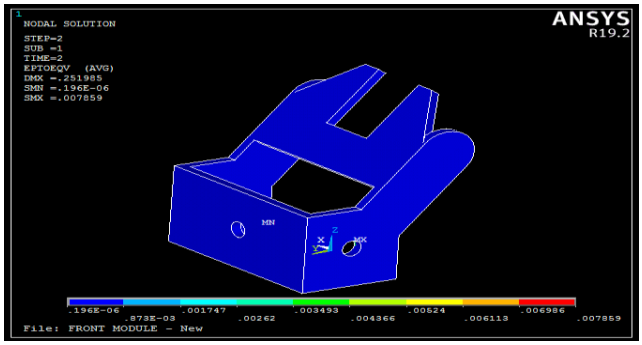

Fig: 7.6: Strain Analysis of Front Module New Design

VIII - CONCLUSION

As shown above figures, the displacement of the design is meshed and solved using Ansys and displacement of new design module is 0.251mm. This is showing us that clearly each component in assembly is having minor displacement. Stress is at the fixing location (Minimum Stress which is acceptable), stress value of new design module is 1515.22MPa. The value which is very less compared to yield value; this is below the yield point. The maximum strain is 0.0078MPa, this solution solving with the help of Ansys software so that the maximum strain. So we can conclude our new design module parameters are approximately correct. The development process may be incremental but the overall concept requires the way we think about mechanization for autonomous machines that is based more on needs and novel ways of meeting them rather than modifying existing techniques.

IX - FUTURE ENHANCEMENT

In the present project our main aim is to monitor different data between two micro controllers, which are not, connected any wire. The data will be transferred through module encoder that acts like a Transmitter. When the data is subjected to transfer the emitter collects it and sends it into the air, which will then be collected by the receiver situated at the other end.

There is a huge scope for improvement in design techniques and solution solving in mechanization for autonomous machines and their systems. Wireless communication is finding a huge development in Satellite Communications. The signals are sensed and reflected back to the earth stations. These signals contain information about weather forecasting, geological surveys and other cosmic developments.

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