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Multi – Directional Pick and Place Robot

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ABSTRACT:

This project presents real-world uses for mobile robotic platforms that are built around unique wheels, in this case, Mecanum wheels. The omnidirectional nature of mobile robots with four Mecanum wheels means that they have the capacity to move instantly in any direction and from any configuration. As a result, these vehicles have many advantages over conventional platforms when it comes to movement in cramped or wide locations. They are capable of carrying out specific tasks with ease in crowded surroundings that are predicted to contain static impediments, dynamic obstacles, or small spaces. Such settings are typically seen in factories, warehouses, hospitals, etc. As a result, there is a need to develop these kinds of robotic platforms to meet the needs of numerous industries, including: industrial, military, naval, medical, and last but not least, the educational industry (as a foundation for research). In the first section of this work, the properties of the Mecanum wheel, a brief comparison of this type of wheel to a regular wheel, and the previously discovered constructive and design solutions are discussed. Then, certain application fields and associated Mecanum wheel-based systems are described.

INTRODUCTION:

Robots are multifunctional, re-programmable, automatic industrial machine designed for replacing human in hazardous work.

Robots can be work as:-

• An automatic machine sweeper

• In space

• A machine removing mines in a war field

• An automatic car for a child to play with

• In military, etc. The aim of the robot is to manipulate the objects by perceiving, moving, picking, modifying the physical properties of object.

• Robotics is a branch of Artificial Intelligence (AI), it is mainly composed of electrical engineering, mechanical engineering and computer science engineering for construction, designing an application of robots.

• Robotics is science of building or designing an application of robots. The aim of robotics is to design an efficient robot. Aspects of Robotics

• The robots have electrical components for providing power and control the machinery.

• They have mechanical construction, shape, or form designed to accomplish a particular task. • It contains some type of computer program that determines what, when and how a robot does something.

BASIC ROBOTIC PARTS :

A robot is a machine that functions automatically and can adapt to changes in its environment. The basic components of robots are: Selection of parts , Control Systems ,Sensors , Actuators , Power Supply , End effectors

Selection of parts :

Once you know the type of robot you wish to build (see Exploring Robot Locomotion Systems) it’s time to turn to both the method of construction, and the materials used, for building robots. It may be a surprise to some, but building a robot is a tad more complicated than going out to the garage and cutting up a hunk of pine. To begin, you have a choice of building the robot from scratch, using raw materials like plywood or sheet metal. Or if you prefer, you can adapt some ready-made product to serve as the base of your robot. Inexpensive house wares, hardware items, and toys can be used in various creative ways to make robot building faster and more economical. A robot is a machine that functions automatically and can adapt to changes in its environment. Although the word "robot" was first used in Czech writer Karl Capek's 1921 play, "Rossum's Universal Robots," human beings have been tinkering with machines that run without human guidance since the time of the Pharaohs. A staple of science fiction, robots are an increasingly important segment of our society, performing many jobs that are too dangerous or tedious for human beings. Control System At the most basic level, human beings and other animals survive through a principle called feedback. Human beings' sense what is going on around them and react accordingly. The use of feedback to control how a machine functions dates back to at least 1745, when English lumber mill owner Edmund Lee used the principle to improve the function of his wind-powered mill. Every time the wind changed direction; his workers had to move the windmill to compensate. Lee added two smaller windmills to the larger one. These smaller windmills powered an axle that automatically turned the larger one to face the wind. A robot's control system uses feedback just as the human brain does. However, instead of a collection of neurons, a robot's brain consists of a silicon chip called a central processing unit, or CPU, that is similar to the chip that runs your computer. Our brains decide what to do and how to react to the world based on feedback from our five senses. A robot's CPU does the same thing based on data collected by devices called sensors. Sensors Robots receive feedback from sensors that mimic human senses such as video cameras or devices called light-dependent resistors that function like eyes or microphones that act as ears. Some robots even have touch, taste and smell. The robot's CPU interprets signals from these sensors and adjusts its actions accordingly. Actuators To be considered a robot, a device must have a body that it can move in reaction to feedback from its sensors. Robot bodies consist of metal, plastic and similar materials. Inside these bodies are small motors called actuators. Actuators mimic the action of human muscle to move parts of the robot's body. The simplest robots consist of an arm with a tool attached for a particular task. More advanced robots may move around on wheels or treads. Humanoid robots have arms and legs that mimic human movement. Power Supply In order to function a robot must have power. Human beings get their energy from food. After we eat, the food is broken down and converted into energy by our cells. Most robots get their energy from electricity. Stationary robotic arms like the ones that work in car factories can be plugged in like any other appliance. Robots that move around are usually powered by batteries. Our robotic space probes and satellites are often designed to collect solar power. End Effectors In order to interact with the environment and carry out assigned tasks, robots are equipped with tools called end effectors. These vary according to the tasks the robot has been designed to carry out. For example, robotic factory workers have interchangeable tools such as paint sprayers or welding torches. Mobile robots such as the probes sent to other planets or bomb disposal robots often have universal grippers that mimic the function of the human hand

INTRODUCTION TO WHEELS:

A Mecanum wheels are a type of omnidirectional wheel that allows a robot or other vehicle to move in any direction without changing its orientation. They were invented by Bengt Ilon in the 1970s and are commonlyused in robotic applications. Mecanum wheels are designed with a series of small rollers mounted at a 45-degree angle to the wheel'smain axis of rotation. These rollers are arranged in a criss-cross pattern, with each roller having an independent axis of rotation. When the wheels are rotated, the rollers on each wheel interact with the groundin a specific way, allowing the vehicle to move in any direction. The movement of a vehicle equipped with mecanum wheels is controlled by varying the speed and directionof rotation of each wheel. By adjusting the speed and direction of each wheel independently, the vehicle canmove in any direction and rotate in place.Wheel Setup 25 Mecanum wheels are commonly used in robotics applications, such as mobile robots, industrial automation,and material handling. They are also used in some recreational vehicles, such as small-scale remote- controlled cars and drones. One potential drawback of mecanum wheels is that they may be less efficient than traditional wheels, as some of the power from the motor is used to rotate the rollers. Additionally, mecanum wheels may be more complex and expensive than traditional wheels, which can make them less practical for some applications.

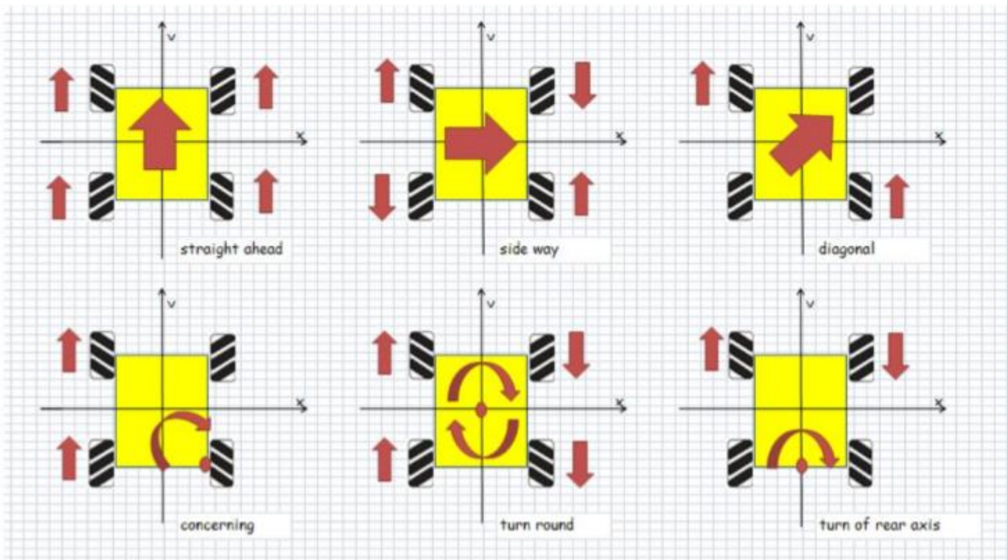


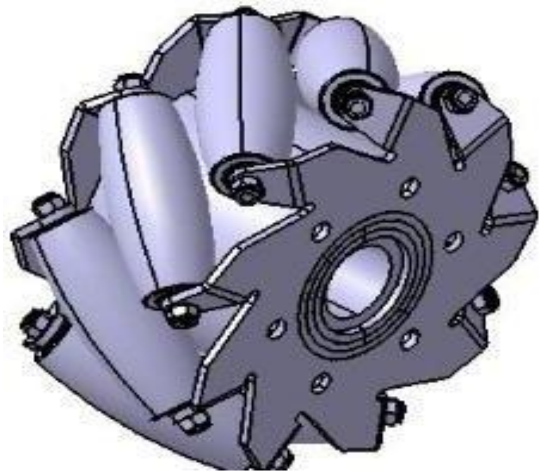
Fig : Mecanum wheels in omnidirectional

DESIGN AND ANALYSIS OF THE MECANUM WHEELS :

The design of the mecanum wheels is done in CATIA V5 Software. There are different ways in which problem related to design can be solved. The five steps involved in solving a design problem are 1. Defining the problem 2. Collecting the information 3. Generation of multiple solutions 4. Analysing and selecting a solution 5. Testing and implementation of the solution First step of the design process starts with defining the problem. This mainly depends on the customer requirements and how much it is needed in the society. The perceived need may not be the real need. Enough information should be collected before dealing with any detail of the design. The next step, therefore describes the collection of the data related to the features of the product to be designed. Information regarding product specification like size, 10 shape, material to be used etc. is gathered to further design the product. Also, a survey should be carried out for the availability of the similar product at this stage. Once the details of the design are identified, the design team generates various alternative solutions. Based on the compatible cost, safety, and other criteria, various other alternatives are selected. The next step is to analyse the solution selected. Detail analysis enables to reach to a conclusion to decide the alternative that best fits the design of the product. The next step includes development of the prototype on which tests are performed to verify and modify the design further. If the solution chosen doesn't work than the previous steps are repeated and Continuous iterative process is carried which is shown in the design process.

FACTORS TO BE CONSIDERED:

There are many factors to be considered while solving a design problem. Some of the factors to be considered are as follows : • Material: Material plays a very important role while designing. If a wrong material is selected, it tends to fail. Material should be chosen based on how the manufacturing has to be carried out and also depends on the budget. • Load: Stresses must be determined accurately as it is responsible for the internal stresses. Different types of loads are static load, dynamic load, etc. • Size, Shape, Space Requirements and Weight: Size, shape, space and weight are very crucial factors that should be taken care of. If the size of the component is too large than required, it will occupy more work space area and might also result in a high cost. Weight mainly depends on the selected material. • Manufacturing: A feasible manufacturing process suitable to the design of the component must be implemented. • Operation: The operation of any component should be as simple as possible. For example, usage of knob or a switch easily starts the machine. In some of the cases number of operations has to be done to get the machine started. The sequence of operating a machine should be designed in such a way that it is user-friendly. • Reliability and Safety: The designed component should work effectively without facing any failure while operating it. Proper analysis of the machine should be done prior to check for its reliability. Excessive heat generation, overloading, wear of elements should be avoided for the proper functioning of the component. Safety is the other important thing that should be taken care of. • Maintenance, Cost and Aesthetics: Maintenance and safety are linked to each other. If the machines are maintained well in a timely fashion, they will be safe to use resulting in low maintenance future costs possible. Cost of the machine should not be too high or too low. The overall cost of the machine depends on the selected material, machine design and components, and manufacturing process. Aesthetic features are not necessary for machine unless they serve a purpose



Advantages

- compact design
- high load capacity
- simple to control
- less speed and pushing force when moving diagonally
- low weight
- compact design
- simple to control

- less speed and pushing force when moving diagonally

- simple conceptually

- simple wheels

- continuous wheel contact

- high load capacity

- robust to floor condition

Disadvantages

- very complex conceptually

- discontinuous wheel contact

- high sensitivity to floor irregularities

- complex wheel design

- more complex conceptually

- discontinuous wheel contact or variable drive-radius

- sensitive to floor irregularities

- lower traction

- complex mechanical design

- heavy and massive design

- complex to program and control

- high friction and scrubbing while steering

CONCLUSION:

An overview of the Mecanum wheels and their useful uses is provided in this project. The primary benefit of this kind of wheel is its omnidirectional capability, which enables exceptional manoeuvrability and mobility in crowded areas. Additionally, some study done on Mecanum wheel mobile robots to enhance the wheel design is mentioned. Both outdoor applications, such as search and rescue missions, military operations, planetary explorations, and mine operations, as well as indoor applications, like the transportation of small goods, powered robotic wheelchairs, or shopping carts, can make use of and benefit greatly from the manoeuvrability offered by omnidirectional vehicles. The omnidirectional property that this sort of wheel offers, allowing for high manoeuvrability and movement in crowded areas, is represented by its principal advantage.The wheel design is described for improvement. Both indoor and outdoor applications, such as the transportation of small goods, powered robotic wheel chairs, or shopping carts, can make use of and benefit greatly from the manoeuvrability offered by omnidirectional vehicles. Examples of outdoor applications include long load transportation, military operations, planetary exploration, and mine operations. The robotic arm's entire concentration is on storage, specifically lifting large items and placing them in storage areas in industrial work environments. The capacity and effectiveness of storage in the industrial sector may significantly enhance when combined with omnidirectional mobility. The main benefit of employing this kind of vehicle is that it needs a very minimal space to turn 360 degrees.

REFERENCES :

[1] Ilon, B.E., ‘Wheels for a course stable self propelling vehicle movable in any desired direction on the ground or some other base”, US Patent and Trademarks office, Patent 3.876.255, 1975.

[2] Song, J.B., Byun, K.S., “Design and Control of a Four-Wheeled Omnidirectional Mobile Robot with Steerable Omnidirectional Wheels”, Journal of Robotic Systems, 21(4), 2004, pp. 193-208.

[3] Doroftei, I., Stirbu, B., “Design, Modeling and Control of an Omni-directional Mobile Robot”, Solid State Phenomena Vols. 166-167, 2010, pp 173-178, Trans Tech Publications, Switzerland. doi:10.4028/www.scientific.net/SSP.166-167.173.

[4] Han, Kyung-Lyong, et al. "Design and control of mobile robot with mecanum wheel." 2009 ICCAS-SICE. IEEE, 2009.

[5] Chu, Baeksuk, and Young Whee Sung. "Mechanical and electrical design about a mecanum wheeled omni-directional mobile robot." 2013 10th International Conference on Ubiquitous Robots and Ambient Intelligence (URAI). IEEE, 2013.

[6] Chu, Baeksuk, and Young Whee Sung. "Mechanical and electrical design about a mecanum wheeled omni-directional mobile robot." 2013 10th International Conference on Ubiquitous Robots and Ambient Intelligence (URAI). IEEE, 2013.

[7] Dickerson, S.L., Lapin, B.D., „Control of an omni-directional robotic vehicle with Mecanum wheels", in National Teleystems Conference Proceedings, p. 323- 328, March 26-27, Atlanta, USA, 1991.

[8] Borenstein, J., Everett, H.R., Feng, L., „Navigating Mobile Robots: Sensors and Techniques", A K Peters, Ltd, MA, USA, 1996.

[9] Doroftei, I., Grosu, V., Spinu, V., „Omnidirectional Mobile Robot – Design and Implementation", Bioinspiration and Robotics: Walking and climbing Robots, Book edited by: Maki K. Habib, ISBN 978-3-902613-15-8, pp. 544, I-Tech, Vienna, Austria, EU, September 2007