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A Review Approach on Design and Development of Transportation Path Follower Robot for Material Handling

[1] Mr. Pathade Akash, [2] Mr. Bajaj Kishan [3] Mr. Bajaj Kaushik, [4] Ms. Patil Tanvi
[1][2][3][4] Mechanical Engineering , Sandip Institute of Technology and Research Centre (SITRC),Nashik

Abstract:-- **In this project instead of doing manual work, automatized work is done. Transportation path follower robot is a type of robot which is used for material handling and transporting the material from one place to another. The main purpose of this project is to reduce labour, cost involved with it and also to save the time. It is six wheel electric rover, which will provide paper work from administration office to every department. Robotic vehicles are capable of traveling where people cannot go, or where the hazards of human presence.**

Keywords: **Automatized, material handling, reduce labour, Rocker bogie, Ultrasonic, RFID.**

I. INTRODUCTION

Transportation path follower robot is a type of robot which is used for material handling and transporting the material from one place to another. The robot is a mechanical or virtual artificial agent, usually an electromechanical machine that is guided by computer program or electronic circuitry, and thus a type of an embedded system.

The field of robotics encompasses a broad spectrum of technologies in which computational intelligence is embedded in physical machines, creating systems with capabilities far exceeding the core components alone. Such robotic systems are then able to carry out tasks that are unachievable by conventional machines, or even by humans working with conventional tools. The ability of a machine to move by itself that is autonomously is one such capability that opens up an enormous range of applications that are uniquely suited to robotic systems. This chapter describes such unmanned and autonomous vehicles and summarizes their development and application within the international perspective of this study.

Robotic vehicles are machines that move autonomously on the ground, in the air, undersea or in space. Such vehicles are unmanned, in the sense that no humans are on board. In general, these vehicles move by themselves, under their own power, with sensors and computational resources onboard to guide their motion. However, such unmanned robotic vehicles usually integrate some form of human oversight or supervision of the motion and task execution. Such oversight may take different forms, depending on the environment and application. It is common to utilize so-called supervisory controll for high-level observation and monitoring of vehicle motion. In other instances, an interface is provided for more continuous human input constituting a remotely operated vehicle, or ROV. In this case, the ROV is often linked by cable or wireless communications in order to provide higher bandwidth communications of operator input. In the evolution of robotic vehicle technology that has been observed in this study, it is clear that a higher level of autonomy is an important trend of emerging technologies, and the ROV mode of operation is gradually being replaced by supervisory control of autonomous operations.

II. METHODOLOGY

Transportation path follower robot for material handling will transfer from one place to another in the definite path. The paper work will be placed inside the robot from administration office to all the departments. The path will be fixed of robot. As the robot is secured by RFID reader, the documentary will be safe. Line follower sensors are provided which will help to follow the given path. Ultrasonic sensors are used to detect the obstacles. Buzzer system is provided which will indicate that the robot is coming. We have used 300 rpm motor. As it is less rpm motor the torque will produce better. There will be a component which will be placed on the robot with 4 compartments in it, compartments will be denoted by different departments. There will be RFID code system which will help to keep the system secured. And mainly we are going to use rocker bogie system which will help us to provide the motion on uneven surfaces also. In this way

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robot will give all the documents and will return to administration office.

2.1 Basic Robot Sketch

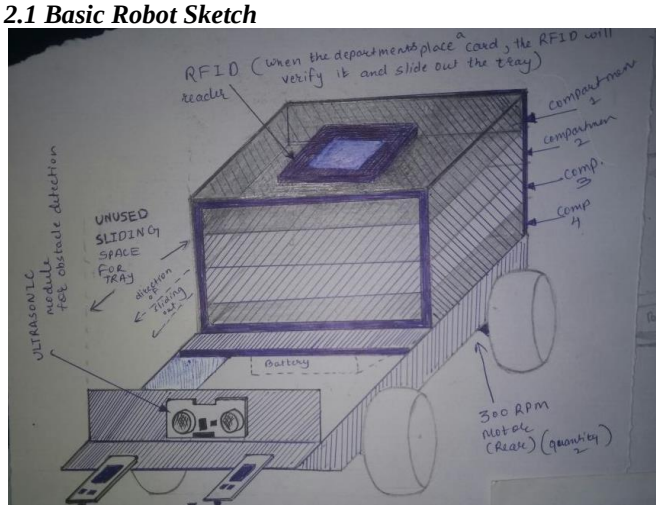

fig. 2.1 Basic Robot Sketch

Why are robotic vehicle important?

First, robotic vehicles are capable of travelling where people cannot go, or where the hazards of human presence are great. To reach the surface of Mars, a spacecraft must travel more than one year, and on arrival the surface has no air, water, or resources to support human life. While human exploration of Mars may someday be possible, it is clear that robotic exploration is a fundamental step that provides enormous scientific and technological rewards enhancing our knowledge of other planets

The Rocker-Bogie design has no springs and stub axles for each wheel, allowing the rover to climb over obstacles, such as rocks, that are up to twice the wheel's diameter in size while keeping all six wheels on the ground. As with any suspension system, the tilt stability is limited by the height of the center of gravity. Systems using springs tend to tip more easily as the loaded side yields. The system is designed to be used at slow speeds of around 10 cm/s, so as to minimize dynamic shocks and consequential damage to the vehicle when surmounting sizable obstacles.

An Ultrasonic sensor is a device that can measure the distance to an object by using sound waves. It measures distance by sending out a sound wave at a specific frequency and listening for that sound wave to bounce back. By recording the elapsed time between the sound wave being generated and the sound wave bouncing back, it is possible to calculate the distance between the sonar sensor and the object.

Arduino is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; we can simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

Infra-Red Sensor commonly known as IR Sensor is nothing but a combination of IR source and a light detector called photo diode and it work on principal of transmitting light and receiving it and comparing the received amount of light with the help of a comparator LM358. IR Sensors are commonly used in detecting object and obstacles; it can also detect colour. In short we can say IR sensor gives ability to autonomous robots to detect lines or nearby objects to autonomous robots.

2.2 Concept of Rocker Bogie

The rocker-bogie system is the suspension arrangement used in the Mars rovers (mechanical robot) introduced for the Mars Pathfinder and also used on the Mars Exploration Rover (MER) and Mars Science Laboratory. The term rocker comes from the rocking aspect of the larger links [clarification needed] on each side of the suspension system. These rockers are connected to each other and the vehicle chassis through a differential. Relative to the chassis, when one rocker goes up, the other goes down. The chassis maintains the average pitch angle of both rockers. One end of a rocker is fitted with a drive wheel and the other end is pivoted to a bogie.

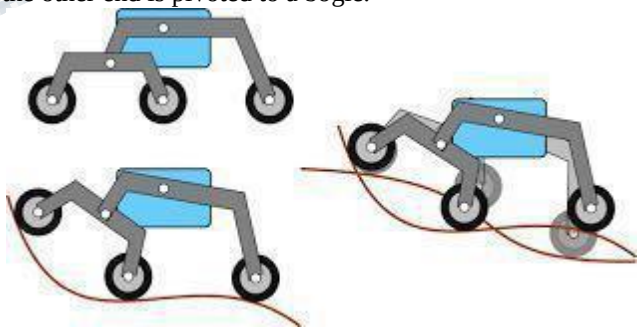

Fig 2.2 Rocker bogie suspension system

The term bogie refers to the links that have a drive wheel at each end. Bogies were commonly used as load wheels in the tracks of army tanks as idlers distributing the load over the terrain. Bogies were also quite commonly used on the trailers of semi trailer trucks. Both applications now prefer trailing arm suspensions.

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The rocker-bogie design has no springs or stub axles for each wheel, allowing the rover to climb over obstacles, such as rocks, that are up to twice the wheel's diameter in size while keeping all six wheels on the ground. As with any suspension system, the tilt stability is limited by the height of the centre of gravity. Systems using springs tend to tip more easily as the loaded side yields. Based on the centre of mass, the Curiosity rover of the Mars Science Laboratory mission can withstand a tilt of at least 45 degrees in any direction without overturning, but automatic sensors limit the rover from exceeding 30-degree tilts. The system is designed to be used at slow speed of around 10 centimeters per second (3.9 in/s) so as to minimize dynamic shocks and consequential damage to the vehicle when surmounting sizable obstacles. JPL states that this rocker bogie system reduces the motion of the main MER vehicle body by half compared to other suspension systems. Each of the rover's six wheels has an independent motor. The two front and two rear wheels have individual steering motors which allow the vehicle to turn in place. Each wheel also has cleats, providing grip for climbing in soft sand and scrambling over rocks. The maximum speed of the robots operated in this way is limited to eliminate as many dynamic effects as possible so that the motors can be geared down, thus enabling each wheel to individually lift a large portion of the entire vehicle's mass.

In order to go over a vertical obstacle face, the front wheels are forced against the obstacle by the centre and rear wheels. The rotation of the front wheel then lifts the front of the vehicle up and over the obstacle. The middle wheel is then pressed against the obstacle by the rear wheels and pulled against the obstacle by the front until it is lifted up and over. Finally, the rear wheel is pulled over the obstacle by the front two wheels. During each wheel's traversal of the obstacle, forward progress of the vehicle is slowed or completely halted. This is not an issue for the operational speeds at which these vehicles have been operated to date.

One of the future applications of rovers will be to assist astronauts during surface operations. To be a useful assistant, the rover will need to be able to move much faster than human walking speed or at least equivalent. Other missions which have been proposed, such as the Sun-Synchronous Lunar Rover, require even greater speeds (4–10 km/h).

III. MAJOR COMPONENTS OF SYSTEM

3.1 Arduino

Fig 3.1.1 Arduino

Arduino is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; we can simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

Arduino will work as heart of the system. It will handle sensor inputs and take action according to the inputs. Line follower module will send signals according to the signals Arduino will rotate motors. When it stops it will continuously check for the RFID inputs. Once RFID input is confirmed door will be opened.

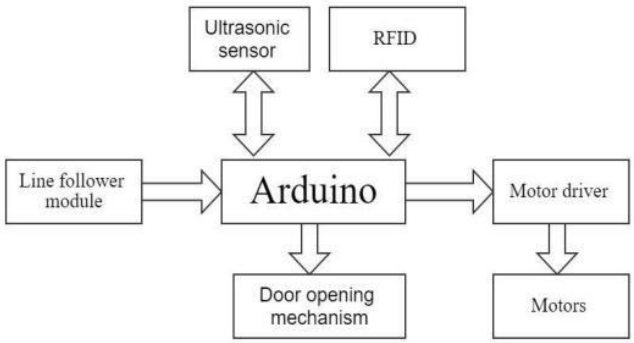

Fig 3.1.2 Block diagram of Arduino

Once the door is closed it will continue its way to the next department. At this time ultrasonic sensor will be

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sensing for the obstacles if there is any obstacle in-between its way it will stop and buzzer will be turned on. Once the obstacle is gone it will continue on its way.

3.2 Ultrasonic Sensor

An Ultrasonic sensor is a device that can measure the distance to an object by using sound waves. It measures distance by sending out a sound wave at a specific frequency and listening for that sound wave to bounce back. By recording the elapsed time between the sound wave being generated and the sound wave bouncing back, it is possible to calculate the distance between the sonar sensor and the object.

The HC-SR04 ultrasonic sensor uses sonar to measure distance to an object. It offers excellent range accuracy and stable readings in an easy-to-use package. It operation is not affected by sunlight or black material like Sharp rangefinders are (soft materials like cloth can be difficult to detect).

Fig 3.2 Ultrasonic Sensor

Ultrasonic sensors emit a sound pulse that reflects off of objects entering the wave field. The reflected sound, or echo is then received by the sensor. Detection of the sound generates an output signal for use by an actuator, controller, or computer. The output signal can be analog or digital. Ultrasonic sensing technology is based on the principle that sound has a relatively constant velocity. The time for an ultrasonic sensor's beam to strike the target and return is directly proportional to the distance to the object. Consequently, ultrasonic sensors are used frequently for distance measurement applications such as level control. Ultrasonic sensors are capable of detecting most objects metal or non metal, clear or opaque, liquid, solid, or granular that have sufficient acoustic reflectivity. Another advantage of ultrasonic sensors is that they are less affected by condensing moisture than photoelectric sensors. 3.3 Line follower module Infra-Red Sensor commonly known as IR Sensor is nothing but a combination of IR source and a light detector called photo diode and it work on principal of transmitting light and receiving it and comparing the received amount of light with the help of a comparator LM358. IR Sensors are commonly used in detecting object and obstacles; it can also detect colour. In short we can say IR sensor gives ability to autonomous robots to detect lines or nearby objects to autonomous robots. The Sensor have Digital as well as analog output also it have 4-pin header which make it easy to connect to main board via female to female jumper wire. A mounting hole lets you easily connect one or more of these on any surface.

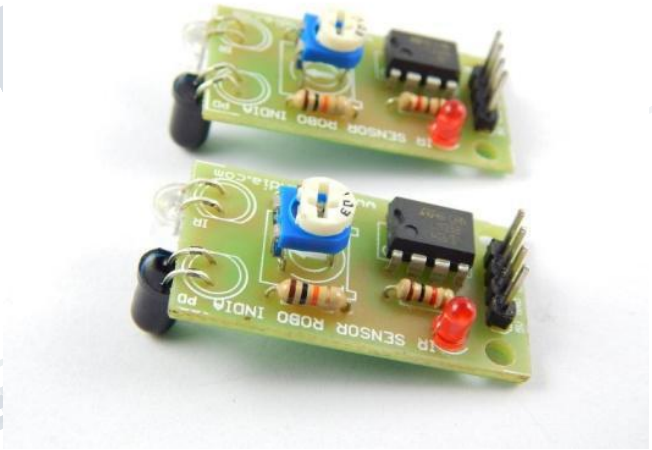

Fig 3.4 RFID Reader A radio frequency identification reader (RFID reader) is a device used to gather information from an RFID tag, which is used to track individual objects. Radio waves are used to transfer data from the tag to a reader. RFID is a technology similar in theory to bar codes. However, the RFID tag does not have to be scanned directly, nor does it require line-of-sight to a reader. The RFID tag it must be within the range of an RFID reader, which ranges from 3 to 300 feet, in order to be read. RFID technology allows several items to be quickly scanned and enables fast identification of a particular product, even when it is surrounded by several other items.

IV. ADVANTAGES

- Reduces man power.
- Better floor space utilization.
- Reduces the time in transportation.

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- Avoid human error.
- Increases standard of work.
- Easy to reach at specific location.
- Can be modified as per our requirement.
- Material handling is accurate.
- Avoid interference with human and building factors.
- It can travel through rough surfaces.

V. APPLICATION

Used for material handling and transporting the material from one place to another.

VI. LIMITATIONS

- Initial cost is high.
- Use for specific application
- Power consumption is more.

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