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Warehouse Management BOT Using Arduino

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Abstract: ***Today's modern world where technical and scientific developments are at a complete innovative intensity, the field of robotics also has experienced an immense bound. Nowadays, in many field robotics and automation is substituted "human touch" to make things easier and better. The critical situations such as aftermath of human and natural disasters, robots can be utilized instead of humans to avoid more casualties. Robotics can also be employed for warehouse management. Human beings pick and choose things up exclusive of thinking about the stages implicated. As a robotic arm or a simple robot system to move or pick up something, someone has to instruct it to execute numerous actions in a correct order for the movement of the robot. This work aims to contribute towards the above mentioned applications using a proposed model to control a warehouse using robot.***
Keywords— robot; warehouse management system; micro controller; sensor array
Keywords: Obstacle Detection, Line Follower, Sensors, Arduino, ROS.

I. INTRODUCTION

A robot is a re-programmable, multi-functional manipulator which is designed to move tools, materials, parts or specialized devices with the assistance of variable programmed motions to perform variety of tasks. The word "Robot" came from the word "Robota" meaning forced labour. The robot control loop involves sensing, thinking and acting. The sensing involves speech, vision acceleration, temperature, position, distance, touch, force, magnetic field, light sound and position sense. The thinking phase involves task planning, plan classification, learning, processing the data, path planning and motion planning. The acting phase involves output information move, speech text, visuals wheels legs, arms tracks, etc,. A warehouse management system (WMS) can be considered as a software application which is intended to maintain warehouse (distribution centre) management and staff. They smooth the progress of administration in their day by day planning (scheduling), organizing (managing), staffing (employment), controlling, and directing the deployment of maximum accessible resources, to stock up and move about materials into and out of a warehouse. The robots and warehouse associates the work together which reduces the travel time and increase productivity by utilizing a novel work process. Industrial robots do material handling, welding and inspection, which in turn improve productivity. Mobile robots move on legs or tracks or wheels. Domestic robots perform household tasks. In this paper, we propose a method where robots can be used for warehouse management. Here the robot performs the operation of searching an object arranged in the shelf and bringing the object to the user and if not needed taking it back to the same place where it was taken. The skeleton of paper is framed as follows. An overview of literature survey is presented in section 2. The proposed approach for warehouse management system using microprocessor based mobile robotic system is explained in section 3. Section 4 contains block diagram of proposed system. Section 5 contains testing of 3D model. Finally the section 6 concludes the paper.

II. LITERATURE REVIEW

Generally, the line follower robot is one of the self-operating mobile machines that follows a line drawn on the floor. The path can be a visible black line on a white surface (reverse).[1] The basic operations of the line follower are as follows:
Capturing the line position with optical sensors mounted at the front end of the robot. Most are using several numbers of photo-reflectors. Therefore, the line sensing process requires high resolution and high robustness. [2]
Steering the robot to track the line with any steering mechanism. This is just a servo operation; actually, any phase compensation will be required to stabilize tracking motion by applying digital PID filter or any other servo algorithm.[3]
Controlling the speed according to the lane condition. The speed is limited during passing a curve due to the friction of the tire and the floor.[4]
This kind of robot can be used for military purposes, delivery services, transportation systems, blind assistive applications. In order to meet all the requirements of an efficient line following and obstacle avoidance robot, obstacle sensor and line sensors are considered in this design, to track the defined path and avoid collisions with any obstacle. Moreover, once the obstacle is avoided, the robot returns on to the specified track.[5]
In case the robot gets lost from the track, as an emergency the robot is designed to make call to a stored number using a GSM module.

An experimental study is made on the time required to overcome various sized obstacle with constant speed and also on time required to overcome a fixed length obstacle with variable speed of robot.[6]
The line-following robot aims to follow a route. The path may be as simple as the black line on the ground, direct markers to detect the different specific lines based on sensors employed. An efficient automated line follower and obstacle avoiding robot is proposed in this paper. In most of the automated robotic applications, it is required that the robot follows a specific path. In case any obstacle is encountered in its path, it avoids the obstacle and then returns back to the
defined track again.[7]
For tracking a path, the Infrared Sensor is used and for the obstacle detection, an Ultrasonic Sensor. The analysis of the data from the sensors and the thereby accordingly decision making regarding the direction of car is performed by the Arduino controller unit.[8]

III. PROPOSED APPROACH FOR WAREHOUSE MANAGEMENT

The major parts of the proposed method is listed as follows:

A. Microcontroller

A computer present in a single integrated circuit which performs one task and executes one specific application is a microcontroller (Robot's brain). It composes of a processor, input/output peripherals and memory. They are usually designed for embedded applications and mostly used in automatically controlled electronic devices.

B. Sensor Array

The sensor array has nine IR emitter detector pairs in total. Eight of the pairs are positioned in a line with a spacing of 18mm in between. The spacing is designed so that the robots can cover tracks of width between 20mm and 40mm without having the need to change the program frequently.

C. Power Supply

A regulated power supply provides a stable voltage, to a circuit or device that should be working within particular power supply limits. The power supply is employed for providing power to the driver circuits and the microcontroller.

D. Lifting Motor

DC motors are widely used because of their small size and high energy output in robots. They are excellent for driving the motors. The lifting mechanism involves the process of picking up the certain object that the user commands the robots to perform.

E. Motor Drive

Using the low current signal from the microcontroller, the required amperage to the motor is provided with the help of motor driver circuit. The motor controller governs the performance of the electric motor in a predetermined manner. Thus the microcontroller and motor controller must together to make the motors move significantly. The physical size and weight of the motor controller varies significantly depending on the size of the robots.
In this work, we used three geared DC motors and they can be controlled by motor driver L293D. for this work, two reference positions are selected. First reference position is to pick the object and next reference position is to place the object. Initially the microcontroller sends signals to the motor-3 through driver circuit to rotate the arm in the desired direction. An Infrared (IR) sensor is employed for the purpose of obstacles detection in front of the robot or to make a distinction among colors depending on the design of the sensor. The sensor emits Infra Red ray which provides signal when it perceive the reflected ray.
An Infrared (IR) sensor includes :

1) an emitter,
2) Detector and its associated circuitry.

The complete circuit consists of two parts;

a) Emitter circuit and
b) Receiver circuit

An IR LED (Light Emitting Diode) can be used as an emitter and an IR photodiode can be used as detector to sense IR light of the similar wavelength which is emitted by the IR LED.

When IR light is received by the photodiode, the resistance and its output voltage change continuously in proportion to the level of the received IR light. This is the working principle of an IR sensor. In this work IR sensor is employed for the detection of the obstacles as carrying out the work i.e., this sensor is employed to sense the obstructions, if any, in the front. In this work, TSOP 1738 is employed for this purpose.

IC 7805 is a DC regulated IC of 5V. This IC is very flexible and is extensively in use for all types of circuits A computer present in a single integrated circuit which performs one task and executes one specific application is a microcontroller (Robot's brain). It composes of a processor, input/output peripherals and memory. They are usually designed for embedded applications and mostly used in automatically controlled electronic devices.

L293D, Motor Driver Circuit, works on the idea of H-bridge which allows the voltage to flow in either direction. So this motor driver circuit can be employed for rotation of motor in both clockwise and anticlockwise direction. So we can easily use H-bridge IC for driving a DC motor.

IV. BLOCK DIAGRAM

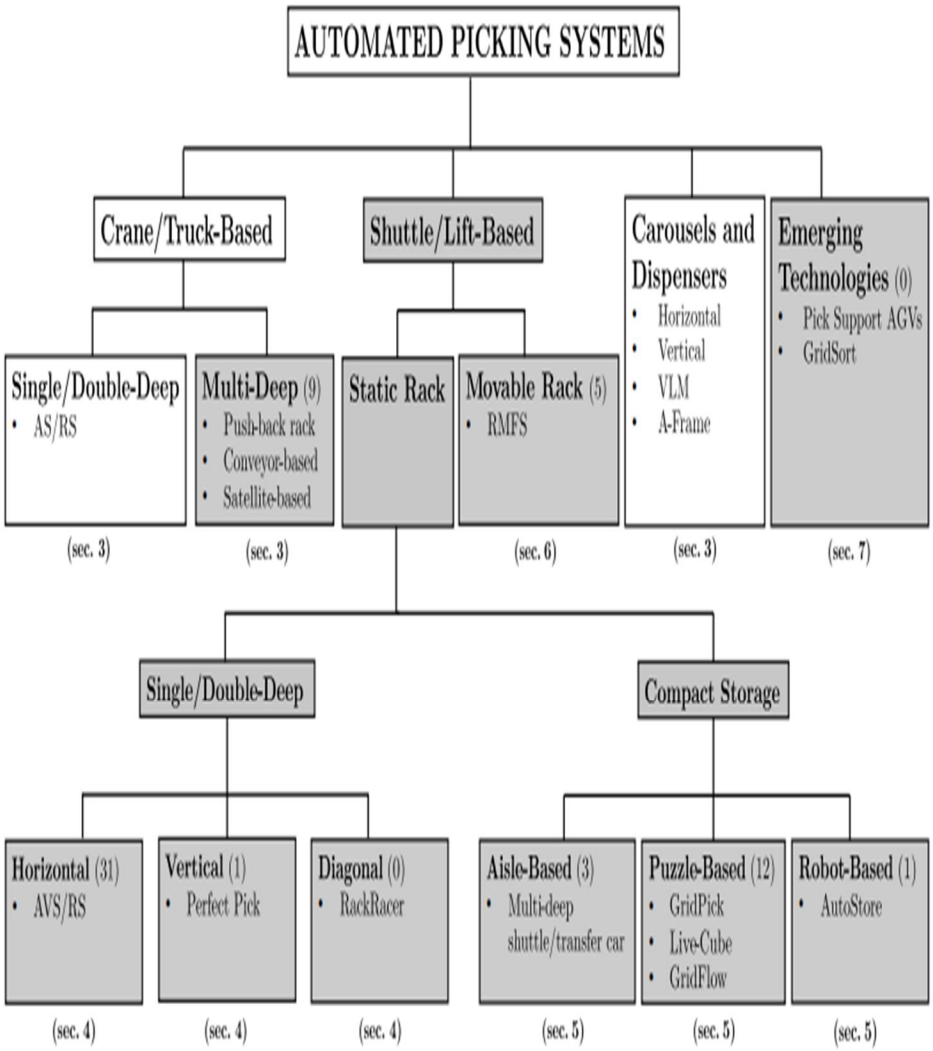
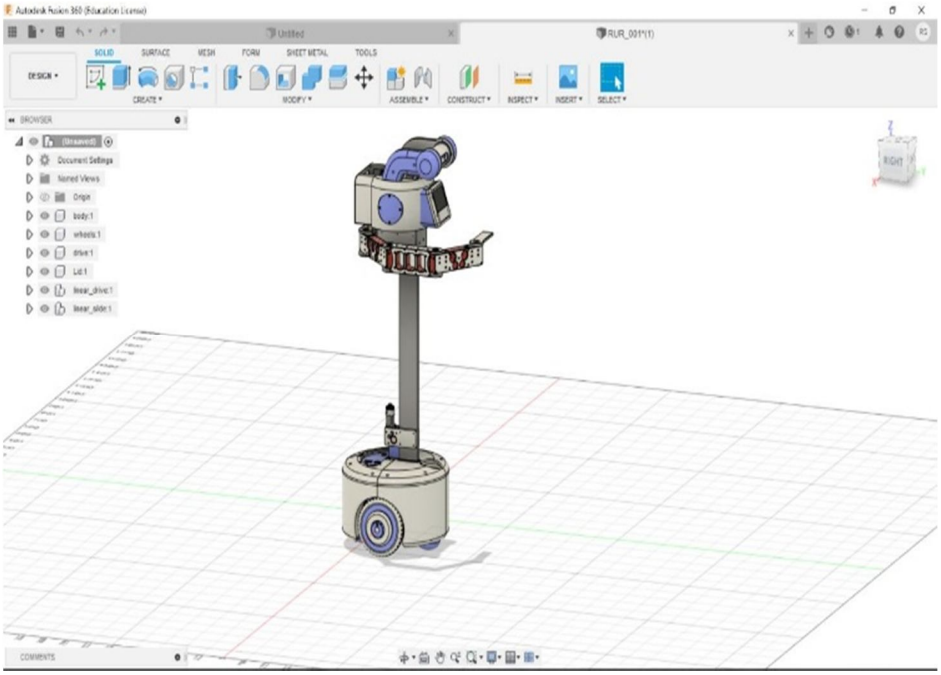


Fig. 1

V. TESTING

Once the navigation goal has been given, the robot will start navigating to the goal location autonomously in Gazebo and can be visualized that in RViz at the same time. Once reach the Goal, we will also get a prompt on the terminal that the robot has Reached the Go.

VI. FUTURE SCOPE



By attaching the Bluetooth module and a camera, this project can be expanded in the future, so that the user can see the obstacle identified on his screen by sitting at just one spot. In warehouse, when some kind of mishandling of products happens then that device will interrupt its routine operation and call the device administrator to check the issue that occurred to fix. A Wi-Fi system, GPS device, and Camera could be used for this purpose to track the production process and the supply chain in real-time. Every industry or medical authority's practical job can be more effective for supply chain management.

VII. CONCLUSION

Robotics play a significant part in the global economy and everyday life. Another challenge of robotics research is to be successful and to develop patents according to the complexity of their applications for global industries. The market for robotics technology is rising in a wide variety of applications and human activities, particularly for the manufacturing, medical, utility, defence and consumer industries. This line follower robot is the prototype of robots for industrial use. This smart and intelligent robot has more benefits because it doesn't consume much power. Our project aims at creating an autonomous robot that intelligently senses the obstacle and the edge in its path and navigates according to the behaviour that we have set for it. So, what this system provides is an alternative to the existing system by replacing skilled labour with robotic machinery.

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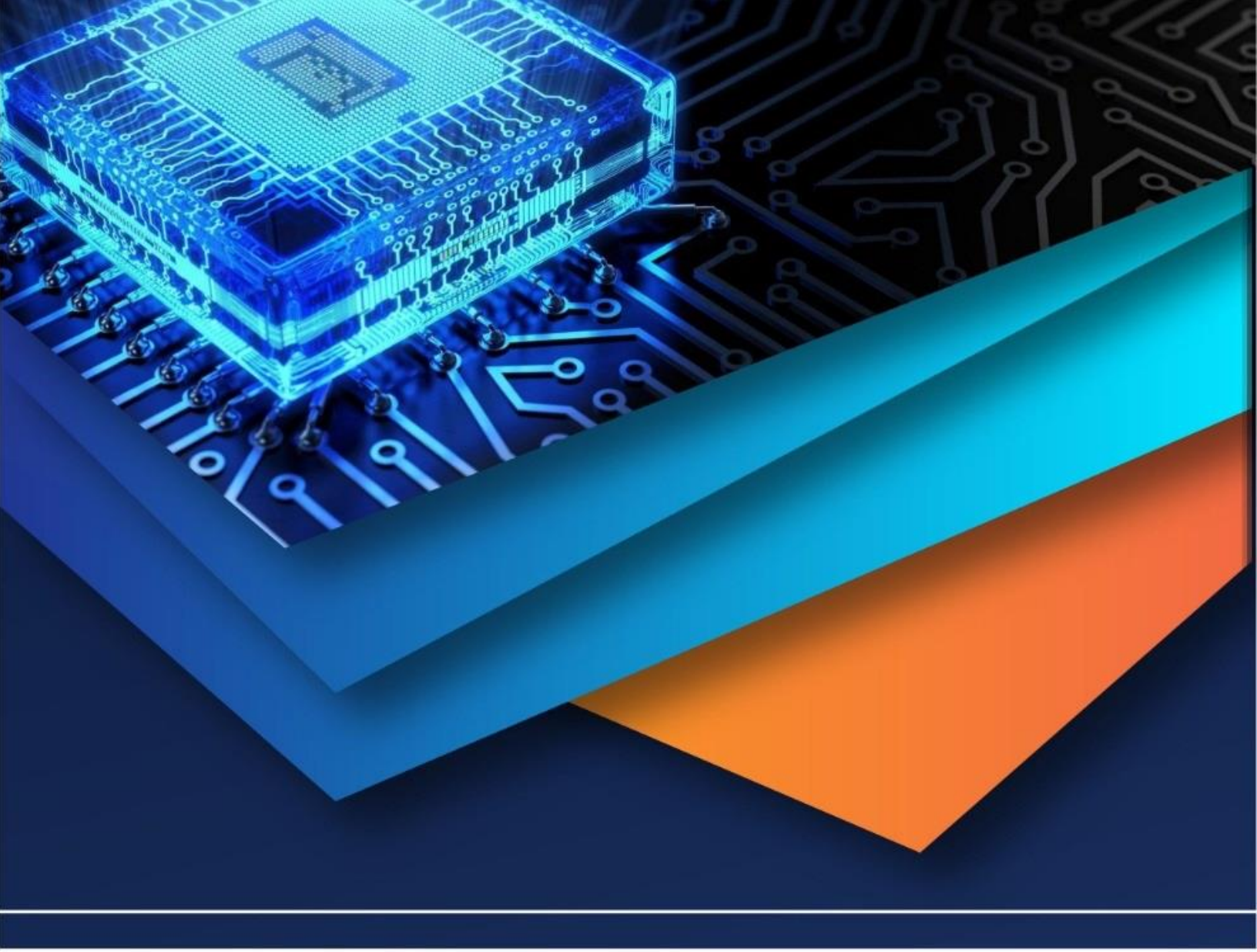

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