SELF-GUIDED CONVEYOR ROBOT

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ABSTRACT

The objective of the project is to reduce the manual work in the warehouse while loading and unloading of the materials .Generally ,in large scale industries large amount of goods are manufactured and the machines involved in lifting and moving them are also heavier and costlier like cranes, forklifts etc. They can be involved in large scale industries because the area involved will be larger for their movement and there will be no inconvenience in operating them. But on considering small scale industries where the production and the area of operation is lesser compared to that of the large scale industries usage of heavy cranes and forklifts are impossible. Thus, to provide solution to this problem Self-Guided Conveyor Robot is designed. The weight lifting Conveyor Robot is thus called as Self-Guided Conveyor because it is completely automated and it can also be manually operated when needed. It uses Arduino microcontroller, sensors, and actuators for its precise operation. It is also compact in size and operates in acute areas thus making it suitable for small scale industries. It has advantages like position sensing, remote controlled operation. It is very economical to the small scale industries and efficient too. Even though, it is completely automated manual control is also provided using wired remote control. It can be able to report is position to the operator and this is made possible through the use of RF relay module. The line follower concept is utilized to provide movement of vehicle in particular path and to avoid interruption in working. The vehicle is capable of rotating for 360' proving that there is no constraint in the movement of the robot. The merit of this robot is it is very economical for small scale industries and provides efficient operation. The drawback is that it reduces manpower affecting the daily wages of the people.

I.INTRODUCTION

The project is to provide easy weight lifting procedure for industrial workers and to help them in loading and unloading of weights within the industry and they can also be used for loading the weights in the vehicles for their export. Its objective is to provide compact and affordable weight conveying vehicle with complete automation for small scale industries where the implementation of large weight conveying machines are impossible. The components involved in this innovative model are a combination of electrical and mechanical materials. The mechanical components provide rigid support to the whole system it uses plywood and steel structures for mechanical strength. It also includes wheel to enable movement and rotation of the system

The electrical components used in this project are Arduino UNO, Arduino mega, Ultrasonic sensor, PIR sensor, IR sensor, NRF transceiver module, RF relay module, DC motor,8 Channel relay module,battery[3] and actuator. The actuator exhibits push and pull force which has been effectively utilized for lifting the weights up and down. The microcontrollers are incorporated for controlling the movement of the robot and also for the control of limb movement of the actuator. Every operation of the robot is coordinated only by means of microcontrollers. All the three types of

sensors are used for motion control. The function of the motor is to rotate the wheels. The higher is the rotating torque of the motor the higher is its load carrying capability. The relay driver is utilized to coordinate the movement of wheels based upon the condition. The combination of transceiver and RFID is used for position sensing. The concept of line follower is used for movement of vehicle in a marked path thus it will not disturb the workers working in the company. Manual operation is also provided to facilitate the operation of the robot under emergency situations. The project not only aims at helping the small scale industries it can also be implemented effectively in large scale industries also.

II.LITERATURE REVIEW

A. CONVENTIONAL METHOD IN SMALL SCALE INDUSTRY

The small scale industries have lesser area and production compared to that of larger industries but they are also in need of machines which are affordable for them to lift the loads produced by them. Most of those industries still use manpower which is time consuming and a tedious one. Generally, they have a trolley like structure which requires manpower for loading and unloading of weights. In those machines load is placed on it by a worker then it is lifted by giving a manual pushing force which is time consuming and also requires hard work. Thus, to reduce the human source and to improve efficiency Self-Guided Conveyor Robot is designed.

The following diagram shows the existing system:

Figure2.1 conventional system

In this system, the amount of weight to be lifted is constrained to the physique of the person operating it. And also the area of operation of the system is inconvenient because of its larger size. After loading, the loads are moved from one place to other by human. There is no automation or control involved in these systems. The limitations of these systems also include that they are larger in size and hence cause interruption in working of labours. They also cause time delay in delivering products, when operating labours physical ability is decreased because of continuous work and the work output is not constant. So, the reliability cannot be surely defined.

While on coming to the conventional systems in large scale industries, they are costlier and are affordable only by rich owners. For owner who has initially started his bigger company cannot afford those larger weight conveying machines. For those industries also self-guided conveyor robot can be implemented. Forklifts and cranes which are implemented in larger industries also are not completely automated and thus the new innovative product overcomes the several limitations of the conventional methods and provides outstanding performance and added features.

III.PROPOSED SYSTEM

A. OBJECTIVE OF THE PROPOSED SYSTEM

The objectives of the proposed system are to:

- Free from manual operation
- Move in acute areas and provide 360’ rotation
- Manual control as additional feature to provide access in critical areas
- Provide their position using position sensing technology
- Enhance operating time using sensors
- Improve precise location of load
- Capable of stopping anywhere in case of any emergency
- Provide wired remote control
- Provide reliability
- Reduce man power cost
- Handle the loads with care
- Provide compact and economical device

B.BLOCK DIAGRAM

The block diagram of the proposed system for machine and limbs movement is

shown below:

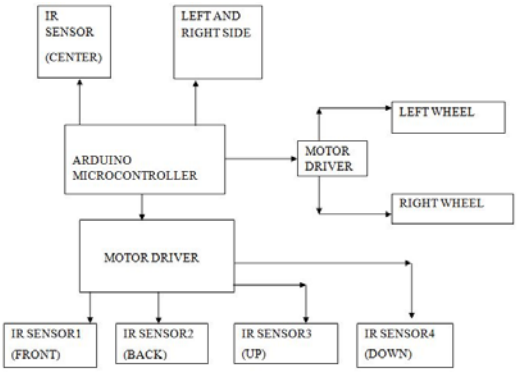

Figure 3.1 Block Diagram for machine and limb movement

The following shows the block diagram of the robot positioning:

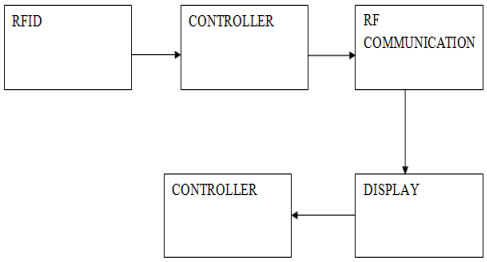

Figure 3.2 Block diagram of Robot position.

IV.ELECTRICAL CONSTRUCTION

A.ARDUINO MICROCONTROLLER

A microcontroller [7] is a device which is used to perform a specific task. Arduino is one among them. Arduino is a open source hardware. It has analog and digital input output pins, USB port for loading the program from the personal computer to the board, power jack, ICSP header, reset button and several combinations of microcontroller and microprocessor. It has 14 digital input output pins among them 6 pins produces pulse width modulated signals. It provides an Integrated Development Environment (IDE). It can be powered via USB cable or by an external supply. Most of the Arduino board consists of Atmel 8-bit AVR microcontroller. There are many types of Arduino boards based on the variations in the flash memory, pins and features. They have a boot loader which simplifies the uploading of the program to the on- chip flash memory.

The Arduino [8] program mainly consists of two functions. They are:

- loop( )
- setup( )

setup ( ) is used to initialize the variables. loop ( ) is executed repeatedly and it contains the function which has to be done several times based upon the condition given. The board consists of in-built LED which indicates that power supply is given to the Arduino board. The Arduino board supports languages like C, C++ and java with some special rules for code structuring. A program written with IDE in Arduino programmable software is mentioned as sketch.

In this project, the Arduino is used as the primary component for coordinating the complete working of the Self-guided Conveyor Robot. The project uses three Arduino microcontrollers. One for limb movement i.e) operating the actuator, the second one for vehicle movement and identifying obstacles and moving accordingly and the final one for the RFID for robot positioning.

B. INFRARED SENSOR

Sensor is a device which converts variations in the physical quantity into electrical parameter. IR sensor is a type of sensor which detects motion of an object and it emits and detects infrared radiation to study and sense about its surroundings. The active IR sensor[6] emits infrared radiation and detects them when they are reflected by the obstacles whereas, the passive IR sensor does not emit ant radiation but detects the infrared radiation emitted by the moving objects. Here an active sensor is used and this IR sensor consists of Light Emitting Diode (LED) which transmits infrared radiation into the transmission medium. The transmission medium can be air, vacuum, optical fiber. Here there are eight number of infrared sensors used. And the transmission medium is air. The IR rays which is emitted by the LED is absorbed by obstacle (if any) present in its path and the remaining rays are reflected back to another diode which is present in the sensor for receiving that reflected radiation and that receiving sensors are either photodiodes or phototransistors.

C. LINEAR ACTUATOR

An actuator is a device which converts electrical energy into mechanical movement. Linear actuator[4], as the name implies it produces motion in linear way. They are used in machine tools, assembly lines and as industrial equipment. The most commonly used actuator type is of Electro-mechanical type. In this project, electric type actuator is used in which the electrical energy is converted to mechanical torque. Actuators are not only used in electrical applications they have their applications in agriculture and medicine.

In Agriculture, soft actuators are used for fruit harvesting and in Medicine it is used for manipulating the internal organs. In comparison to other actuators soft actuators are designed to be a flexible one. The electric motor is also an actuator but it is so called motor because it produces rotational output. The actuator produces a linear output. On coming to the inner construction of the actuator it has a built-in screw which gets projected when the actuator gets activated. The actuator is connected to the system by mechanical support provided by the metal frames and structures. The length of this projection describes the length up to which the push and pull force exists. The push and pull force can be used for lifting purpose and only this concept is used in this project. In simple way, the linear motion of the actuator is turned into a weight lifting process.

V.MECHANICAL CONSTRUCTION

A.PLYWOOD BOX

Wooden box is made of plywood as they can withstand heavy weight. If it is made of steel the cost effectiveness which is the advantages of the wooden box will be in vain. Thus plywood which is cost effective and also effective in weight lifting is used. Plywood[5] is made up of thin layers of wood sheets which are sticked and compressed together to produce a strong wood which is known as plywood. The usage of plywood is of large extent that a type of wood called mahogany is used for designing aircraft bodies.

B.METAL FRAMES AND SUPPORT

The mechanical design is made using the metal frames which are made up of steel[9]. The whole system is provided only with the steel to provide the mechanical strength. The capability of the steel to withstand the weight is also a deciding factor in the amount of weight to be lifted.[2] The effort force to be experienced by the lever is calculated using the formula,effort force is given by,F=(F1*D1)/D. Here,F=lever effort force,F1=load force,D1=distance from load force to fulcrum,D=distance from effort force to fulcrum. Thus for a load force of 980N,distance from load force to fulcrum of 400mm,distance from effort force to fulcrum of 70mm,the calculated effort force will be 5600N. It indicates that the metal frames supports upto the effort force of 5600N

VI.HARDWARE IMPLEMENTATION

A. MODEL DIAGRAM

The CADD [10]model diagram shows the outlook of the proposed system as a three dimensional picture for clear understanding to capture the basic structure and working of the Self-Guided Conveyor Robot. The blue ball is the castor wheel which facilitates the 360’ rotation. The green limb indicates the actuator which is used for weight lifting and dropping. The orange and red limb are for the forward and backward movement of the limbs. The transparent body shows the conveyor body which is the actual complete setup. The general model diagram is shown below in the figure 7.1.

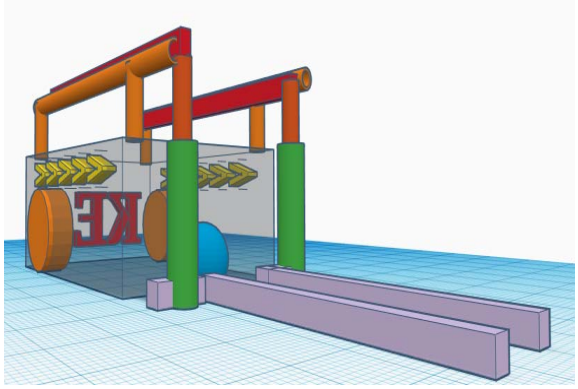

Figure 6.1 CADD model of hardware implementation

The following diagram shows the completed project:

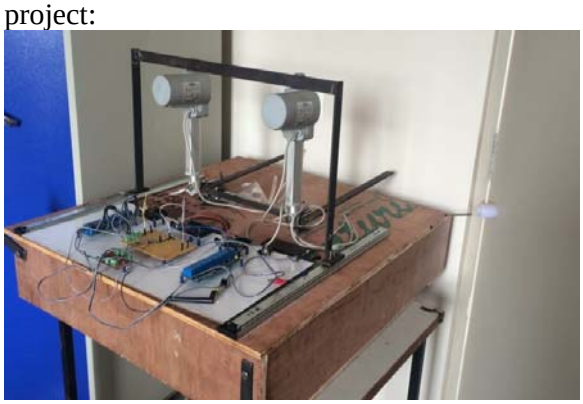

Figure 6.2 Hardware implementation

VII. RESULT AND CONCLUSION

The system is used to provide support to the industrial workers and is user friendly and non polluting. It if implemented can dramatically increase the amount of weight lifted thus increasing the efficiency. It can be used not only in the small industries if investment is made, higher efficient vehicles for heavy and bigger industries can also be designed. It will be an

effective alternative for costly weight lifting vehicles.

VIII. FUTURE SCOPE

This prototype model can be expanded in future in many ways to serve many purposes such as:

- Expanding the mechanism to industrial plant
- The whole arrangement can be made as easy reassembling in any other places.
- The cost of power supply unit can be reduced by using solar power and also it becomes more user friendly.

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