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ARDUINO ASSISTED AUTOMATIC TROLLEY

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ABSTRACT - This work is focusing on the development of a flexible and intelligent sensor- controlled trolley to support physical distribution of goods. Transporting goods is a common trend in laboratories, offices, supermarkets warehouses and industrial settings. In developing countries, handling and transporting of materials are usually done using manually operated trolleys. Such practice could be time consuming and laborious, thus this work will help to reduce the human effort. The driving of the trolley is controlled by the two dc gear motors, which are attached to the two wheels at front end and powered by 12V DC battery. The circuit board consist of Bluetooth Module, relay board and proximity sensor. Two caster wheels are used for free rotation of trolley which is mounted at rear side.

This work mainly aims to fabricate a smart trolley with simple technologies for carrying academic records or books from one block to other blocks in our institution. It is an automated trolley which is made with a mechatronics design and works by electronic assistance. The prime objective of this trolley is simplicity in design for its usability and durability. It is a simple load carrying device which is controlled with predefined instructions from the Arduino micro-controller.

Key Words: Automatic Trolley, Mechatronics

1.INTRODUCTION

As the world advances with new technologies, we engineering students have decided to fabricate an automated trolley for our institution. The prime objective of the work is to carry academic books and records from one block to another in our institution. Today, as material handling is important in every sector, the industries find it difficult to meet the financial burden in implementing the handling systems. Also, in every institute or office, it is necessary to appoint an employee to move goods and services from one point to another. When our institution was experiencing the same situation, we thought of solving it by developing an automated trolley that can move files or goods from one place to another without any human intervention.

Automatic trolley, the name itself says that it will reduce the human interference to carry a load from one place to another. So, it will increase the comfort of both employees and employers in a firm. An automatic trolley enhances the working speed by reducing the time of load carrying. The design is focused to reduce the self-weight and to carry the predefined payload. The structure and body of the trolley is made simple in manner with all standard dimensions.

The Arduino assisted automated trolley is a robotic load carrying machine that functions with the help of a programming system. One of the important design criteria was reducing the weight of the trolley economically. To achieve this, the body is constructed out of aluminum composite panels. The frames are constructed by using the MS L-angle section. The trolley has 2 drive wheels and 2 caster wheels. A rechargeable battery is used as a source of power and a DC gear motor is used to transmit the power from battery to wheels. Special purpose sensors known as proximity sensors are used to avoid collision with obstacles on the path. The maximum load carrying capacity is approximately 80 kg.

2.METHODOLOGY

- Idea collecting, sharing.
- Proper dimensioning of our drawing using auto cad and Creo software
- Designing of each part for manufacturing.
- Selection of materials for fabrication
- State the basic cost estimation of the work.
- Purchasing of suitable materials required such as electronic components, battery, Motors& sheet metal etc.
- Marking, cutting, bending, fitting, finishing and circuit connections are to be done.
- Strength analysis & analysis of motion characteristics, efficiency of motor, load bearing rate, capacity of battery
- Checking of sensitivity of sensors used. And motion of trolley is controlled by proper programming done on the micro controller.
- Submission of the project for inspection by officials.

3.SMART TROLLEY SYSTEM

This automated system on a trolley allows the transportation of goods and material through a defined path

by using programming on an Arduino microcontroller. In this work, we focus on a conventional trolley itself, which is altered based on an Arduino controlled system with some customizations. It inevitably will have a user-friendly design. Thus, we wish to integrate the automatic robotic system into the traditional trolleys to ensure the design which will meet the requirements of the end users.

This automatic trolley is considered as one of the most effective trolleys as it can travel easily and more flexibly compared to traditional trolleys. The Arduino assisted trolley is a smart system based on the simple programming language

FIG 1: - Arduino Assisted Automatic Trolley

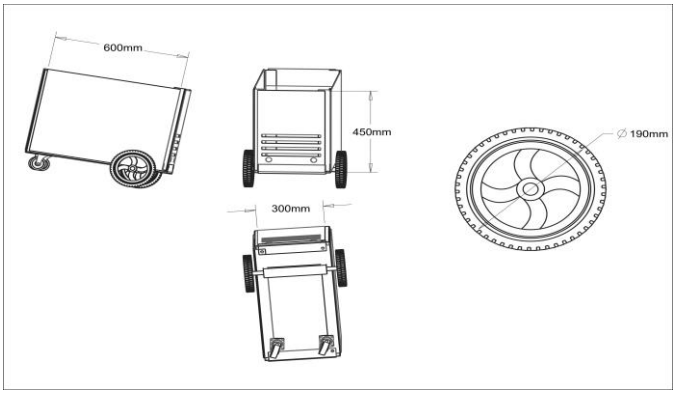

FIG 3.2: - 2D Dimension of Trolley

4.HARDWARE DESIGN

The Arduino assisted automatic trolley consists of following hardware components;

- ACP sheet is used for body works
- MS L-angle section is used for framework
- 2 Wheels of diameter 19 cm and 2 caster wheels of diameter 10 cm are used to help movement of trolley
- Battery 12V, 35Ah
- Arduino UNO R3 microcontroller unit
- Robotronics HC-05 6 pins wireless Bluetooth module
- DC gear motors (12 V, 12 N-m) are used to rotate the wheel on the smart trolley.
- Auslese obstacle avoidance proximity sensor E18-D80NK
- Super debug optocoupler 4 channel 5v relay board

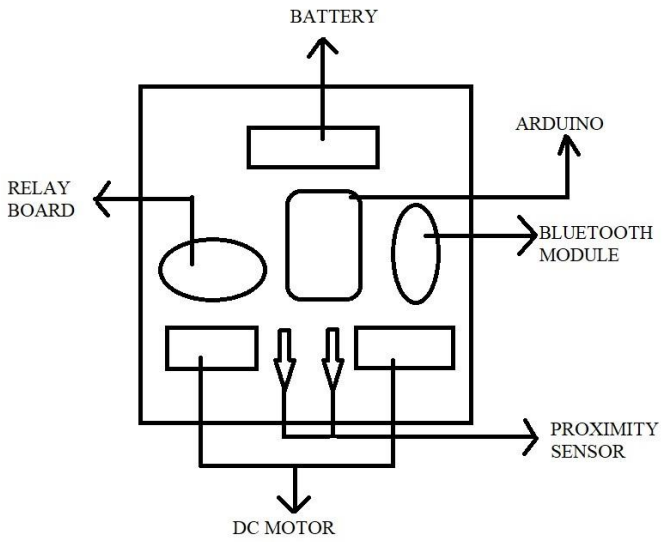

Fig 2: -Circuit Diagram of Smart Trolley

4. SOFTWARE DESIGN

The working of smart trolley is based on Arduino microcontroller. It can also be controlled with an android mobile phone as a secondary controlling method. This application is based on programming languages such as C and C++ on Arduino. The direction of movement of trolley is controlled by the programming language as instructions to the Arduino. Creo software is used to design the model of smart trolley. The main working of smart trolley is;

4.1. PROGRAMMED PATH: -

The trolley is moving in a defined direction based on the program by the Arduino controller. Each and every movement of the trolley is controlled by pre-defined instructions in the program. This trolley can be instructed in simple techniques with small words (move forward, turn left, turn right etc.…

4.2. OBSTACLE AVOIDING TROLLEY ON PATH: -

Proximity sensors are used to avoid the hitting of unexpected obstacles on the path of the trolley. The proximity sensors sense the obstacles on the path and it decides to stop the motion of the trolley. The movement of trolley will continue after the removal of the obstacles by us.

5.COMPONENTS OF TROLLEY

5.1 ARDUINO UNO R3:

Arduino is an open-source electronics platform based on easy-to-use hardware and software. It is boards are able to read inputs and convert into an output.

FIG 5.1: - Arduino

5.2 BLUETOOTH MODULE:

It can receive and transmits the data from a host system with the help of host controller interface.

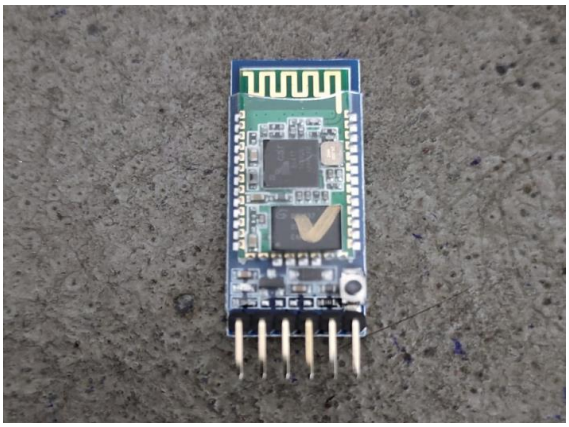

FIG 5.2: - Bluetooth Module

5.3 RELAY BOARD:

Relay boards are computer boards with an array of relays and switches. They have input and output terminals and are designed to control the voltage supply.

FIG 5.3: -Relay board

5.4. PROXIMITY SENSOR:

It is a non-contact sensor that detects the presence of an object when the object enters the sensor's field.

FIG 5.4: - Proximity sensor

5.5 DC gear motor:

A gear motor is an all-in-one combination of an electric motor and a gearbox. It has the ability to deliver high torque at low speeds.

FIG 5.5: - DC gear motor

6.CALCULATIONS

Maximum load carry by trolley = 80*9.81 =784.8 N =800N

(Max weight = 80 kg)

Assume coefficient of friction =0.3

Force required to pull the trolley = 800*0.3=240 N

Diameter of wheel = 0.19m, Radius = 0.19/2 =0.095m

Torque available at wheel =F * r = 240 * 0.095=22.8 N-m

1. **Motor Specification,**

T=23 N-m, P=240Watt, N= 100rpm

Angular velocity w=2piN/60

= 2*3.14*100/60

= 10.47 rad/sec

Linear velocity v = wr

= 10.47 * 0.095

= 0.99 m/s

2. **Battery Specification,**

Voltage = 12v

Capacity = 45Ah

6.RESULT

The objective of work is to develop an automatic trolley for transport the college academic files and other goods from one block to another. This trolley is user friendly and simple programming micro controlling system. So that it helps change the programmed paths in future. The body work is done with ACP sheet; it gives the good finishing appearance. The trolley is moved in the defined path that programming on Arduino.

Fig 6.1: -Miniature of smart trolley

7. CONCLUSION

The Adriano assisted automated trolley is a small trolley with simple controlling technique. It helps to reduce the human effort to carry loads. Its design and fabrication had done in a simple manner to reduce the human interference on the carrying loads. Its design mainly focuses on reducing weight, high durability, corrosion resistance, less power consumption and is also economically feasible. This smart trolley is a simple load carrying trolley developed from the conventional trolley with adding some design features and software assistance. The design of smart trolley mainly focuses on reducing the self-weight of the trolley and to carry predefined payload.

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