

Design & Fabrication of Remote-Controlled Robotic Trolley

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Abstract:- This mission is aimed at designing a Remote-Controlled Robotic Trolley, which could characteristic as transferring unit in isolated ward. The reason of this action is solely based on past two years We all have been affected due covid pandemic that modified the lives throughout the globe. In this pandemic health practitioner, nurses, fitness-care employees and medical group of workers and many others. Labored as front-liners. In covid isolation ward even with social distancing observed, food water and medicinal drug supply is energetic. These offerings are being provided through our medical staffs which at once placed them into danger because of their direct contact with covid advantageous patient. And we're keen to reduce this danger by way of permitting our faraway-managed trolley to roam in the ones wards and deliver these primary services. We targeted on designing and fabricating a movable trolley which can be controlled through Remote manipulate. This initiative was taken in the course of lockdown because of covid. To avoid contactless service. It can be used to hold medication, water, and meals and so forth. This faraway operation is programmed with the assist of Embedded C. An Arduino Mega is used for motion control and wheels used is Mecanum Wheels for motion in each viable direction. For actual time viewing, a camera is used. We can get admission to the actual view in front of trolley. For self-sanitization a sanitizer doling out unit is connected.

Key words: - Trolley, Arduino Mega, Self-Sanitization, Mecanum wheel, Self-Sanitization.

I. INTRODUCTION

The function of hospital trolley is distributed in various ways like stretcher and other medical equipment carrying trolley, some are pushed physically in general ward that carries food supplements and medicine . For past two years a new pandemic has hit us, making physical contact dangerous. Covid-19 is spreading due to increase in contact with one infected person to other non-infected one. It can pursue highest rate in hospitals because of more access to covid-positive patients. More threat is to our health care workers who has been working Non-stop for previous strenuous year.

Smart trolleys are being used in various fields with different methodologies and working principle aiming the objective. As for a RFID (Radio frequency identification) supermarket trolley. The program is loaded into the Arduino Uno, and it is interfaced with smart phone using Bluetooth module Inductive proximity sensor are interfaced with

Arduino. We based our design of trolley on this basis. The input is given through supply software and the trolley operates accordingly, the trolley completes the task and come back to the original function after carrying necessities.

Automated surgical trolley was also proposed. The proposed system is implemented for automatic medical surgical trolley movement using Arduino Uno R3.

In our project we have designed and fabricated the skeleton of project, material used for this is Iron rod. Due to its ductile nature, easy availability and cheap cost we have selected this material. As for shelves, stainless steel plates is used-which will be bolted to the skeleton of trolley. Mecanum wheels for motion is run with the help of Arduino Mega. The infrared sensors also act as crucial element, it is basically a device which emits the light in order to sense objects in surroundings. For real time viewing, Esp32 camera module kit will help to see view in front of trolley in our mobile devices.

II. LITERATURE REVIEW

Follow Me includes collection of technology which encompass computerized human guided travelling with use of an Arduino Mega, gadgets monitoring and billing with the help of a Bar code reader and an android based totally tablet with large User Interface (UI) strategies. Furthermore, Follow Me consists of computerized parking to its slot and automated charging whilst the trolley is parked in the slot. The research group has provided an accurate, person great smart purchasing trolley to make clients purchasing existence extra handy and less difficult.

RFID Tags and RFID Reader: The Smart Trolley may be utilized by the ones clients who are having the club card. In widespread, RFID Tag is attaching with club card. RFID Reader is connected to the trolley. Whenever a patron put RFID Tag close to RFID Reader, RFID Reader detects the RFID Tag and trolley act as Smart Trolley. All this method going to works the use of radio frequency. [1]

A smart trolley (ST) is a strength trolley (PT) to which computer systems, sensors (Proximity Inductive), and assistive technology (Arduino Controller, Bluetooth) are attached. The paper ambitions to offer and complete today's review of ST studies traits. they count on that the information collected on this examine will beautify attention of the popularity of ST technology. The proposed machine is designed to offer higher provider for the patients, children, and elderly humans. It includes a trolley supplied with DC Geared Motors which is managed via Android App

or Voice Command. The trolley is dispatched and received wherein its miles utilized by supplying the needy by remedy, meals, and different components. This makes the aged one or the needy partially independent, nonetheless there must be a person to location the supplies on the trolley. [2]

The maneuverability of the wheelchair will growth and then make the lifestyles of the customers simpler. The traits of this mecamum wheel have been chosen primarily based within the traits of the wheelchair. Therefore, the most velocity of the wheelchair changed into constant in 5 Km/h, and the burden capacity, a person of 80 kilograms. Based on that, the radius R of the mecamum wheel must be 114.61 millimeters. Four mecamum wheels and the frame have been connected with revolute joints and the driving torque was carried out to each revolute joint. [3]

The gift study goals to expand a conventional hand sanitizer device. Sensor-based computerized hand sanitizer dispenser is an automatic system which dispenses a managed amount of cleaning soap answer with out even touching to the knob, consequently decreasing the opportunity of spreading of infection and creates extra sterile sanitization. Dispensers will best distribute a set quantity of soap in line with motion activation. A programmed amount of sanitizer to be disbursed may be set to a fairly successful amount, wherein waste will be minimal. The average price of automated hand sanitizer to be had in the marketplace could be very excessive, and it's far tough to reach out to negative humans. Hence, our important goal is to develop contemporary approach of automated sanitization economically and ensuring the availability to the not unusual people. Hence, being in fitness-care profession, we've got formulated natural hand sanitizer and developed sensor-primarily based automatic hand sanitization technique [4]

smart trolley (ST) is a power trolley (PT) to which computer systems, sensors (Proximity Inductive), and assistive generation (Arduino Controller, Bluetooth) are attached. This paper targets to offer a whole ultra-modern overview of ST studies developments. We expect that the facts gathered on this look at will beautify recognition of the repute of ST generation. The proposed system is designed to offer higher carrier for the sufferers, kids and aged people. It includes a trolley provided with DC Geared Motors that's managed via Android App or Voice Command. The trolley

is sent and acquired in which it is utilized by imparting the needy by way of medicine, meals and different components. This makes the elderly one or the needy in part, nevertheless there should be someone in vicinity for the supplies. [5]

A. Objectives:

Trolley which will minimize the risk of spreading virus outside the Covid Isolation ward as it will provide services like food and medicines to covid positive patients. With completion of this trolley it will also reduce usage of PPE (personal protective equipment) kit in large number as every time staff has to enter, they would need to wear it in the ward to treat.

B. Scope Of Study:

This study is designed whilst Looking at ongoing situations, as there is fear of third wave to strike the country in couple months, for that and also to reduce the risk and workload on 'frontline workers' operating at mediocre and basic level Around 748 Doctors died in First wave of covid-19 which came as result of treating the infected patients and providing services to them. This projects acts as a baby step in saving these lives by keeping our frontline workers as safe as possible

III. METHODOLOGY

A smart trolley is in current use considering the industry however a smart -medical trolley aiming at delivery of essential supplements isn't invented as such, to fill this gap we're operating on our mission.

Automated surgical trolley became additionally proposed. The proposed machine is applied for computerized medical surgical trolley motion using Arduino Uno R3. The invention presents an automated clinical surgical trolley which comprises computerized steering, a wi-fi controller, an impediment avoiding detection device, a touch display controller via smart telephone, an IP digicam, a trolley, an incorporated electricity delivers and a processor. Medical equipment is loaded in the trolley, the wireless faraway drives the trolley to transport forwards and backwards.

Indian Army EME as part of anti-COVID measures has innovated a remotely operated car that may supply essentials to personnel from a hundred feet as a part of social distancing.

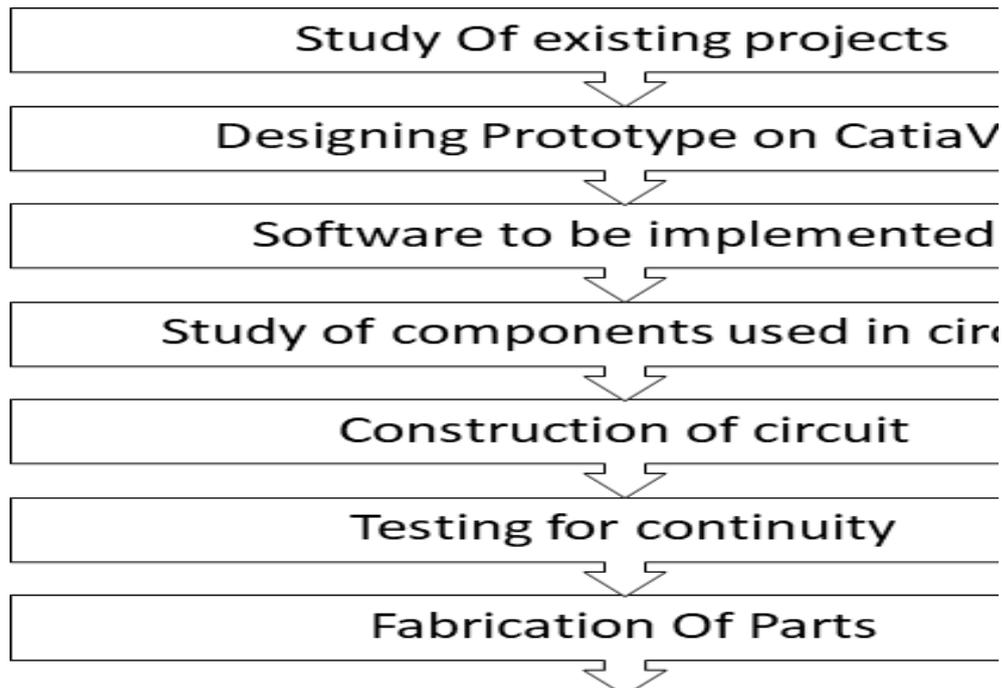


Fig.1: Methodology

A. *Design of machine:-*

As for design parameters

- Height of trolley based upon the height of general hospital beds. These have heights around 60-70 cm above ground.
- One can easily grab things from our trolley or in other words, the supplements are on one hand distance for easy access.
- For motion we are using Mecanum of size 127mm
- Maximum weight carried by wheel = 16kg
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- These wheels have ability of lateral movement, it can move sideways.
- Providing supplements between beds become easy due to these wheels.
- A battery presumably 12/24-volt lithium ion battery 3600 mAh –rechargeable to increase efficiency.
- -We are using proximity sensor /ultrasonic sensor to minimize the condition of collision.

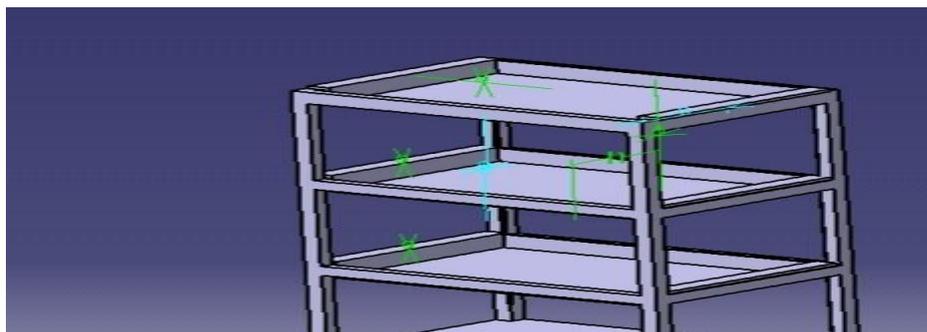
B. *Design on CATIAV5 :-*

Fig. 2: Design of body

- **Total Height = 110 cm**
- **Total length, l = 66 cm**
- **Total width, w = 46 cm**
- **Total dead weight = 12 kg**

- **PLATE:-**

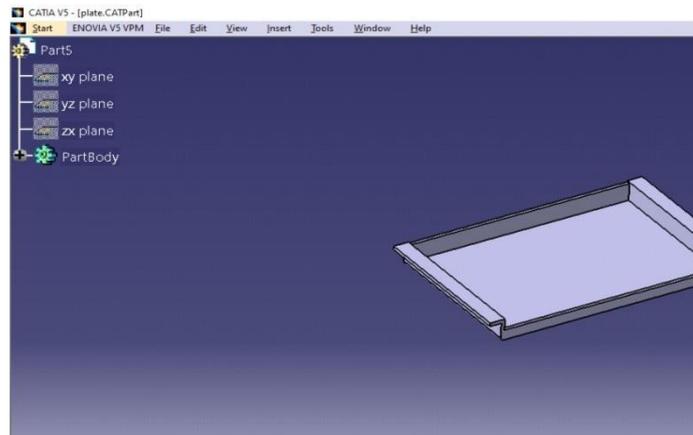


Fig. 3: Design of Plate

- **Length = 60**
- **Width = 40**
- **Thickness = 3 mm**

C. Stepper Motor

Stepper motors are DC motors that move in discrete steps. Having multiple coils, organized in groups called "phases". each phase energize in sequence, the motor will

rotate, one step at a time. By computer controlled stepping we will achieve very precise positioning and/or speed control.

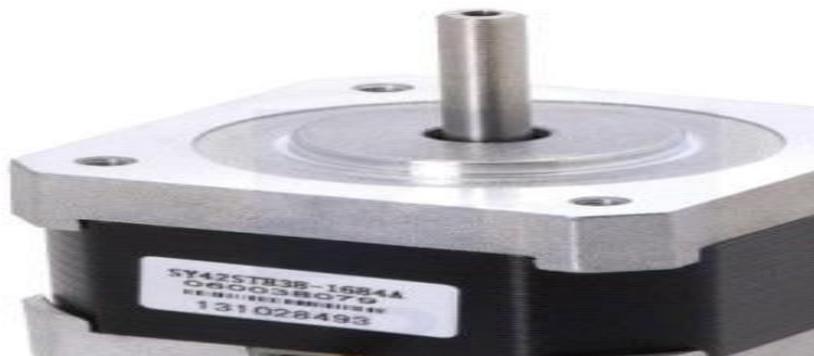


Fig. 4: Stepper motor

D. The Arduino Mega 2560-R3,

Is the successor to the Arduino Mega, it is a microcontroller board based on a ATmega2560 AVR microcontroller. It is having 70 digital input /output pins . 16

MHz resonator, USB connection, a power jack, and in-circuit system programming (ICSP) header, and a reset button.



Fig. 5: Arduino mega

E. Motor Driver (DRV8825)

The **DRV8825** is a Motor Driver with two H-bridge drivers and a micro-stepping indexer. The driver has a maximum output capacity of 45 V and ± 2.5 A. It can

operate on bipolar stepper motors in full, 1/2, 1/4, 1/8, 1/16 and 1/32-step modes. In Robotics, ATMs and Gaming Machines This driver module is generally used.

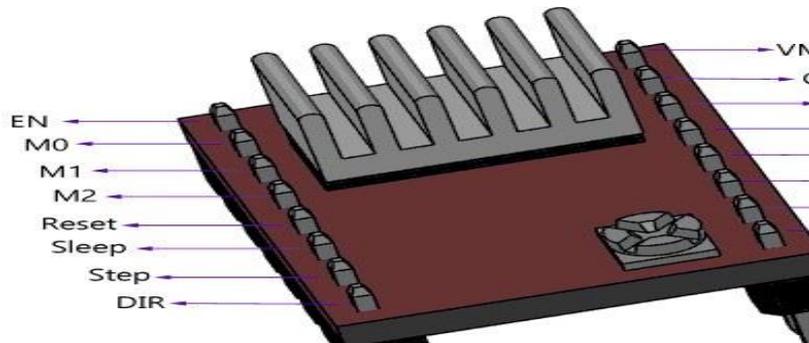


Fig. 6: Motor Driver

F. Transceiver Module(NRF24L01)

The NRF24L01 is a wireless Transceiver Module , each module can both send as well as receive data. They operate with frequency of 2.4GHz, falling under the ISM band and hence it is legal to use in almost all countries for engineering applications.

H. Mecanum Wheels

A Mecanum wheel has rollers attached to its circumference. These rollers are positioned in way diagonally or at 45-degree angle to the axis of rotation of the wheel. Making the wheel exert force in diagonal direction when moving forward or backward. Hence by rotating the wheels in certain pattern, we utilize these diagonal forces and thus the robot can move in any direction.

G. Ultrasonic Sensor (HC-SR04)

The HC-SR04 ultrasonic sensor uses sonar to determine the distance to an object.



Fig.7: Mecanum wheel

Li-Ion Battery(12V 5000mah Rechargeable)

I. Automatic-Sanitizer-Dispenser

24V Power supply, 24V DC Pump, Water supply, Mist Nozzle, Red LED, Indicator LED.

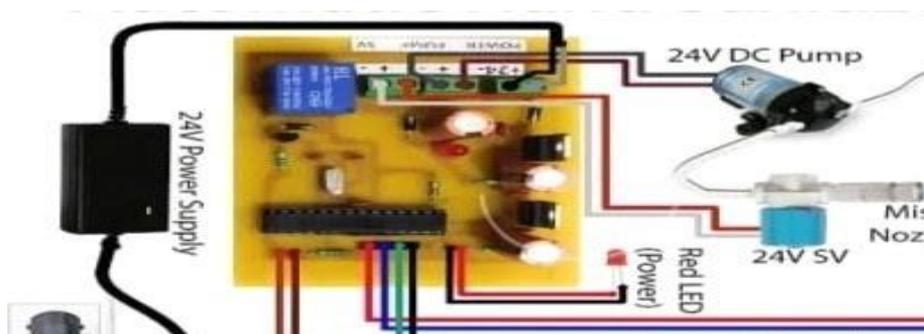


Fig. 8: Connection diagram for ASD.

J. Camera-module

ESP32 Cam Board with OV-2460 camera, FTDI Module, Jumper wires, USB Cables.



Fig. 9: Connection diagram for camera module

K. RC-Module

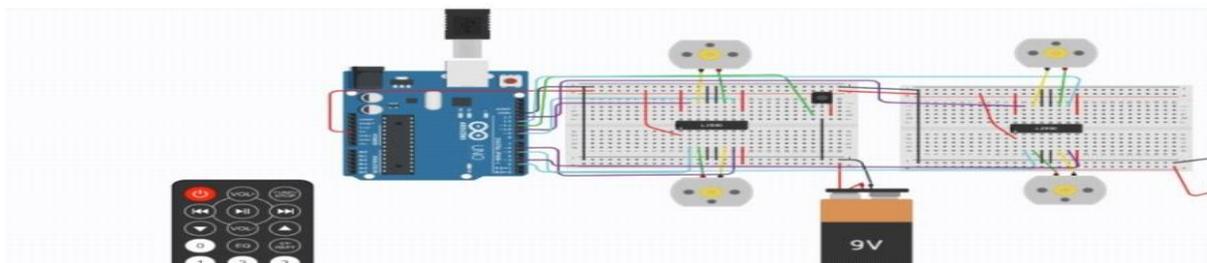


Fig. 10: Connection diagram for RC module

L. Wheels for motion- Mecanum Wheels:

Mecanum wheel is that they are made up of two major parts: Hub and the roller. The hub is the main body bracket of the consisting entire wheel, and the roller is a drum mounted on the hub. The hub axle of the omni- directional wheel is perpendicular to the roller shaft, the hub axle of the Mecanum wheel is at an angle of 45° to roller shaft. this angle can be of any value, different wheels can be made up according to the different angles.

M. Automatic Sanitizer Dispenser:

Automatic hand sanitizer where sanitizer liquid can come out automatically. the circuit includes an ultrasonic sensor SC-04. The sensor sense the proximity of hands under the machine. The machine will be designed for wall mount at a height of 4 feet such that anyone can reach to get sanitizer dispense. The sensor sends signal to the microcontroller and controller takes decision to actuate the pump and valve simultaneously so as to dispense the liquid sanitizer through a mist nozzle .

N. Calculations:-

- **Considering Live Mass, m = 18 kg**

Weight, w = 18

$$9.81 = \underline{166.77 \text{ N}}$$

Wheels used for motion is Mecanum Wheels

Diameter of wheels, d = 12.7 cm.

Radius, r= 6.35 cm

Coefficient Of friction, $\mu = 0.6$ -- for ideal

tiles Force, F= 0.6

$$166.77 = \underline{100.062 \text{ N}}$$

$$\text{Torque, } \tau = 100.062 \times 0.635 = 63.54 \text{ Nm}$$

Considering maximum speed 1.4 m/s .i.e. 5 km/h

$$\text{Speed, } V = \text{radius} \times \text{angular velocity}$$

$$1.4 = 0.635 \times 2 \times 3.14 \times N$$

$$N = 21.42 \text{ rpm}$$

Power developed by motor = Torque x $\frac{2\pi N}{60}$

$$= 63.54 \times \frac{2\pi \times 21.42}{60}$$

$$= 142.45 \text{ W or J/s}$$

For four motors connected = $4 \times 142.45 = 569.8 \text{ W}$

O. Working Of ESP32 Cam Module

The ESP32-CAM is a full-featured microcontroller that also has an incorporated video digicam and microSD card socket. The ESP32-CAM board has no USB port, so you can't simply connect it up to your computer and start loading programs. Instead, we need to upload an outside FTDI adapter.

P. Working of Hand Sanitizer dispenser

After turning on the ultrasonic sensor, the sensor begins searching at if there are any gadgets around its location. Whatever the case, the sensor will ship the data back to the Arduino board. In case there are not any gadgets within the location, the Arduino board will no longer give out any commands. As quickly as there is any object in the place of the ultrasonic sensor, it'll deliver the command to the Arduino. Furthermore, the ultrasonic sensor will ship data about how away that object is located. The point is to decide a threshold distance below which the Arduino will deliver the command to pump out the sanitizer. So, while the object in the vicinity of the ultrasonic sensor comes below the threshold, the Arduino board will give the command to pump out the sanitizer. This is finished by switching on the transistor transfer that is linked to the Arduino board.

IV. CONCLUSION

The layout and fabrication of this task will henceforth allow contactless transmission of supplements in Covid Isolation ward. This in addition helps our medical experts to provide offerings without risking their lives. The addition of Sanitizer dispenser will help in self sanitization, which in turn has become crucial of human lives in recent times. For actual time viewing, camera enables to show the images on our electronic devices.

This concludes a working version of Robotic Trolley.

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