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Multipurpose Robotic Trolley with Detachable Robotic Arm

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***Abstract* - Taking under the current situation of COVID-19, there is need of social distancing. So, the machine can be used to transport basic amenities to the patients with not physical contact. If used in defence it can be used to remotely scan the laying objects. With the arm detached it can be used to remotely transport the goods. The trolley is a radio controlled or an automated machine which can be used for multiple purposes. The four wheeled trolley can be easily access to place where human contact should be less. Due to the long transmission and receiving range it can be controlled from distance. With the help of the cameras, we can monitor every action it does. The trolley can be programmed as per the user requirement and can be fully automated or radio controlled as per requirement. This trolley will be a prototype model which will demonstrate all the functions. Humans can eventually perform two tasks simultaneously and can perform two different tasks at different places using the detachable body concept. If used in defence it can be used to remotely scan the laying objects. With the arm detached it can be used to remotely transport the goods.**

Keywords: Robot, trolley, arm, multi-purpose robot.

I. INTRODUCTION

Detachable Body using the arm and the trolley is a new concept. Humans can eventually perform two tasks simultaneously and can perform two different tasks at different places using the detachable body concept.

We often need to perform concurrent tasks at two separate locations as part of daily life.

For example, if a visitor arrives while we are cooking, we may want to continue cooking in the kitchen while opening the door for the visitor at the entrance. However, our body can only physically be in one place at any one time; it is also difficult for humans with only two arms to perform two or more concurrent tasks.

Therefore, we propose a new extended body concept called Detachable Body - it can be attached not only to the trolley but also in the environment and aims to perform "co-presence" tasks. Presence has multiple definitions, and copresence can be defined as a situation in which humans are face-to-face and co-located together or the "experience of being with others" regardless their location. However, in this review, we define the co-presence as a situation in which a user feels to be located at different locations simultaneously.

Thus, the co-presence task is defined as a kind of concurrent task which is performed by one human with "sense or state of being there" at two distant places simultaneously.

II. METHODOLOGY

While selecting the components we have to look after many criteria's like, the material, the weight of the component, the specifications of the component, and many more. The components chosen should be of desired specifications:-

The Motors of the trolley the NEMA 17 stepper motors are used for the movement of the trolley. The specifications of the motor are:

1. The weight of the motor is 350 g
2. Shaft diameter 5mm
3. Shaft length 22mm
4. Steps per revolution 200
5. Current rating 1.2 A per coil (has 6 coils)
6. Voltage rating 4 V
7. Resistance 3.3 Ω per coil
8. Holding torque 4Kg-cm

The motor with following specifications were considered and are required for the smooth and efficient operation of the trolley.

The transceiver module

The transceivers with following specifications were considered and are required for the smooth and efficient communication between the trolley and controller:

1. 2.4GHz RF transceiver Module

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2. Operating Voltage: 3.3V
3. Nominal current: 50mA
4. Range: Up to 1Km
5. Operating current: 250mA (maximum)
6. Communication Protocol: SPI • Baud Rate: 250 kbps - 2 Mbps.
7. Channel Range: 125
8. Maximum Pipelines/node: 6
9. Low-cost wireless solution

Rechargeable Li-ion Battery

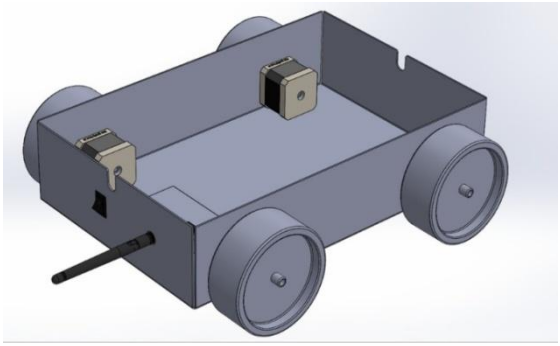
The battery with following specifications was considered and is required to supply the needed power.

1. Battery Type: Lithium-ion (Li-ion) Rechargeable
2. Voltage: 12 Volts; 4000 mAh Battery Capacity
3. Package Include 1 x 12V 4000 mAh Battery
4. Size: 82 x 63 x 15 mm (L x W x H)

Arduino Mega

Arduino Mega is selected as it has a greater number of analog pin and was easy to program.

1. It has 54 digital input/output pins
2. 16 analog inputs
3. 4 UARTs (hardware serial ports)
4. A 16 MHz crystal oscillator
5. A USB connection
6. A power jack



Component Selection for Arm

While selecting the components we have to look after many criteria's like, the material, the weight of the component, the specifications of the component, etc.

The components chosen should be of desired specifications: -

A. The Motors of the arm

1. The MG996r servo motors are used for the movement of the arm. The specifications of the motor are: -
2. The weight of the motor is 55 g
3. Rotation:0-180degrees
4. Current rating -2.5A
5. Voltage rating 6 V
6. Resistance 3.3 Ω per coil
7. Operating torque 2.5Kg-cm

The motor with following specifications were considered and are required for the smooth and efficient operation of the arm.

B. The transceiver module

The transceiver with following specifications were considered and are required for the smooth and efficient communication between the trolley and controller:

1. 2.4GHz RF transceiver Module
2. Operating Voltage: 3.3V
3. Nominal current: 50mA
4. Range: Up to 1Km
5. Operating current: 250mA (maximum)
6. Communication Protocol: SPI
7. Baud Rate: 250 kbps - 2 Mbps
8. Channel Range: 125
9. Maximum Pipelines/node: 6
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C. Arduino Mega

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2. 16 analog inputs
3. 4 UARTs (hardware serial ports)
4. A 16 MHz crystal oscillator
5. A USB connection
6. A power jack

D. Arduino Nano

1. Less power consumption(19mA)
2. Occupies less space (8.1 sq.cm)
3. Light weight(7g)
4. 14 digital I/O pins
5. 8 analog inputs

III. CONCLUSION

Trolley

1. Used stainless steel for the construction of the body so that it is durable and anti-corrosive
2. Weight of the trolley is around 7 kilograms as per the motor's carrying capacity
3. Dimensions of the upper platform were chosen in such a way that it easily slides in and during motion it stays affixed
4. Wheel diameter was chosen accordingly so as to distribute the weight evenly
5. Nema17 stepper motor is used to fulfill the weight constraints.

Arm

1. Material was 3d printed to make the arm light-weight
2. The 3d printed material was filled 60% so as to achieve durability and stay in cost constraints
3. Universal configuration i.e 4 dof was chosen
4. MG996r servo is used for movement of the arm
5. Used PLA for the construction of the body so that it is durable and anti-corrosive.

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