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Electronic System Design for an Automated Trolley

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ABSTRACT: The world has suddenly experienced a virus Outbreak that have infected millions of people and taken lives of lakhs of people.This sudden Pandemic has put a stress on the current Medical infrastructure of our Country and The World. In the current scenario of COVID-19, it is very important tomaintain social distancing to avoid contact with any corona virus infected person. The medical health workers have to work for hours a day so that the patients are taken care of 24x7. Also due to this highly contagious Virus it have been difficult for the Doctors and Staff to treat patients while taking care of the themselves. Since our country is facing shortage of medical staff with respect to our population, it becomes very neccesary to assist these Corona warriors in their task with advanced technology. Also to use PPE kit every time is not a feasible option and at the same time very costly solution. Thus we are proposing a system which aim to establish an interdisciplinary approach between medical science, Electronic and Mechanical Engineering.

KEYWORDS: Coding,COVID-19,Interfacing, Motor Selection, Simulation

I. INTRODUCTION

Automation is gaining importance on a large scale in the field of medical science. This field has a great scope as the stress on the medical infrastructure is increasing as the population is continuously increasing . By introducing the bluetooth controlled automated trolly into Hospitals , the efficiency of treatment will be increased. since a number of different jobs could be done by a single trolly , a lot of workforce could be saved. The overall cost of the hospital could also be saved since the battery operated trolly could work for hours and the human work hours could be reduced and there is no need toemploy more worforce for double shift.This development is very promising in future since it is battery operated , therefore it will help in reducingcarbon footprint.

To design and develop automated trolley to serve COVID-19 patients, in order to avoid the contact between the health-workers and patients and establish an effective communication between the doctors and patients.

To Avoid Contact Between Doctors and Patients and to establish safe and better Audio-Visual interaction between them .To reduce the number of daily requirement of PPE kits leading to reduction of disposal problem.

II. LITERATURE

An Android Based Mobile Robot for Monitoring and Surveillance [1] The android based mobile robot is a cost-effective solution for many surveillance applications. The mobile robot will accomplish tasks such as navigating the environment safely for monitoring and surveillance purposes that may be strenuous for humans in some special cases. Experimental results with varied positions of obstacle show the flexibility of the robot to avoid it and have shown a decent performance and it is getting a communication range of nearly 50m, which is good enough for many surveillance applications. This project developed is an android based mobile robot forsurveillance.

Non-contact infrared temperature acquisition system based on IOT [2] This paper had presented an IoT solution temperature real-time supervision named iRT. This solution offers a feasibility method to monitor ambient and object supervision in real-time.With the proliferation of IoT and mobile computing technologies, there is a significant perspective to design automatic monitoring systems for enhanced living environments and occupational health but also to provide correct laboratorial conditions evaluation.

Printable, Highly Sensitive FlexibleTemperature Sensors for Human Body Temperature Monitoring [3] This research paper, reviews the recent research progress of high sensitivity fexible temperature sensors in human body temperature monitoring, heat-sensitive materials. As a relatively stabledynamic variable in the human body, body temperature or local temperature may have different degrees of small fuctuations (about0.5 ℃) under the influence of emotions or physiological activities.

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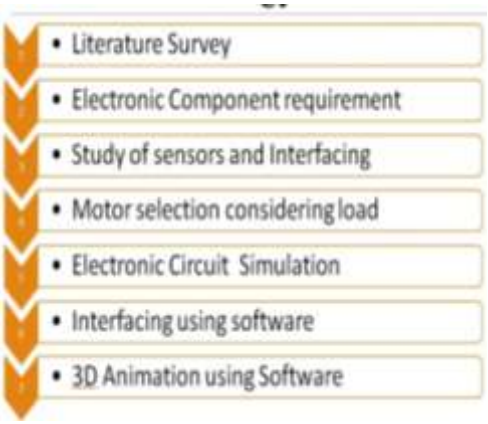
Based oIntelligent Tracking Obstacle Avoidance Wheel Robot n Arduino [4] With the development of Internet technology, the development of wheeled robotshas gradually matured. It is a kind of concentration that senses the surrounding environment, automatic planning and operationdecisions, intelligent driving and soon.Inthis paper,an intelligent wheel type robot capable of realizing automatic tracking function is designed according to the requirements. This article uses Arduino technology to control mobile robots in specific environments.The main purpose of the intelligent wheeled robot is to reach the target point from a starting point and avoid obstacles. In general, the wheeled robot designed this time is considering intelligent tracking, obstacle avoidance, and improving safety.

III. METHODOLOGY



HARDWARE SPECIFICATION:

- Battery12V 12Ah : Long service life, Maintenance free operation , Rechargeable Battery, Continuous 12 hrs working
- Motor : Johnson DC gear motor, High power density and compact packaging, Massive torque, affordable price
- Arduino ATmega1280:Less power consumption with fast startup, Easier to use with less complex structure
- Bluetooth module HC05 :Low cost and power consumption,Better range than infrared communication.
- Ultrasonic Distance sensor HC-SR04 : High frequency and sensitivity ,Greater accuracy than other methods,Maximum range is 4 m.
-Infrared temperature sensor MLX 90614: Compact ,lightweight , easy to use, Non-contact type.
- LCD : Dimensions: 20*4, Uses Samsung KS0066 LCD controller
- PCB Relay: High switching power of 10A,Pre-soldered terminals
-Relay Driver : High voltage, high currentUsed for driving relay DC motor

SOFTWARE DESIGN

1.Arduino :- We have installed arduino new version in Windows 10. Windows operating system is open source operating system. Coding for the simulation is done using Arduino. Arduino is easy and free to use.

2. Proteus Software:-Circuit Simulation is done using the Proteus Software.Codes were prepared and uploaded in the software and Simulation was done.

3.MAYA Software:- MAYA software has been used for the animation of the Trolley.

SOURCE CODE FOR THE MICROPROCESSOR (ARDUINO) :

```
#include<LiquidCrystal.h>
#include <Wire.h>
#include <Adafruit_MLX90614.h>
#define echoPin 2 // attach pin D2 Arduino to pin Echo of HC-SR04
#define trigPin 3 //attach pin D3 Arduino to pin Trig of HC-SR04
#define BACKLIGHT_PIN 3 // Declaring LCD Pins
#define En_pin 2
#define Rw_pin 1
#define Rs_pin 0
#define D4_pin 4
#define D5_pin 5
#define D6_pin 6
#define D7_pin 7

lcd(En_pin,Rw_pin,Rs_pin,D4_pin,D5_pin,D6_pin,
D7_pin);
Adafruit_MLX90614 mlx = Adafruit_MLX90614();
Intval;
intdist;

LiquidCrystallcd (4,5,6,7,8,9);
long duration;
int distance;

 void setup()
{  pinMode (16, INPUT);
pinMode (17, OUTPUT);
pinMode (22, OUTPUT);
pinMode (23, OUTPUT);
pinMode (24, OUTPUT);
pinMode (25, OUTPUT);
Serial.begin(9600);
Lcd.begin(20,4);
        lcd.print("PIMPRI CHINCHWAD
COLLEGE OF ENGINEERING");
        lcd.setCursor (0,1);
        lcd.print("DEPT OF MECHANICAL
ENGG.");
```

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```
        lcd.setCursor(0,2);
        lcd.print("COVID 19 ROBOT");
        lcd.setCursor(0,3);
        lcd.print("2020-2021");
        delay(2000);
        lcd.clear();
pinMode(trigPin, OUTPUT); // Sets the trigPin as an OUTPUT
pinMode(echoPin, INPUT); // Sets the echoPin as an INPUT
Serial.begin(9600); // // Serial Communication is starting with 9600 of baudrate speed
Serial.println("Ultrasonic Sensor HC-SR04 Test"); // print some text in Serial Monitor
.println("with Arduino UNO R3");
mlx.begin();
        lcd.begin (16,2);
        lcd.setBacklightPin(BACKLIGHT_PIN,POSITIVE);
        lcd.setBacklight(HIGH);          //Lighting backlight
        lcd.home ();
}
 void forward()
{
        Lcd.setCursor(0,1);
        lcd.print("FORWARD");

        digitalWrite(22,HIGH);
        digitalWrite(23,HIGH);
        digitalWrite(24,LOW);
        digitalWrite(25,LOW);4

}
 void reverse()
{
        Lcd.setCursor(0,1);
        lcd.print("REVERSE");
        digitalWrite(22,LOW);
        digitalWrite(23,LOW);
        digitalWrite(24,HIGH);
        digitalWrite(25,HIGH);
}
 void right()
{
        lcd.setCursor(0,1);
        lcd.print("RIGHT");
        digitalWrite(22,LOW);
        digitalWrite(23,LOW);
        digitalWrite(24,LOW);
        digitalWrite(25,LOW);
}

void left()
{
        lcd.setCursor(0,1);
        lcd.print("LEFT");
        digitalWrite(22,HIGH);
        digitalWrite(23,HIGH);
        digitalWrite(24,HIGH);
        digitalWrite(25,HIGH);
}

 void stop()
{
        lcd.setCursor(0,1);
        lcd.print("STOP");
        digitalWrite(22,HIGH);
        digitalWrite(23,LOW);
        digitalWrite(24,HIGH);
        digitalWrite(25,LOW);
}
 void loop ()
{
        While   (Serial.available( )>0)
         {
        val=Serial.read( ) ;
           if (val==49)
        forward( );
           else if (val==50)
        reverse( );
else if (val==51)
        left( );
           else if(val==52)
        right( );
           else if(val==53)
        stop( );
        }
digitalWrite(trigPin, LOW);
delayMicroseconds(2);
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);
duration = pulseIn(echoPin, HIGH);
distance = duration * 0.034 / 2;
Serial.print("Distance: ");
Serial.print(distance);
Serial.println(" cm");
lcd.setCursor(0,0);
lcd.print("Ambient ");
lcd.print(mlx.readAmbientTempC());
lcd.print(" C");

lcd.setCursor(0,1);
lcd.print("Target  ");
lcd.print(mlx.readObjectTempC());
lcd.print(" C");
delay(1000);
          }
 }
```

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IV. PROPOSED SYSTEM

Proposed system is implemented on Arduino ATMega 1280

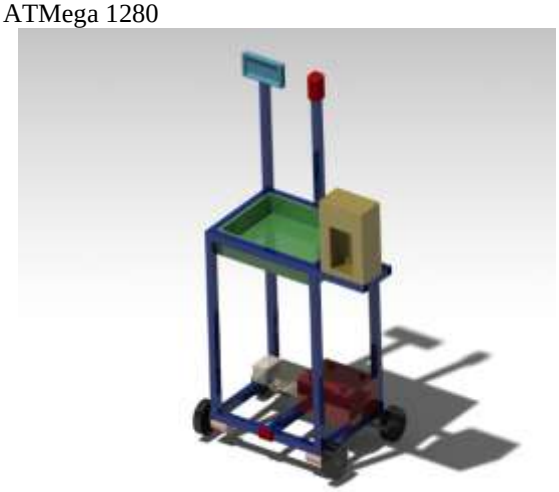

Fig 1. Proposed System

Above is the CAD model of the trolley. Going through the basic working of the trolley, it is a Bluetooth operated automated trolley having a range of 10m -20 m. It has two sensors mounted on it, one is the temperature sensor and other is the accident avoidance ultra sonic sensors. The trolley is also mounted with the sanitization system and mobile for video call. Briefing about the working, once the trolley is connected to the Bluetooth module the video calling starts. The trolley will be operated by the ward boy and doctor will sit in the cabin through video calling the doctor and patient will be in contact. Ward boy can handle the trolley from a distance of 10 m to 20m. So both doctor and patient will be at safe distanceheat energy into mechanical energy.

V. MOTOR AND BATTERY SELECTION

Number of motors- 4
Weight on 1 motor- 3.6 kg
Coefficient of friction - 0.4
Speed - 0.15 m/s
$F = 9.81*3.6*0.4 = 14.22$ N
$R = 0.05$ m
$T = RF = 0.05*14 = 0.7$ N-m
$v=(\pi dN)/60$
Hence,
$N=(v\times60)/(\pi d)=(0.15\times60)/(\pi\times0.05)=29$rpm
$P=(2\pi NT)/60$
$P = (2\pi \times29\times0.7)/60 = 21.26$W
-Specifications of motor selected is Johnson DC geared motor having voltage V=12V and Current I=2 Also power output P=24 W
-Battery Selected is 12 V 12Ah with Power =144 W

VI. RESULT

-We have also done the motor calculations.
-The model of our project has also been prepared by CATIA software.
-simulation and interfacing is done using the Proteous Software.
- The 3D representation of our model working on field, is done by usingAutodesk Maya Software ,as follows-

Fig 2. Maya Software Animation

Fig 3. Electronic Circuit Simulation

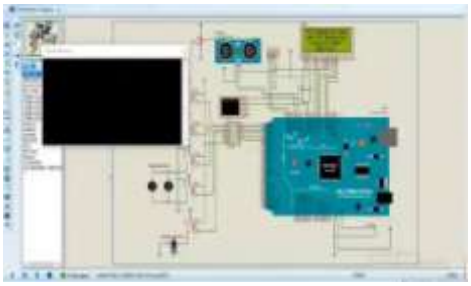

Fig 3. Interfacing Diagram

VII. CONCLUSION

Therefore by considering recent medical science development trend and studying various research papers ,we have decided to make an Automated trolley to serve COVID 19 patients in hospitals. Thus our below objectives are fulfilled by this:

1 .Cost reduction
2.Social distancing between healthcare workers and patients.
3. Reduced number of attendants.

4. Reducing medical waste by reducing number of PPE kits requirements.
5. Containing transmissibility of the virus are achieved.

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