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Development of Smart Robotic System by Using Automatic Sensors for Healthcare Application

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ABSTRACT
As a result of the difficulties brought by COVID-19 and its associated lockdowns, many individuals and companies have turned to robots in order to overcome the challenges of the pandemic. Compared with traditional human labor, robotic and autonomous systems have advantages such as an intrinsic immunity to the virus and an inability for human-robot-humanspreadofanydisease-causingpathogens,though there are still many technical hurdles for the robotics industry to overcome. This survey comprehensivelyreviewscovering robotic systems which have emerged or have been repurposed duringthe past several months, to provide insightsto both academia and industry. Ineachchapter, we cover both the advantages and the challenges for each robot, finding thatrobotics systems are overall apt solutions for dealing with many of the problems broughton by COVID-19, including: diagnosis, screening, disinfection, surgery, care, logistics,manufacturingandbroaderinterpersonalproblemsuniquetothelockdown so thepandemic. By discussing the potential new robot capabilities and fields they applied to,weexpecttheroboticsindustrytotakealeapforwarddue tothisunexpectedpandemic.The Line follower robot is a mobile machine that can detect and follow the linedrawn on the floor. Generally, the path is predefined and can be either visible like a black line
Keyword : sensors,Aurduino

I. INTRODUCTION

Automation is a need of time. Automation makes task easier and reliable. The advancement in the technology has brought a revolutionary change in the field of robotics especially in automation sector. Robot is a reprogrammable, multifunctional gadget which is basically intended to work like human being, for example, pick and place an object, stacking and emptying, observation, social insurance, and widely used in modern and aviation application. Robots can perform in hazardous environment and possesses precise work to build the profitability as it can work 24 hours without rest.

The Internet of Things (IoT) and robotics communities have so far been driven by different yet highly complementary objectives, the first focused on supporting information services for pervasive sensing, tracking and monitoring; the latter on producing action, interaction and autonomous behavior. Development of new laboratory prototypes of intelligent service robots, intended for applications in indoor environment, was designated as one of the main project objectives . For this reason, it is increasingly claimed that the creation of an internet of robotic things (IoT) combining the results from the two communities will bring a strong added value. The main objective of this project is to fabricate a robotic trolley for material handling in industries .The trolley controlled by a microcontroller module unit. It can stop, turn right, turn left, forward and backward. It can follow wherever they go, during they were in range.The designed robot can be easily controlled by sending the commands to the micro controller from anywhere from the world. These commands can be observed by using Attention commands and acceptable action is taken.

In this project, we will mainly focus on the issues of patients as well as safety and security,

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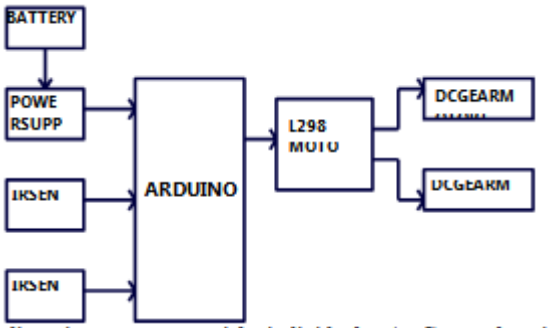
specifically the effect of medical device regulation and data protection laws on robots in healthcare. To overcome the issues like direct contact with patients in Covid-19 wards, we will develop a robot i.e., corona warrior robot which will be used to provide medicines to patients and sanitize the person when any person comes in front of the robot. IP camera placed on the robot will help to monitor the movement of robot and we can also visually inspect the robot using Android application. Artificial intelligence technique is used in this system. Proximity sensor is used to sensor the obstacle and stop robot automatically.

Wireless tracking of human body parameters has attracted significant interest in recent years due to its wide-ranging applications. Elderly care facilities are especially at risk to heavy breakouts because of relatively enclosed spaces with intrinsically vulnerable population. Without a robot, healthy residents in these facilities face much higher risks of getting infected by others, e.g., an asymptomatic nurse, and then spreading it to more at-risk individuals A Comprehensive Survey working remotely for employees. E.g. Home.



What is line following robot?

The Line follower robot is a mobile machine that can detect and follow the line drawn on the floor. Generally, the path is predefined and can be either visible like a blackline on a white surface with a high contrasted color or it can be invisible like a magneticfield.Therefore,thiskindofRobotshouldsense thelinewithitsInfraredRay(IR)sensorsthatinstalledund ertherobot.Afterthat,thedataistransmittedtotheprocess orby specific transition buses. Hence, the processor is going to decide the proper command send then it sends them to the driver and thus the path will be followed by the linefollowerrobot.

Where is the line following robot?

robotics systems are overall solutions for dealing with many of the problems brought on by COVID-19, including: diagnosis, screening, disinfection, surgery, care, logistics,manufacturingandbroaderinterpersonalprobl emsuniquetothelockdownsofthepandemic. By discussing the potential new robot capabilities and fields they applied to,weexpecttheroboticsindustrytotakealeapforwarddu etothisunexpectedpandemic. The use of line following robot is transport the materials from one form to another place .this robot completely depends on the track. Used for shopping malls ,homes, .

II. METHODOLOGY

As shown in the figure above, Arduino microcontroller is used for the project. It willwork at operation voltage of 5V DC which will be provided by battery using powersupply. For movement of the robot or chassis, DC gear motors are used connecting themthrough the wheels of the robot. Motor driver IC L298 module is used for the connectionof both motors using single module. Robot works on Line following manner using Blackline which will be drawn on the floor as per requirement. For this, we are using 2 IRsensorsfor pathfollowing and turning ofthewheels accordingly.

The second part is sanitization. Proximity sensor is used for detection of presence ofhumanbeingor obstacle in frontoftherobotandusingrelaycircuit,sanitizermotor willON automatically. Thus, reducing spread of the virus by any touch or contact with therobot.

III. DESIGN DETAIL

CAD Model :

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Fig.1 front viewFig.2 side view

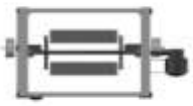

Fig 3.Top view

Design consists of application of scientific principle, technical information, and imagination for development of new mechanism to perform specific function with maximum economy and efficiency. Hence careful design approach has to be adopted. The total design work has been split into three parts.

1. System Design
2. Mechanical Design
3. Circuit/ Electronic Design

3.1 System Design:

System design is mainly concerns the various physical constraints and ergonomics, space requirement, arrangement of various components on frame at system, man-machine interaction, no. of controls, working environments, of maintenance, scope of improvement, weight if machine from ground level, total weight of machine and a lot more. In system design we mainly concentrated on the following parameter:-

System selection based on constraints:

Our machine is used in small-scale so space is major constrain. The system is to be very compact so that it can be adjusted in small space.

Arrangement of various components:

Keeping into view the space restrictions all components should be laid such that their easy removal on servicing is possible. Every possible space is utilized in component arrangements.

Man machine interaction:

Friendliness of machine with the operated that is operating is an important criterion of design.

Chances of failure:

Losses incurred by owner in case of any failure are impotent criterion of design. Factor of safety while doing design should be kept high so that there are less chances of failure. Moreover periodic maintenance is required to keep unit healthy.

Servicing facility:

Layout of Components should be such that easy servicing is possible. Those which require frequent servicing can be easily disassembled.

Scope of future improvement:

Arrangement should be provided in such way that if any changes have to be done for future scope improvement efficiency of machine.

Height of machine elements from ground:

All the elements of the machine should be arranged to the height from where it is simple to operate by operator. Machine should be slightly higher than waist level, also enough clearance should be provided from the ground for cleaning purpose.

Weight of machine:

Total weight depend on the selection of material of all components as well as their dimensions. Higher weight will result in difficulty in transportation; it is difficult to take it to workshop because of more weight.

3.2 Mechanical design:

In mechanical design the components are listed down and stored on the basis of their procurement, design inn two categories namely:

1. Designed parts
2. Parts to be purchased

Mechanical design phase is very important from the view of designer as whole access of project depends onthe correct design analysis of the problem.

Many preliminary alternatives are eliminated during this phase. Designer should have adequate knowledge about physical properties of material, load stresses and failure. He should identify all internal and external forces acting on machine parts.

These forces may be classified as:

a) Dead weight forces
b) Friction forces
c) Inertia forces
d) Centrifugal forces
e) Forces generated during power transmission etc.

Designer should estimate these forces very accurately by using design equations. If he does not have sufficient information to estimate them he should make certain practical assumptions based on similar conditions which will almost satisfy the functional needs. Assumptions must always be on the safer side. Selection factor of safety to find working or design stress is another important step in design of

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working dimensions of machine elements. The correction in the theoretical stress values are to be made according in the kind of loads, shape of parts & service requirements. Selection of material should be made according to the condition of loading shapes of products environment conditions & desirable properties of material provision should be made to minimize nearly adopting proper lubrication method.

3.2.1. Design of Shaft :

Fig 3.3: Shaft

A shaft is a rotating element which is used to transmit power from one place to another. The power is delivered to the shaft by some tangential force and the resultant torque set up within the shaft permits the power to be transferred to various machines linked up to shaft. In order to transfer the power from one shaft to other, the various members such as pulleys, gears, etc. are mounted on it. These members along with the forces exerted upon them causes the shaft bending.

The shaft usually cylindrical, but may be square or cross shaped in section. They are solid in cross section but sometimes hollow shafts are also used.

Material used for shaft:

1) It should have high strength.
2) It should have good machinability.
3) It should have good heat treatment properties.
4) It should have high wear resistance properties.

Design of shaft

The material used for ordinary shafts is carbon steel of grades 40C8, 45C8, 50C4 & 50C12. Also M.S. & En8 can be used.

Stresses in shafts

1) Shear stress due to transmission of torque.(i.e. due to torsional load.)
2) Bending stresses (tensile or compressive) due to the forces acting on the machine elements like gears, pulleys etc. as well as due to the self-weight of the shaft

The shafts are designed on the following basis of Strength & Rigidity:

The following cases may be considered:

a) Shaft subjected to twisting moment or torque only.
b) Shaft subjected to bending moment only.
c) Shaft subjected to combined bending twisting moment.
d) Shaft subjected to axial loads in addition to combined torsional & bending.

- **Material Selection :-**

Designation	Ultimate Tensile Strength (N/ mm2)	Yield Strength (N/mm2)
15C8	505	215

Table No. 3.1: Material Of Shaft

- **ASME code for design of Shaft :-**

Since the loads on most shafts in connected machinery are not constant, it is necessary to make proper allowance for harmful effects of loads fluctuation.

According to ASME code permissible values of share stress may be calculated from various relation.

$\sigma_{s(allowable)}=0.18\sigma_{(ut)}$
$= 0.18 \times 505$
$= 90.9$ N/mm2
OR
$\sigma_{s(actual)} = 0.3\ \sigma_{s(yt)}$
$= 0.3 \times 215$
$=64.5$ N/mm2
Considering minimum of the above values,
$\sigma_{s(allowable)} = 64.5$ N/mm2
This is allowable value of shear stress that can be induced in shaft material for safe operation
To calculate Input Torque :-
Selecting the motor of 90 watts,
POWER =

$T= 60 \times (P/2\pi n)$
$=60 \times 90/(2\times\pi \times 30)$
$=28.65$ N-m

Assuming 100% overload,
$T_{(design)} = 2 \times T$
$= 2 \times 28.65 \times 10^3$
$= 57.29 \times 10^3$ N- mm
Check for Torsional shear failure of shaft
Assuming minimum section diameter of input shaft =20mm
d=20mm
$Td = \times f_{s(actual)} \times d^3$
$\sigma_{s(actual)}=16T_d/\pi d^3$
$= 16T_d /[\ \pi d^3 (1-k^4)]$
$= (16 \times 57.29 \times 10^3) /[\pi (20)^3\times (1-0.622^4)]$

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$\sigma_{s(actual)}$= 42.89 N/ mm2
as $\sigma_{s(actual)}$ is less than $\sigma_{s(all)}$
Thus, Input Shaft is safe under torsional load.

3.2.2 Bearing selection:

Fig.3.4: Deep Groove Ball Bearing

We have selected bearing of 20 mmm bore diameter as we selected the
shaft of 20mm so we used bearing of 20mm inner diameter.

The bearing no. 6204 we used deep groove ball bearing.

Specification-

1. Bearing Number- SKF 6204 2Z
2. Bore diameter- 20mm
3. Outside diameter- 47mm
4. Width- 14mm
5. Basic dynamic load rating(C)- 13.5kN
6. Basic static load rating(C_0)- 6.55kN
7. Fatigue load limit(P_u)- 28.5kN
8. Limiting speed- 17000 rpm
9. Minimum load factor (k_r)-0.025
10. Weight- 0.11kg

3.2.3. Selection of Motor :-

Motor Selection,

Suppose 4kg of Medicine and food to be lifted,

Force required = 4 * 9.81
= 39.24 N Torque Required = Froce * Radius
= 39.24 * 0.075
T = 2.943 Nm
Power = (Consider Motor of 30 rpm)
P= 2*Pi*n*T/60
P = 9.11 Watt

Hence, we used motor of 30 RPM and 10 Watt.
We used motor of 12V.
So we are Using battery of 80 Watts, Efficiency 75%.

3.2.4. Selection of Drive :-

Fig.3.6: Sprocket

Roller chain or bush roller chain is a type of chain drive most commonly
used for transmission of mechanical power on many kinds of domestic, industrial and agricultural machinery, etc.

1. Pitch angle, $\alpha = 360/z$
= 360/44
= 8.182

2. Pitch circle diameter of sprocket, $D = P/(\sin(180/z))$
=12.84/(sin(180/44)
= 180 mm

3. Velocity Ratio: i=z2/z1
= 44/44
=1

4. Averge velocity of chain: $v=\pi Dn/60000$
$= \pi$* 180*25/60000
= 0.23561 mm/sec

5. Length of chain: L= 2*[(π*r)+(450)+(π*r)]
= 2*[(π*90)+(450)+(π*90)]
= 2*1016
= 2032 mm

6. kW rating of chain= $\frac{\text{kW to be transmitted} * Ks}{k1+k2}$.....(Reference- Machine DesigData Book, By V.B. Bhandari, Table No.14.10, Table No. 14.11, Table No. 14.12)
$= \frac{9.11*1.0}{1.0*1.95}$
= 4.67kW

7. Power rating of simple roller chain= 10A.....(Reference- Machine design Data Book,By V.B. Bhandari, Table No. 14.9 Page No. 14.7)

Selection of Sprocket wheels-

1. Chain pitch: p= 12.84 mm
2. Pitch Circle Diameter: D= 180mm

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3. Roller Diameter: d_1= 8mm
4. Width between inner threads: b_1= 7mm
5. Transverse Pitch: p_t= 17 mm
6. Top diameter: D_a=

$(D_a)_{max}$= D+1.25p-d_1
= 180+1.25*12.84-8
= 188.08 mm

$(D_a)_{min}$= $D + p\left(1 - \frac{1.6}{z}\right)$-$d_1$
= 180+12.84(1-0.036)-8
= 184 mm

7. Roller Seating radius: r_i=

$(r_i)_{max}$= $(0.505+0.069\sqrt[3]{d1})$
= $(0.505*8+0.069\sqrt[3]{8})$
= 4.178 mm

$(r_i)_{min}$= $0.505d_1$
= 0.505*8
= 4.04 mm

8. Root Diameter: D_f= D - 2ri
= 180-2*4.178
= 171.644 mm

9. Tooth flank radius: r_e=

$(r_e)_{max}$ = $0.008d_1$ (z^2 +180)
= 0.008*8(44^2 +180)
= 135.424 mm

10. Roller seating Angle: α=

$\alpha_{min} = [120 - \frac{90}{z}]$
$= [120 - \frac{90}{44}]$
$= 117.95^o$

$\alpha_{max} = [140 - \frac{90}{z}]$
$= [140 - \frac{90}{44}]$
$= 137.95^o$

11. Tooth side radius: $r_x = (r_x)_{nom} = p$
= 12.84 mm
12. Tooth side relief: $b_a = (b_a)_{nom} = 0.13p$
= 1.6692 mm

IV. CONCLUSIONS:-

By successful implementation of such project, essentials such as food and medicine will be delivered to patients on time and direct contact with corona patient is avoided using Robot. Have, Wireless remote control operation as well as compact designVisual inspection is possible with IP camera mounted on the top of the Robot.

Automatic sanitization whenever patient touches the essentials put in the tray of Robot. Also, By Using Proximity sensor, obstacle will be sensed and any of the command given to robot will be denied and Robot will stop automatically. In its current form robot is enough capable. It can follow any curve and cycle. We must build a robot that has light weight and high speed because points are awarded based upon the distance covered and the speed of the overall robot. Therefore, we used two high speed motors and high sensitivity sensors circuit. The body weight and wheels radius have effects on speed, too. The weight of the designed robot is around 15 kilo gram and it can be lighter. To get better maneuver, we must build a robot that uses two motors and two wheels on the rear and a free wheel on the front.

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REFERENCES: -

[1]. M.ZafriBaharuddin, "Analyst of Line Sensor Configuration for Advanced Line Follower Robot", University Tenaga Nasional.
[2]. Cao QuocHuy, "Line Follower Robot", University UPG din Ploiesti.
[3]. P. Heyrati, A. Aghagani, "Science of Robot Disgn and Build Robot", Azarakhsh Publication, 2008.
[4]. M. Mashaghi, "Robotic Guide", KanoneOloum Publication, 2008.
[5]. A. Kahe, "AVR Microcontroller", Nas Publication, 2007.
[6]. Robotic Competition Rolls site: http://www.tjrc.ir/roles.asp in date 2009/05/15.
[7]. AleksandarRodića&etal "Building technology platform aimed to develop service robot with embedded personality and enhanced communication with social environment"Science Direct (IJERT)1440–1449, Jun. 2020
[8]. Leng Ng, Y., Siong Lim, C., A. Danapalasingam, K., Loong Peng Tan, M., & Wei Tan, C. (2015). Automatic Human Guided Shopping Trolley with Smart Shopping System. JurnalTeknologi, 73(3).
[9]. Pieter Simoens, Mauro Dragone, Alessandro Saffiotti"The Internet of Robotic Things: A review of concept, added value and applications ", Distributed Robotic Systems and Society.
[10]. G. BalaKrishnan, D Mohan Kumar, C. JagadeeshVikram, P.Naveenchandran, M.Tech student,, Assistant Professor, "Design And

Fabrication Of Robotic Trolley For Material Handling''Department of Automobile Engineering, BIST,BIHER, Bharath University, Chennai.

[11]. G. Anandravisekar,A. Anto Clinton, T. Mukesh Raj, L. Naveen, "IOT Based Surveillance Robot''Department of Electronics and Communication Engineering Saranathan College of Engineering Trichy, Tamilnadu, India

[12]. Ansari Asmat Ali, Patel Mayank, SoniShivang, Shukla Abhishek"Follow Me Trolley'', IJSRD - International Journal for Scientific Research & Development|

[13]. Shashank Kumar, Rakesh D. Raut&Balkrishna E. Narkhede (2020) , "A proposed collaborative framework by using artificial intelligence-internet of things (AI-IoT)in COVID-19 pandemic situation for healthcare workers", International Journal of Healthcare Management.

[14]. Cheng Siong Lim&etal Automatic Human Guided Shopping Trolley with Smart Shopping System Research gate (IJERT)111347–111354, 2020.

[15]. Pieter Simoens , Mauro Dragone and Alessandro Saffiotti "The Internet of Robotic Things: A review of concept, added value and applications"International Research Journal of Advance Robotic Systems (IJERT) : Nov. 4, 2020.

[16]. G. BalaKrishnan&etal Design and Fabrication of Robotic Trolley for Material Handling International Journal of Pure and Applied Mathematics ISSN: 1314-3395.

[17]. G. Anandravisekar&etal IOT Based Surveillance Robot International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181

[18]. Dr. M. Ramkumar Raja &etal International Journal of Recent Trends in Engineering & Research (IJRTER) Conference on Electronics, Information and Communication Systems ISSN: 2455-1457.

[19]. [19]Eke Dodo Suryanto&etal Design of automatic mobile trolley using ultrasonic sensorsJournal of Physics (IRJET) Oct. 2011, pp. 31–35.

[20]. D. Kalaiarasi, Pavithra .S&etalIot Based Motion Control System Of A Robotic Car International Research Journal of Engineering and Technology (IRJET) ISSN: 2395-0056.

[21]. Raj Kumar Mistri International Journal of Engineering Development and Research ISSN: 2321-9939.

[22]. V.B. Bhandari, "Design of Machine Element"

[23]. Design Data Book