

DESIGN AND FABRICATION OF MULTIPURPOSE ROBOT

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ABSTRACT

The need for fire safety devices has increased enormously these years. Hence our robot is designed as one of the advanced fire safety device according to the above scenario. Our system senses the occurrence of fire using a typical sensor and also put-off the fire using fire extinguishing foam. This robot is built for multipurpose and hence performs other actions like "Pick and Place" and "surveillance" simultaneously. This multifunctioning robot is also cost efficient and complies within the budgets of small scale industries. Our approach is to build a robot with many functions compiled in a single unit. The pick and place function helps the operator to move important files out from the reach of fire. The security camera helps the operator to view the factory operations lively from anywhere. This camera also serves as the supervising device. Using different operations at the same time ensures quick outcome from fire and ensures complete safety. This robot can be used to take immediate action under any circumstance. There will not be any problem to the movement of the robot due to fire since it has chain drive system. Firefighting & protecting important documents can be done simultaneously. Using foam as fire extinguisher instead of water will help to put-off fire during circumstances such as electrical short circuits also.

Keywords: Hands-Free Profile (Hfp), Robot, Gripper, Helical And Worm Gear

INTRODUCTION

The need for fire safety devices has increased enormously these years. Hence our robot is designed as one of the advanced fire safety device according to the above scenario. Our system senses the occurrence of fire using a typical sensor and also put-off the fire using fire extinguishing foam. This robot is built for multipurpose and hence performs other actions like "Pick and Place" and "surveillance" simultaneously. This multifunctioning robot is also cost efficient and complies within the budgets of small scale industries. Our approach is to build a robot with many functions compiled in a single unit. The pick and place function helps the operator to move important files out from the reach of fire. The security camera helps the operator to view the factory operations lively from anywhere. This camera also serves as the supervising device [1-5]. Using different operations at the same time ensures quick outcome from fire and ensures complete safety. This robot can be used to take immediate action under any circumstance. There will not be any problem to the movement of the robot due to fire since it has chain drive system. Firefighting & protecting important documents can be done simultaneously. Using foam as fire extinguisher instead of water will help to put-off fire during circumstances such as electrical short circuits also [6-10].

PROPOSED SYSTEM

Approach is to build the robot with many functions compiled in a single unit. Added fire safety systems help the industry to be precautious in case of fire accidents. The pick and place function helps the operator to move important files out from the reach of fire. The security camera helps the operator to view the factory operations lively from anywhere. This camera also serves as the supervising device. The multipurpose function makes the robot cost efficient and hence suited for all type of industries. Using different operations at the same time ensures quick outcome from fire and ensures complete safety.

SPUR GEAR

A gearwheel with teeth projecting parallel to the wheel's axis. Spur gears are the most common type of gears. They have straight teeth, and are mounted on parallel shafts. Sometimes, many spur gears are used at once to create very large gear reductions. Spur gears are used in many devices that you can see all over How Stuff Works, like the electric screwdriver, dancing monster, oscillating sprinkler, windup alarm clock, washing machine and cloths drier. But you won't find many in your car. This is because the spur gear can be really loud. Each time a gear tooth engages a tooth on the other gear, the teeth collide, and this impact makes a noise. It also increases the stress on the gear teeth. To reduce the noise and stress in the gears, most of the gears in your car are helical shown in fig 1.

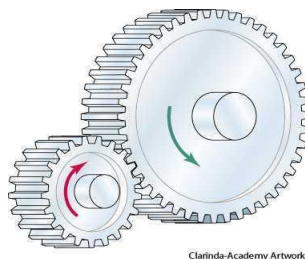
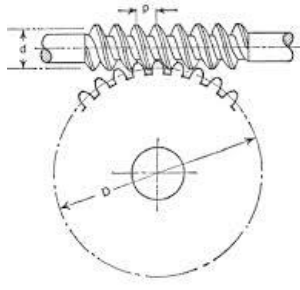
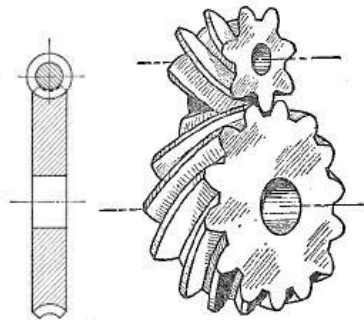


Fig 1 SPUR GEAR

HELICAL AND WORM GEAR

The teeth on helical gears are cut at an angle to the face of the gear. When two teeth on a helical gear system engage, the contact starts at one end of the tooth and gradually spreads as the gears rotate, until the two teeth are in full engagement. This gradual engagement makes helical gears operate much more smoothly and quietly than spur gears. For this reason, helical gears are used in almost all car transmissions. Because of the angle of the teeth on helical gears, they create a thrust load on the gear when they mesh. Devices that use helical gears have bearings that can support this thrust load. One interesting thing about helical gears is that if the angles of the gear teeth are correct, they can be mounted on perpendicular shafts, adjusting the rotation angle by 90 degrees shown in fig 2 & 3.

**Fig. 2 WORM GEAR****Fig.3 HELICAL GEAR****GRIPPER**

Gripper is used to hold the objects firmly and shift it to a desired location. It is made up of 1.2 mm thick aluminium sheet metal. DC motor is used to actuate the gripper arms and as a high torque geared motor of 24 volt which is a brush type motor. The current rating of the motor is 0.65A. The power of the motor is $P = VI = 15.6W = 1/48 \text{ HP}$. The rpm (revolution per minute) of the motor is 150 for 24 volts. The torque in which the motor works is 1.25kg. The gear which is used is high density nylon plastic with no hollow shown in fig 4.

**Fig 4 GRIPPER****BASE**

The base is used to carry the entire weight of the robot. It provides the surface area for mounting the arm, batteries, circuit boards and foam. The entire weight is balanced on the base. It also acts as the locomotive part of the robot. At the bottom of the base two motors are fixed diagonally to move the robot. They use chain drive for locomotion shown in fig 5&6.

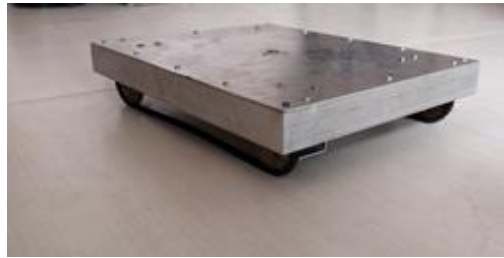


Fig 5 BASE 1

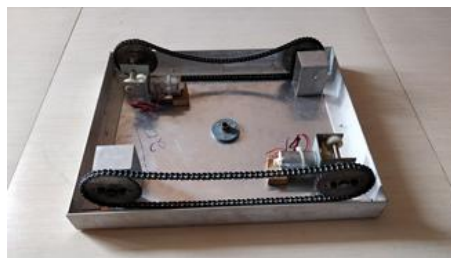


Fig 6 BASE 2

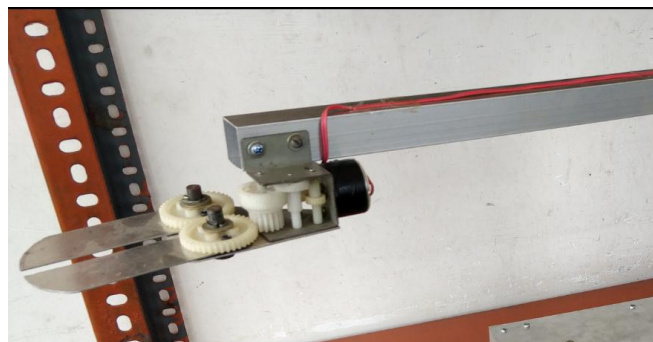
VERTICAL ARM

The arm post rotates 360 degree and it carries the end effector which holds the gripper. The camera is mounted on the arm such that the 360 degree movements can help to surveillance more area shown in fig 7.



Fig. 7 VERTICAL ARM**END EFFECTOR**

The end effector is also known as the hand of the robot. it holds the gripper which helps to pick and place an object. The end effector can move up and down only shown in fig 8.

**Fig. 8 END EFFECTOR****MOTOR**

Geared DC motors can be defined as an extension of DC motor. A geared DC Motor has a gear assembly attached to the motor. The speed of motor is counted in terms of rotations of the shaft per minute and is termed as RPM. The gear assembly helps in increasing the torque and reducing the speed. Using the correct combination of gears in a gear motor, its speed can be reduced to any desirable figure. This concept where gears reduce the speed of the vehicle but increase its torque is known as gear reduction. This Insight will explore all the minor and major details that make the gear head and hence the working of geared DC motor. The current rating of the motor is 0.65A. The power of the motor is $VI = 15.6W = 1/48 \text{ HP}$. The rpm (revolution per minute) of the motor is 150 for 24 volts. The torque in which the motor works is 1.25kg shown in fig 9.

**Fig. 9 MOTOR**

BATTERY

An electric battery is a device consisting of one or more electrochemical cells with external connections provided to power electrical devices such as flashlights, smartphones and electric cars. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode. Here we used lead acid battery which is a 6V and 4.5 mAh chargeable battery . A lead acid battery is a secondary cell, meaning that it is rechargeable. We have used two batteries of such kind. The power of the battery is 54W. Operating time is 1 hours shown in fig 10.



Fig 10. BATTERY

CAMERA

In order to use Bluetooth technology, a device must be compatible with the subset of Bluetooth profiles (often called services) necessary to use the desired services. A Bluetooth profile is a specification regarding an aspect of Bluetooth based wireless communication between devices. It resides on top of the Bluetooth Core Specification and (optionally) additional protocols. While the profile may use certain features of the core specification, specific versions of profiles are rarely tied to specific versions of the core specification. For example, there are Hands-Free Profile (HFP) 1.5 implementations using both Bluetooth 2.0 and Bluetooth 1.2 core specifications. The way a device uses Bluetooth technology depends on its profile capabilities. The profiles provide standards which manufacturers follow to allow devices to use Bluetooth in the intended manner. For the Bluetooth low energy stack according to Bluetooth 4.0 a special set of profiles applies shown in fig 11.



Fig. 11.CAMERA

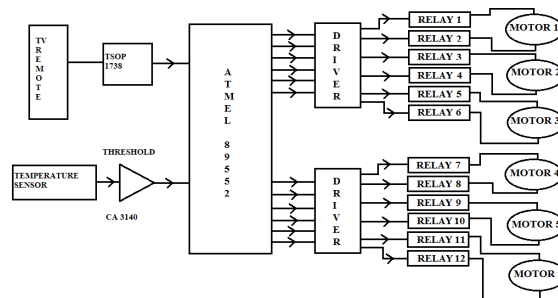
ELECTRONIC BLOCK DIAGRAM

Fig. 12 BLOCK DIAGRAM

Table 1 BASE MOVEMENT TABLE

	RELAY 1	RELAY 2	RELAY 3	RELAY 4
	MOTOR 1		MOTOR 2	
FORWARD	ON		ON	
BACKWARD		ON		ON
SHORT RIGHT	ON			ON
SHORT LEFT		ON	ON	
LONG FORWARD LEFT			ON	
LONG BACKWARD LEFT				ON
LONG FORWARD RIGHT	ON			

LONG		ON		
BACKWARD				
RIGHT				

The Robot receives data from the remote hand set. The transmitted data is carried by the IR transmitting LED at frequency of 38 kHz. Each key in the remote have different data address. The IRD sensor TSOP 1738 receives the data from the remote and send to the 10 the pin of the micro controller which is serially input. Microcontroller is the heart of the circuit. The programs are written in assembly language or text format. These programs are compiled by ASM compiler. The compiler convert the assembly language in to X-coding. These X-coding installed in the IC. From the micro controller the output are connected in to the driver IC. The driver IC increases the volt and operates the relay. We can the polarity of the D.C motor for a different movement shown in fig 12 and table shown in 1.

FABRICATION

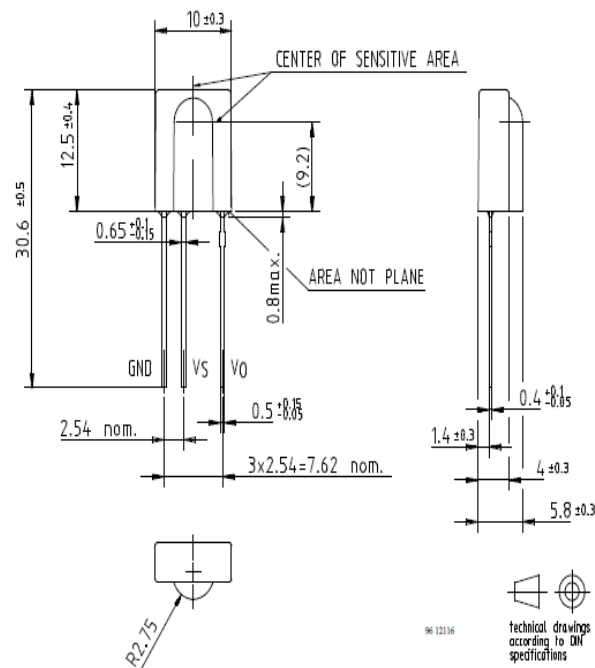


Fig. 13. DIMENSIONS IN mm

The base is made up of 1.5mm aluminum sheet. A hole is drilled at the middle of the base 80mm length shaft is inserted in to the hole. 90 teeth spur gear inserted on the shaft and locked by a circler. The vertical arm is attached on the top surface of gripper by a L-clamp. At the

bottom a brush is fixed to support the shaft and locked by a circler. At the top of the vertical arm 8mm hole is drilled horizontally. 80mm length shaft is inserted through the hole. 34 inch square channel is attached with the 48 teeth spur gear. Horizontal hole is drilled to the channel and the spur gear. This spur gear and square channel is fitted in to the vertical arm by a 8mm shaft and lower by circuit. In the vertical arm U-shaped is with at the front. A D.C motor with gear mechanism placed in the vertical arm and supported by an L-clamp. The spur gear and gear in the D.C motor are meshed together gripper in the square channel. At the end of end effector gripper is fixed and also D.C motor with gear mechanism fixed at the end of the end effector to operate the gripper. Four wheels are fixed at the bottom of the base plate for the movement of the robot. Chain drive system is used. The four wheels are attached by a U-clamp one D.C motor is fixed at the left front wheels and another D.C motor is fixed at the right rear wheel. The micro controller board is fixed on the surface of the base. 12v battery and five sets of relay is fixed on the base plate. D.C motor is fixed on the back side of the 90 teeth gear to give a vertical arm movement. When a current flows through the coil of wire, a magnetic field is produced. This pulls a movable arm namely, the armature that forces the contacts to open or close. Usually there are two sets of contacts with one opened and the other closed by the action. This action might then be used to supply a current to a D.C motor. Power supply 12 volts battery is used. 7812 regulator are used to drop the 12v in to 5v constant supply to the micro controllers shown in fig13.

EXPERIMENTAL RESULT: CAD MODELING

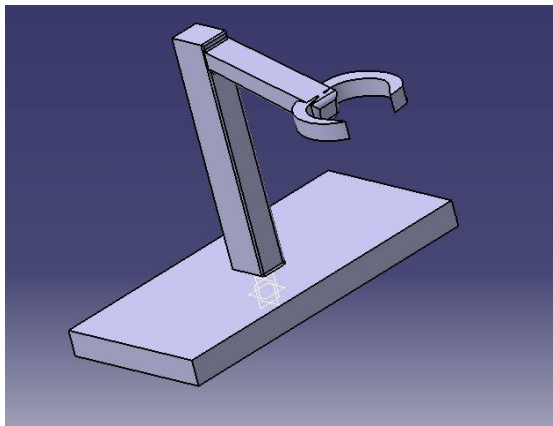


Fig. 14 CAD MODELING

The existing system of picking files with bush type gripper can be upgraded with a required type of gripper according to the industries use. The material of the robot can be upgraded so that it can withstand up to higher degree of temperature. Additional sensors can be used to identify if any human beings are stuck in the fire and to alarm fire stations. Height of the

robot can be increased so that the important things in elevated places can also be secured shown in fig 14.

CONCLUSION

This multipurpose robot can be used to do multiple tasks simultaneously and immediate measures can be taken. Since it is cost efficient this robot can be used even by small scale industries. We have used foam instead of water so we can use this robot even in electrical short circuits. This robot will be a boon for the small scale industries who cannot afford to buy a humanoid robot. Afford less and secure more is the concept of this robot.

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