

# Android Based Automated Guided Vehicle for Fire Fighting

Arkan Aslam Sanadi<sup>1</sup>, Asif Sultan Sanadi<sup>2</sup>

U.G. Student, Department of Mechanical Engineering, RMD Sinhgad School of Engineering, Pune, India<sup>1</sup>

U.G. Student, Department of Mechanical Engineering, Institution of Engineers (India), Pune, India<sup>2</sup>

**ABSTRACT:** Fire has a wide range of applications and is most useful for us. But we as a human have seen some terrible, deadly, and destructive cases of Fire Wreaking havoc. We have seen cases where humans have to lose their lives and a bad situation that becomes worse one if not handled on time. "Prevention is always better than cure". And hence, humans have developed various firefighting techniques which include a combination of traditional methods and technology of the 21st century. These methods help us to quench fire with the utmost care and save lives. The efficiency is also increased with new generation technology and robots. However, firefighting is still a very dangerous job that definitely puts our lives at risk. Fire accidents are usually encountered in nuclear power plants, petroleum refineries, gas tanks, chemical factories, and other industrialized areas. Apart from all these domestic fires and also wildfires are types which go out of control even on tremendous efforts as there is a limitation to all the humans to deal with such kind of accidents. And we have seen from past experiences that these accidents cause property damage, pollution, and most importantly loss of life and injuries to humans. They ultimately lead to destruction and global warming as well.

This project is a contribution towards society to reduce the risk factor involved and to save human life. In a world full of robots this automated guided vehicle can be used for firefighting. This AGV is handled and controlled by a smartphone application and it plays very important role in quenching of fire. It uses Bluetooth or Wi-fi connectivity for its operation. The concept of this project omits direct involvement of humans for firefighting and the AGV is fully automated which will perform its task as per command given and can be used as required on affected areas. This AGV can be used very effectively and usage of an android application makes it reliable and convenient. This idea can further be improved with new technology available such as usage of various types of sensors like smoke and heat detecting sensors, etc and we can also use fireproof parts for making it advance and more useful.

**KEYWORDS:** Fire, AGV, Quenching, Automated, Humans, Reliable, Convenient, Smartphone application, Android.

## I. INTRODUCTION

An automated guided vehicle or AGV is a portable robot that follows along marked long lines or wires on the floor, or uses radio waves, vision cameras, magnets, or lasers for navigation, android applications, etc. AGV's are mostly used in industries in transfer lines but now a days as technology is so sophisticated & advanced AGV's are used in warehouses, container terminals, underground and in places where humans can't reach. They are mostly Laser Guided, Remote operated, Smartphone operated or Program based. They are generally used in industrial applications to transport heavy duty materials in industrial areas, such as a factory or warehouse. Application of the automatic guided vehicle broadened during the late 20th century. Barrett Electronics Corporation invented the world's first PC based Guided Vehicle for industrial applications in 1954. It was a tow truck that was following the wires in the floor. Automated Guided Vehicle is a mobile AGV that follows the marked path or wires in the floor. It also called as Laser Guided Vehicle or Self-Guided Vehicle as it uses laser or can be controlled by programming or simply by using a remote. We have come with this unique idea of a robot which can be fully automated and can be used for many applications at the same time as well. This AGV is portable and can be used for many different applications, such as AGV for firefighting, spray painting, or bomb diffusing unit, etc. It is operated by batteries, which makes it compact in design and eco-friendly. The idea of placing bomb diffusing unit on this AGV will be of greater use in future. This AGV is operated and controlled by an android phone application which makes it more reliable in its operation. It uses concept of Mechatronics and plays very important role in safety and control. It has an electronic circuit with HC-05 Bluetooth and LCD connector display. AGV uses various other components for its motion and operation such as pneumatic cylinder, DCV's, DC motors, etc. A standard fire extinguisher is used for fire quenching purpose. Fire is quenched by directing and extinguishing the fire extinguisher at the required area. It minimizes chances of accident and plays a vital role in human safety. AGV is a new generation robotic concept that can be improved further. This is a concept that is smarter, more mobile, more collaborative and more adaptable. This is an idea that will help humans for

various other applications as well. Its compact design helps us to reach in difficult areas where, humans cannot reach. And to make it more advance one can also place cameras, fire detection sensors, smoke sensors, fire proof body, fire proof pipes and wires, Wi-fi connectivity, etc. And present idea of Artificial Intelligence can also be used to make it futuristic. Concept of AGV's is not new to us but making it more efficient and using new generation technology and futuristic concepts makes them more useful in various fields. This AGV is one such idea that will definitely grow and will help for firefighting purpose. Handling of AGV is easy job due to android application. One can easily handle AGV and can perform fire quenching task. This is a vision guided robot that can be used specifically on a required area. This project completely eliminates involvement of humans and saves us from putting our life in danger. This AGV reduces the chances of making mistakes and performs its task efficiently. The most important part that is mostly concerned is the cost involved in manufacturing of AGV's. But using such AGV's will definitely help us as the cost is very less as compared to other robots. One more thing that is very useful is the voice operation. The commands can also be given vocally to using android application and project can be handled easily by a smartphone. Growing industries and other fields demand one such AGV which will be of greater use. The tendency to save human life by eliminating human involvement is increased with decreasing chances of any kind of damage, injuries, or destruction. Implementing this technology can be eco-friendly and beneficial.

## II. OBJECTIVES

- ✚ To quench a fire effectively with the help of AGV for safety.
- ✚ To develop new generation AGV with high accuracy and efficiency for safety and control.
- ✚ To save lives and prevent destruction or damage to properties by controlling fire.
- ✚ To eliminate or minimize human involvement.
- ✚ To perform task of firefighting in minimum time and to reduce pollution.

## III. SPECIFICATIONS OF AGV FOR FIRE FIGHTING

1. Working pressure of fire extinguisher : 12-14 Bar
2. Vertical reach : 150 mm
3. Horizontal reach : 350 mm
4. Configuration : Cylindrical
5. DOF : 3 (2-linear, 1-rotation)
6. Actuator : Electrical (DC Motors) & Pneumatic.
7. End Effector : Screw operated mechanical spray gun
8. Controller : Microcontroller 89C51
9. Sensor : Blue Tooth
10. Application : Fire Fighting

Fire fighting is a hefty task as it also risk the life of humans involved. To save lives and to prevent destruction, damage, accident or any kind of injury this 'MOBILE OPERATED AUTOMATED GUIDED VEHICLE' can be used for quenching of fire in an effective and efficient way with minimum efforts.

**IV. PARTS LIST****NON-STANDARD PARTS:**

Table 1. Non-standard parts list

Sr.No.	Parts	Material	Quantity
1.	Chassis	Stainless Steel 202	01
2.	Column	SS	01
3.	Horizontal Lead Screw	Aluminium	01
4.	Arm	SS sq. tube 10mm	02
5.	Column Support	Nylon	01
6.	Column Support Bush	Nylon	01
7.	Wheel Brackets	SS 202	03
8.	Supporting Plate & brackets	SS	02
11.	Screw Guiding Block	Nylon	01
12.	Actuation mechanism	SS	01

**STANDARD PARTS LIST-MECHANICAL COMPONENTS:**

Table 2. Mechanical Components List

Sr.No.	Parts	Material	Quantity
1.	Skidder	Stainless Steel	01
2.	Wheels	Plastic	02
3.	Screw normal & CS (M 4 x2)	Mild Steel	10
4.	Screw (M 3 x2)	Mild Steel	30
5.	Nut (M3)	Mild Steel	05
6.	Hex Nut (M10x1.25)	MS	02
7.	Pneumatic Cylinder (25x150)	Al	01
8.	5/2 Single Solenoid Valve (NO)	-	01
8.	Extinguishing Mechanism	Stainless Steel	01

**ELECTRONIC COMPONENTS:**

Table 3. Electronic Components List

Sr.No.	Parts	Material	Quantity
1.	12V Battery	-	01
2.	Android Mobile	-	02
3.	Display	-	01
4.	Electronic PCB	-	01
5.	DC Motors 60RPM	-	02
6.	DC Motors 10 RPM	-	01
7.	DC Motors 15RPM	-	01

**V.STUDY & ANALYSIS**

**Automated Guided Vehicles (AGV):-**

AGV's are designed to perform their operations without direct human guidance. They are used in a wide variety of industrial applications and can be laser, initially or Cartesian-guided. AGVS are consists of one or more computer-controlled wheel based load carriers (normally battery-powered) that runs in the industries or plants (or if outdoors on a paved area) without the need for an onboard operator or driver. AGVs have fixed paths or areas within which or over which they can be operated. Navigation is achieved by any one of several means, including following a path defined by buried inductive wires, surface mounted magnetic or optical strips; or alternatively by way of inertial or laser guidance. Usually there are three types of AGVs, aside from custom or proprietary styles, unit load, forklift and tugged: Unit load automatic guided vehicles are powered, wheel based vehicles that carry loads, such as an individual item (e.g. a large roll of paper, coil of steel or vehicles engine) or items contained on a pallet or in a tote or similar temporary storage medium. AGVs are generally operated by computer or application interface.

**DESCRIPTION OF DIFFERENT PARTS OF AGV:**

**CHASSIS:**A chassis (pronounced TCHA-see or CHA-see) is a structure that holds the entire body of a machine. The main function of a automotive chassis is holding all the components together while driving, and transferring vertical and lateral loads, caused by accelerations, on the chassis through the suspension and two the wheels. Hence it should be strong and rigid.The figure shows the basic structure of the chassis used in the AGVs. It is provided with two wheels and one skidder with the help of which the AGV can move on a given path. The load of the whole assembly is carried by the chassis.

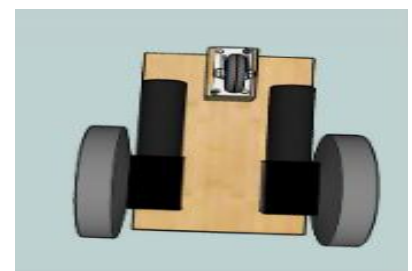


Fig.1 Chassis

**WHEELS AND SKIDDERS:** Wheels are usually circular in shape and they are capable of rotating about their axes, and they are also responsible for movement or transportation and they also carries load or (mass), or acts as alabour in machines. Common examples are found intransportvehicles and other transport applications. A wheel is usually mounted on an axle andit is subjected tofrictiondue to the motion by rolling. To rotate the wheels a moment must be given or a motion of wheels must be their about their axes due to gravity or external forces. Two wheels are used in this AGV for the transport of the Extinguishing unit.



Fig.2 Wheels

**SKIDDER**

A skidder is used in the front of the AGV for its locomotion. It is asimple ball bearing that rotates 360° and provides motion in the required direction.



Fig. 3 Skidder

**ARM:** An arm is a AGV manipulator, usually programmable, with similar functions to a human arm. The links of arms are connected by joints allowing multiple motions such as rotational motion (motion found inarticulated AGV) or translational (linear) displacement. The links of the arm form skinematic chain to perform their function. The business end of the kinematic chain of the manipulator is called the end effector and it is analogous to the humanhand. The end effectors are designed in such a way that they perform various tasks such as welding, gripping, spinning etc., depending upon the application. For example AGV arms in automotiveassembly lines perform a variety of tasks such as welding and parts rotation and painting or placement during assembly.

**PNEUMATIC CYLINDER:** They are used in different applications. They uses power generated by a compressed gas or air to perform required action or motion.These are similar to that of hydraulic cylinders that uses fluid power to perform its preferred function. These types of cylinders are used in lightweight as well as in heavy duty applications. Nowadays these types are mostly preferred by the engineers as they are quite in operation, cleaner, and requires less storage space. Whereas hydraulic cylinders drips out oils, as well as cleanliness is required for their operation.



Fig. 4 Pneumatic Cylinder

**D.C. MOTORS:** Motors utilizes electrical energy to perform mechanical work. The D.C. motors that we have been dealing with here convert electrical energy into rotational energy. That rotational energy is then used to

lift things, propel things, turn things, etc...

The output shaft is rotated by supplying specified voltage to to motor.

This rotational speed or angular velocity,  $\omega$  is typically measured in radians/second {rad/s}, revolutions/second {rps}, or revolutions/minute {rpm}.

The figure shows the actual mechanical construction of the DC series motor.

DC motors have two main parts:

1. The armature
2. The field poles

Fig.5 Component parts of circuit

Magnetic field is created by armature and field poles and by using this magnetic field mechanical power is developed by motor. A motor has various parts some of them are listed below.

1. Commutator
2. Armature Drive Shaft
3. Brushes, etc.

**TORQUE SPEED CHARACTERISTICS OF D.C. MOTOR:**

It is the force which causes rotational motion of the motor shaft is called **torque**.

The rate at which the motor rotates around its axis usually expressed in radians or rps or rpm is called **speed**.

**MOTOR:**The graph in Fig.9 shows a torque/speed curve of a typical D.C. motor. We can clearly see that torque is inversely proportional to the speed of the output shaft.

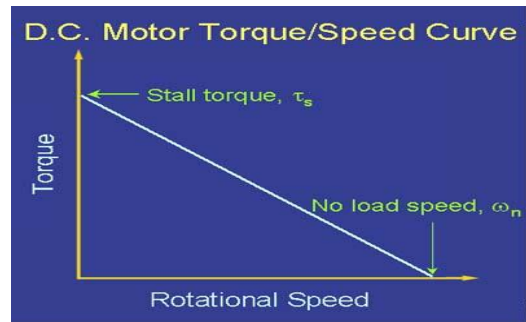
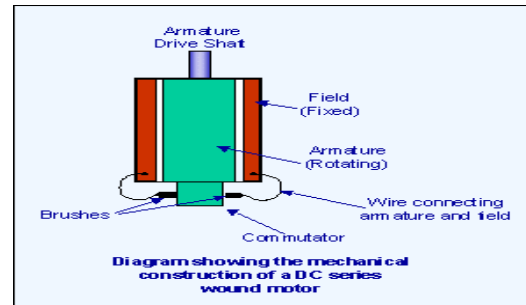


Fig.6 Torque / Speed Curve Of A Typical D.C

- ✚ The stall torque,  $\tau_s$ , represents the point on the graph at which the torque is maximum, but the shaft is not rotating.
- ✚ The no load speed,  $\omega_n$ , is the maximum output speed of the motor (when no torque is applied to the output shaft).
- ✚ Motor driver ICs are provided to which motors are connected. 12 volts, 100 rpm DC motors are used which move the wheels.
- ✚ A DC motor is a mechanically commutated electric motor powered from direct current (DC). In DC motor, operation is based on simple electromagnetism. A current-carrying conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field. Opposite (North and South) polarities of magnet attract, while like polarities (North and North, South and South) repel. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current-carrying conductor and an external magnetic field to generate rotational motion.

**SELECTION OF DC MOTORS FOR DIFFERENT PARTS OF AGV:**

✚ **WHEELS:**

The criteria for selection of motors for wheels are the speed of the wheels and the weight of the assembly which the wheels are going to carry.

We have selected motors of 30 rpm. because the speed of the AGV during the performance of the tasks should be less.

✚ **COLUMN:**

The column is fixed to the chassis with the help of a bush. Now, this column is used for the movement of the arm of AGV in 360 degrees. A stylus is fixed to the column as an element of a limit switch. In our application the rotational movement of the arm should not be fast to maintain the accuracy. Thus a 10 rpm motor is selected for the rotational movement of the arm.

**MICROCONTROLLER:**

A microcontroller is a small, low-cost computer-on-a-chip which usually includes:

- An 8 or 16 bit microprocessor(CPU)
- A small amount of RAM
- Programmable ROM and/or flash memory
- Parallel and/or serial I/O



Fig.7 D.C. Motor

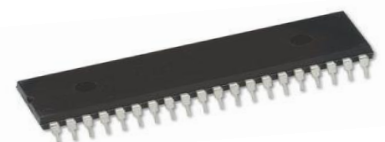


Fig.8 Microcontroller



- Timers and signal generators
- Analog to Digital (A/D) and /or Digital to Analog (D/A) conversion

It is often used to run dedicated code that controls one or more tasks in the operation of a device or a system. They are also called as embedded controllers, because the microcontroller and the support circuits are often built into, or embedded in, the device they control. Many devices controlled by microcontrollers are operated by batteries as they have a low power requirement as well.

**FIRE EXTINGUISHER:**

A Fire extinguisher is generally used for fire fighting or fire quenching. Fire extinguisher is a standardized component which is available in the market. It has various types and is being sold according to applications as well. The extinguisher used in this AGV is Safe pro fire extinguisher of 1 kg. Its cost is low and it is available in the market. It is generally used for domestic safety and other small applications.



Fig.9 Fire Extinguisher

**BATTERY:**

A 12-volt battery which is used for many other applications such as in automobiles is used. Circuit is entirely powered by battery and performs various functions. Battery makes this AGV eco-friendly. And this project gains accuracy with speed and its function are performed for a long time. A 12 volt, 8ah battery of fuzison is used to operate this AGV.



Fig.10 Battery

**In the COMPONENTS LAYOUT DIAGRAM:**

1. 7812: Regulator to convert 230 V AC to 12 V DC
2. 7805: Regulator to convert 230 V AC to 5 V DC
3. C1, C2, C3: Capacitors of 1000 microF, 100 microF, 10 microF
4. D1, D2, D3, D4: Diodes in bridge rectifier
5. R1, R2, R4: Resistors
6. AT89C51: Microcontroller ATMEL 89C51
7. XT C1: Crystal, capacitor of 33 picoF
8. CON LCD- Liquid Crystal Display Connector
9. LED1, LED 2: Light Emitting Diode to indicate that whether the supply is ON or OFF
10. SL1, SL2, SL3, SL4, SL5, SL6, SL7, SL8: Pin connectors
11. POT1: Potentiometer
12. IC1, L239D: Respective ICs 7812: Regulator to convert 230 V AC to 12 V DC
13. 7805: Regulator to convert 230 V AC to 5 V DC
14. C1, C2, C3: Capacitors of 1000 microF, 100 microF, 10 microF
15. D1, D2, D3, D4: Diodes in bridge rectifier
16. R1, R2, R4: Resistors
17. AT89C51: Microcontroller ATMEL 89C51
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19. CON LCD- Liquid Crystal Display Connector
20. LED1, LED 2: Light Emitting Diode to indicate that whether the supply is ON or OFF.

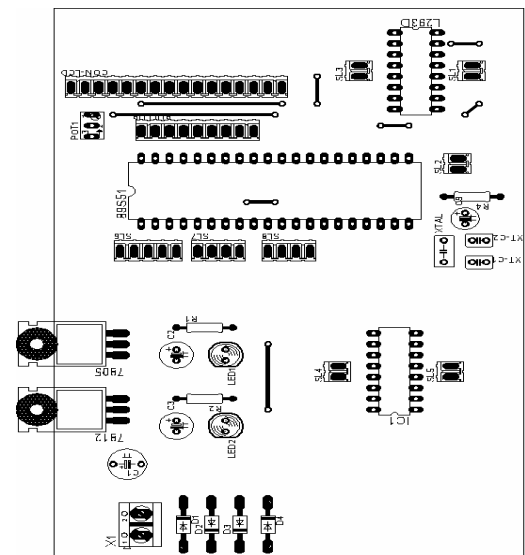


Fig.11 Components of circuit

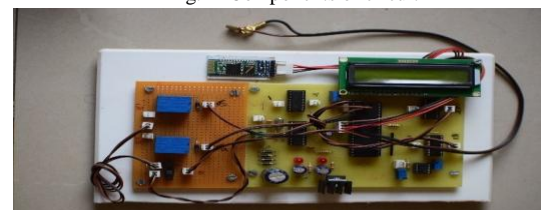


Fig.12 Circuit

**VI. DESIGN**

Different operations performed for manufacturing:-

- ✚ Turning
- ✚ External & internal screw threading
- ✚ Sheet metal cutting
- ✚ Drilling
- ✚ Fitting
- ✚ Welding (Spot & Arc)
- ✚ Assembly.

**DESIGN OF ARM:**

The figure shows the loading diagram of the arm of AGV. Consider the arm AB. There are different forces acting on the arm at points B, C, D, E, F and G. Now, these forces will cause the arm to bend in the direction of forces. These forces are as follows:

1. Weight of end plate (point B)
2. Weight of movable plate (point C)
3. Weight of horizontal lead screw (point D)
4. Weight of object to be picked up (point E)
5. Weight of fixed plate (point F)
6. Self weight of arm (point G)

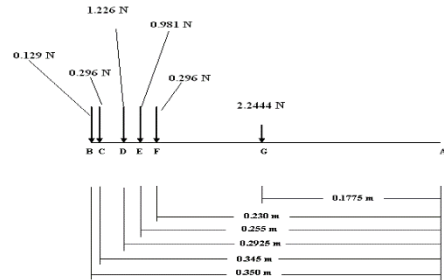


Fig.13 Loading diagram of arm

To find the bending moment of the arm, we have to take moment of arm about point A.

We have to make the design such that the forces do not cause the arm to bend.

Taking moment of arm about point A ( $\sum M_A$ ), we get,

$$\sum M_A = (0.129 \times 0.350) + (0.296 \times 0.345) + (1.226 \times 0.2925) + (0.981 \times 0.255) + (0.296 \times 0.230) + (2.2444 \times 0.1775)$$

$$\sum M_A = 1.222 \text{ Nm} = 1222 \text{ N.mm}$$

Now, According to the principle of superposition, The resultant stress at point A is,

$$\sigma_A = \frac{-p}{A} \pm \frac{M \times y}{I_{xx}}$$

$$\sigma_A = \frac{-4.5096}{0.2d \times d} \pm \frac{((1.222 \times (d / 10) \times 10^3))}{((1/12) \times d \times (0.2d)^3)}$$

Now, considering the factor of safety as 3, we get,

Tensile stress

$$\sigma_t = 125/3 = 41.67 \text{ N/mm}^2$$

And Compressive stress

$$\sigma_c = 300/3 = 100 \text{ N/mm}^2$$

Consider tensile stress:-

$$41.67 = (-22.548 / d^2) + (168300 / d^3)$$

$$41.67 d^3 + 22.548d + 168300 = 0$$

$$d = 15.91 \text{ mm} \dots \dots \text{width of the arm}$$

$$\text{Take } d = 20 \text{ mm}$$

$$b = 0.2d$$

$$= 4 \text{ mm} \dots \dots \text{height of the arm}$$

Consider compressive stress:-

$$-100 = (-22.548 / d^2) - (168300 / d^3)$$

$$100 d^3 - 22.548d - 168300 = 0$$

$$d = 11.90 \text{ mm}$$

$$\text{Take } d = 15 \text{ mm} \dots \dots \text{width of the arm and } b = 0.2d = 2.38 \text{ mm} \approx 3 \text{ mm} \dots \dots \text{height of the arm}$$

Take greater of the two diameters which we have got.

Thus, width of the arm according to the design is  $d = 20 \text{ mm}$ .

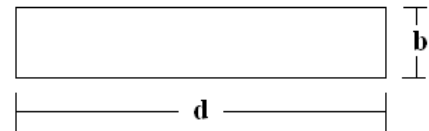
The actual width of arm of the AGV = 70 mm.

The width of the arm according to the calculation is less than the actual width of the arm i.e.  $20 \text{ mm} < 70 \text{ mm}$

Thus the design of arm is safe.

**DESIGN OF CYLINDER:**

The material used for the cylinder which is used in this project is Mild steel and it has some advantages which are as follows:





✚ Advantages of Mild steel:

1. Cheap
2. Wide variety available with different properties
3. High stiffness
4. Most carbon steels are easy machine and weld

✚ Advantages of square threads:

1. It gives maximum efficiency
2. It gives minimum radial or bursting pressure on nut
3. It has self locking property

✚ The total load on the vertical lead screw is the sum of the different parts as follows:

1. Weight of arm
2. Weight of object to be lift
3. Weight of the guiding block
4. Weight of the motor which rotates the lead screw

✚ This total weight is the load capacity that is = 7.738 N

The lifting height of the object required = 150 mm. This lifting height is considered so as to prevent the object from touching down i.e. for the safety reasons.

Ultimate tensile strength of mild steel is  $S_{ut} = 450 \text{ N/mm}^2$

Coefficient of friction = 0.20 and Factor of safety ( $N_f$ ) = 3 (assumed)

Now, Permissible compressive stress in material =  $\sigma = \frac{S_{yc}}{N_f} \sigma = \frac{450}{3} = 150 \text{ N/mm}^2$

Permissible compressive stress in piston rod body =

$$\sigma = \frac{W}{\pi \times 4 \times d_c^2} 150 = \frac{(7.738 + (0.1 \times 7.738))}{\pi \times 4 \times d_c^2} \quad d_c = 0.268 \text{ mm} \quad \text{Hence, Take } d_c = 1 \text{ mm}$$

$$d_c = d - p \quad \text{Therefore, } d = d_c + p = 1 + 6 = 7 \text{ mm}$$

The mean diameter ( $d_m$ ) of the lead screw is given by,  $d_m = d - (p/2) = 7 - 3 = 4 \text{ mm}$

Now, The compressive stress in the screw body ( $\sigma_c$ ) is given by

$$\sigma_c = \frac{W}{\pi \times 4 \times d_c^2} \sigma_c = \frac{7.738}{\pi \times 4 \times 1^2} = 9.84 \text{ N/mm}^2$$

The maximum shear stress in the piston rod body ( $\tau_{max}$ ) is given by

$$\tau_{max} = \frac{16 \times T_t}{\pi \times d_c^3} \tau_{max} = \frac{16 \times 11.57}{\pi \times 1^3} = 58.92 \text{ N/mm}^2$$

To determine whether the design of the piston rod is safe we have to compare the maximum shear stress with the  $\frac{S_{sy}}{N_f}$ .

$$\frac{S_{sy}}{N_f} = (0.5 \times 450) / 3 = 75 \text{ N/mm}^2$$

As  $\tau_{max} \leq \frac{S_{sy}}{N_f}$ , Thus, we select 25 x 150 mm pneumatic cylinder. Thus design is safe.

### DESIGN OF GUIDING BLOCK:

The guiding block which is made of Nylon is used to guide the vertical column. This block is 30 mm in height and has four holes in it. These holes are of 2.5 mm diameter which is the diameter of column and 32 mm diameter which is the diameter of the vertical hollow column.

Design of nut:

Yield strength in shear of Aluminium ( $S_{sy}$ ) = 95 N/mm<sup>2</sup>

Considering factor of safety ( $N_f$ ) = 3

Load acting on it (W) = 7.738 N

Nominal diameter (d) = 7 mm

Thickness at the root of the thread (t) = 6mm

Number of threads (Z) = height of nut / pitch  
= 30 / 6 = 5

Direct shear stress in nut threads

$$\tau_n = \frac{W}{\pi \times d \times t \times Z} \tau_n = \frac{7.738}{\pi \times 7 \times 6 \times 5} = 0.1 \text{ N/mm}^2 = 1 \text{ N/mm}^2$$

Now,  $\tau_{max} = \frac{S_{sy}}{N_f} = 95 / 3 = 31.67 \text{ N/mm}^2$ . As  $\tau_n < \tau_{max}$ , design is safe.



**VII. WORKING**

- ✚ Set the initial positions of actuation mechanism.
- ✚ Connect the android phone with the control circuit.
- ✚ Then as per commands set on control-panel AGV will actuate.
- ✚ Press down key.
- ✚ The AGV arm will move vertically down.
- ✚ Press up/stop key.
- ✚ The arm will move vertically upwards.
- ✚ Press forward key.
- ✚ The AGV will move in the forward direction.
- ✚ Press reverse key.
- ✚ Then the AGV will move in the reverse direction.
- ✚ Press left/right keys.
- ✚ The AGV will move in either left side or right side.
- ✚ By these commands one can move the AGV in the required direction and position.
- ✚ Then press the pull command.
- ✚ AGV shall start quenching the fire.
- ✚ To stop the extinguishing process, press the release key.
- ✚ AGV will stop the extinguisher.
- ✚ Two more commands as clockwise and anticlockwise are there to move the arm in either of the directions respectively.
- ✚ One can have downward inclined or upward inclined movement of AGV arm with actuation mechanism for inclined extinguishing of extinguisher by simultaneous command of either up and clockwise or down and clockwise keys, and vice versa.
- ✚ To stop any operation or command given press ‘STOP’ button.
- ✚ One needs to use stop key after every key given, if no other command is to be given after that.
- ✚ At the end of operation switch off the battery/supply switch.

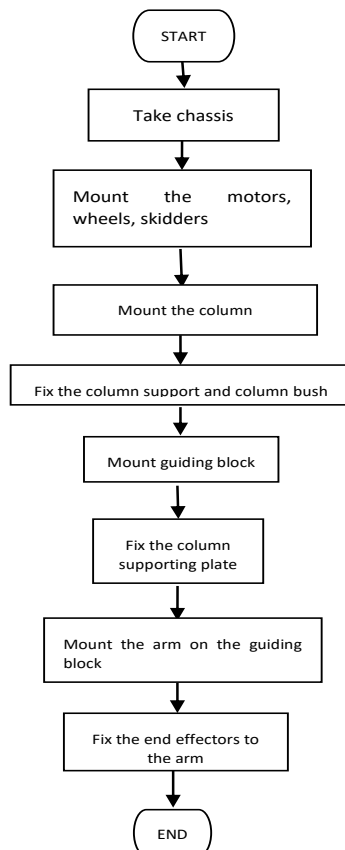


Fig.15 Assembly Procedure



Fig .14 Control mobile screen

### VIII. RESULT

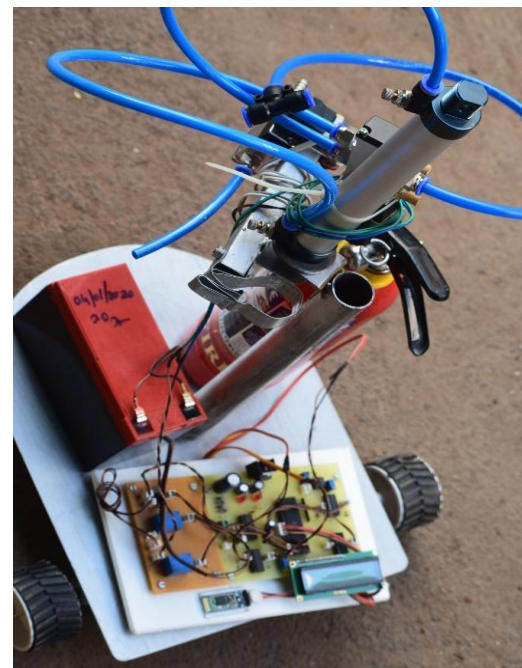


Fig. 16 AGV FOR FIRE FIGHTING

This project can be used for safety and control during fire fighting effectively. This unique idea of an AGV with 21<sup>st</sup> century technology and innovations can further be improved in future. This AGV can further be upgraded to make it more advance and efficient. Making use of an android application reduces direct human involvement for fire quenching and can save lives. It is also cost effective and can be implemented further in industrial sector as well as household purposes. Usage of an android application also has voice control, which makes it more reliable for an operator. AGV is compact and can be manufactured easily by using standardized parts and its handling is also very simple in this world full of smartphones. AGV has Bluetooth connectivity however, Wi-fi connectivity is also possible. Further this project can also be fully automated by using fire proof parts and will increase its life.

### IX.CONCLUSION

The main aim for designing of a“FIRE FIGHTING AGV” is that it can be used for various industrialized areas as well as in many other regions such as hospitals, domestic firefighting, wildfires, etc.A low-cost firefighting Mobile AGV was attempted, but future developments can be achieved to make it more versatile with good and fire proof equipment’s.Human safety is very important and this project is a contribution towards it. Firefighting with such robots reduces risk by reducing human involvement and fire can be controlled even in difficult areas where humans cannot reach. Usage of new technology and 21<sup>st</sup> century ideas helped us to contribute towards future. Using such AGV’s is beneficial as well as can be cost effective. Such AGV’s can be further improved with new technology available in the market and can always be preferred for various application that are harmful to humans. Not only firefighting but many other applications where involvement of humans may put our lives in danger can be handled with such AGVs.We feel that our product serves something good to this world and can contributes towards society and we like to present it before this prosperous world.

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