International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 10 Issue: 03 | Mar 2023 www.irjet.net p-ISSN: 2395-0072

FIRE FIGHTING BOGIE

Vivek Kavitkar[1], Sahil Gawade[2], Shrihari Nair[3], Govind Madye[4], Akanksha Varnekar[5], Prof. Mr. H. A. Pawar[6]

[1, 2,3,4,5] *Students, Dept. of Electrical Engineering, Yashwantrao Bhonsale Polytechnic, Sawantwadi, India*
[6]*Lecturer, Dept. of Electrical Engineering, Yashwantrao Bhonsale Polytechnic, Sawantwadi, India*

Abstract- *Fire Fighting bogie is a concept which extinguishes the fire and reduce the loss of humans in hazardous conditions which is caused due to fire. In India Fire Fighting Robot and Fire Fighting Van exist in small prototype models. In abroad countries these types of robots are innovated in fire brigade vans which needs conventional supply such as water, etc. We tend to make this project in medium scale. This model is portable version of fire brigade van which use in the particular area and extinguish the fire in easy and safe way. With the help of remote control we will lead this model to the fire prone area. Then this model will extinguish this fire with the help of Nozzle located. In future also making this project in automatic level which includes electronic gears and robotics. The wheels on these bogie lift each component as they travel slowly and climb over the obstacles. When a vehicle needs to pass over an impediment, the rear wheels push the front wheels into the obstruction, which causes the front wheel to rotate and lift the front of the vehicle up and over the barrier, lifting the suspension over the obstruction one section at a time. The middle wheel is then pushed up and over the obstruction after being pressed against it by the rear tyre and pulled against it by the front wheel. The front two wheels eventually lift the rear wheel over the obstruction. The vehicle's forward motion is either slowed down or stopped entirely as each wheel crosses the impediment. As a result, this bogie can climb any obstacle with the aid of this system.*

Key Words: **Fire Extinguishing, Rockie Bogie Mechanism, Arduino, water tank, water pump motor.**

1. INTRODUCTION

Fire safety is the set of practices intended to reduce the destruction caused by fire. Fire safety measures include those that are intended to prevent ignition of an uncontrolled fire and those that are used to limit the development and effects of a fire after it starts. The fire extinguishing vehicle can be used as a Fire Fighting Bogie which can extinguish the fire in a fire hazard zone. The advantage of using this Fire fighting Bogie is that it didn't need the direct presence of the fireman at the fire zone. Instead, this Bogie can be controlled by a user with the help of a Remote control. The bogie suspension we are using is an another positive factor as this will help the vehicle to move easily over the obstructions in their path. Special cameras used will help them in having a view of the surroundings through which they move.

Firefighting is the act of extinguishing fires. A firefighter suppresses and extinguishes fires to protect lives and to prevent the destruction of property and of the environment. In most of the cases when fire hazard occurs, the fireman will throw himself into danger for saving the lives of others. Also in all cases, they won't be able to reach direct where fire occurs. The direct presence of fireman will make their life is at risk in most cases.

Another important part we are introducing to the fire safety is Rocker-bogie suspension systems. This system will provide the vehicle to move more easily over the path which is covered with obstructions. The way in which rocker bogie is built will help the vehicle to climb over the obstructions which are twice its size.

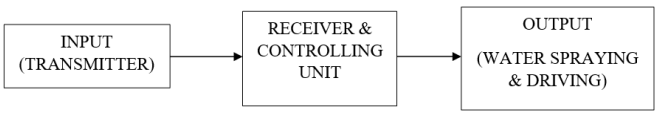

Fig-1.1 Block Diagram

2. METHODOLOGY

The fire fighting bogie is basically mini version of fire brigade van. The fire brigade van is consist of water tank which have capacity of 3000 ltr-6000 liter, long pipes which is use to carry water, nozzle which is use to throw pressurized water for extinction of fire. Mainly our project is based on this principle but in small in size which is use in anywhere.

The fire fighting bogie have controlled by RF (Radio Frequency) signal drive mechanism which send the signal to the receiver of the prototype and receiver give signal to the controlling unit which take action. The main parts and mechanism of the fire fighting bogie is motors, controlling unit transmitter and receiver, high pressure water pump motor, rocker bogie mechanism and tank steering wheel mechanism. Before here question is that how the bogie is run? We introduce rocker bogie mechanism and tank steering wheel mechanism which is explain below.

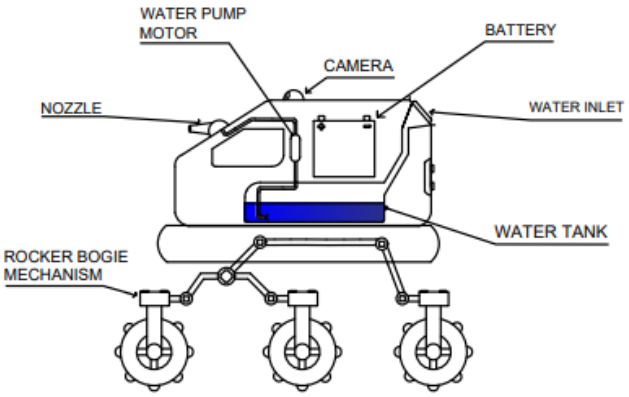

Fig-2.1 Fire Fighting Bogie

1. Rocker bogie mechanism-

The rocker-bogie design consisting of no springs and stub axles in each wheel which allows the chasis to climb over any obstacles, such as rocks, ditches, sand, etc. that are up to double the wheel's diameter in size while keeping all wheels on the ground maximum time. The Rocker-Bogie design, which has stub axles for each wheel and no springs, enables the rover to climb over obstacles like boulders that are up to twice as large as the wheel's diameter while maintaining contact with the ground with all six wheels. The centre of gravity's height determines the tilt stability, as it does for any suspension system. Systems that use springs are more prone to tipping as the laden side gives. In order to reduce dynamic shocks and subsequent damage to the vehicle when navigating large obstacles, the system is intended to be employed at slow speeds of about 10 cm/s. Each wheel has a practically identical load. It has no joints or springs, which helps to keep the amount of traction on each wheel the same. can maintain all 6 tyres on the ground while scaling over obstacles twice the size of the wheel. The bulk can virtually be lifted by one wheel alone. The centre of gravity's height determines the tilt stability, as it does for any suspension system. The suspension system utilised by the Mars rovers has been the Rocker-Bogie system. Nowadays, NASA favours this design.

2. Tank steering wheel mechanism-

Tanks turn by varying the speed of the tracks on one side, causing the tank to turn in the direction of the slower or stopped track or by turning the tracks in opposite directions. One track goes forward, the other in reverse. This can allow the tank to turn in place. Tanks and other continuous track vehicles can turn thanks to ank steering systems. The only way to steer is to speed up one track, slow down the other (or reverse it), or do both at once because the tracks cannot be angled in relation to the hull (in any operable design). By combining steerable wheels with fixed-speed rails, half-track vehicles avoid this. Early steering systems, which often used a clutch to decrease power to one track and slow it down, were adapted from tracked industrial vehicles. These designs have a number of drawbacks, especially while running fast or climbing hills, as the total speed slows due to the loss of power. A challenging design challenge is to provide electricity to both tracks while rotating them at various speeds. Regenerative steering is a term for a number of more sophisticated systems that were created, particularly during World War II. Regenerative steering maintains power to both tracks while steering. In some, a feature known as neutral steering enabled one track to advance while the other reversed, allowing the tank to spin in place. The British double differential design of 1924, which was imitated by both the US and Germany, was the first truly successful system.

We use these method by combine it because rocker bogie mechanism has suspension and tank steering wheel mechanism has turning mechanism. We use this principle to run the bogie. To get an torque and speed we use PMDC motor which is sufficient to run the bogie with the load capacity of 50 kg. It is also reduce cost of the project. If using BLDC motors, also give high speed and high torque; additional equipment like BLDC controller high voltage battery conversion unit is must be install which is increase overall budget of the project. The brain of the bogie is transmitter and receiver which use to take action which is required for operation. To control the bogie we had two options i.e. Motor controller or driver and relay modules. We take relay modules because we use low power motor and low voltage battery to operate system so it is sufficient.

3. Relay-

A relay is an electromechanical device that can be used to make or break electrical connections. It consists of flexible moving mechanical parts that can be electronically controlled via electromagnets. A relay is basically like a mechanical switch, but rather than being manually turned on or off, it can be controlled by an electrical signal. Also, this working principle of relays is only applicable to electromechanical relays. A core is wound with copper windings (forms a coil) on a casing. A moveable armature is made up of a spring support or stand-like structure linked to one end and a metal contact connected to the other, both of which are arranged above the core in such a way that when the coil is activated, it attracts the armature. The moveable armature is commonly seen as a common terminal to be linked to external electronics. The relay also has two pins, ordinarily closed and normally opened (NC and NO), with the normally closed pin connected to the armature or the common terminal and the typically opened pin left unconnected (when the coil is not energized).

A core with copper windings (forming a coil) is placed over the case. A moving armature consists of a spring support or

post-like structure connected at one end and a metal contact connected at the other end. All of these arrangements are arranged on the core in such a way as to attract the armature when the coil is energized. A movable armature is generally considered a common terminal that is connected to an external circuit. The relay also has two pins, normally closed and normally open (NC and NO), the normally closed pin is connected to the armature or common, and the normally open pin remains free (when the coil is not energized). if not). When the coil is energized, the armature moves and connects the normally open contacts until current flows through the coil. When the power is turned off, it moves to the home position.

Relays are used to control small loads of 15A or less. Electromechanical relays are commonly used in motor circuits to control the coils of motor contactors and starters. Other applications include switching solenoids, indicator lights, audible alarms, and small motors (1/8 HP or less). The relay's coil is energized by the low- voltage (12-V) source. Closing and opening the switch energizes and de-energizes the coil. This, in turn, closes and opens the contacts to switch the load on and off (small motors). So for that we use relays as controlling unit.

4. Motor controller-

A motor controller is a device that coordinates the operation of an electric motor. In man-made elevators, motor control generally refers to the device used in conjunction with the control panel or VFD to control the operation of the hoist. Engine controls often include manual or automatic means for starting and stopping the engine, selecting forward or reverse, accelerating or decelerating, and controlling other operating parameters. In addition, motor controllers can protect artificial lift systems by regulating or limiting torque and protecting against overloads and failures. Many motor controllers include additional functionality such as data acquisition, data logging, and application-specific control logic. Motor controllers accept power supply voltages and provide signals to motor drives, which are connected to motors. They are used to programmatically start, stop, and operate motors. Motor controllers can be used to gently start or raise the speed of a motor, to boost torque, or to reverse the motor's rotational orientation. They can also be utilised to minimise cost by employing thinner cable and reduced-amperage devices to regulate the motor. Controllers are employed owing to operating system requirements, installation constraints, or to enhance motor efficiency.

5. DC Double Pump Sprayer-

DC powered pumps transfer fluid in a number of ways by using direct current from a motor, battery, or solar power. Motorized pumps are commonly powered by 6, 12, 24, or 32 volts of direct current (DC). Photovoltaic (PV) panels with solar cells that create direct current when exposed to sunlight are used in solar-powered DC pumps. A 12 volt water pump is perfect for providing flowing water to a recreational vehicle (RV), towed camper, or powered camper. Its small size saves room in the limits of an RV's fairly limited interior. Most crucially, its capacity to be supplied by a standard 12 volt direct current (DC) automotive battery ensures flowing water regardless of where the RV is parked, whether near a municipal power supply or not. A 12 volt water pump is often positioned adjacent to the fresh-water holding tank in a standard RV. The pump is connected to an electrical panel, which is connected to a separate 12 volt battery or batteries. The 12 volt water pump is often equipped with two hoses, one for pulling water from the holding tank to the pump and the other for connecting the pump to the tap or faucet. When the pump is turned on at the panel, a little impeller in the pump suckers, or pulls, water from the tank and pushes it towards the tap.

Construction-

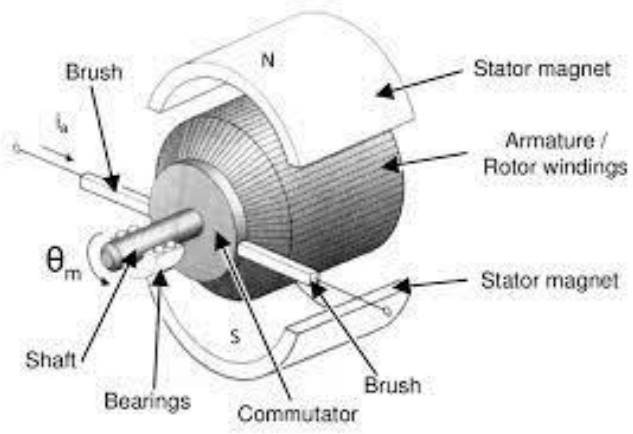

Fig-2.2 Brushed Motor

A brushed motor is a type of electric motor that uses brushes and a commutator to convert electrical energy into mechanical energy. It consists of a rotor (the rotating part) and a stator (the stationary part), which contains a set of electromagnets.

When an electric current is applied to the brushes, it flows through the commutator and into the coils of the rotor. This creates a magnetic field that interacts with the magnetic field of the stator, causing the rotor to rotate. As the rotor rotates, the brushes make contact with different segments of the commutator, which changes the direction of the current in the rotor coils and keeps the rotor spinning.

Brushed motors are simple and inexpensive, and can be used in a wide range of applications, such as in toys, power tools, and small appliances. However, they have some disadvantages, including limited lifespan due to the wear of

the brushes and commutator, lower efficiency compared to other types of motors, and the generation of electrical noise and sparks.

3. HARDWARE IMPLEMENTATION

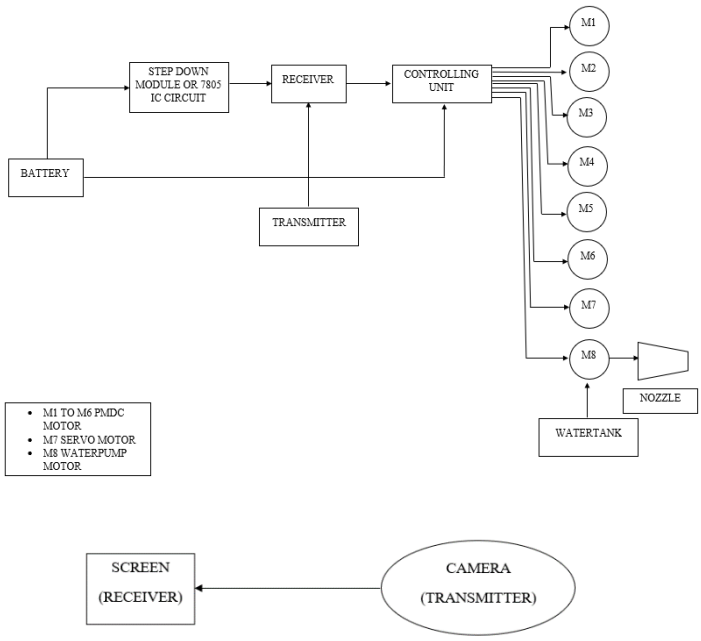

Fig.3.1 Block Diagram

The above diagrams represent the arrangement of fire fighting bogie. This bogie is use for where the particular area is fired up and any fire brigade van or fireman is unable to reach there. It basically the mini version of fire brigade van. It consist of battery which provide dc power supply to the all circuitry. Transmitter and receiver is use to send and receive the rf signal which bogie is operated by remote control also it it act as a brain. The heart of the system is controlling unit which taking signal by receiver and take action that which is required means which motor will be run. To drive the the bogie here 6 motors is available which pairly 2 is operated simultaneously. Remaining 2 motors is connected in middle to give torque for bogie. For visualization purpose the camera module is added which transmit the signal wirelessly and the video is shown by the mobile screen through the app. It gives visualization for where the bogie goes to extinguish the fire. The main purpose of this project is extinguish the fire using water sprayer which is possible by the water pump motor to throw the high pressurize water. To store the water the water tank is put in the bogie which carry maximum 20-30 liter water.

4. CONCLUSION

We try to build a real time fire fighting bogie which moves in a constant speed, identify the fire and then extinguish it with the help of pumping mechanism. This prototype is compact in size so it can use in small areas easily. Most of the time fire fighter to take risk to give life to common man to trap in fire .fire accident areas this areas fire fighter take time to reach their. So main purpose of project is to give a fire fighting van to people which they can afford at reasonable price and fire fighter van are fast available to fire accident.

5. FUTURE SCOPE

We can add electronic and programming devices for multi-purposes so we can operate firefighting bogie remote control and automatic. Since automatic fire fighting bogie can be made completely automatic by adding some additional components as well as installing GPS location to track live location. We can also add flame sensor then it can automatically detect the fire accident and do automatic extinction which can be also called as fir fighting robot. We can also add more protection to fire fighting bogie because there are electronic components in it. To make it at automatic we can add AI, so that it could be smart firefighting robot.

REFERENCES

[1] *Fire Fighting Robot*, Author- Pramod B. N., Hemalatha K. N., Poornima B. J., Harshitha R., Oct. 2019

[2] *Fire Fighting Robot*, Author- K. Shamili Devi, Akhileswar, Ch. Vinayaka, M. Karthik, Y. K. Viswanadham, July 2020

[3] *Fire Fighting Robot*, Authors- Nikita Kose, Chandrakala Khot, Mamta Bandhekar, Anshu Sahare, J. Shelke, Volume. 07 Issue. 2 Feb 2020

[4]*Design & Development Of Fire Fighting Robot*, Authors- Dnyanesh S. Kadu, Pooja V. Kale, Jeevan D. Kadam, Tejraj R. Late, Amol Suradkar Amol Suradkar, Volume. 07 Issue. 05 May 2020

[5]*Unmanned Multipurpose All Terrain Rover Using Rocker Bogie Mechanism*. Authors- Devi R, B. Dharrun, P. Gokul Raj, C. Gowtham, A.S. Kabilan, 02 August 2021.

[6]*Study Of Rocker-Bogie Typed Mobile Robot For Driving, Climbing And Standing Upright*. Author- Eunho Seo, Jooyoung Chun, Hunkeon Ko, Sangin Park, Dong Jin Hyun, 28 December 2021.