

# Design and Fabrication of Pneumatic Braking system with Speed Control

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## ABSTRACT

The aim is to design and develop a control system based on an intelligent electronically controlled automotive braking system called “Design and Fabrication of Pneumatic Braking system with Speed Control” it consists of Tachometer, Control Unit, Pneumatic breaking system. When the driver sets a desired speed limit the tachometer detects any increase above the set speed limit and uses the pneumatic braking system to apply sufficient braking to bring down the speed to the set limit, reducing mental and physical strain on the driver.

**Keywords :** Pneumatics, Braking, Speed Control, Reduced Strain, Heavy Transport Vehicle and Technology

## I. INTRODUCTION

We have pleasure in introducing our new project “Design and Fabrication of Pneumatic Braking system with Speed Control”, which is fully equipped by tachometer circuit and Pneumatic breaking circuit. It is a genuine project which is fully equipped and designed for heavy duty automobile vehicles. This forms an integral part of the project where it can be applied to any heavy duty vehicles without any change to the existing system.

The pneumatic braking system can reduce the vehicle’s speed to its set limit within 2 to 3 seconds of running. The intelligent breaking system is a fully automated project.

This is an era of automation where it is broadly defined as replacement of manual effort by mechanical power in all degrees of automation. The operation remains an essential part of the system although with changing demands on physical input as the degree of mechanization is increased.

## II. METHODS AND MATERIAL

### A. Methodology

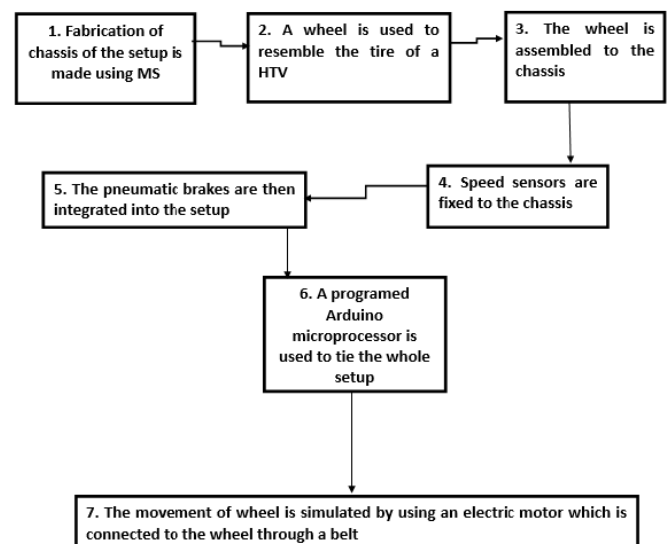


Fig 2.1 Methodology

The base or frame of the system was made with mild steel as it was light and strong enough to hold all the components while also keeping the vibrations created to a minimum. To represent the rotation of the HTV wheel a normal scooter wheel was used. A typical HTV system pneumatic system was used after careful consideration and observation. Speed sensors or

tachometer was integrated into the frame of the system. The control unit was programmed and required connections to it were made. To simulate the rotation of the wheel an electric motor was used.

### B. Components Used

- Control Unit (Arduino Uno)
- Pneumatics
- Brake Arrangement
- Solenoid Valve
- Flow Control Valve
- Pu Connector, Reducer, Hose Collar
- Frame
- Single Phase Induction Motor

Control Unit is the brain of this system which controls the pneumatics , flow control valve and receives signal from the tachometer. It is used to detect the increase in speed from the wheel and allow for air to pass through the flow control valve , into the pneumatics.

One of the main features of this system is its cheap and easy to install. Thus in order to keep this feature this system is designed in a way there is no change needed to the pneumatics of the vehicle. The only change is the addition of the control unit and speed sensors (tachometer).

### III. RESULTS AND DISCUSSION

The project was designed and fabricated according to the mentioned specifications. The initial tests performed on the fabricated project worked wonderfully. The functionality of the project was achieved which was to reduce the speed of the vehicle and not stop it completely , which was achieved with slight tweaking to the software and the position of the pneumatics.

There were 5 tests done on the fabricated machine which proved to us that the model worked according to design and functional specifications.

Due to the recent pandemic no further tests could have been performed on the model and thus some aspects of the model are still to be tested out and unidentified issues are still to be rectified. There were no calculation done on the model , therefore identifying working of few key components are yet to be determined.

### A. Working

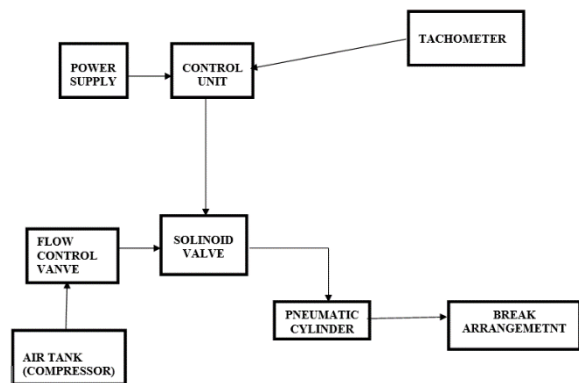


Fig 3.1 Working Block Diagram

The block diagram depicts the working of the system. The tachometer continuously sends the speed of the wheel to the control unit. When the driver sets his required speed limit the control unit monitors for any increase in the speed of the wheel . When the speed increases the control unit sends a signal to the actuator which controls the flow of air into the pneumatic braking system. This actuator allows enough pressure to reduce the speed of the vehicle but not stop the vehicle

This project is designed to reduce stress of drivers of heavy duty vehicles. Keeping this in mind the project makes the use of already available systems in the vehicle to help integrate this equipment easily. The use of pneumatic brakes in the vehicle is important as pneumatics use atmospheric air to control the braking

system, which reduces the force required to apply the brakes. When the driver of the vehicle decides he needs to maintain a certain speed limit, be it for docking , toll plaza or even to maintain the speed limit of the road all he needs to do is set the speed limit to his liking. The wheel speed sensors (Tachometer) which will always be monitoring the speed of the wheel, sends its information to the programed control unit (Arduino Uno) which monitors the speed of the vehicle and checks if any limit has been set by the driver. When a limit is set and the vehicle is moving above the set limit the control unit also connected to the actuator, sends the signal to the actuator which is intern connected to the control valve. This control valve is the main part of the pneumatic braking system which regulates the flow of air into the pistons. This control valve has an input connection from the air tank/reservoir ,which holds compressed air from the air compressor. When the speed limit is crossed the actuators are activated opening the control valve and slowly reducing the speed of the vehicle back to the set limit. The system then resets and the whole cycle is repeated if the limit is crossed.

### B. Scope of Future Work

This project hold a strong ground for future work. Some key parts of the projects can be worked on in the future to check for usability in the market. Some of the tests could not be performed due to the pandemic and thus are included in the scope of future works. Some of the key areas where future work can be done is listed as below

- The effects of this system on the brake pads of the vehicle. From a general perspective this system would have a large impact on the longevity of the brake pads , as brake pads are the active component in this project keeping the vehicle's speed on the set limit.
- Tests on higher RPMs and high speed can be done. Due to the costs involved in using powerful

motors to achieve high RPM and high speed they couldn't be performed.

- Use of better pneumatic equipment for more sensitive and accurate reduction of speed. The use of better two way pneumatic pistons for faster engage and disengage of braking. Use of a better control valve.
- The software of the system can be updated to get better results. The control unit which is the Arduino Uno can be programed better to help with lowering of wear of brake pads , it can also help with more accurate and precise braking and integrating some sort of ABS module into the system will surely help with smooth application of braking.

### C. Advantages and Disadvantages

#### Advantages

- Maintaining constant speed.
- Provides relief for the driver mentally and physically.
- Less use of the brake pedal by the driver while docking and at toll plazas.
- This system can be used against over speeding
- This system can be used to maneuver through tough , high stress roads like canyons, muddy roads, uphill climbs and downhill descends there by avoiding any accident
- Cost of the system is cheap if the vehicle already has a pneumatic braking system.

#### Dis-Advantage

- Wearing of the break-pads increases therefore, the need to change them also increases.

### IV. CONCLUSION

This project has helped us to showcases our capabilities by providing a great opportunity and showcase our experience and knowledge that we gained form our academies. We gained a lot of practical and theoretical knowledge by reading the

many articles and journals papers related to our topic. Which made to understand the concepts related to pneumatic brakes.

We gained knowledge on planning, purchasing , assembling , machining and manufacturing while doing this project. We tried to eliminate the problems faced by truck drivers on their day to day routine on the road. By doing so we hope to ease their mental and physical pain of the truck drivers.

We are proud to complete this project with the limited time and limited sources that was available to us. The project “**Design and Fabrication of Pneumatic Braking system with Speed Control**” is going on with satisfactory condition, also justifies its functionality. Few trials were done inially to check the functionality of the model. But due to the pandemic, calculations was not complete. We realize the need for tolerance and quality which play an important role in manufacturing a product. With few changes and adjustments this project could see the market in the coming future.

## V. REFERENCES

We would like to thank these authors for their help in making this project come to life. Without their papers and insight into this field , I would like to believe this project would not come to life. The only way I can thank these authors is by adding them as my reference.

- [1] A Microprocessor System of Automatic Control by pneumatic Braking of Freight Long Trains.O. E. Pudovikov and S. A.
- [2] Pneumatic Brake Control for Precision Stopping of Heavy-Duty Vehicles. Fanping Bu+, Han-Shue Tan
- [3] Fabrication Of High Speed Indication And Automatic Pneumatic Braking System P.Balashanmugam1 , K.Balasubramaniyan2 , G.Balasubramaniyan3 ,S.Vinoth4 1Assistant

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- [4] Microcontroller based automatic vehicle over speed indication and controlling system
- [5] Over speed indication and accident prevention system. Prof. V.V.khadakkar 1 , Prof. S.M.Awhale 2 , Prof. V.V. Brokar 3 1,2,3Lecturer in Mechanical Engineering Department CSMSS college of Polytechnic, Aurangabad.
- [6] Automatic Brake Failure Indicator and Over Heating Alarm Dr.N.Venkatachalapathi1 , V. Mallikarjuna2 Professor and Head1 , Assistant Professor2 Department of Mechanical Engineering, Annamacharya Institute of Technology & Science, Rajampet, A.P – India.
- [7] Design and Analysis of Intelligent Braking System Mr. Tushar Kavatkar1 Mr. Harshal Salvi2 , Mrs. Minal Rahate3 1,2Assistant Professor, 3Lecturer 1,2Department of mechanical Engineering, Finolex Academy of Management & Technology, Ratnagiri, 415639 3Department of Electronics & Telecommunication Engineering, Rajendra Mane Polytechnic Devrukh, Ratnagiri, 415639

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