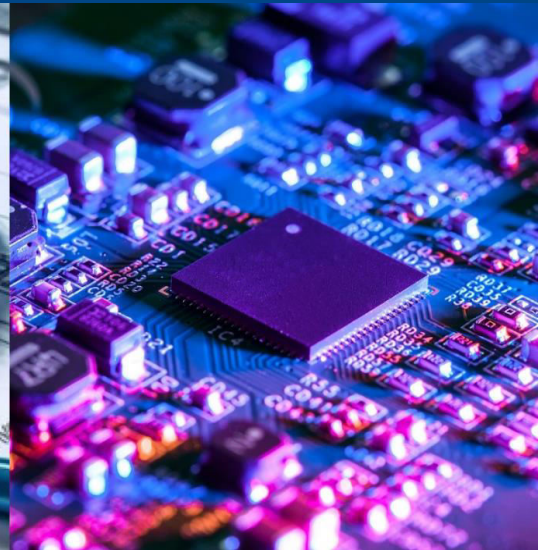
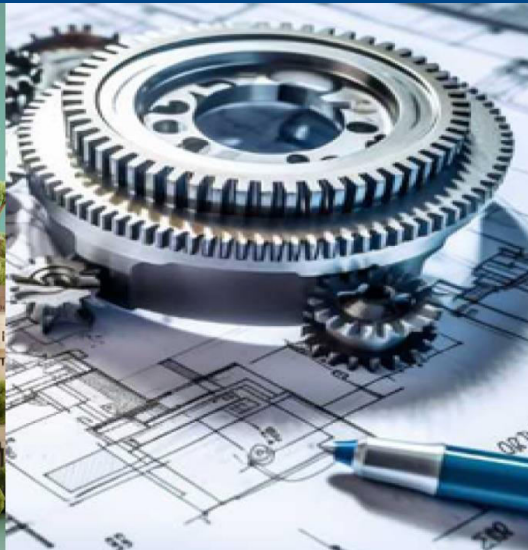
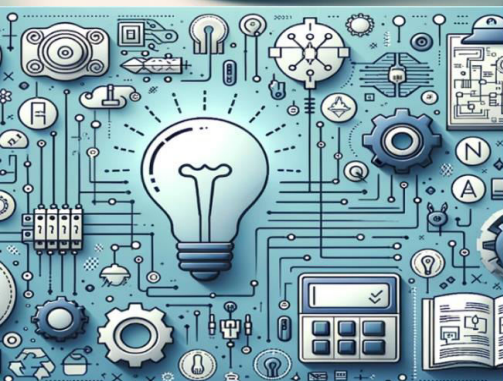




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Design and Development of Automatic Seat Belt Integrated Safety Brake System

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ABSTRACT: It observed that the people who drive the vehicle other than metro cities like. Village Area generally not use seatbelt compulsory. It is breaking the traffic rules also will Have safety problem of driver of car as well as passenger. To overcome this problem & to compulsory use of seatbelt we will make this system for driver safety. The Statement of project is “design & development of automatic seatbelt integrated Safety parking brake system” for used in safety of automobile. The main purpose of This project is to ensure drivers safety through a modified handbrake in car. A Handbrake is an additional braking mechanism installed on all commercial vehicles That's completely separate from foot pedal -operated in cars the parking brake, also Called hand brake, emergency brake, or brake, is a latching brake, usually used to Keep the vehicle stationary. Most commonly used to prevent the vehicle from rolling When it is parked. Automobile hand brakes consist of a cable directly connected to The brake mechanism on one end and to a lever at the driver's position. Using your Handbrake to stop a moving car can damage the brake system. The statement of Project is design & fabrication of safety parking brake for used in safety brakes of Automobile. The main benefit of this system is that passenger/driver safety, if you Don't use seatbelt the vehicle handbrake dose not remove for safety. This system Reduces the extra efforts during operation of handbrake removal at the time of Starting of vehicle braking system. It performs the most rigid operation with safe Braking system at the time of starting & stopping of vehicle.

KEY WORDS: Handbrake, pneumatics, automation,

I. INTRODUCTION

The main purpose of this project is to ensure drivers safety through a modified handbrake in car. A handbrake is an additional braking mechanism installed on all commercial vehicles that's completely separate from foot pedal -operated in cars the parking brake, also called hand brake, emergency brake, or brake, is a latching brake, usually used to keep the vehicle stationary. Most commonly used to prevent the vehicle from rolling when it is parked. Automobile hand brakes consist of a cable directly connected to the brake mechanism on one end and to a lever at the driver's position. Using your handbrake to stop a moving car can damage the brake system.

Pneumatics is a section of technology that deals with the study and application of pressurized gas to produce mechanical motion. Pneumatic systems that are used extensively in industry and factories are commonly plumbed with compressed air or compressed inert gases. This is because a centrally located and electrically powered compressor, that powers cylinders and other pneumatic devices through solenoid valves, can often provide motive power in a cheaper, safer, more flexible, and more reliable way than a large number of electric motors and actuators. Pneumatics also has applications in dentistry, construction, mining, and other areas. Welding, superior insulating qualities and design versatility. Simplicity of design and control - Machines are easily designed using standard cylinders and other components, and operate via simple on-off control. Reliability- Pneumatic systems generally have long operating lives and require little maintenance. Because gas is compressible, Equipment is less subject to shock damage. Gas absorbs excessive force, whereas fluid in hydraulics directly transfers force. Compressed gas can be stored, so machines still run for a while if electrical power is lost.

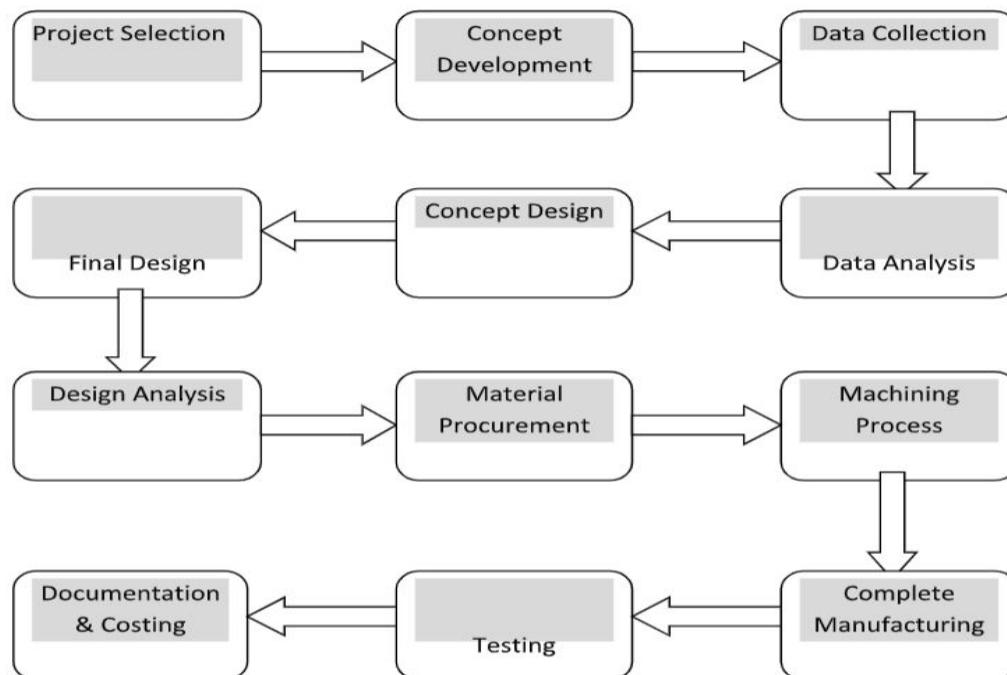


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1.1. Methodology & steps to solve the problem:

The below flow chart shows the sequential operation/steps that will be performed during the project process.



In this chapter introduction of the project as well as the problem definition are discussed. To solve all the problems discussed above we are producing a new machine, as our project under this topic in our academic year 2024 – 2025 are preparing a working scale model of this system. We have proposed a methodology to solve the problems. Our methodology is divided in different parts, under different titles. Sequence of proposed methodology is as follows –

1. Proposed Methodology 1 – Basic Information & Literature survey.
2. Proposed Methodology 2 – Design of system Components.
3. Proposed Methodology 3 - Selection of Components for system.
4. Proposed Methodology 4 – Fabrication of system parts.
5. Proposed Methodology 5 – Assembly, Testing & Documentation of system.

II. CONSTRUCTION

It consists of mainly;

2.1. Frame:

The frame is of MS material. The frame of our machine is basically used to support the all components of system.

2.2. Double acting cylinders:

Cylinders are linear actuators which convert fluid power into mechanical power. They are also known as JACKS or RAMS. Hydraulic cylinders are used at high temperature and produce large forces and precise movement. For this reason, they are constructed of strong materials such as steel and designed to withstand large forces. Because gas is an expensive substance, it is dangerous to use pneumatic cylinders at high pressures so they are limited to about 10 bar pressures. Consequently, they are constructed from lighter materials such as aluminum and brass. Because gas is a compressible substance, the motion of a pneumatic cylinder is hard to control precisely. The basic theory for hydraulic and pneumatic cylinder is same. Parameters consider during the design of cylinder.



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Fig.2.1. Double acting cylinder.

2.3. Pneumatic pipe fittings:

Pneumatic tubing is also available in a number of other materials both with and without reinforcement for use in standard applications. SMC fittings incorporate a positive tube seal while the fitting is under pressure which allows polyurethane tubing to be used. This can be used for connection of pneumatic system with assemble.

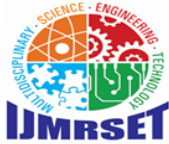


Fig.2.2. Pneumatic hoses and fittings.

2.4. Hand brake set:



Fig.2.3. Hand brake set.



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2.5. Seat belt and lock clamp:



Fig.2.4. Seat belt lock.

2.6. Solenoid type 5/2 dc valve:

A valve is a device that regulates the flow of fluid (gases, liquids, fluidized solids or slurries) by opening and closing or partially obstructing passage ways. A 5/2 way directional valve from the name itself has 5 ports equally spaced and 2 flow positions. It can be used to isolate and simultaneously bypass a passage way for the fluid which for example should retract or extend a double acting cylinder. There is variety of ways to have this valve actuated. A solenoid valve is commonly used, a lever can be manually twist or pinch to actuate the valve, an internal or external hydraulic or pneumatic pilot to move the shaft inside, sometimes with a spring return on the other end so it will go back to its original position when pressure is gone, or a combination of any of the mention above.



Fig.2.5. 5/2 Solenoid valve.

III. WORKING

The inlet port of the 5/2 pneumatic Solenoid valve is been connected to the compressor, The 5/2 valve is been integrated within the seat belt locket in such a way that the seat belt end activates the push button, Double acting cylinder is been clamped along the body of the hand brake. The end of the piston rod is bolted with the clamp connecting with the hand brake A Solenoid valve type pneumatic valve is being integrated within a seat belt locket. When the seat belt is been locked it activates the Solenoid valve. By this pneumatic cylinder is been activated. The pneumatic cylinder is been welded with the clamp connected with the hand brake lever. During the forward stroke of the piston the lever of hand brake is been pushed down and the brake is released. On return stroke the lever is brought to its initial position and the brake is engaged. The Fig.3.1. Shows the circuit diagram of the set up.



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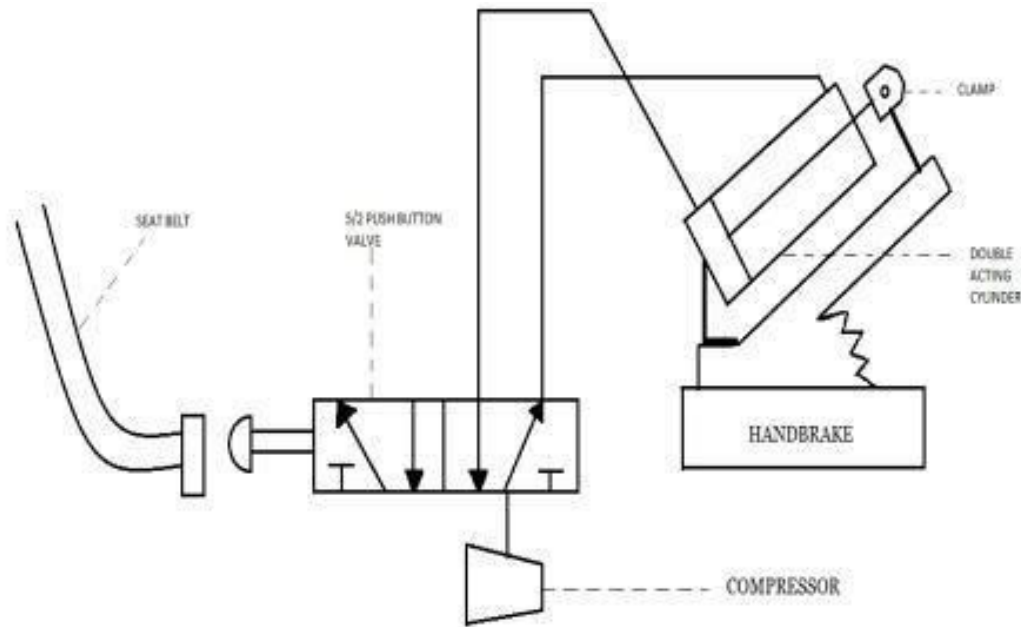


Fig.3.1. General Layout of seatbelt activated hand brake.

IV. ADVANTAGES, LIMITATIONS AND APPLICATIONS

4.1. Advantages: -

- 1) The safety of driver is ensured.
- 2) Manual effort in engaging the hand brake is reduced.
- 3) Both seat belt wearing and brake release is done in single operation.
- 4) The cost of brake modification is low.
- 5) The operation of the new system is well controlled.

4.2. limitations-

1. Pneumatic actuators are suitable for only low payload capacity machine.
2. Pneumatic actuators have low power to weight ratio.
3. The operation of actuators & motor clean but noisy.
4. Constant monitoring is required to avoid the air leakages.

4.3. Application: -

- 1) It is used for handbrake of commercial vehicles like Car, Buses & Trucks automation system.

V. CONCLUSION

Conclusion:

The development of an automatic seat belt integrated safety brake system represents a significant step toward enhancing vehicle safety. By combining seat belt engagement with automatic braking, this system ensures that both primary passive and active safety measures are simultaneously activated during critical moments. The design successfully addresses the delay between driver response and system activation, helping to minimize injury risks and reduce accident severity. The integration of sensors and control units allows real-time monitoring and swift decision-making, improving the overall effectiveness of safety mechanisms. Future advancements can focus on refining sensor accuracy, reducing system complexity, and integrating this solution with emerging autonomous vehicle technologies to further enhance road safety.



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REFERENCES

1. Prasad.P.S, Design of Seatbelt Activated Handbrake System In Cars, International Journal of Mechanical And Production Engineering, ISSN: 2320-2092, Volume- 2, Issue-10, Oct.-2014,pp.53-55.
2. S. Ekinovic A, E. Saric B, Optimisation of the composing part of hand brake Mechanism, Journal of Achievements in Materials and Manufacturing Engineering,VOLUME 24 ,ISSUE 1 September 2007,pp.208-211.
3. William K. Lennon and Kevin M. Passino, Intelligent Control for Brake Systems ,IEEE Transactions On Control Systems Technology, Vol. 7, No. 2, March 1,pp.188-202.
4. Sanjay B S, Sunil M K, Akhilesh P, Nataraj G & Sunil Kumar B., Design and Fabrication of Automatic Hand Braking System, IJSRD – International Journal for Scientific Research & Development| Vol. 5, Issue 04, 2017 | ISSN (online): 2321-0613,PP.729-731.
5. Rohan E. Dalvi, Ramesh G. Sutar, Prashant H. Karke & Jitendra B. Satpute, Design and Development of Hand Brake Release System, GRD Journals- Global



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