Final Year Project Showcase Batch-2020
Year 2024

	Department: Automotive and Marine Engineering Department Programme: Automotive Engineering
1	**Project Title:** Design and Development of a Prototype Electromagnetic Braking System for an Automobile
2	**Project Idea:** The project aimed to design and develop a functional prototype of an electromagnetic braking system as an alternative to traditional friction brakes in automobiles. The project explored the feasibility of Using electromagnetic forces to decelerate a vehicle, beginning with a small-scale model for conceptual understanding, followed by detailed calculations, and the creation of a 1:20 scaled-down prototype.
3	**Process:** • **Initial Exploration**: Created a small model using a motor, aluminum foil as a disk, and a hand-woundelectromagnet to understand the basic principles. • **Calculations:** Detailed theoretical calculations to determine the necessary braking force for the system, both forthe initial model (prototype) and for a real car. • **Design:** Developed CAD models to visualize the integration of the system into a full-sized vehicle. • Prototype Development: Built a 1:20 scaled-down prototype incorporating the electromagnetic braking system. • **Testing and Evaluation:** Conducted performance tests on the prototype, analyzing braking times and systemeffectiveness.
4	**Outcome:** Successfully demonstrated the viability of an electromagnetic braking system with a working prototype.The project showed potential for application in real vehicles, offering a new avenue for braking technology that couldreduce wear, improve efficiency, and provide a safer alternative to traditional systems.
5	**Evidence (Theoretical Basis):** The project compares the traditional friction braking system with an electromagnetic braking system. Calculations show that the traditional system provides a braking force of **1.28 kN** per wheel, while the electromagnetic system delivers **3.84 kN** with a Factor of Safety (F.O.S.) of **3**. For the 1:24 scaled prototype, the traditional braking force is **54 N**. The electromagnetic system in the prototype Generates **165 N** with **241 turns** of wire, resulting in an F.O.S. of **3.07**, confirming the design's effectiveness and safety.
6	**Competitive Advantage or Unique Selling Proposition** (Cost Reduction, Process improvement,Attainment of any SDG (Sustainable Development Goal), 1. **Cost Reduction:** Maintenance Costs: Electromagnetic brakes typically have fewer moving parts compared to traditional braking systems, leading to lower wear and tear. This results in reduced maintenance costs and a longer lifespan for the braking system. Energy Efficiency: In certain designs, electromagnetic brakes can contribute to energy recovery systems, reducing overallenergy consumption. 2. **Process Improvement:** Enhanced Safety: Electromagnetic braking systems offer smoother and more controlled

	braking, which can significantly improve vehicle safety. This is particularly valuable in high-speed or heavy-duty applications where traditional brakes may not perform as efficiently. Precision Control: The system allows for more precise braking control, especially in automated and smart vehicle systems, improving overall vehicle performance.
a	**Attainment of any SDG** : SDG #9, (Industry, Innovation, and Infrastructure): The development of an electromagnetic braking system aligns with SDG 9 by fostering innovation in the automotive industry. It represents a step toward more advanced and sustainable transportation technologies. SDG# 11, (Sustainable Cities and Communities): By improving the safety and efficiency of vehicles, this system contributes to the development of sustainable urban transport systems, which is crucial for creating safer and more resilient communities. SDG# 12, (Responsible Consumption and Production): The energy efficiency and reduced material waste associated with electromagnetic braking systems promote more responsible production and consumption patterns in the automotive industry.
b	**Any Environmental Aspect:** **Energy Efficiency and Carbon Reduction** The electromagnetic braking system reduces reliance on traditional friction brakes, leading to less wear and tear. This results in lower energy consumption and reduced carbon emissions, contributing to a cleaner environment.
c	**Cost Reduction of Existing Product:** The electromagnetic braking system minimizes the wear on traditional brake components, leading to lower maintenance costs over time. This cost efficiency makes it a valuable alternative to conventional braking systems.
d	**Process Improvement which Leads to Superior Product or Cost Reduction, Efficiency Improvement of the Whole Process** (e.g. What is the issue is current process and what improvement you suggests) **Current Issue** Traditional braking systems, such as hydraulic brakes, rely on friction between brake pads and discs to stop vehicles. These systems are prone to wear and tear, leading to frequent maintenance, reduced efficiency over time, and potential safety risks due to brake fade during prolonged use. Additionally, the energy generated during braking is typically lost as heat, contributing to inefficiency in energy management. **Improvement** Reduction in Wear and Tear: Electromagnetic brakes operate using magnetic fields to generate braking force, eliminating the need for physical contact between components. This greatly reduces the wear and tear on the braking system, lowering maintenance costs and extending the lifespan of the braking components. Energy Recovery: Electromagnetic braking systems can be integrated with regenerative braking systems, which convert the energy generated during braking into electrical energy. This energy can be stored in batteries and reused, leading to improved energy efficiency and reduced fuel consumption in electric and hybrid vehicles.
e	**Expanding of Market share** (e.g. how it expand and what is the problem with the current market Electromagnetic braking systems are not yet widely adopted in the automotive industry due to their relatively higher upfront costs and the dominance of traditional hydraulic braking systems. This limits the market share for manufacturers of electromagnetic brakes. Existing vehicle designs are primarily tailored for traditional braking systems. Retrofitting or integrating electromagnetic brakes into these designs can be challenging, which may deter manufacturers from adopting this technology.

7	**Target Market** The primary market includes automotive manufacturers looking for innovative braking solutions, Especially those focused on electric and hybrid vehicles. Secondary markets may include industries involved in heavy machinery and transport vehicles, where brake wear and maintenance are significant concerns.	
8	**Team Members** (Names alongwith email address)	Muhammad Uzair Akhtar Siddiqui (siddiquiuzair553@gmail.com) Shazad Ali Arbaz Khan Adeeb Sikandar
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11	**Video (If any)**	Please provide the link of the video

Pictures (to be pasted below