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THE SPARK

Igniting Innovations

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

DEC 2024

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (A)
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

Inside

ACHIEVEMENTS

Congratulations!
On your well deserved achievements.

- Dr. Naga Kota Reddy Chegireddy and Dr. Sai Babu Choppavarapu were honored with the Best Paper Presentation Award for their outstanding work at the IEEE-sponsored International Conference on Recent Trends in Microelectronics, Automation, Computing, and Communications Systems (ICMACC-24), held from December 19-21, 2024, at VNR Vignana Jyothi Institute of Engineering and Technology, Hyderabad.

- Ms. M. Anusha (24021A0226) secured a gold medal in skating at the state meet held in November 2024, Kakinada, showcasing remarkable talent and dedication. Previously, she earned a silver medal in skating at the 2021 National Championship in Mohali, Punjab, further highlighting her exceptional skills and commitment to excellence.

- Ms. Killana Kavya (24025A0256) has been selected for the national-level competition under the theme “Tech for Viksit Bharat: Transforming Agriculture.” She participated in the state-level competition conducted by APSCHE at Acharya Nagarjuna University on 31st December 2024, after excelling in earlier phases including a quiz and essay competition. She will now represent at the final phase on 11th and 12th January 2025 at Bharat Mandapam, New Delhi, as part of National Youth Day, with Honorable Prime Minister Shri. Narendra Modi as the Chief Guest.

- Mr. Upadasta V S Satya Sri Vatsa (210221A0238) has been offered with Project Traineeship at Tata Advanced Systems Limited in Bengaluru. In project training, he was selected in “Testing” department to get trained from Jan 06, 2025 to March 18, 2025.

Mr. Upadasta V S Satya Sri Vatsa
(210221A0238)

REVOLUTIONIZING E-MOBILITY: A LEAP TOWARDS PEDAL-FREE STEERING SYSTEMS

The automotive industry has entered an exciting era where technological innovations reshape how we experience driving. This newsletter dives into a groundbreaking advancement in electric vehicle (EV) design—a steering-integrated control system that eliminates traditional pedals. By merging brake and acceleration controls with the steering mechanism and implementing x-by-wire technology, we present an ergonomically superior, lightweight, and efficient system. This innovation not only reduces weight but also paves the way for enhanced accuracy, safety, and adaptability, bringing us closer to the future of autonomous and inclusive mobility.

HISTORY

The journey of steering systems has been a fascinating saga, marked by relentless engineering advancements:

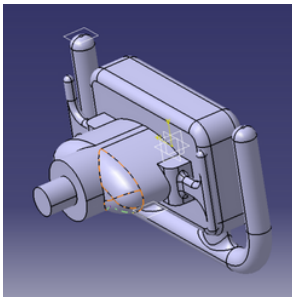
1. Manual Steering (Early 1900s):
Vehicles were steered using a direct mechanical linkage, requiring considerable effort from the driver. These systems were robust but lacked precision and ease of operation.

2. Hydraulic Power Steering (1940s):
Hydraulic power-assisted steering reduced driver effort significantly. However, its heavy weight and energy inefficiency became drawbacks as automotive technology advanced

3. Electric Power Steering (EPS) (2000s):
EPS introduced lighter and more energy-efficient steering mechanisms. This paved the way for partial automation, offering improved driver assistance and adaptability for various vehicle designs.

4. Steer-by-Wire (SBW):
The modern SBW systems eliminated mechanical linkages, replacing them with electronic controls. While they reduced weight and improved performance, issues such as sensor inaccuracies and dependency on redundant systems persisted.

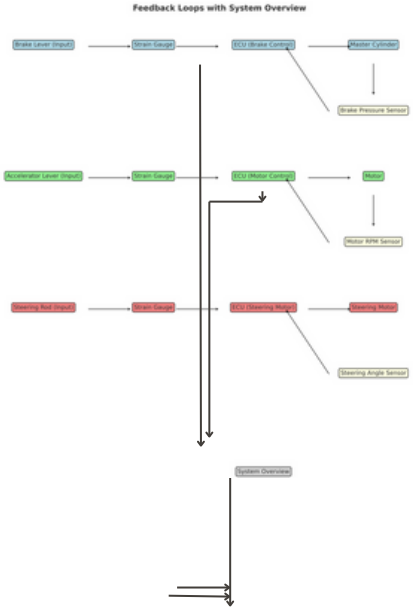
Our model takes inspiration from SBW while introducing an innovative approach to further enhance accuracy, ergonomics, and weight efficiency.



OUR MODEL: THE PEDAL-FREE STEERING REVOLUTION

Imagine a car without pedals—a system where braking and acceleration are entirely controlled by levers integrated into the steering wheel. Our design offers:

1. Structure and Shape:
   - The steering wheel is equipped with two pull levers:
     - Left Lever: Controls braking intensity.
     - Right Lever: Manages acceleration.
   - Pulling the levers towards the driver increases the corresponding braking or acceleration force, while releasing them decreases it.
2. Integration of Acceleration and Brake:
   - Sensors mounted within the steering assembly detect the intensity of the lever pull.
   - The data is processed by an advanced ECU (Electronic Control Unit) that controls the braking system and motor output with



TECHNICALITIES

Our system's hallmark lies in its innovative use of strain gauge technology and feedback loops, ensuring precision and reliability. Here's a deeper dive:

Strain Gauge Technology and Derivation

Strain gauges operate based on the principle of material deformation under stress. This deformation, though minute, is accurately measured as a change in resistance. The strain gauge equation is derived as follows:

1. **Basic Formula for Strain:**
   Strain (ε) is the ratio of change in length to the original length:
   $$\varepsilon = \frac{\Delta L}{L}$$
2. **Hooke's Law Relation:**
   For elastic materials:
   $$\varepsilon = \frac{\sigma}{E} \quad \text{where} \quad \sigma = \frac{F}{A}$$
   F: Applied force, A: Cross-sectional area, E: Young's Modulus.
3. **Change in Resistance (ΔR):**
   The strain gauge's electrical resistance changes in proportion to the strain:
   $$\Delta R = R \cdot k \cdot \varepsilon$$
   R: Original resistance, k: Gauge factor (a material constant).

This allows the system to precisely measure lever inputs, converting physical strain into electrical signals, which are processed by the ECU.

Feedback Loops: Ensuring Real-Time Adjustments

The integration of feedback loops in our design improves system responsiveness and ensures real-time adjustments. Here's a closer look at the core loops:

1. Brake Feedback Loop:
   - Input: Signal from the brake lever (strain gauge).
   - Process: ECU calculates hydraulic pressure needed and adjusts the master cylinder.
   - Feedback: Sensors measure actual brake pressure, sending data back to the ECU to correct discrepancies.
2. Acceleration Feedback Loop:
   - Input: Signal from the accelerator lever (strain gauge).
   - Process: ECU determines required motor torque and adjusts accordingly.
   - Feedback: Motor RPM sensors report back to the ECU, ensuring torque matches the input signal.

Block Diagram for Feedback Loops

Below is a simplified representation of the feedback loops for braking and acceleration.
System Block Diagram:

1. Inputs:
   - Brake lever and accelerator lever signals.
   - Strain gauge outputs proportional to lever pull intensity.
2. Process:
   - ECU processes input data and determines control outputs for the master cylinder and motor.
3. Outputs:
   - Adjusted braking pressure and motor torque.
   - Feedback sensors send real-time data to refine the output.

ANALYSIS

Weight Reduction Recap

By replacing conventional pedals and mechanical linkages with x-by-wire technology, significant weight reduction is achieved.

Component	Conventional EV (kg)	Steer-by-Wire EV (kg)	Our Model (kg)
Brake Pedals and Linkages	8	5	0
Accelerator Pedals and Linkages	6	4	0
Sensors and Electronics	3	2.5	2
Total Weight	**17 kg**	**11.5 kg**	**2 kg**

Efficiency Improvements

The reduced weight directly impacts the energy efficiency and mileage of the vehicle. Here's how:

1. **Energy Consumption Reduction:**
   In electric vehicles, energy consumption (E) is proportional to the vehicle's weight (W) and drag force (F):

$$E = W \cdot F$$

   With an 88% weight reduction in our model compared to conventional systems, energy consumption decreases proportionally.

2. **Mileage Improvements:**
   EV mileage is inversely related to the vehicle's weight:

$$\text{Mileage (km/kWh)} = \frac{\text{Battery Capacity (kWh)}}{\text{Energy Consumption per km (kWh/km)}}$$

   With the reduced energy consumption due to weight savings, the mileage of the vehicle improves.

   Example Calculation:

   - Conventional EV: 5 km/kWh.
   - Steer-by-Wire EV: 6.5 km/kWh.
   - Our Model: **7.5 km/kWh**, showing a 15% improvement over Steer-by-Wire systems and a 50% improvement over conventional systems.

Result

The innovations in our design lead to measurable improvements in performance and efficiency.

Feature	Conventional Vehicle	Steer-by-Wire System	Our Model
Control Mechanism	Pedal-based	Electronic steering + pedals	Steering-integrated levers
Accuracy	Moderate	High	Very High (strain gauge)
Weight (kg)	17	11.5	2
Energy Efficiency (km/kWh)	5	6.5	7.5
Driver Ergonomics	Foot and hand coordination	Improved	Maximum comfort (hands only)

CONCLUSION

The automotive industry is on the cusp of a paradigm shift, where every innovation aims to improve efficiency, sustainability, and accessibility. Our steering-integrated control system represents a bold leap forward in this evolution, addressing key challenges faced by traditional and modern electric vehicle designs.

Comparison with Existing Models

1. Conventional Vehicles with Mechanical Pedals:
   - These systems rely heavily on mechanical linkages, which add significant weight and complexity.
   - Drivers need to coordinate hand and foot movements, making the system less ergonomic and less inclusive for people with limited mobility.
   - Accuracy in such systems is limited due to wear and tear over time.
2. In contrast, our model eliminates mechanical linkages entirely, significantly reducing weight (by 88%) and improving driving comfort through an all-hands interface.
3. Steer-by-Wire Systems:
   - While SBW systems replace some mechanical components with electronics, they still retain traditional pedals for braking and acceleration.
   - Sensor inaccuracies in SBW systems can lead to suboptimal responses, requiring redundant systems for safety.
4. Our design outperforms SBW systems by integrating braking and acceleration into the steering wheel, reducing system complexity and achieving superior accuracy through strain gauge technology. Weight savings of 82.6% compared to SBW vehicles further enhance energy efficiency.
5. Autonomous Vehicle Prototypes:
   - Autonomous prototypes often incorporate electronic control systems but require extensive hardware and software redundancies to ensure safety.
   - These systems prioritize automation over manual ergonomics, making them less versatile for semi-autonomous or manual operation.
6. Our model bridges the gap by offering a hybrid solution: it maintains manual control while being fully adaptable for autonomous applications, thanks to its x-by-wire foundation and feedback loops.

The Future of E-Mobility

Our pedal-free design introduces a new dimension of inclusivity and ergonomics, ensuring that drivers with mobility challenges or disabilities can operate vehicles effortlessly. The integration of strain gauges not only improves measurement accuracy but also future-proofs the system for advancements in autonomous driving technologies.

Furthermore, the substantial weight reduction directly impacts energy efficiency, extending EV mileage by up to 50% compared to conventional vehicles. This improvement reduces battery load, leading to longer battery life, fewer recharges, and a smaller carbon footprint making EVs even more sustainable.

Our model is a testament to the power of engineering innovation. It combines the best aspects of existing systems precision, adaptability, and efficiency—while introducing transformative elements that redefine the driving experience. As the industry progresses toward fully autonomous and eco-friendly vehicles, this system lays the foundation for safer, smarter, and more accessible e-mobility solutions.

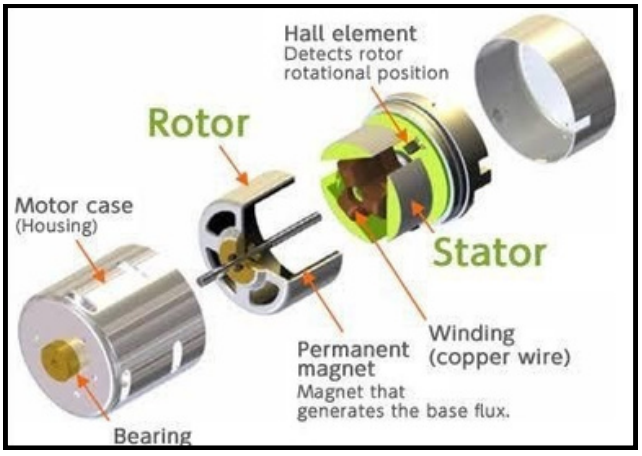
In summary, this innovation is not just a step forward; it's a leap toward a new era of transportation, where every component is optimized for performance, sustainability, and inclusivity. Our model sets a benchmark, inviting the automotive industry to rethink and reimagine how we interact with our vehicles.

Written by
T R S KARTHIK (21021A0248)

BRUSHLESS DC MOTOR

A Brushless DC Motor (BLDC), also known as a electronically commutated motor (ECM) , is an electric motor that operates without brushes and a commutator. Instead of using brushes and a commutator to control the flow of current to the motor's windings, a BLDC motor uses electronic commutation to achieve the same purpose. This design offers several advantages over several brushed motors, including higher efficiency, longer lifespan, lower maintenance requirements, and better control.

In the brushless DC motor, the rotor, made of a permanent magnet, is driven by the magnetic force of the stator's winding circuit. While the brush DC motor uses a brush and commutator for current switching, on the otherside the brushless DC motor uses a sensor and an electronic circuit for current switching. Hence the working principle of a BLDC motor is based on lorentz force law. This motor has advantageous characteristics of DC motors (current and voltage are respectively proportional to torque and rotating speed) and AC motors (brushless structure). Features of the brushless DC motor include compact size, high output, long life, and no generation of sparks and noise, and it is used in a wide range of applications from PCs to home appliances.



source :https://pin.it/117R7FBTA

With a BLDC motor, it is the permanent magnet that rotates (N and S); rotation is achieved by changing the direction of the magnetic fields generated by the surrounding stationary coils. To control the rotation, you adjust the magnitude and direction of the current into these coils.

source :https://images.app.goo.gl/fAh626BQu7aHk3KB7

The permanent magnet on the rotor alings with the stator's magnetc field and causes the rotor to turn.Hall sensors continuously detect the position of the rotor and send the information to controller.The electronics speed controller uses its feed back system and adjusts the energising of windings to ensure a smooth operation. This electronic communication system in BLDC motor not only improves efficiency but also allows more precise control over the speed and torque of the motor and makes them ideal for various industrial applications. When converting electricity into mechanical power the brushless motors are more efficient than brushed motors primarily due to the absence of brushes, which reduces mechanical energy loss due to friction. The enhanced efficiency is greatest in the no-load and lowload regions of the motor's performance . Hence BLDC motors are more expensive than others due to their advanced technology and electronic compnents. Bldc motors are used in electric vehicles,drones,medical equipment, automobiles,industrial automation,home appliances.

Challenges faced by the BLDc motor:Intial cost :

- higher costs for BLDc motors and advanced control electronics add to the intial investment.
- Motor Selection : choosing the right motor types based on appliction requirements.
- Sensor integration: deciding on the type and placement of sensors for accurate rotor position detection.
- Heat Management: effictive dissipation of heat generated by poer electronics and motor operation.
- Some salient features of BlDC motors:
- High Efficiency: BLDC motors convert more electrical energy into mechanical energy, leading to less energy waste and lower operating costs.
- Precise Control: These motors can be precisely controlled, allowing for smooth and accurate movements. This is crucial in applications like robotics, drones, and automated systems.
- Long Lifespan: Without the mechanical wear and tear of brushes, BLDC motors have a significantly longer lifespan, reducing maintenance costs.
- High Power Density: BLDC motors pack a lot of power into a small size, making them ideal for portable devices and applications where space is limited. In conclusion, BLDC motors are revolutionizing various industries by offering superior performance, efficiency, and reliability. As technology continues to advance, we can expect to see even more innovative applications powered by these remarkable motors

Written By:
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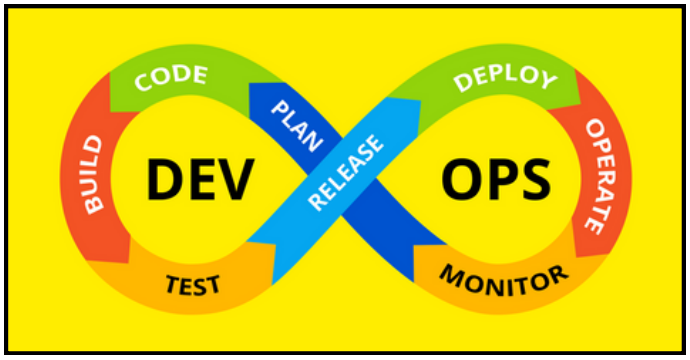
UNLOCKING THE POWER OF DEVOPS

A beginner's Guide



source : https://fortyseven47.com/lv/

Introduction

Imagine this: You're part of a development team working on a new app. You've written some great code, but when it gets deployed, something breaks. Fixing it takes hours of back-and-forth between developers and operations. Sounds frustrating, right?

This is where DevOps steps in. It's not just about tools or automation; it's about bridging the gap between development and operations to create a smoother, faster, and more reliable software delivery process.

In this article, I'll guide you through the basics of DevOps, its principles, key tools, and a simple example of how it all works together. Let's dive in!

what is devops?

- In technical terms: DevOps is a culture and set of practices that bridge the gap between development and operations teams, ensuring faster delivery of high-quality software.

In simple terms: devops is the process of improving the application delivery
by ensuring
1)proper automation.
2)quality.
3)continous monitoring (or) obserbility.
4)continous testing

The Core Principles of DevOps

Let's break down the main ideas behind DevOps:

Collaboration: Development and operations work as one team.

Automation: Repetitive tasks, like testing or deployment, are automated.

Continuous Integration and Delivery (CI/CD): Code is always ready to deploy.

Monitoring: Issues are caught and fixed quickly through constant feedback.

Why Should You Care About DevOps?

Here's why DevOps is a game-changer:

1. Faster Delivery: New features and fixes reach users quicker.
2. Improved Collaboration: Teams work together, not against each other.
3. Increased Reliability: Automated testing catches bugs early.
4. Happier Teams: Less frustration, more innovation!

Fun fact: Netflix uses DevOps to deploy updates hundreds of times a day while handling billions of streaming requests. That's the power of DevOps!

How DevOps Works: A Simple Workflow

Here's a basic example of how DevOps might work in real life:

Developers write code and push it to a repository like GitHub.

Jenkins builds and tests the code automatically to ensure it's error-free.

The code is packaged into a container using Docker, ensuring it runs consistently on any machine.

Kubernetes deploys the container to a production environment, making it live for users.

Monitoring tools like Prometheus track the app's performance, providing insights to improve.

This process, called the CI/CD pipeline, ensures that software is always ready to deploy.

Challenges in Adopting DevOps

Like any transformation, DevOps comes with its challenges:

Resistance to Change: Teams might be hesitant to adopt new practices.

Learning Curve: New tools and processes require time to learn.

Initial Setup: Building a DevOps pipeline takes effort upfront.

But the rewards—faster delivery, fewer bugs, and better collaboration—make it worth it.

WRITTEN BY
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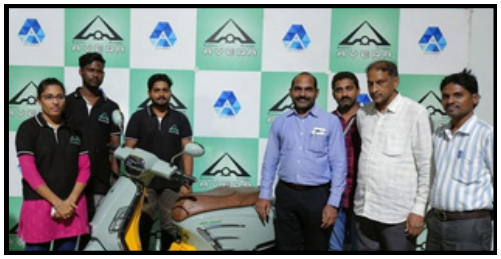
EVENTS AND WORKSHOPS

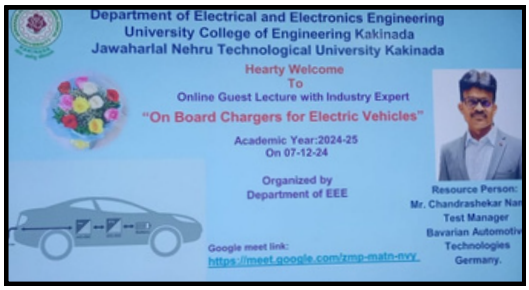
- Dr. K. Venkat Reddy, professor & HOD-EEE, had given a clear insights on "Need and Evolution of EV's, Architecture of Hybrid Electric Vehicle, Charging Schemes and Charges for EVs Smart Charging and VtoG Technologies " in the workshop as a resource person. The workshop was named "Artificial Intelligence Based Energy Storage Systems Integrated with Renewable and Sustainable Energy Sources for Electric Vehicles" held on 02/12/2024 at NRI Institute of Technology(A), Vijayawada(rural).

- Dr. K. Ravindra, professor of EEE, had given a clear insights on "PWM Inverters for EVs, Integration of Renewable and sustainable Energy sources for Electric vehicles" in the workshop as a resource person. The workshop was named "Artificial Intelligence Based Energy Storage Systems Integrated with Renewable and Sustainable Energy Sources for Electric Vehicles" held on 02/12/2024 at NRI Institute of Technology(A), Vijayawada(rural).



- Dr. K. Venkat Reddy, Professor and Head of the Department of Electrical and Electronics Engineering at JNTU Kakinada, visited Avera Electric Vehicles in Vijayawada on 2nd December. The visit aimed to explore advancements in electric vehicle technology and strengthen the collaboration between academia and the EV industry.

- The Department of Electrical and Electronics Engineering (EEE), University College of Engineering Kakinada, JNTUK, organized an insightful online guest lecture on the topic "On Board Chargers for Electric Vehicles" on 7th December 2024. The Resource person was Mr.Chandrashekar Namala, Test Manager Bavarian Automotive Techologies ,Germany. A total of 75 students participated in the workshop.



- On 07-12-2024, the Communication Club held its first session in B3 Lecture Hall. President CH. Pragya spoke about the importance of communication skills and the club's rules. The session included introductions, key points, and a fun task for all students.

- Dr. Naga Kota Reddy Chegireddy delivered a presentation on his research titled "DC-DC Converter for Electric Vehicles Based on PV with MPPT" on December 19, 2024, during the IEEE-sponsored International Conference on "Recent Trends in Microelectronics, Automation, Computing, and Communications Systems (ICMACC-24)", held from December 19-21, 2024.

ARTS AND CULTURALS

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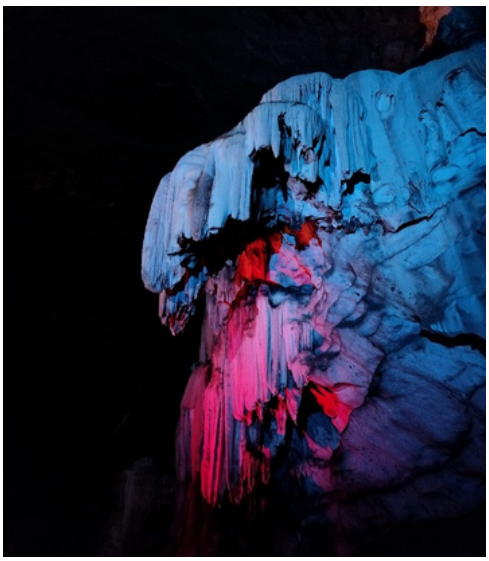

D.K.Murali
22021A0207

Story writing...

"WHISPERS OF THE FORGOTTEN"

Episode 1: The Discovery

This story revolves around four students who entered a Mysterious college which has its dark secrets which will be unveiled by them while they are experiencing different situations

Arjun leaned casually against the cafeteria counter, grinning as he flexed his arms. "I'm telling you, there's no way I can get scared. A macho guy like me? Please."

Jai rolled his eyes, his laptop balanced on his lap. "You said the same thing during that horror movie marathon, and you screamed louder than Priya when the zombie showed up."

Priya, who was engrossed in a detective novel, didn't even look up. "That's because Arjun's definition of bravery only applies to things he can punch," she said dryly. "Ghosts and the supernatural? Different story."

Kumar, seated at the edge of the group, fidgeted with his watch, his nervous energy filling the space. "Can we not talk about ghosts? This campus already gives me bad vibes."

"Speaking of bad vibes," Jai interrupted, swiveling his laptop around, "look at this." He showed them a picture of the abandoned hostel block he had snapped earlier. "This place is...weird. I swear I felt someone watching me when I walked past it."

"That's the old block, isn't it?" Priya asked, finally looking up.

"Yeah, but here's the weird part—no one knows anything about it. I tried searching the university database. Nothing. No records, no blueprints, not even a mention of it in old brochures." Jai's voice dropped. "It's like the place doesn't exist."

"Perfect," Arjun said, standing up. "Let's check it out."

"No way," Kumar blurted out, his voice shaking. "What if it's cursed or something?"

Priya's eyes lit up with curiosity. "Come on, Kumar. Don't you want to know the truth? It could just be an old storage building or something."

But deep down, they all knew it wasn't just an old building. Something about the hostel pulled at them, an unexplainable urge to uncover its secrets.

...To Be Continued

The Spark

Igniting Innovations

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