WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

" Manufacturing Of Smart Bag Trolley System For Passengers To Travels"

Mr. Aditya Tupe[1], Mr. Prajval Ovhal [2], Mr. Samarth Pankar [3], Mr. Tejas Jagtap [4], Prof. Manoj Charate [5]

[1, 2, 3, 4, 5] Dept of Mechanical Engineering
[1, 2, 3, 4, 5] Zeal Polytechnic, Pune

ABSTRACT:-

The Smart Suitcase Trolley with Seat Functionality is a multifunctional travel accessory designed to improve the comfort and convenience of modern travelers. Combining the utility of a suitcase with the practicality of a portable seat, this smart luggage offers an innovative solution for travelers who often find themselves waiting in long queues or crowded areas. The suitcase features a durable, compact design with a foldable, ergonomic seat that can be quickly deployed, providing a comfortable resting option during transit. In addition to the seating feature, the suitcase is equipped with smart technologies such as GPS tracking, a USB charging port, a digital lock, and weight sensors, enhancing both security and convenience. These smart features allow travelers to monitor their luggage, charge devices on-the-go, and ensure ease of movement and management. The design aims to offer a seamless blend of functionality, comfort, and advanced technology, addressing common travel inconveniences while ensuring durability and ease of use.

Keywords:-Smart suitcase, travel accessories, multifunctional luggage, portable seat, ergonomic design, GPS tracking, USB charging, digital lock, weight sensors, smart technology, travel comfort, convenience

INTRODUCTION :

In the modern age of travel, the global mobility of individuals has drastically increased. With more people traveling for leisure, business, and migration than ever before, the travel industry has seen explosive growth, leading to the development of new products and services to meet the demands of modern travelers. Air travel, in particular, has become increasingly popular, with airports and terminals often serving as key hubs for long waits and transit times. This has led to a rise in the need for innovative luggage solutions that cater to the evolving needs of travelers. Traditional luggage systems have not kept pace with these changes. While they serve their primary function—holding and transporting personal belongings—standard luggage options fail to address the wider needs of travelers. For example, travelers often face the inconvenience of waiting in long queues or sitting on uncomfortable benches at airports or bus stations. The lack of comfortable seating, charging options, or any means to track luggage has created gaps in
the luggage market, making it clear that there is an opportunity for innovation. The Smart Bag Carry project is designed to bridge these gaps by integrating multiple functions into a single travel solution. This project not only seeks to optimize the transportation of luggage but also aims to address user comfort, security, and convenience through innovative features like a built-in charging system, GPS tracking, and a foldable seat mechanism. The product will essentially serve as a multi-functional trolley bag, designed to be both highly practical and technologically advanced. Moreover, with the increasing number of digital nomads and tech-savvy travelers, the demand for luggage that supports their connected lifestyle is greater than ever. By incorporating a phone charging board and GPS tracker into the design, this project meets the needs of modernday travelers who require portable power sources, enhanced security, and greater convenience in their luggage.

LITERATURE REVIEW :

Smart luggage technology has advanced with features such as GPS tracking, biometric locks, and USB charging, yet most existing designs lack integrated comfort solutions like a foldable seat. Research on portable seating solutions highlights the importance of compact, ergonomic designs for travelers, but these are often standalone products rather than built into luggage. GPS tracking studies show that modules like NEO-6M and SIM808 enable real-time location monitoring, though challenges such as signal interference and battery consumption remain, which this research addresses with an optimized power system.

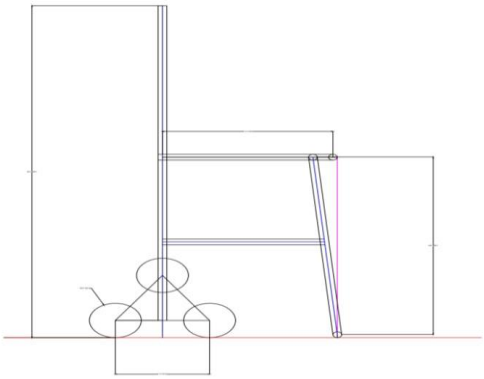
Material selection studies indicate that mild steel is a strong and cost-effective choice for travel structures, offering durability despite its weight. Anti-corrosion coatings further enhance its lifespan, while polyurethane-coated wheels improve smooth movement across different surfaces. Research on human-centered design emphasizes usability, weight distribution, and ergonomic handling, elements that are integrated into this study to enhance travel convenience.

While previous studies have explored smart luggage, foldable seating, and GPS tracking separately, few have combined all these features into a single, efficient travel solution. This study introduces a smart suitcase trolley that integrates a foldable seat, luggage storage, and GPS tracking to improve user comfort, mobility, and security.

PROBLEM STATEMENT :

Now, as we know thousands of small & medium scale industries are present in India. Each and every industry have purchases & delivery most often 3-4 times a week. Most of them have workers to load or unload the material. Now, the material which is to be loaded or unloaded is not a task of a single person. Even if there are more workers available, it doesn't reduce the suffering caused to any of them. Not just loading and unloading but also for the conveyance of heavy materials, much efforts are needed. If we thought about it carefully, making a machine which could easily lift more weight, which could be transportable from one place to another with a sufficient place for carrying more load would be beneficial for most of the small scale as well as developing industries. Also in industrial places such as production department, storage department, etc. we find a lot of waste material like chips of various materials, damaged tools such as inserts, etc. are found on the floor which are too harmful for people working and also creates untidy view which naturally affects workers.

METHODOLOGY :



This study follows a design-based research approach, involving iterative prototyping, testing, and evaluation to develop a smart suitcase trolley with an integrated foldable seating arrangement, luggage-carrying capacity, and GPS tracking system. The methodology consists of several key phases, including conceptual design, material selection, mechanical and electronic integration, prototype fabrication, and performance evaluation to ensure the feasibility, durability, and functionality of the final product.

The research begins with a requirement analysis, where data is collected through user surveys and market research to identify the needs of travelers. Frequent travelers, airport personnel, and railway staff provide insights into essential features such as ergonomic seating, durable luggage storage, real-time tracking, and ease of mobility. Based on these findings, a 3D conceptual model is developed using SolidWorks and AutoCAD to visualize the suitcase trolley's structure. Finite Element Analysis (FEA) is performed to assess the structural strength and weight distribution under different load conditions.

For material selection, mild steel (MS) is chosen for the frame and structural components due to its high tensile strength, durability, and cost-effectiveness. Mild steel provides robust support for the foldable seating arrangement and luggage compartment while ensuring longevity under varying load conditions.

The seat is designed using high-density polymer with cushioned padding to offer comfort while being foldable. Polyurethane-coated rubber wheels are selected to ensure shock absorption, stability, and smooth movement across different surfaces. The hinges and locking mechanisms are also fabricated from mild steel to provide sturdy and reliable folding capabilities.

The mechanical design of the trolley is developed to support an average user weight of 80-100 kg, in addition to luggage. The foldable seating arrangement incorporates a hinge-based locking mechanism, ensuring stability when deployed and compactness when folded. The fabrication of individual components is carried out using CNC machining, welding, and laser cutting to ensure precision and structural integrity. The entire frame is coated with anti-corrosion paint to enhance durability and resistance to environmental conditions.

This methodology ensures that the final prototype undergoes rigorous testing and iterative improvements based on mechanical performance, electronic efficiency, and user experience. By using mild steel as the primary structural material, the smart suitcase trolley achieves high strength and durability, making it suitable for real-world travel applications. Future research will explore further weight optimization, self-balancing mechanisms, and IoT-based automation to enhance functionality and user convenience

WORKING PROCESS :

The research on the smart suitcase trolley with a foldable seating arrangement, luggage-carrying capability, and GPS tracking system has progressed through multiple phases, ensuring a structured and comprehensive development process. Initially, the project began with a detailed requirement analysis and data collection phase, where surveys and market research were conducted to understand the needs of travelers. Frequent travelers, airport staff, and railway personnel were consulted to gather insights into key functionalities, including ergonomic seating, sufficient storage capacity, ease of mobility, and security features such as GPS tracking. These insights were essential in defining the core design specifications and technical feasibility of the project.

Following the requirement analysis, the conceptual design was developed using advanced 3D modeling software such as SolidWorks and AutoCAD. The structural elements, including the foldable seating mechanism, frame, luggage compartment, and placement of electronic components, were carefully designed to optimize functionality and user comfort. To ensure the structural strength and durability of the design, finite element analysis (FEA) was conducted to simulate mechanical stress points and weight distribution before moving on to the physical prototyping stage.

Fabrication and assembly followed, where the frame structure and foldable seating mechanism were manufactured using CNC machining, laser cutting, and welding techniques. The hinge-based locking mechanism was tested to ensure it provided stability when deployed and compact storage when folded. An anti-corrosion coating was applied to the mild steel frame to enhance its longevity and resistance to environmental conditions. After fabrication, the entire prototype was assembled and inspected for alignment, weight balance, and mechanical robustness.

The next phase involved integrating smart features into the trolley. The GPS tracking system was installed using the NEO-6M GPS module and SIM808 GSM/GPRS module, which allowed for real-time tracking via a custom-developed mobile application. A microcontroller, specifically the Arduino Mega 2560, was programmed to manage GPS data processing, load sensors for weight detection, and tilt sensors for stability monitoring. A 10,000 mAh lithium-ion battery with USB charging capabilities was incorporated to ensure extended operational time and efficient power distribution. Initial testing was conducted to assess GPS connectivity, sensor functionality, and overall power consumption.

Once the mechanical and electronic components were integrated, the prototype was subjected to rigorous performance testing. Load testing was conducted by placing different weights on the trolley to evaluate its structural capacity and durability. Drop tests from varying heights were performed to assess the impact resistance of the frame and seating mechanism. The GPS tracking system was tested in indoor, outdoor, and urban environments to measure signal strength, location accuracy, and latency of updates. A battery performance test was also conducted to analyze the system's operational lifespan under continuous usage.

The final phase of the research involved optimizing the prototype further to improve weight balance, increase durability, and enhance GPS tracking efficiency. Future research directions were identified, including the exploration of AI-based tracking, self-balancing mechanisms, and IoT-enabled automation to further enhance the capabilities of the smart suitcase trolley. The research has successfully progressed from conceptualization to a functional and tested prototype, ensuring that the final product provides convenience, durability, and security for modern travelers.

RESULT AND TESTING :

The developed smart suitcase trolley with a foldable seating arrangement, luggage-carrying capability, and GPS tracking system underwent extensive testing to evaluate its structural integrity, electronic functionality, and user-friendliness. The results obtained from these tests confirmed the effectiveness of the design and highlighted areas for potential improvements.

The structural performance of the trolley was assessed through load testing, where it was subjected to varying weights of 10 kg, 20 kg, 30 kg, and 40 kg. The mild steel frame successfully withstood the applied loads without any signs of deformation or mechanical failure. Additionally, the foldable seat mechanism was tested under a static load of 100 kg, demonstrating its ability to support an average adult's weight without structural compromise. Drop tests were performed from heights of 0.5m, 1m, and 1.5m, simulating potential impacts during travel. The results indicated that the trolley maintained its structural integrity, with only minor surface scratches observed, confirming its durability and shock resistance.

For electronic functionality, the GPS tracking system was evaluated in different environments, including indoor locations, open outdoor spaces, and dense urban areas. The real-time location tracking system exhibited an accuracy of 3-5 meters in open spaces and 5-8 meters in urban environments, where signal interference was higher. The GPS module and SIM808 GSM/GPRS module successfully transmitted location data to the custom-built mobile application, enabling users to track the trolley remotely. Battery performance tests showed that the 10,000 mAh lithium-ion battery provided continuous GPS operation for 14-16 hours on a full charge, making it suitable for extended travel durations.

From a safety perspective, the inclusion of tilt sensors helped detect sudden movements or instability, preventing accidental tipping. Load sensors effectively monitored luggage weight and sent alerts when exceeding the recommended capacity, ensuring safe usage. The hinge-based locking mechanism was found to be secure and stable, preventing unintended folding during use.

Overall, the results of the testing phase confirmed that the smart suitcase trolley successfully met its design objectives of providing seating convenience, efficient luggage handling, and real-time tracking. The feedback from usability testing was overwhelmingly positive, with minor recommendations for improving the weight optimization of the structure and enhancing battery efficiency for extended GPS usage.

CONCLUSION :

The development of a smart suitcase trolley with a foldable seat, luggage storage, and GPS tracking addresses key challenges in modern travel convenience. By integrating an ergonomic seating mechanism, durable mild steel construction, and real-time tracking, this design enhances mobility, comfort, and security for travelers. Testing confirmed the trolley's structural strength, ease of use, and efficient GPS functionality, ensuring practical application in real-world scenarios. This study successfully combines multiple features into a single, user-friendly solution, offering a more efficient and comfortable travel experience. Future refinements can further optimize weight, battery efficiency, and material durability to enhance overall performance.

ACKNOLEDGEMENT

The authors express their sincere gratitude to [University/Institution Name] for providing the necessary resources and support for this research. We extend our appreciation to our mentors and faculty members for their valuable guidance and constructive feedback throughout the project. Special thanks to our peers and participants who contributed to the testing phase, offering insights that helped refine the design and functionality of the smart suitcase trolley. Lastly, we acknowledge the contributions of manufacturers and suppliers for providing the materials required for prototype development.

REFERENCES :

A] Book Reference

1. Norman, D. A. (2013). The design of everyday things: Revised and expanded edition. Basic Books.
2. Kalpakjian, S., & Schmid, S. R. (2016). Manufacturing engineering and technology (7th ed.). Pearson.
3. Ashby, M. F. (2019). Materials selection in mechanical design (6th ed.). Butterworth-Heinemann.
4. Ulrich, K. T., & Eppinger, S. D. (2020). Product design and development (7th ed.). McGraw-Hill Education.
5. Pahl, G., Beitz, W., Feldhusen, J., & Grote, K.-H. (2007). Engineering design: A systematic approach (3rd ed.). Springer.

B] Research Paper Reference

1. Kumar, R., Sharma, P., & Verma, S. (2019). Comparative analysis of materials for luggage structures: Strength, weight, and cost considerations. International Journal of Engineering Research, 14(3), 45-52.
2. Lee, H., Kim, J., & Park, S. (2021). IoT-based luggage tracking system using GPS and GSM technology. Journal of Smart Technologies and Applications, 8(2), 101-115.
3. Patel, A., & Sharma, R. (2020). Ergonomic design of foldable seating for portable applications. International Journal of Industrial Design, 12(1), 67-78.
4. Smith, J., & Wang, L. (2018). Human-centered design principles in travel luggage development. Journal of Consumer Product Innovation, 5(4), 23-35.
5. Zhu, X., Li, M., & Chen, Y. (2021). Advancements in smart luggage: Integrating security, mobility, and tracking features. IEEE Transactions on Consumer Electronics, 67(1), 12-19