

Research Article

# Smart Tumbler

Nurul Nadhira Amalin Azhari<sup>1,\*</sup>, Nor Emylia Syazwanie<sup>2</sup>, Nur Atiqah Aisyah Abu Hasan<sup>3</sup>, Nurhidayah Shuhaimi<sup>4</sup>, and Nur Syairah Mohd Shaifudin<sup>5</sup>

<sup>1</sup> Universiti Teknologi MARA; nurulnadhira@uitm.edu.my;  ORCID ID (<https://orcid.org/0009-0008-7848-0426>)

<sup>2</sup> Universiti Teknologi MARA; emyliasyazwanie@gmail.com

<sup>3</sup> Universiti Teknologi MARA; nuratiqahabuhasan@gmail.com

<sup>4</sup> Universiti Teknologi MARA; dayahshuhaimi42@gmail.com

<sup>5</sup> Universiti Teknologi MARA; nursyairah0438@gmail.com

\* Correspondence: nurulnadhira@uitm.edu.my; 011-33718616

**Abstract:** *In an era of increasing mobility and technological reliance, individuals face the dual challenge of staying hydrated and ensuring their devices remain powered throughout the day. This project introduces an innovative Smart Tumbler, a multifunctional solution that integrates a reusable tumbler with a detachable power bank. Designed for students, professionals, travelers, and riders, this product addresses the inconvenience of carrying multiple essential items while promoting sustainability. By combining hydration with on-the-go charging, the Smart Tumbler enhances user convenience, reduces clutter, and aligns with the growing demand for eco-friendly products. The design incorporates features such as an anti-slip base, leak-proof technology, and temperature retention to cater to diverse user needs. The commercialization potential of this product is significant, targeting a broad consumer market that values both functionality and sustainability. Collaborations with leading tumbler and power bank manufacturers can further enhance its market appeal. Despite challenges such as material selection, heat management, and waterproofing of electronic components, this project aims to deliver a stylish, durable, and practical solution that improves daily efficiency. By fostering a seamless blend of hydration and portable charging, the Smart Tumbler represents a forward-thinking approach to modern lifestyle needs.*

**Keywords:** *Smart Tumbler; Multifunctional Design; Sustainable Innovation.*



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## 1. INTRODUCTION

In today's world of rapid change and a high-octane drive toward mobility, management of these basic needs—a drink and charging devices—is becoming exceedingly complex. This is a project that develops a multipurpose tumbler with a removable power bank to address serious problems faced by an assorted set of user groups—students, professionals, travellers, and riders (Young Holt et al., 2021). The idea of merging hydration and charging into one device aims to minimize the burden of carrying multiple devices while enhancing sustainability and usability.

One of the major challenges is to provide continuous mobility and operation while giving a high degree of user convenience (Young Holt et al., 2021). Recent studies indicate a sharp rise in the demand for green eco-friendly multifunctional products that serve to cater for needs of the modern consumers (Young Holt et al., 2021), for instance, recent market study data shows that the global reusable tumbler market globally is expected to grow at the rate of 6.4% with sustainability and

practicality driving this development. The power bank segment also is expected to grow at a CAGR of 18.2% from 2023 to 2030—a testimony to the increased dependency on portable charging. These data are coupled together to bring home some clear need for products to be developed that are not only viable but also with an eye on environmental concern.

Combining two purposes into one device, i.e., hydration and charging, this innovation thus addresses the weariness of users due to clutter, misplacement of items, and inefficiency in their days. Targeted interviews and observational studies on the users help the project include different groups' feedback concerning features like a leak-proof design, anti-slip bases, and temperature retention. So, the initial concept of a multifunction tumbler is viewed as a euphemism for tidying lives while complementing the larger agenda on reduction of single-use plastics and nurturing a sustainable future.

## 2. PROJECT OUTCOMES

For students, this innovation aim is to deliver a solution that fits smoothly into their everyday routine. The tumbler has a compact and lightweight design with a removable power bank, allowing students to effortlessly charge their gadgets whenever needed. This removes the need to carry several chargers or heavy power banks, freeing up crucial bag space. This solution allows students to focus on their academics or extracurricular activities without worrying about running out of battery, ensuring they are constantly connected and ready to face their assignments.

For workers, the goal is to provide a solution that improves both functionality and professionalism at work. The tumbler is fitted with anti-slip soles that keep it stable on desks and tables, reducing spillage during hectic work periods. This clever design guarantees that workers can stay focused and productive without fear of their drinks going over. Furthermore, the tumbler's sleek and professional appearance suits the workplace setting, making it a fashionable but functional tool for the modern worker.

The project also aims to build a product that streamlines travellers' trip experiences. The tumbler is not only compact and durable, but it also has a detachable power bank for consistent charging while on the go. Travellers can conveniently charge their smartphones without having to unpack baggage or carry additional equipment. The design is built to resist the challenges of regular travel, making it the ideal travel companion for saving space and keeping electronics charged during the journey.

For riders, the target is to provide a tumbler that supports their active lifestyle while also meeting their specific demands. The team developed the tumbler to be leak-proof and shock-resistant, so it can tolerate bumpy or rocky travels without leaking or sustaining damage. Riders can be confident that their tumbler will remain safe and functioning, giving uninterrupted hydration and power. This device is designed to be both dependable and practical, making it an excellent choice for cyclists, motorcyclists, and anybody on the go.

The team is committed to offering a product that is targeted to the demands and lifestyles of our broad user base, giving them the convenience, dependability, and functionality they want in one attractive package.

### 3. PROJECT CHALLENGES

One of the most difficult aspects of designing a tumbler with a built-in power bank is ensuring that all of the technical components function properly. We need to safely and functionally integrate electronic components such as a battery, charging ports, and circuitry into the tumbler. A crucial challenge is waterproofing, which protects electronics from water or other liquids that may spill or leak inside. Another difficulty is heat management. When batteries are used, they might generate heat, particularly when charging a gadget, which can make the tumbler uncomfortable to handle or influence the drink inside. Furthermore, the battery must be safe, meaning it cannot overheat, leak, or cause a fire. These technical issues necessitate careful planning and exact design to guarantee the tumbler functions properly and is safe to use.

Secondly, selecting the appropriate materials is another key difficulty. The inside of the tumbler, where the liquid goes, must be composed of food-safe materials that will not release dangerous chemicals or alter the flavour of the beverage. At the same time, the tumbler's outer shell and electronics portion must be sturdy and strong enough to survive regular use, including accidental drops and moisture exposure. Because the battery bank adds weight, it's critical to choose materials that are both lightweight and sturdy enough to keep the electronics secure. Balancing these safety, durability, and weight requirements can be difficult, especially when attempting to make the device affordable.

Thirdly, controlling costs is critical in bringing this product to market. High-quality batteries and food-safe components can be costly, perhaps making the tumbler too expensive for some clients. The manufacturing process itself may further increase the cost because integrating electronics and waterproofing them necessitates additional processes and precision. To keep prices reasonable, the team must carefully consider where to spend and where to save, without sacrificing quality or safety. Furthermore, the pricing must be competitive with comparable tumblers or portable chargers on the market, which requires striking the correct balance between profitability and customer value.

Fourth, developing a tumbler that serves as both a drinking vessel and a power bank is difficult. It must appear attractive while also serving its intended purpose. For example, it must be comfortable to grip and drink from, even if the power bank adds weight and bulk. The charging connections should be easily accessible, but not in the way of drinking or transporting the tumbler. Another problem is making the tumbler appealing enough that people want to buy it. A sleek, modern design may appeal to some, but others may prefer something more colourful or personalised. To suit the needs of a variety of customers, the design must strike a balance between utility and aesthetic appeal.

Finally, delivering a positive user experience is critical. The tumbler should be basic and easy to use. For example, the power bank should be easy to charge and attach gadgets to. At the same time, the tumbler must be easy to clean, with no hard-to-reach areas where dirt or bacteria can accumulate. The power bank must also have enough battery capacity to charge devices effectively while keeping the tumbler light and compact. Customers want a product that is not only functional, but also entertaining to use in their daily lives.

### 4. PROJECT SUCCESS INDICATORS

The creation of a tumbler with a built-in power bank is a unique challenge, requiring a delicate mix of technical performance, material selection, cost management, design, and user experience. As the team works to develop this unique product, clear success indicators must also be set to guide the project's progress and assure its efficacy in satisfying the demands of the target market. The following

success indicators are crucial for ensuring that the product works properly, is safe and durable, and delivers a consistent user experience. If these signs are satisfied, we expect that people will be strongly compelled to buy the product.

The tumbler's power bank and drinking container must be seamlessly integrated to be considered technically successful. The battery, charging ports, and circuits must all work together to keep the tumbler's core function running smoothly. It is critical to ensure that the tumbler charges devices consistently without creating excessive heat or interfering with your drinking pleasure. In addition, the tumbler must be waterproof to protect the electronics from spills and leaks, as well as sturdy enough to survive accidental accidents. Successful testing for waterproofing, heat management, and electrical stability will demonstrate that the tumbler works as planned. Users are more inclined to acquire a device that performs easily and safely, knowing it will meet both their hydration and charging demands.

The selection of materials is critical for both safety and durability. The inside of the tumbler, which carries liquids, must be composed of food-safe materials that do not affect the flavour or quality of the beverage. At the same time, the outside section that houses the electronics should be built of strong, lightweight materials that can resist regular wear and tear. The tumbler must be lightweight enough to be portable while still securely housing the battery and other components. The tumbler's success will be assessed by its ability to pass food-grade safety standards while also producing a sturdy, long-lasting product that is convenient to carry. Users will trust the product and consider it a dependable investment if the materials are safe, robust, and lightweight.

Cost management is critical to making the tumbler inexpensive while keeping excellent quality. Material costs can be significant, particularly for food-safe and long-lasting components, as well as high-quality batteries. Manufacturing techniques that need accuracy, such as waterproofing and electronics integration, may significantly increase costs. A crucial success indicator will be the ability to price the tumbler competitively with other portable chargers or tumblers on the market while maintaining quality. A healthy profit margin, while keeping the product affordable to target buyers, demonstrates that cost management is on track. If we can sell the tumbler at a competitive price, people will see it as a wonderful deal and be more likely to buy.

The tumbler's design must combine practicality and aesthetic appeal. It should appear professional enough for office workers, sleek and trendy for students, and appealing to travellers and passengers. The design should accommodate a variety of preferences, providing solutions that are both functional and physically appealing. The tumbler should be convenient to transport, handle, and drink from, while also storing the power bank in a way that does not interfere with its primary use. Positive comments on the product's appearance and feel, as well as a design that appeals to people of all demographics, will indicate success. If the design is visually appealing and fits customers' own preferences, they will be more tempted to acquire the product since it matches with their lifestyle preferences.

User experience is the most significant indicator of a product's success. The tumbler should be simple, easy to use, and practical for regular usage. This involves making the power bank simple to charge, ensuring that gadgets connect easily, and offering a comfortable drinking experience. Furthermore, the tumbler must be easy to clean, with no difficult-to-reach areas where dirt or germs might build. The device should be lightweight and well-balanced, providing customers with the convenience of a drink container and a portable charger in one. High user happiness, as seen by favourable reviews and word-of-mouth, will be the primary indicator of success for the whole

experience. If the user experience is outstanding, it will motivate users to acquire the product since it provides convenience to their daily lives.

By meeting these success indicators, we can definitely predict that customers will be more likely to purchase the tumbler. They will value the mix of usefulness, safety, durability, affordability, and usability. The product will not only meet their practical demands, but will also give them a pleasurable and convenient experience, making it a popular option among a wide range of consumers.

## 5. CONCLUSION

The project set out to create an innovative solution that says goodbye to everyday clumsiness by combining hydration and portable charging within a single multifunctional tumbler. The solution took these diverse approaches into account by conducting thorough research, engaging users to receive feedback, and collaborating with design work, all in an effort to produce a product that makes lifestyles easier, has an eco-friendly basis, and has some way to accommodate different user groups. It should provide a decluttering mechanism, promote portability, and inspire eco-consciousness through the advocacy for reusable solutions. Some practical repercussions may lead to the movement of simplifying daily existence for students, workers, travellers, and riders. Identified limitations include input constraint, cost management issues, and problems with technical integration. However, they provide opportunities for improvement in future such as advanced materials, more modular implementations, and enhanced functionality. This whole project becomes a new way for the introduction of pioneering products which keep the user and the environment together in accordance with the new lifestyle.

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