Prototype Design and Research Collection

Series 1

Universiti Teknologi MARA
Pasir Gudang Campus

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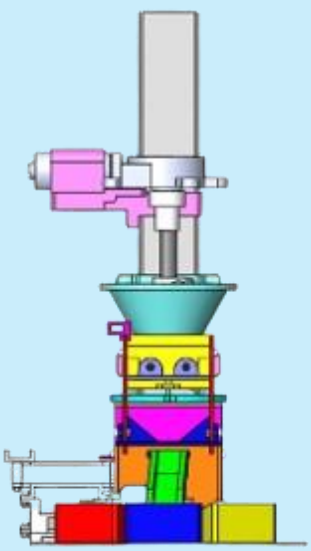

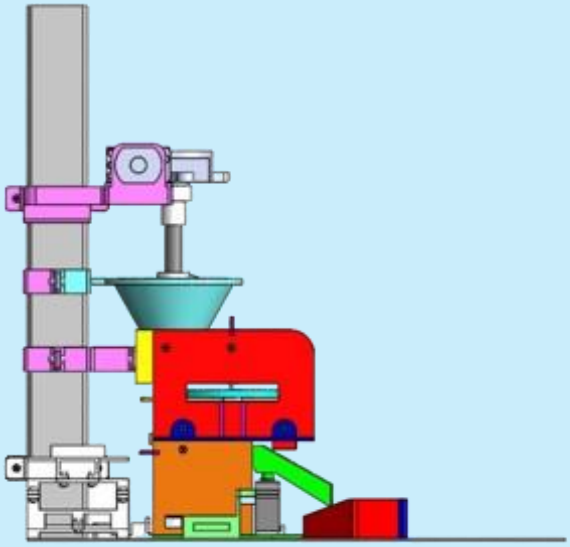

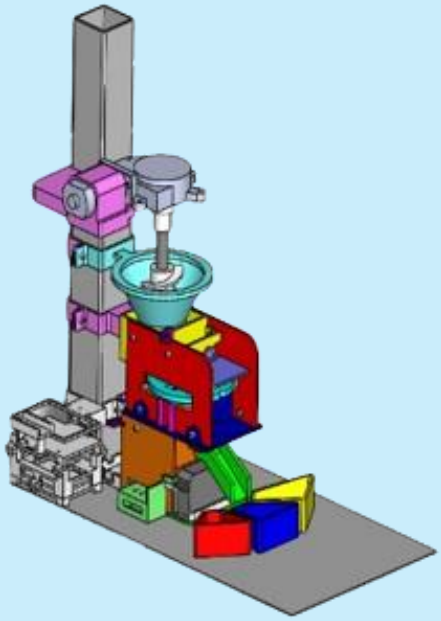

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FOREWORD

This digital book on Prototype Design and Research Collection Series 1 (PDRC Series 1), is designed as a comprehensive reference for mechanical engineering students. The designs featured in this collection undergo an extensive analysis process, incorporating both prototype development and research to ensure a thorough understanding of design principles. Each project is carefully analysed before the prototype fabrication with detailed summaries of the project description and design parameters. The design and research products presented in this series cover a wide range of tools and equipment for various applications including household, workshop and entrepreneurial purposes.

This collection aims to foster innovation by offering students valuable insights into both the technical and research aspects of product design. It is hoped that this book will inspire future engineers and designers to approach product development with a deeper understanding of the design and research processes.

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CHAPTER 5

Innovative Design and Construction of a Mini Coin Sorter Device

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ABSTRACT

A mini coin sorter machine is a device designed to sort coins into different categories. Often, coins are stored together without being sorted, leading to disorganization in daily life. This project aims to address this issue within our community. The project includes several objectives, such as designing a prototype and fabricating the machine. Additionally, the project explored the concept and mechanism of the mini coin sorter machine, the fabrication process, and how the machine operates. This involves considering the materials used for fabrication, determining the necessary components and engineering requirements. Furthermore, the project provide instructions for manual operation and safety precautions. Issues such as using low-quality materials and limitations in workplace utilities may affect the final product, prompting recommendations for improvement. Through this discussion, the project aims to identify areas for enhancement and contribute to the development of more efficient mini coin sorter machines in the future.

Keywords: Mini Coin Sorter Device, Mini Machine, Design and Fabrication process

1 INTRODUCTION

Throughout childhood, individuals are taught the importance of managing finances, often through the traditional method of the "Piggy bank." In this system, children are encouraged to save money received from parents for daily expenses. Alternatively, money can be deposited in banks equipped with sorting technology for efficient storage. The concept of automated counting devices for coins and banknotes was introduced in the 1950s by companies like Kokei (Glory) in Japan, aiming to streamline banking operations. However, the challenge remains: how do we effectively manage loose change?

Often, the coins received daily are haphazardly stored in a single container, leading to disorganization, particularly in financial matters. A significant issue highlighted in project proposals is the challenge of locating or losing coins stored in such a manner when needed. Furthermore, in Malaysia, coins are still widely used in various establishments like laundry machines and vending machines. However, sorting and transporting numerous coins from home to these locations can be time-consuming, discouraging individuals from carrying excess coins due to concerns about weight and bulkiness in their handbags or wallets.

Coins collected daily are often stored in a single container without organization. This lack of order can lead to confusion, especially in managing finances. One common problem is the difficulty in locating needed coins when required. Furthermore, in Malaysia, certain

establishments still rely on coins for transactions, like laundry machines and vending machines. However, it can be inconvenient to sort and transport coins from home to these locations. Many individuals prefer not to carry excessive coins to avoid adding weight to their bags or wallets.

2 LITERATURE REVIEW

Sorting is a crucial method in manufacturing industries to organize things neatly. Many coin sorter machines have been invented, but most are large and not portable.

One invention, the US7971699B2 coin counter/sorter and coupon/voucher dispensing machine by Vae E. Sun, automatically gives out cash vouchers based on coin values and coupons. Coins are sorted, counted, and dropped into a holding area, then approved or rejected for the transaction. This invention is mainly used in big companies like banks [1].

Another invention, the US10049521B1 coin processing system by John R. Blake and others, manages rejected coins during processing. It sorts coins into genuine and reject categories, with high durability and a professional appearance, suitable for professional settings [2].

The US4531531A coin handling machine by Victor Gory Ristvedt and Roy Black Johnson sorts coins of various values using rotating discs. It effectively sorts coins based on their dimensions, offering a simple and space-saving solution [3].

In simple words each of the innovation have their own specification related to the purposed of the design such as 1) Automatically distributes cash vouchers based on the value of the collected coins, manufacturer coupons, and retailer coupons 2) Handling processed coins, coin-processing equipment, computer-readable storage media, and related information are described 3) The coin sorter is made up of a stationary disc with a first surface positioned close to the resilient surface of the rotatable disc, and a rotatable disc

3 METHODOLOGY

The design and fabrication undergo several steps. The first step was concept design. The concept design serves as the project's initial step, providing a foundational vision for the product. It incorporates considerations such as materials and product shape, influencing the ultimate design decisions. Utilizing tools like morphological charts aids in exploring various design options and clarifying distinctions between them.

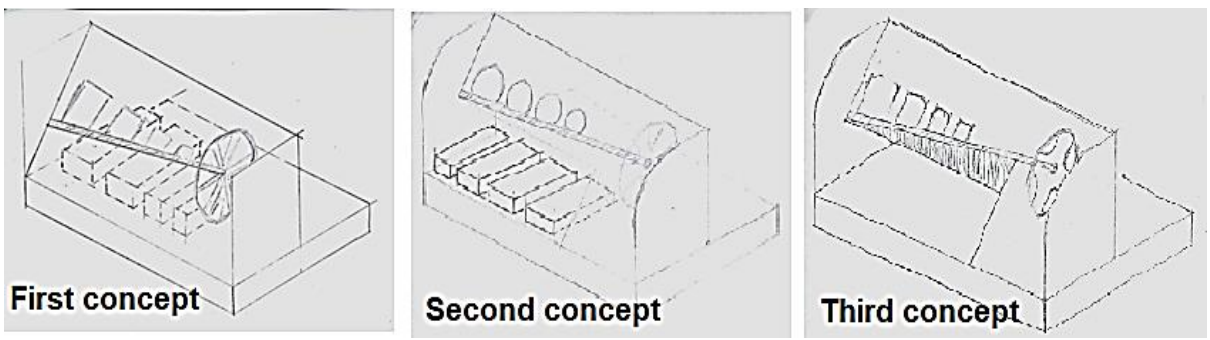

Fig. 1: Concept design of mini coin sorter machine

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Figure 1 shows the concept design of the mini coin sorter. The after the consideration the first concept lack certain safety features, posing risks such as sharp edges that could potentially cause injury. Additionally, constraints like inadequate space for container movement and the complexity of generating circular plates can hinder efficiency and effectiveness.

To address these shortcomings of first concept, iterative improvements are made to the second design concept. Safety concerns are addressed by adding protective features, such as smoothing out sharp edges and ensuring secure placement of components. Enhancements are also made to optimize functionality, such as expanding the space available for container movement and simplifying the design of circular plates to improve efficiency.

Despite these enhancements, challenges persist. For instance, ensuring the optimal placement of components like the motor and power supply remains a concern, as does refining the design to accommodate the sorting system effectively while minimizing the risk of coins becoming stuck.

Ultimately, the selection of the final design is based on a holistic assessment, considering factors such as safety, ergonomics, and functionality. By integrating the best elements from each iteration of the design process, the final design aims to strike a balance between efficiency and usability. Furthermore, additional features like a rocker switch button are incorporated to enhance the product's overall aesthetic and user experience.

NO.	PART
1	BASE
2	PILLAR
3	SORTING SECTION
4	COIN TRACK
5	MOTOR BLADE
6	DC MOTOR
7	ENTRANCE WALL
8	SPEED REGULATOR
9	ROCKER WHITCH
10	CONTAINER
11	HEIGHT EXTENDER
12	SCREW / RIVET

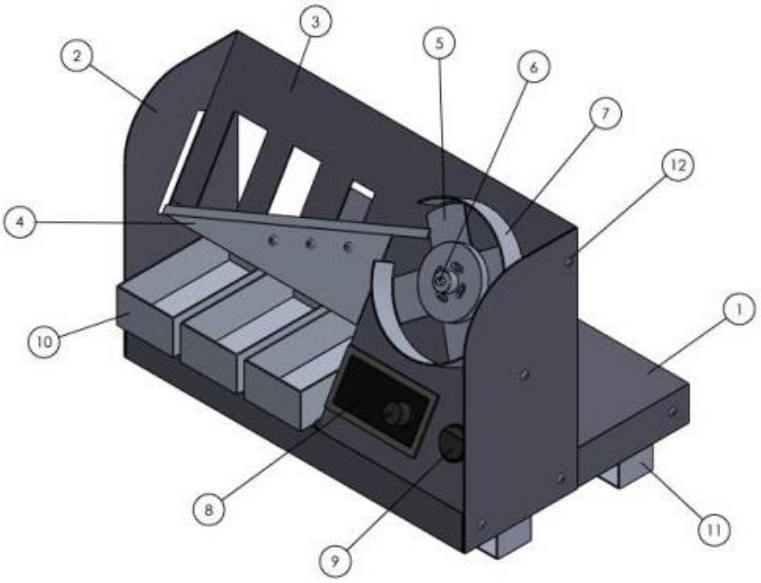

Fig. 2: Model of the mini coin sorter machine

Based on the consideration the final design shows in Figure 2 was preliminary designed and expressly along with the preparation of final construction plans using SolidWorks software that be compiled as a final design for the product that was fabricated. The full dimensions of the final project design were depicted in Figure 3, which showed measurements of 300mm (length) x 200mm (width) x 221mm (height). The main structure was use of aluminum plates as the primary material, which were bent accordingly. All the parts were joined using a combination of rivets and screws for assembly.

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4 RESULTS AND DISCUSSION

Figure 3 shows the final prototype of the machine. The manual operation instructions for users of the mini coin sorter machine are outlined in this section, aiming to facilitate safe and effective use while minimizing the risk of incidents. Additionally, this manual operation guide serves as maintenance guidelines to ensure the long-term functionality of the machine.

To operate the machine, first, connect the micro-USB cable to the micro-USB charging board port. Use a plug adapter with a voltage of 33V or higher to supply sufficient power to the DC motor and ensure the adapter has a current rating of 5A or below to prevent short circuits. Verify that the LED on the micro-USB charging board flashes red, indicating that the circuit is connected, and then gently connect the cable to the port to avoid damage.

Next, insert the coins vertically into the entrance of the machine. Turn on the rocker switch until the red LED on the voltage regulator appears. Adjust the speed regulator to set the suitable speed of the DC motor, typically between 40 to 60. The motor blade will lift the coins to the sorting section, where they will be sorted based on their dimensions into respective categories. Finally, the sorted coins will fall through the hole into the container for storage, which can be easily pulled out as needed by the user.

It is important to carefully follow the product manual operation to ensure the safe operation of the mini coin sorter machine. Avoid increasing the voltage regulator beyond the recommended levels to prevent potential incidents such as overheating or electrical malfunctions. Refrain from touching the circuit wires to prevent damage or breakage, which could lead to electrical hazards. Be cautious of sharp edges on the machine, as they pose a risk of scratching or injuring hands during operation. It is essential to use an appropriate current adapter to prevent short circuits, ensuring the machine operates safely and efficiently. Additionally, utilize the ON/OFF rocker switch as a safety feature to immediately cut off power to the circuit in case of emergencies or to prevent unauthorized use, enhancing overall safety during operation. By adhering to these safety precautions, users can minimize risks and ensure a safe experience when using the mini coin sorter machine.

Fig. 3: Final prototype of mini coin sorter

5 CONCLUSIONS

In conclusion, the mini coin sorter machine offers a convenient and efficient solution for sorting and organizing coins. Its compact design and user-friendly operation make it suitable for various settings, from households to small businesses. By following the provided manual operation instructions and safety precautions, users can ensure the machine's proper function and longevity. Additionally, the machine's ability to sort coins accurately and quickly enhances productivity and streamlines coin handling processes.

However, ongoing maintenance and adherence to safety guidelines are crucial to prevent incidents and ensure safe operation. Overall, the mini coin sorter machine serves as a valuable tool for simplifying coin management tasks while promoting efficiency and organization.

REFERENCES

[1] Molbak, J. H., & Sun, V. E. (2006). U.S. Patent No. 7,028,827. Washington, DC: U.S. Patent and Trademark Office.
[2] Blake, J. R., Hallowell, C. W., & Jagielinski, T. M. (2016). U.S. Patent No. 9,430,893.Washington, DC: U.S. Patent and Trademark Office.
[3] Johnson, R. B., & Ristvedt, V. G. (1985). U.S. Patent No. 4,531,531. Washington, DC: U.S. Patent and Trademark Office.