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Integrated Portable Device for Camping and Disaster Response

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***Abstract*: The goal of this study was to develop an Integrated Portable Device with features such as a fan, a power bank, a flashlight, a small stove, and thermally insulated compartments. The materials used include plywood for its structure, a BMS charging circuit 12V, a lithium battery charging module board 5V 2.4A, and an 18650 lithium-ion battery holder. The device utilizes electric batteries and solar energy as its sources of power. A survey was carried out to evaluate the product in terms of size, shape, weight, durability, portability, and functionality. The study used an experimental approach for its methodology because of its accurate variable measurement and control, which ensures the reliability and validity of the findings. The results showed that the size of the product is suitable, and its weight and shape provide further security. Its durability ensures resilience against damage, protecting its contents. The device also provides easy portability, making it easy to carry along. Additionally, all its features are functional. These findings may suggest potential areas for further research or application in similar contexts, particularly regarding solar-powered Integrated Portable Devices suitable for emergency situations or travel.**

***Keywords*: Integrated Device, Portable, Power Bank, Flashlight, Fan, Solar Powered.**

1. Introduction

People are becoming more conscious of their surroundings due to the quick development of social media and technology. Filipinos, renowned for their love of travel, use modern technologies to identify desirable and well-known destinations. Despite these advantages and positive developments, emergencies are still rising in other regions, particularly those at most risk, like the Philippines. Since they are well-prepared and informed about these calamities and issues, Filipinos—renowned for their resilience—overcome these difficulties.

These circumstances are unavoidable as we deal with many economic, societal, and environmental challenges. Despite these issues, the government and researchers worldwide promoted the use of renewable energy sources like solar, hydrothermal, etc. By using these energy sources, we may reduce our spending and even do our part to protect the environment by lowering greenhouse gas emissions and other air pollutants.

According to Kirpichnikova et al. (2023), the local environment is investigating how the chemical and electro-physical characteristics of accumulated dust affect the performance of solar panels. Attention, in particular, to how dust accumulation on solar panels impacts their efficiency and pinpoints the critical period for dust deposition in terms of power generation loss. The Republic of Tajikistan and the Chelyabinsk area of the Russian Federation both participated in the experiments in April 2022. Both domestic and foreign articles looked at the impact of surface pollution on solar cell efficiency.

In a related study, Ansari et al. (2022) state that solar radiation is the primary energy source for solar panels. Various factors, such as meteorological conditions, seasonal variations, and diurnal cycles, affect the presence of solar radiation. These variations can significantly impact the efficacy and power output of solar panels. Understanding how fluctuations in solar radiation affect solar panels is crucial for optimizing solar energy use.

Based on the findings of Ge et al. (2022), the Federal Emergency Management Agency (FEMA), established by the United States in 2003, is a specialized institution that provides financial support and expertise to state and local government emergency preparedness projects. The organization has launched a national disaster preparedness campaign in the United States to encourage people to stockpile emergency supplies like home first aid kits. However, studies show that just 30 to 40 percent of Americans maintain first aid kits and other emergency supplies at home.

According to Varghese et al. (2017), the disaster preparedness kit is an indispensable part of preparedness in cases of emergency. The gold standard for such a kit should be based on the needs of a household in the event of any natural or man-made disaster. The conditions in the disaster could include power outages, limited drinking water, and being unable to go out to get additional supplies for a few days. Therefore, the items in a disaster preparedness kit should include bottled drinking water, food that will last a minimum of three days, a portable battery powered radio and extra batteries, a flashlight with extra batteries, a metal whistle, a first aid kit, and other appropriate things that can be of help. This gold standard for a disaster preparedness kit guides individuals and households to assemble their disaster supply kits to meet their needs effectively.

As per Srilakshmi.Ch (2021), solar power banks are an

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affordable, economical, environmentally beneficial, and dependable power source for gadgets. The world is currently experiencing a number of environmental threats, with global warming being the most evident. By employing solar electricity, you may reduce pressure while preserving energy. This is due to the fact that solar energy is clean, renewable, and pollution-free. Things can change if you decide to use a solar power bank. You will not consume as much regular electricity, resulting in lower utility expenditures.

In the study by Shah et al. (2018), a solar powered ventilation system was developed. The solar panel was mounted on the car's roof to maximize exposure to sunlight and collect the most solar energy possible. A PIC Microcontroller was integrated into the system to control it, enhancing its efficiency automatically. After the ventilation system was applied, performance analysis tests showed that the system reduced heat gain inside the car's cabin by approximately 12%, making the interior cooler and more comfortable for passengers.

According to Liu et al. (2020), a first aid kit is necessary for providing pre-hospital first assistance, which can reduce the mortality and morbidity of severely ill patients. The clinic's first aid apparatus is difficult to operate at night and prone to cracking injections. Consequently, we developed the "Owl" first aid kit and received a national utility model patent for it. It includes a pharmaceutical storage box and an injectable storage lid. Numerous injection storage plates are arranged on the injection storage cover. These plates secure injections of different sizes and can stop injectable pharmaceuticals from being destroyed, extruded, or shed.

Building on this idea of innovative energy solutions, this study presents the development of an Integrated Portable Device that uses electrical and solar energy. It has additional storage compartments for food, a first aid kit, and other items. Additionally, there is a single drawer beneath it that holds the small stove. Based on the literature and studies, the researchers intend to create an easily reusable device to benefit campers, travelers, first aiders, and rescuers. Since it runs on solar power, the community can save money by using less electricity, and campers and travelers will be able to carry this Integrated Portable Device. Furthermore, this item can be used by travelers in the same manner as if they were camping.

2. Methodology

A. Research Design

This study used a quantitative research approach, specifically an experimental research design. Based on the study of Sirisilla (2023), the experimental research design is a framework or procedure used in experimenting with the progress of product making. It also helps the researchers gather the necessary data to make the product and assess its desired characteristics. Thus, this design is appropriate for the study's development and evaluation of the new product's features and efficacy. Using this, researchers obtain the information they need to complete the study and test their ideas to improve the product's functionality.

B. Product Development

1) Planning Phase

The researchers met to discuss our study, which involves developing the device. Through planning, they have developed ideas for the product. They talk about its design, purpose, components, and methods. They also considered using inexpensive but high-quality supplies. The timeline also included the schedule for meetings and experimentation. Each group member has been given a task to do.

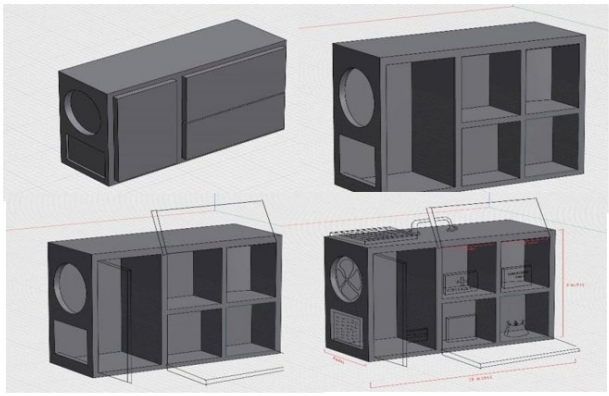

Fig. 1. Prototype design of the integrated portable device

2) Development Phase

The development phase indicates the materials, tools, and procedures for making the multifunctional portable device.

3) Materials

Table 1
Materials used in the development of the product

Fan
LED Light
Solar Panel 1
BMS Charging Circuit 12V
18650 Li-I on Battery
18650 Li-ion Battery Holder
Wood Glue
Nails
Plyboard
Wood Strip
Mini Stove
Li-ion Battery Charging Module Board
Door Hinge
Cabinet Pulls
Magnetic Catches with Screw
Brush
Varnish
Plastic Wood
Lid Support Hinge
Amplifier Handle

4) Tools

Table 2
Tools used in the development of the product

Sand Paper
Screwdriver
Measuring Tape
Cutter
Analog Multimeter
L-square Ruler
Hammer

5) Equipment

Table 3
Equipment used in the development of the product

Circular Saw
Wood Saw
Hand Drill

6) Procedure

I. Preparation of the Case - Measuring and Cutting the Plyboard to form the Case
II. Shaping the Case - Where the fan and the light will be placed.
III. Assembling the Parts - Putting all the cut parts of the plyboard together to form the case.
IV. Assembling the fan and LED light - Putting the fan and LED light in the case.
V. Repairing the shape of the fan - The fan has a little bigger hole that has to be covered and fixed.
VI. Testing the circuits - Checking to see if the power bank, fan, light, and solar panel are functioning properly.
VII. Varnish the case - Applying brown colour to tarnish the casing.
VIII. The prototype of the product

Fig. 2.

C. Testing and Evaluation

A series of observations was conducted to assess the developed Integrated Portable Device's portability and performance. The researchers created a self-made instrument for product evaluation, which experts validated.

D. Data Gathering and Data Analysis

The researchers conducted a survey to determine how the respondents felt about the product's portability and functionality.

For the questions to be considered closed-ended, the respondents rate the product in terms of functionality and portability, with 4 being the highest score and 1 being the lowest.

The researchers gathered data and analysed it using statistical analysis. They organized, systematized, classified, and tallied it. Using a Likert scale, the physical characteristics and functionality of the product can be assessed and interpreted into numerical data. The Likert scale uses close-ended questions to provide more granular information on people's attitudes toward a certain subject (Elliott, 2021). In addition, the researchers will use frequency distribution, percent distribution, and a weighted mean to come up with a more accurate conclusion.

The researchers record and assess the qualitative data they obtain. These data are utilized to figure out how the researchers can improve the quality of the product.

Table 4
Criteria in gathering data needed

CRITERIA	1	2	3	4
Size	The size of the device is not good enough.	The size of the device is barely good enough.	The size of the device is good enough.	The size of the device is suitable for its functions.
Shape	The shape of the device is not good enough.	The shape of the device is barely good enough.	The shape of the device is good.	The shape of the device is ideal for its portability.
Weight	The weight is too heavy to be moved around by the campers.	The weight is barely heavy enough to be moved around by the campers.	The weight is enough to be moved around by the campers.	The weight is good enough to be moved around by the campers.
Portability	The device is too difficult to carry and move around by the campers	The device is difficult to carry and move around by the campers.	The device can be carried and moved by the campers.	The device is easily carried and moved by the campers.
Durability	The device's durability is not good enough.	The device's durability is barely good enough.	The device's durability is good enough to be damaged.	The device's Durability is perfectly maintained.
Functionality	The product's functions don't make it simple to utilize.	The product's functions barely make it simple to utilize.	The product's functions make it simple to utilize.	The product's functions make it easy to utilize.

Table 5
Assessment rubric for the grand mean

Mean Range	Numerical Response	Adjectival Response	Verbal Description
1.00-1.75	4	Strongly Agree	It has very outstanding craftsmanship.
1.76-2.50	3	Agree	It is outstanding.
2.51-3.25	2	Disagree	It is some way not bad but rather excellent.
3.26-4.00	1	Strongly Disagree	It failed to meet the standards.

Table 6
Interpretation of weighted mean

Mean Range	Adjectival Response	Verbal Response	Verbal Interpretation
3.26-4.00	Strongly Agree	Excellent	The product meets its purpose at all times.
2.51-3.25	Agree	Satisfactory	The product meets its purpose of the time.
1.76-2.50	Disagree	Fair	The product fairly meets its purpose.
1.00-1.75	Strongly Disagree	Poor	The product failed to meet its purpose.

3. Summary

The product obtained an excellent rating, which suggests that it is ideal for the device's size. The device has significantly enhanced its usage and how the tools and other items are stored in the compartments. According to the responses, its weight and shape are outstanding for securing and keeping the things inside. The product's durability was outstanding; no matter how

hard it was dropped, it could sustain a significant impact without breaking the items inside. The product's portability is outstanding because it is simple to use and carry, and it can still be carried conveniently because tools and other items are stored inside the compartments. The device is fully functional, with a fan, light, solar panel, and power bank. Based on the results, it has an outstanding rating and can be used in an emergency.

4. Conclusion

Based on the summary of the findings, the study concludes that the Integrated Portable Device was successfully constructed. The respondents strongly agreed that the product size can be used indoors and outdoors. Also, the device's rectangular shape can be easily stored and placed elsewhere. Emergency responders and first aid experts claim that because it is travel-friendly and sufficiently lightweight for one person to carry, it is simple to transport to a place. The device can continue operating even when not connected to a power source or outlet. Regarding how portable the Integrated Portable Device is, the respondents overwhelmingly agreed that carrying the case about is still possible, even with the tools and materials stored inside the compartments. The fan, light, solar panel, and power bank have all received outstanding evaluations from respondents, and the product's functionality appears to be working as said. Each component demonstrates how the device can be developed into a reliable and useful travel and emergency device.

5. Recommendations

Based on the conclusion drawn, the product is outstanding. However, some factors should be considered to further improve the product. Instead of employing wood and heavy materials, it is advisable to choose an eco-friendly and lightweight alternative; the case should be made of aluminum for better cooling and protection. The researchers can transform the fan into something more useful for camping and assisting. Shoulder straps are also recommended for carrying over the shoulder while trekking or hiking. It is suggested that shockproof materials, such as plastic or rubber, be used on the corners to fasten or make the product water-resistant. It should be bigger, especially for those who travel all around the province only in vans or other vehicles.

References

[1] Andres, H. P. (2002). A comparison of face-to-face and virtual software development teams. Team Performance Management, 8(1/2), 39-48.

[2] Blenke, S., Nguyen, C., & Kauffeld, S. (2017). Meetings matter: Effects of team meetings on team and organizational success. Small Group Research, 48(2), 199–231.

[3] Cummings, J. N., & Kiesler, S. (2006). Coordination costs and project outcomes in multi-university collaborations. Research Policy, 35(10), 1381–1394.

[4] González-Torres, T., et al. (2020). A systematic review of teamwork in higher education. International Journal of Educational Research, 100, 101538.

[5] Hung, Y. C., et al. (2004). Building trust in virtual teams: A leadership perspective. Journal of Management Information Systems, 20(4), 201–226.

[6] Kim, M. J., & Maher, M. L. (2022). Creativity in virtual design teams: An interactionist perspective. Design Studies, 78, 101064.

[7] Liu, Y. (2007). Developing a scale to measure the interactivity of websites. Journal of Advertising Research, 47(2), 156–168.

[8] Purvanova, R. K. (2014). Face-to-face versus virtual teams: What have we really learned? The Psychologist-Manager Journal, 17(1), 2–29.

[9] Smith, J. A., & Doe, R. (2013). Team dynamics and project success. Journal of Engineering Management, 29(3), 205-219.

[10] Wei, W., Wang, X. H. F., & Liu, X. Y. (2024). Trust development in virtual teams: A multilevel perspective. Journal of Organizational Behavior, 45(1), 3–20.