college of human environmental sciences
CLOTHING TEXTILES & INTERIOR DESIGN

Self-Lit Multi-Functional Diaper Bag: The Smart Bag That Will Last A Lifetime

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ABSTRACT

An interdisciplinary student team will participate in the Technology Collaboration Center's (TCC) University Wearables Challenge to develop a light-up handbag with the intention of being a multi-use diaper bag which would also have applications for low-light human aerospace missions.

TCC is an independent 501(c)(3) non-profit formed as a partnership between the NASA Johnson Space Center, industry, and universities, solving challenging technology problems through innovative solutions by connecting collaboration partners from across technology sectors. The University Wearables Challenge allows university students from diverse disciplines to engage with industry and government researchers to identify and solve challenges in Wearable Technology today. Through this engagement with wearable technology, students can envision the application of their skills to careers in space science, aerospace technology and allied fields, preparing University of Alabama students to contribute to Alabama's space exploration and aerospace engineering enterprises.

DESIGN BRIEF

VINSS LLC is a start-up company from Houston, TX looking to create a multifunctional diaper bag when attempting to view the contents at a low light level. For this year's University Wearables Challenge, a product is needed to integrate today's wearable technology solutions into a this bag, which would be useful to VINSS LLC as well for NASA's long-duration space missions, providing a convenient way for astronauts or travelers to easily view the contents of bags in low light-level conditions.

Assistance is needed with:

- Creating a bag which adheres to all ISO and safety standards and has a battery capable of charging a modern smartphone at least two times.
- Efficiently integrating the color and light level detection of ARDUINO LEDs and sensors within the bag that connect to an app
- Creating the aforementioned app allowing the user to manage the light, turn it on/off, find the bag in low light situations, and locate items in the interior of the bag
- Connecting the bag system via Bluetooth to be accessible via phone app

The goal of the challenge is to have a fully functional and final prototype of the unisex bag/diaper or multipurpose bag.

REFERENCES AND ACKNOWLEDGMENTS

VINSS LLC. (2023). Wearable Technology Workshop Challenge. Houston, Texas; VINSS LLC.

Thank you to the Alabama Space Grant Consortium for sponsoring student travel to Houston for TCC's 2023 Wearables Workshop & University Challenge.

MATERIALS

ESP-32
The ESP-32 development board was selected for its diverse GPIO selection as well as its integrated Bluetooth and Wi-Fi connectivity. Together these features allow the ESP-32 to pair with a companion phone app as well as control various LEDs and interact with an array of sensors.

Various 3D Printing Polymers
The selected 3D printing plastics have been chosen for their high temperature resistance as well as the printers that use them. For example, ABS was selected for the Dimension 1200est which also allows for soluble support material allowing for more complex geometries. Nylon was selected for use with the MarkForged Mark II which allows for direct continuous carbon fiber inlay which exponentially strengthens parts.

8000mAh Battery
The project required an 8000mAh battery which can refill a smartphone twice. This will be used to sustain the lights on the bag, while a separate power pack is used to charge phones and other electronic devices.

Garolite Plastic Frame
A garolite sheet was selected as the frame for the backpack. This is easily machinable for weight reduction and will be reinforced by carbon fiber prints using the MarkForged Mark II printer.

Double Faced Satin Weave Polyester Blend
This textile was selected as the primary material for the bag for its durability, abrasion resistance, and ease of cleaning.

Thinsulate Interfacing
This interfacing was chosen for its thermal retentive properties in addition to its minimal bulk, in order keep necessary items such as baby bottles of milk at the proper temperature.

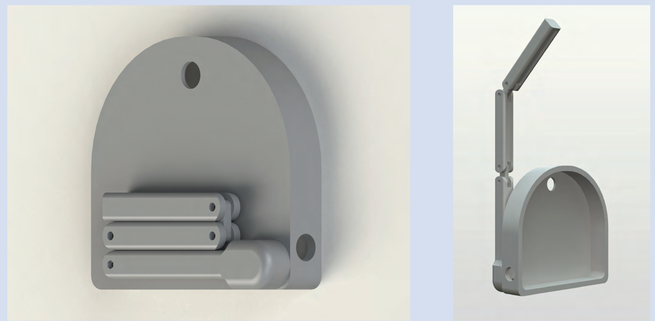
INSPIRATION

Figures 1-6: AI generated images created during the ideation phase of design

FINAL PRODUCT

The final product is an adaptable canvas bag which can be carried as a duffel bag as well as worn as a backpack (see **Figure 7**). The lengthening and shortening of straps, adjustment of strap position, and use of snap attachments allows this transformation. In backpack orientation, the base of the bag has a special zippered compartment designed to contain the electrical and mechanical components of the light and battery pack; the light extends out like a lamp over the bag to allow visibility within the bag and in its surroundings (see **Figures 8 and 9**). The main compartment is lined with Thinsulate to keep this portion of the bag insulated. It has modular divisions to organize belongings of the caretaker and the baby. The bag also has a separately accessible miniature compartment to hold the most important belongings, such as a phone and wallet. The design of the bag allows for its use as more than just a diaper bag, extending its usefulness for a lifetime of utilization.

Figure 7 (above)**:** Product flats and colorways



Figures 8 and 9 (Left to right)**:** Mechanics of the lighting arm which provides visibility within the bag and its environment