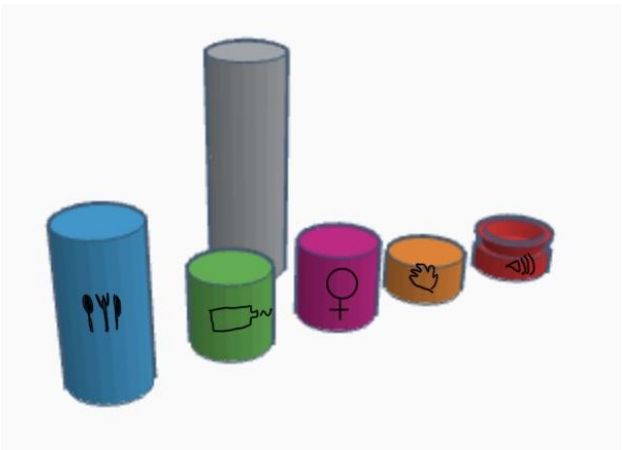

Adaptable Emergency Survival Backpack Utilizing Multipurpose Modularity

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Introduction

We live in a world filled with various conflicts and disasters brought by both natural and human causes. Whether hiking in the wilderness, navigating a city during an emergency, or trying to survive in a disaster zone, our backpack provides everything you need to stay safe, warm, and fed. With our Modular Medical Technology (ModMed Tech) designs, which allow for the compact storage of food, water, first aid supplies, and survival gear, we prepare you for anything that comes your way. Essential for experienced outdoorsmen or a family in a storm-wrought region alike, our survival backpack ecosystem is an investment that will provide peace of mind and security no matter where life takes the user.

Throughout the design process, we strove for multipurpose modularity, or the ability to not only have a modular design but also function for multiple different environments. With basic necessities built into the core of our product, we used additive manufacturing to create the foundation of the entire ModMed Tech ecosystem. We noticed similar patterns about solutions that may be helpful in diverse scenarios, so we were able to focus on the urgent needs that the user may come across, such as an emergency siren for signaling, rather than wants. The siren is applicable to multiple scenarios, including survival in regions of conflict, surviving wildfires, and calling for help amidst the wreckage of powerful storms like tornadoes and hurricanes.

Our solution is a backpack with exterior pockets for easy access. We designed our backpack so that every portion allows for seamless user interaction. One example of our innovative thinking is our light and camera, both located on a strap of our ModPack, or Modular Backpack. The light can be used in lieu of a flashlight and free both hands for handling items, carrying young children, and maneuvering throughout the surrounding environment. Knowing how important media coverage of disasters and conflict is for the greater education of civilization, our built-in camera has a hard drive attached. This camera allows for the capture of first hand imagery of what might be too dangerous or isolated for conventional media to cover.

At the core of our ecosystem design is the ModPod, or Modular Pod, a cylindrical container that is roughly the size of a 24 oz. water bottle. Our ModPods are tailored to the specialized needs of each user. Depending on the priorities and situation of the user, different Pod Slices can vertically slide in and out of the main ModPod “sleeve.” These Pod Slices, similarly to the ModPod framing, are 3D printed with a low infill and can be disposed of following use, building the foundation for a circular economy. Reiterating on how we used multipurpose modularity, we offer multiple different lines of pods so that each user can stay protected against the threats relevant in their area, such as wildfires, floods, earthquakes, war, and more. ModMed Tech helps everyone combat catastrophic events, both natural and manmade.

Industrial Overview

When analyzing current solutions and products in the survival space, we noticed a lack of adaptability and modularity in options that are open to current consumers. We began designing a solution to fill this inadequacy with a new ecosystem that allowed for individuals to choose their personal priorities and assess the various threat levels around them. The ModMed Tech ecosystem is necessary for our world–a place constantly recovering and experiencing a multitude of diverse crises.

Despite the lack of current feasible solutions for our target user group, the industry of first aid is relatively large–valued at over 167 million USD as of 2021, and growing at 5% annually (IMARC). Our

product will enter this market as a revolutionary modular and multipurpose product that provides a biodegradable solution for emergency and crisis supplies. Our design effectively utilizes all space available while remaining lightweight and affordable. We have included side pockets for increased accessibility and are using the straps of the backpack for a light and camera. The backpack is crafted from rip-stop nylon and hemmed together with thick rip-stop threads. The material is made to last and is formulated to be fireproof and waterproof.

We prioritize basic needs over extravagant wants. Our core product will be equipped with a basic first aid kit, containing bandages, gauze, sterile gloves, antiseptic wipes, ointments, scissors, tweezers, distilled water, and painkillers (with explicit directions to promote safe use) (NHS), as well as a menstrual kit consisting of organic, biodegradable period products.

Our backpack will also contain long-lasting food packs and a refillable canteen. Our product can be stored in homes or distributed to people in times of need. It can also help reduce waste because each user will only need to order the supplies they directly need. Our multipurpose modularity will help meet each individual's specific needs, while allowing for different use cases to take advantage of the same product.

In terms of our critical timeline, we expect to perfect, patent, and then disseminate designs to additive manufacturing industry members to discuss the production process. Afterwards, we expect to produce these ModPods and ModPacks. We estimate that when users order our product online, shipping will take two weeks at most–depending on the distance from the manufacturing plant to the purchaser. In the typical situation, we will get products to purchasers quickly because of the efficiency of digital and additive manufacturing. ModMed Tech products may also be available at local retail stores. Our target audience includes people looking to be prepared for disasters and governments looking to support their disaster-stricken people. We look to reach a global audience, as we want all people to feel secure about their futures.

Constraints

When considering the multitude of criteria we need to achieve, we came across a few constraints that gave us a realistic insight into the manufacturing of the product. Our first restriction was cost. We wanted to make our product affordable to be able to reach the largest market. While designing the ModPod and ModPack, we focused on the importance of size and weight as well. ModPacks are restricted to the size of a typical backpack for the convenience of travel, which is one downside of our solution. We also aimed to make the ModPods lightweight to increase versatility and accessibility for all users. By using additive manufacturing, we can achieve these goals.

Another hurdle was the material used to create the ModPod; in order to achieve a waterproof design, we utilized polylactic acid (PLA) as the filament to print the ModPods. While PLA is advertised as biodegradable, it takes about 80 years for it to decompose, which contributes to the increasing volume of plastic waste. After researching, we found that companies such as NonOilen and Compost3D invented biodegradable 3D filament (All3DP). As a product of its biodegradability, the ModPod can be thrown into a compost bin after being used, which continues our practice of following the circular economy. Using 3D printing allows us to utilize the existing infrastructure of cheap and reliable 3D printers so that we can harness the benefits of additive and digital manufacturing. One of the benefits of using additive manufacturing, in the form of 3D printing, is the ability to alter the mass of the material used to create each Mod Slice and ModPod sleeve by shifting the infill amount. Our final constraint was prioritizing

needs over wants, which we solved by creating a tier list of the items we had generated as possibilities and narrowed them down to items that everyone would need in adverse natural and man-made disasters. The items on our final list made it into the ModPacks and ModPods.

Digital Manufacturing Process

Digital manufacturing was an essential part of our project process. Being able to visualize our design with a three dimensional model allowed us to hone our vision and develop a working solution that fit our collective vision as a creative team. In the idea development stage of our project, each team member had a slightly different idea of what the final ModPack and ModPods would look like. We used sketches to put our visual images to paper, but the drawings we crafted revealed a static view of what is meant to be a tangible object, so they were not entirely effective. It was difficult to visually map out the dimensions of the ModPack's pockets, the width of the bag, measurements of its interior space, and how many ModPods would fit inside one ModPack. By using digital manufacturing, we were able to solve these conceptual issues and collaborate to build our ideal product model. Through CAD design in Onshape and Tinkercad, our team designed 3D models of the ModPack and ModPods, which we were able to adjust as needed and critique as a team. Each member's input altered the final innovative result into something that we are all proud of and excited to share!

Iterations and Improvements

The ModPack went through a series of iterations. We considered adding a buoyant ring around its base, and we had originally planned to design a first aid box rather than a backpack. We considered a backpack with a full flap opening system, but changed this idea to a zipper opening in order to improve the bag's durability and to make it more water resistant. We considered designing individual strap systems that could each hold one ModPod and be used by young children as an alternative to the bulkier main backpack, but decided against using this system in favor of a more realistic and practical solution, a mini ModPack. Taking the original ModPack and appropriately sizing it for children would make the product easier to wear than our other alternatives, such as a fanny pack, and would ensure that children can have the maximum amount of maneuverability while having access to their most essential items.

Product Lifetime

The anticipated lifetime of our product varies depending on how the user utilizes our multipurpose modularity. With the base ModPods including items such as bandages, gloves, and scissors, most modules have a very long lifetime. The first aid elements of the ModPods would last 3-5 years, keeping in line with typical first aid kits. The dehydrated food cylinders would last 15-20 years, and the fire blanket would last forever.

Ensuring that items like sanitary wipes do not exceed their expected lifetime guarantees that they will not lose sterility or dry out, both of which deprive their ability to clean wounds. As long as the Mod Slices continue to serve their respective purpose, then their performance is successful enough to be kept in until their expiration date passes.

Design

Our design is crafted to be recyclable and biodegradable to support a circular economy. We use renewable energy from a solar panel at the top of the ModPack to power the flashlight, camera, and user's phone. The environmentally friendly biodegradable material that makes up the filament of the ModPods will not contribute to the growing problem of overflowing landfills.

Most emergency backpacks on the market are not all-inclusive and cannot meet a variety of needs experienced by people affected by disasters. Our modular design is flexible and adapts to our user's situational needs. Our thoughtful and creative design leaves no space unused. We have envisioned various use cases and are confident our design can help people in need. Once it has been utilized to its full capacity, it can be recycled and composted.

Our product is tailored to fit our users. While many existing items are devised with an adult user in mind, our smaller ModPack option can be worn and used by young children. We recognize that disasters can potentially separate families and value every user's personal security. Parents can have the peace of mind that their children are independently prepped with their basic needs.

After researching multiple competing emergency backpacks and spending time unpacking and examining their contents, we observed flaws in the current solutions on the market and identified how we could improve them. One major flaw is the "one size fits all" theme that occupies the majority of the market. Outdoor Newsletter and its publishing platform, AllOutdoor, highlights how, "A kit is a one-size-fits-all approach to an experience that should be unique to individuals." (AllOutdoor). Like previously stated in the Industry Overview, our solution allows users to select which utilities they need. We also observed how heavy the current survival backpack was, rendering it useless for young children in situations that call for a transportable emergency solution. The modularity of our ModPod and ModPacks means that weight can be adjusted between multiple Packs and allow younger children to carry lighter items, while adults carry more densely packed ModPods and ModPacks. The ModTech ecosystem's Modularity also means that it overall costs the user less, because they only purchase what they need and not extra pieces that are not relevant to their situation.

Cost and Manufacturing

Our product uses aspects of existing designs on the market, such as first aid backpacks and kits, but there is not currently a solution similar to ours. The most basic existing solutions in the first aid sector are typically valued at around $30-60, but more complex first aid backpacks can cost upwards of $200. Our ModPack would be priced at $115 because it is more sophisticated than the average base model. This price accounts for its modularity and waterproof nature, but is still beneath the maximum price range in order to make it a more affordable option.

On Amazon, rip-stop nylon, which will make up the base of our ModPack, costs an average of $9 per yard. Our ModPack design requires four yards of rip-stop nylon, meaning that our backpack base will cost $36, and the additional material needed to sew the pockets and the zippers will cost an estimated $5. The 3D printed inner frame will not contribute much to the overall cost, and the camera and flashlight system will cost about $40. The ModPack listing includes the basic ModPod, with typical first aid supplies, which will add $10 to the price. Our final value of $115 will cover the cost of materials, at $91, while giving us a profit of $24 per ModPack sale. The customizable ModPods will each cost an average of $20.

ModMed Tech products are anticipated to have many beneficial effects on the world. Our product will have positive effects on the environment, as our filament for our ModPods are biodegradable. All of our parts are secured and choke-proof for young children. We hope to see our product around the world helping people in the near future and positively impacting the first aid sector.

Conclusion

We have designed a revolutionary modular and multipurpose backpack ecosystem to combat the numerous crises that occur worldwide. Using ModPods, our backpack provides everything necessary to stay safe, warm, and fed in emergency situations. Throughout our design process, we focused on multipurpose modularity, enabling our design to function in various environments. The product design includes a ModPack, which is a backpack with exterior pockets for easy access, and a ModPod, a cylindrical container roughly the size of a 24 oz. water bottle, built from biodegradable 3D printing filament. These designs are based on additive manufacturing techniques and are tailored to the specialized needs of each user.

Our ModPods are built to hold multiple Pod Slices, which ensure the user is protected against relevant threats in their area, such as wildfires, floods, earthquakes, and war. The product is lightweight, affordable, fireproof, waterproof, and can be stored in homes or distributed to people in times of need. The backpack material is designed to last, and the product offers multipurpose modularity, which enables different use cases to take advantage of the same product, unlike previous solutions. As an impactful, affordable, and innovative approach to storing emergency supplies, ModMed Tech will change the emergency survival gear market. Our modular design provides users with a convenient, functional way of using first aid and focuses on the needs of the individual, providing fully customizable care. Our product is a must-have for anyone looking to be ready for anything unpredictable.

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