

Original Article: Designing a Smart Wearable Product for Hikers with an Emphasis on Physiological Characteristics

Niknaz Amiri^{1*}, Nasser Koleini Mamaghani², Seyed Hashem Mosaddad³

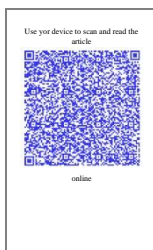
¹Industrial Design Dept, school of Architecture and Environmental Design, Iran university of science and Technology, Tehran, Iran

²Industrial Design Dept, school of Architecture and Environment Design, Iran university of science and Technology, Tehran, Iran


Email: Koleini@iust.ac.ir

³Industrial Design Dept, school of Architecture and Environment Design, Iran university of science and Technology, Tehran, Iran

Email: h_mosaddad@iust.ac.ir



Citation N. Amiri, N. Koleini Mamaghani, S.H. Mosaddad, **Designing a Smart Wearable Product for Hikers with an Emphasis on Physiological Characteristics**. *EJCMPR*. 2023; 2(1):47-53.

 <https://doi.org/10.5281/zenodo.7946876>

Article info:

Received: 05 March 2022

Accepted: 01 May 2022

Available Online:

ID: JEIRES-2205-1031

Checked for Plagiarism: Yes

Peer Reviewers Approved by:

Dr. Amir Samimi

Editor who Approved Publication:

Dr. Frank Rebout

Keywords:

Nature Tourism, Smart, Physiological Characteristics, Wearable Product

ABSTRACT

Nature tourism or hiking is one of the types of mountaineering, the definition of hiking is: long walks and going to places with difficult paths in nature for recreation or exercise, according to the report of the official statistics center of Iran in the spring of 2018 187,772,940 Local travel without staying overnight was done for sightseeing and entertainment. Considering the nature of Iran, this sport has attracted the attention of various people from the society, in this research, it is tried to improve the quality of nature climbing by providing innovative solutions and with the help of technology. The current research is included in the category of applied research, the sampling method in different parts of the research is the voluntary non-probability method and the research population includes people aged 20 to 45. To achieve the objectives of the research, double diamond method was used, the research stages were carried out in two phases, the first phase included the collection of theoretical information including the literature review, similar products in the market analyses, review of standards, and the second phase of data collection. The design was collected through persona compilation, conducting interviews and field observations. Finally, the final checklist for the design was compiled and idea generation was done with the brainstorming method, the selected idea was evaluated and selected with the AHP method, and a prototype was made and improved during four stages of user testing. The final product is a smart wearable that is designed for less than one day nature travel, the main function of which is to carry nature travel equipment in addition to providing information related to vital and environmental signs, this product was named Hamnavard.

*Corresponding Author: Niknaz Amiri (niknazamiri@yahoo.com)

Introduction

Functional clothing is clothes or wearables that increase or improve our ability to adapt to the surrounding environment or protect against harsh and unfavorable environmental conditions. Each garment has several functions, including protection, beauty and clothing. For this reason, independence may be a bit unfamiliar to functional clothing among other clothes. Whether with the metaphorical language including second skin and artificial organs or with the functional language including protective clothing, work clothing and business clothing, it should be said that functional clothing is specifically clothes or wearables that improve our abilities against different and harsh environmental conditions.

And personally improve or increase or upgrade. The function here can be added value or a level of expected technical function based on the definition of the problem. From protection against the thermal conditions of workers to monitoring the vital signs of soldiers and premature babies. It can even have an aesthetic function and can be used to improve the shape of the body.

This is where it is necessary to cross the boundaries of the previous definitions of clothing and enter the realm of medical, nanotechnology, biotechnology, textile and computer technology to address the multifaceted and complex needs of the user and identify and control the effect of various factors. As a result, apart from fashion and clothing designers, the presence of other specialists will be needed and interdisciplinary cooperation will be formed. The developing branch of functional clothing indicates the need to pay attention to design issues for their greater acceptance (1).

The general purpose of this research is to design a smart wearable product for hikers with an emphasis on physiological characteristics. The study environment for the design of this product is walking paths, both designed and undesigned,

which can be tropical/cold/temperate depending on the geographical location. For sampling and better understanding of the user and user behavior in the environment regarding the use of the product of the common hiking route of Darabad, Golabdreh and Tochal, located in one area of Tehran city, was carried out in the form of surveying, behavioral recording, and inconspicuous observation. Also, the samples were selected from the same areas to conduct interviews in a voluntary manner.

The current research was conducted between 2016 and summer 2018. Vital signs are various statistical and physiological measures that are used to evaluate the most basic functions of the human body. Vital signs naturally include monitoring and recording body temperature, pulse rate (heart rate), blood pressure, and respiratory rate. Vital signs are often somewhat different according to the age of people (2). Wearable technology is any type of electronic device designed to be worn on the user's body. Such devices can take many forms, including jewelry, accessories, medical devices, and clothing or clothing elements (3). Wearable products are embedded with built-in sensors that can track body movements, such as tracking Location or biometric identification changes help. The target group is divided into two main and beneficiary categories: 1- The main users include Iranian people in terms of gender, women and men, 20 to 40 years old, and in terms of social class, the middle class and privileged class of the society.

Prototype: prototyping, building a concrete model and testing our desired product is a different scale that is used to develop and test ideas by design groups, employers and users (4, 5). The research of this experimental model for user testing was made in 3 stages. The initial concept test was done in two stages. The first stage was by showing the 3D image and explaining the design to 10 people from nature and conducting interviews, and the second stage was by covering the prototype.

Due to the difficulty of wearing it, it was tested with only one person, (even with the zippers on the side, it was very difficult to wear the dress) and at that moment it was decided to correct the design. New behavioral findings: Backpacking on the road is the biggest problem for mountaineers and hikers. Even the straps of famous brand bags do not spread enough pressure on the shoulders. It is very important for the bag to fit perfectly on the shoulder, shoulder and waist.

Even the clothes that are designed for summer should have long sleeves to prevent sunburn. Often, hikers don't put their phones in their pockets for fear of breaking them, but put them in their backpacks so that they don't get damaged in the event of an accident or falling. For some users, beauty is more important than functionality. The light weight of the clothes and the wide range of motion are very important for users. The display is functional, but the information it provides is the same as smart watches. The previous concept cannot be used in other spaces. Ethel designed in the body is almost impractical because there is a possibility of more damage if the companion is not skilled, or if the injured person is alone, there is a small possibility that he will be able to use it alone. The parts that can be attached and detached with a zipper or other mechanisms are practical. The clothes should not take up a lot of space when they are not being worn (for example, in a suitcase). Easy washing is very important because the clothes get dirty either due to environmental factors or perspiration. Accessing the lower parts inside the bag is difficult for the hiker.

Strengths: Among the most important things that can be used to identify strengths, the following can be mentioned: suitable production infrastructure (presence of quality factories), international experience in production, access to expert labor, high product quality. Finally, it has two conditions of use, the ability to use this product for women and men, covering the needs of several age groups, after-sales service.

Weaknesses: Among the most important things that can be used to determine the weaknesses,

we can mention the following: low productivity rate in the industry, very little investment in development and research compared to international models, technological backwardness of devices. and production tools during sanctions, unknown product market.

Limitations of the research: due to the interference of the research time with the spread of the infectious disease Covid-19, conducting field research and interviews (user tests) faced a lot of problems due to financial limitations and also the unavailability of technological resources. It was not possible to develop the ideas that are used to make them from today's technology.

Method

Methodology is the specific procedures or techniques used to identify, select, process, and analyze information about a topic (6).

The current research was carried out in three stages: library studies including the review of the applied and research background of the subject, literature review and standards, official statistics, related articles and books, field studies including: conducting interviews with users and stakeholders, passive and active observation, Behavioral testing of user tests including: Prototyping in several stages in a flexible way.

Library study is an inseparable part of scientific studies. Of course, this method is also considered a beneficial part of every design process in order to gather information and summarize the available information in the field of the project (8, 9).

Interview

Interview is one of the basic research methods that leads to direct communication with the participants and collects first-hand personal information from people's experiences, opinions, attitudes and perceptions (10, 11). In the current research, the interviewees included two groups of users and beneficiaries, and the

interviews were conducted in several stages during the project process in order to get to know the user's needs, both obvious and obvious.

Observation

This method is used in experimental and quasi-experimental research, where the questionnaire method cannot be used. In fact, with this method, it is possible to observe and examine the behavior of the society or sample under investigation in relation to a specific variable.

The prototype, building a concrete model and testing of our desired product is a different scale that is used to develop and test ideas by design groups, employers and users (12).

Discussion

product design: The ideation process is the creation and re-production of products that can solve the user's needs or target a specific market. product designers by knowing the habits, behaviors, conflicts, complaints, interests and hobbies of the target group and using their practical knowledge and experience in the product design process; They design a practical product that fits the user's needs (13).

Smart: Simply put, smart tools basically make users more accurate in terms of action, learning, thinking, as well as improved user experiences (14). management, proper administration of affairs, simplification of activities, improvement of lifestyle, making work and activities more professional, speeding up affairs, doing the right work, reducing energy consumption and generally making maximum use of the quality and services that can be used Information technology used it in line with indicators and factors of life.

Hiker: Nature walker, nature walker or hiker refers to a person who takes a long walk and goes to places with difficult paths in nature for recreation or exercise, which usually lasts less than a day (15). Hiking is an activity that is done for fun and spending time in nature. For example, walking along a river, through a long forest, walking on a mountain path, etc. is known

as hiking. This activity usually lasts half a day or a full day in a particular route. The path is always prepared in advance and you usually start the activity from one point and end at the same point. The principles of nature tourism include minimal harmful effects, creating environmental and cultural awareness and respect, providing a constructive experience for hosts and guests, generating direct income to preserve the environment, providing economic benefits and improving the lives of local people, and increasing attention to the conditions Political, social and environmental of the host country (16)

Wearable technology is any type of electronic device designed to be worn on the user's body. Such devices can take many forms, including jewelry, accessories, medical devices, and clothing or clothing elements (17). Wearable products are embedded with built-in sensors that can track body movements, such as tracking Location or biometric identification changes help.

Physiological indicators of vital signs are various statistical and physiological criteria that are used to evaluate the most basic functions of the human body. Vital signs naturally include monitoring and recording body temperature, pulse rate (heart rate), blood pressure, and respiratory rate. Vital signs are often somewhat different according to the age of people (18) in order to better understand the user and the environment of using the product, texts from reliable information bases, both domestic and foreign, such as Civilica, Google Scholar, Science Direct and other reliable websites, with keywords related to the title of the research paper. The investigated keywords include nature tourism, ecotourism, smart products, physiological indicators, design of clothing and sports and mountaineering products, smart fabrics and textiles. Mehmotoglu has divided the nature tourists into two specialized and general categories. Specialized people travel with the purpose of seeing and experiencing nature, while the general group sees nature as a part of a tourist package. He has also categorized the activities of nature tourists into three types of

cultural-entertainment, nature walks and activities that require little movement (19).

Mowforth states four types of activities under nature tourism, which include nature tourism, tourism with cultural purpose, adventure travel and specialized tourism. (20) Arenger et al. Focusing on nature, including: 1 nature protection, nature experience, sports and adventure, hedonistic (pleasure-seeking) and 4 service organization factors from independent to fully organized) have been categorized into 16 matrixes. (21, 22)

The checklist of functional criteria of items that should be considered in the design is as follows. The product does not require previous experience to be used. Its appearance should reflect the social aspect, identity and dignity of the wearer. Designed for an ever-changing environment. Electronics must be fully integrated with clothing. It should be washable and easy to charge, drive and handle. work passively and do not occupy a part of the user's memory and attention for no reason. Be free of any extra parts. No need to wear the bottom layer under other clothes. No need to use bulky and heavy electronic parts. No need for constant user attention. The center of gravity of the body should not disturb the user's overall movement and balance. The checklist of aesthetic criteria of items that should be considered in the design is as follows.

- Using polished lines
- Use of simple shapes
- Use future forms

Using technology in a simple and suitable way

- Considering fashion and trends
- Avoid unnecessary decorations
- The use of phosphorescent and high-concentration colors.

Conclusion

Differentiating features of the final product differentiation involves highlighting the features of a product or service that make it unique and valuable to customers. When this is done successfully, product differentiation creates a competitive advantage; Because customers consider a product superior to other available options. This work can also act as a catalyst when the buyer makes a decision. Although the designed product does not have a completely similar example, the factors that can affect the choice of this product are as follows. The product or nature traveler does not get lost in nature. Smartness and following the trends of the world. Water-resistant body, tear-resistant. Water-resistant compartment for mobile phones. The light material makes it easy to maintain and carry the product, the possibility of easy repair of possible tears in the body of the product, the control of vital signs, easy access to all the necessary equipment without occupying the user's hands, market analysis allows a more accurate understanding of the target and it provides designers with a clearer vision. All businesses need a proper understanding of their internal environment as well as their surroundings to be successful. In the sense that they recognize what kind of environment they are working in? Who are their competitors and what kind of activities do they do? Who are the customers and what group are they from and what do they think about the product? Also, market analysis helps to know the trends in this field and to follow them as much as possible.

References

- [1] Sanseverino, G., Krumm, D., Kilian, W., & Odenwald, S. (2022). Body-attached Sensor Nodes for Automatic Detection of Hike Events and Parameters. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [2] Angelucci, A., Cavicchioli, M., Cintorrino, I. A., Lauricella, G., Rossi, C., Strati, S., & Aliverti, A. (2021). Smart textiles and sensorized garments for physiological monitoring: A review of available solutions and techniques. *Sensors*, 21(3), 814. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]

- [3] Bichler, B. F., & Peters, M. (2020). Soft adventure motivation: an exploratory study of hiking tourism. *Tourism Review*, 76(2), 473-488. [[Google Scholar](#)], [[Publisher](#)]
- [4] Vistad, O. I., Øian, H., Williams, D. R., & Stokowski, P. (2020). Long-distance hikers and their inner journeys: On motives and pilgrimage to Nidaros, Norway. *Journal of Outdoor Recreation and tourism*, 31, 100326. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [5] Masohor, S. M. A. S., Bakar, M. Z. H. A., Yamin, W. S. A. W., Abd Wahab, M. H., Ahmad, M. S., Ma'Radzi, A. A., ... & Choon, C. C. (2020, May). Tracking system using RFID for hiking activity with IoT technology. In *Journal of Physics: Conference Series* (Vol. 1529, No. 5, p. 052030). IOP Publishing. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [6] Renberg, J., Christiansen, M. T., Wiggen, Ø. N., Roeleveld, K., Bardal, E. M., & Reinertsen, R. E. (2020). Metabolic rate and muscle activation level when wearing state-of-the-art cold-weather protective clothing during level and inclined walking. *Applied Ergonomics*, 82, 102956. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [7] Memarian, F., Rahmani, S., Yousefzadeh, M., & Latifi, M. (2019). Wearable Technologies in Sportswear. In *Materials in Sports Equipment* (pp. 123-160). Woodhead Publishing. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [8] Mitten, D., Overholt, J. R., Haynes, F. I., D'Amore, C. C., & Ady, J. C. (2018). Hiking: A low-cost, accessible intervention to promote health benefits. *American journal of lifestyle medicine*, 12(4), 302-310. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [9] Islam, T., & Mukhopadhyay, S. C. (2017). Wearable sensors for physiological parameters measurement: Physics, characteristics, design and applications. In *Wearable sensors: applications, design and implementation*. IOP Publishing. [[Google Scholar](#)], [[Publisher](#)]
- [10] Stelter, T., & McCrickard, D. S. (2017). Hiking the appalachian trail with technology. In *NatureCHI 2017 workshop at MobileHCI*. [[Google Scholar](#)], [[Publisher](#)]
- [11] Abdurahman, A. Z. A., Ali, J. K., Khedif, L. Y. B., Bohari, Z., Ahmad, J. A., & Kibat, S. A. (2016). Ecotourism product attributes and tourist attractions: UiTM undergraduate studies. *Procedia-Social and Behavioral Sciences*, 224, 360-367. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [12] Lim, C. H., Kim, K., & Cheong, Y. (2016). Factors affecting sportswear buying behavior: A comparative analysis of luxury sportswear. *Journal of Business Research*, 69(12), 5793-5800. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [13] Spinelli, G., Micocci, M., & Ajovalasit, M. (2016). Behavioral strategies of older adults in the adoption of new technology-based products: the effects of ageing and the promising application of smart materials for the design of future products. [[Google Scholar](#)], [[Publisher](#)]
- [14] Seo, M. N., & Koo, Y. S. (2016). A Study on Textile Design Preferences in Outdoor Clothing According to New Senior Women's Psychological Comfort. *Journal of Fashion Business*, 20(3), 1-16. [[Google Scholar](#)], [[Publisher](#)]
- [15] Manshahia, M., Das, A., & Alagirusamy, R. (2016). Smart coatings for sportswear. *Active Coatings for Smart Textiles*, 355-374. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [16] Suchecki, K. Hiking (2016) Hiking, as Sustainable Tourism-The Possibilities Realization of the Idea on Walking Routes. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [17] McLoughlin, J., & Hayes, S. (2015). Joining techniques for sportswear. In *Textiles for Sportswear* (pp. 119-149). Woodhead Publishing. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [18] Schlosser, J. A., & Carroll, K. (2013). Textile and clothing applications for health monitoring of athletes and potential applications for athletes with disabilities. *Journal of Textile and Apparel, Technology and Management*, 8(1). [[Google Scholar](#)], [[Publisher](#)]
- [19] Rodway, G. W. (2012). Mountain clothing and thermoregulation: A look back. *Wilderness & Environmental Medicine*, 23(1), 91-94. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [20] Chowdhury, H., Alam, F., Mainwaring, D., Beneyto-Ferre, J., & Tate, M. (2012). Rapid

- prototyping of high-performance sportswear. *Procedia Engineering*, 34, 38-43. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [21] Arnegger, J., Woltering, M., & Job, H. (2010). Toward a product-based typology for nature-based tourism: a conceptual framework. *Journal of sustainable tourism*, 18(7), 915-928. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [22] Rodrigues, Á., Kastenholz, E., & Rodrigues, A. (2010). Hiking as a relevant wellness activity-results of an exploratory study of hiking tourists in Portugal applied to a rural tourism project. *Journal of Vacation Marketing*, 16(4), 331-343. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]

This journal is a double-blind peer-reviewed journal covering all areas in Chemistry, Medicinal and Petroleum. EJCMPR is published quarterly (6 issues per year) online and in print. Copyright © 2022 by ASC ([Amir Samimi Company](#)) which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.