Proceedings of the International Conference on Industrial Engineering and Operations Management

Publisher: IEOM Society International, USA DOI: 10.46254/GC03.20250140
Published: February 2, 2026

Designing and Manufacturing a Protective and Interactive Helmet for Children

Sultanah Abdulrahman Al Mutairi and Wajd Sulaiman Al Mehaileb
Computer Engineering Department
University of Mustaqbal
Buraidah, Saudi Arabia
sa3almutairi@uom.edu.sa, wsalmehaileb@uom.edu.sa

Faisal Saud Al Harbi
Industrial Engineering Department
University of Mustaqbal
Buraidah, Saudi Arabia
fas.alharbi@sr.edu.sa

Abstract

This project aims to design and prototype a cost-effective, lightweight, and 3D-printable protective helmet for children. The design was developed using SolidWorks and Ultimaker Cura, fabricated with PLA material on an Ender 3 Pro printer, and integrated with an Arduino-based sensing system. Motivated by statistical evidence of high fall-related injury rates among children, the helmet incorporates an interactive feature: an LED indicator that activates at the side of impact to provide an immediate visual alert for parents. The prototype demonstrates adjustable sizing, ease of fabrication, and protective potential. Preliminary evaluations highlight its promise as a practical and scalable approach to reducing fall-related injury severity, while future work will focus on mechanical testing and system optimization.

Keywords
3D printing, Injury prevention, Helmet design and Impact detection.

Acknowledgements
The authors would like to express sincere gratitude to University of Mustaqbal and the Computer Engineering Department for their financial support for this project. Deep appreciation is also extended to the authors' family for their constant encouragement and prayers.

Biographies
Sultanah Al Mutairi is a bachelor's student in Computer Engineering at University of Mustaqbal, Saudi Arabia. Her academic interests include signal processing, logic circuit design, machine learning, and computer vision. She has participated in several projects within the Computer Engineering Department that reflect her enthusiasm for research and innovation in these fields.

Wajd Al Mehaileb is a bachelor's student in Network and Computer Engineering at the University of Mustaqbal, Saudi Arabia. Her academic focus includes Arduino-based projects, embedded systems, and the creative applications of microcontrollers in engineering solutions. She has participated in several university projects that highlight her strong problem-solving skills and enthusiasm for applying technology to real-world challenges.

Faisal Al Harbi is a Mechanical Engineer with over four years of combined experience in higher education, industrial projects, and emerging technologies, including 3D printing and digital manufacturing. Their expertise includes project management, technical training, and leading cross-disciplinary teams within the education, engineering, and manufacturing sectors.