Design of a robotic first aid system for passenger car occupants

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Abstract

Traumatic and non-traumatic health emergencies occur in passenger cars where victims do not have immediate access to either layperson or professional, proper medical services, resulting in deterioration of their health or death. Installation of robotic first aid systems for passenger car occupants has been proposed, with the objectives of assessing the victim's health, assisting in administration of first aid and sharing the victim's medical information with responders. A literature study on the past, present and future of automobile emergency healthcare has been carried out to get a deeper understanding of the topic. Guided by principles of lean product development, functionality, positional and internet of things requirements have also been determined through research studies. These have culminated in the invention of a hyper-redundant and adaptive self-contained collapsible robotic arm. Key features of the arm include a compact architecture, absorption of shock loads, variable natural frequency and high strength to weight and size ratios. The arm has also been designed and analysed for structural strength by the finite element method in Autodesk Inventor. Standard mechanical components such as bearings and screws have also been generated in the software's component generation tool. Results of the analysis indicate a minimum safety factor of 1.27 and a maximum displacement of 4 mm. The researcher has concluded that the work done so far towards passenger car robotic first aid has been progressive, with the invention, design and analysis of the robotic arm. The researcher has also introduced and advanced the research area by submitting five research manuscripts for publication and filing a patent application for the invention. However, there have been challenges in getting vital information on costing and environmental assessment, particularly where components are not available locally and existing manufacturing databases do not have information on Zimbabwe. Recommendations have been made for local development of advanced electronic components and manufacturing analysis software for efficient local product development. Work in progress has been specified as the design of the base and end effector. The research carried out so far lays a foundation for further development and implementation of passenger car robotic first aid. It is set to enrich lives around the world through health, personal safety and emotional wellbeing. It is also anticipated to drive Zimbabwe towards sustainable development by investment in robotics, artificial intelligence and the internet of things – Industry 4.0.

Key Words: Artificial Intelligence, First Aid, Health Emergency, Industry4.0, Internet of Things, Passenger Car, Road Traffic Accident, Robotics, Trauma.