INNOVATION ENGINEERING

Is a Smart Helmet the Key for Injury Prevention in the Construction Industry?

AUTHORS

Johanna Ögren
ogren.jhe@gmail.com

Sarah Johannesson
sarahjohannesson95@gmail.com

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The construction industry is subject to the highest rate of occupational injuries and illnesses among all industries in Sweden. Furthermore, overload factors are causing as much as 47 percent of long-term occupational injuries, calling for a proactive approach. Could a smart helmet be the key to cope with occupational injuries in the construction industry?

A newly conducted study investigates the possibilities for a smart construction helmet to be adopted for the prevention of long-term injuries in the construction industry. The smart helmet used in the study is equipped with sensors to capture the acceleration and the angular velocity from movements carried out by users. The research is based on a two-step approach. Firstly, the researchers conducted a prestudy to understand the stakeholder attitudes towards the smart helmet and its adoption. Secondly, it was examined whether the smart helmet through machine learning and data processing methods would be able to identify different types of movements carried out by users.

The significant findings of the study point towards several trends that should be considered in further research and implementation of the smart helmet. Firstly, it was discovered that the helmet weight is of high importance among construction workers and the construction company involved in the study. The utilized sensors, together with other hardware components required for the helmet's functionality, would together design an IoT device. As this device is located at the back of the helmet, it leverages the initial weight which the head and neck are exposed to when performing activities with the head in movement. Therefore, for the helmet to at all be able to compete with other construction helmets on the market, the weight of the device must be minimized.

Furthermore, the study shows that although occupational injuries are an apparent problem in the daily life of construction workers, the engagement expressed to change the situation on an individual level is low. However, the attitude towards external initiatives for injury prevention is positive.

Hence, for a successful adoption of the smart helmet, it is crucial to clearly communicate the purpose, i.e. preventing injuries caused by harmful movement patterns, of the smart helmet towards construction workers and construction companies. This, in order to ensure stakeholders that the value from the added safety outweighs the disadvantages of the additional helmet weight, technology resistance of the industry, and potential privacy issues from collecting personal data.

Lastly, the smart helmet shows satisfactory results when analyzing the movement data with the machine learning algorithm Random Forest together with selected data processing methods. Although the quality of the data used in the study was rather poor due to technical issues, it was shown to be possible to distinguish between both different activities such as walking and lifting, as well as activities with smaller differences such as lifting with different weights. Most significant was the distinction between movements with the head in different angular positions such as when walking and looking upwards.

This initial study shows that the possibilities for the smart construction helmet to function and be adopted exists. However, further work must be done for it to become a solution to lower the number of occupational injuries in the Swedish construction industry. A part of this is to develop the technological architecture of the smart helmet to guarantee the best prerequisites for data collection and processing, and to cope with both helmet weight, technology resistance, and privacy issues.

EAGER TO READ MORE?

The full study titled "Machine Learning for the Prevention of Injuries in the Construction Industry" can be read for a more comprehensive understanding.