Smart personal protective equipment

Intelligent protection for the future

EU-OSHA
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Bilbao, 12 February 2020
PPE can be viewed as the last line of defence to protect workers from harm in potentially hazardous work situations. (HSE research report 419)

ensure that PPE fulfil its mission: protection of the wearer
smart PPE
Smart PPE – combines traditional PPE with ‘intelligent’ elements

collar activity sensor
GPS receiver
textile antennas
visual alarm module
wrist activity sensor
electronic box
wireless communication module
CO sensor
heat flux sensor
external temp. sensor

source:
Let me replace you!

We're fine!!
What is smart PPE for?

smart PPE increases protection level

• using enhanced materials
• using electronic elements
• provides higher protection level / more comfort
• may collect data on the condition of the PPE after use
What is smart PPE?

- smart PPE is characterised by a certain degree of interaction with the environment

Definition from European standardisation

Smart PPE is “personal protective equipment that … exhibits an intended and exploitable response either to changes in its surroundings/environment or to an external signal/input”.

(Definition 10.1 in CEN/TC 162/WI 439 from July 2019)
Smart PPE

With electronics

Without any data collection

- a smart visibility garment incorporating lighting
- a smart, conductive textile constituting a resistance heater

With collection of non-personal data only

- data on the condition of the PPE, either for direct analysis by the user or a central control point after the transmission of the data or for later analysis
- data on the wearer’s environment

With collection of personal data

- biometric data
- localisation data
- movement detection data

Without electronics

With enhanced material that interacts with the environment (no data collection)

- knee protectors with smart shock-absorbing material
- gloves with a smart textile that changes colour if it comes into contact with a hazardous substance
Challenges

• No additional risk
• Reliability
• Privacy
• Security
• Ergonomics
• Acceptance by users
• Certification
• Market surveillance
• Recycling
The combination is the smart PPE!

- smart elements are protective elements and therefore part of PPE
- certified textile + certified electronics ≠ certified PPE
- textile + electronics = smart PPE

**certification of smart PPE = certification of the entire combination**

➡️ PPE community has to learn electronics!!!
- manufacturers, notified bodies, authorities, users, …
Information is crucial!

- users have to adapt to new capabilities
- users must know chances but also limits of smart PPE
- manufacturers must provide transparent information
- feed back experiences from the field to development
Need for standards

- up to now there are no standards available for smart PPE
- there are ongoing projects at European level

basis is standardisation request M/553: “advanced garments and ensembles of garments that provide protection against heat and flame, with integrated smart textiles and non-textile elements for enhanced health, safety and survival capabilities”
Expectations of future users

• acceptance is a precondition

• results of a survey among firefighters:
  – additional functions must always enhance safety
  – “less is more” regarding presentation of data to the wearer
  – no excessive collection of biometric data
One after the other!
Requests and recommendations to stakeholders
Main requests and recommendations to policy-making

• create an appropriate legal framework for notified bodies

  – certification is bottleneck for this new technology

  – should be possible that two or more notified bodies work together and each of them taking responsibility for its area of competence

    (up to now European legislation requires that one NB takes full responsibility)

• formulate standardisation requests regarding smart PPE
Main requests and recommendations to R&D

develop:

• appropriate testing methods for smart PPE (for combinations of textiles and electronics)

• processes for appropriate and environmental recycling of smart PPE

• safe batteries that can be worn near the human body (e.g. no overheating, no explosions, no interferences with the human)
Requests and recommendations to standardisation

- develop appropriate standards for smart PPE
  - terms and definitions
  - product standards
  - test methods
  - guidance documents for users
    (SUCAM documents - Selection, Use, Care And Maintenance)
Requests and recommendations to notified bodies

• gain competences in the field of electric/electronics (includes development of relevant testing methods for smart PPE)

• establish close connection to notified bodies of other sectors (to work together on the certification of smart PPE)
Main requests and recommendations to users

- put great value on detailed user information
- evaluate the product before purchasing (Are all the functions necessary? Do the workers accept them?)
- train workers before use
- avoid unnecessary collection of personal data
- if there are any questions, seek the dialogue with the supplier (purchasers cannot yet orient themselves using standards)
Main requests and recommendations to manufacturers

- develop smart PPE that provides
  - indeed an enhanced protection level
  - a reliability at high level
  - practical usage

- cooperate with potential users on the development and design (e.g. with regard to the necessary functions and the challenges relating to monitoring personal data)

- provide transparent and detailed information with smart PPE
Requests and recommendations to OSH experts

• gain competence in smart PPE

• inform users about the opportunities in using smart PPE but also about the challenges

• work together with other stakeholders on developing smart PPE and appropriate testing methods and standards

• guide and train users on the selection, safe use and appropriate maintenance of smart PPE
**Conclusion**

Smart PPE has great potential to make workplaces safer and healthier in the future.

- provide increased protection and new possibilities
- however, view the market with a fair degree of scepticism
- smart PPE is a fast-moving area
- participants still learning to fully exploit the potential of smart PPE
- needs continuous R&D and experience in use, supported by appropriate changes in the relevant legislation
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