V-AID trauma – **V**ideo and **AI**-assisted clinical **D**ecision Support in prehospital **trauma** care

Master´s thesis proposal

Introduction

Prehospital care may be described as "care provided before hospital care" and is mostly associated with care provided by ambulances or helicopters. It is often also associated with more or less acute situations where quick transport to a hospital is needed, but prehospital care includes much more than this. It can be care provided at ships or oilrigs, in combat zones or during disasters, but also non-acute care provided and finished in a patient's ordinary home. Typical for prehospital care is the wide clinical spectrum, sometimes rough and exposed working environment, and that the distance to medical back-up at hospital etc. may be very far away – sometimes several hours of transport. Furthermore, for instance for ambulance personnel, care must be carried out both inside and outside of the ambulance – and also during transport in a heavily moving vehicle.

In this project, V-AID trauma, we will focus on ambulance care and the design and evaluation of a technical solution utilizing streamed video with a portable device that can enable consulting about patient management with experts in remote locations, e.g. the receiving hospital. The portable video system could allow to monitor patient assessment anywhere, which is especially important for trauma, where patients can be encountered in many different situations where they cannot be moved directly into the ambulance. One example would be a patient that is entrapped in a deformed vehicle following a crash.

Mobile Video support and telemedicine

Medical personnel or others working in prehospital settings like ambulances, helicopters, mobile teams, on oilrigs, ships, etc. face many different situations and clinical, often acute, situations that need to be assessed and treated in an optimal way in order to give the victim best possible chances for a good medical outcome. The spectrum is too wide for a single person to be expert on everything, so various types of decision support including telemedicine with human expert backup, with or without video, can improve the situation drastically. Apart from the clinical assessment it is also very important to early decide upon the best logistical way to handle a patient – is the closest hospital the best choice or can there be alternatives based on services and competences available? Or is it best to leave patient at site and refer to for instance local primary care since the need isn't acute or potentially life threatening? In situations like these the option to stream live video from site to clinical backup and expertise can be irreplaceable for making optimal decisions on care and transport.

In ViPHS (Video in the PreHospital Stroke care), a project at PICTA, a telemedicine solution with streamed real-time video from fixed cameras in the ambulance is being evaluated in clinical operations within Region Västra Götaland (VGR). So far, the results are very promising, and this has propelled the ambition to also test and evaluate mobile video, i.e. video streaming outside for instance an ambulance, for various prehospital situations like trauma (e.g. a traffic accident) or triaging a patient in their own home. There are various types of mobile equipment that may be considered, but as part of V-AID trauma the goal is to test a head-worn equipment - RealWear HMT-1 (Figure 1). When applied in practice this equipment may be used alone or in combination with another camera, e.g. due to problems for the remote viewer associated with head movements, given by actual application and situation.

Figure 1: RealWear HMT -1 in clinical applications.

Scope of master's thesis project

The project deals with the video and speech device and interface planned for the V-AID project - the head-worn RealWear HMT-1. It is described as the world's first hands-free Android™ tablet class video-equipped wearable computer for industrial workers including speech control. The work includes getting acquainted with the device and evaluate its pros and cons both related to hardware, software, and practical functionality as well as constrains of various origin.

Since telemedicine always include communication with some other parties like hospital experts, it is necessary to also include how to handle videoconferencing as part of the prehospital use of HMT-1. In the project we focus on ambulance use, which also can act as model for other mobile units like emergency cars, helicopters etc. In principle there are two ways to setup the communication – either set-up a separate secure link directly between the parties involved using standard mobile telecommunication like 4G, or integrate it in some way with a video platform already used by the ambulance for videoconferencing from inside the ambulance with fixed cameras. In the project both alternatives shall be evaluated and explored. The first alternative will probably use some type of standard video facility designed for multiple HW-platforms.

As template for the second alternative the video-infrastructure of the ViPHS project shall be used. This infrastructure offers mainly two alternatives, both to be explored. The first is to find a way to locally wirelessly connect, probably using Wi-Fi, to the CODEC in the ambulance. The other is to use mobile communication (i.e. 4G) and connect directly to the regional video server and be part of the virtual video room present for each ambulance unit. By using the regional platform security issues are taken care of and there are various alternatives, like the one used in ViPHS, to handle the "receiving end", the expert.

Finally, the project includes design of a demonstrable prototype which may include using the Test ambulance present in VGR. Details on the demonstrator will be defined as part of the project. It may be based on illustrating how a standardized patient assessment procedure, such as one of the assessments described by National Association of Emergency Medical Technicians (NAEMT) Prehospital Trauma Life Support (PHTLS, see https://www.naemt.org/education/phtls) education program, could be performed in collaboration with a clinical expert at a remote location.

Links

RealWear in Ambulance service: https://vimeo.com/395034759
RealWear web site Health Care: https://www.realwear.com/solution-healthcare/
PHTLS: https://www.naemt.org/education/phtls
ViPHS: http://picta.lindholmen.se/en/projects-4/viphs-video-support-prehospital-stroke-chain

Supervisors and Examiner

Stefan Candefjord, Main supervisor, Assistant Professor, Dept. of Electrical Engineering, Chalmers stefan.candefjord@chalmers.se , 031-772 15 49

Anna Bakidou, Co-supervisor, PhD Student, Dept. of Electrical Engineering, Chalmers and University of Borås, bakidou@chalmers.se , anna.bakidou@hb.se , 076-174 36 72

Bengt Arne Sjöqvist, Professor of Practice emeritus, Co-supervisor and Examiner, Dept. of Electrical Engineering, Chalmers, bengt.arne.sjoqvist@chalmers.se , 070-787 77 97

Magnus Hagiwara, Co-supervisor, Associate Professor, Dept. of Caring Science, University of Borås, magnus.hagiwara@hb.se, 070-541 02 55