Using Google Glass to enhance pre-hospital care

Antoine Widmer and Henning Müller

University of Applied Sciences Western Switzerland (HES-SO),
Techno-Pôle 3 · CH-3960 Sierre
antoine.widmer@hevs.ch

Abstract. This article describes an application using Google Glass to allow emergency paramedics to access information from a hospital and send information from an accident side. This can potentially enhance pre-hospital care and also reduce costs. This article describes the goals of the application, its challenges and presents preliminary results of tests using Google Glass to prepare the final application. Results will be finalized in a Bachelor thesis at the HES-SO Valais in Sierre.

Keywords. Telemedicine; Google Glass; Web Applications;

1 Introduction

Swiss paramedics are trained to bring basic and advanced life support to accident scenes or other scenarios away from hospitals. They often face difficult situations where a fast intervention requiring specific medical knowledge is needed. To answer this need, the Swiss cantons have implemented Mobile Emergency and Resuscitation Units (MERU) in complement to paramedic crews. A MERU is composed of an emergency physician accompanied by a driver and is engaged alongside an ambulance by a dispatcher only if specific medical criteria are met. On the accident scene, the emergency physician becomes the leader of the medical staff on site. However, patients are still carried to the hospital by an ambulance. While answering the need for specific medical knowledge on an accident scene, MERUs lead to additional costs in pre-hospital care and remove skilled physicians from hospitals. Research has shown that telemedicine approach can help reduce the cost of pre-hospital care while improving patient safety [1,2].

Following the telemedicine approach, we propose to use an augmented pair of glasses (Google Glass) able to stream video and audio of what paramedics see and hear to a hospital. Google Glass is able to interact with different online services. As illustrated in Figure 1, Google Glass features a camera taking photos at 5 MPixels and recording video with 720p, a prism in front of the right eye, a touchpad on the right side of the frame as well as speakers and microphones. As an Android device, Google Glass is able to connect to the Internet through Wi–Fi or Bluetooth and is capable to understand spoken commands and read text via earplugs. As a new wearable device, Google Glass uncovers new health applications that can ease the work of medical staff from paramedics, nurses to surgeons. Research papers involving Google Glass for medical applications already exist in the literature [4,5]. Researchers used Google glass during 4 weeks in a hospital [4]. They focused on a limited usage of the built–in capabilities of Google Glass. They tested voice recognition as well as latency, lag time and visual quality of local and transatlantic videoconferencing. Their findings demonstrate that Google Glass could be useful in various medical tasks. However, the current version of Google Glass lacks battery life and Internet connection stability.

In our scenario, this pair of glass allows paramedics to call a hospital physician to gather specific knowledge or medical history of a patient (preconditions, allergies…). During the exchange, the hospital physician can see and hear what the paramedic sees and hears, can talk to the paramedic through a Bluetooth headset and see the real-time vital parameters of the patient such as ECG channel, cardiac rhythm, respiratory rhythm, saturation or blood pressure transmitted to a computer located in the hospital. The physician can then guide paramedics to perform the right actions on the patient.

The advantages using Google Glass for pre-hospital care are as follows: (1) Video transmissions allow physicians to stay at the hospital where they are the most needed and still have a detailed view at the accident scenes, also to prepare the intervention in case of large accidents or when operation rooms need to be prepared. (2) Without losing time traveling between accident scenes, physicians can help multiple paramedic crews in a short amount of time. (3) Vital parameters of patients can be stored for more precise diagnosis made at the hospital. Storage of real time parameters can be useful for health problems that do not occur frequently or are difficult to interpret by non-experts such as cardiac problems [3]. (4) Paramedics can access medical knowledge and patient history that was not accessible to them beforehand while performing actions with their hands as they can work with patients directly and access information at the same time.

To reach the goals listed in the proposed scenario, we identified several challenges in collaboration with paramedics. The challenges are as follows: (1) To allow communication under different network coverage. (2) To integrate different kinds of data from various kinds of communication channels. (3) To send information from an accident scene to an hospital. In the rest of the paper, we discuss the methods used to solve the challenges and we show the preliminary results of the project.

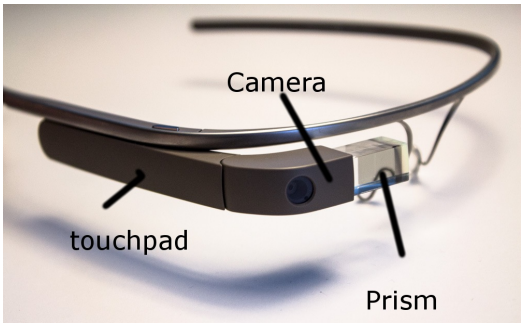

Figure 1 Google Glass with its main components

2 Methods

Figure 2 illustrates the general hardware infrastructure for the project. This infrastructure includes a smartphone as central component. Gathering data from Google Glass and monitoring devices, it acts as a gateway between the accident scene (Between monitoring systems, Google Glass and the hospital computer for communication).

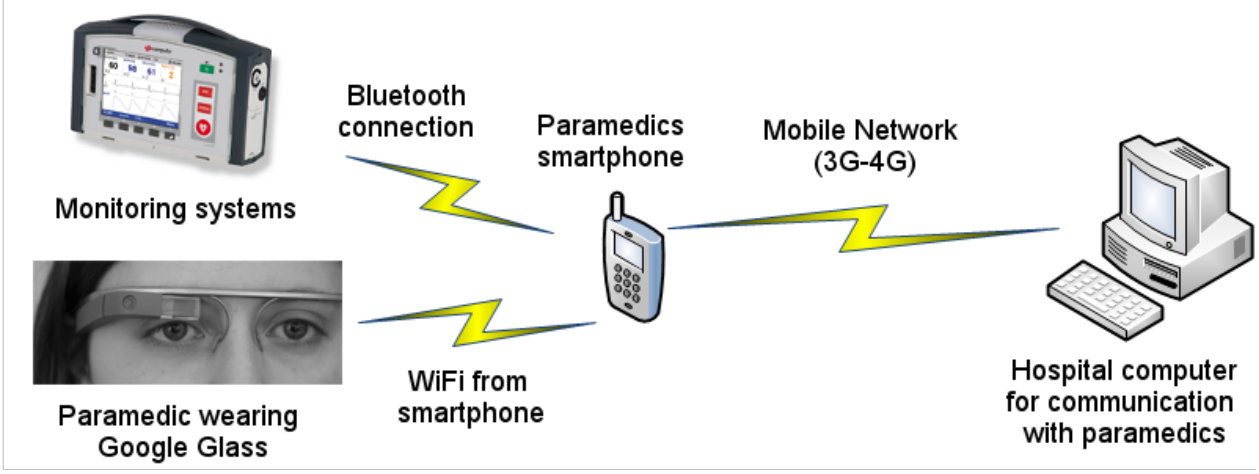

Figure 2 – General infrastructure for the project

2.1.1 Android smartphone

An Android smartphone is responsible to collect data from the accident side to send it to the hospital and to transfer video calls from Google Glass to the hospital.

2.1.2 Monitoring systems

On the accident scene, paramedics can use various monitoring systems to gather data about the health status of a patient. Most of these monitoring systems can already transmit health data via a Bluetooth connection. This connection can be used to retrieve real-time data and send the data to the hospital as additional parameters to allow a physician to take the right decision. The data can also be displayed on the Google Glass.

2.1.3 Google Glass

An application on Google Glass captures the camera and the microphone feeds to transmit them over a Wi-Fi network to the android smartphone. In addition another application displays information received from the hospital on the prism of Google Glass. This allows the paramedic to view the information about a patient when he/she needs it.

2.1.4 Hospital computer

On the hospital side, a computer application is needed to allow a physician to communicate with a crew of paramedics. Due to hospital IT regulation, this application is accessed through an Internet browser. On a related web page, the physician is able to see what the paramedics are looking at and can check health parameters of the patient on the fly. This should permit the physician to guide the paramedics through medical procedures to save or stabilize the patient.

2.2 Video conference

Heterogeneous network bandwidth and quality of service are available throughout rural areas of Switzerland. Therefore, we need to implement algorithms that prioritize the transmission of patient data over voice and video and use all available communication channels at each given location. For example, the communication could switch to regular voice network when the data network is not strong enough to transmit voice and video. Among multiple existing video and audio standards, WebRTC fits the needs of this project well due to its ability to be rendered natively in an Internet browser.

3 Results

Feasibility studies involving use cases discussed with paramedics show that the concept and the methods to reach the goal of the project are sound. Furthermore, we obtained preliminary results for the various aspects.

3.1 Video conference

Using the same application programming interface as the one found on Google Glass, we are able to send and receive video calls from an Android smartphone to an Internet browser on a laptop using Wi-Fi connection and WebRTC. The next step is to try to send audio and video on a mobile network in varied settings.

3.2 Google Glass

We already submitted a conference paper describing the development of a Google Glass application able to take a photo and send it to a medical image retrieval system along with keywords in order to retrieve similar cases [6]. As a preliminary assessment of the usability of the application, we tested the application under three conditions (images of the skin, printed CT scans and MRI images, CT and MRI images acquired directly from an LCD screen) to explore whether using Google Glass affects the accuracy of the results returned by the medical image retrieval system. The preliminary results show that despite minor problems due to the relative stability of the Google Glass, images can be sent to and processed by the medical image retrieval system and similar images are returned to the user, potentially helping in the decision making process. Based on this early work, an application to display information from the hospital on the prism is in development and is expected to be ready by early August.

4 Conclusions and Future Work

This article shows preliminary results from an ongoing bachelor project at the HES-SO Valais in Sierre. While the project is not finished, the medical partner is satisfied with the outcome. As future work, we are in the process of completing the first prototype as described in the method section and then we will perform a user study to test scenario in a real-world setting.

5 References

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