Smart glasses:
Interaction, privacy and social implications

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ABSTRACT

Smart glasses are wearable devices that display real-time information directly in front of users' field of vision by using Augmented Reality (AR) techniques. Generally, they can also perform more complex tasks, run some applications, and support Internet connectivity. This paper provides an overview of some methods that can be adopted to allow gesture-based interaction with smart glasses, as well as of some interaction design considerations. Additionally, it discusses some social effects induced by a wide-spread deployment of smart glasses as well as possible privacy concerns.

Keywords: Smart glasses, Head-worn displays, input techniques, interaction, body interaction, in-air interaction, privacy, social implications

INTRODUCTION

Head-worn displays (HWD) have recently gained significant attention, in particular thanks to the release of a temporary version of Google Glass. Moreover, the anticipation of the commercial launch of Google Glass[1] in the upcoming months and the fresh news that Facebook, Inc. acquired Oculus Rift[2] increased the popularity of such devices even further.

The trend of wearable device purchases is importantly growing and some business analysts [1] forecast more than 20 million annual sales of Google Glass in 2018. Furthermore, researchers have been already studying and investigating HWD for several years. As a consequence, it is important to give an overview of different methods that could be used to interact with smart glasses and, above all, analysing privacy concerns and identifying the current and potential social implications related to these devices has a great significance at this point.

[1] http://www.google.com/glass/start/

[2] http://www.oculusvr.com/

INTERACTION

The main purpose of smart glasses is to provide users with information and services relevant for their contexts and useful for the users to perform their tasks; in other words, such devices augment users' senses. In addition, they allow users to do basic operations available on today common mobile devices such as reading, writing e-mails, writing text messages, making notes, and answering calls.

Therefore, although most of the usage of smart glasses is passive for the users, i.e. reading content on the little screen of the device, active interaction with such devices is fundamental to control them and supply inputs. In fact, users need ways to ask smart glasses for instance to open a particular application, answer something they need to know, insert content for emails, messages or input fields, or to control games.

Designing interaction techniques

Before presenting how users can interact with smart glasses, it is worth mentioning the main aspects that have to be taken into account during the design process of such techniques, which is summarized in [2]. As for technical characteristics, a gesture recognition system for HWD should ideally be very accurate, i.e. able to distinguish fine shape-based gestures, insensitive to daylight, as small as possible, consume low power, and be robust in noisy and cluttered environment that are typical conditions in everyday life scenarios. As far as user experience is concerned, the physical effort required to users to interact with the devices is relevant, as well as easiness of use and encumbrance of the device.

Interaction approaches

Two different categories of interaction methods can be distinguished for smart glasses: free form and others. The former includes for example eye tracking, wink detection, voice commands, and gestures performed with fingers or hands. On the other hand, the latter comprises for instance the use of hand-held devices, e.g. point-and-click controllers, joysticks, one-hand keyboards and smartphones, or smart watches to control the HWD.

The aforementioned examples should help to understand the difference between the two kinds of interaction. However, it can be expressed by saying that the free form does not require any extra device other than the smart glass to be performed and detected; on the contrary, it is obvious how the control of the smart glass that happens via smartphones, pointer, etc. cannot satisfy the free form criterion.

GESTURE-BASED INTERACTION

Thereinafter, we will only focus on gesture-basted interaction, because it is preferable to assure a great user experience. Gesture-based interaction has been researched more than eye tracking and wink detection so far, and voice recognition has already reached a huge diffusion on today mobile devices.

It is relevant to note that several different techniques to detect gestures exist; analysing them in detail would lead us to stray from the purpose of this paper. Some of them make use of devices and sensors that have to be tied to users' body, e.g. to wrists, hands or fingers, whereas others exploit cameras that are external to the smart glass itself and are located around the user. In addition, some of these methods are used together with markers, e.g. reflective, infrared, coloured, in order to identify the position of users' hands.

Alternatively, gestures can be recognized by using cameras or sensors, such as RGB or 3D cameras and depth sensors, that can be embedded into smart glasses. It is essential to stress that real free forms of interaction are realized only by using cameras or sensors embedded into the HWD as they nullify the need of external components and reduce the encumbrance. As a consequence, these approaches are ideal for the commercial version of the smart glasses that will be launched on the market. Differently, the other recognition techniques that have been classified as non-free forms are usually used in research for several studies in this context.

Gestures on body/smart glass

Another significant distinction applicable to gestures is based on where the gesture is performed. A common solution is doing gestures very close to or directly on some surfaces such as some parts of the smart glass itself or the user's body. The following paragraphs present two different studies that have investigated this approach.

Hand-to-face input. In [3], Serrano et al. describe their study aimed at identifying which gestures and surfaces allow fast interaction with as little effort as possible. As regards the surface, they considered and compared the results about some parts of both the smart glass and the user's face. In particular, the face has been chosen since it is a part of the body we interact with very often, i.e. 15.7 times/hour in a working set; consequently, this means that gestures performed on some parts of the face could be less intrusive than others and may reach a good level of acceptance. On the other hand, the high frequency of hand-face contacts leads to the need of gesture delimiters used by the users to inform the system that a new gesture is starting and avoid unintentional triggers; for instance, voice commands or long pressing on the surface can be used to invoke new gestures.

The need to find an alternative to performing gestures directly on the smart glass itself arises from the fact that the touchable area available for interaction on such devices is usually only a narrow strip in correspondence to the user's temple; in fact, this means that many gestures are needed to browse some pages or applications that require a lot of panning and zooming due to the very small size of the interaction surface. As a result, the time taken to reach a target in a page is negatively affected as well as the arm-shoulder fatigue is significant because of the prolonged lifting.

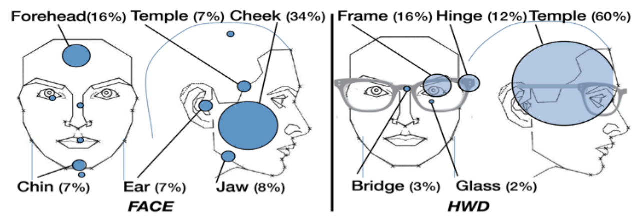

Figure 1: Main areas identified by participants as suitable for input on the face (left) and on the HWD (right). The size of the circles is proportional to the percentage of gestures. Source: [3]

The first relevant result of this study is that most of the participants preferred the temple to all the other parts of the smart glass and voted the cheek as the best part of the face for interaction, as it can be observed in figure 1. Moreover, some participants found interacting on the cheek more suitable than performing gestures on the device thanks to its

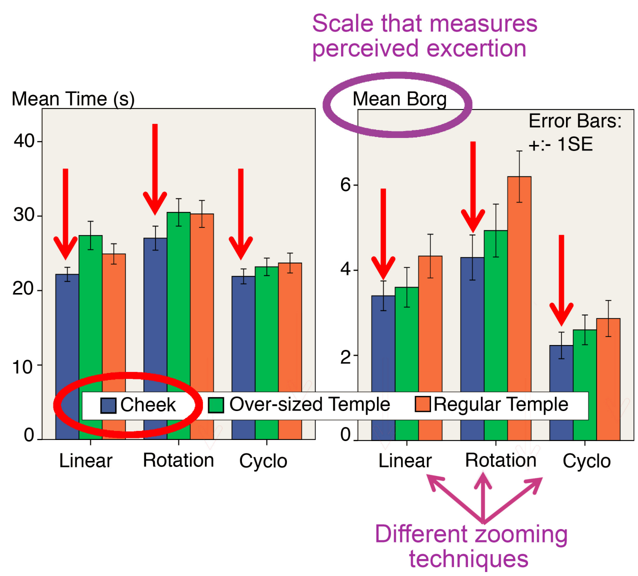

Figure 2: Mean time in seconds (left) and mean Borg value (right) for technique and interaction area. Source: [3] modified

bigger size; also, they stated that this part of the face can be considered somehow similar to a touchpad.

As far as the performances are concerned, figure 2 illustrates that cheek obtained better results in terms of both time taken and exertion required to perform the interaction. In addition, using the cheek took the participants roughly 20 seconds to perform three different zooming and they considered it the easiest method compared to the over-sized temple and regular temple. The mean Borg referenced in the plot is a scale for ratings of perceived exertion; in particular, it allows to estimated fatigue and breathlessness during physical work [5].

The last result that is presented about this study concerns the social acceptance of these gestures and showed that participants still prefer interacting with the smart glass over using their face. In particular, this result is not a consequence of only appearance matters, however it is due to some other relevant aspects, e.g. hygienic issues, damage to make-up, meaning of some gestures in other ethnic groups, etc.

In conclusion, the study shows that cheek is a valid alternative to the touchable areas on smart glasses as for performances; though, social approval is very important and may

Figure 3: Gustafson et al. adapted a non-visual audio interface that announced targets as users touch them, which allows users to browse an unfamiliar imaginary interface. Source: [4]

influence users even more than interaction speed and fatigue.

Palm-based imaginary interfaces. The purpose of this second study is to identify and quantify the role of visual and tactile cues when browsing imaginary interfaces [4]. Specifically, imaginary interfaces can be defined as spatial and non-visual interfaces for mobile devices and, in this particular case, they consist of matching between some application to be opened or actions to be triggered and some parts of the user's hand (see figure 3).

This approach is very useful to impaired users and eye-free interaction with smart glasses and, above all, is less intrusive and tiring than hand-to-face and hand-to-HWD interaction.

Figure 4 shows the four study conditions investigated in this study. The study shows that when not blindfolded (Figure 4a), the grid drawn on the fake phone (Figure 4c) orients users on the screen and helps them to find the targets that were reached faster than on the palm (Figure 4d). Additionally, this experiment proved that, in contrast, touching the palm was faster than touching the fake phone when blindfolded; this has a great importance because it demonstrates that the tactile cues received by the users

Figure 4: Study conditions – (a) *sighted* vs. (b) *blindfolded*, using a partial blindfold that only obscures the participants' view of their hands; (c) *phone* vs. (d) *palm*. Source: [4]

touching their own palms is very significant.

After having found that the tactile cues are relevant, it is interesting to understand how the two different tactile senses, i.e. active and passive, contribute to help users to browse the interface. In particular, the active sense is perceived by the finger that actively touches the palm, whereas the passive one is sensed by the palm when touched by the finger.

Therefore, a second experiment has been conducted as a 3x2 factorial design where the measured variable and one

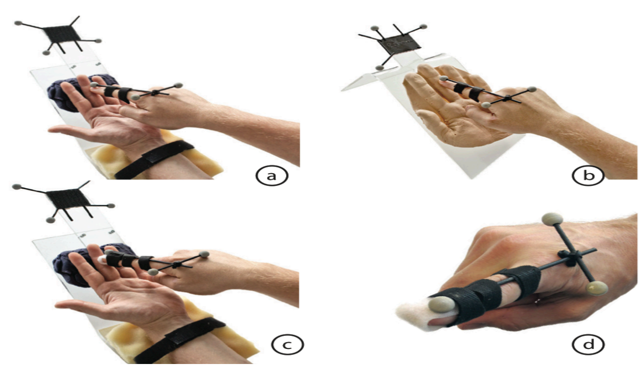

Figure 5: Study conditions – (a) *palm* vs. (b) *fake palm* vs. (c) *palm with finger cover*; (d) close up of finger cover. Source: [4]

factor, i.e. user condition sighted vs. blindfolded, remained the ones of the first experiment; as for the other factor, i.e. the touching surface, the touch on the palm with a cover finger was tested in addition to the touch on both the real and fake palm with the bare finger.

The results were meaningful since they showed that browsing on the fake palm is much slower than on the real palm, while in contrast there is no significant difference between touching the real palm with a cover or with a bare one. As a consequence, this certainly means that the majority of tactile cues come from the passive tactile sense rather than the active one, contrary to what authors' expected.

To sum up, the study explained in [4] is notable in this overview as it demonstrated that controlling devices such as smart glasses by touching the palm phone has much better performances than using the phone when blindfolded; as a result, this means that this approach is suitable to be used on-the-go since it does not require users to turn away from the scene. On the other hand, detecting taps on different parts of the hand may be difficult, above all if the aim is to provide a free form of interaction; in fact, an external OptiTrack system with reflective markers was used to perform the presented experiment. For this reason, there are different approaches that detect gestures by using only cameras and sensors embedded in the smart glass. The next section discusses some of these approaches.

In-air gestures

An alternative to performing gestures on the top of a surface or very close to it is doing them in-air. The following paragraphs explain two research projects that investigated the recognition of this kind of gestures and could potentially be valid solutions to interact with smart glasses.

SixthSense is a project described in [6] and developed at Massachusetts Institute of Technology (MIT) within the Media Lab team. It is aimed at building the wearable gesture interface that is partially represented in Figure 6. In detail, the system is mainly constituted of a small projector and a simple camera fixed to the user's head; in addition, some coloured markers have to be tied to the user's fingers to allow the gesture detection. A common mobile computing device has to be connected to these appliances.

Substantially, this system projects the content on any surface in front of the user's head, instead of displaying it on the mobile device or on the little screen of a smart glass. Moreover, it is able to recognize and track a user's hand and physical objects thanks to the camera, the markers, and some computer-vision based techniques. Therefore, basing on the mutual position of hands and projected content while performing gestures, the system interprets the hand movements as particular inputs and triggers certain actions consequently.

Even though no smart glasses are directly involved in this project, it is reasonable and very interesting to think of building smart glasses that embed a little projector; this may be possible thanks to the small size of the projector

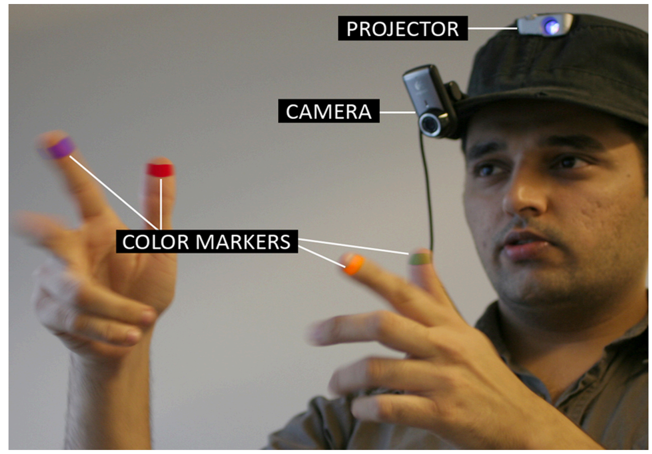

Figure 6: Some components of the SixthSense wearable gestural interface. Source: [6]

used in the SixthSense project that is likely to decrease considerably even more in the next years. Specifically, SixthSense may be promising in the context of interaction with smart glasses: such devices with embedded projectors would allow users to interact with contents that they want to see in big size on any surface, whereas they could still see data that they want to keep private on the smart glass lenses.

Furthermore, if HWDs alone become computationally powerful enough, this scenario could eventually evolve to all-in-one smart glasses that would let users dispose of today common mobile devices, e.g. smartphones and tablets, since users would be able to see their content on arbitrarily large surfaces.

Mime is a different project developed at MIT and explained in [2]. The purpose of Mime is to implement "compact, low-power 3D gesture sensing" approach for interaction with HWD. In this case the focus is on smart glasses and Colaco et al. have built a model of a smart glass that improves on existing technology in the field of gesture recognition.

The innovative aspect it introduces is the combination of two different techniques to detect gestures performed by a single hand and without any marker; in particular, it exploits the data that come from both a depth sensor called 3D Time Of Flight (TOF) module that has been integrated into the smart glass and an RGB camera also embedded. The TOF module (Figure 7) is composed of three photodiodes located on the left, centre and right of the device and a NIR LED that emits a pulsed light source. The basic operation of this 3D sensor is the following: the source emits the signal and, as soon as the signal hits the user's hand, it is reflected back and sampled by the photodiodes on the device.

In particular, the system measures the time of flight of the signal and it can compute the 3D position of the hand basing on these measurements: supposing to put the hand on

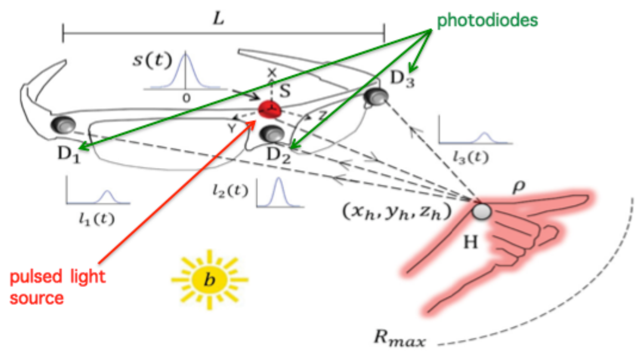

Figure 7: Components and basic operation of the TOF module. Source: [2]

the left side of the device (Figure 7), the first photodiode that samples the returning signal is the one on the left and it receives the signal with the highest amplitude, then the signal arrives to the centre photodiode and finally to the right one. Thus, it is possible to obtain a centimetre-accurate 3D localization of the hand by considering the order in which

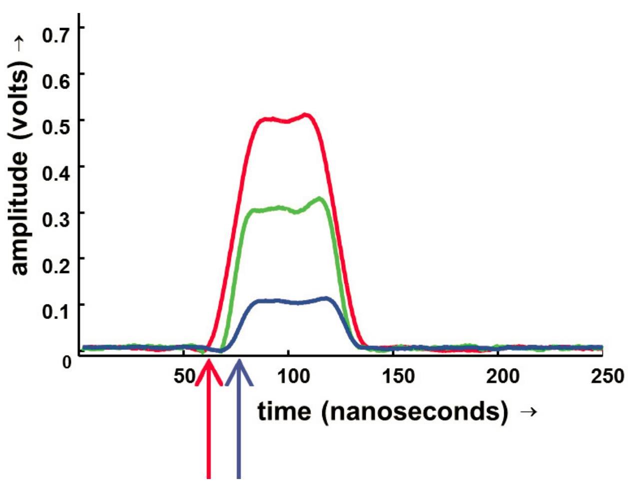

Figure 9: Sensor data visualization for hand on the left. The red, green, and blue curves are the responses at the left, centre, and right photodiode, respectively. Source: [2]

the photodiodes receive the signal and how long the return flight takes.

Moreover, simple gestures such as swipe, point and click, circle and zoom in-out, can be recognized by the TOF module alone. In contrast, finer shape-based gestures are detected by using the RGB camera and computer-vision algorithms. Though, the latter technique does not operate individually; the role of the TOF module is still fundamental for this system because the 3D coordinates of the hand that it identifies are used to define a certain Region Of Interest (ROI) around the hand. Then, the computer-vision algorithms are applied only to the ROI and not to the whole images captured by the RGB camera. This is a key aspect of this research project as it allows to reduce the computation and, as a consequence, the consumption of power. In addition, this combination leads to very high accuracy since RGB cameras alone often fail in cluttered environment and, thanks to the previous TOF module operation and the ROI identification, the number of failures decreases significantly.

In conclusion, Mime is a promising system that allows a free form of interaction and is suitable to be used in everyday life scenarios thanks to its insensitivity to daylight and the cheapness of its components, as well as to its limited encumbrance (all the sensors needed are embedded, so the size depends on the smart glass design).

Interaction conclusion

The first section of this paper has discussed some methods that could be used to interact with smart glasses. The one that plays the most significant role in this overview is Mime as it matches many of the requirements that have to be considered when designing such systems; moreover, it is the only project/study among the introduced ones that proposes a complete, unobtrusive and cheap approach that could be adopted soon to control smart glasses during everyday tasks. The main drawback related to Mime is that it is able to recognize only one-hand gestures.

PRIVACY AND SOCIAL IMPLICATIONS

The second section of this paper concerns privacy and social implications related to smart glasses. In particular, these topics have already won some significant attention of the media and the research trends related to them are growing. As a consequence, it is reasonable to suppose that, in the future, many of us will wear some kind of HWD always connected to the Internet and helping us with everyday tasks by augmenting our view and brain.

However, it is interesting to note the results of two surveys conducted by YouGov, an internet-based market researcher, in the United States: the first study [7] revealed that 59% of the participants would not buy and wear Google Glass and the second study [8] showed that 54% of the participants would not feel comfortable interacting with someone wearing Google Glass. A different survey conducted recently by Wireless technology experts CSR found that 72% of participants would only buy wearable devices if they look good and 67% of participants stated that devices need to fit their own personal style. It is essential to mention that these surveys are not scientific studies and the conditions under which they have been done are unknown. As a consequence, it is important to consider these data carefully in a scientific context. In any case, they have been reported above since they are an interesting starting point to introduce some of the topics that are explained hereinafter, such as the dependence of social implications on the geographic area and acceptance.

Perceived drawbacks

As it has been briefly introduced in the previous paragraph and in some Google Explorers' reports like [9], it emerges that many people in some regions like USA and Europe are sceptical about smart glass and in particular Google Glass. The main reasons that worry these people are explained below.

Acceptance. In many cases people still do not accept smart glasses' appearance and find such devices flashy and awkward, so much that they would feel ashamed wearing them. Furthermore, most of the people averse to smart glasses find that these appliances cause a disturbance while interacting and would not be ready to accept them in everyday scenarios of social interaction.

Security. Smart glasses can be exploited to threaten the security of their users. In particular, it is interesting to note that many applications on such devices provide immersive feedback; as a consequence, if malicious applications get installed, they may be able to deceive users about the real world. Moreover, thieves could even be able to build a 3D indoor model of users' houses if they come into possession of the images recorded by the camera in case users use such devices at home [10].

Health. There are some people who are worried by wearing an always-connected device close to their brain for a long time, above all if such devices include cellular modules; although this statement should be supported with scientific results, it is significant to mention it because it is perceived as a real issue among people and may brake the diffusion of HWDs. Additionally, wearing or carrying devices such as smart glasses and smartphones throughout the whole day tempts users to reduce their effort and fatigue since they can optimize their actions by using ad-hoc applications or web services; a significant and simple example of this is the possibility to get the shortest path to reach a place in a fast and effective way, in particular on Google Glass. More in general, the raise of Ubiquitous Computing increases the sedentariness due to the diffusion and the constant progress of smart houses and smart offices that automatically adjust and control the environment; as a consequence, users are not required to stand up to turn on/off lights, washing machines, ovens, heating systems, etc. anymore.

Personal data and privacy

The biggest threat that people perceive concerns privacy: the ability of smart glasses and Ubiquitous Computing devices in general to gather huge amounts of data about users as well as record anyone and anything is seen as a "subtle" way to violate one's privacy.

Firstly, it is interesting to mention some example of data, called personal data, that a smart glass may be able to collect [11]: preferences and taste about anything by analysing the browser history and the bookmarks and by tracking online and real-life (thanks to the camera) purchases; habits in terms of activities and places by exploiting sensors and Internet connectivity that provide users' location and are able to identify some of the tasks that users perform; users' mood, anything they look at in a particular scene and how they react to something they see thanks to eye tracking and by analysing gestures and speeches; opinions, political and religious beliefs, gender, name, wage, bank details, text messages, calls, emails, pictures, etc.

Then, it is worth looking at what privacy is, therefore two different and significant definitions are considered. The first one comes from [12] by Warren and Brandeis and defines privacy as "the right to be let alone" and "general right to the immunity of the person, the right to one's personality"; this definition shows the American way to perceive privacy, that is the right to freedom from intrusions by the state, especially in one's own home [13]. The second definition describes privacy as "the claim of individuals, groups, or institutions to determine for themselves when, how, and to what extent information about them is communicated to others." [14]; this second statement is closer to the European way to perceive privacy that basically consists of the rights to one's image, name, reputation, and informational self-determination. In particular, the latter definition is the more relevant in this overview since it stresses the need for data protection.

After having introduced the concept of personal data and privacy, it is interesting to explain what privacy issues people perceive. These issues were raised every time a revolutionary technological innovation arose; for instance, when the first Kodak portable cameras were invented in the late 19th century, they were initially forbidden on beaches and into other public places since people largely felt that these appliances invaded "the sacred precincts of private and domestic life." [15] During the last years, mobile and ubiquitous devices have started to face similar issues and the reasons are presented in the next subsection.

Access to our data

As it has already been briefly mentioned, one of the biggest threats that people perceive is the ability of smart devices to collect very big amounts of data. In particular, this happens because Ubiquitous Computing is interested to ordinary actions rather than special events, therefore users' actions are monitored continuously during their everyday life. Then, these data are analysed by using Data Mining techniques to extract behavioural patterns and preferences; this is very useful in order to provide both individuals and society in general with tailored services. These analyses lead to some issues because, even though devices are secure, i.e. do not leak data, and service providers are trusted, users do not know who can legitimately access their data and what their data are used for. In fact, a European study conducted in 2011 [16] revealed that only 18% of the participants felt in complete control of their data.

That being so, it is worth investigating who usually accesses our data with the aim explained in the previous paragraph: government, to segment the population and understand its needs, with the final purpose to provide proper services; financial institutions and banks, when they have to decide whether loan customers money; employers, in order to check potential employees' habits, behaviours, lifestyles, etc.; law enforcement officials who need to investigate; companies, to understand how they should do business with us and, above all, to target advertisements. Advertisement targeting is one of the most significant and popular purpose among the ones mentioned above; Google, for instance, scans the content of Gmail users' emails in order to target advertisements and, given that all data recorded by Google Glass will be stored on Google servers, it is likely that the same will happen with data coming from such smart glasses [17].

After having introduced people's worries and which subjects use to access our personal data, it is essential to present another central point: users accept terms and conditions when they buy or start to use such devices, as well as when they install some applications or access some services for the first time. By doing this, they give these subjects the rights to access their data in a legitimate way. Even though these conditions are sometimes difficult to understand by users and do not always mention explicitly all the subjects that have access to users' data, law does not respond since there is neither illegitimate access nor direct injury, i.e. not very intimate data are accessed and users' dignity and reputation are not damaged.

Loss of control and skills

This subsection presents different ways in which users may perceive to lose control of data and their choices by using smart glasses. The first one is related to the main dreaded issue among the public, that is being captured or recorded by strangers during ordinary life along the street, in public spaces, shops, and restaurant, etc. This is an end-user vs. end-user problem and, although smart glasses' users have intentionally decided to somehow trade their privacy to use such devices, bystanders who are recorded by them have not made the same choice. In particular, this drawback derives from the fact that people do have expectations of anonymity when they are in public; the ability of smart glasses to capture and record is considered really worrying because of the small size of these devices and the potential possibility to identify the subjects in the frame. Though, it is essential to specify that almost all over the world, with some exceptions like Hungary, concerts, movie theatres, etc., capturing and recording anyone and anything is legal in the public space also without the consent of the subjects; differently, as for private places the owner has the right to allow or forbid these actions. Even though Google Glass is not designed to be an always recording device and its recording/capturing frequency and conditions are comparable to the ones of today smartphones, it is likely that smart glasses will lead people to change their social and public behaviour. In fact, people will perceive smart glass like always recording and, as a result, they will limit their actions and oppress some forms of expressiveness with significant social implications.

Furthermore, many smart devices that make some decisions autonomously in place of the user, and in some cases also smart glasses, may lead people to lose the control of themselves and their choices. These devices are designed to proactively anticipate users' needs and take action on their behalf, so that humans can focus on higher-level tasks, with less cognitive and physical effort. This happens often, for example, when some services propose to the users some items they could like or need to buy, basing on previous purchases and tastes. Alternatively, the device may start to bother users notifying that they should decrease the speed while driving and respect the limits, although they want to keep a high speed. Therefore, it has to be observed that actions done by the device on its own may not correspond to real needs or intentions and some corrective actions may be required and perceived annoying by users; moreover, preference of people change over time so they may not like anymore what services recommend and, in some cases, users could even consider devices as disloyal if they act to respect third parties' interests. All these factors may cause cognitive dissonance, which means the device becomes psychologically obtrusive and users may not know what they want or need anymore.

Additionally, a significant use of such devices may lead to lose skills, abilities and knowledge since people commit basic tasks to the Internet and many apps more and more. For instance, many users do not do special effort to remember names, definitions, and phone numbers, do calculations and orient themselves anymore.

Benefits

After having analysed in detail some perceived drawbacks and social issues related to smart glasses, it is relevant to mention the main benefits such devices offer.

Everyday life empowered. Smart glasses empower our senses and brain and allow us to concentrate on most of our ordinary tasks without having to give them up to check emails and text messages, surf the Web, get advise from friends or experts, etc. In other words, Context-Awareness is significantly enhanced thanks to smart glasses and livestreaming as well as translations on the fly, may become the order of the day.

Security enhanced. Even though it is paradoxical that security is both a drawback and a benefit, it is essential to note that people feel much more safer when they carry mobile devices. Specifically, smart glasses increase this safety perception since they can be controlled via voice and gestures; therefore, emergency calls or status on social networks can be enabled quickly. Moreover, directions that appear instantly directly in front of the eyes make users feel safer while travelling. In addition, security is also improved more generally speaking because smart glasses may allow users to see their password as plain text on the little screen, assuming that no one else is able to see what is on it; this does not require users to remember their passwords and much longer and stronger ones can be set as a consequence, for instance, to operate at ATMs.

Scientific progress. One relevant example is progress in the field of surgery, that has already experimented augmented reality in general and also Google Glass, to let surgeons be advised during operations by other experts from all over the world. [18]

Privacy and social implications conclusion

In order to conclude the second section and the overview in general, it is interesting to observe that the ethnical group plays a fundamental role when social implications and the privacy concept are considered. In contrast to the data that have been presented at the beginning of this section about openness to buy and wear Google Glass and acceptance in USA, Indian people are really enthusiastic about smart glasses and their potential and not worried about privacy concerns at all; this may be a consequence of the really high Indian human density and shows how people do not care about being captured/recorded within a huge crowd, probably because identifying and tracking a single individual is very difficult.

Moreover, worries about privacy and social implications depend also on users' age; it was really surprising to read about two grandparents who tried Google Glass and were very excited and satisfied about it. They even proposed interesting applications like medicine consumption tracking and livestreaming to get advised while gardening; they also said that they would like to receive such device and use it everyday. [9]

To sum up, what emerges from this overview is that the biggest issues related to smart glasses are well-known: similar matters were raised when, for instance, camera phones became popular [19], as well as when phones started to identify users' locations [20]; though, both these features are today commonly used in ordinary life and almost no one renounced to use mobile devices because of these functionalities. In fact, expectations of privacy change after devices are used for a while: users only need to get used and then, once they realize they feel safer and empowered, they do not concern about privacy matters anymore.

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