Prototyping a Semi-Automatic In-Car Texting Assistant

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ABSTRACT
Texting while driving is dangerous and illegal in most countries. But both social as well as business forces led to a widespread ignorance of those bans and in turn to a potential lethal situation. We argue that, in addition to legislative regulations, in-car texting should be made less distracting and dangerous. We offer a solution for one specific communication goal, namely staying connected to a social network. We propose a semi-automatic status-posting system and present a prototype based on a Pleo. We argue that our approach should be extended by automated answering mechanisms. The aim of this paper is to foster discussion on texting while driving. The solution for one type of semi-atomatic texting is outlined, other types of texting need to be looked at separately.

Author Keywords
texting while driving, pleo, semic-automatic texting

ACM Classification Keywords
K4.2 Computers and society: Social Issues

INTRODUCTION
Ubiquity and convenience being a major driving factor, the spread of mobile email devices such as BlackBerry, iPhone, and others, has grown to tens of millions over the last several years [13]. [12] expect a sustained growth of this trend in the next decade. Mobile email promises seamless anywhere anytime connectivity. Employees connect with their organizations increasing productivity [13]. Participants in a study on *BlackBerry* use by [12] emphasized the liberating nature of mobile email by showing how it allowed them the freedom to work anywhere.

On the other hand, using mobile devices while driving is without doubt distracting and thus dangerous. After a surge in horrific automobile accidents in which distracted driving was proven to be a factor, 38 US states have enacted texting-while-driving bans [5]. Other countries issued similar bans.

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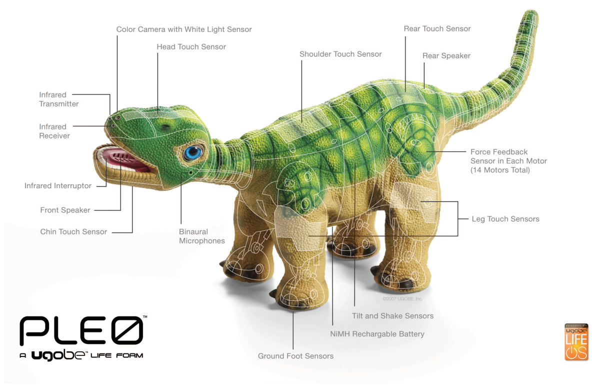

Figure 1. Pleo robot (Source: Ugobe)

Nevertheless, people continue to text while driving. Reasons for ignoring bans on texting while driving vary, and include both business and social forces. People may be tempted to ignore texting while driving bans, because

- professional communication partners expect universal availability.
- driving is perceived as ”dead time” that needs to be filled with small talk.
- intimates / buddies expect a message to be replied promptly.
- there’s an audience to be constantly supplied with great content.

In order to tackle this problem, we have to take a closer look at the different types of texting and the underlying motivation.

Aside from widely known mobile email, we consider the following texting services relevant in the automotive context: SMS, Twitter (twitter.com), and Facebook (facebook.com). The latter are briefly introduced in the following.

Short Message Service (SMS) is mostly used for person-to-person messaging (chat with friends). The text is limited to 160 characters but the system can segment messages that exceed the maximum length into shorter messages. [12] argue that SMS is mostly a private communication means that has not been widely adopted by the worldwide business community.

Microblogging sites like Twitter provide a new means of communication [10]. Twitter provides the ability to deliver the data to interested users over multiple delivery channels: cell phone, Facebook application (see below), email, or as an Instant Message. A Twitter user interested in the statuses of another user signs up to be a "follower". Updates or posts are made by succinctly describing one's current status within a limit of 140 characters. According to [8], Twitter fulfills the need for an even faster mode of communication compared to regular blogging.

Facebook belongs to the category of online social network (OSN) services. Its core functionality is managing connections or "friends" [9]. However, Facebook also provides opportunities for communication and hosting of content. Facebook is currently having the most users worldwide–other OSNs are MySpace, Friendster, Bebo, hi5, and Xanga, each with over forty million registered users [10].

As we pointed out earlier, legislation is unfortunately not sufficient to keep drivers from potentially lethal habits, so additional safeguards and alternative solutions need to be developed.

In this paper we propose a way to circumvent composing twitter messages.

OUR PROTOTYPE: PLEOPATRA

The driving context and the nature of the communicative goal of Twitter lead to a limited amount of likely messages, which are usually diary-like. A typical status might be "We are already so close to Paris, but now we hit a traffic jam!" (see Figure 5). We argue that such a message could as well be generated using a set of message templates and current status information of the car, e.g. GPS position, current speed, and available traffic jam warnings. Due to its nature and complexity, a car on the street is not a very suitable environment for fast prototyping. In order to evaluate the concept on a smaller scale, we developed a prototype [4] on a Pleo toy dinosaur. Due to its complex sensors and single data bus, the Pleo can be considered a downscaled model of a modern car, which we will explain below in more detail.

A Pleo is a rather sophisticated device–sometimes also referred to as artifical lifeform–equipped with a multitude of sensors (see Figure 1).
The Pleo hardware is based on an Atmel ARM7 32bit processor (main CPU), a NXP ARM7 32bit microprocessor (camera, audio) and four Toshiba TMP86FH47AUG 8bit microprocessors (motor control).
The movement is achieved trough 14 motors with feedback sensor. Additional sensors are:

- A color camera with white light sensor
- Two microphones
- Eight touch-sensors

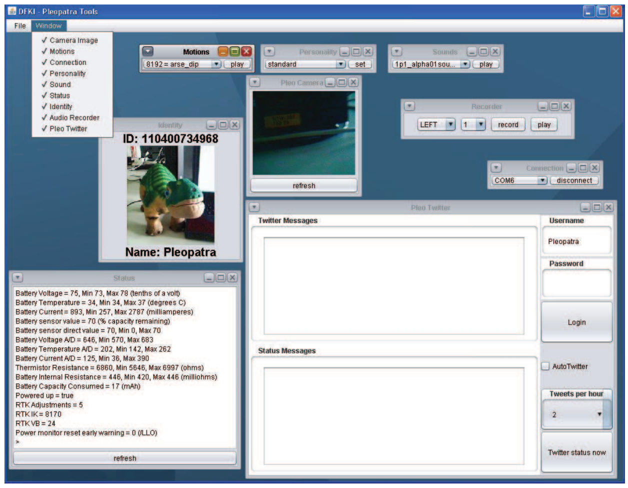

Figure 2. Pleopatra Tools Screenshot

- Four push-buttons (one under each foot)
- Tilt and Shake sensors
- Infrared transmitter and receiver in the mouth
- Infrared transmitter and receiver at the head

Pleo is also equipped with two speakers and both internal flash memory as well as a SD card slot and a USB interface. We connect Pleo via its USB interface to a computer in order to communicate with it. Pleos USB interface is wrapping a serial port to which we can connect using standard libraries such as RXTX [7]. To facilitate the communication, we implemented an API wrapping the serial protocol in Java. It is called Pleopatra Tools [3] (see Figure 2). We published the library under GPL license. Higher level functions are included in a graphical user interface, which makes interaction with the Pleo easy. Included are: establishing a connection to Pleo, storing personalized information about different Pleo such as photo or name, which is recognized instantly once the Pleo is connected, Recording audio from Pleo and direct playback on the PC, inspection and playback of sound-, motion-, and personality files as well as displaying live camera images from pleo. The API itself furthermore offers: controlling motors and sensors, access to the file system, recording audio from pleo in wav format and accessing pleos camera and saving bmp images.

Using this API we implemented a monitoring tool which constantly checks the sensor data for anything extraordinary, such as sudden darkness, very loud noise, very high or low temperature, detection of something green which is considered food for Pleo, etc. On detection, an event is triggerd. Depending on the type of event, a pre-formulated message is picked from a small database and refined with actual sensor values, e.g. "35 centigrades? It is very hot in here!". These messages are then twittered (see Figure 3) via an automated Twitter interface (jTwitter) [1]. The Twitter application is also accessible via the Pleopatra Tools' GUI.

Figure 3. Pleopatra: the first twittering dinosaur in the world

The task we handled here is a typical example for a dual restricted data selection process (see Figre 4). The raw data from the sensors (e.g. motor 4 is blocked at an angle of 35 degrees) is transformed and filtered into some higher level data (e.g. somebody/something holds the front paw). The resulting data is then further filtered according to two resource limitations: First more technical (”what is extraordinary enough to be presented?”) and then more cognitive (”how much information do we want to publish?”). We will get back to that concept in more detail later on.

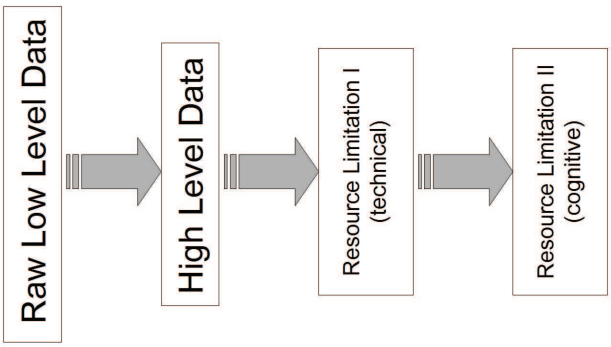

Figure 4. Dual restriction on data

FROM DINOSAUR TO CAR

We argue that a toy robot sensing his environment is comparable to a sensor-equipped car when it comes to automatic status message generation. In order to work properly, the driver has to be identified with his Twitter ID, just as each Pleo connected to the Pleopatra Tools API must be recognized by its serial ID before starting the Twitter application. In a car environment, this could be achieved for instance by checking the bluetooth ID of the drivers phone. Typical car sensors are much more complex than the sensors we have seen at the Pleo robot, and the access of data is usually not as uniform as a single USB interface. Data accessible in a car include current postion, speed, heading, temperature (inside and outside), etc.

The Controller Area Network (CAN) interface standard [2] was specified by Bosch in 1991 and is nowadays widely used in cars. It was devised to enable communication between subsystems of the car, since each subsystem may need to control actuators or receive feedback from sensors. The CAN bus may be used in vehicles to establish a commection between transmission and engine control unit (the cars main processor), or, for example, to connect the window openers, air condition, seat control, etc.

The amount of pre-fabricated messages needed for a useful tweet-generation in a car is by far higher than the few dozens of messages in our Pleopatra prototype. Nevertheless, the basic principle stays the same: Sensor data is monitored, exceptional values are matched to a database of pre-fabricated messages and blancs in the message are filled with current values. The driver then only needs to accept a message for sending, which is clearly significantly less distracting than composing a message on a mobile device.

SELECTION OF RELEVANT CONTENT

Selection of relevant information based on a constant sensor data or information stream is not a trivial task. In [11], Maybury presents the SumGen system, which “selects key information from an event database by reasoning about event frequencies, frequencies of relation between them, and domain specific importance measures.”. The system is able to tailor a summarized report for a stereotypical user.

More recent works aim at performing such a summarization in real-time in order to emulate a reporter at for instance a sports event. The IVAN system [6] “generates affective commentary on a tennis game that is given as an annotated video in real-time. The system employs two distinguishable virtual agents that have different roles (TV commentator, expert), personality profiles, and positive, neutral, or negative attitudes to the players.”

In our example, the information streams to be monitored are sensor data. Defining which data is “extraordinary” is rather straightforward here: If the usual environment temeprature of the Pleo dinosaur ranges between 18 and 23 centigradess, then 35 centigrates is extraordinary. If the dinosaur does not have any input on his touch sensor on the back for 90 percent of its time, then getting an input there is extraordinary.

The interpretation of sensor data usually depends on the context. In a toy context as our Pleopatra prototype, there is not much variation of context. The dinosaur usually stays more or less in the same environment, and extracting information from sensor data is straightforward.

In the automotive context, we have to extend our information flow example from Figure 4. The car is moving in a complex environment, so in order to doublecheck our interpretation of the sensor data, we need additional environmental evidence as a second component. If the car is on the highway and moving at an extraordinary slow speed or even not at all, it doesn’t necessarily mean that the driver is stuck in a traffic jam. He might as well just rest on a parking lot or visit a fast food restaurant's drive-trough. But if we do have for instance traffic information announcing a traffic jam in that highway to verify our interpretation, the interpretation gets more reliable. So our first resource limitiation is environmental evidence:

	sensor data
+	envionmental evidence
	interpretation of the situation

The situation might be unusual or extraordinary, but to make it interesting and thus worth tweeting, another contextual component is usually needed. In our example: Being in a traffic jam could be something ordinary you encounter on your everyday commute, but being stuck close to your destination on a weekend trip is special. We add unusual context as part of the second, cognitive restriction:

	exceptional sensor data
+	envionmental evidence
+	unusual context
	relevant message

At the same time, user defined parameters like desired frequency of status posts can be used to optimize the second resource limitation according to the drivers needs.

CONCLUSION AND OUTLOOK

We presented a prototype of a twittering toy dinosaur and argued that the introduced principle could - with an increased complexity and some modifications - be used for an automated generation of tweets. This automation would reduce the risk of driver distraction, especially for power users of social networks who have an urge to stay connected to their environment. This is of course just a part of the solution. Other communication goals need to be looked at and analyzed separately.

In a next step, we can try to include automatic answering mechanisms. For instance, if driver A is on it's way to person B, there could be an incoming tweet saying "@DriverA: Where are you?" and based on the current status, the car could respond immedeately: "I am on my way, but right now I am stuck in a traffic jam near Frankfurt, driving at less than 10mph!". This is just one example, the possibilities here are manyfold.

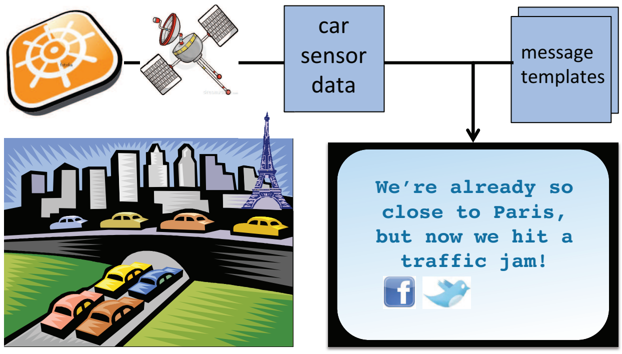

Figure 5. Twittering car

REFERENCES

1. JTwitter - the Java library for the Twitter API. http://www.winterwell.com/software/jtwitter.php, 2008.
2. Bosch. Can specification, 2.0. http://www.semiconductors.bosch.de/ media/pdf/canliteratur/ can2spec.pdf, 1991.
3. C. Endres and D. Braun. Pleopatra Tools. http://www.dfki.de/pleopatra, 2009.
4. C. Endres and D. Braun. Pleopatra: A Semi-Automatic Status-Posting Prototype For Future In-Car Use. In *Adjunct proceedings of the 2nd International Conference on Automotive User Interfaces and Interactive Vehicular Applications (AutomotiveUI 2010)*, page 7, Pittsburgh, PA, USA, November 2010.
5. Governors Highway Safety Association. State cell phone use and texting while driving laws. http://www.ghsa.org/html/stateinfo/laws/cellphone_laws.html, 2010.
6. I. Gregory. Embodied presentation teams: A plan-based approach for affective sports commentary in real-time. Master's thesis, Saarland University, 2010.
7. K. Jarvi. RXTX : serial and parallel I/O libraries supporting Sun's CommAPI. http://www.rxtx.org/, 2006.
8. A. Java, X. Song, T. Finin, and B. Tseng. Why we twitter: understanding microblogging usage and communities. In *WebKDD/SNA-KDD '07: Proceedings of the 9th WebKDD and 1st SNA-KDD 2007 workshop on Web mining and social network analysis*, pages 56–65, New York, NY, USA, 2007. ACM.
9. A. N. Joinson. Looking at, looking up or keeping up with people?: motives and use of facebook. In *CHI '08: Proceeding of the twenty-sixth annual SIGCHI conference on Human factors in computing systems*, pages 1027–1036, New York, NY, USA, 2008. ACM.
10. B. Krishnamurthy, P. Gill, and M. Arlitt. A few chirps about twitter. In *WOSP '08: Proceedings of the first workshop on Online social networks*, pages 19–24, New York, NY, USA, 2008. ACM.
11. M. T. Maybury. Generating summaries from event data. *Inf. Process. Manage.*, 31:735–751, September 1995.
12. C. A. Middleton and W. Cukier. Is mobile email functional or dysfunctional? two perspectives on mobile email usage. *European Journal of Information Systems*, 2006.
13. O. Turel and A. Serenko. Is mobile email addiction overlooked? *Commun. ACM*, 53(5):41–43, 2010. chi2011.