MODERN EMERGENCY CONTACT METHODS

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ABSTRACT

Current methods for contacting emergency services primarily utilize phones to connect a caller with an emergency service operator. The backend technology for routing 911 calls are highly inefficient and operators rely heavily on the caller to provide critical information. These inefficiencies lead to a tremendous waste of time when the consequences are most dire. This problem was approached with the goal of resolving the inefficient backend processes through automation as well as reducing the reliance on the caller. A wearable prototype has been developed which fulfills both requirements by storing emergency contact information, current location, and relevant medical information. In addition, biometric sensors allow the device to record recent biometric data, predict the occurrence of a medical emergency, and automatically contact emergency services. This process is quick and removes the reliance on the user by initiating contact and sending the stored information directly to emergency operators. This advancement aims to modernize the HCI field in one of the most important and critical social services.

INTRODUCTION

Emergency services are one of the most important social institutions constructed for maintaining the wellbeing of society. Yet the technology behind this is incredibly lacking and advancement has lagged behind other social services; dramatic improvements must be made to modernize the current system. Cellphones, wearable technology, and other devices have not yet been integrated as tools in contacting emergency services. We believe there is tremendous potential in using these devices to update the current systems to meet modern demands.

MOTIVATION

A literature review was conducted to determine the problems existing in the current system and assess the user need. These results helped identify the problems which should be solved in a proposed solution.

Social Barriers

The current system for contacting emergency services relies on the person contacting emergency services to provide critical information. A common form of contacting emergency services is to call 911; the caller would then have to provide information such as the location and nature of the emergency.

This process is slow, inefficient, and prone to disruptions. In an emergency situation, people may not have the presence of mind to communicate necessary information. Furthermore, the caller may not know, remember, or make mistakes when providing the information; these mistakes or omissions will waste previous time or cause disastrous accidents.

Another concern is language or cultural differences. In countries such as Canada, there is a significant amount of people who do not speak English as their primary language. As such, they may not be proficient in their communication skills when communicating with emergency services; the stress of an emergency situation will only exacerbate the problem [1].

Technological Barriers

The backend systems for handling emergency services have not been adequately updated for the modern world. Tremendous inefficiencies exist which affect many users of emergency services.

The most critical inefficiency in the current systems is routing 911 calls. Historically, landlines are easy to localize and routing may be done automatically by the phone company. Calling 911 on a landline will usually be the best number to reach emergency services. However, landline usage is declining and cell phones are increasingly becoming people's only form of telephone communication [2]. When a 911 call is made from a cell phone, the call is routed to the national 911 system; cell phones cannot be localized like landline phones. The operator must determine the caller's location and manually forward their call to their local 911 operators. This process can take multiple minutes in worst case scenarios.

Obtaining localization data is even more difficult when the caller is unable to provide that information, such as if they are in an unfamiliar area. The current technology used to determine the location of a cell phone caller is extremely unprecise. At best a large area may be marked on a map estimating the source of the call [3]. This is extremely problematic when the call is being made from a densely populated city where even a small area could contain a large number of housing units, such as high rise apartments. Although there have been proposed solutions to improve the efficacy of the technology, none of the solutions have been implemented [3].

Finally, the backend technology for handling cases where translation services are required is severely lacking. There

is no fast way for the operator to determine the language the caller is familiar with; a significant amount of time is spent simply determining the language used. Even when that determination is made, the call must be transferred to a translation service, which spends even more time finding a translator. When a translator has finally been found, they must then listen for the 911 operator to tell them the questions to ask the caller and rely the responses back. This process is hugely inefficient leading to callers often times resorting to desperately attempting to use the native language. This has left a negative impression on many callers who did not speak the native language proficiently [4].

RESEARCH RESULTS

The research data confirmed many of the problems which arose during the literature review. Many smaller problems identified were analyzed and found to have similar themes.

Initiating Contact

The first problem identified is the process of initiating contact with emergency services. Although native people may be very familiar with the 911 number, they are usually unaware there exists a local emergency number which will result in faster service. There may also be non-native people who are not as familiar with 911 due to their native countries using different numbers for contacting emergency services. Most people are not aware there is a local emergency number. Even if they are aware, the local number is not as short or memorable like 911 making it easy to forget. Although the problems differ among different groups of people, the underlying problem is that there is not an easy way to reach the local 911 operators, which is increasingly important as more people transition towards using cellphones [5].

It is also important to address cases where common tools such as cell phones are not available. It is possible for a person to forget to carry their cell phone, or it may be out of battery. Groups such as the elderly may not even have cell phones, or may not be able to reliably access one in case of an emergency. As such, there is demand for an external device whose primary purpose is to facilitate contact with emergency services.

Communicating Information

Even when contact is made with emergency services, it is often difficult to communicate critical information. Location information is critically important, but may be difficult to provide if the caller is in an unfamiliar or difficult to describe area. Relying on current localization technology will result in a tremendous delay as the operator attempts to guess the caller's location.

In cases such as medical emergencies, there may be steps bystanders can take to assist the victim while waiting for an ambulance to arrive. It may be difficult to describe the condition of the victim. As such, the emergency operator may not be able to guide the caller in assisting the victim.

Prototype Creation

From the literature review and research results, it was clear that a proposed solution should target the two main problems, which are initiating contact and communicating information with emergency services.

Preliminary Sketches

The preliminary design is a smart watch with specific capabilities designed to facilitate communication and send critical information [6]. It is separate from a cell phone or other device to ensure its usability is not compromised by any other function. It can store information as well as naturally accompany a user without being intrusive or annoying to use.

Data Storage

Critical information such as location, personal information, emergency contact information, and medical history are commonly requested information when emergency services are contacted. By prerecording the information, the user may enter all relevant information before an emergency situation arises. This removes the time constraint and stress induced by an actual emergency situation. Users unfamiliar with the native language may receive assistance in entering information, reducing their involvement when an emergency situation arises. Information entered may be verified for completeness and correctness at any time. When an emergency situation occurs, this information can be provided to emergency service operators for a complete, accurate, and detailed record without requiring any effort from the user. This was the first feature envisioned, as it seems like the easiest to implement using current technology and has the most significant impact.

Data Collection

Similar to many preexisting smart watches, sensors may be integrated with the watch to collect relevant real-time information [7]. An accelerometer can detect sudden changes of movements to predict a possible accident, such as a fall. This feature would be especially useful for groups such as the elderly which may become incapacitated and unable to contact emergency services. Biometric data such as heart rate or blood pressure can also be used to predict a possible accident, but also provide medical information to emergency responders in case of a medical emergency. The data from these sensors can be added to the other data made available to emergency responders.

Automatic Emergency Contact

In order to address difficulties in contacting emergency services, the watch uses its sensors to predict emergency situations. For example, if a fall is detected, the watch will automatically prompt the user asking if emergency services are needed. The user will not need to know the local

emergency number to initiate contact. Furthermore, this helps people who are alone and become incapacitated by their emergency; if the watch does not receive an answer to its prompt, it will automatically contact emergency services. The prompt is accompanied by an alarm sound which will alert nearby people there may be an emergency. The user is also given ample warning to dismiss the prompt if there is not an emergency situation. If emergency services must be contacted, all information stored on the device will be sent to them.

USABILITY TESTING

Users were asked to test the prototype and give their input on the watch's functionality. In addition, they provided insight on how new users would approach the device. These suggestions were used to improve the functionality of the design as well as highlight possibly confusing aspects of the design. Testers were instructed to use a PowerPoint which had all the animations, screens, functional buttons, and transitions a real smart watch would have.

Initial Impressions

In order for the prototype design to be successful, it must actually be fashionable and entice users to wear it. Since watches are worn in a semi-prominent position, we recognize the fact that users may not want to wear this device despite its merits if they do not like its appearance. We have based our design's physical appearance on the Apple Watch; testers seem to appreciate its aesthetics and would wear this watch.

Information Form

For the user to utilize the data storage feature, they must first fill out a form with all of their information. In order to be comprehensive, the form was fairly long; testers complained that there may be too much information to enter even though there is no time constrain. Although the main benefit of filling out the form is to have the information ready before an emergency occurs, there is merit in slimming the information down such that only the most important information remains. This allows the data to be more concise when sent and reviewed by emergency responders. As such, the form has been modified to only hold the most critical information.

Automatic Emergency Contact Alert

Testers liked the concept of the watch's ability to automatically detect and prompt the user when it believes a possible emergency situation is occurring. However, they complained about the alert sound. The alert sound was designed to be very noticeable; if the user does not notice the prompt, emergency services will be contacted. It is critical to prevent false alarms from disrupting emergency operators. The alert will be changed to utilize a less disruptive sound.

Automatic Emergency Contact Prompt

The prompt presented to users when the watch believes an emergency situation has occurred is a very simple display screen with three buttons. The user is asked if they are fine, they may choose "Yes", "No", or "Maybe". While the meanings of "Yes" and "No" are self-evident, some testers were confused about the "Maybe" option. This option is intended to give people access to non-emergency contacts if they are unsure of their condition; they may want to contact someone for advice. Although testers understood and supported its inclusion once they understood its purpose, that option was changed to have a more obvious functionality.

Biometrics Data

Testers were very supportive of the biometrics data feature. The information provided by this feature is unlike any data currently available to emergency responders. We believe this data may be critical in allowing emergency responders and doctors to understand the onset of the victim's condition. For many medical conditions, onset information is extremely important in reaching an accurate diagnosis [8].

CONCLUSION

The current system for contacting emergency services is dramatically lacking and does not utilize the technology or principles of HCI. This is an important advancement in HCI as emergency services is a critical institution in modern society. Our prototype design has modernized the process in contacting emergency services by addressing user needs and increasing the efficiency and efficacy of communication during emergency situations.

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