Session No. 657

Mobile Applications for the Safety and Health Professional

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Abstract
Mobile devices have a plethora of applications that can be extremely useful to the safety and health professional. These applications include monitoring, communication, and information retrieval for the technical aspects of safety and health practice. In addition, numerous applications provide support for self-management and organization such as calendars and document management.

Introduction
A safety and health (S&H) professional is expected to have training and experience to implement programs and procedures to improve the safety of people, environment, and property. Successful safety and health programming is built upon the elements of hazard anticipation and recognition; quantitative measurement of exposures; hazard control; and recordkeeping. Mobile device applications can be used in each step and have many applications that can be extremely useful to the S&H professional.

Hazard anticipation is a primary skill safety professional achieve through a combination of education and experience. While many hazards are self-evident, others are subtle and not known to the lay person. The S&H professional should be able to be aware of safety and health hazards before they arise, especially during design planning stages. The recognition of hazards occurs as the S&H professional engages with workers, the occupational environment, and event-triggered investigations. Once hazards have been recognized, further information is often needed and obtained with the use of specialized instruments such as noise meters, light meters, air sampling, etc. As hazards are identified, the responsive control priorities, in order, (Brauer, 1994, p. 82) are:

1. Eliminate,
2. Reduce,
3. Install safety devices (guarding),

4. Provide warnings,
5. Training in safe procedures, and
6. Personal protective equipment.

Recordkeeping to document of all of the preceding is essential to assure completion of tasks and provide a basis for program review to aid in the process of continual improvement. Mobile device general and safety-specific applications are available for all of these elements: a valuable tool for the S&H professional.

The widespread use of mobile devices began with simple cellular telephones in the 1990s. Early prototypes combining a mobile phone and personal digital assistant (PDA) such as the IBM Simon and Nokia 9000 (refs) were also released as early as 1992. These eventually came to be known as smartphones. Currently, smartphones have many more capabilities, such as digital cameras, touchscreens, web-browsers, accelerometers, media players, and global-positioning-systems (GPS) combined with very large memory storage capacity.

With the advent of smartphones, commercial 3rd party applications were developed and availed to enhance the utility of cellphones.

Applications

General applications easily adapted for use in S&H include:

- GPS,
- Floor plan layout,
- Bar and quick response code scanning,
- Photography,
- Webcam monitoring,
- Weather alerts,
- Emergency broadcasts, and
- Access to safety, health, and environmental regulations, information, and instructions.

Specific applications designed for S&H include:

- Noise measurement and dosimetry, using microphone
- Vibration measurement, using accelerometer
- Light level assessment, using camera

A summary of these features is presented in Table 1.

The GPS functions can be used to mark the location of observations or measurements. Using MagicPlan (Sensopia) allows the user to construct a fairly reliable floor plan of a room to aid in monitoring, ventilation evaluation, or layout rearrangement. Bar or Quick Response codes provide immediate access to product identification or instructions through applications, an example of a Quick Response Code is shown in Figure 1. The ability to document observations in still or moving digital format from a pocket sized device frees the S&H professional from carrying cumbersome equipment.

Table 1. A summary of select general and specific S&H uses of mobile device tools and applications.

General applications	**Uses in S&H**
GPS	• Locating an individual, directions • Finding or locating an individual, equipment, buildings, etc.
Create floor plans	• Create a floor plan to document locations of sample readings taken.
Bar code scanning Quick Response Code scanning	• Product identification • Retrieve MSDSs • Inspection documentation
Photography, High definition video Webcam	• Documentation of inspections or investigations • Training
Internet connectivity Data connectivity	• Communication • Information retrieval o MSDSs o NIOSH Pocket Guide o Instructions • Weather and emergency alerts
Specific hazard applications	**Uses in S&H**
Noise	• Sound levels • Noise dosimetry
Vibration	• Human vibration exposure measurement
Light	• Lighting surveys

Figure 1. Quick Response code example

Noise monitoring and mapping has been conducted in urban environments using NoiseSPY. This application simultaneously measures and logs time, sound levels and GPS data to help produce a map of environmental noise (Kanjo, 2010). Urban noise is traditionally monitored at fixed sites by a technician. With mobile applications, numerous surveyors can be employed, yielding a wider range of locations.

Noise applications such as NoiseSPY, Sound Meter, or Sound Meter Pro, (AppBrain, 2011) can easily be used within an industrial environment for monitoring. Evaluation of NoiseSPY, which uses a filter to report sound in dBA, showed a relatively close correlations

between Nokia NSeries (Kanjo, 2010) and N95 8GB (Maisonneuve et al., 2009) phones and calibrated occupational noise meters. However, with the many different mobile devices and variations due to wear and tear and user techniques, further investigation is indicated to measure accuracies under laboratory and field conditions. The mobile device and application has an advantage over traditional noise measuring instruments in its ability to map locations.

The Vibration Meter application by Smart Tools (AppBrain, 2012) or Accelerator Monitor (AndroidZoom, 2012) appears to have been designed primarily for seismographic recordings and may have limited applications for occupational exposures.

LightMeter (Ambertation, 2012) will provide measurements of lighting in foot candles and lux. At the same time, it can record a picture of the task being evaluated.

Benefits

Perhaps the main benefit of using mobile application devices is the widespread ownership due to availability and low prices. Anyone with an S&H responsibility can easily and cheaply download applications that can be repurposed for their needs. The compact size of mobile application devices allows the S&H professional to carry a single pocket-sized tool in various work environments.

Mobile application devices are normally equipped with microphones and accelerometers. The microphones can be used for the recognition of potential high noise situations, with later follow up with more accurate instrumentation. Likewise, the vibration monitoring functions are useful to obtain a rough assessment of human vibration exposure. Built-in light meters give us an approximation of lighting levels. The devices, while not highly accurate, provide much better assessments than human senses alone to dictate further evaluation with S&H hazard specific instruments.

Limitations

For monitoring applications, the mobile application devices may not be as accurate as industrial hygiene sampling instruments. Shortcomings of a mobile application for environmental noise monitoring may include noises introduced by an untrained user, wind, GPS accuracy, disconnects, and limited data-logging memory. Also, the measurements may not comply with ANSI, ACGIH, ISO, NIOSH, etc. methods. Controlled experiments comparing mobile device applications and scientific precise instruments such as sound level meters, vibration meters, and light meters are needed to further assess accuracy.

Conclusions

The *tricorder* used by Mr. Spock in the original Star Trek television series was not nearly as compact and versatile as our current smartphones, but could provide readouts of element and biomedical analysis. With future technology advances and design, it is not unreasonable to expect smart phone versions that may incorporate element sensing chips and refinements of existing hardware/applications to greatly enhance utility. At the present, mobile devices combined with downloadable application provide numerous tools to enhance the S&H professional's ability to assess, measure and document occupational health exposures.

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