//ANGEL React

Deep Dive

Emergency Detection

Overview

Ensuring the safety of lone workers is one of the most important topics in everyday work, and emergency detection plays a central role in this safety.

This paper therefore focuses on emergency detection:
What distinguishes good from less good ones?

We have summarized the most important information on emergency detection and created a test. Based on just a few characteristics, this test helps determine which tool can help in a future emergency.

Emergency detection primarily means motionlessness detection, as serious emergencies almost always end motionless.
Therefore, we have dedicated chapter 3 to motionlessness.
Chapter 5 takes up the fall detection, as there are significant qualitative differences in the implementation.
In between, the device test can be found in chapter 4.

1. Why emergency detection?

There are countless situations in which people unintentionally – and especially unnoticed – become lone workers. Of course, technicians on a construction site always work in pairs. But doesn't it also happen that one of the two people quickly drives back to the company to fetch a missing part? Or grabs lunch? Or simply has something to do in another room?
How long can that take?
And the even better question: How long can a person lie unnoticed after an emergency at work without severe consequences occurring?

What about people in sales: Aren't they always alone? Or the last person to leave the company in the evening?

To secure all these situations, there are small electronic devices for emergency detection. They call for help when we need assistance and can no longer help ourselves.

Hopefully, you will never need the fire extinguisher in the corridor or the defibrillator in the entrance area, but perhaps the emergency call button in the elevator. Nevertheless, no one would try to save money here today.

We are firmly convinced that this will also be the case in the future with electronic solutions for the protection of lone workers.

So what's stopping us from investing in emergency detection systems today?

Especially where you can already see the benefits for little money?

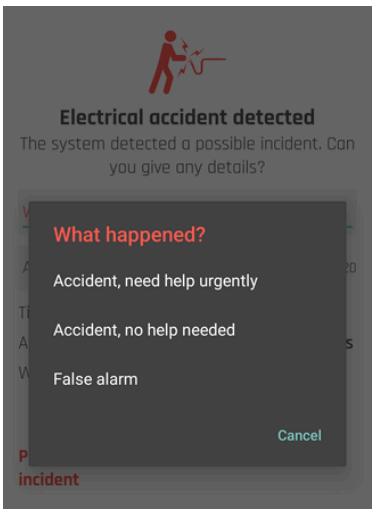
2. Excursus: Communication as the be-all and end-all for rapid help

Ideally, emergency detection systems notify not (only) the emergency responders but, above all, fellow employees. These can often provide initial care and, more importantly, grant professional responders access to the company premises.

It is ideal if the emergency detection system is connected to a porter's lodge that is manned around the clock, for example. This ensures immediate help. If such a facility is not available, a larger number of people can be notified in the event of an emergency alarm.

It is important to note:

- Emergency contacts must be notified via various channels to ensure the emergency alarm is received.
- The selection of emergency contacts must not be arbitrary. It must be adaptable to the daily work situation. This means that the emergency contacts must be very easy to change.
- The higher the number of emergency contacts in the event of an emergency, the greater the probability that someone will be nearby and can help immediately.
- The emergency contacts must be able to communicate with each other: Who is nearby, who can help, what needs to be done?
- The person involved in the accident must also be able to communicate with the emergency contacts, for example, to indicate if the emergency alarm is a false alarm.



3. Recognize motionlessness: What matters

Detecting motionlessness may seem simple at first. In detail, however, it presents us with significant challenges.
We have listed these specific challenges here:

3.1. Distinction between motionlessness and resting work

More specifically: How does electronics actually know whether a person is motionless or just quietly working on the PC, perhaps reading e-mails?

This requires an incredibly sensitive accelerometer. It measures the smallest movements that one makes — even during desk work. If a movement is detected, an 'egg timer' that counts down is reset to the maximum time.

If no 'sign of life' is detected during the entire timer duration, a pre-warning alarm is issued. In good systems, this pre-alarm starts very quietly and then gradually gets louder.

A person who is simply quietly working will just move slightly, and the pre-alarm will stop. If someone is motionless in the medical sense, unfortunately, some noise will not help to prompt the victim of an accident or medical emergency to move.

By the way, such sensors are also built into mobile phones, but as of 2024, they are still far too insensitive for applications of this kind.

3.2. Differentiation according to the severity of the emergency

More specifically: How can we ensure that in the event of a severe emergency with respiratory arrest, the alarm is triggered as quickly as possible?

Good systems have two or more timers that operate simultaneously with different motion thresholds. A relatively short timer with 60 seconds, for example, responds to minimal movements in the single-digit milli-g range, which is a few thousandths of the acceleration due to gravity. A person with cardiac arrest will be absolutely motionless, thus never exceeding the movement threshold, and an emergency alarm will be triggered particularly quickly in this case.

However, if the person is "only" severely injured, breathing, but unable to call for help themselves, this short timer would never trigger. Therefore, there is a second timer that only responds to larger movement thresholds but naturally has to be set for a longer to avoid constantly triggering during desk work, for example.

3.3. Detection of motionlessness apart from tilt angle detection

More specifically: Aren't systems for detecting motionlessness actually designed to detect when an injured person slumps and lies down? What if I remain in a vertical position during an emergency?

To prevent this, emergency detection must not rely on tilt angle detection alone. This would be problematic because any work performed while lying down, such as screwing something, would automatically be classified as an emergency.

If a system combines motionlessness detection with tilt angle detection, it won't cover all types of emergencies.

Only a pure and well-functioning motionlessness detection system can detect emergencies where a person is not classically lying on the ground.

3.4. Security despite pre-alarm

In concrete terms: How can we ensure that the vibration of the pre-alarm does not trick the system into detecting movement and thus turn off the emergency alarm?

In systems where an app on the smartphone measures motionlessness without additional hardware, the pre-alarm can become a problem: The vibration of the smartphone can trick the system into detecting movement, preventing an emergency alarm. To be on the safe side, a system with additional hardware is a good solution.

It is important that the hardware is not worn directly next to the smartphone, or that the system is designed to filter out these vibrations.

4. Device test

Finding the right device for emergency detection can be challenging due to the wide selection available. That's why we've developed a short, simple test to help you determine if a system is suitable for detecting motionlessness.

1. Borrow a device from the manufacturer. Keep in mind: If a manufacturer doesn't offer rentals (or rents it out cheaply), there may be reasons for it.

2. Wear the device for a few working days. Is it annoying? Each system will emit pre-alarms when sitting quietly on the couch. However, if you are constantly disturbed by a pre-alarm even while working at a desk, avoid that system! You won’t wear it for long in your everyday work.

3. Place the device on the windowsill to test the pre-alarm: After about a minute, the pre-alarm should sound. The vibrations of the pre-alarm must not be enough to stop the system again.

4. PLACE the device on the windowsill to avoid tilt angle detection tricks. If you are deliberately testing a device with a tilt angle function, carry out all tests while lying down.

5. Test what happens in the event of an alarm. Are enough emergency contacts alerted, and can they easily coordinate the help? As the person who triggered the alarm, can you also communicate?

A good system in the business sector should meet all of these criteria.

5. Fall detection:
The basics

The most important aspect of any emergency detection system is the detection of motionlessness, as there are always falls that cannot be reliably detected.

Why is motionlessness detection more significant than fall detection?

- After a minor fall, the injured person can usually call for help themselves.
- However, a serious fall typically leaves the person helplessly on the ground. In such cases, motionlessness detection will trigger the emergency alarm if fall detection fails.

Nevertheless, fall detection is also crucial because it ensures that a call for help is accelerated.

A fall is usually detected based on three phases:

- Phase I: Weightlessness or significantly reduced gravity is detected for a certain period of time. In a vacuum, the sensor would measure zero acceleration (0g). In real life, significantly reduced acceleration due to gravity can be measured.
- Phase II: The impact is measured. Depending on the hardness of the ground, very large accelerations occur, which can be easily detected.
- Phase III: The duration of motionlessness is measured. This prevents every joyful jump in the air or brisk sprint up the stairs from being classified as a fall. Attention is paid to the duration of motionlessness: After a fall, a pre-alarm is issued after just a few seconds of motionlessness. This is the only way to communicate a fall accident in a timely manner.

5. Fall detection:
more than a matter of luck

An ideal fall consists of

- free fall,
- violent impact with more than ten times the acceleration due to gravity,
- a short calming phase,
- absolute motionlessness.

Any system will detect this and report a fall immediately.

However, real falls look different.
For example, if a person wearing the emergency detection sensor on their hip falls over like a board, the sensor performs a semicircular movement. Thus, the system does not recognize a real free fall.

What does that mean for you in practical terms?

- If the device you're testing has a fall detection sensitivity setting, be suspicious!
  - How exactly are you supposed to set and test this? By means of simulated falls from the ladder, for example?
- You can be sure:
  - Reputable manufacturers use fall dummies. They test them in all conceivable scenarios, throwing them down stairs, letting them fall from ladders, or letting them trip over objects.
  - Only with significant investment and time can ideal fall detection be determined and adjusted.
  - If the system leaves the sensitivity setting for fall detection to you, the manufacturers have not done their job.

Motionlessness detection is the reliable method for detecting emergencies, and you can easily test that yourself. Fall detection is the advanced feature of emergency detection, but here you largely have to rely on the quality of the manufacturer.

Result

In this paper, we show that although many emergency call systems claim to secure everyday work, the quality varies greatly.

The most reliable means of detecting emergencies in everyday working life is the detection of motionlessness.
Therefore, it is crucial that motionlessness detection is

- accurate
- prompt
- and not triggered for no reason.

At ANGEL React, we offer emergency call systems that excel in motionlessness detection and have also perfected fall detection.

Feel free to explore our ANGEL React systems through our Try and Buy. We welcome testing and comparisons, as only through comparison can you be sure of the best choice.

Contact us via angelreact@adresys.com.
We are looking forward to it!