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Establishing security measures for the protection of production workers through UWB real-time localization technology

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Abstract: This article discusses Sewio's real-time positioning system, which helps organizations protect workers in production areas by improving their safety, reducing the time needed for collection and rescue operations, increasing safety and simplifying the reconciliation of workplace time. The system works on the principle that every employee, supplier or visitor to the production plant receives a tag that identifies their exact location in real time. The tag can be part of a standard visitor card, such as cards issued at conferences. Optionally, the labels can also be attached to the clothing within the worker's arm or possibly to a part of the helmet. This article describes the applications of the use of the RTLS localization system in critical cases of threats to workers' health.

1 Introduction

Locating objects, vehicles and especially people is on the rise these days as it is a technology that collects real-time location data. In this case, the basic component is the aforementioned location. If we want something, we need to know what location and position it is in. If we want to point to something, we need to know the correct location. A manufacturing company can implement processes to ensure that certain items are in a predetermined location and thus increase sales.

On the other hand, a business can also ensure that processes are implemented to enable an employee to find materials or tools in significantly less time by using location technology. This case also focuses on security. This idea can be understood as the possible discovery of an injured person in large manufacturing companies and thus increase the percentage of worker survival in a dangerous situation [1,2].

2 Functionality of UWB technology in real case

RTLS technology is based on the transmission of short UWB signals that transmit tags and then on anchors that receive and evaluate these waves through software support, namely RTLS Studio. UWB technology is characterized by its ability to transmit a lot of data with low power consumption, making it an environmentally friendly and low-cost technology to operate. In the Department of Industrial and Digital Engineering, we use Sewio's RTLS technology.

The Sewio Networks company is described in this article. This company provides both hardware and software support to the Department of Industrial and Digital Engineering. The company is ranked among the European leaders in the creation of RTLS localization technologies and their applications in manufacturing enterprises around the world. Through the open API port, it is possible to create various other applications for specific use.

The Sewio UWB RTLS hardware consists of two types of hardware. The first type is signal transmitters, we know them by their name tags, which are used to track objects. The second type of hardware are signal receivers, anchors, used to receive signals from tags [3].

Tags are small electronic devices that are attached to any object or person we need to track. The tags serve as signal transmitters, which are then received by the anchors and sent to a location server where the location of the tags is calculated.

Sewio's tags are characterized by high localization accuracy, up to 30 cm, and a long battery life of up to 5 years. Durability and battery life depend on the frequency of tag location updates during use. The tag can be equipped with a group of sensors, namely: accelerometer, gyroscope, magnetometer, barometer, thermometer, dosimeter or others. The tags can operate reliably at temperatures ranging from -20 to +60 °C. Sewio's positioning technology uses three types of tags: Tag Leonardo Personal, Tag Leonardo Asset and Tag Leonardo Vehicle [4,5].

Figure 1 Tag Leonardo Personal for worker monitoring [4]

2.1 RTLS locating system use cases for worker protection

Smart Quarantine

With one click, you can find out who has been in contact with a Covid-19 positive employee.Saving lives by making sure these exposed employees are tested and receive treatment immediately Keeping critical factory operations running (quarantine applies to a selection of employees, not the entire team). "Smart Quarantine" reduces the COVID-19 reproductive number. RTLS software Sewio offers free consulting to implement "Smart Quarantine" to any company worldwide.

Faster collection time

In today's industrial world, even paper-based collection processes require a large amount of time to finally determine safely who is safe and who is still missing. The complexity of the process is directly proportional to the size of the device, but also to the number of floors within the selected building, as well as the number of assembly lines. Digitizing the assembly process greatly helps reduce the time required for completion and provides up-to-date information on those found and still missing along with an immediate evacuation list.

Figure 2 Safe zone [4]

Faster rescue of injured persons and emergency injuries

In critical cases such as fires, explosions or leaks of various gases, the RTLS system can be used to determine the exact location of people in the affected area, thus reducing the risks associated with these events. The software platform also provides a so-called emergency button with a quick call for help. In case of any health problem, the person is able to call for help and send a notification with the exact location of the person. Dispatch can send rescue units based on this instruction.

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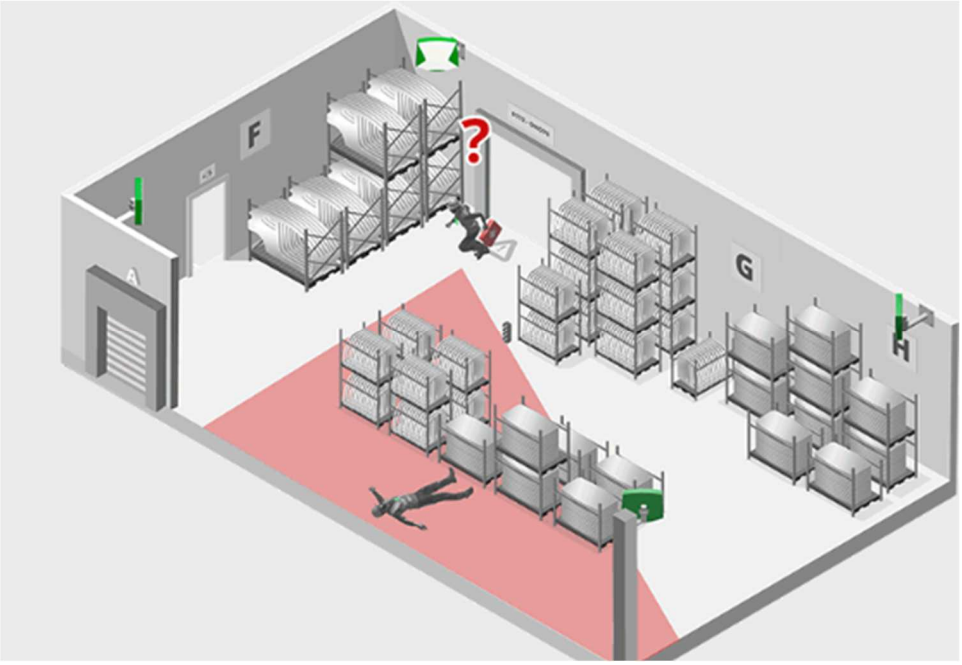

Figure 3 Injured Worker Locator system [4]

Improving emergency exercises through analysis

Real historical data on the movement of all people and possibly key items during emergency drills helps to validate evacuation routes, detect blockers in both routes and processes and make them more efficient. Facility emergency managers can use this real-life knowledge to handle special emergency scenarios in the best possible way, maximizing the safety of all people in the facility.

Geofencing and reducing movement in a confined space

Thanks to the unique function of Geofencing, which is based on the principle of RTLS localization, it is possible to set a selected number of virtual zones. These zones represent geographic boundaries and thus trigger automatic responses. This response to the system is triggered precisely with the help of tags and their bearers when entering or exiting the virtual zone. Thus, it is possible to analyze various types of danger in a collision with, for example, a collaborative robot and other mobile devices.

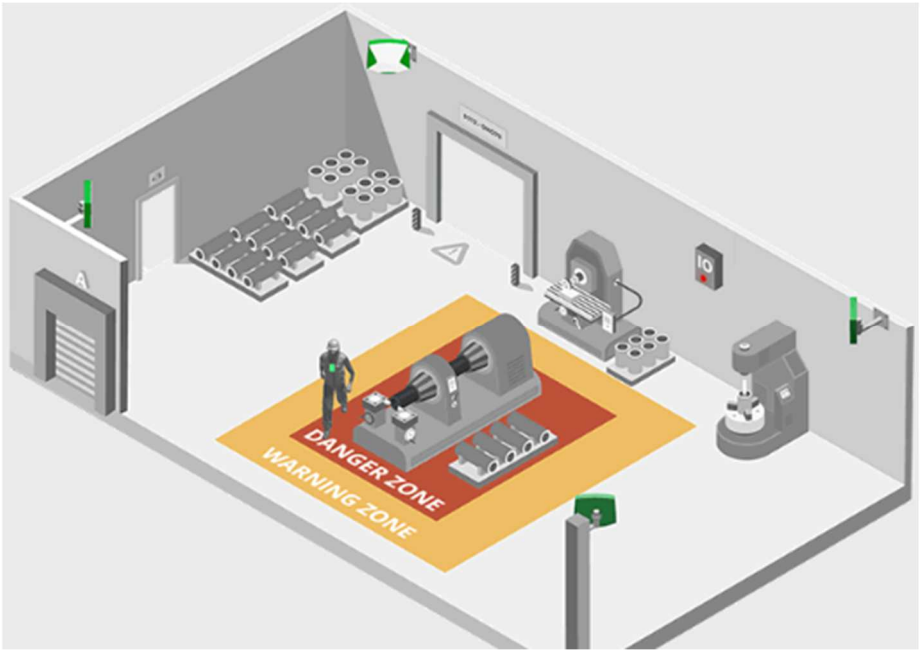

Figure 4 Dangerous zones [4]

Enhancing the safety of moving entities with dynamic zones

Dynamic zones enable alerting, reporting and tracking based on the proximity of two moving entities and the duration of their encounter. This feature unlocks employee safety scenarios where the proximity of two moving entities can generate alerts and warnings. For example, when a person is walking down an aisle and a forklift approaches from around a corner, dynamic marker zones will make these entities visible to those located around corners or around aisles and can alert them to prevent incidents or fatalities [6,7,8].

Increase safety by creating a detection zone for workers

As part of the prevention of injuries in manufacturing companies, the RTLS localization system is also used as a tool to prevent the collision of moving objects, such as a forklift truck with people. Because of these accidents, their mutual movement is monitored, for example, in the areas of the truck bed, where the highest percentage of collisions between these two elements occurs. The system on its monitor can warn the driver of the forklift truck that there is a person in his work zone and thus prevent personal injuries.

Navigation for people indoors

Indoor navigation using the RTLS localization system from Sewio provides navigation to workers but also to visitors of production enterprises or similar buildings that contain an RTLS localization network. With this technology, it is possible to direct a person to the selected destination with regard to the shortest path and in the shortest and most efficient time. The method of navigation consists in the fact that the worker or visitor is navigated using a mobile device in cooperation with a signal transmitter, namely a tag. The latest application consists in the fact that it is a great advantage even for people who are visually impaired and can be navigated to the destination using the voice from the device.

Analysis of the flow of people indoors

In engineering terminology, heatmaps and spaghetti diagrams are analytical elements for monitoring the flow of material, people, means of transport within the framework of enterprises, but also the general interaction of workers and management in physical space. These analytical elements can provide data such as downtimes, bottlenecks in material flows, and according to them, it is possible to propose a suitable optimization for each of these parameters. As a result, it is possible to create synchronization of workers and their time spent at a given workstation with, for example, automatic replenishment of materials in production lines [9,10].

Figure 5 Heatmap

3 Conclusions

Nowadays, technologies based on the transmission of UWB signals can definitely be considered as important and effective elements in the field of innovative Industry 4.0 tools. The main idea and goal of this paper was to highlight the different possibilities of their use in the concept of "smart factory" worker searches and consequently to interpret possible solutions for streamlining these processes using RTLS localization technology. Examples and pictures were used to illustrate these facts. The

elements of digitalization and the exponential functions of modern industry affect not only "classic" manufacturing companies, but also companies involved in heavy industry. The importance of protecting the health of workers in hazardous situations is extremely important for manufacturing companies. There is a prediction that these parameters will be taken into account more in the future, and not only because of digitalization.

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