APU011 APPLICATION NOTE

AN INTRODUCTION TO DW1000 SECURITY AND SAFETY APPLICATIONS

Security and Safety applications and their implementation with DecaWave's DW1000 Wireless Transceiver

Version 1.00

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1 INTRODUCTION

This is one in a series of notes on application areas for DecaWave's DW1000 Ultra-Wideband (UWB) wireless transceiver technology.

This note considers the use of DecaWave's DW1000 in Security and Safety systems.

2 DW1000 IN SECURITY AND SAFETY APPLICATIONS

The DW1000 device is suitable for safety applications and deployment in many environments to enhance security: -

- Security and protection of assets and persons
- Secure access
- Hazardous environments

The applications outlined below are suitable for integration in a facility-wide Real-Time Location System (RTLS).

Every security system is an attempt to address the need to know the location of people and/or things in the secure area. Existing solutions generally do not fulfill this need; instead they control the entrances and exits to the controlled area. The technology has not existed in the past to allow an economical and practical method to identify all persons and items of interest and their locations in real time. DW1000 allows this additional or alternative capability to solve the security problem in a more effective way.

If we consider a human alternative to a typical security system; it is clear that a human would endeavour to check the persons and assets present in real-time, rather than to record their history at the points of entry. In practice, it is difficult for a person to perform this function across a sophisticated site and to have all of the necessary information. But, this task is well-suited to a Real Time Location System (RTLS) deploying DW1000 devices.

The design of a security system depends very much on the building layout and the particular security concerns of the site managers. Whilst this will always be the case, the next step in a security system design is how to best achieve the security requirements using the most cost-effective technology.

The DW1000's capacity to provide economical real-time location means that security system design need no longer be a compromise as all tagged objects and persons' locations may be known at all times. DW1000 may be integrated into an RTLS to deliver a system capable of automatically managing complex security requirements across a variety of deployment areas.

Please find more general information on RTLS implementation using DW1000 at www.decawave.com.

3 SECURITY AND PROTECTION

The DW1000's location feature offers many benefits in applications protecting assets and people. Theft prevention and site security can be implemented with RTLS's using DW1000 tags and anchors or in less complex systems using discrete nodes or paired devices.

3.1 Protection of Assets

A system using DW1000 will allow for tracking of assets within an area so that their position can be monitored. In such a system, an alarm can be raised automatically when an asset has moved out of an area where it is expected to be or when it can no longer be located on the system.

Simpler systems could use a security portal at an exit to alarm automatically if a protected asset is detected in an exit area.

Implementation schemes depend on factors such as: -

1. Physical environment; building or yard layouts
2. Relative locations of assets and exits
3. Potential threats
4. Desired security level

If a protected asset is very valuable and portable, a protection scheme based on location will require several layers of checks and tamper-proofing. A system which only protects assets at certain areas of a security site will be likely to be insufficient in such cases. A system which tracks assets at all times will be more suitable as an alarm can be raised if the asset cannot be found as well as if it is in an area where it is not permitted to be.

If assets are less valuable, a less sophisticated system may be deemed more satisfactory as an adequate level of protection may be provided without incurring the additional expense of a more comprehensive system where it may not be justified. Less sophisticated systems can still provide an adequate level of asset tracking and event history to serve as a deterrent to thieves and to allow detection of ongoing theft.
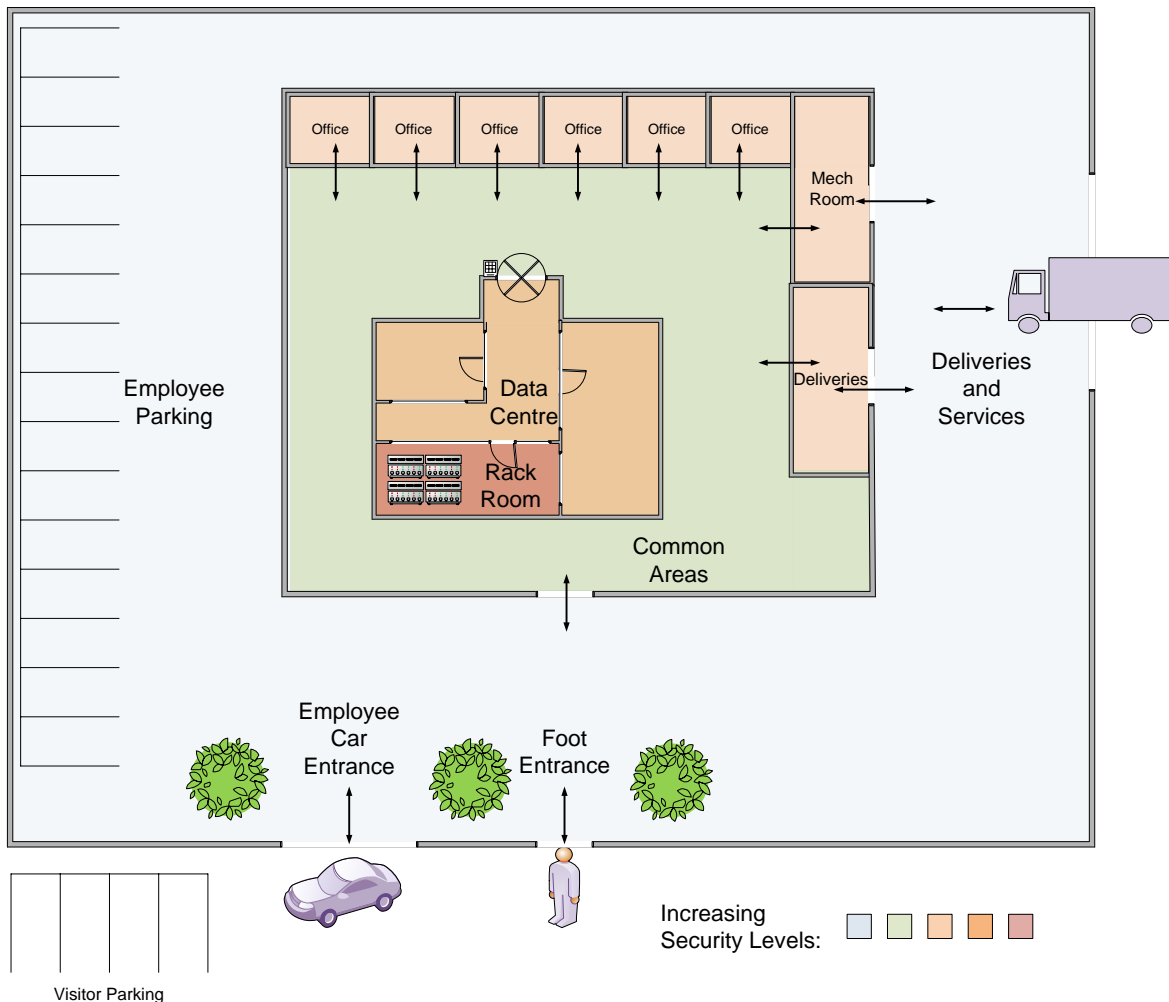
Figure 1: Data Centre Example Security System

The example of a data centre is given in Figure 1 to illustrate how security systems are typically administered in security levels by location. Traditional security methods dictate that security levels are organized by location to allow control of entrances and exits. A system using the DW1000 can simplify administration of such systems by automatically identifying the security level of the location of a tagged person or object. Without real-time location data, the only information that the system administrator has as to a tagged item's location is the entry/exit data log.

3.2 Security and Protection of Persons

Employees and visitors to an environment equipped with DW1000 location sensors can be monitored automatically resulting in many benefits. For instance, personal tags can be equipped with push buttons to flag emergency situations where they require assistance with a no requirement for any further information from the operator. Their location is known.

If a tagged person wanders into a restricted area, a system incorporating DW1000 can detect this event immediately and warn the tag wearer and building authorities before any damage or harm can result to the person or to property.

4 SECURE ACCESS

Secure access to buildings represents considerable overhead to companies and building management service providers. Systems in common use today focus on access points and use a magnetic fob system, as one example. These systems have evolved to perform this form of access control due to their relative ease of implementation. They do not entirely address the need for knowledge of who is present and where they are within the controlled area. The technology required to fulfill this more basic requirement in an economical way has not existed in the past, leading to the proliferation of systems which merely check which fob has accessed the system at which time. Most of the automatic versions which do not include on-site security personnel cannot reliably monitor which fob has left the system either.

The DW1000 device enables a new, more intuitive approach to secure access and building management.

4.1 Building Security Management

Security and protection of staff and other personnel on public and private sites is a major concern for many businesses. DW1000 can facilitate the automation of security procedures for personnel and eliminate some manual security procedures which can be tiresome and inconsistent. For instance, when personnel may be individually tagged in an economical way and their movements tracked automatically, there is no requirement for sign-in and sign-out procedures which commonly cause quite a lot of overhead. Instead, it may be known at all times which personnel are on-site and where they are located.

Management of building security is greatly simplified by use of a system incorporating DW1000. Security personnel can be tracked at all times automatically, allowing the generation of automatic work reports and easy location of personnel requiring assistance.

Essential personnel can be located at any time when on the business premises, resulting in increased productivity and efficiency, especially in situations where a prompt response is necessary. This capacity is invaluable to institutions such as hospitals, but offers many benefits to other work environments also.

DW1000 data rates allow speech transmissions which can be useful in building management applications and can eliminate the need for walkie-talkie devices carried by staff such as security guards. Speech carried over the network can similarly be logged automatically. Please find more information on audio and data streaming implementation using DW1000 at www.decawave.com.

Low-rate video streaming and image transmission is also possible using the DW1000. These features are useful in building management in order to update screens by location for emergency announcements and evacuation procedures.

It is possible to stream security camera video across a network using DW1000 devices, depending on the network traffic and local regulations on UWB usage. Please see data streaming application notes on the DecaWave website at www.decawave.com and local regulatory standards for more relevant information.

4.2 Abduction Prevention and Child Safety

Abductions of infants and child safety are cause for growing concern in many industries.

Child care, health care and educational institutions are facing increasing requirements to address these security concerns. Please see the healthcare application notes at www.decawave.com for more details of infant abduction prevention systems using DW1000.

Child safety schemes may be implemented using the DW1000 device in a similar way to other security monitoring systems. Children however, may be likely to wander which represents a serious safety problem and liability to the institution managing their care. When the location of a child is not known to a managing institution, even if there is little risk to safety, the reputation of the institution is compromised.

4.3   Wander Prevention

General wander prevention schemes can be used to monitor children as discussed above or any group of personnel or animals where the protected population may autonomously cause harm to themselves or to others by leaving a safe area. The harm in question may be a financial liability or exposure as well as physical harm.

4.4   Resident and Prisoner Management

Wander prevention schemes may also be used for the management of institutional residents (including prisoners). The applications are very similar except that a higher level of security is required. Institutional residents may be dangerous and can represent a physical threat to other residents and staff due to their violent or confused behavior.

Residents may go to extraordinary lengths to escape the residence in the case of convicted prisoners with long sentences. There are many additional considerations in design of security systems for resident management.

Safety of staff in these institutions is the other important requirement differentiating resident management systems from other wander prevention systems. One-touch button or buttons may be required on staff tags to ensure that emergency events requiring assistance can be communicated immediately.

Security and safety in resident management systems can be enhanced by using the DW1000. What can be said in general for security systems' dependence on site layout applies very strongly to resident and prisoner management facilities.

Prisons are planned carefully in terms of their layout making them particularly suitable for DW1000 deployment because real-time location data can add so much information to a prison system. In a high-security prison, the expected location of a prisoner is known at all times.

Figure 2 shows a simplified example of a DW1000 deployment in a prison RTLS. In the example, prisoners outside the orange dashed area who are unaccompanied by a warden and prisoners who are in the incorrect cells raise an alarm on the system and may be flagged automatically in real-time with their location. Prisoners in the common area dashed in green are not subject to controls on their location, but their location is known. In a system such as this any prisoner who cannot be found on the system can also be flagged along with their most recent location data. There are many configurations possible.

Events such as prisoner congregation or violation of warden to prisoner ratios can be configured as alarm events on the system. Many events that managers may wish to be made aware of are automatically detectable using location data.

DW1000 also offers many advantages to prisons and other residential institutions by allowing staff to be located in real-time at all times. A panic button can be integrated into tags which will allow staff or residents in distress to be flagged with their location on an RTLS.
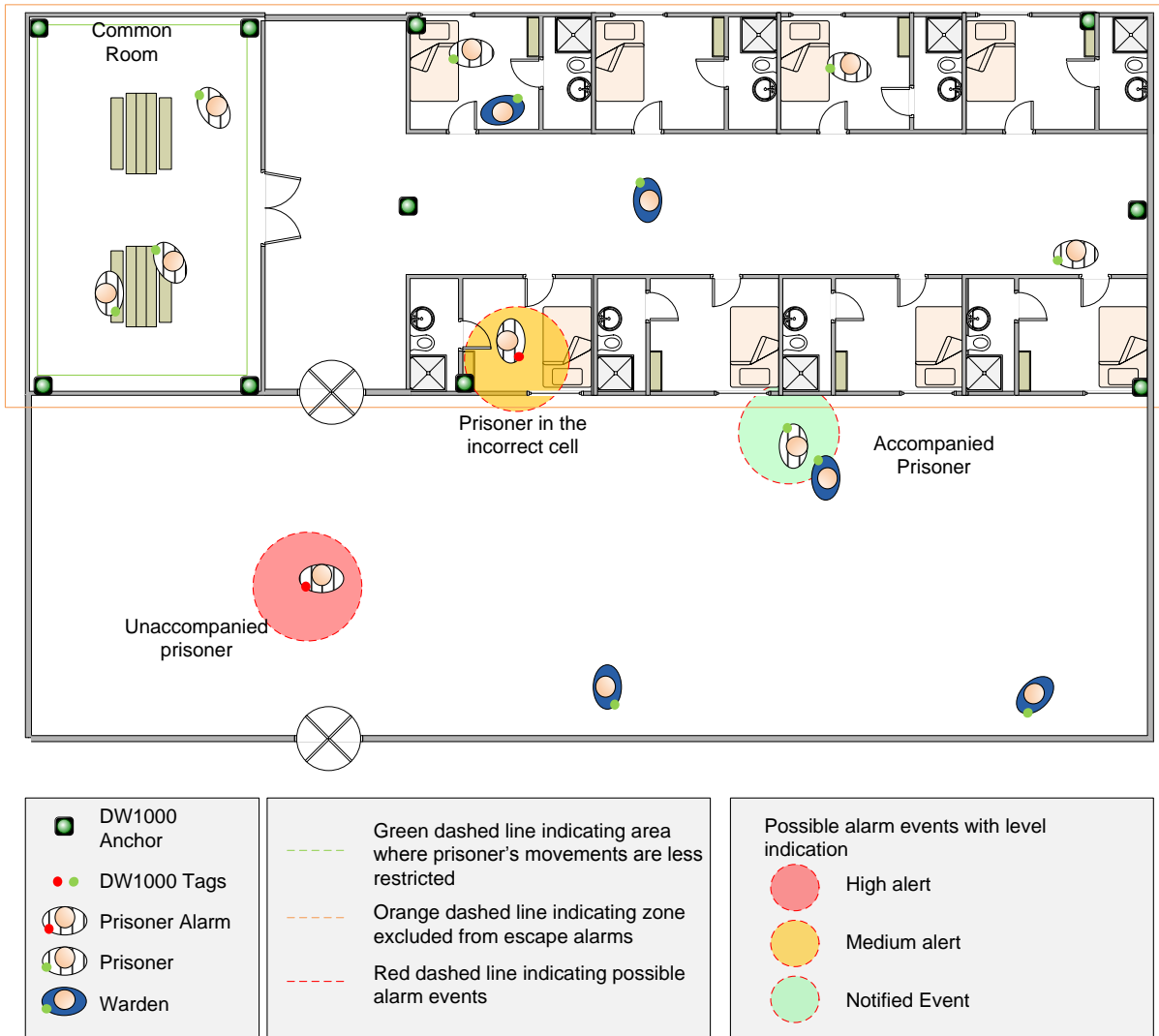

Figure 2: DW1000 Deployment in a Prison Example

5 HAZARDOUS ENVIRONMENTS

The management and safety of hazardous environments face several challenges common to many working environments. Usually, the implementation of systems and procedures is more difficult and expensive. Systems using the DW1000 device adapt very well to hazardous environments as the devices are robust, have long range and high multipath interference immunity. The devices may track at high speeds and in difficult environments.

DW1000's location capabilities are more valuable in hazardous environments. All personnel can be located at any time and tracking can be logged automatically. In the event of accidents, the exact location of those in need of rescue is known.

5.1 Industrial Safety

Some industrial environments are very hazardous for humans. Despite this and despite advances in safety procedures and technologies, industrial accidents continue to cost the lives of workers and rescue workers. Non-fatal industrial accidents are much more frequent.

Procedures to ensure safety represent a significant overhead to businesses working in hazardous environments. Most of these procedures require reporting by an operator of his identity and of safety procedures' performance at particular times and locations. Automation of these reporting procedures is enabled using the communications and location features of the DW1000. This can result in an increase in productivity.

Safety of workers is enhanced due to the capacity of a system using DW1000 to locate them at any time within the site.

5.2 Fire Services

Despite many technological advances, communications devices used by fire fighters have remained unchanged for many years. When fire fighters most need their communications, when in buildings where parts of the building are collapsing, debris can make it impossible for their radios to communicate.

Fire trucks can be fitted with DW1000 anchors or sets of anchors to locate the tagged fire fighters. Proposals for improved fire fighting communications systems include ideas based on mobile self-powered wireless communications routers enabling the establishment of self-configuring networks within the rescue area. These additional communications hubs in the environment using the DW1000 device can increase range and throughput in a system allowing the fire fighting personnel to venture further whilst still being reliably located.

Figure 3: Firefighters at work

The accuracy of the DW1000 device allows a location system to identify which floor of a building a tagged person is on, which could be crucial to maintaining fire fighter safety in a burning building. Visibility can be very poor in such situations and the ability of the DW1000 to maintain radio communications in

difficult environments as well as to locate accurately has the capacity to significantly improve safety for fire fighters.

6 REFERENCES

6.1 Listing

Reference is made to the following documents in the course of this Application Note: -

Table 1: Table of References

Ref	Author	Date	Version	Title
[1]	DecaWave		2.00	DW1000 Data Sheet
[2]	DecaWave		1.00	DW1000 User Manual

7 ABOUT DECAWAVE

DecaWave is a pioneering fabless semiconductor company whose flagship product, the DW1000, is a complete, single chip CMOS Ultra-Wideband IC based on the IEEE 802.15.4-2011 UWB standard. This device is the first in a family of parts that will operate at data rates of 110 kbps, 850 kbps and 6.8 Mbps.

The resulting silicon has a wide range of standards-based applications for both Real Time Location Systems (RTLS) and Ultra Low Power Wireless Transceivers in areas as diverse as manufacturing, healthcare, lighting, security, transport, inventory & supply chain management.

Further Information

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