

Mobile Duress Technology Recommendation Report

# Introduction

Mobile duress systems in the healthcare sector provide assistance to clinical staff in the event of an emergency where a patient or member of the public may become threatening or violent. These systems primarily involve using a pendant or smart device to trigger a duress alarm that is sent to relevant parties such as response teams or security, who use the system to locate the staff member in distress. To operate, the mobile duress solution uses a real-time location system (RTLS). Since GPS locating systems cannot operate reliably indoors, the RTLS infrastructure used typically utilises Wi-Fi, Bluetooth Low Energy (BLE), UWB, IR, or RF technology to locate the pendant/smart device held by the staff member initialing the duress alarm. There are a range of important factors that determine which type of RTLS technology should be implemented to facilitate a healthcare facilities mobile duress operation.   
  
This report outlines and provides three ranked recommendations for the most suitable RTLS technologies for this project's mobile duress needs. The recommendations are based on several key factors of the project. These factors include but are not limited to:   
- The location accuracy requirements of the project  
- Whether the facility is new or existing  
- The current or planned Wireless Local Area Network (WLAN)  
- The available budget, the state of any existing services infrastructure within the facility  
- The types of devices intended to be used as locating devices  
- The materials used in the building.  
  
The top ranking recommendation is number 1, followed by recommendations 2 and 3.

# 1.0 Digital Enhanced Cordless Technology (DECT)

## 1.1 Technical Description

DECT (Digital Enhanced Cordless Telecommunications) refers specifically to a common telecommunicaitons protocol that is used amongst landline phones. However, it can be used to support mobile handsets within a facility. It uses a connection between a handset and a basestation (via an antenna or repeater) to facilitate telephony services. Typically DECT handsets are more rugged handset solutions than smart-phone type solutions, which may be beneficial in the specific operating circumstances of the staff. Typically DECT has long range capability (~50m indoors) and is more resilient to interefence than Wi-Fi.

## 1.2 Characteristics

Advantages:  
  
+ Since the handsets to be deployed in this facility are DECT handsets, utilising this capability and implementing a DECT-based RTLS is recommended, since this provides the hardware capability to connect the DECT handsets to the locating beacons within the facility.  
  
Disadvantages:  
  
- The DECT locators may not be able to reliably provide the high level of accuracy required by the project.  
  
- The existing WLAN is RTLS-grade, so despite it being possible to implement an RF network, it might be more sensible to utilise the existing RTLS-grade Wi-Fi network to provide location services for the Mobile Duress System.  
  
- Although DECT solutions provide a reliable and low-cost solution for RTLS, utilising the existing RTLS-grade network would generally be a better solution.

# 2.0 Bluetooth Low-Energy (BLE)

## 2.1 Technical Description

Bluetooth Low Energy (BLE) based Real-Time Locating Systems are a newer technology that has been developing in the RTLS industry. Its structure is that it uses locators that listen for a BLE signal from a tag or BLE device then relay that information back to a location engine via an aggregator and the facility's telecommunications network. The locator tag or BLE device in the context of mobile duress would be either a personal duress tag or a smartphone handset that the staff carry on their person.  
Typically beacons are placed per room and operate using an angle-of-arrival techniques with a cone of vision to calculate a tag's location within a room. This means that the locator beacons must have overlapping or at least bordering cones of vision within a space in order to get full RTLS coverage. BLE RTLS solutions offer high accuracy locationing, down to within 10cm using dedicated BLE tags, with lower accuracies being available if BLE devices such as mobile smart phones are used as locator tags. Note that the accuracy achievable may also be dependent on the license that is purchased from the supplying solution vendor. The technology itself allows for cheaper and smaller tags than other RTLS technologies with longer battery-life due to its low-power nature. Once deployed, BLE-based RTLS does not need to be recalibrated upon changes to the network such as in the event of replacing faulty beacons, unlike some other RTLS technologies such as Wi-Fi.

## 2.2 Characteristics

Advantages:  
  
+ BLE locators can provide high accuracy positioning as required by this project.  
  
+ BLE-based systems are suited to low-budget since the cost of each locator point is significantly cheaper to alternatives such as wireless access points for Wi-Fi. Additionally, the cost of the individual locator tags is relatively low (approximately in the $60 range) and the battery life is relatively long (up to approximately 7 years) which significantly reduces the on-going costs of the solution. However, since there is an existing RTLS-grade Wi-Fi network, the higher operating costs might be comparable to the cost of installing an entirely new BLE locator network, therefore further budgeting work for the individual project should be performed to compare the two solutions more effectively.  
  
Disadvantages:  
  
- The existing WLAN is RTLS-grade, so despite it being possible to implement a BLE locator network, it might be more sensible to utilise the existing RTLS-grade Wi-Fi network to provide location services for the Mobile Duress System

# 3.0 Wi-Fi Bluetooth Low-Energy Hybrid

## 3.1 Technical Description

Wi-Fi BLE Hybrid solutions are somewhat flexible in nature and can be implmented differently depending on a facilities needs. However, a hybrid solution will be comprised of Wireless Access Points for the WLAN accompanied by BLE beacons which act in a complementary manner to provide location services to the facility. This offers a cost/performance compromise between implementing a more expensive and less flexible Wi-Fi based RTLS and designing/installing a completely new and separate BLE locator network.  
A typical use case of this type of RTLS is when a facility already has a Wi-Fi network that is close to RTLS-grade but has some zones that do not satisfy the requirements to be considered RTLS-grade. In those cases additional BLE beacons are deployed to offer more precise zoning without the need to redesign and modify the existing WLAN network.

## 3.2 Characteristics

Advantages:  
  
+ The Wi-Fi Wireless Access Points coupled with BLE locators can provide high accuracy positioning as required by the project.  
  
+ The existing WLAN is RTLS-grade, so bluetooth beacons could be used in tandem with the existing Wireless Access Points to create more precise zones for location tracking. This would in turn further narrow down the location of a staff-member in distress, though this further level of performance may not be needed.  
  
Disadvantages:  
  
- High numbers of glass panels within internal areas will negatively impact the signal propagation of RTLS which utilises Wi-Fi, therefore negatively impacting its performance.  
  
- Plant rooms have high amounts of electromagnetic interference due to plant, therefore RTLS solutions utilising Wi-Fi in particular may perform poorly due to their higher signal quality requirements compared to other technologies.