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 Bluetooth Low-Energy (BLE)

## 1.1 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.

## 1.2 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.  
  
+ Since intended locating devices to be deployed in this facility are bluetooth-capable handsets, utilising this capability and implementing a BLE-based RTLS is recommended, since there is already the hardware capability for connecting the locating devices to the beacons.  
  
+ The thick walls within the facility do not heavily affect the BLE solution, since locators are typically placed with high density, e.g. one per room.

# 2.0 Digital Enhanced Cordless Technology (DECT)

## 2.1 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.

## 2.2 Characteristics

Advantages:  
  
+ RF solutions provide a reliable and low-cost solution for RTLS. While not able to provide as precise zoning as some other technologies, will still be suitable for this project's requirements  
  
Disadvantages:  
  
- The DECT locators may not be able to reliably provide the high level of accuracy required by the project.

# 3.0 Radio Frequency (RF)

## 3.1 Description

RF-based RTLS is a well-documented solution that has wide use within justice applications along with some implementations in healthcare. The architecture uses several antennas, each of which indicate a zone, and the person/device being located is a transmitter device carried on the staff's person. The received signal strengths from the antennas in the building then become an indication of the zone that the person is located in.  
The main overall benefits from this solution come from its well-established presence in existing facilities, its reliability and its lower cost, however it is not as accurate or complex a locating system as some other technologies, and in the case of some vendors is reaching the end of its life.

## 3.2 Characteristics

Advantages:  
  
+ RF solutions provide a reliable and low-cost solution for RTLS. While not able to provide as precise zoning as some other technologies, will still be suitable for this project's requirements  
  
+ The thick walls within the facility do not heavily affect the RF solution, since the signal frequencies for communication are not as heavily attenuated as other technology types.  
  
Disadvantages:  
  
- The RF locators may not be able to reliably provide the high level of accuracy required by the project.  
  
- If the RF frequencies being used are infrared, then the performance will be limited in bright outdoor locations due to high amounts of signal interference with ambient RF radiation.