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Real Time LocationSystem Hardware Guide (RTLS)

V.200.15

1. SETTING UP DEVICES & RF NETWORK

Rest of themanualguidesyouthroughthestepsnecessaryforsettingupandconfiguringyourWipelotdevices. Pleasereadthismanualbeforesystemsetup.

1.1. Safety

Thedevicemust be usedsolelywithitsoriginalpoweradaptor. Pleasenotethattheadapter is 110/220V AC

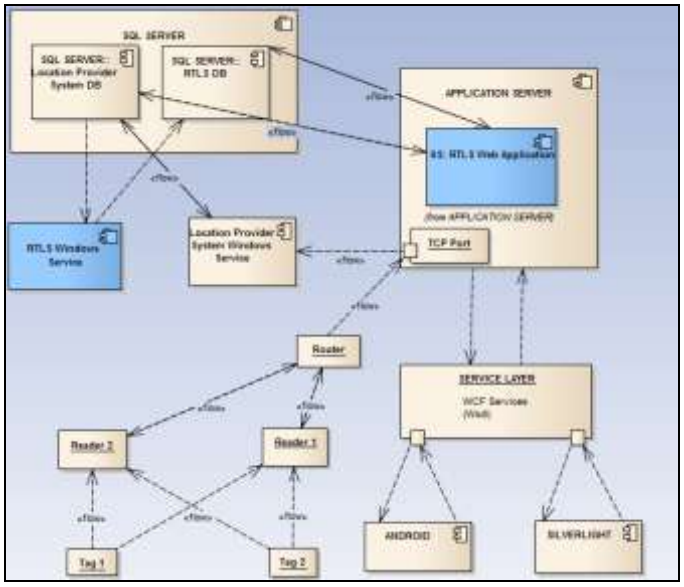
1.2. Introduction

Wipelotdevicesarebased on 2.4GHZ IEEE 802.15.4 compliant RF wireless network.To form a minimal 802.15.4 RF Network, youshouldhave at least 1-Router, 1-Reader and MobileDevices.

Main coordinator (router) establishes a mesh network once it is installed. Eachpluggedreader (receiver), attendsthis network automaticallyandrelays data forthe network. Allreadernodescooperate in thedistribution of data in the network.

Wipelot'ssmallsizednewbornbabytag is affixedtotheankle of thenewborninfantto be tracked. Thetagcontains an RF transmittercircuit. Ittransmitsmessagesignal, comprisinguniqueidentityinformation, toreceiverswhicharestrategicallyplacedwithinthehospital.Themessage is propagatedalong a pathbyhoppingfromnodetonodeuntil it reachesthe port wihch is beinglistenedbytheLocation Provider Service software.

Location Provider Software calculatestags' positionsbyusing RSSI (receivedsignalstrengthindicator) levels, dimensions of theregionto be trackedandfixedpositioninformation of thereceivers on thatregion.



Component Interoperability

Calculated positions are being written on the Location Provider System database. These positions can also be used in real time by remoting technology. This architecture providesflexiblity in integration with third party softwares. Wipelot H-RTLS application comprises an independent service which listens the Location Provider System database. It interpretes fetched informationa nd applies some business rules on it prior to UI interaction.

Tags comprise a conductive security element attachment having two ends, whose electrical state will change when stretched, severed, or removed by parting the end. When the electrical state changes an alarm codewill be generated and sent toreceivers. This information will then be processed as explained above.

Built in motion sensor is able to detect unnatural movements like falling, being idlefor a certain period of time etc. Alarm will be generated as soon as this kind of movement is detected.

1.3. **RF affecting factors**

All devices's RF signals can affect some material some extent. If our devices's RF signal encounter some material especially high-level obstacle severity material as stated in Table 1. Router, Reader and Tags will be decreased range of distance. For this reason, all device have to position as far as possible from especially obstruction of high level obstacle severity material as in Table 1.

Obstruction	**Obstacle Severity**	**Sample Use**
Wood / Wood paneling	Low	İnside a wall or hollow door
Drywall	Low	İnside Walls
Furniture	Low	Couches or office partitions
Clear glass	Low	Windows

Tinted glass	Medium	Windows
People	Medium	High-volume traffic areas that have consirable pedestrian traffic
Ceramic tile	Medium	Walls
Concrete blocks	Medium/High	Outer wall construction
Mirrors	High	Mirror or reflective glass
Metals	High	Metal office partitions, doors, metal office furniture
Water	High	Aquariums, rain, fauntains

Table-1 RF Obstacles Found Indoors

1.3.1. **Active RFID Tag for New Personnel Tag 1 (Wipelot Model No: MT-02BDC-IP)**

It has two leds (Red, Green) If device is powered up, Blue led blinks by each wake/sleep cycle. There is no led indication in stand-by mode.It has one button with following functions:

- Button Short Press/Release : Send Emergency Message / Wake-up the device if in stand-by
- Button Press for 5 Seconds: Enter to standby mode.

Power : Wipelot MT-02BDC-IP contains rechargable lithium battery which has 900 mAh lithium polymer battery. Wipelot MT-02BDC-IP must charge with wireless charger.

This button is also used for matching mobile devices.

Wipelot MT-02BDC-IP device has 2.4GHz RF propagation (JN5168 chip) that is programmed to output power 1mW of power and it has 2,4 GHz internal PCB chip antenna. Also, MT-02BDC-IP device has UWB design that has 3.1 ~ 8 GHz monopole antenna. We operation at 4.4GHz due to special reason. UWB chip output power is fully adjustable from 0 dBm to 15.5 dBm via firmware however for this product the power will be tuned by the manufacturer to the same power level required to meet FCC Part 15 Subpart F requirements. This feature is not user programmable.

The device's both of internal PCB chip antenna and UWB monopole (DW1000 chip) antenna are omnidirectional. Both of antenna are fixed on PCB, that's why İt cannot change reorient and relocate.
Therefore MT-02BDC-IP can take signal every direction. If Wipelot MT-02BDC-IP obstructs by obstacle of in Table 1. The device's RF signal will decrease as stated in Table 1.
MT-02BDC-IP can transmit until 200 meters to readers if RF output power is fully.

THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS:

(1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND (2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRED OPERATION.

Warning: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

—Reorient or relocate the receiving antenna.
—Increase the separation between the equipment and receiver.
—Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
—Consult the dealer or an experienced radio/TV technician for help.

How to comply with 10 second rule for handheld devices

When the tag is “awake” it sends out a a signal from UWB. We call this “Hello” signal.
If there are anchors (readers) in the area, they send an acknowledgement signal back. When the tag receives this acknowledgement, it sends the “location” signal (actual data) to the anchor and goes into “sleeping” mode.
The tag awakens in determined period and send out a a signal from UWB again.
This cycle is repeated continuously depending on the signaling frequency (in most projects the signaling frequency is 1 signal per second it could go up to 1 signal per 15 seconds)
The whole signaling process takes 5 milliseconds
If there is no acknowledgement response from the anchors, tag goes into deep sleeping mode for at least 1 minute (is parametric, can be set to be longer).
During deep sleeping mode, tags out a signal in every 10 seconds to check if there are any anchors in its range. This signal is not sent on UWB, but it is sent on 2,4 Ghz.
If it receives an acknowledgment response, the cycle starts again.

Figure 1: Wipelot MT-02BDC-IP Hardware Structure