

1 Introduction

1.1 Purpose

This is the solution overview for the R5 Device. It describes the hardware and software contained in the R5 solution, and how that hardware and software is used to deliver the functionality of the solution to the user.



2 Product Overview

2.1 Target Users

The primary intended user of the R5 solution is an aging adult that wants to continue to live independently in their own home. They may not always carry a mobile phone, so they carry (wear) the R5 device so they can get help quickly if needed. Many users are at an increased risk of falling due to their age and medical conditions, so they add the optional fall detection service to their account.

A secondary user of the R5 solution is the Caregiver of the primary user. The Caregiver may buy the R5 solution for the primary user and pay for their service. The Caregiver may be the person making the purchase decision and may choose to use the Link Application to follow status of the primary user's R5 device to ensure they are using it, keeping it charged, and may receive alerts if the primary user leaves home at unexpected times such as the middle of the night.

2.2 Use Cases

The primary use case of the R5 solution is to allow the end user to access the "Urgent Response" service to get help when they need it. The user can do this manually by pressing the button, or it can happen automatically when a fall is detected (if the user has the fall detection feature) when the user is wearing the device on the lanyard. Note that in this product iteration, fall detection is only intended to work when the device is being worn on the provided lanyard.



In addition to the primary use case, a Caregiver for the user may use the Link mobile application to observe details about the device such as battery/charge state, instances when the user used the Urgent Response service, and device location. The Link user may also register to receive notifications if the R5 device user leaves home.

2.3 Mechanical Attributes

The R5 device has the form of a small pendant and is typically worn around the neck using the provided lanyard. There is one main button and a few LEDs on the device for user interaction. The LEDs are used to indicate the various states of the device. Additionally, the device can play audio files to inform the user of state.

The user must use the provided charging cradle to charge the device. The R5 device is expected to have multi-day battery life (approx. 3 days), but users are instructed to charge their devices daily. The charging cradle has contacts that align with contacts on the back of the device to charge it. The cradle also has LEDs to communicate the state of the charger and the charging device. The cradle is powered by a USB C power supply that most users will plug into the wall. It is also possible that a portable USB battery bank can be used to provide power to the cradle, making it portable.

2.4 Functionality

2.4.1 User-Facing Features

The following user-facing functions and features are provided to the user by interacting directly with the R5 solution (device and/or cradle).

- Device Setup Experience
- Press Button to make voice call to URCC
- Fall Detection triggers voice call to URCC
- Low and Critical battery level alerts
- Place Device in cradle to charge battery
- Fall Detection Test by dropping device (free fall)
- Device Status Check by pressing user-button on cradle

There are also some user/Caregiver features that can be accessed from the website or Link Application.

- Send Test Call to device from Web/App
- Play Find Device Sound from Web/App
- View device location

2.4.2 Supporting Features

The following functions and features are not user-facing but exist to support the proper operation of the device and related systems.

- Location Services
 - Location tracking during URCC calls
 - Geofencing
 - BLE-based proximity (using cradle)
- Sensor Data Processing
 - Fall Risk Assessment (Stability)
 - Step Counting
 - Device Orientation
- Device Management



- Configuration
 - Device State
 - User Settings
- Utility/Support Commands
 - Get Log
 - Reboot
 - Request Network Report
 - Update MQTT Host
 - MQTT Pause
 - Play Find Device Sound
 - Request GPS Fix
 - Set Logging Threshold
 - Start Communication Test
 - Start Refurb
- MQTT Connection
- Data Collection (Device Analytics)
 - Power Events
 - Battery Events
 - Charger Events
 - Location Events
 - Fall Detection Events
 - Step Count Events
 - Fall Risk Events
 - Network Events
 - Voice Call Events
 - Button Events
 - BLE/Proximity Events
 - Firmware Update Events
 - Sensor Data Events
- Firmware Update (FOTA)

3 System Overview - R5 Device

3.3 Software Modes

The R5 software implements distinct modes; each with its own set of behaviors and resulting power profile. These modes are described in this section.

3.3.1 Operation Modes

These are the most important modes in determining the device's battery life because the device spends the most time in these modes during normal use.

Roaming Mode

This mode is used when the device is considered traveling/roaming because it is not near a BLE Charging Cradle with a known location. This mode is most like the behavior of the R4 device.

The following behaviors occur in Roaming Mode:

- Fall Detection, Step Count, and Fall Risk Analysis running on Sensor Hub
- UI LEDs indicate service and battery state
- Sensor Hub scans BLE to check if known BLE Cradle is near at least every 5 minutes.



- Device is connected to MQTT
- Device wakes every 20 minutes to
 - Obtain an updated location (50m accuracy)
 - Collect updated network status
 - Send the location over MQTT
- eDRX up to 10s MAY be used

At Home Mode

This mode is used when the device is at home because it is near a BLE Charging Cradle with a known location. This mode is expected to be the most common non-idle mode.

The following behaviors occur in At Home Mode:

- Fall Detection, Step Count, and Fall Risk Analysis running on Sensor Hub
- UI LEDs indicate service and battery state
- Sensor Hub scans BLE to make sure BLE Cradle is still near at least every 5 minutes.
- Device is connected to MQTT
- Device wakes every 20 minutes to
 - Collect updated network status
 - Send location or just MQTT keep alive over MQTT
- eDRX up to 10s MAY be used

Idle Mode

This mode is used to save power when the device is not moving. This mode is an optimization and may not provide practical power savings while the user is wearing the device. This mode assumes the user is not actively using/observing the device. Significant movement of the device in this mode will cause the device to return to At Home Mode or Roaming Mode.

The following minimal behaviors occur in Idle Mode:

- Motion Detection running on IMU
- UI LEDs off to save power
- Device is connected to MQTT
- Device wakes every 20 minutes to
 - Collect updated network status
 - Sends keep alive over MQTT
 - eDRX with longer delays (minutes) MAY be used

Charging Mode

This mode is used when the device is placed on the charging cradle. This mode takes advantage of the fact that the user is not actively using the device to perform several operations that consume more power than is acceptable in other modes. These higher power operations are only started once the device has reached a minimum battery level that can ensure they can complete successfully.

The following behaviors MAY occur in Charging Mode:

- UI Audio & LEDs indicate device connected to charger and charging
- Device scans BLE for cradle and connects to collect additional data from cradle (within few seconds.)
- Device checks for firmware update (based on configuration)
- Device installs any pending firmware update
- Device is connected to MQTT
- Device sends any pending collected data over MQTT (no keep alive needed in this case)



- Collected button, fall, call event
- Collected network events
- Collected battery events
- Collected sensor or supplemental location data
- Device wakes every 20 minutes to
 - Collect updated network status
 - Get updated location for charging cradle if needed
- eDRX IS NOT used in this mode

Calling Mode

This mode is used when the device detects a fall or the user presses the button. Both result in a UI flow that prompts the user to cancel or allow the device to make a voice call to the URCC.

The following behaviors occur in Calling Mode:

- Fall Detection, Step Count, and Fall Risk Analysis running on Sensor Hub
- UI LEDs and Audio indicate a URCC call
- Device uses the location engine in "tracking mode" to obtain an updated location every 30 seconds.
- Device places voice call to URCC
- Device remains connected to MQTT
- Device sends the location updates over MQTT as they are received
- eDRX IS NOT used in this mode

It should be noted that the minimum required modes for R5 device launch are Roaming Mode, Charging Mode, and Calling Mode. The R5 device **MUST** have acceptable battery life in Roaming Mode.

3.3.2 Device Setup Mode

The device is shipped from the factory in this mode. This mode runs the Device Setup flow and transitions the device to an Operation Mode upon successfully completing the flow. If the Device Setup flow fails for some reason, the device remains in this mode upon reboot.



FCC statement

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.

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.

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

These requirements set a SAR limit of 1.6 W/kg averaged over one gram of tissue. The highest SAR value reported under this standard during product certification **Head 1g: 1.376 W/kg; Body 1g: 0.407 W/kg; Extremity 10g: 2.99 W/kg.**

IEEE1725

- a) In the event of a battery leak, do not allow the liquid to come in contact with the skin or eyes. If contact has been made, wash the affected area with large amounts of water and seek medical advice.
- b) Seek medical advice immediately if a battery has been swallowed.
- c) Communicate the appropriate steps to be taken if a hazard occurs