

Requirement Specification

Emergency call system

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Use case diagram

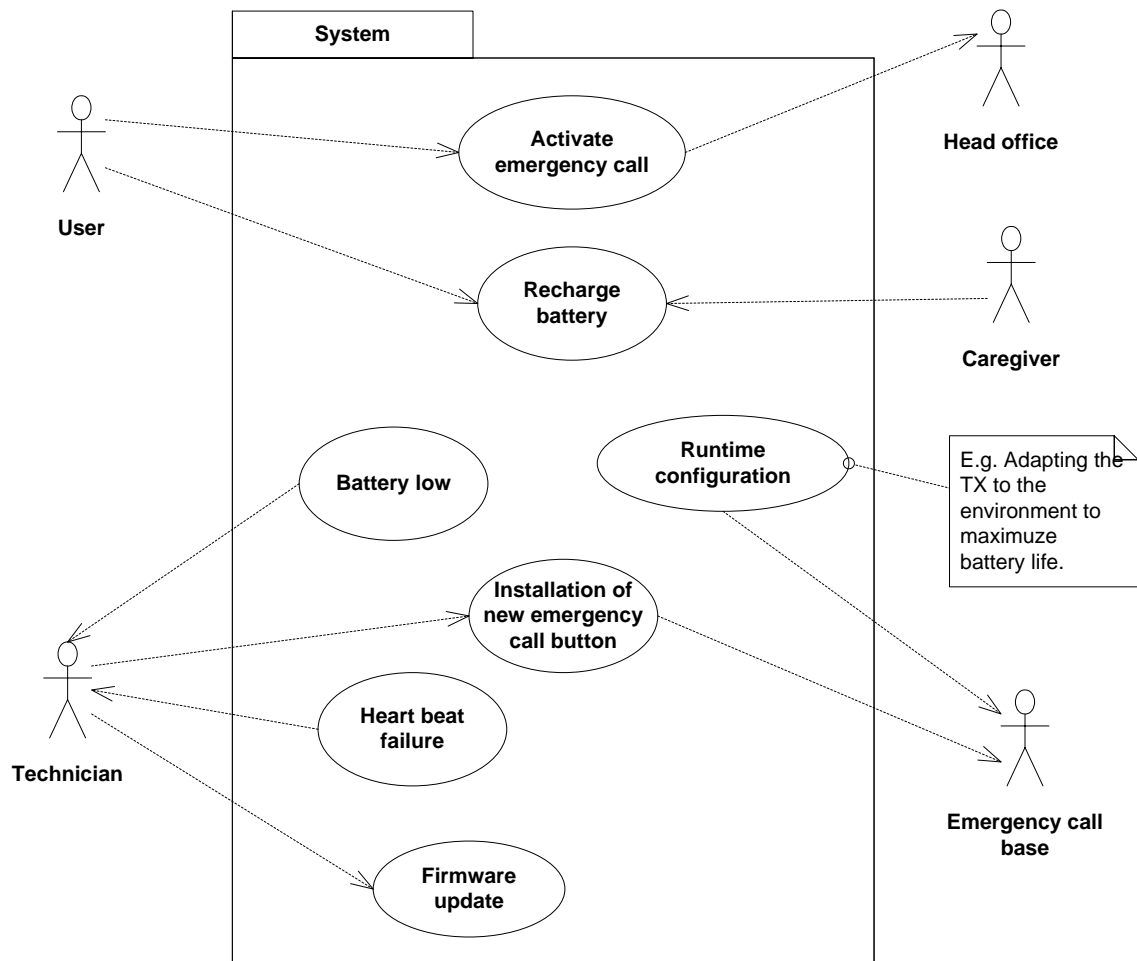


Figure 1 - Use case diagram

In Figure 1 all communication goes through the Emergency call base, yet where the communication is merely relayed to another actor the Emergency call base is not shown as part of the communication.

The overall states of the system may also be seen in Figure 2. Here it can be seen that since there is only one way of activating the emergency call button, the button is also used to enable a firmware update or a configuration of the button to an emergency call base or to configure the transmission strength. This is done to reduce power so the only unsolicited activity required by the emergency call button is to wake up and transmit a heart beat as a fire-and-forget.

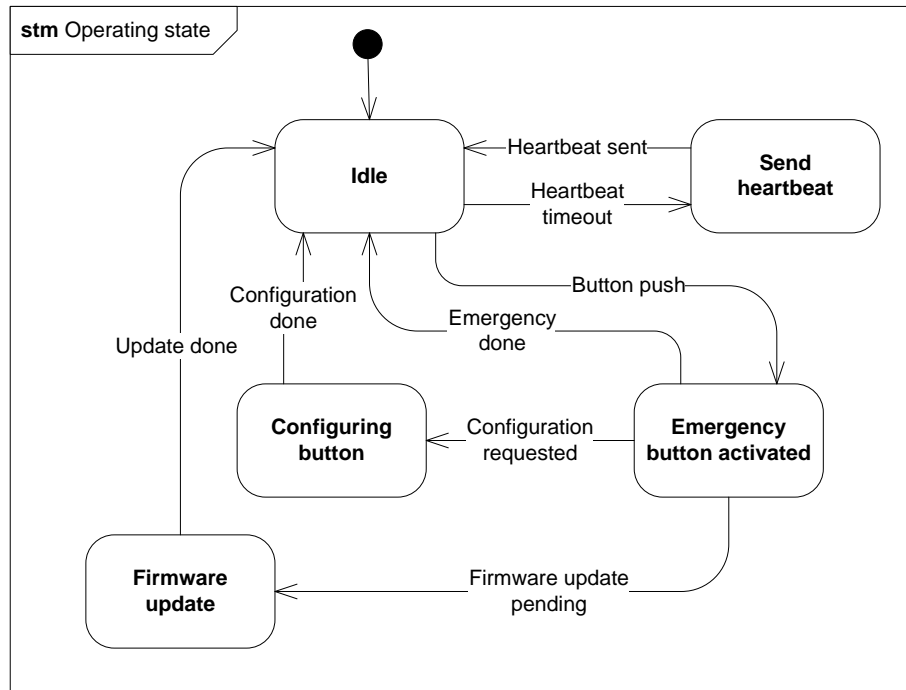


Figure 2 - Main states

Actor description

Actor Name:

Technician

Type [primary / secondary]:

Primary actor

Description:

The technician deals with the initial setup of the emergency call button as well as handles error conditions and firmware update. The Technician is typically an employee of the "Hjælpemiddelcentralen" in the local municipality. He is well skilled in the technical aspects of the emergency call button from a functional point of view as well as being equipped with a custom configuration and servicing tool allowing him the necessary interface to the emergency call button.

Number of concurrent actors:

Just one

Actor Name:

Caregiver

Type [primary / secondary]:

Primary actor

Description:

The caregiver is responsible for servicing the emergency call button under normal working conditions. This means ensuring that the emergency call button is recharged and responding to emergency calls issued by the user (dispatched by the head office). The caregiver only has a brief introduction to the emergency call button limited to expected battery life, warning indicates for battery level and usage (push button to get help).

Number of concurrent actors:

Just one

Actor Name:

Head office

Type [primary / secondary]:

Primary actor

Description:

The caregiver head office is responsible for receiving the emergency calls and dispatching a caregiver.

The caregiver at the head office is familiar with the administration system, and not the emergency call button itself.

Number of concurrent actors:

Just one

Actor Name:

Emergency call base

Type [primary / secondary]:

Primary actor

Description:

The emergency call base is responsible for forwarding the emergency calls, battery low status and missed heart beat warnings to the head office and also to maintain the audio communication between the head office and the emergency call button and to close the connection when no longer needed.

The emergency call base is paired with the emergency call button during configuration. Finally the emergency call base is responsible for assisting the emergency call button in automatically determining the minimum required transmission power to conserve power.

Number of concurrent actors:

Just one

Actor Name:

User

Type [primary / secondary]:

Primary actor

Description:

The user is responsible for the main interaction with the emergency call button and carries it on his or her person up to 24 hours a day.

The user only has a brief introduction to the emergency button limited to expected battery life, warning indicators for battery level and usage (push button to get help).

Number of concurrent actors:

Just one

Use case description

Use Case #1: Activate emergency call

Goal:

To obtain immediate aid from a caregiver not presently in the vicinity.

Description:

The user pushes the button on the emergency call button and is placed in verbal contact with a caregiver at the head office, who comforts and aids her until a caregiver arrives in person.

Variations:

If the emergency can be handled verbally without a caregiver showing up in person then the emergency call may be cancelled from the central office.

Initiation:

This use case is activated by the user by pushing the button.

Actors and Stake Holders:

User & caregiver

Frequency:

Rare (no more than 1-5 times a day, though up to a frequency of every 30 seconds should be supported).

Non functional requirements:

- REQID-5

Preconditions:

The emergency call button has been properly configured and has a sufficient battery charge.

Main Scenario:

1. The user activates the emergency call
[Insufficient battery for audio]
2. The head office responds and asks what the emergency is.
[User is unable to respond]
3. The user explains the emergency
[Emergency handled verbally]
4. The head office dispatched a caregiver to the address of the user.
5. The head office calms the user and disconnects the emergency call audio.
6. The caregiver arrives at the address of the user.

Exceptions:

Insufficient battery for audio:

1. The head office dispatched a caregiver to the address of the user.
2. The caregiver arrives at the address of the user.

User is unable to respond:

1. The head office dispatched a caregiver to the address of the user.
2. The head office calms the user and disconnects the emergency call audio.
3. The caregiver arrives at the address of the user.

Emergency handled verbally:

1. The head office is able to handle the emergency verbally and the emergency call is cancelled.

In Figure 3 may be seen the overall sequence of what happens when a user pushes the emergency call button on a charged and configured emergency call button.

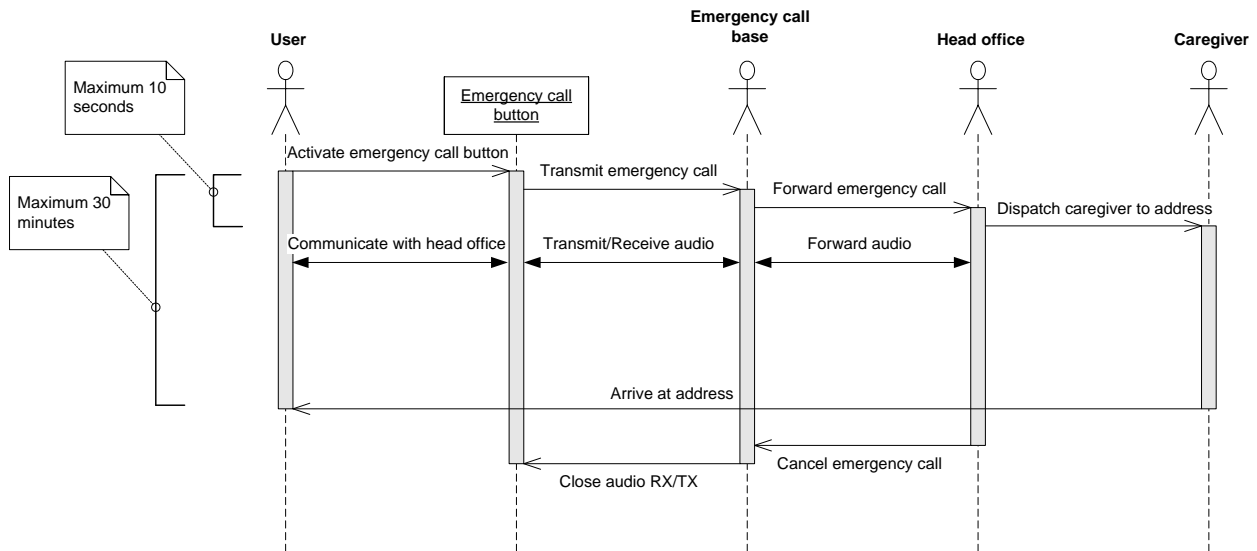


Figure 3 - Emergency scenario sequence diagram

In Figure 4 may be seen a simplified activity diagram of what happens when a user pushes the emergency call button on a charged and configured emergency. What is left out is e.g. the technical mechanism for cancelling the emergency (e.g. in-stream messaging).

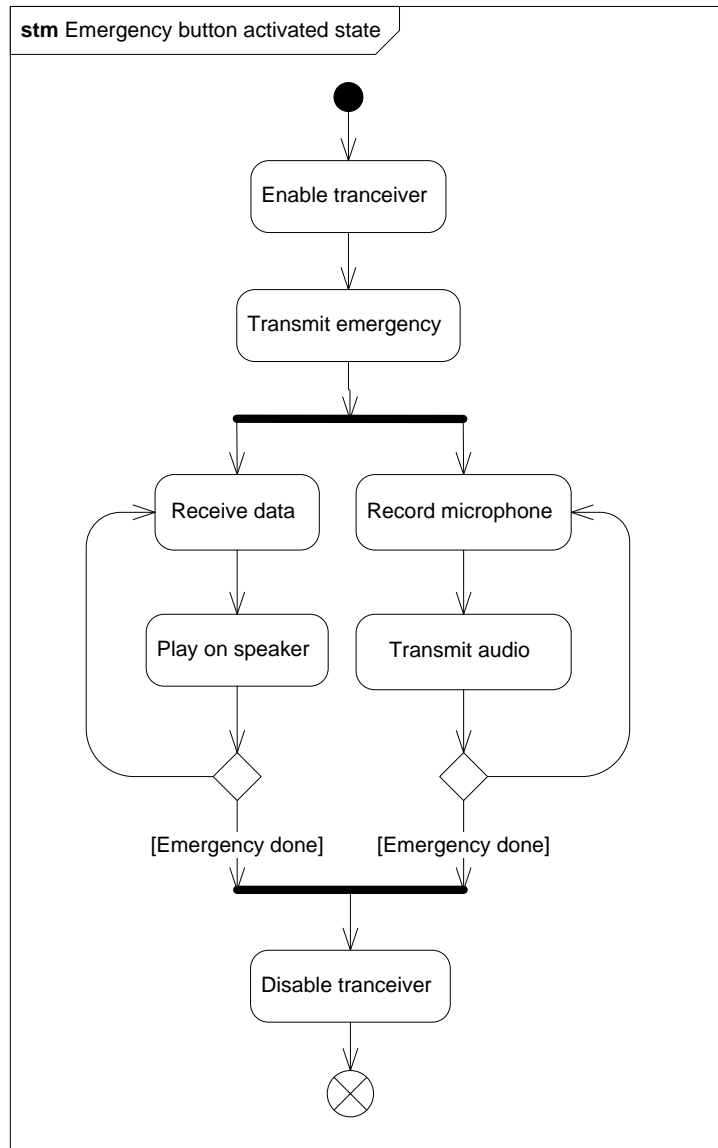


Figure 4 - Emergency scenario activity diagram

Use Case #2: Recharge battery

Goal:

To recharge the emergency call button batteries.

Description:

The user or the caregiver places the emergency call button on a charging plate (e.g. an inductive plate) for charging and removes it when it is charged.

Variations:

If the user prefers to have an emergency call button on at all times then a replacement unit is used while the other unit charges. Each user simply has two emergency call buttons.

Initiation:

This user or caregiver takes the device off the user and places it on the inductive plate.

Actors and Stake Holders:

User & Caregiver

Frequency:

Rare (no more than once a day or once after each emergency call).

Non functional requirements:

- REQID-8

Preconditions:

None (an un-configured emergency call button can also be recharged).

Main Scenario:

[Battery getting low]

[Battery getting low 2]

[Caregiver replaces emergency call button]

1. The user places the emergency call button on the charging plate next to his or her bed after going to bed.
2. The user places the emergency call button back on him- or herself when he or she leaves the bed.

Battery getting low:

1. The user notices that the yellow LED is lighting up.
2. The user replaces the device with his or her spare and places the other emergency call button on the charging plate.

Battery getting low 2:

1. The caregiver notices that the yellow LED is lighting up.
2. The caregiver replaces the device with the users spare and places the other device on the charging plate.

Caregiver replaces emergency call button:

1. The caregiver replaces the emergency call button with the spare while servicing the user and places the emergency call button on the charging plate.
2. Not needed

Use Case #3: Runtime configuration

Goal:

To lower the transmission power level to the lowest possible for the environment.

Description:

Automatically adjust the transmission strength to fit the environment and thereby lower power consumption.

Variations:

None

Initiation:

Initiated by any communication.

Actors and Stake Holders:

Emergency call base

Frequency:

Rare (same frequency as the communication).

Non functional requirements:

None

Preconditions:

The emergency call button has been properly configured and has a sufficient battery charge.

Main Scenario:

1. An emergency call or other communication is initiated.
2. The emergency call button registers the receiving transmission strength and adjusts its transmission strength accordingly (as low as possible).
3. The emergency call button adjusts its transmission strength according to the BER for minimize power consumption.

Use Case #4: Battery low

Goal:

To notify the technical staff that an emergency call button is about to become in-operational.

Description:

There are four battery levels “indicated by” the emergency call button.

1. Green/nothing – OK
2. Yellow – Please recharge (less than 6 hours of battery left)
3. Red – Low (less than 1 hour of battery left).
4. Off – emergency call button in-operational.

When the battery level becomes low the technical staff should be informed and may at first contact the caregiver, who in turn may ask the user to please recharge his or her emergency call button.

Variations:

If the user is unable to replace the emergency call button themselves, the caregiver must drive out to the user and replace the emergency call button for them.

If the emergency call button battery life has deteriorated with time, the technician may drive out and replace the battery cell.

Initiation:

The emergency call button itself.

Actors and Stake Holders:

Technician, (Caregiver, User)

Frequency:

Rare (no more than once a day).

Non functional requirements:

- REQID-4

Preconditions:

The emergency call has been properly configured.

Main Scenario:

1. The emergency call device button information (via the emergency call base) to the technician on call about its low battery situation.
2. The technician contacts the caregiver head office.
[User cannot replace unit]
[Battery quality deteriorated]
3. The caregiver head office call the user in question (on the normal phone) and guides her through replacing the unit and charging the low one.

User cannot replace unit:

1. A caregiver is dispatched to replace the low emergency call button and set it for charging.

Battery quality deteriorated:

1. The technician makes arrangements to go and replace the battery in the deteriorated emergency call button.
2. The caregiver head office call the user in question (on the normal phone) and guides her through replacing the unit and charging the low one.
3. The technician replaces the battery cell as arranged.

Use Case #5: Heart beat failure

Goal:

To replace a defective emergency call button

Description:

If an emergency call button stops sending heartbeats the technician must replace it and/or identify the problem (and solve it if possible – e.g. user has removed battery or has worn the emergency call button out of range)

Variations:

The problem may be rectified on the phone

Initiation:

The emergency call base

Actors and Stake Holders:

Technician

Frequency:

Rare (never to once a year per unit).

Non functional requirements:

- REQID-6

Preconditions:

The emergency call button has been properly configured.

Main Scenario:

1. The emergency call base discovers that the emergency call button has not transmitted a heartbeat in a timely manner.
2. The emergency call base transmits an alert to the technician on call.
3. The technician on call informs the caregivers and makes arrangements to go and replace the defective emergency call button.
4. The caregivers contact the user (on the phone) and get an overview of the situation and makes arrangements for the replacement.
[Problem can be handled on the phone]
5. The technician replaces the defective emergency call button.

Problem can be handled on the phone:

1. The problem can be rectified on the phone and the technician is cancelled.

Use Case #6: Installation of new Emergency call button

Goal:

To install a new emergency call button.

Description:

When a new emergency call button is issued to a user it must be configured to the emergency call base in the user's home.

Variations:

The emergency call button may also be configured for optimal battery life by identifying the worst case transmission requirements.

Initiation:

The technician

Actors and Stake Holders:

Technician

Frequency:

Rare (A few times per new user).

Non functional requirements:

None

Preconditions:

None

Main Scenario:

1. The technician initiates the emergency call device pairing on the emergency call base and the emergency call device.
2. The pairing is performed by the emergency call button and base and a notification of success is given.
[Configuration of worst-case TX]
3. The emergency call button is given to the user.

Configuration of worst-case TX:

1. The technician moves to the furthest away part of the house (grounds)
2. The technician initiates worst case TX configuration.
3. The emergency call button measures optimal TX strength and stores it as its maximum TX strength (makes automatic adjustment of TX more effective).
4. The emergency call button is given to the user.

Use Case #7: Firmware update

Goal:

To update the firmware on the emergency call button.

Description:

If a bug is found or an optimization is implemented, the firmware on an already deployed emergency call button may be updated on the fly.

Variations:

The unit may be updated by a special service tool and not “on-the-fly”.

The firmware update may fail.

Initiation:

The technician

Actors and Stake Holders:

Technician

Frequency:

Rare (A few times a year, yet support for more often should not be ruled out).

Non functional requirements:

- REQID-7

Preconditions:

The emergency call button has been properly configured and has a sufficient battery charge.

Main Scenario:

[Special tool update (the technician has the emergency call button in hand)]

1. The technician makes arrangements with the caregivers for when the emergency call button may be placed off-line for up to 30 minutes.
2. The technician places the firmware for update with the emergency call base.
3. When the caregiver arrives she pushes the emergency call button and the firmware update is initiated.

[Firmware update failure]

4. The emergency call button updates its firmware and a success notification is sent to the technician.

Special tool update (the technician has the emergency call button in hand):

1. The technician connects to the emergency call button with his special tool.
2. The technician updates the firmware.

Firmware update failure:

1. The technician receives a detailed firmware update failure notification and the emergency call button reverts to its pre-update firmware (if the other firmware was ever in effect).

Non-functional requirements

This sections details the non-functional requirements. It is divided into design constraints (physical limitations) and performance requirements.

Design constraints

ID	Requirement	Use case
REQID-1	The emergency call button itself shall not weigh more than 125g	-
REQID-2	The emergency call button shall not be larger than 40x60x15mm	-
REQID-3	The buttonon the emergency call button must be at least 20x30mm or have a circumference of at least 75mm.	-
REQID-9	The ISM band used shall be the EU allocated frequency for social alarms (EN 300 220) at 869.2 – 869.25MHz	-
REQID-10	All requirements set down by the EU and Denmark regarding EMC, transmission strength and frequency hopping must be met, as well as other legal obligations pertinent to the product/project.	-

Performance requirements

ID	Requirement	Use case
REQID-4	The devices battery life shall be sufficient for at least 24 hours of stand-by (with heart beats) and a 5 minutes conversation*	4
REQID-5	The emergency call button shall transmit a button-push to the emergency call base within 500ms of the button being pushed**	1
REQID-6	An emergency button failure must be reported by the emergency button base no later than 2 hours after the actual time of failure.	5
REQID-7	A firmware update shall take no more than 30 minutes to complete.	7
REQID-8	The emergency call button shall be able to charge from empty to fully charged in no more than 6 hours***	2

* A graph showing the dimensions/weight vs. battery life shall be shown starting at the smallest battery supporting the above time constraint and continuing until the size and/or weight constraint is reached.

** The caregiver must be at the home of the user no more than 30 minutes from the activation of the emergency call. From this a requirement of a maximum delay from emergency call button is pressed until the alarm is received by central office of 10 seconds is created, and as the possible delay on the GSM network covers most of the 10 seconds allotted, the ISM delay of 500ms is determined.

*** If the user is to charge the emergency button themselves they must be able to do so while they sleep.