Naloxone Safety Kit User Manual

Full Version, Mar. 25th, 2023

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Introduction

The United States is currently facing an opioid epidemic, with an increasing number of people dying each year because of opioid overdoses. Naloxone is a life-saving medicine that can be administered to overdose victims, however it takes some time for emergency services to show up after 911 has been called, which can frequently be too late. This has led to a need for publicly accessible naloxone to be made available, which is where the proposal for a naloxone safety kit comes in.

We intended to develop and prototype a safety kit that aims to offer safe, reliable, and temperature-controlled storage space of publicly available naloxone, which, when opened, will automatically call 911 and request medical emergency services. The kit might help reduce fatalities due to opioid overdoses by lowering the time it takes for emergency services to reach overdose victims.

Traditionally, naloxone is provided through intramuscular shots by professionals. However, in 2015, the first naloxone nasal spray, the Narcan Nasal Spray, was authorized by the FDA, making it simpler for any individual to offer first aid in case of an overdose. Some organizations, like NaloxBox, have introduced naloxone safety kits to the marketplace after the authorization of the nasal spray. However, these kits cannot call emergency services automatically when opened, rather triggering a siren. Furthermore, their cost is too expensive to be deployed massively, with each kit costing about $250 to $300 without naloxone.

An Internet-connected naloxone safety kit will solve these issues by automatically calling 911 when opened to report the place of the incident. Such a device will have life saving potential in places where recreational drugs are consumed, and the enclosure will be designed to be an artistic reminder of the opioid epidemic. The kit aims to decrease the cost of the entire safety kit while accomplishing these enhancements.

User Roles and Permissions

Admin

The administrator has access to the program and manages all the settings. They are in charge of constructing, putting in naloxone, and examining the safety kit that the software runs on. While anybody can use naloxone in a crisis by opening the lock of the unit, the administrator and the building manager are liable for supplanting the naloxone after it has been used. The paramedics can also replace the naloxone if the admin permits that. The admin should give the naloxone passcode instead of the admin passcode to the building manager.

Building Manager

The building manager can replace the naloxone and enter the new expiration date and maximum temperature for the replaced naloxone. The building manager can only change the naloxone information settings and have limited access to the software's settings. The building manager should have knowledge of using the software and proper response to drug overdose. The manager should also help the paramedics resetting the device when needed.

Paramedics

After the safety kit dials 911, the patient must be taken to the hospital by the paramedics. By pressing a button on the safety kit, they can contact the administrator for assistance if they require additional information. After receiving their phone numbers, the administrator will call the paramedics to provide additional support. If admin permits, the paramedics can replace the naloxone inside the safety kit as well as making changes to the naloxone information. The paramedics do not have access to other settings of the device.

First Responder

When dealing with a drug overdose, the first responder is absolutely necessary. They are the ones who first notice the overdose and need to act quickly to give the patient naloxone. Unlike the administrator and building manager, the first responder does not have access to the software's settings. However, they can use naloxone by opening the safety kit door. Additionally, the safety kit will automatically dial 911 on their behalf in an emergency. In critical situations, the quick actions of the first responder can help save lives.

Getting Started

Source Code

The source code for the software is offered at https://github.com/zyl120/Naloxone_Safety_Kit and is open-sourced under the GNU Lesser General Public License (LGPL) version 3. This implies the software can be freely distributed, modified, and used for commercial and non-commercial purposes. Individuals are encouraged to review the terms of the LGPL V3 license before using or customizing the software. Furthermore, individuals could contribute to the continuous development of the software by sending bug reports, function requests, or code improvements to the project's GitHub repository.

Prerequisites

- Raspberry Pi 3B+ or 4 with latest Raspberry Pi OS Full (32-bit);
- Physical Keyboard and Mouse;
- Monitor;
- Stable Internet Connection.

Change Raspberry Pi Settings

- Disable fan control in the Raspberry Pi Preferences. The software to be installed will control the fan.
    a. Click on the Raspberry Pi icon in the top left corner and select Preferences then Raspberry Pi Configuration.
    b. Select the Performance tab.
    c. Next to Fan, click Disabled.
- Disable Screen Blank in the Raspberry Preferences. This will prevent the screen from going to sleep.
    a. Click on the Raspberry Pi icon in the top left corner and select Preferences then Raspberry Pi Configuration.
    b. Select the Display tab.
    c. At the bottom of the short list is Screen Blanking, click Disable.
- Set the audio output to the USB speaker if needed. You can do it by running the following command in the terminal:

    sudo raspi-config

    and then go to the System > Audio to select the USB speaker as the output.

Installation

Depending upon your choice and level of technical expertise, there are two methods to set up the software. The first choice is to use a Python script that automates the setup and configuration procedure with default settings. Individuals with a basic understanding of Python and a preference for a quicker setup should use this method. The second choice is to manually set up the software by following the user manual's detailed instructions. Individuals that have a deeper understanding of system administration and desire more control over the setup procedure should use this method. The device will set up the software in a completely functional way using either method. The first step, regardless of which one you choose, is to use the following command to download the source code:

git clone https://github.com/zyl120/Naloxone_Safety_Kit

Automatic Installation using Script

To install the software, you can use the provided Python script. Please follow these steps:

1. Run the script as a super user by running the command
   sudo python /home/username/Naloxone_Safety_Kit/scripts/install.py
2. When prompted, provide your Linux user name.
3. During the installation process, the device will download and install several additional packages using apt and Python packages, so it is recommended to have a stable internet connection so that the software can be downloaded.
4. The qt virtual keyboard component will take around 30 minutes to compile, and the compiled file will be located at */home/username/qtvirtualkeyboard*.
5. After the installation process is complete, it is recommended to reboot your system.

You will need to run the script as a super user. If you experience issues during the installation process, refer to the troubleshooting section of the user manual for help.

Manual Installation

1. Before installing the dependencies, refresh the package list to get the latest package and dependency information from the server. Open the terminal window and enter the following command:
   sudo apt-get update
   If the output shows that some packages can be upgraded, you can enter the following command in the terminal window to upgrade them:
   sudo apt-get upgrade
   After upgrading the packages, reboot the Raspberry Pi for the changes to be applied.
2. Install the following packages using apt:
   - matchbox-keyboard
   - libgpiod2

- python3-pyqt5
- mpg123
- git
- build-essential
- qtdeclarative5-dev
- libqt5svg5-dev
- qtbase5-private-dev
- qml-module-qtquick-controls2
- qml-module-qtquick-controls
- qml-module-qt-labs-folderlistmodel
- libxcb-composite0-dev
- libxcb-cursor-dev
- libxcb-damage0-dev
- libxcb-dpms0-dev
- libxcb-dri2-0-dev
- libxcb-dri3-dev
- libxcb-ewmh-dev
- libxcb-glx0-dev
- libxcb-icccm4-dev
- libxcb-image0-dev
- libxcb-imdkit-dev
- libxcb-keysyms1-dev
- libxcb-present-dev
- libxcb-randr0-dev
- libxcb-record0-dev
- ibxcb-render-util0-dev
- libxcb-render0-dev
- libxcb-res0-dev
- libxcb-screensaver0-dev
- libxcb-shape0-dev
- libxcb-shm0-dev
- libxcb-sync-dev
- libxcb-util-dev
- libxcb-util0-dev
- libxcb-xf86dri0-dev
- libxcb-xfixes0-dev
- libxcb-xinerama0-dev
- libxcb-xinput-dev
- libxcb-xkb-dev
- libxcb-xrm-dev

- libxcb-xtest0-dev
- libxcb-xv0-dev
- libxcb-xvmc0-dev
- libxcb1-dev
- libx11-xcb-dev
- libglu1-mesa-dev
- libxrender-dev
- libxi-dev
- libxkbcommon-dev
- libxkbcommon-x11-dev

3. Install the following packages using pip3:
   - twilio
   - qrcode
   - adafruit-python-shell
   - adafruit-circuitpython-dht
   - gtts
   - phonenumbers
   - rpi-backlight
4. If you do not want to use a virtual keyboard for the touch screen, you can ignore these steps and just copy the edited "safety.conf" to the directory of the GUI script. Otherwise, go to step 5.
5. Since the PyQt5 will load the module from the prefix path, we need to determine the prefix path using the following command:

   python -c "from PyQt5.QtCore import QLibraryInfo; print('QT_PREFIX_PATH:', QLibraryInfo.location(QLibraryInfo.PrefixPath))"

   - In most cases, the prefix path is at */usr*. However, if your prefix path is not at */usr*, you need to adjust the command in later steps.
   - We define *QT_PREFIX_PATH* as */usr* in later steps. You should adjust the path accordingly before executing the command.
6. You need to download the latest LTS source code of the Qt virtual keyboard, run the following command:

   git clone -b 5.15 https://github.com/qt/qtvirtualkeyboard.git
7. Open the qtvirtualkeyboard folder. By default, we download the source code to a directory called qtvirtualkeyboard in your home directory. To open that directory, run the following command:

   cd ~/qtvirtualkeyboard

   - You can verify the current working directory by using running the following command:

     pwd

- You are expected to see the output of the above command as /home/USER_NAME/qtvirtualkeyboard, where USER_NAME is the name of the account.

8. Run qmake. To generate the makefile automatically, run the following command:

qmake

9. Then you can use the below command to compile the Qt virtual keyboard automatically. This will take around 15 minutes on Raspberry Pi.

sudo make

10. By running the below command, the binary files will be moved to the appropriate locations on the system.

sudo make install

- By default, the destination is at ~\qtvirtualkeyboard

11. Copy libQt5VirtualKeyboard.so.5.
    - In the terminal window, enter the following command:

sudo cp -L ~/qtvirtualkeyboard/lib/libQt5VirtualKeyboard.so.5 QT_PREFIX_PATH/lib/libQt5VirtualKeyboard.so.5

    - If your QT_PREFIX_PATH is /usr, the command will be

sudo cp -L ~/qtvirtualkeyboard/lib/libQt5VirtualKeyboard.so.5 /usr/lib/libQt5VirtualKeyboard.so.5

    - If your compiled version is 5.15.8, you need to adjust the command to match the version number.

12. You need to create the folder *QT_PREFIX_PATH/plugins/platforminputcontexts* using the following command:

sudo mkdir QT_PREFIX_PATH/plugins
sudo mkdir QT_PREFIX_PATH/plugins/platforminputcontexts

    - Again, you should replace the path with the QT_PREFIX_PATH on your system.

13. You need to copy the *libqtvirtualkeyboardplugin.so* to *QT_PREFIX_PATH/plugins/platforminputcontexts* using the following command:

sudo cp ~/qtvirtualkeyboard/plugins/platforminputcontexts/libqtvirtualkeyboardplugin.so QT_PREFIX_PATH/plugins/platforminputcontexts/

14. You need to cop the whole virtualkeyboard folder to QT_PREFIX_PATH/plugins using the following command:

sudo cp -r ~/qtvirtualkeyboard/plugins/virtualkeyboard/ QT_PREFIX_PATH/plugins/

15. Copy virtual keyboard Qml folder. You will also need to copy the Qml's virtualkeyboard folder to *QT_PREFIX_PATH/qml/QtQuick* folder. But first, you need to create the destination folder using the command:

sudo mkdir QT_PREFIX_PATH/qml
sudo mkdir QT_PREFIX_PATH/qml/QtQuick

16. Then, you can copy the whole folder using the following command:

sudo cp -r ~/qtvirtualkeyboard/qml/QtQuick/VirtualKeyboard/ QT_PREFIX_PATH/qml/QtQuick/

Start the Software

A virtual keyboard has been installed on your Raspberry Pi. You can find it in the start menu under Accessories. After finishing the installation, first change the working directory to your home directory by running

cd ~/Nalxone_Safety_Kit/main

Then enter the following command to start the program:

python main.py

You should see the GUI start up. It will search for "safety_kit.conf" to read configurations. If the file does not exist, it will ask the user to enter the necessary information. A "safety_kit.conf" template is provided in the appendix. You can create the file by yourself so that you don't need to type the information on the touch screen again.

Initial Setup

When you first start the software, you will need to enter necessary information. You will see an "Initial Setup" notification in the taskbar. Please refer to Settings for more details on how to enter the correct information.

Autostart

The user can set the software to start automatically when booting the device. The function is utilized by using the Systemd unit file. To enable this function, follow the instructions below:

1. Create the unit file by entering the following command in the terminal:

   sudo nano /lib/systemd/system/kit.service

2. In the nano text editor window, type the following text:

   [Unit]
   Description=Safety Kit
   After=multi-user.target

   [Service]
   User=username
   Group=usergroup
   Environment=DISPLAY=:0
   Environment=XAUTHORITY=/home/username/.Xauthority
   Environment=XDG_RUNTIME_DIR=/run/user/1000
   Environment=QT_QPA_PLATFORMTHEME=qt5ct
   WorkingDirectory=/home/username/Documents/Naloxone_Safety_Kit/main
   Restart=on-failure
   RestartSec=5s
   ExecStart=/usr/bin/python3 main.py

[Install]
WantedBy=graphical.target

- Remember to replace the *username* with your user name. Also remember to replace the *usergroup* with your user group. By default, the user group has the same name as the user name.
- For the environment variables in the unit file, you can view the current environment variable by typing the command

  env

  in the terminal. Double check that the environment variables in the unit file are the same as the current environment variables on your system.
- Double check the *WorkingDirectory*. It should be the absolute path to the *main.py*.
- The unit file is configured so that it will restart the software if it fails after waiting for 5 seconds. To disable the auto restart function, comment the line
  Restart=on-failure
  RestartSec=5s
  by adding # to the front of the two lines.
- Close the nano text editor by using Ctrl+x. Remember to save the file.

3. You will then enable the service so that it will be automatically started by systemd after reboot. To enable the service, run the following command in the terminal:

   sudo systemctl enable kit
4. You can also start the service now to check whether the unit file is written correctly. To start the service, using the command:

   sudo systemctl start kit
5. If nothing happens after the above command, you can check the status of the service by using the command:

   sudo systemctl status kit
6. Now, the software is configured to run automatically at boot. To disable this feature, you can run the command to disable the service:

   sudo systemctl disable kit

User Interface

Taskbar

The taskbar, which displays the time as well as pushbuttons, indicators, and notifications, is an essential component of the user interface. It can always be found on the screen's bottom. It is intended to adapt to the safety kit's current state dynamically. Indicators for the safety kit's status include whether the CPU fan is on and whether the naloxone has been destroyed. Users can quickly check the safety kit's status and take the necessary action by monitoring the taskbar.

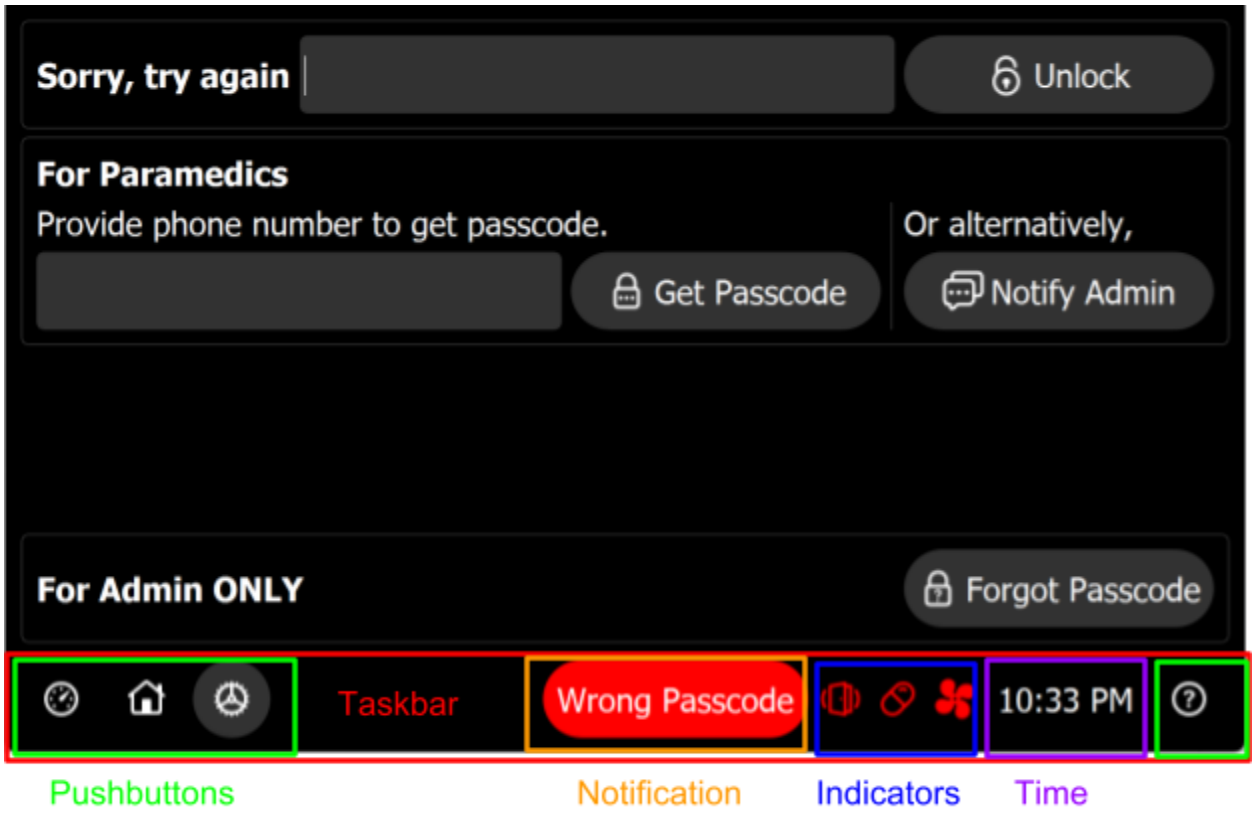

Figure UM1: Taskbar Location.

Pushbuttons

The taskbar's pushbuttons are an essential user interface component that enables fundamental user interactions. To access various software pages, users can click on the push buttons. For instance, the software's settings can be accessed and modified by pressing the "Settings" push button. The software's detailed usage instructions can also be found by pressing the "Help" button. It is essential to keep in mind that although the pushbuttons' availability may change depending on the device's state, they will always offer users an easy way to navigate the software.

Pushbutton	Action
	Go to the home page.
	Go to the dashboard page.
	Go to the settings page.
	Show help for the current page.
	Save the current settings to “safety_kit.conf”. The settings will be applied immediately after saving. You will only see this push button when you are on the settings page.
	Go back to the door open page. You will only see this pushbutton when you access the settings from the door open page.

Table UM1: Taskbar Pushbuttons.

Indicators

Similar to the dashboard of a car, indicators on the taskbar display the device's current state. The indicators may show the state of the door sensor, the network status, or whether the Twilio account has sufficient balance. Users can quickly and easily assess the situation and take the necessary actions thanks to these indicators, which provide essential information about the device's status at a glance.

Indicator	Meaning
	The settings have been unlocked.
	More than one Twilio request is in the request queue.
	The CPU fan has been turned on to prevent CPU overheating.
	The stored naloxone has been destroyed due to expiration or overheating.

	The device cannot connect to the Twilio service.
	The door sensor is disarmed. Emergency service will not be called when the door opens.
	The remaining Twilio account balance is less than $5.

Table UM2: Taskbar Indicators.

Notifications

Notifications displayed on the taskbar provide more detailed information about critical events or changes in the status of the safety kit. These notifications may include alerts for missing config files, destroyed naloxone, and disarmed sensors. Users should pay close attention to notifications and take appropriate action to ensure the safety kit functions properly. Notifications may also provide instructions on resolving the issue or seeking further assistance.

Notification	Meaning
Config File Missing	The file “safety_kit.conf” does not exist.
Wrong Passcode	The provided passcode does not match the admin or paramedic's passcode.
911 Requested	The emergency call request has been created and placed in the request queue.
Naloxone Destroyed	The stored naloxone has been destroyed because of expiration or overheating.
Door Sensor OFF	The door sensor has been disarmed. The device will not place emergency phone calls until the door sensor has been armed again.
Close Door First	When trying to reset the system, the door is open.
SMS Requested	An SMS request has been created and placed in the request queue.
SMS Failed	The device cannot send the SMS using the Twilio service.
SMS Delivered	The device successfully sends the SMS using the Twilio service.

Call Requested	A non-emergency call has been created and placed in the request queue.
Call Failed	The device cannot send the call using the Twilio service.
Call Delivered	The device successfully sends the call using the Twilio service.
System Reset	The system has been reset to the default state.
Alarm Generated	An alarm mp3 file called “alarm.mp3” has been generated in the./res directory. If the device cannot place emergency calls, it will be played during an emergency.
Settings Saved	The settings have been saved to “safety_kit.conf”.

Table UM3: Taskbar Notifications.

Home Screen

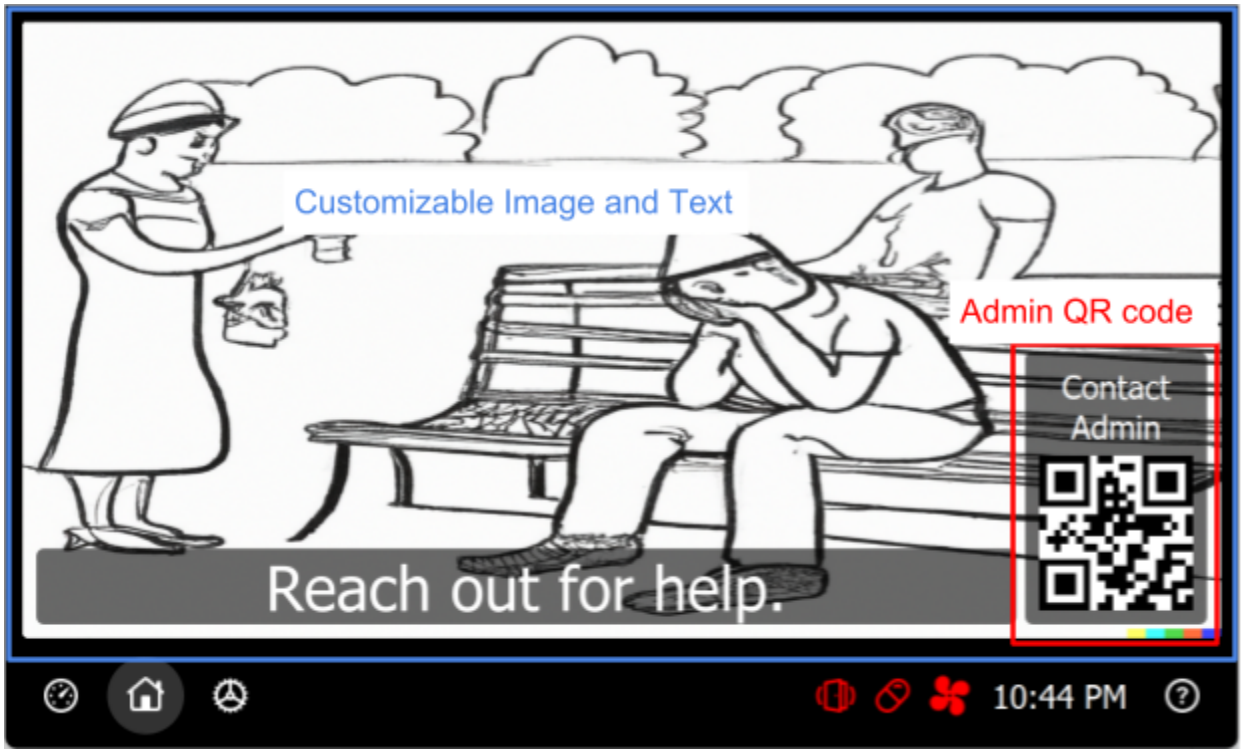

Figure UM2: Home Screen.

Home Screen Image and Text

The home screen of the Naloxone safety kit displays images and text that aim to increase public awareness about the overdose epidemic. This screen serves as an educational tool to raise awareness about the prevalence of drug overdoses and how to respond to an overdose emergency. The admin can customize the pictures and text displayed on the home screen before deployment to meet specific demands and maximize public awareness. This allows the admin to tailor the content to the target audience and location of the safety kit.

QR Code for Admin Contact

The admin's phone number is displayed in a QR code on the home screen in addition to the educational content. Anyone with a smartphone can scan this code to contact the administrator to report any problems or learn more about the Naloxone safety kit. The public can quickly and conveniently contact the administrator through this feature to report whether the safety kit works appropriately.

Dashboard Screen

The device's current state is shown on the Dashboard page. The user can view the current state of various device components on this page and take any necessary action. The Dashboard page helps the user monitor the device and take the necessary steps to ensure its proper operation by providing a comprehensive overview of its status. The dashboard screen will transit to the home screen after 1 minute automatically.

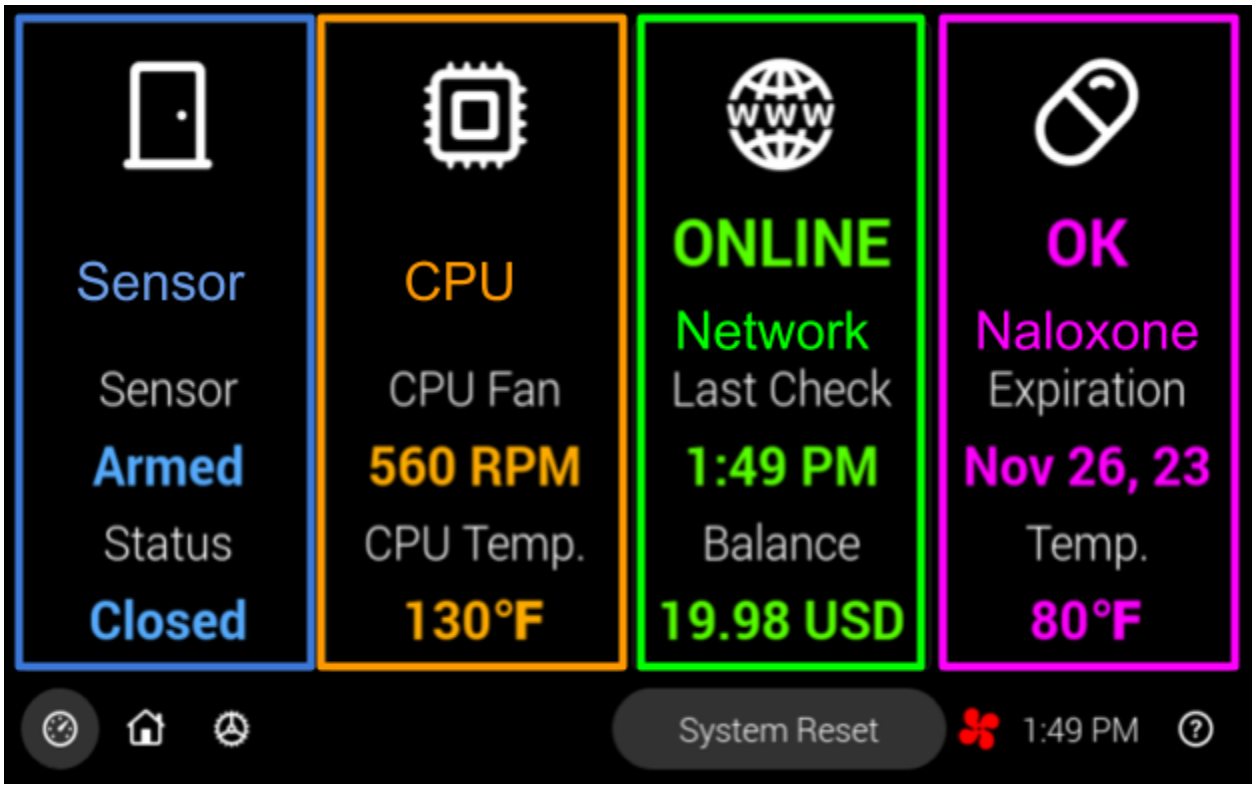

Figure UM3: Dashboard Screen.

Sensor Column

The Sensor column displays the door's status, including whether it is closed and whether the door sensor is disabled. This column provides information on the door sensor of the device.

CPU Column

The CPU column displays the CPU's current temperature and the CPU fan's speed. Monitoring the CPU temperature can help identify potential issues with the device’s hardware, and the CPU fan speed indicates the device’s workload.

Network Column

The Network column shows whether the device is connected to the Twilio service and the remaining Twilio account balance. This information helps the user ensure that the device functions correctly and that there is sufficient balance to cover communication costs.

Naloxone Column

The Naloxone column shows the expiration date of the naloxone and whether the naloxone has been destroyed due to overheating or expiration. The status of the naloxone can help the user ensure that the device has a reliable naloxone supply.

Settings Screen

The Settings allows the user to set different device parts. Security, Naloxone, Twilio, Emergency Call, Alarm, Power Management, and Admin are among the tabs on the settings page. Users can lock or unlock settings through the Security tab. Users can set the naloxone's expiration date and maximum temperature in the Naloxone tab. Users can modify the information associated with their Twilio account through the Twilio tab. Users can set the phone number called in an emergency using the Emergency Call tab. The Alarm tab permits users to create MP3 documents to alarm nearby people and change the volume. The Power Management tab lets users decide whether to enable active cooling and adjust screen brightness. The Admin tab helps users to test their settings utilizing calls or SMS messages. The software can be tailored to meet the user's specific requirements by allowing users to modify these settings.

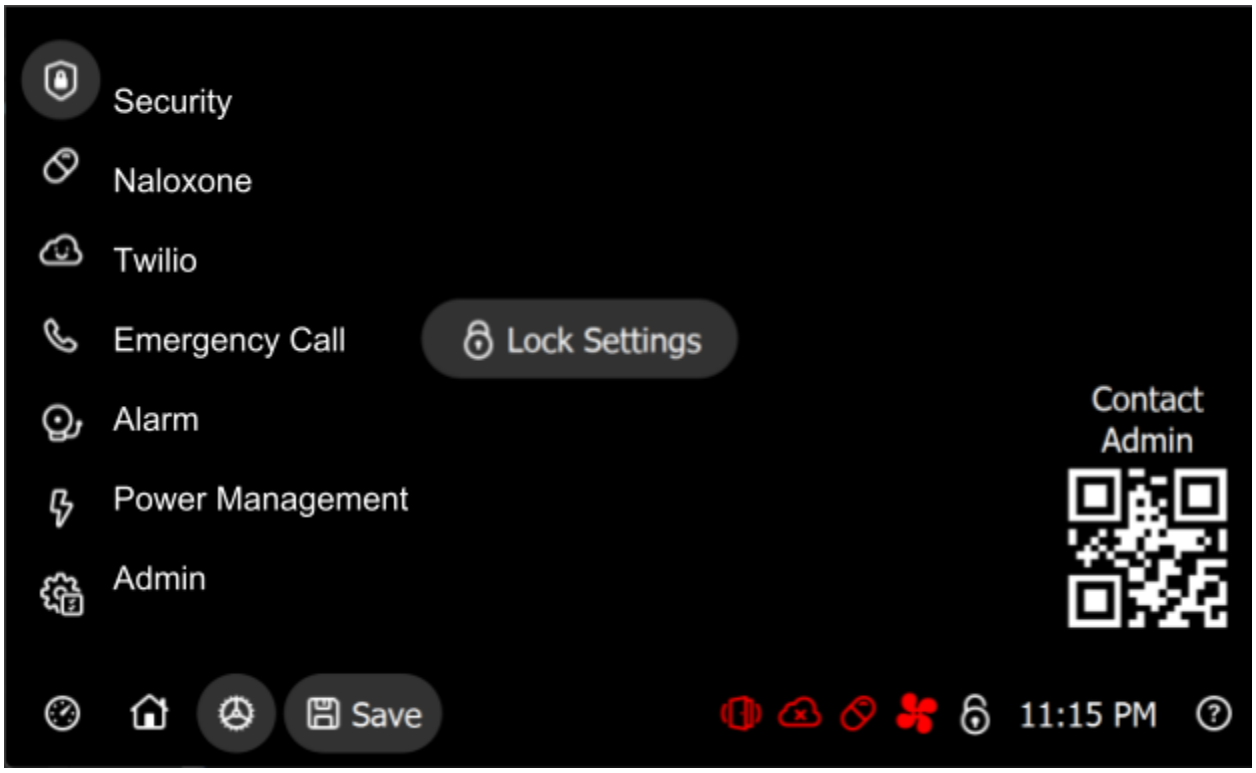

Figure UM4: Settings Tabs.

Door Open Screen

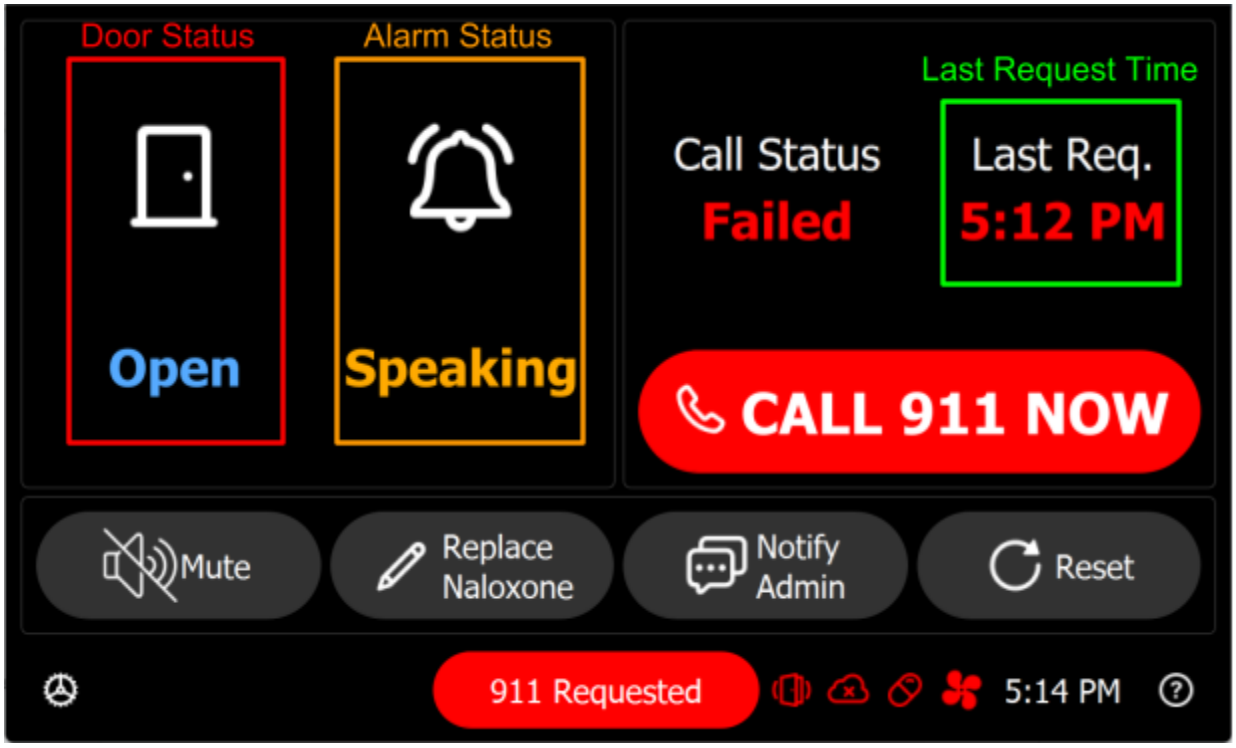

Figure UM5: Door Open Page UI.

Pushbutton Function Summary

Note that not all pushbuttons will be shown on the door open screen at the same time. The UI will adjust itself so that the user can get access to the most needed function in a simplified manner.

Pushbutton	Function
Stop	Stop the countdown timer so that the emergency phone call will not be automatically called.
CALL 911 NOW	Call the emergency number immediately. Pressing this button will automatically set the countdown timer to timeout.
Mute	Stop the alarm sound. You cannot enable the alarm again unless the next emergency call request failed.
Replace Naloxone	The settings page will appear so the user can enter new information about the replaced

	naloxone.
Notify Admin	The admin will receive an SMS saying that paramedics have arrived.
Reset	Reset the device to the default state. Always close the door before pressing this button.

Table UM4: Door Open Screen Pushbuttons.

On Door Open

The door open screen will be shown when the door is opened, and the door sensor is enabled. It will first show a countdown timer. Within the countdown period, the user can stop the countdown to disable emergency phone calls by pressing the “Stop.” They can also shut down the door to go back to the previous screen when opening it accidentally.

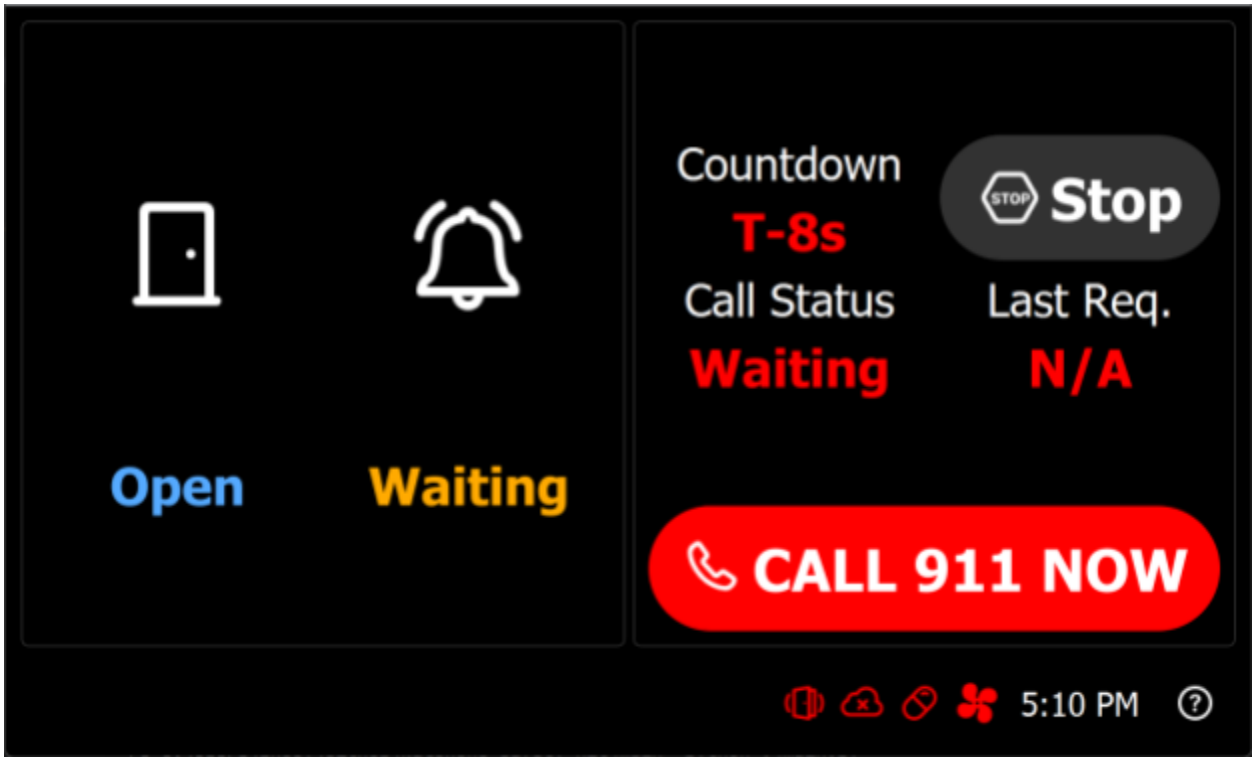

Figure UM6: Door Open Page with Countdown Timer.

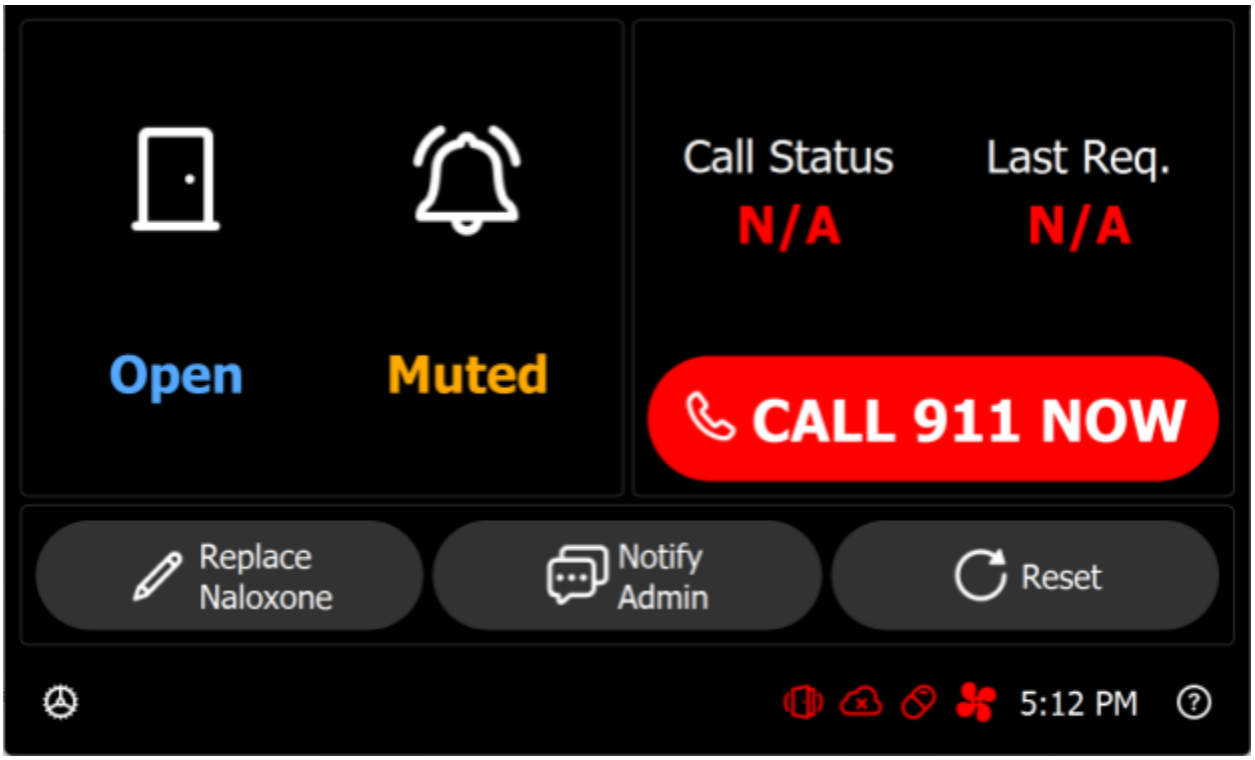

Figure UM7: Door Open Page after Pressing Stop.

After pressing the “Stop” button, the user must manually reset the device. They need to ensure that the door is closed before resetting. Otherwise, the device will not be reset and a warning will be shown in the taskbar. They can also observe the text under the door icon to check whether the door is closed or not.

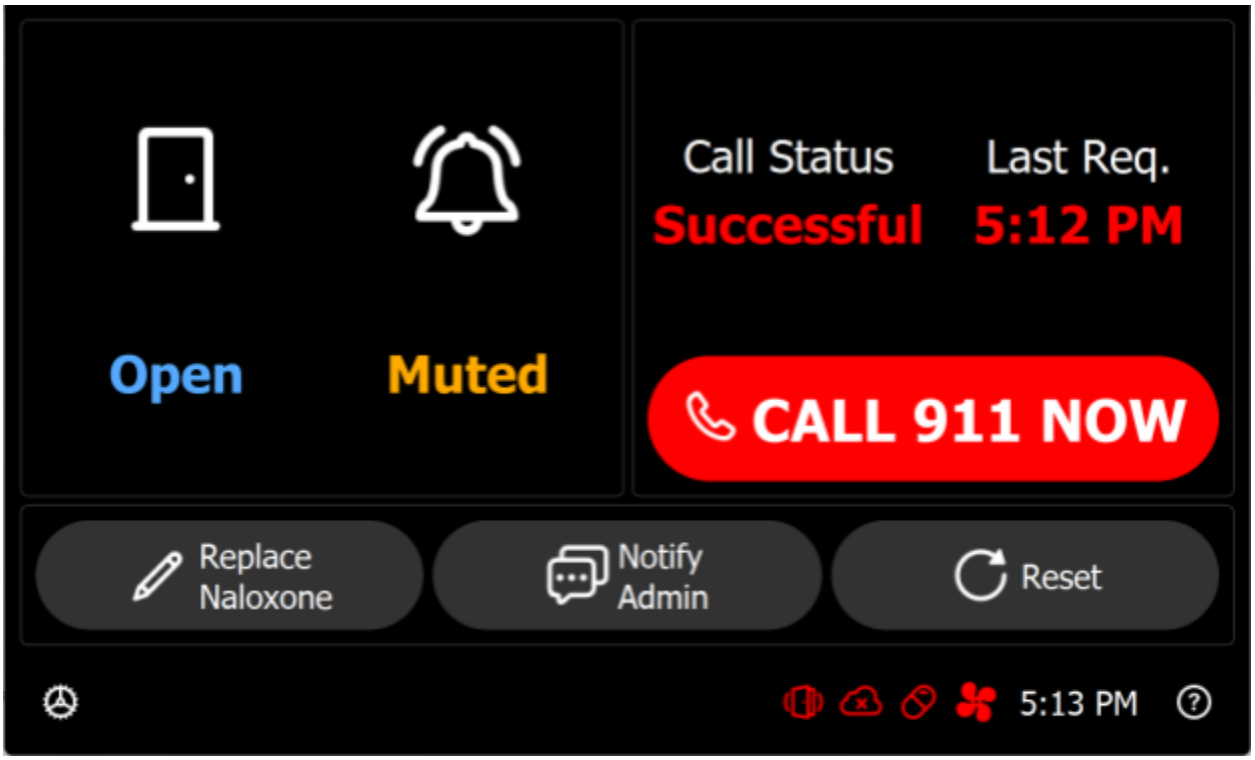

Figure UM8: Door Open Page after Successful Emergency Call.

If there is indeed an emergency, the user can press the “CALL 911 NOW” to call the emergency immediately or wait for 10 seconds before the device calls 911 by itself. If the 911 is placed successfully, the alarm will not be played by the device to minimize disruption.

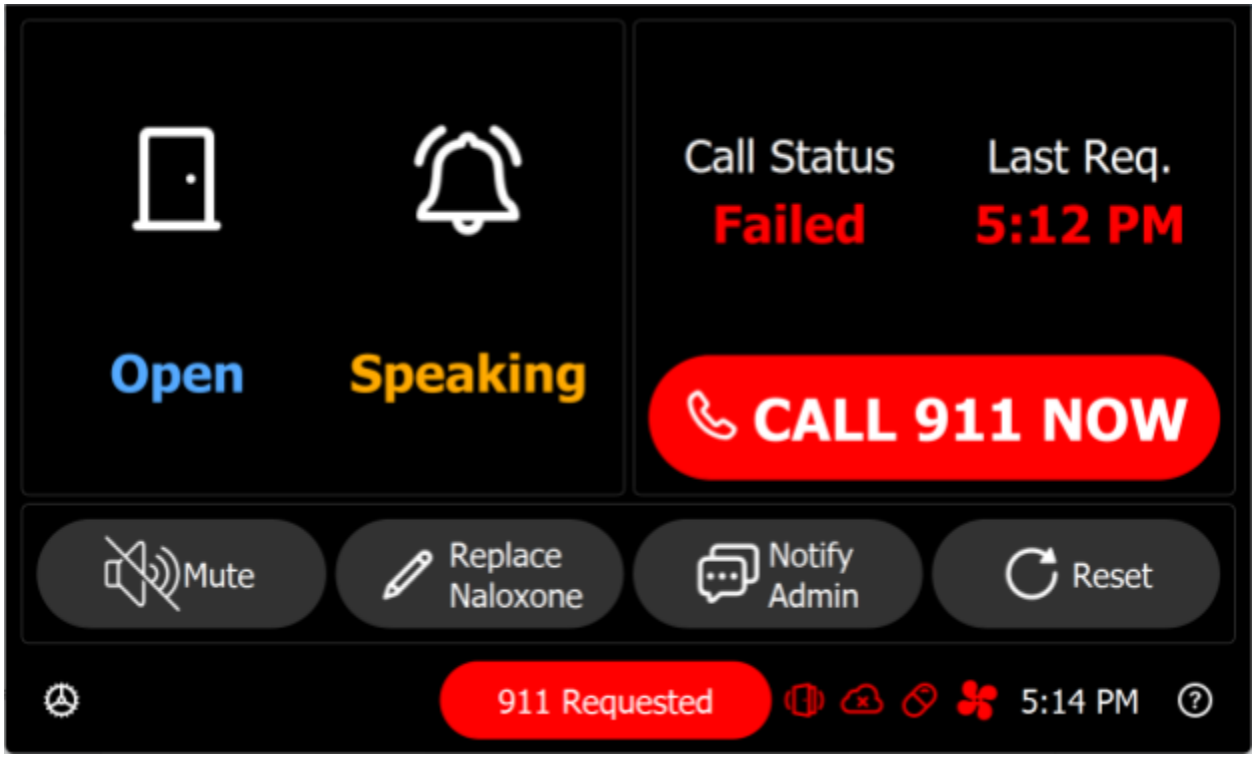

Figure UM9: Door Open Page After Unsuccessful Emergency Call.

If the emergency call cannot be placed successfully, the device will play the alarm file generated when setting up. The user can press “Mute” to stop the alarm if they want to.

Passcode Screen

Both the administrator and the building manager can enter their passcodes on the passcode screen to access the various settings that are available to them. Paramedics can use the "Notify Admin" button to send an SMS to the admin so that the admin can come and replace the Naloxone on their own if the admin has restricted access to only the admin. Paramedics can enter their phone number into the designated field to retrieve the Naloxone passcode on their phone if the administrator grants them access. Using the "Forgot Passcode" function, the administrator can also get their passcode by sending an SMS to their registered phone number. This screen with a passcode helps ensure that only authorized individuals have access to the sensitive safety kit settings.

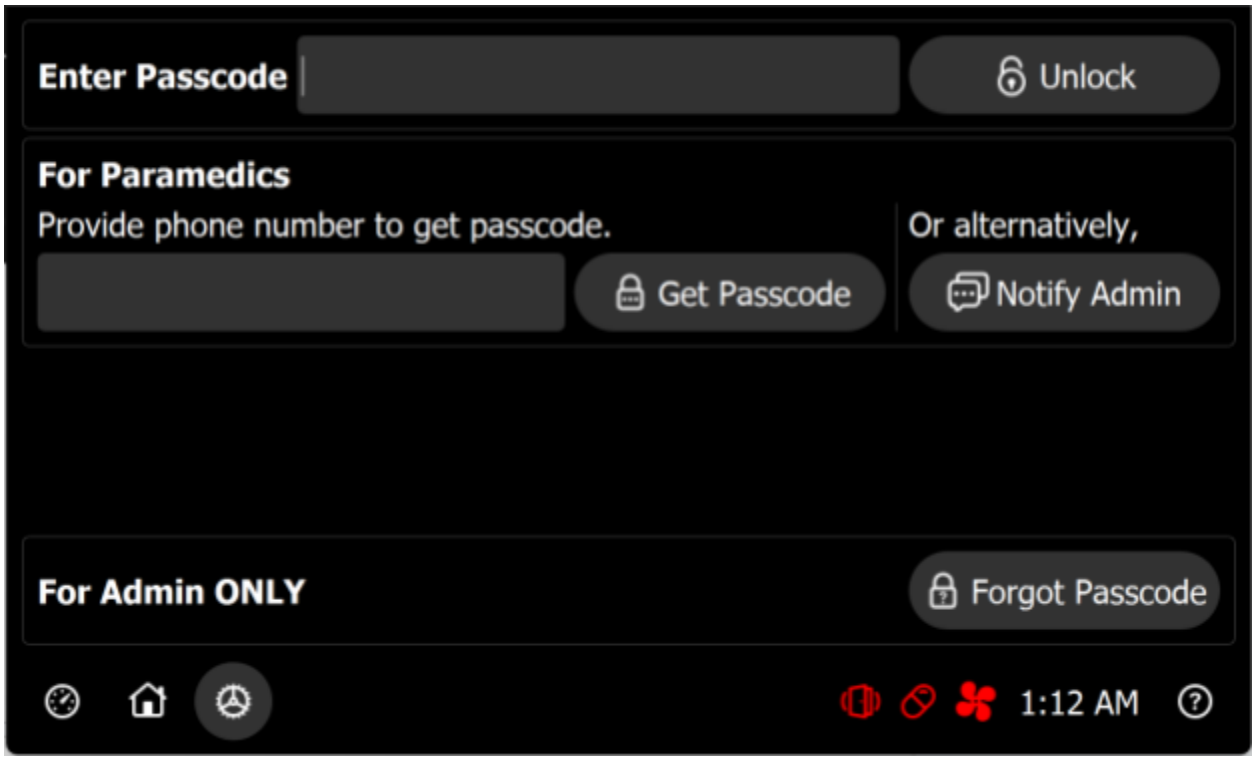

Figure UM10: Passcode Screen.

Settings

This section includes detailed information about all available settings to customize the user experience.

Security Settings

The Security page of the Naloxone safety kit allows you to secure the device's settings by locking or unlocking them. By default, all settings are locked, and you need to enter an admin passcode to unlock them.

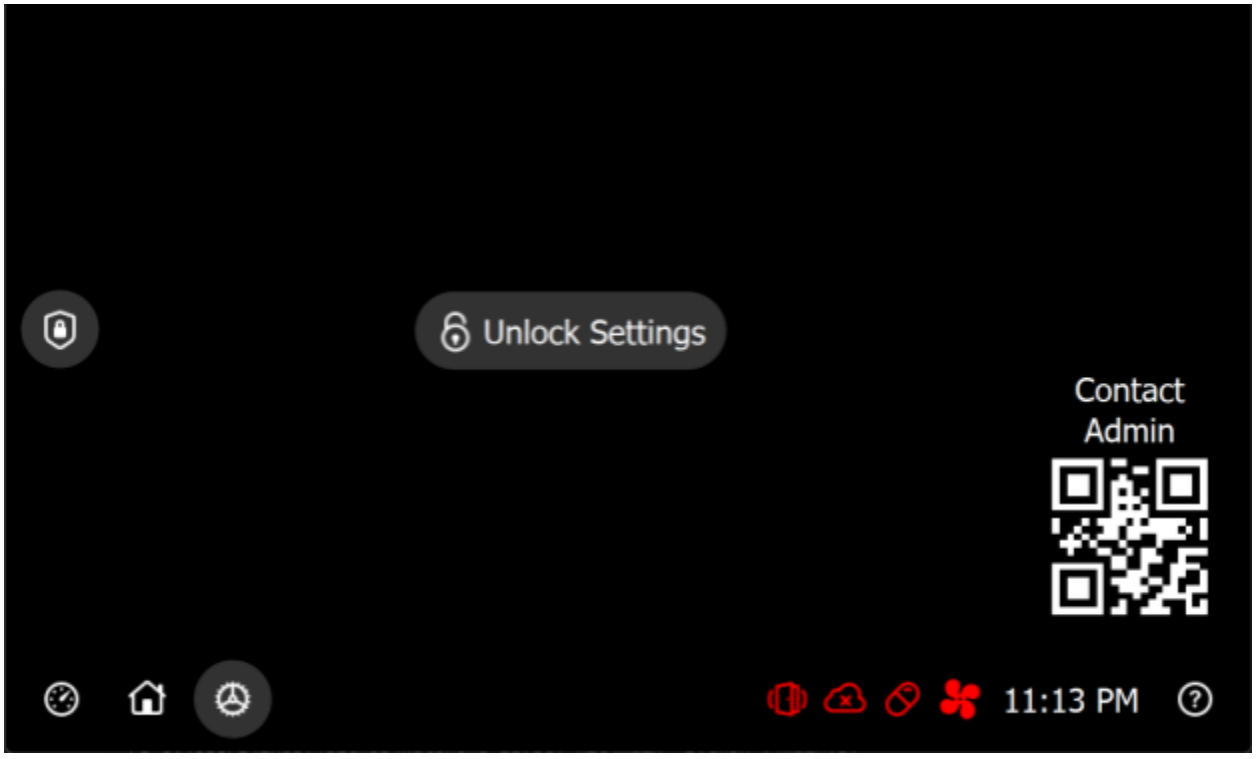

Figure UM11: Security Settings.

Unlock Settings

To unlock the settings, navigate to the Security page and press the "Unlock Settings" button. You will be taken to the Enter Passcode page, where you can enter the admin passcode. If no passcode is set, pressing the "Unlock Settings" button will automatically unlock all settings. Once the settings are unlocked, a white unlock icon will appear in the bottom right corner of the screen.

Lock Settings

To lock the settings on your device, navigate to the Security page and press the "Lock Settings" button. If a passcode is set, you will need to enter it again to access the settings. Alternatively,

the settings will be automatically locked when you leave the settings pages. By locking the settings, you can prevent unauthorized access to your device and ensure the safety of the Naloxone safety kit.

Contact Admin QR Code

Similar to the QR code on the home screen, the user can get the admin phone number by scanning the QR code.

Naloxone Settings

The Naloxone page on the Naloxone safety kit allows you to update information about the Naloxone nasal spray stored in the device. By using the controls on this page, you can set a new maximum temperature for storing the Naloxone and update the expiration date of the Naloxone using the calendar widget.

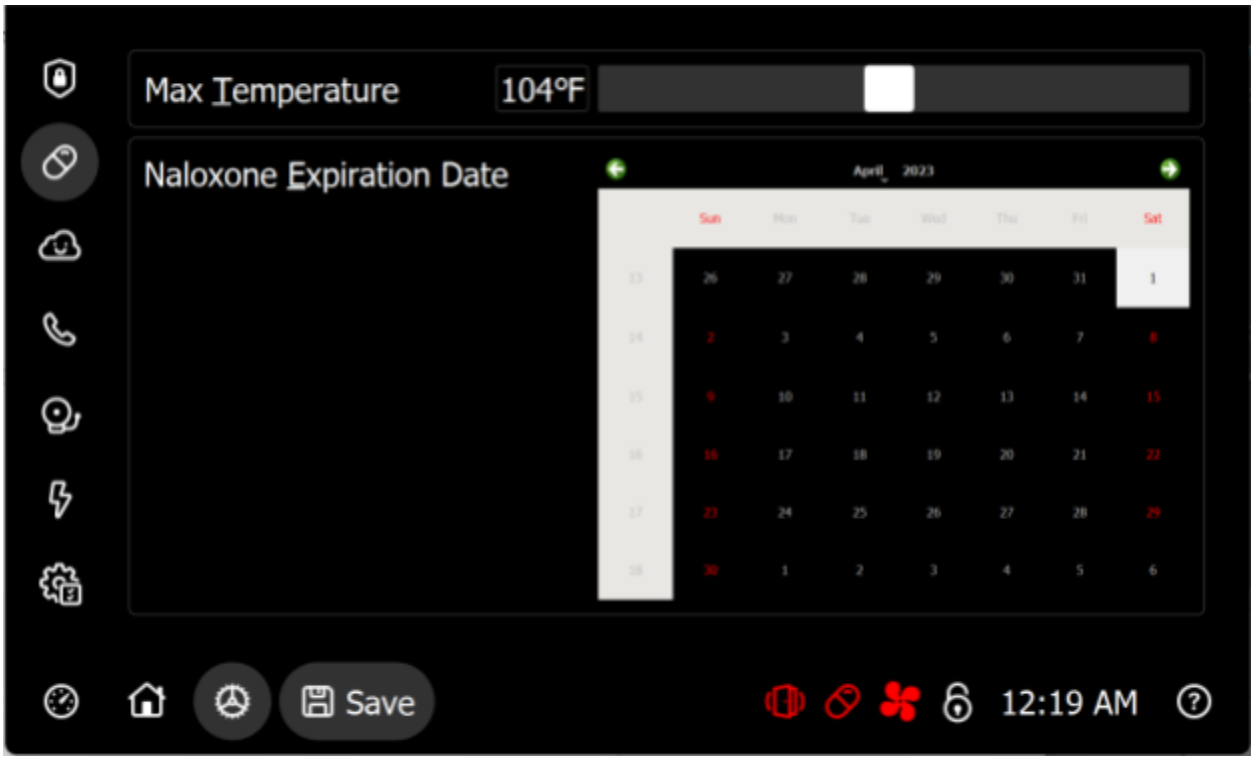

Figure UM12: Naloxone Settings.

Max Temperature

The Naloxone nasal spray should be stored at a maximum temperature of 104 degrees Fahrenheit to ensure its effectiveness. You can adjust this temperature by using the slider control on the Naloxone page. The current temperature setting will be displayed on the adjacent label. If the maximum temperature is reached, the system will display a red pill icon in the taskbar as well as a persistent notification. To ensure the proper functioning of the Naloxone safety kit, it is recommended to enable SMS reporting so that the admin can be notified in the event of overheating.

Naloxone Expiration Date

The Naloxone page also allows you to view and update the expiration date of the Naloxone. Once the Naloxone has expired, the system will display a red pill icon in the bottom right corner of the screen. It is recommended to enable SMS reporting so that the admin can be notified in the event of an expired Naloxone.

Twilio Settings

The Twilio page allows you to configure all the settings related to the Twilio service. Twilio is a cloud communications platform that enables you to send and receive text messages and phone calls. To use the Twilio service with your Naloxone safety kit, you will need to enter your Twilio virtual phone number, Twilio Account SID, and Auth Token. These settings can be found in the Twilio online console.

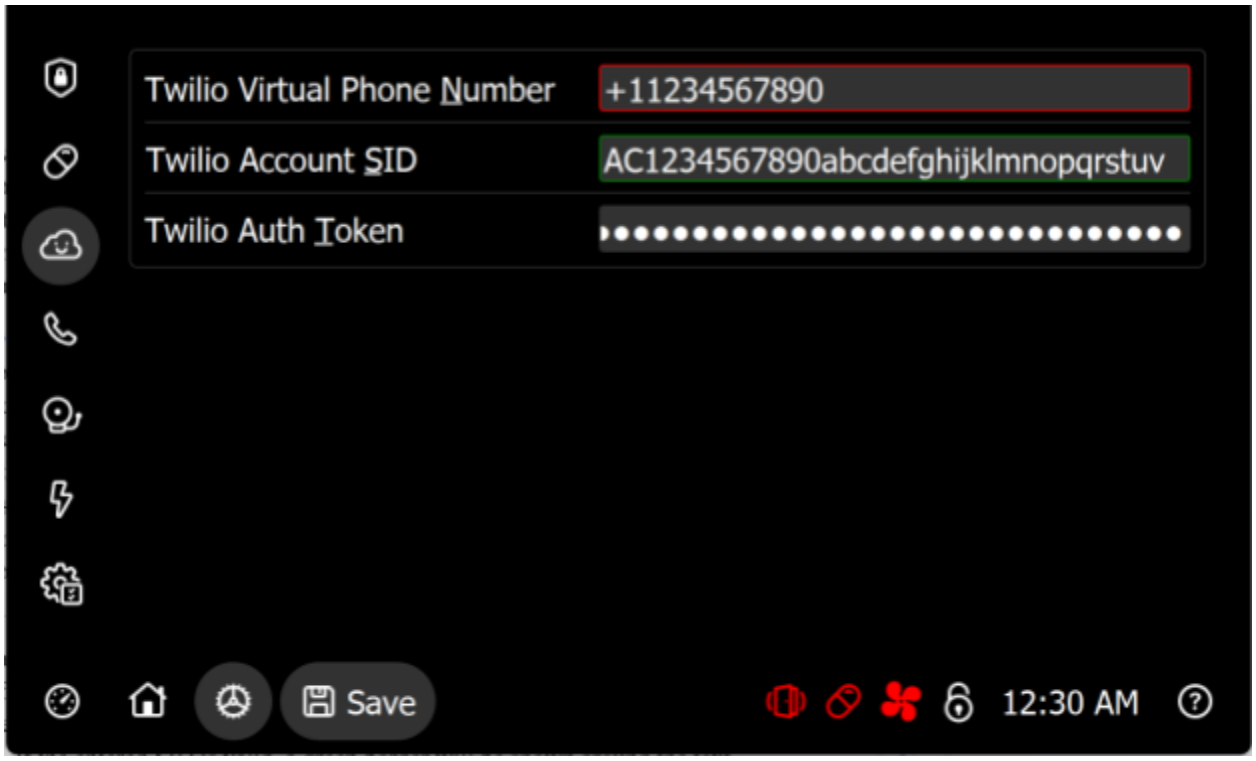

Figure UM13: Twilio Settings.

Twilio Virtual Phone Number

This is the leased phone number from Twilio that will be used to make and receive phone calls and text messages. You can enter the virtual phone number in the text box provided. Please make sure to include the area code (+1 for the U.S.) when entering the virtual phone number. The system will automatically check the validity of the phone number. A green border will be shown around the text box if the entered phone number is valid. If it is invalid, the frame will be red. Please note that the system does not prevent invalid phone numbers from being saved, but this will cause phone call requests to fail.

Twilio Account SID

The Account SID is a 34-character string identifier for your Twilio account, and it always starts with “AC”. You can find your Twilio Account SID in the Twilio online console. Make sure to include the “AC” when entering the SID. A validator will run in the background to check the

entered Account SID. If the entered SID is valid, a green border will be shown around the text box. If it is invalid, the border will be red. The system does not prevent an invalid Twilio account SID from being used.

Twilio Auth Token

The Auth Token is a security token that acts as a password for your Twilio account when sending requests. You can find your Twilio Auth Token in the Twilio online console. You will need to enter this token to access your account using Twilio's APIs. Please make sure to enter the token exactly as it appears in the Twilio online console.

Emergency Call Settings

The Emergency Call page allows you to set the emergency call destination, address, and message that will be used when making an emergency call.

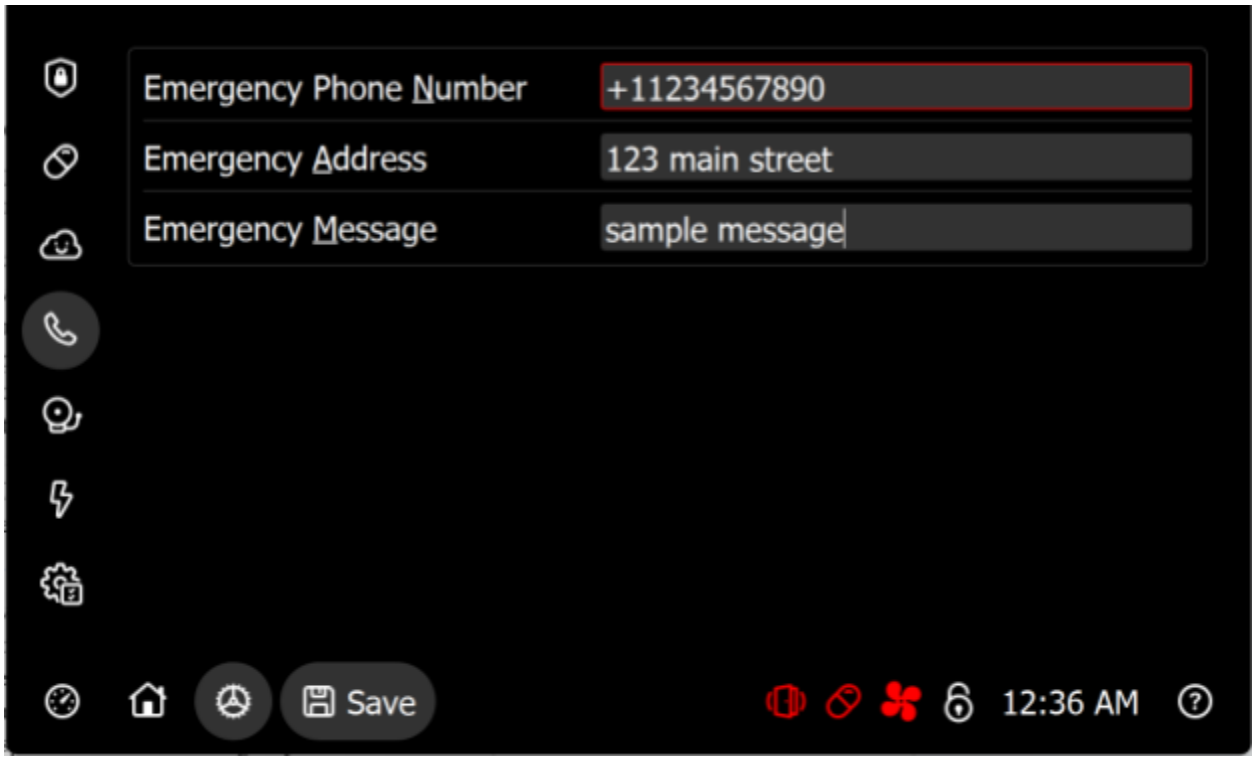

Figure UM14: Emergency Call Settings.

Emergency Phone Number

This setting allows you to set the destination for the emergency call. In most cases, it should be set to 911 to call emergency medical services in the event of an overdose incident. You can also set it to another phone number, such as the phone number of a local hospital or public safety department. It is important to make sure to include the area code when entering the phone number if you are not using 911 as the destination. The system will automatically check the validity of the phone number. A green border will be shown around the text box if the entered phone number is valid. If it is invalid, the border will be red. Please note that the system does not prevent invalid phone numbers from being saved, but this will cause phone call requests to fail.

Emergency Address

This setting allows you to set the installation address of the Naloxone safety kit. Make sure to be specific about the address, including the room and floor number and street name. **It is important to note that after entering the emergency address, you must also update it in your Twilio account. Failure to do so will result in high costs on your bill and may delay the response**

time of the emergency service. For details, visit [Emergency Calling for Programmable Voice | Twilio](#).

Emergency Message

This setting allows you to set a specific message that you may want paramedics to be aware of immediately, such as the route to the address. This information will be sent to the emergency service when making phone calls. Keeping this message brief and relevant to the emergency situation is essential.

Alarm Settings

The Alarm page is where you can set the alarm settings that will be used when it is impossible to make emergency phone calls.

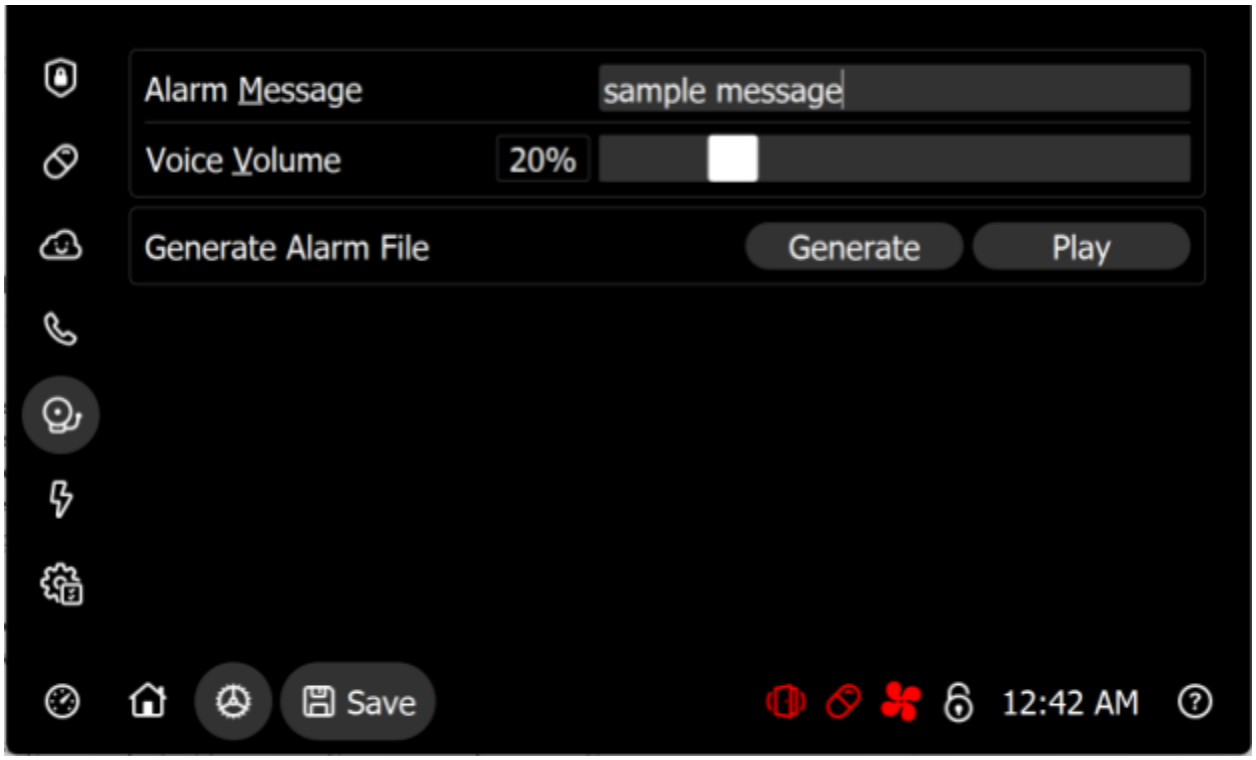

Figure UM15: Alarm Settings.

Alarm Message

The message will be spoken loudly by the system in the event of an emergency. It is important to use meaningful words in the message, such as “someone has overdosed,” so that people have a better understanding of the incident. The message will be passed to the Google text-to-speech engine, which will generate an mp3 file. This file will be played as the alarm message. It is recommended to keep the message clear and easy to understand.

Voice Volume

You can adjust the volume of the alarm using the slider. The best volume setting should make the alarm message clear without being too loud or too quiet. The volume of the USB speaker cannot be adjusted using the slider.

Generating File

Before the alarm message can be played, you need to generate the mp3 file using the Generate button. This function requires an active Internet connection. Once you have generated the file, it will be stored on the device for future use.

Testing

You can test the current alarm settings using the Play button. It is recommended to start with a lower volume setting before increasing the volume. Remember to save the settings after testing, as changes will not be automatically saved.

Power Management Settings

The Power page provides control over the power consumption of the device and cooling options.

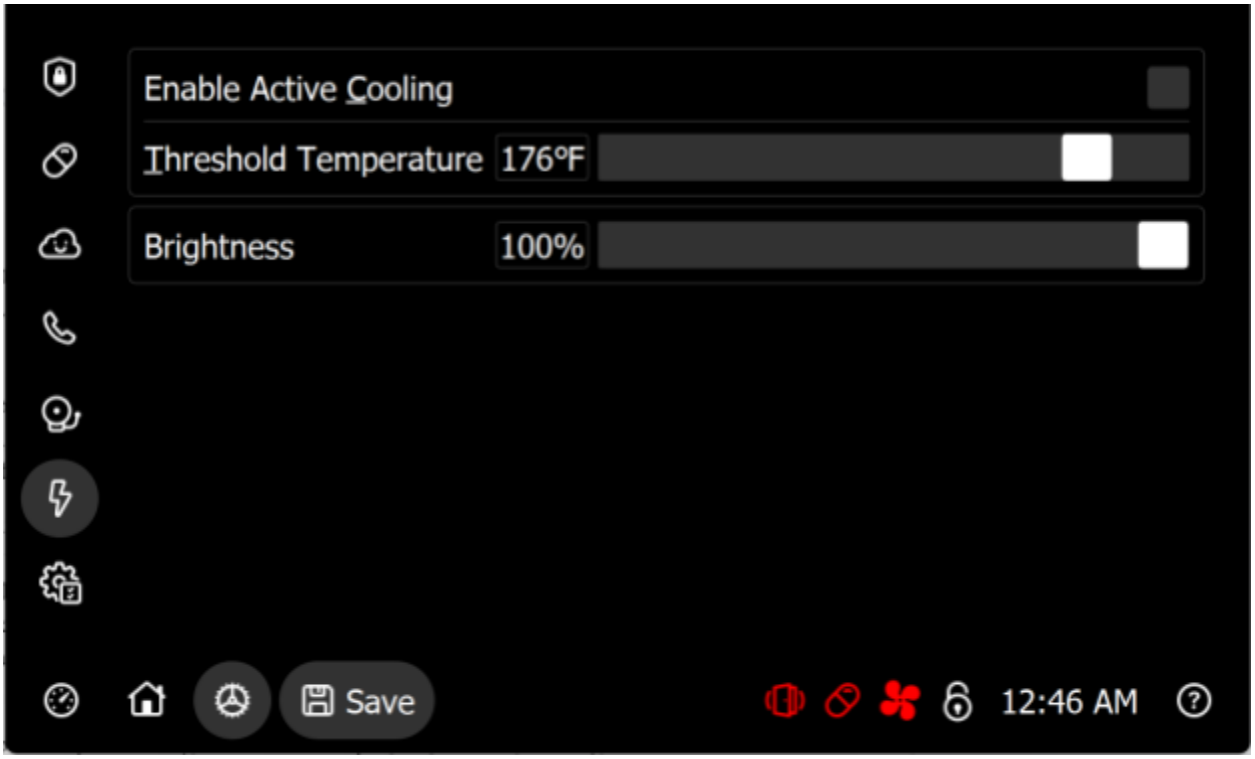

Figure UM16: Power Management Settings.

Enable Active Cooling

This option allows you to enable or disable the active cooling feature of the device. Active cooling involves using a fan to remove hot air from the device quickly. When this option is enabled, the cooling fan will turn on as needed. If it is disabled, the fan will always be off.

Threshold Temperature

This is the minimum temperature at which the cooling fan will turn on. By default, the threshold temperature is set to 176 degrees Fahrenheit. This value is recommended to minimize noise while still ensuring adequate cooling. A linear relationship between temperature and fan speed will be used to regulate the fan.

Brightness

This option allows you to adjust the brightness of the display. By default, the brightness is set to the system default level. You can use the slider to increase or decrease the brightness to your preference. You need to use the “Save” button to make the change persistent.

Admin Settings

The Admin page is designed for advanced users who need to control the behavior of the device and access advanced settings. These settings should be adjusted only by the admin after reading the user manual thoroughly.

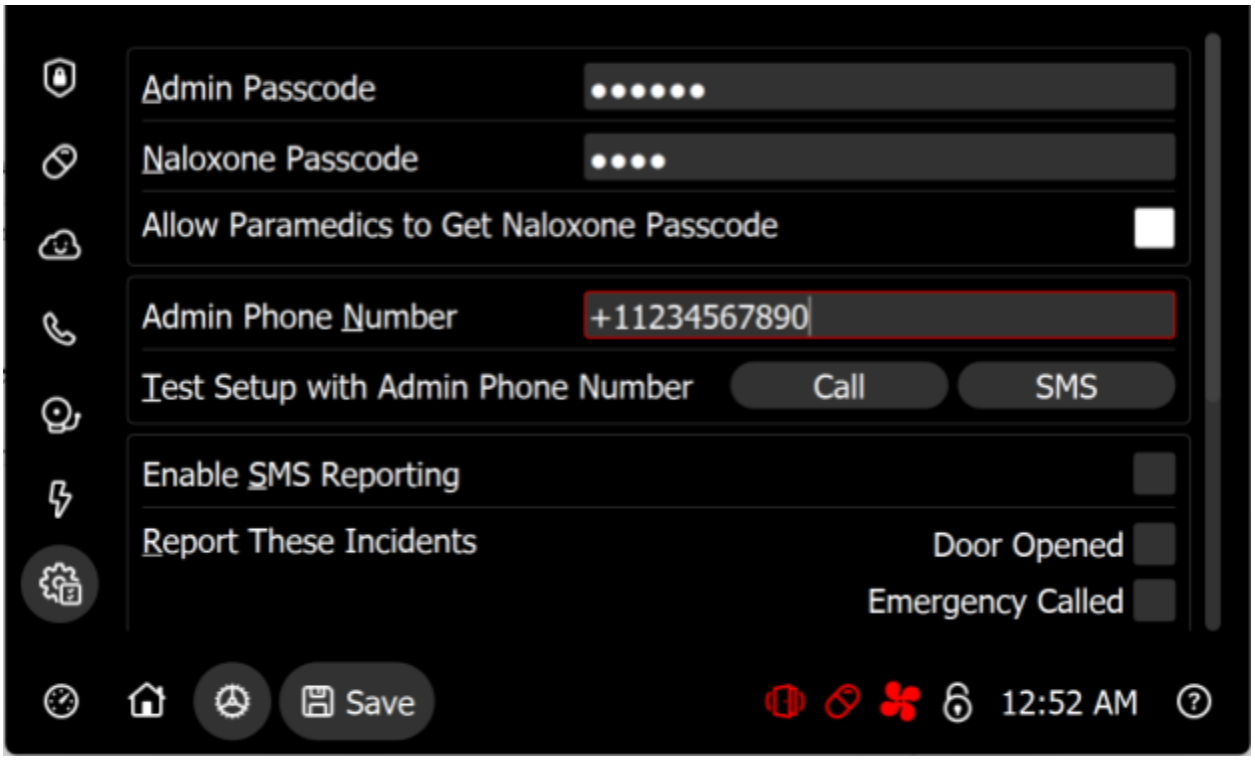

Figure UM17: Admin Settings 1.

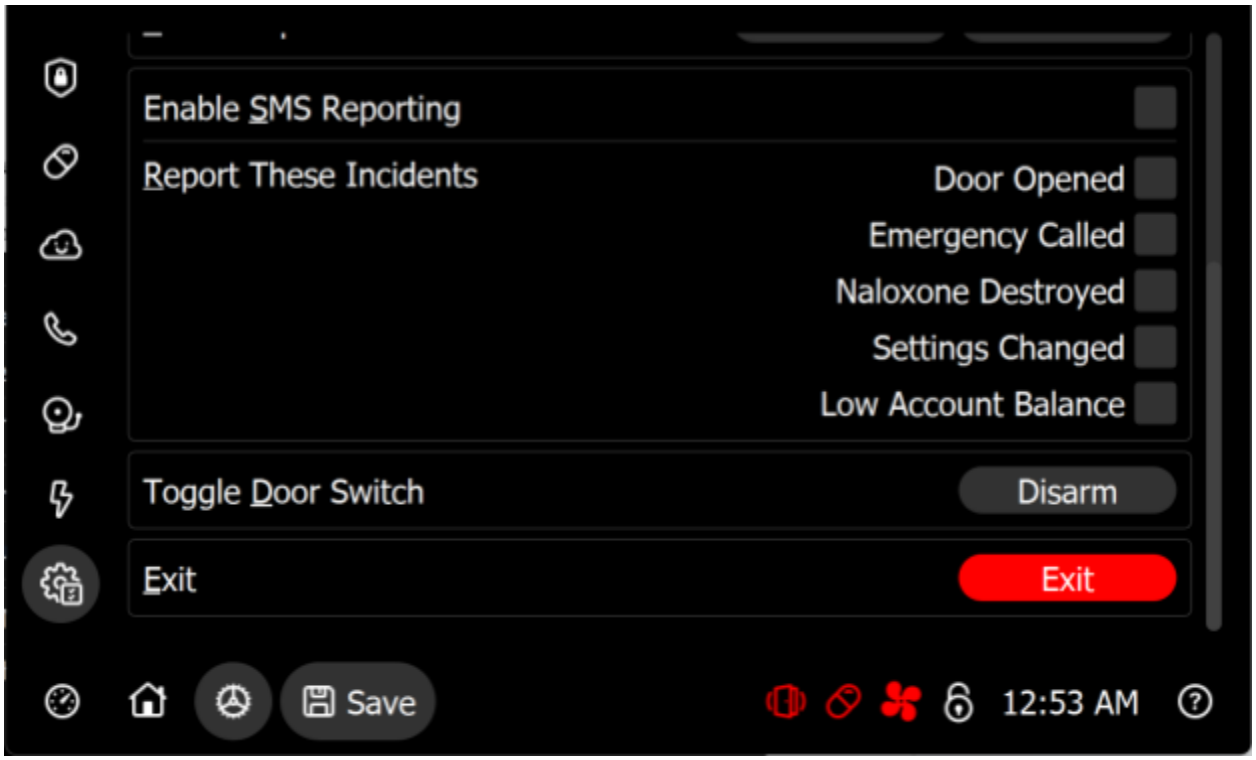

Figure UM18: Admin Settings 2.

Admin Passcode

This is the passcode used to unlock all setting sections on the device. If you leave this field empty, then anyone will be able to access the settings, which may be convenient in certain situations. However, if you want to ensure that only authorized personnel can make changes to the device, then you should create a strong admin passcode.

To create an admin passcode, simply enter your desired passcode into the “Admin Passcode” field and then click the “Save” button.

Naloxone Passcode

The Naloxone passcode is a separate passcode that is used to unlock the Naloxone settings of the device. This can be useful if you want to restrict access to all settings but still allow authorized personnel to make changes to the Naloxone settings. To set a Naloxone passcode, enter your desired passcode into the "Naloxone Passcode" field and then click the "Save" button.

Allow Paramedics to Get Naloxone Passcode

When this option is enabled, paramedics who arrive on the scene of an overdose can retrieve the Naloxone passcode by entering their phone number into the passcode page.

The phone numbers of the paramedics will be sent to the admin for additional support. If this option is disabled, paramedics can only notify the admin via SMS. Please note that the passcode retrieval feature requires a balance on your Twilio account.

Admin Phone Number

This is the phone number of the admin, which can be used to receive SMS updates on the status of the device. To set the admin phone number, simply enter the phone number into the "Admin Phone Number" field and then click the "Save" button. The system will automatically check the validity of the phone number. A green border will be shown around the text box if the entered phone number is valid. If it is invalid, the border will be red. Please note that the system does not prevent invalid phone numbers from being saved, but this will cause phone calls or SMS requests to fail.

Test Setup with Admin Phone Number

You can test the emergency call during the setup process by pressing the "Call" or "SMS" button. This will send a phone call or an SMS to the admin with the message that the emergency service will hear. This can be a valuable way to ensure that the emergency calling feature is working correctly before deploying the device.

Enable SMS Reporting

By enabling this option, the admin can receive status updates on the device via SMS. This can be useful for keeping track of the device's status when you are not physically present. Some SMS notifications, such as the passcode retrieval request by paramedics, cannot be disabled. You can find the details in Management.

Door Opened
By enabling this option, the device will automatically send an SMS to the admin phone number when the door is opened and the door sensor is armed. The SMS will be sent as soon as the door has been opened.

Emergency Called
By enabling this option, the device will automatically send an SMS to the admin phone number when the emergency phone number has been called. The result of the calling will be sent to the admin as well so that the admin can come to help if the emergency call fails.

Naloxone Destroyed
By enabling this option, the device will send a daily SMS to the admin phone number if the Naloxone has been destroyed so that the admin can come to replace the destroyed Naloxone.

Settings Changed
By enabling this option, the device will send an SMS to the admin phone number if the settings are changed.

Low Account Balance
By enabling this option, the device will send a daily SMS to the admin phone number if the Twilio account balance is less than $5. The admin should refill the account balance as soon as possible since the daily SMS will be sent daily if the account balance is lower than $5.

Toggle Door Switch

This feature allows the admin to disable the door sensor when modifying the device. After pressing the “Disarm” button, the device will ignore signals sent by the door sensor. A red door sensor icon will be displayed in the taskbar. The device can also be reset with the door sensor disabled on the door open page. Entering the settings page on the initial setup will automatically disarm the door switch. Remember to turn on the door sensor after completing any modifications by pressing the “Arm” button.

Exit

By pressing this button, the program will exit to the desktop. Any unsaved changes will be lost when you leave the program. If you have made any changes you want to keep, click the "Save" button before leaving.

Core Functionalities

The Naloxone safety kit provides several core functionalities to help prevent and respond to overdose incidents. The most important functionality is the emergency call feature, which allows the automatic calling of emergency medical services in the event of an overdose. The kit also allows users to store Naloxone nasal spray at an appropriate temperature, with the option to set a maximum temperature and expiration date.

The kit also provides a secure passcode system to restrict access to specific settings and features, allowing for greater control and safety. Other core functionalities include a customizable alarm message and volume, power management options such as active cooling and brightness control, and the ability to generate and play audio files during network outages. By providing these core functionalities, the Naloxone safety kit offers a comprehensive solution for preventing and responding to overdose incidents.

Emergency Call

Emergency calling is a critical function of the Naloxone safety kit, designed to quickly alert emergency services in the event of an overdose incident. When the door is opened, and the door sensor is armed, the door open page will show automatically and wait for 10 seconds before calling the emergency number. This is to give the user enough time to stop the countdown in case of a false alarm or accidental door opening.

Suppose the emergency number cannot be reached due to poor network coverage or technical difficulties. In that case, an alarm will be played via the built-in speakers to attract the attention of nearby individuals. The volume of the alarm can be adjusted on the Alarm page of the settings. The alarm message can also be customized to provide more information about the emergency incident.

It is important to note that the emergency calling function requires a valid Twilio phone number to be set in the Emergency Call settings page. By default, the phone number is set to 911, but it can be changed to any other phone number for testing purposes. It is also essential to keep the device connected to a reliable network to ensure that the emergency call can be made promptly.

If the user accidentally triggers the emergency calling function, there is no way to cancel the phone call. The user should contact the admin immediately by pressing the “Notify Admin” pushbutton on the door open page.

Naloxone Monitoring

The Naloxone monitoring function of the safety kit is a critical feature that helps ensure the effectiveness of the naloxone nasal spray stored in the kit. The DHT22 temperature sensor constantly monitors the temperature of Naloxone. The admin or building manager can set the expiration date on the Naloxone settings page. It is important to note that once the Naloxone has expired, it will no longer be effective in reversing an overdose.

If the Naloxone has been destroyed, a red persistent notification will be shown in the taskbar. Additionally, if the admin has opted to receive notifications, they will receive an SMS alert about the destroyed Naloxone. However, it is important to remember that there is no way to prevent people from using expired or damaged Naloxone. Therefore, it is crucial for the admin to regularly monitor the Naloxone safety kit and ensure that it is stored properly to maximize its effectiveness.

In summary, the Naloxone monitoring function of the safety kit is a crucial feature that helps ensure the effectiveness of the Naloxone nasal spray stored in the kit. By regularly monitoring the expiration date and temperature of Naloxone, users can help maximize its effectiveness in reversing an overdose. Additionally, by enabling SMS reporting and regularly checking the Naloxone safety kit, users can help ensure that any issues related to Naloxone are addressed promptly.

Security

The device's security is of utmost importance to ensure that only authorized individuals have access to the settings and functions of the safety kit. The Security page allows you to lock or unlock the settings on your device, providing an extra layer of protection against unauthorized access. Press the “Unlock Settings” button to unlock the settings and enter the admin passcode on the “Enter Passcode” page.

It is recommended to set a secure admin passcode to prevent unauthorized access to the safety kit. This passcode can be used to unlock all setting sections, and if left empty, the settings will be accessible to everyone. You can also set a different Naloxone passcode for the Naloxone settings to provide quick access to paramedics when replacing the Naloxone while keeping most settings secret.

Additionally, the safety kit comes equipped with a door sensor that will automatically trigger an emergency call in the event that the door is opened. When the door is opened, and the door sensor is armed, the Door Open page will show automatically and wait for 10 seconds before calling the emergency number. If it is impossible to call the emergency number, an alarm will be

played via the built-in speakers. This feature ensures that any attempt to tamper with the safety kit will trigger an immediate response.

Finally, it is worth noting that enabling the SMS Report feature on the Admin page will allow the admin to receive status updates of the device via SMS. This feature can be useful in detecting any attempts to tamper with the safety kit and notifying the admin if the Naloxone is destroyed or expired. The safety kit is designed with security in mind, ensuring that only authorized individuals have access to the settings and functions of the device.

Alarm

The administrator can set an alarm message that will be played through the built-in speakers with the Naloxone Safety Kit when the Twilio service is unavailable. This feature can be used to notify people in the area about the emergency. The administrator has the ability to modify the alarm message to include any necessary information. The feature converts text to speech using Google Text-to-Speech (TTS), which is compatible with numerous languages. The volume slider can be used to adjust the alarm message's volume so that it can be heard even in noisy environments.

Management

The Naloxone Safety Kit provides a variety of reporting options to make device management simpler for administrators. The daily report of the destroyed naloxone is one of these features. When naloxone is destroyed either by overheating or expiration, the device will send a daily SMS to the admin directly so that the admin can come to replace the destroyed naloxone. Moreover, the admin can choose to get a notification about the low account balance so that they can refill the Twilio account balance to ensure that the emergency call can be made successfully. Both of these events will only send one SMS per day to minimize the communication cost.

Some critical events, such as door open events and emergency calling events, will be reported immediately if the admin chooses to enable the SMS reporting feature. The admin will get a SMS in the event of an emergency so that the admin can come and help resetting the Naloxone safety kit. When a tampering incident occurs, such as when someone enters the wrong passcode, the administrator can also receive SMS notifications.

Please keep in mind that the SMS notifications feature is dependent on the Twilio service. To avoid service interruptions, the administrator ought to make certain that their Twilio account has sufficient funds. Also note that the SMS reporting feature can be disabled completely in the admin settings if the admin decides to do so.

Appendix A: Troubleshooting

This appendix shows some troubleshooting steps to some common software problems. Also, you should follow these steps as well to solve general problems:

- Try to restart the device to see whether the problem disappears,
- Check the connection between sensors and Raspberry Pi to rule out hardware connection issues,
- Check the Twilio account balance. The SMS and calling will not work with insufficient account balance.

System Menu Bar Shows in GUI

You can re-hide the menu bar by pressing anywhere in the GUI. If you want to prevent the menu bar from showing in GUI, you can right click on the menu bar and select Panel Settings. Then, go to the Advanced tab and tick Automatic Hiding and set size when minimized to 0 pixels. However, you will need to use the mouse to interact with the menu bar afterwards.

Persistent Notification “Naloxone Destroyed” Shows in Taskbar

You need to replace the naloxone immediately. This notification means that the naloxone is ineffective to reverse the overdose because it is either overheated or expired. After replacing the naloxone, you need to enter the new information of the naloxone in the settings.

CPU Fan Not Working

First, you need to check whether the active cooling is enabled in the settings. You also need to ensure that the CPU temperature is higher than the threshold temperature in the settings. To avoid conflict PWM signal, you need to disable the Fan in the Raspberry Pi Configuration.

GUI Does Not Respond Immediately to Switch Changes

This is normal. The IO thread in the software is designed to be run every second to avoid lock up while maintaining a high sample rate. The GUI should respond in less than 1 second after the switch state changes.

Cannot connect to the Internet

Ensure that the Wifi is connected correctly. The Raspberry Pi is unable to connect to the eduroam network by default, you need to use the wpa_supplicant following the manual from your organization.

Emergency Call Not Working

First, do not try to test the device with the emergency phone number set to 911. You need to first change the emergency phone number to your personal phone number. You do not need to add area code before 911 when setting the emergency phone number. Also, make sure that the provided phone number is correct and start with the area code. Also ensure that your Twilio account has sufficient balance.

Naloxone Temperature Not Displaying

First check the wiring to the temperature sensor. If the wiring is correct, wait for around 15 seconds since the software will try to read from the temperature sensor every 10 seconds. A new temperature data should be available when the software reads from the temperature sensor again.

Alarm Not Working

First, you need to press “Generate” after entering the alarm message in the settings so that gTTS will be used to generate the alarm file needed. Also, when pressing “Generate”, ensure that the network is working properly. You can also observe the taskbar since a notification will be displayed when the file is generated. You can also press the “Play” button in the settings to play the file once. The alarm will only be played when the Twilio emergency phone call failed.

Appendix B: References and Resources

- Software Source Code: zyl120/Naloxone_Safety_Kit: Repository for Meng ECE design project (github.com)
- PyQt5 - Show virtual keyboard: https://stackoverflow.com/questions/62473386/pyqt5-show-virtual-keyboard
- Install QtVirtualkeyboard in raspberry-pi?: https://stackoverflow.com/questions/63719347/install-qtvirtualkeyboard-in-raspberry-pi
- The Twilio Python Helper Library: https://www.twilio.com/docs/libraries/python
- Connect Raspberry Pi to eduroam: https://inrg.soe.ucsc.edu/howto-connect-raspberry-to-eduroam/
- Resources for icons: https://icons8.com

Appendix C: License Information

Software License

GNU Lesser General Public License
Version 3, 29 June 2007

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An “Application” is any work that makes use of an interface provided by the Library, but which is not otherwise based on the Library. Defining a subclass of a class defined by the Library is deemed a mode of using an interface provided by the Library.

A “Combined Work” is a work produced by combining or linking an Application with the Library. The particular version of the Library with which the Combined Work was made is also called the “Linked Version”.

The “Minimal Corresponding Source” for a Combined Work means the Corresponding Source for the Combined Work, excluding any source code for portions of the Combined Work that, considered in isolation, are based on the Application, and not on the Linked Version.

The “Corresponding Application Code” for a Combined Work means the object code and/or source code for the Application, including any data and utility programs needed for reproducing the Combined Work from the Application, but excluding the System Libraries of the Combined Work.

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b) under the GNU GPL, with none of the additional permissions of this License applicable to that copy.

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The object code form of an Application may incorporate material from a header file that is part of the Library. You may convey such object code under terms of your choice, provided that, if the incorporated material is not limited to numerical parameters, data structure layouts and accessors, or small macros, inline functions and templates (ten or fewer lines in length), you do both of the following:

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a) Give prominent notice with each copy of the Combined Work that the Library is used in it and that the Library and its use are covered by this License.

b) Accompany the Combined Work with a copy of the GNU GPL and this license document.

c) For a Combined Work that displays copyright notices during execution, include the copyright notice for the Library among these notices, as well as a reference directing the user to the copies of the GNU GPL and this license document.

d) Do one of the following:

0) Convey the Minimal Corresponding Source under the terms of this License, and the Corresponding Application Code in a form suitable for, and under terms that permit, the user to recombine or relink the Application with a modified version of the Linked Version to produce a modified Combined Work, in the manner specified by section 6 of the GNU GPL for conveying Corresponding Source.
1) Use a suitable shared library mechanism for linking with the Library. A suitable mechanism is one that (a) uses at run time a copy of the Library already present on the user's computer system, and (b) will operate properly with a modified version of the Library that is interface-compatible with the Linked Version.
e) Provide Installation Information, but only if you would otherwise be required to provide such information under section 6 of the GNU GPL, and only to the extent that such information is necessary to install and execute a modified version of the Combined Work produced by recombining or relinking the Application with a modified version of the Linked Version. (If you use option 4d0, the Installation Information must accompany the Minimal Corresponding Source and Corresponding Application Code. If you use option 4d1, you must provide the Installation Information in the manner specified by section 6 of the GNU GPL for conveying Corresponding Source.)

5. Combined Libraries
You may place library facilities that are a work based on the Library side by side in a single library together with other library facilities that are not Applications and are not covered by this License, and convey such a combined library under terms of your choice, if you do both of the following:

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Icon Sources

Icons on the GUI come from https://icons8.com.

Appendix D: Naloxone Replacement Manual For Paramedics

Print this manual and stick it on the door of the naloxone safety kit for reference.

Naloxone Replacement Procedure

1. Enter your phone number in the box provided, including your area code. If you have a US phone number, please format it as “+1XXXXXXXXXX”.
2. Press the “Get Passcode” button. You will receive the passcode on your phone via text message.
3. Enter the passcode in the top box on the screen and press the “Unlock” button to gain access to the Naloxone expiration date settings.
4. Update the expiration date for Naloxone by using the calendar widget or entering the date manually.
5. Also change the maximum storing temperature if needed. You should be able to find the maximum storing temperature at the box of the naloxone.
6. After entering the new expiration date, press the “Save” button to save the changes.
7. Once you have saved the changes, press the “Home” button to exit the settings page.

Notifying Admin Procedure

Press the “Notify Admin” button so that the admin can know that an overdose incident has occurred.

What information will be collected?

Your phone number will be sent to the admin so that they can help you replace naloxone and reset the device afterwards. Other personal information will not be collected.

Appendix E: safety_kit.conf Template

You can choose to edit the configuration file *safety_kit.conf* on a personal computer and then copy the file into the directory containing *main.py*. Below is a template for the configuration file. Remember to replace the fields with the correct information.

```
[twilio]
twilio_sid = AC123456
twilio_token = abcdefg
twilio_phone_number = +11234567890

[emergency_info]
emergency_phone_number = +11234567890
emergency_address = 123 Main Street
emergency_message = Sample Emergency Message

[naloxone_info]
naloxone_expiration_date = Sat Apr 1 2023
absolute_maximum_temperature = 104

[admin]
passcode = 123456
naloxone_passcode = 0000
admin_phone_number = +11234567890
enable_sms = False
report_door_opened = False
report_emergency_called = False
report_naloxone_destroyed = False
report_settings_changed = False
report_low_account_balance = False
allow_paramedics = True

[power_management]
enable_active_cooling = False
threshold_temperature = 176
brightness = 100

[alarm]
alarm_message = Sample Alarm Message
voice_volume = 20
```

Appendix F: Systemd Unit File

You can use the following file to start the software automatically at boot. Follow the instructions in the section Autostart.

```
[Unit]
Description=Safety Kit
After=multi-user.target

[Service]
User=username
Group=usergroup
Environment=DISPLAY=:0
Environment=XAUTHORITY=/home/username/.Xauthority
Environment=XDG_RUNTIME_DIR=/run/user/1000
Environment=QT_QPA_PLATFORMTHEME=qt5ct
WorkingDirectory=/home/username/Documents/Naloxone_Safety_Kit/main
Restart=on-failure
RestartSec=5s
ExecStart=/usr/bin/python3 main.py

[Install]
WantedBy=graphical.target
```