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# Purpose

This document is the user manual for the first alpha release of the IdeasX system for trial users. The document covers the capabilities of the system and each of its components. As this document is targeted to users it does not cover the technical details of the system and its components beyond how they may affect the user.

Weblink for a demo of the system: <https://youtu.be/xG4UFKREzh8>

Before I continue I want you to understand what “Alpha” means. According to Merriam-Webster, it is defined as follows:

## **Definition of Alpha:**

**1** : the 1<sup>st</sup> letter of the Greek alphabet

**2** : something that is first

**3** : Alpha Wave

**4** : Alpha Particle

**5** : the first version of a product that is being developed and tested – usually used before another noun • *alpha* versions • *alpha* testing; also : a stage of product development in which alpha prototypes are released • a product that is available in *alpha*

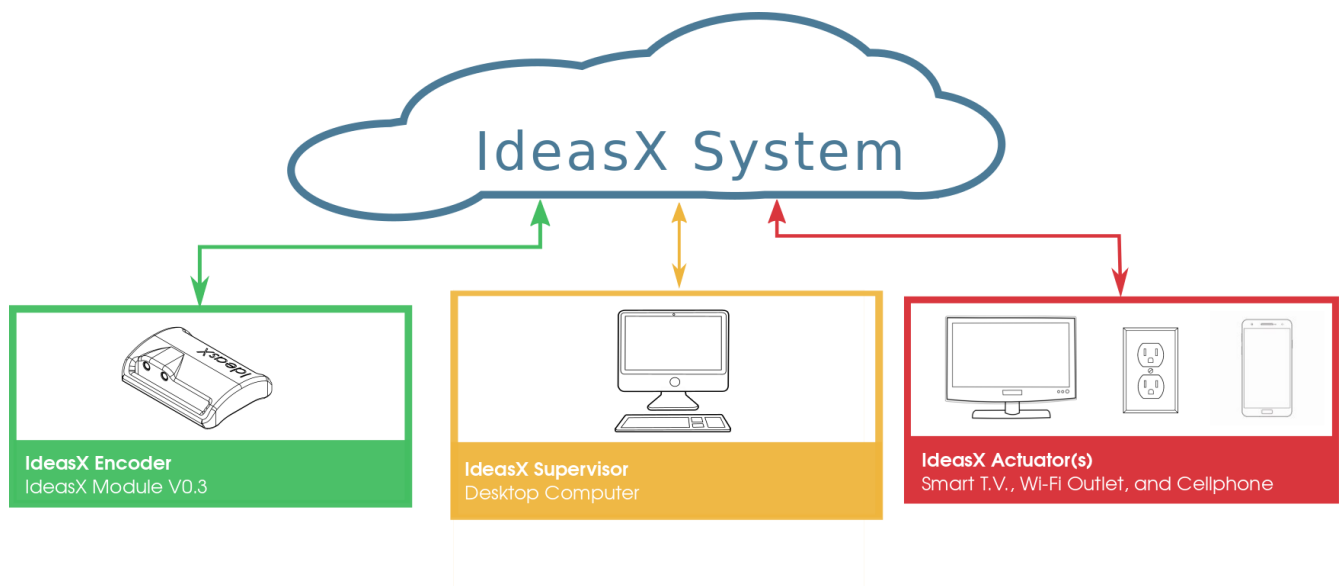
IdeasX is definitely defined by **2** and **5**; therefore, there will inevitably be bugs and issues. You’ve been warned! If you’re still willing to stick around to help me discover and fix them, I’m excited you’ve decided to join in!

# Introduction

IdeasX is an ecosystem which is designed specifically for users which are incapable of using consumer electronics due to severe motor disabilities such as Cerebral Palsy, ALS, Parkinson's Disease, etc. It is especially useful for classroom and institutional settings while still being applicable for domestic settings.

The ecosystem will provide an adaptive and modular set of alternative avenues for user inputs based on custom and consumer hardware, and a cloud based bridge for controlling consumer electronic devices.

The IdeasX system consists of four categories of components:



*Illustration 1: IdeasX ecosystem components and example of devices.*

**Encoders** – Encoders are wireless battery powered devices which provide the alternative avenues for control. They contain embedded sensor(s) which stream sensor data to the IdeasX cloud. Encoders can consist of consumer devices running a custom application, such as a cellphone streaming motion data, or custom devices designed to detect more specialized movements such as a user inhaling / exhaling.

**Actuators** – Actuators are wirelessly controllable devices a user would wish to control. Smart televisions, computers, and Wi-Fi controllable outlets / switches are all examples of potential Actuators in the IdeasX ecosystem. Currently, the only actuator will be computers for this Alpha.

**Cloud** – The IdeasX Cloud is an abstraction for a local or remote server which manages IdeasX devices and connects Actuators to Encoders.

**Supervisors** – Supervisors are Android / iOS device(s) or PC(s) loaded with “supervisor” software. The software enables caretakers or therapists to manage the IdeasX ecosystem by listing the devices in the system, the capabilities of the devices, and the health of the devices. The core function of the supervisor software is providing an interface to the caretaker or therapist to specify which Encoder(s) will control which Actuator(s), how the sensor data from the Encoder will be interpreted, and how the Actuator will be controlled based on the interpretation.

# IdeasX Alpha

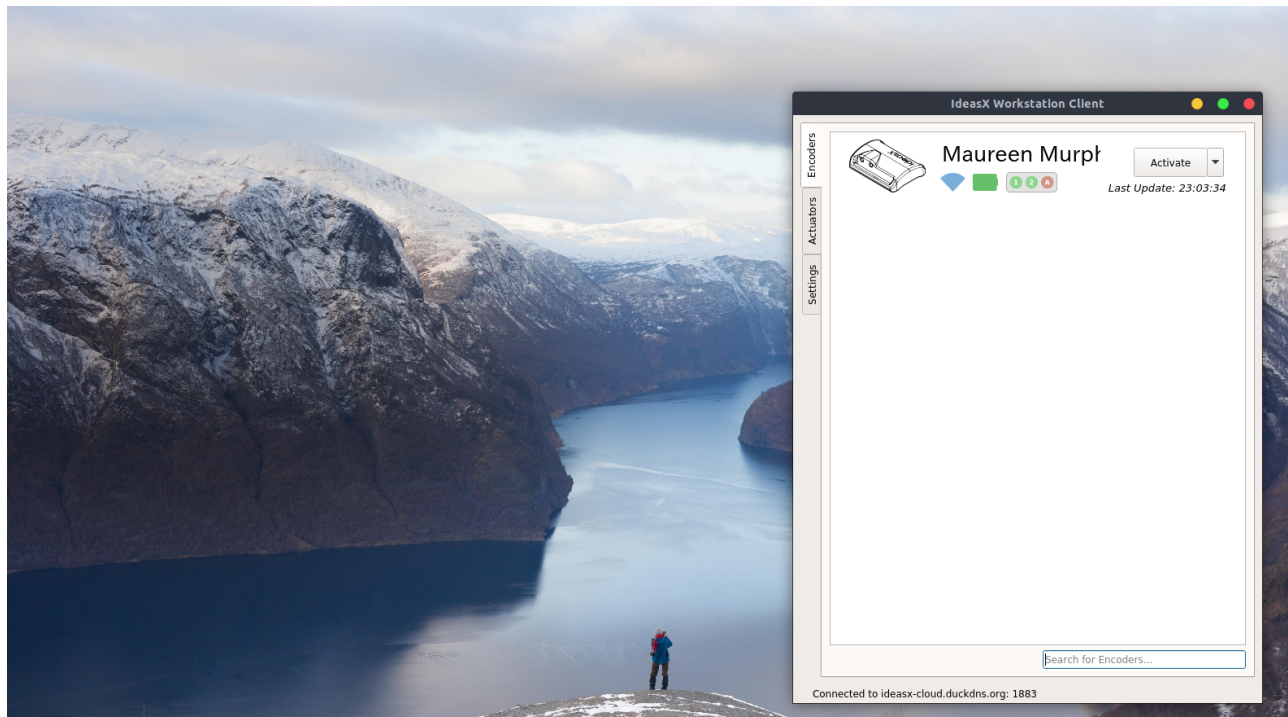
This section describes the components which will be supplied in the Alpha, provide an example use case, and discuss the capabilities.

The first IdeasX release is limited to wireless abstraction of adaptive switches.

## Overview of Components

The alpha release will consist of three components:

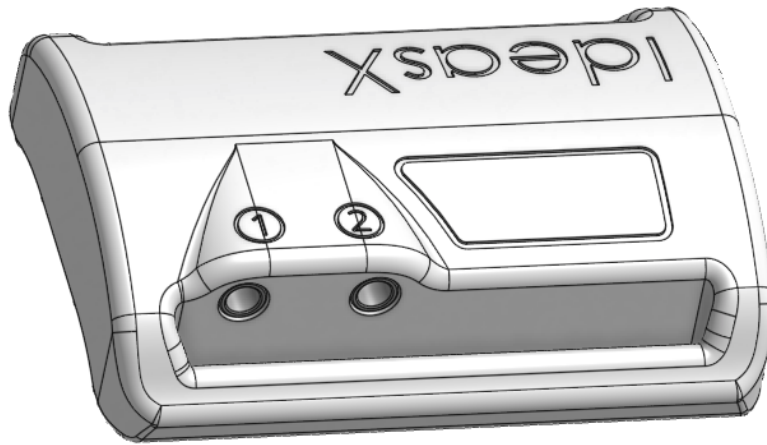
1. The IdeasX Cloud – This will be provided to the user or the user will have to setup an IdeasX Cloud locally due to networking constraints or performance requirements.
2. The IdeasX Workstation Client (WSC) v3.X – The cross platform application (Windows / OSX) provides a user interface for therapists and care takers to configure IdeasX devices (i.e. supervisor) and also permits the user to turn the computer into an actuator.



*Illustration 2: Screenshot of the IdeasX Workstation Client (WSC) with a single encoder.*

3. The IdeasX Encoder v0.3.2 – The IdeasX encoder is a wireless battery powered device which currently supports two adaptive switch inputs. This device connects to a wireless access point via Wi-Fi and enters the IdeasX system. The device can

support multiple access points. The device has a strap for mounting to user or user equipment, such as a wheelchair.



*Illustration 3: Render of IdeasX encoder v0.3.X*

## Example Use Case(s)

If you're anything like me, the best way to describe the purpose of a new product or service is a description of how it would affect the users. The following use cases explain how the current alpha implementation of IdeasX could affect users in their day-to-day operations.

### Classroom #1

**Background:** IdeasX Encoders are mounted to the user's person or wheelchair, and the adaptive switch jacks are connected to the user's existing assistive switches. Computers that are normally used daily activities with students all have the IdeasX Workstation Client installed.

**Scenario:** Students are arriving at school equipped with their IdeasX encoders. As the students enter the school, their Encoders automatically recognize and connect to the school's Wi-Fi. The Encoders LED indicator turns from flashing green to a steady blue to indicate it has entered the IdeasX system.

As the students arrive to class, the WSC application begins to populate with students. The WSC lists the students' full name and the Encoder's battery level.

### Classroom #2

**Background:** There are a number of students in a classroom equipped with Encoders and assistive switches. The teacher is going to setup each student to work individually on a computer. The computers are loaded with assistive software from AbleNet and the IdeasX WSC.

**Scenario:** On each of the computers, the therapist searches for the student he/she wishes to "connect" to the computer via the Encoder and clicks activate. When the student presses or activates one of his sensors / switches, the WSC software emulates a key-press on a keyboard or a mouse - whatever is required for the assistive software installed on the computer.

### Classroom #3

**Background:** There are a number of students in a classroom equipped with Encoders and assistive switches. The music teacher would like for all of the students to control a single note on an electronic keyboard.

**Scenario:** The teacher goes online to find a website which allows the user to use the computer as a music keyboard, and connects all the Encoders in the classroom to her computer. She then maps each of the switches on all of the Encoders to a different key press (i.e. "a", "b", "c", etc) so each student can control a different note on the musical keyboard.



# Home

**Background:** The student leaves school with their IdeasX Encoder and is heading home.

**Scenario:** As the student leaves the school, the Encoder's status LED changes from steady blue to flashing green to indicate it is looking a Wi-Fi access point. The student is automatically removed from the WSC application when the Encoder disconnects.

Upon arriving at home, the Encoder automatically connects to the student's home Wi-Fi and appears in the WSC application installed on the student's computer.

## Limitations / Capabilities

1. The Encoders use Wi-Fi to connect to the IdeasX system. Therefore, the device must have a reliable Wi-Fi connection to operate. The WSC application lists the signal strength each device has to the Wi-Fi network. Two factors may influence the latency between activating an assistive sensor / button and a key press being emulated by the WSC: a device being farther away from the access point and excessive Wi-Fi traffic.
2. The number of Encoders which can be connected to a single computer / or network is only limited by the Wi-Fi infrastructure of the institution. Based on standard networking rules, 25 units should easily be supported by a standard home 802.11n access point. Professional 802.11n access points can support a larger number (51 to 327 per access point depending on the quality of the units)
3. The latency of the system is also affected by the location of the IdeasX Cloud. If the user is using the remote Cloud and there is strong signal strength between the Encoder and the access point, but there is unacceptable latency, it would be recommend to switch to a local Cloud. This will be discussed in person.
4. Encoders can send key-presses to any computer that has the WSC application installed and are connected to the same IdeasX Cloud. For example, I could connect my Encoder, located in Philadelphia, to the WSC application installed in a computer located in California, and send key-presses as long as we are connected to the same IdeasX Cloud.

Protocol	Type of web use	Amount of bandwidth allocated per device	# of Clients per AP
802.11b	A little over Web-Casual	600 kbps	13
802.11g	A little over Web-Casual	600 kbps	43
802.11n (1 Spatial Stream)	A little over Web-Casual	600 kbps	43
802.11n (2 Spatial Streams)	A little over Web-Casual	600 kbps	273
802.11b	Web-Casual	500 kbps	15
802.11g	Web-Casual	500 kbps	51
802.11n (1 Spatial Stream)	Web-Casual	500 kbps	51
802.11n (2 Spatial Streams)	Web-Casual	500 kbps	327

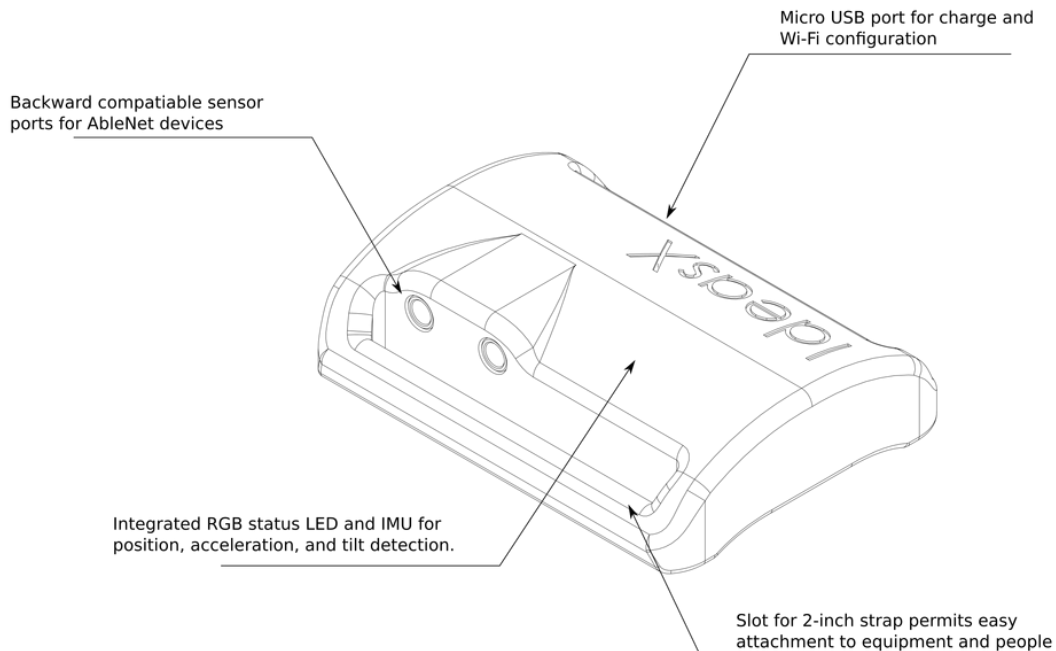
*Illustration 4: Cisco provided table which describes the number of clients per 802.11 protocol based on two different data rates.*

## Component Details

This section provides further detail into the current and future capabilities / specifications of each device.

### Encoder v0.3.2

The IdeasX Encoder is the first input device designed for IdeasX. It is battery powered, equipped with multiple sensors, and in future revisions will ideally become as close as possible to a singular solution for the assistive market.



### Features

- 24+ Hours of Battery Life (connected)
- 2 Assistive Switch Inputs
- Internal Motion Unit (Gesture recognition / Motion Sensing)
- Multi-Color Status LED
- Micro-USB Port
- Pressure Sensor (Sip+Puff)
- 2-Inch Wide Strap Slot

## Battery Life

The battery life of the Encoder is currently 24+ hours connected to a Wi-Fi access point. The battery life exceeds 24 hours when the device is not connected, but has not been measured as power consumption as yet to be optimized when the device is disconnected. The unit re-charges is less than 2 hours.

## Micro USB Port

The micro USB port is used for charging the device, configuring the Wi-Fi credentials (SSID and Password), and manually sending the device commands if Wi-Fi is unavailable. For example, if Wi-Fi is unavailable but the device needs to be shutdown, the user can attach the unit via the USB port to a computer and use the WSC to manually shut the device down. Lastly if necessary, the port also allows the devices to be upgraded in the field.

## Assistive Inputs

The Encoder supports 3.5mm mono switch inputs. The industry standard. The input jacks are labeled (1) and (2). Switch (1) cannot be used if adaptive switching (motion / gesture recognition) is used.

## Status LED

The status LED varies in color and pattern to indicate the status of the device. The different states and how they reflect the operation of the Encoder are illustrated in the table below.

Color / Pattern	Status Description
Pulsing	The device is not connected to Wi-Fi and not looking for a Wi-Fi access point.
Solid	
Pulsing	The device is looking / attempting to connect to a Wi-Fi access point.
Sold	
Pulsing	The device establish a Wi-Fi connection, but has yet for form a connection with the IdeasX Cloud.
Solid	
Solid	The device is actively streaming motion data for adaptive switching.
Solid	The device is actively streaming barometric data for adaptive switching.

## Workstation Client v3

The Workstation Client (WSC) is a cross platform application used to manage the IdeasX Encoders.

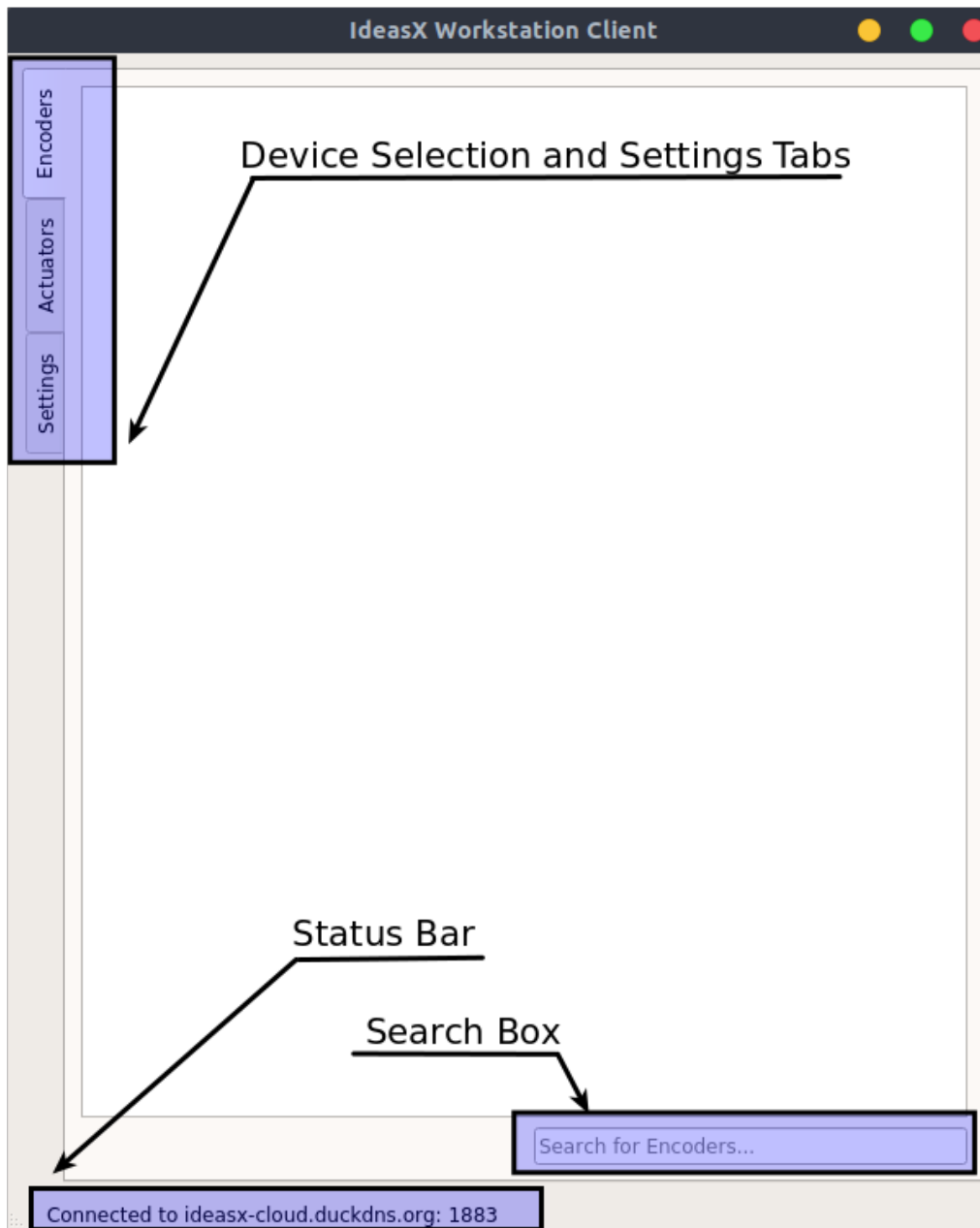
### ***Features***

- Lists all IdeasX devices (Encoders + Actuators) currently in the IdeasX system and health information
- Can remotely send command to IdeasX devices (i.e. Shutdown, Reset, etc.)
- Used to configure IdeasX devices with Wi-Fi access point information (SSID and Password)
- Capable of emulating any keyboard key-press

### ***User Interface***

#### **Main Window UI**

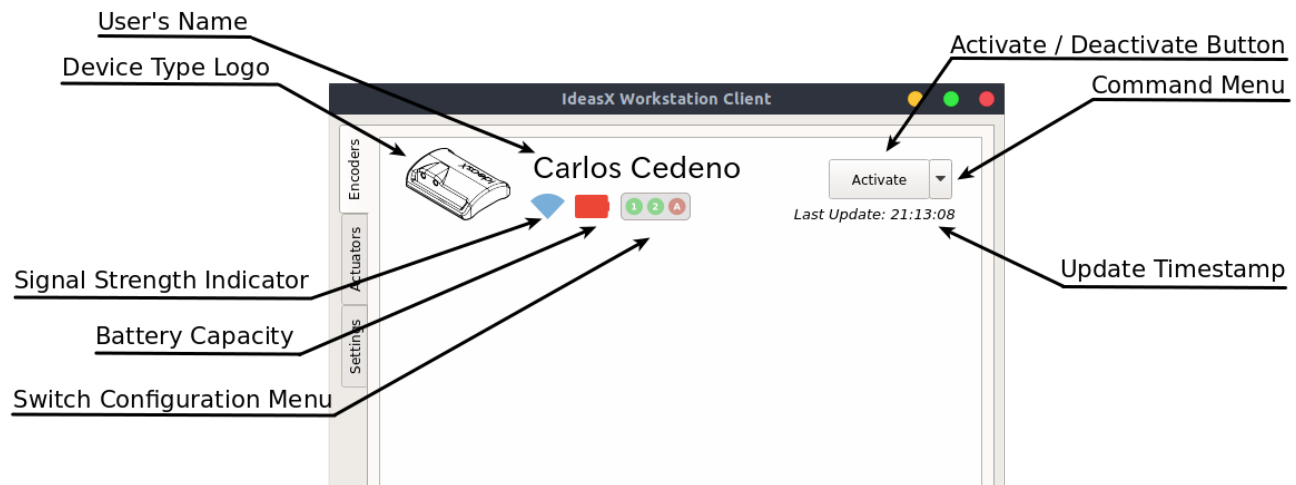
The WSC consists of three tabs: “Encoders”, “Actuators”, and “Settings”. The Encoders and Actuators tabs list all devices in the system categorically. The Settings tab provides an interface to configure the WSC and store Wi-Fi credentials in the IdeasX device. There is also a global status bar which indicates if the WSC is connected to the IdeasX Cloud. The device tabs are equipped with a search bar to isolate specific devices by user name or MAC address.



*Illustration 5: Screenshot of the WSC highlighting the main UI (user interface) components of the application.*

## Encoder Tab

The figure below illustrates what the WSC would display when a single Encoder is connected to the IdeasX Cloud. If the Encoder is disconnected from the Cloud, the Encoder would automatically disappear from the Encoder tab. The view is annotated and described below.

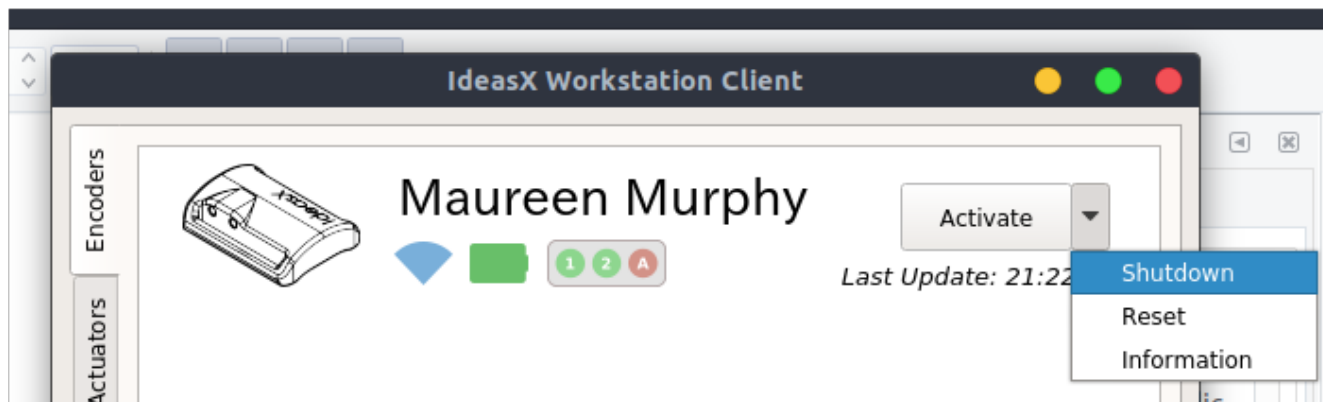


*Illustration 6: Annotated screenshot of the WSC-v3 of the Encoder Tab with a single device in the system.*

- **User's Name:** User settable field used to help the caretaker or therapist determine to whom the Encoder belongs
- **Device Type Logo:** Picture which indicates which type of Encoder the device is
- **Signal Strength Indicator:** Visual representation of the strength of the connection between the access point and the device (the icon has a tool tip which indicates the exact RSSI in dBm)
- **Battery Capacity:** Visual representation of the remaining battery life of the device (the icon has a tool tip which indicates the exact remaining capacity as a percentage)
- **Switch Configuration Menu:** Menu used to configure what key press will be emulated when the assistive switches connected to the Encoder are activated (additional information in following sections)
- **Activate / Deactivate Button:** Enables / disables the WSC from emulating a key press when the Encoder's sensors or connected assistive switches are activated
- **Command Menu:** Lists commands which can send to the Encoder and contains an information dialog to list additional detail regarding the device
- **Update Timestamp:** List the last time the IdeasX Cloud received a health update from the device

## Encoder Tab: Command Menu

An example of the command menu is listed below. The commands listed in the menu are all remote commands and will be sent using the IdeasX system; therefore, if the device is not connected, the command cannot be received.

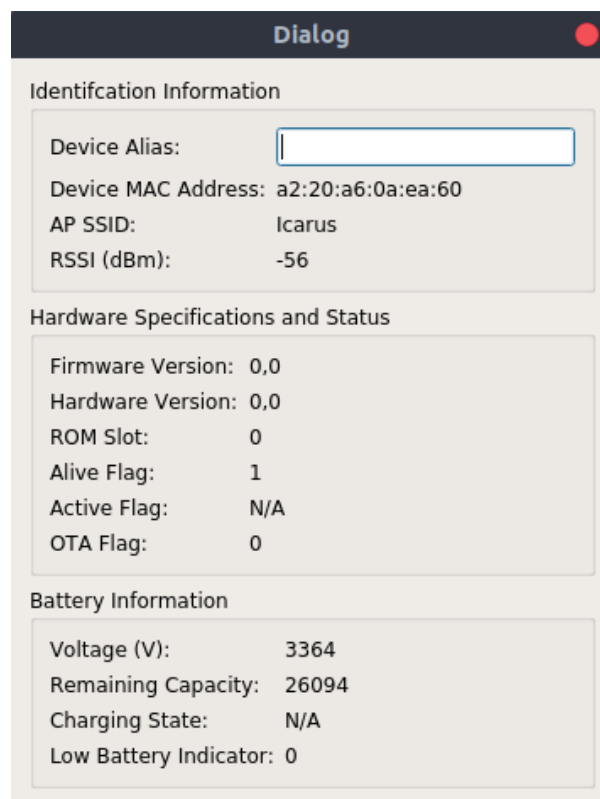


*Illustration 7: Screenshot of the command menu for an Encoder.*

The current commands supports are:

- Shutdown
- Reset

There is third tab in the command menu called "Information" which opens a separate dialog listing additional information about the specific device. The device alias field in the information view is used to set the Encoder's user name.

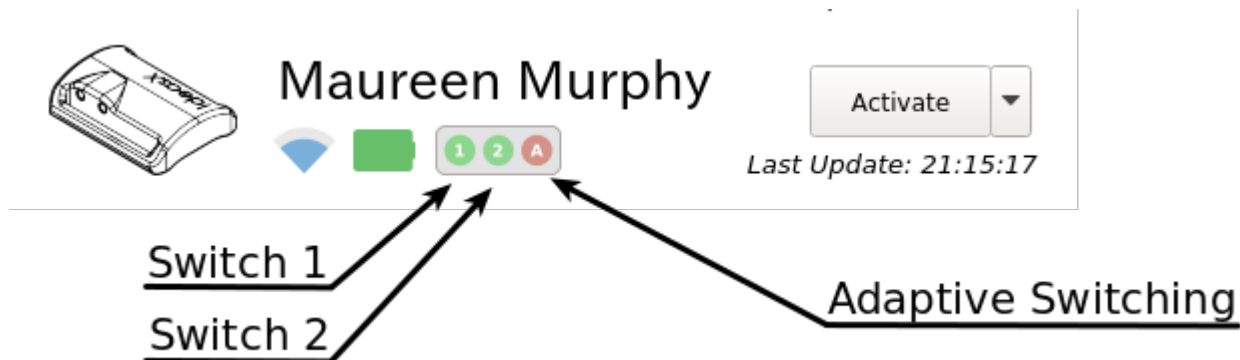


*Illustration 8: Screenshot of the "Information" dialog listed in the command menu.*



## Encoder Tab: Switch Configuration Menu

The switch configuration dialog is used to configure what key-press will be emulated which one of the assistive switches is activated. In the future, it will also be used to configuration the built-in motion sensor and sip+puff functionality.



*Illustration 9: Screenshot highlighting the Switch Configuration Menu*

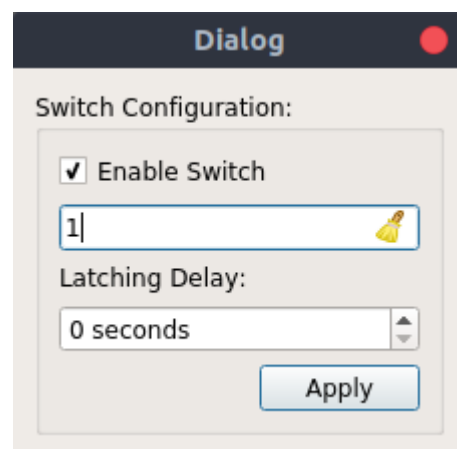
Clicking the Switch 1 or Switch 2 icons will open a dialog to configure what key-press will be emulated when the switch is activated. This correlates to the (1) and (2) logo on the case of the Encoder.

The features of the dialog are listed below:

**Enable Switch** – Enable / Disable the switch selected. This permits the user to use only one assistive switch by disabling the switches individually.

**Key-press:** The character the WSC should emulate when the switch is activated.

**Latching Delay:** The time the WSC will hold the key-press down. If this is set to zero, the WSC will hold the key-press down until the user releases the key.



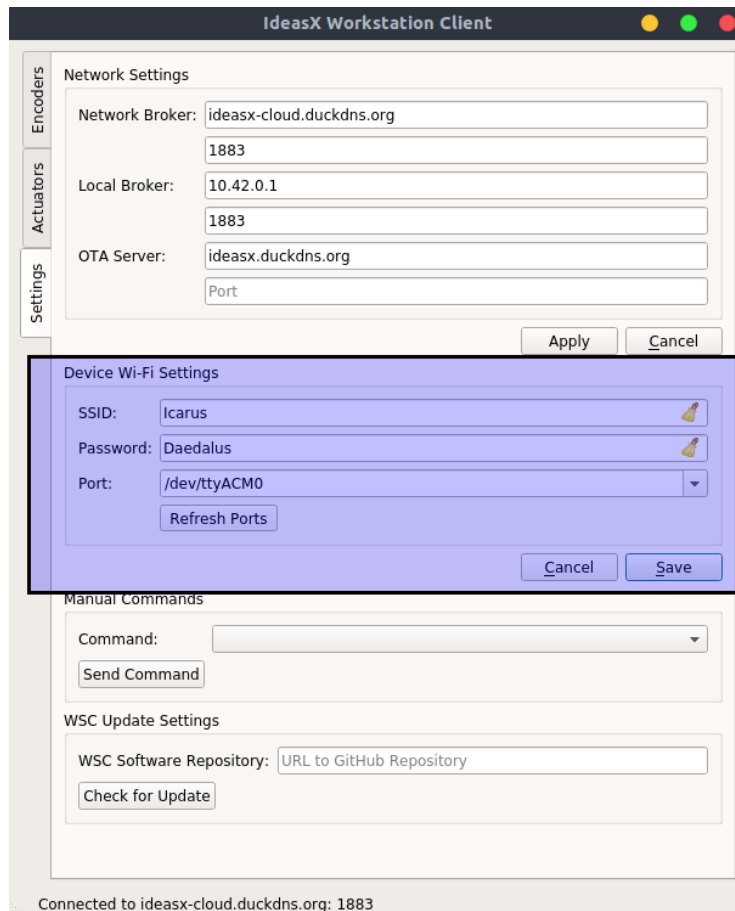
*Illustration 10: Screenshot of the Switch Configuration Dialog opened with the icon for switch 1 or 2 is selected in the Switch Configuration Menu.*

## Training an IdeasX Device

Training an IdeasX device is performed from the “Settings” tab. The procedure is as follows:

1. Connect to the computer running the WSC application via a USB cable. A new COM port will be created when the device is connected. Remember the COM port number.
2. Enter you access point’s SSID and password under the “Device Wi-Fi Settings” group highlighted in the following image.
3. Select the COM port the device is connected to.
4. Press the save button.

The status bar will change to “Training Device...” and transition to “Device Successfully Trained” when finished. The Encoder will now reset and connect to your access point.



*Illustration 11: Screenshot of the Device Wi-Fi Settings group used to program the Wi-Fi access points SSID and password in an IdeasX device.*

## Cloud

The cloud is simply a server which broadcasts the messages of all IdeasX devices to each other. The cloud operates automatically, and therefore does not require a user.