

**DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
THE UNIVERSITY OF TEXAS AT ARLINGTON**

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**STREAM HOPPERS
THE STREAM HOPPER**

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1 PRODUCT CONCEPT

This section describes the purpose, use and intended user audience for the Stream Hopper. The Stream Hopper will provide "in-real-life" notifications for streamers based on stream events. The intended user audience of the Stream Hopper is any streamer who wants to grow their stream by conveniently increasing the entertainment value of their stream.

1.1 PURPOSE AND USE

The Stream Hopper will be an IOT Hub that connects to the user's Twitch and reads live data from their stream through the Twitch and Streamlabs API. The user will be able to select the events to trigger their devices and they will be able to add their own custom devices.

1.2 INTENDED AUDIENCE

The Stream Hopper is intended to be used by streamers who want to grow their channel and add entertainment value to their stream. If this product were sold commercially, it would be popular among Twitch Streamers who want an active viewing experience for their viewers. In addition the Stream Hopper is intended to be used by individuals who are technologically competent as it will be much more customizable and useful for these individuals.

2 PRODUCT DESCRIPTION

This section provides the reader with an overview of the Stream Hopper. The features and functions, external inputs and outputs and product interfaces are defined here. This section will provide the necessary context and overview to understand the requirements and guidelines that are outlined later.

2.1 FEATURES & FUNCTIONS

As seen in Figure 1, the Stream Hopper will be an IOT Device that connects to various smart devices via WiFi, USB and Raspberry Pi GPIO pins. The central processing unit will process data from Twitch and Streamlabs and will issue trigger commands on Twitch Stream Events to the various devices connected to the IOT Hub. There will be Smart bulbs, Smart LED Strips, Smart Plugs, and a LED Message Board that come with the Stream Hopper, however the user can add any compatible device to the Hub via GPIO, WiFi or USB.

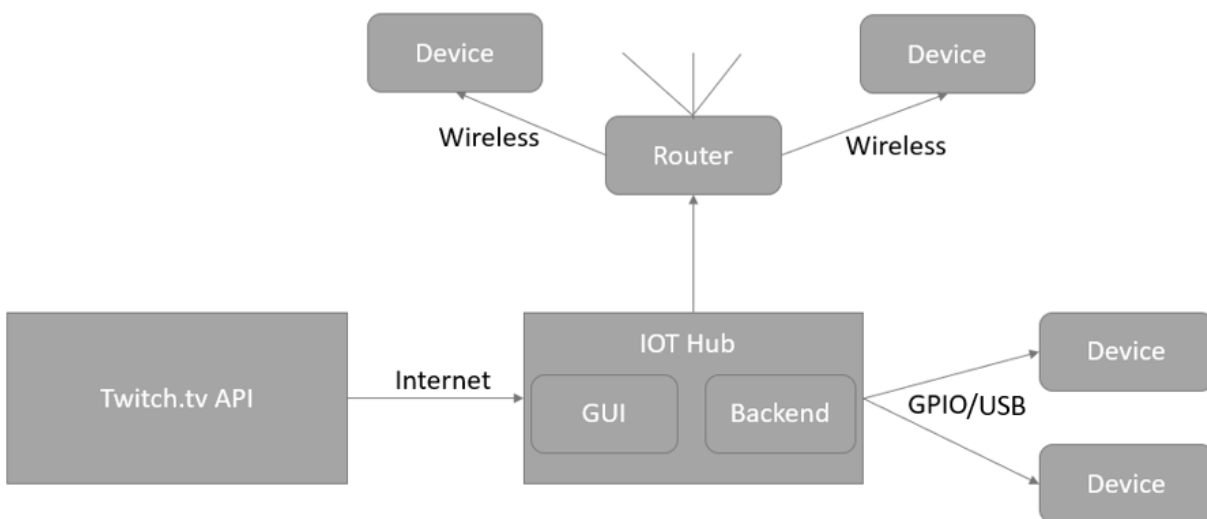


Figure 1: System Overview Conceptual Drawing

2.2 EXTERNAL INPUTS & OUTPUTS

The following are internal and external data flows for the Stream Hopper:

Name	Description	Use
Twitch.tv API	Subscriptions, chat messages, and stream details	Obtain relevant stream information
Streamlabs API	Follows, channel points, and donations	Obtain relevant stream information
Stream Information	Stream keys and login information	Data to connect the hub to the user's stream
GUI Input	User input to the Stream Hoppers GUI	Add and remove devices, set up triggers, and set stream presets
WiFi	802.11 WiFi from connected router	Trigger devices over WiFi
USB	Raspberry Pi USB output	Trigger devices over USB
GPIO	Raspberry Pi GPIO output	Trigger devices over GPIO
DSI	Raspberry Pi DSI output	Connection from Raspberry Pi to touchscreen
Ethernet	Raspberry Pi Ethernet Input and Output	Connect via Ethernet to Internet and Router

Table 2: Internal and External Data Flow

2.3 PRODUCT INTERFACES

The IOT devices will be connected to the Stream Hopper via USB, WiFi and the GPIO pins on the Raspberry Pi. As seen in Figure 3, devices can connect via any of the GPIO pins and will be activated by the Pi on Twitch Stream Events. Additionally, devices can connect via USB as seen in Figure 4 and Figure 5 and will be triggered by Twitch through the Pi as well. The user will be able to interact and customize the Stream Hopper via a GUI available by a web server or touchscreen as seen in Figure 5. The user can add and delete IOT devices via the GUI and they can customize the Twitch events by which the IOT devices will be triggered. The user will also be able to set presets for the Stream Hopper as seen in the mock-up of the Raspberry Pi GUI in Figure 2.

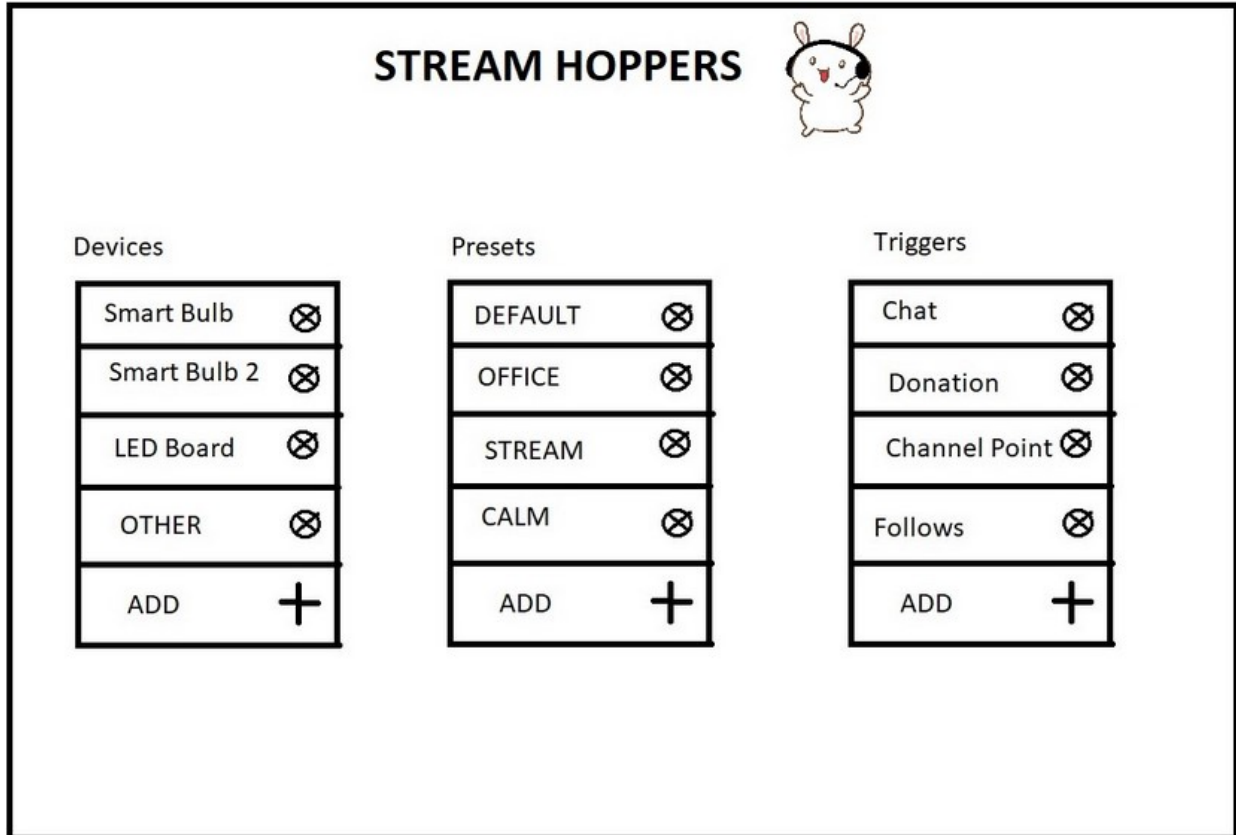


Figure 2: Mock-up of Stream Hopper GUI

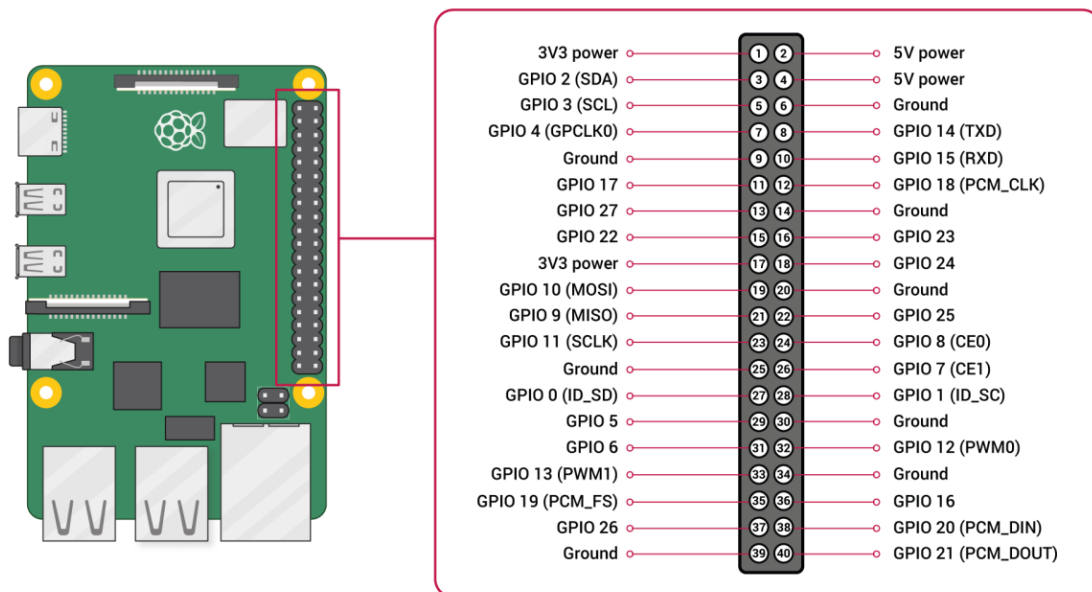


Figure 3: Raspberry Pi 4b+ GPIO Pinout

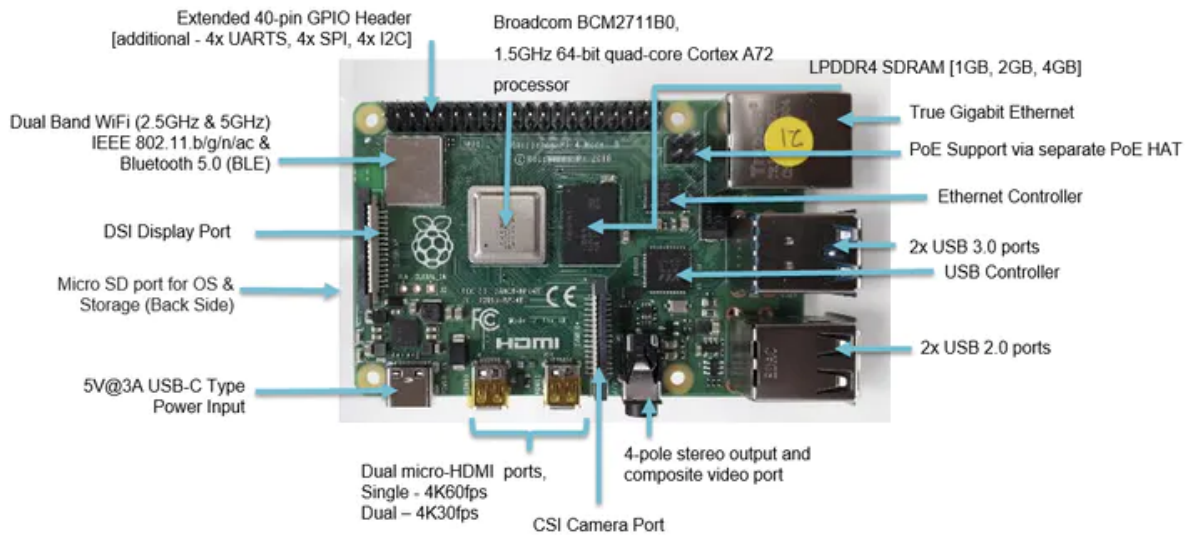


Figure 4: Raspberry Pi 4b+ Interfaces



Raspberry Pi 4 Case

All USB Ports
are accessible
including HDMI



Figure 5: Raspberry Pi 4b+ Touchscreen Case

3 CUSTOMER REQUIREMENTS

The goal of the Stream Hopper is to conveniently add entertainment value to the user's Twitch Stream. It is designed to be customizable and easy to use. There are certain requirements, that have been stated by the customer, that must be added in order to satisfy the customer. This section will outline and discuss these specific requirements.

3.1 TWITCH STREAMING COMPATIBILITY

3.1.1 DESCRIPTION

The Stream Hopper will be able to interact with the Twitch Streaming Platform and successfully enable triggers chosen by the content creator.

3.1.2 SOURCE

Customer

3.1.3 CONSTRAINTS

The Stream Hopper must be compatible with Twitch.tv stream events and triggers through the Twitch API.

3.1.4 STANDARDS

API Reference - Twitch.tv Streaming API

3.1.5 PRIORITY

Critical

3.2 EVENT TRIGGERS: DONATIONS

3.2.1 DESCRIPTION

Have events configurable to be triggered when a donation is made to the stream.

3.2.2 SOURCE

Customer

3.2.3 CONSTRAINTS

Requires use of the Streamlabs API that makes donation interactions possible.

3.2.4 STANDARDS

API Reference - Streamlabs API

3.2.5 PRIORITY

High

3.3 EVENT TRIGGERS: CHANNEL POINTS

3.3.1 DESCRIPTION

Have events configurable to be triggered when channel point rewards are redeemed by viewers.

3.3.2 SOURCE

Customer

3.3.3 CONSTRAINTS

The Stream Hopper must be compatible with Twitch.tv channel point redemption triggers.

3.3.4 STANDARDS

API Reference - Twitch.tv Streaming API

3.3.5 PRIORITY

Critical

3.4 EVENT TRIGGERS: SUBS

3.4.1 DESCRIPTION

IOT Hub will trigger events based on Twitch Subscriptions.

3.4.2 SOURCE

Customer

3.4.3 CONSTRAINTS

The Stream Hopper will be constrained by the Twitch API as the IOT device will be limited in the amount of requests it can make to the API. Also limited internet bandwidth will limit the responsiveness of the Stream Hopper.

3.4.4 STANDARDS

HTTP

3.4.5 PRIORITY

Critical

3.5 EVENT TRIGGERS: FOLLOWS

3.5.1 DESCRIPTION

IOT Hub will trigger events based on Twitch Follows.

3.5.2 SOURCE

Customer

3.5.3 CONSTRAINTS

The Stream Hopper will be constrained by the Twitch API as the IOT device will be limited in the amount of requests it can make to the API. Also limited internet bandwidth will limit the responsiveness of the Stream Hopper.

3.5.4 STANDARDS

HTTP

3.5.5 PRIORITY

Medium

3.6 EVENT TRIGGERS: BITS

3.6.1 DESCRIPTION

IOT Hub will trigger events based on requests made by viewers via Bits.

3.6.2 SOURCE

Customer

3.6.3 CONSTRAINTS

The Stream Hopper will be constrained by the Twitch API as the IOT device will be limited in the amount of requests it can make to the API. Also limited internet bandwidth will limit the responsiveness of the Stream Hopper.

3.6.4 STANDARDS

HTTP

3.6.5 PRIORITY

Critical

3.7 CENTRAL HUB

3.7.1 DESCRIPTION

The Stream Hopper will have a central hub to manage all physically connected devices and their triggers.

3.7.2 SOURCE

Customer

3.7.3 CONSTRAINTS

Limited internet bandwidth and poor connection could reduce the responsiveness of the Stream Hopper. Also the Stream Hopper can only support a limited amount of USB and GPIO connections.

3.7.4 STANDARDS

National Electrical Code (NEC), or NFPA 70

3.7.5 PRIORITY

Critical

3.8 PRIVATE NETWORK

3.8.1 DESCRIPTION

The Stream Hopper will have a private local network to manage all IOT devices and their triggers.

3.8.2 SOURCE

Customer

3.8.3 CONSTRAINTS

The Stream Hopper will only support a local network and local web-based user interface if the router allows it.

3.8.4 STANDARDS

IEEE 802.11ac

3.8.5 PRIORITY

Critical

3.9 PHYSICAL USER INTERFACE

3.9.1 DESCRIPTION

The Stream Hopper will have a physical UI on the Central Hub to manage linked devices.

3.9.2 SOURCE

Customer

3.9.3 CONSTRAINTS

The Physical GUI is limited to the pre-built options that are available at the time of assembly.

3.9.4 STANDARDS

Node.js Coding Standards

3.9.5 PRIORITY

Critical

3.10 WEB USER INTERFACE

3.10.1 DESCRIPTION

The Stream Hopper will have a web based UI on the Private Network to manage linked IOT devices.

3.10.2 SOURCE

Customer

3.10.3 CONSTRAINTS

The Web User Interface will be limited by the supported figures and graphics of Node.js.

3.10.4 STANDARDS

IEEE 802.11ac, Node.js Coding Standards

3.10.5 PRIORITY

Critical

3.11 SUPPORT OUTPUT DEVICES VIA WIFI

3.11.1 DESCRIPTION

The Stream Hopper will be able to trigger connected devices through WIFI.

3.11.2 SOURCE

Customer

3.11.3 CONSTRAINTS

Only devices that have WIFI capability can be triggered by the Stream Hopper through WIFI.

3.11.4 STANDARDS

IEEE 802.11ac

3.11.5 PRIORITY

Critical

3.12 SUPPORT OUTPUT DEVICES VIA USB

3.12.1 DESCRIPTION

The Stream Hopper will be able to trigger connected devices through USB.

3.12.2 SOURCE

Customer

3.12.3 CONSTRAINTS

Only devices that have USB capability can be triggered by the Stream Hopper through USB.

3.12.4 STANDARDS

USB 2.0, USB 3.0, RS-232

3.12.5 PRIORITY

Critical

3.13 SUPPORT OUTPUT DEVICES VIA GPIO

3.13.1 DESCRIPTION

The Stream Hopper will be able to trigger connected devices through GPIO.

3.13.2 SOURCE

Customer

3.13.3 CONSTRAINTS

Only devices that have GPIO capability can be triggered by the Stream Hopper through GPIO.

3.13.4 STANDARDS

RS-232

3.13.5 PRIORITY

Critical

3.14 CONFIGURATION PRESETS

3.14.1 DESCRIPTION

The Stream Hopper will have configuration preset options for the devices and triggers.

3.14.2 SOURCE

Customer

3.14.3 CONSTRAINTS

The configuration options for devices and triggers will be constrained on the number of devices supported by the Stream Hopper.

3.14.4 STANDARDS

N/A

3.14.5 PRIORITY

Critical

3.15 OFFICE MODE

3.15.1 DESCRIPTION

The Stream Hopper will have a Office Mode configuration option for the devices and triggers, turning off the devices while in the mode.

3.15.2 SOURCE

Customer

3.15.3 CONSTRAINTS

The configuration options for devices and triggers will be constrained on the number of devices supported by the Stream Hopper.

3.15.4 STANDARDS

N/A

3.15.5 PRIORITY

Critical

3.16 STREAM START

3.16.1 DESCRIPTION

The Stream Hopper will have a Stream Start configuration option for the devices and triggers.

3.16.2 SOURCE

Customer

3.16.3 CONSTRAINTS

The configuration options for devices and triggers will be constrained on the number of devices supported by the Stream Hopper.

3.16.4 STANDARDS

N/A

3.16.5 PRIORITY

Critical

3.17 SAVE BUTTON

3.17.1 DESCRIPTION

The Stream Hopper GUI will have a save button that will allow the user to save the current device and trigger settings.

3.17.2 SOURCE

Customer

3.17.3 CONSTRAINTS

The number of available save states will be constricted by the amount of memory on the Raspberry Pi.

3.17.4 STANDARDS

SD Standard

3.17.5 PRIORITY

Critical

4 PACKAGING REQUIREMENTS

The Stream Hopper will include the central hub with the software already installed, a router for connecting the wireless devices, and a configuration manual to help the customer assemble the product upon receiving it.

4.1 STREAM HOPPER INCLUDED DEVICES

4.1.1 DESCRIPTION

The Stream Hopper will include a Raspberry Pi and the hardware needed to operate it as well as a router.

4.1.2 SOURCE

Customer

4.1.3 CONSTRAINTS

The Stream Hoppers included devices is constrained by the cost to include more devices than the aforementioned Raspberry Pi and router. Including more than these devices would result in the Stream Hopper being too expensive.

4.1.4 STANDARDS

ASTM Paper and Packaging Standards

4.1.5 PRIORITY

Critical

4.2 STREAM HOPPER INCLUDED SOFTWARE PRE-INSTALLED

4.2.1 DESCRIPTION

The Stream Hopper will include the software needed to connect devices to the hub as well as control the trigger actions. This includes software to control the connected devices, a Graphical User Interface to set and control the desired settings, and software to help configure the network the Stream Hopper will operate on.

4.2.2 SOURCE

Customer

4.2.3 CONSTRAINTS

The Stream Hoppers Included Software will be constrained on availability of the software and packages used to be included in the product under the FOSS software's license.

4.2.4 STANDARDS

SO/IEC 12207:2008

4.2.5 PRIORITY

Critical

4.3 SUPPORTED DEVICES

4.3.1 DESCRIPTION

The Stream Hopper will included a list of currently supported devices for the customer to reference.

4.3.2 SOURCE

Customer

4.3.3 CONSTRAINTS

The supported devices of the Stream Hopper will be constrained on how expensive the device is to purchase, the maintainability of maintaining the support of the device, as well as the safety of the devices being supported.

4.3.4 STANDARDS

SO/IEC 12207:2008

4.3.5 PRIORITY

Low

4.4 CONFIGURATION MANUAL

4.4.1 DESCRIPTION

The Stream Hopper will included a setup manual to assist the customer in configuring the Stream Hopper for use as well as how to use the Graphical User Interface to interact with the triggers and connected devices.

4.4.2 SOURCE

Customer

4.4.3 CONSTRAINTS

The configuration manual of the Stream Hopper will be constrained on the technical depth the project reaches, as well as how technically literate the customer is.

4.4.4 STANDARDS

SO/IEC 12207:2008

4.4.5 PRIORITY

High

4.5 SOFTWARE WILL BE AVAILABLE VIA DOWNLOAD

4.5.1 DESCRIPTION

The Stream Hopper's software will be available via download.

4.5.2 SOURCE

Seth Jaksik

4.5.3 CONSTRAINTS

The Stream Hopper being available via download will be constrained by the operating systems that the software can run on, as well as the download size of the Stream Hopper software.

4.5.4 STANDARDS

SO/IEC 12207:2008, MIT License

4.5.5 PRIORITY

High

5 PERFORMANCE REQUIREMENTS

The Stream Hopper will be a real time device so performance is paramount to the success of this project. Connectivity and data transmission are two very important factors that will contribute to an overall positive user experience. If there are delays in the responses from the IOT Hub, the user will experience slow trigger times and long connection times. Some of these delays are inevitable however we will do everything we can to mitigate these delays.

5.1 INITIAL SETUP TIME IS LESS THAN 2 HOURS

5.1.1 DESCRIPTION

The setup of the Stream Hopper should take less than 2 hours to complete. The User Experience is key to the success of the Project as the main purpose of this device is to conveniently add entertainment value to the user's stream so the setup should be easy and fast.

5.1.2 SOURCE

Justin Erdmann

5.1.3 CONSTRAINTS

The setup time for the Stream Hopper will be constrained by the user's internet speeds and their ability to acquire the proper setup tools. The user's internet will potentially limit the initial connection speed due to congestion or low overall internet speeds. Also, if the user does not have the proper tools, the setup time could be increased.

5.1.4 STANDARDS

National Electrical Code (NEC), or NFPA 70 Standards

5.1.5 PRIORITY

Critical

5.2 DATA TRANSMISSION RATES

5.2.1 DESCRIPTION

During the user's stream, data should be sent from Twitch to the Stream Hopper in less than a second. The user shouldn't experience any delays in data transmission as the Stream Hopper will trigger events in real time and it must have very low latency.

5.2.2 SOURCE

Justin Erdmann

5.2.3 CONSTRAINTS

The Stream Hopper will be constrained by the user's internet speeds and the quality of the router used to communicate with the IOT Devices. The Stream Hopper will be sending data over the internet so typical internet issues will potentially cause inevitable delays.

5.2.4 STANDARDS

National Electrical Code (NEC), or NFPA 70 Standards

5.2.5 PRIORITY

Critical

6 SAFETY REQUIREMENTS

The Stream Hopper will require proper electrical packaging as to avoid a short of the Stream Hopper and to protect the device from environmental factors as well. Proper Cooling is needed to prevent damage to the Stream Hopper and to ensure it does not become a fire hazard. The Stream Hopper must not haphazardly interact with heating device e.g Ovens. The Stream Hopper will utilize a private network for safe communication and to deter communication with devices outside the private network. The Stream Hopper will have a profanity filter to prevent unhealthy communication.

6.1 LABORATORY EQUIPMENT LOCKOUT/TAGOUT (LOTO) PROCEDURES

6.1.1 DESCRIPTION

Any fabrication equipment provided used in the development of the project shall be used in accordance with OSHA standard LOTO procedures. Locks and tags are installed on all equipment items that present use hazards, and ONLY the course instructor or designated teaching assistants may remove a lock. All locks will be immediately replaced once the equipment is no longer in use.

6.1.2 SOURCE

CSE Senior Design laboratory policy

6.1.3 CONSTRAINTS

Equipment usage, due to lock removal policies, will be limited to availability of the course instructor and designed teaching assistants.

6.1.4 STANDARDS

Occupational Safety and Health Standards 1910.147

6.1.5 PRIORITY

Critical

6.2 NATIONAL ELECTRIC CODE (NEC) WIRING COMPLIANCE

6.2.1 DESCRIPTION

Any electrical wiring must be completed in compliance with all requirements specified in the National Electric Code. This includes wire runs, insulation, grounding, enclosures, over-current protection, and all other specifications.

6.2.2 SOURCE

CSE Senior Design laboratory policy

6.2.3 CONSTRAINTS

High voltage power sources, as defined in NFPA 70, will be avoided as much as possible in order to minimize potential hazards.

6.2.4 STANDARDS

NFPA 70

6.2.5 PRIORITY

Critical

6.3 ELECTRICAL PACKAGING

6.3.1 DESCRIPTION

Electrical Packaging is important to not only protect the device from any hazards but it also ensures it will safely get to the customer upon arrival.

6.3.2 SOURCE

Alexander Isaula

6.3.3 CONSTRAINTS

Packaging must be able to properly protect the devices from electromagnetic interference as well as moisture, contamination, chemicals and radiation.

6.3.4 STANDARDS

ISO/IEC Guide 41

6.3.5 PRIORITY

Critical

6.4 PROPER COOLING

6.4.1 DESCRIPTION

It is essential for the Stream Hopper to have proper cooling either through fans or passive cooling to ensure it does not get damaged internally nor become a fire hazard.

6.4.2 SOURCE

Alexander Isaula

6.4.3 CONSTRAINTS

Proper Cooling must be either through a fan system or passive cooling with metal fins or with the use of thermal pads on heat generating components.

6.4.4 STANDARDS

IEC/TS 62610-2

6.4.5 PRIORITY

Critical

6.5 PRIVATE NETWORK

6.5.1 DESCRIPTION

The Private Network is used to ensure that the supported devices can communicate efficiently with the Stream Hopper.

6.5.2 SOURCE

Customer

6.5.3 CONSTRAINTS

Private Network must not be accessible by outside users, it should only allow approved or compatible devices onto the network.

6.5.4 STANDARDS

IETF

6.5.5 PRIORITY

Critical

7 MAINTENANCE & SUPPORT REQUIREMENTS

The maintenance of the stream hoppers will be mostly remote and can be done by one of our technical staff. The software will be upgraded based on rolling requirements and different protocols in place and will be distributed by the company. All other maintenance requests can be submitted through the ticket system.

7.1 MANUAL/GUIDE

7.1.1 DESCRIPTION

The guide will contain the minimum system requirements and also will entail information on how to setup the devices and start-up the software in general.

7.1.2 SOURCE

Kevin Chawla

7.1.3 CONSTRAINTS

Predicting the software setup process from a consumer perspective and predicting failures and writing the guide accordingly

7.1.4 STANDARDS

IEEE 1063-2001

7.1.5 PRIORITY

Critical

7.2 TOOLS REQUIRED FOR MAINTENANCE

7.2.1 DESCRIPTION

Tools needed for maintenance would be a toolkit to fix the router and the pi and some back stock would be required in cases of the failure of the IOT devices.

7.2.2 SOURCE

Kevin Chawla

7.2.3 CONSTRAINTS

Different users will have various devices connected to the HUB so predicting the appropriate tools would be hard to predict

7.2.4 STANDARDS

IEEE 1219-1998

7.2.5 PRIORITY

Low

7.3 SOFTWARE/ENVIRONMENT REQUIRED FOR MAINTENANCE

7.3.1 DESCRIPTION

The maintaining staff would required remote access to the user's environment to rule out the possible failures and find a solution or the source of the problem.

7.3.2 SOURCE

Kevin Chawla

7.3.3 CONSTRAINTS

Will have to abide the the maintenance standards while following privacy laws during maintenance.
Have enough staff on hand to be available to help all the costumers.

7.3.4 STANDARDS

IEEE 1219-1998

7.3.5 PRIORITY

Critical

8 OTHER REQUIREMENTS

The Stream Hopper will be able to support multiple devices and communicate with them correctly. The Stream Hopper will support multiple configurations for different settings. Compatibility with the Raspbian Operating System

8.1 RASPBIAN COMPATIBILITY

8.1.1 DESCRIPTION

The Stream Hopper will be compatible with the Raspbian Operating System.

8.1.2 SOURCE

Seth Jaksik

8.1.3 CONSTRAINTS

Raspbian Operating System will allow for a software application to be used and allow for configuration of the Stream Hopper.

8.1.4 STANDARDS

NEC

8.1.5 PRIORITY

Critical

8.2 PROFANITY FILTER

8.2.1 DESCRIPTION

Profanity Filter will not allow vulgar language to be used on supported devices.

8.2.2 SOURCE

Alexander Isaula

8.2.3 CONSTRAINTS

Will not allow vulgar language in sentences or over multiple lines.

8.2.4 STANDARDS

N/A

8.2.5 PRIORITY

Critical

9 FUTURE ITEMS

Future compatibility with Facebook Live and YouTube Live Streaming is necessary as to allow content creators to have multiple streaming platforms to utilize the Stream Hopper with. Facebook Live and YouTube Live Streaming are popular streaming platforms that have a variety of interactions content creators can use to interact with their viewer, in the future the Stream Hopper will support Donation Triggers. In the future the Stream Hopper will also be able to trigger events during certain game activity actions.

9.1 YOUTUBE LIVE STREAMING COMPATIBILITY

9.1.1 DESCRIPTION

Stream Hopper device will be able to interact with the YouTube Live Streaming Platform and successfully enable triggers chosen by the content creator.

9.1.2 SOURCE

Customer

9.1.3 CONSTRAINTS

Stream Hopper will utilize the API reference to ensure compatibility of service.

9.1.4 STANDARDS

YouTube Live Streaming API

9.1.5 PRIORITY

Future

9.2 FACEBOOK LIVE COMPATIBILITY

9.2.1 DESCRIPTION

Stream Hopper device will be able to interact with the Facebook Live Platform and successfully enable triggers chosen by the content creator.

9.2.2 SOURCE

Customer

9.2.3 CONSTRAINTS

Stream Hopper will utilize the API reference to ensure compatibility of service.

9.2.4 STANDARDS

Facebook Live API

9.2.5 PRIORITY

Future

9.3 GAME ACTIVITY ACTION TRIGGERS

9.3.1 DESCRIPTION

The Stream Hopper will allow triggers based on what is going on the games being played.

9.3.2 SOURCE

Customer

9.3.3 CONSTRAINTS

Stream Hopper triggers will interact with supported device base on game activity.

9.3.4 STANDARDS

ASTM 3D Imaging System Standards

9.3.5 PRIORITY

Future

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