Oregon State University
College of Engineering

CS Capstone Requirements Document

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Axolotl

Prepared for

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1 Introduction

1.1 Purpose

The purpose of this software requirements specification (SRS) document is to outline and detail the capabilities of the NVIDIA Jetson TX2 infotainment and black box our group will develop, known henceforth as the Axolotl Infotainment System and Axolotl OS. Doing so will enable us to describe the requirements of the Axolotl Infotainment System and Axolotl OS such that we and our client will have a detailed understanding of the form factor and capabilities of the deliverable system we will develop. The intended audience for this SRS includes our client, the CS Capstone Instructors, and our group.

1.2 Scope

Our project entails the development of an infotainment system and black box that can be divided into two products: the Axolotl and the Axolotl Software. The Axolotl will connect vehicle sensors, controllers, receivers, and a touchscreen to a NVIDIA Jetson TX2 computer in a package that can be installed in a vehicle. The Axolotl Software runs on the Axolotl and provides users with media playback, navigation, and vehicle data logging capabilities.

2 Definitions

- NVIDIA Jetson TX2: A versatile, efficient, and high-performance computer made by NVIDIA to be used in robots, drones, and smart cameras.
- OBD-II: OBD-II refers to On-Board Diagnostics II, a standardized connector installed in all automobiles sold in the United States since January 1st, 1996. Devices connected via a car's OBD-II port can read the vehicle's sensor data on the fly.
- LIDAR: LIDAR refers to Light Detection and Ranging, a method of using laser pulses to determine the 3D properties of a faraway object.
- AHRS: AHRS refers to Attitude, Heading, and Reference System, a system used in modern aircraft to determine and display roll, pitch, and yaw.
- Infotainment: A portmanteau of information and entertainment. When we use the term infotainment, we are referring to the center console touchscreen that gives drivers access to information and media in modern cars.
- RDS: RDS refers to Radio Data System, a method of transmitting the current track information of an FM radio broadcast.
- UPS: UPS refers to Uninterruptible Power Supply, an auxiliary power source that enables a device to function for a limited time if its main power source is unavailable.

3 Overall Description

3.1 Product Perspective

The Axolotl Infotainment System is comprised of the Axolotl Head Unit and the Axolotl Software. The Axolotl Head Unit consists of all of the necessary sensors, receivers, and controller hardware connected physically and wirelessly with the NVIDIA Jetson TX2 system. The Axolotl is designed to be integrated into a car to either provide or replace an in-car infotainment system. Users will not interact directly with the sensors, receivers, or controllers.

The Axolotl Software will be installed on the Axolotl Head Unit's TX2 unit and directly interface with the user. The software will operate on Linux, as it is the base operating system installed on the TX2. The Axolotl Software will interact with the hardware and provide users with the ability to control media playback, conduct mapping and routing with navigation, and also exert limited control over system settings.

3.2 Product Functions

The main functions of the Axolotl are:

- The Axolotl will allow users to play media from multiple sources including: USB, Bluetooth, Auxiliary, and FM.
- It will also offer navigation with destination entry, mapping, and offline capabilities.
- The black box portion of the Axolotl logs output from a dashcam and all sensors tied into a car's OBD-II port. Users are able to download the black box data to a storage device or clear all black box data.
- The Axolotl display will also switch to the backup camera whenever user is reversing the car.

3.3 User Interfaces

The Axolotl Software will be interacted via a touchscreen using an iOS-inspired graphical user interface divided into the content window and the dock. The dock offers touch zones that will change the content window to either the media, navigation, or system menu. Each content window will have a submenu that displays contextual options and a content box encapsulating the main interactive content that changes based on the option selected in the submenu.

3.4 Hardware Interfaces

The hardware components of the system will include: the use of OBII which will receive information from multiple onboard car sensors, all related audio connection capabilities (which includes radio, bluetooth, auxiliary, and USB), the storing of data for navigation, and logging of all sensor data from the car in hard drives. The NVIDIA TX2 has native support for all hardware that is being used.

3.5 User Characteristics

The Axolotl will be used by ourselves, our client, and the general public, specifically car owners with any level of technological experience.

3.6 Constraints

- Hardware limitations including input, memory space, and form factor
- Entertainment to be limited as to not cause distraction

3.7 Assumptions

- This SRS assumes the availability of an accessible WiFi network with internet connectivity.
- This SRS assumes the availability of GPS signal.
- This SRS assumes the TX2 runs Linux.

4 Specific Requirements

4.1 External Interfaces

Axlotl Software

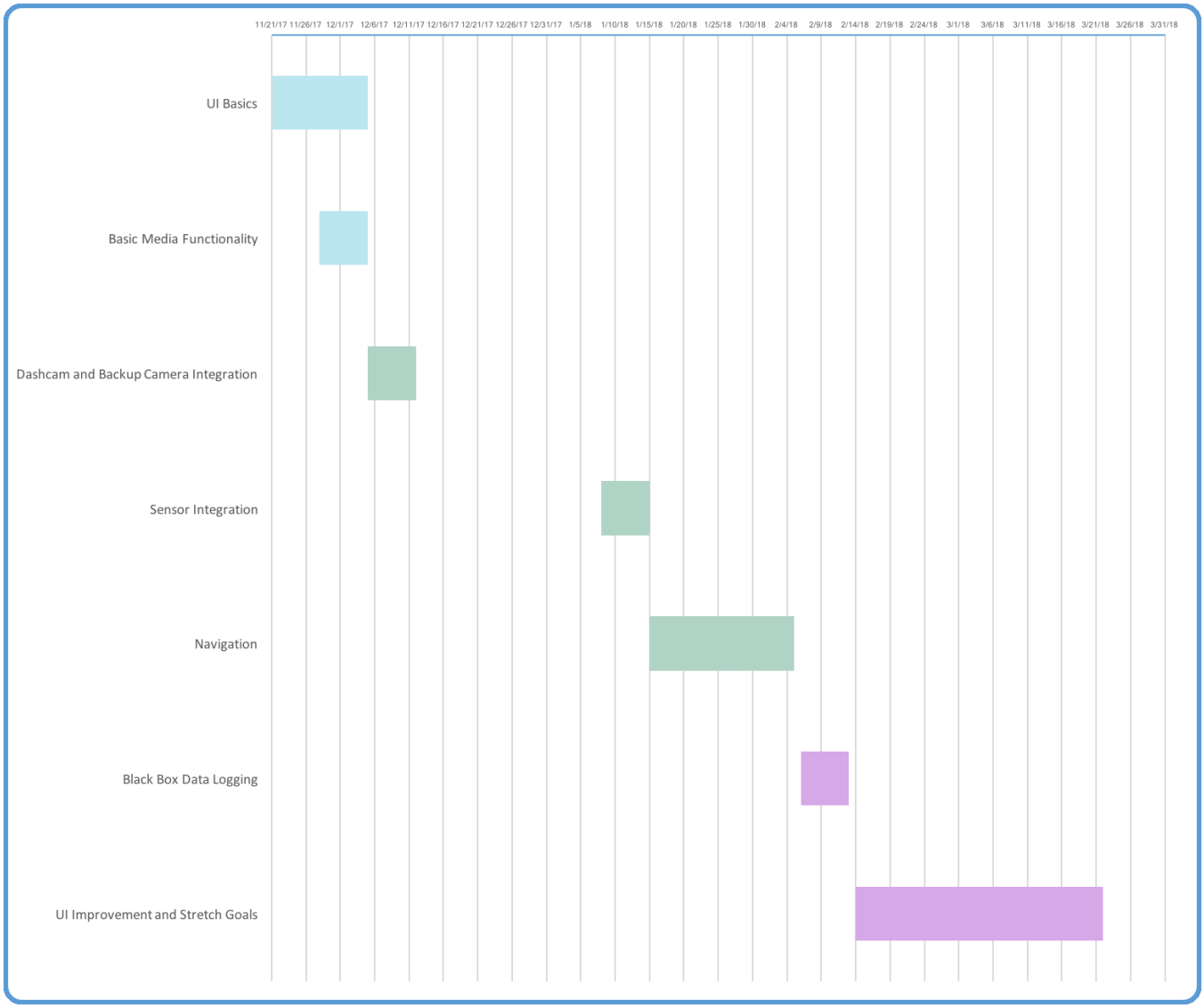
- The Axolotl Software is a Linux program that is installed on the NVIDIA Jetson TX2.
- Users interact with the Axolotl via a graphic user interface displayed on a touchscreen.
  - Users are able to operate three critical subsystems: Media, Navigation, and System, and may switch between them at any time.
- Users may set FM, Aux, USB, or Bluetooth as the audio source and manage each audio source independently.
  - FM will allow users to change the current FM radio frequency.
  - Users may control pause/play/previous track/next track functionality with USB and Bluetooth media sources via the touchscreen.
  - All media options will offer a volume slider for users to adjust global audio output volume.
- Users may utilize map, destination entry, and view route Navigation functions.
  - Users may input an address to set the destination of the routing system.
- Users may turn off the system's WiFi connectivity by a toggle switch.
- Users may download or wipe black box data by selecting the Black Box option.

5 Functions

5.1 Axolotl Software

- The FM media option will display RDS data.
- The Aux media option will indicate that media playback is controlled by the connected aux device.
- The USB media option will allow for full exploration of the connected USB drive's file structure.
  - Playback of following file formats is supported: mp3, flac, m4a, wav, and aac.
- The system shall record vehicle data from an OBD-II port, connected dashcam, and AHRS onto a SATA hard disk drive.
- Navigation will be capable of routing and mapping even if a mobile data signal is not available. Navigation will also parse address strings entered for destination input into a valid destination address for routing. The system will alert the user if the address entered is invalid.
- Navigation will utilize a single GPS receiver unit to determine location.
- The Navigation system will be limited to addresses within the United States.
- Users must enter a password in order to interact with the Black Box option within the System menu.
- The display will automatically switch to the backup camera feed when the vehicle is reversing.
- The Axolotl implementation will offer a minimum of three of any of the following optional functions:
  - Display of current driving statistics to improve driver's habits.
  - Use of multiple GPS receivers throughout the vehicle to improve accuracy of GPS location.
  - Display of live AHRS data in a System submenu.

- Control over supplemental turn signals and backup lights managed by a wireless controller in order to better signal other drivers.
- Topographical maps option of surroundings in navigation.
- Users can utilize a file browser to wirelessly download media from a home computer to a USB drive connected to the Axolotl.
- Physical knobs for volume and radio.
- Bluetooth calling support.
- Dashcam lane departure warning.
- Use of LIDAR to assist parking.



Task Name	Start Date	End Date	Duration (Days)	Days Complete	Days Remaining	Percent Complete
UI Basics	2017/11/21	2017/12/05	14	0.00	14.00	0%
Basic Media Functionality	2017/11/28	2017/12/05	7	0.00	7.00	0%
Dashcam and Backup Camera Integration	2017/12/05	2017/12/12	7	0.00	7.00	0%
Sensor Integration	2018/01/08	2018/01/15	7	0.00	7.00	0%
Navigation	2018/01/15	2018/02/05	21	0.00	21.00	0%
Black Box Data Logging	2018/02/06	2018/02/13	7	0.00	7.00	0%
UI Improvement and Stretch Goals	2018/02/14	2018/03/22	36	0.00	36.00	0%