System Requirements Specification

for

Smart Mirror

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Version 1.0 Initial release

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Table of Contents

Revision History

Name	Date	Reasons for change	Version
JB,AE,NG,JH,AR	10/11/2019	Initial release	1.0
JB,AE,NG,JH,AR	1/08/2020	Updated Use Cases and Milestones.	1.1
JB,AE,NG,JH,AR	1/31/2020	Updated Use Cases and Milestones.	1.2

JB,AE,NG,JH,AR	2/28/2020	Updated Use Cases and Milestones.	1.3
JB,AE,NG,JH,AR	312/2020	Finalized	1.4

1. Purpose

The goal of this project is to provide a new way of interaction and communication with a mirror in your house. Bring a new experience to homeowners who want to make their house smarter. With the smart mirror, users can get the latest information and provide visual and voice interaction to simplify and solve daily tasks.

2. Project Scope

The "Smart Mirror" is a smart home device with modern stylish design that can be a perfect addition to the modern smart house. The basic functionality includes displaying default widgets, voice commands and visual recognition of a person. Additional functionality would be synchronization with personal accounts for example with Google account which will give ability to use Google services. Users can view on the surface of the mirror their daily schedule, weather forecast, commute time, ask to read incoming emails, and read the latest news. The "Smart Mirror" will identify a user by searching user face in the database.

3. System Interfaces

SI-1: Hardware Controller

- Done through Core app
- Interfaces with camera, speakers, microphone through browser

SI-2: Stream Manager

- Manages widget access to Camera, Microphone, Speaker
- Can manage priority of widget control over hardware
- Can manage speaker/microphone levels, ON/OFF switches for hardware

SI-3: Authentication

- Allows user sign into the core application
- Allows 3rd party federation, manages profiles

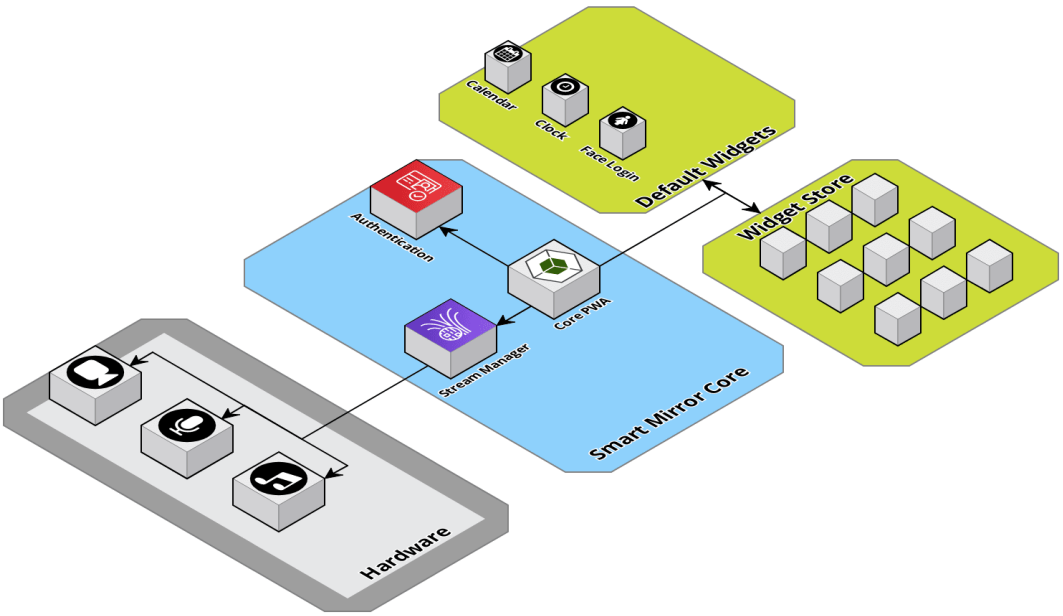
SI-4: Core PWA

- Manages Auth
- Manages layout
- Manages settings

- Steam Manager
- Widget Manager
- Creates internal API for Widgets

SI-5: Default Widgets

- Shipped with Core
- Required Core API
- Stand-alone npm packages

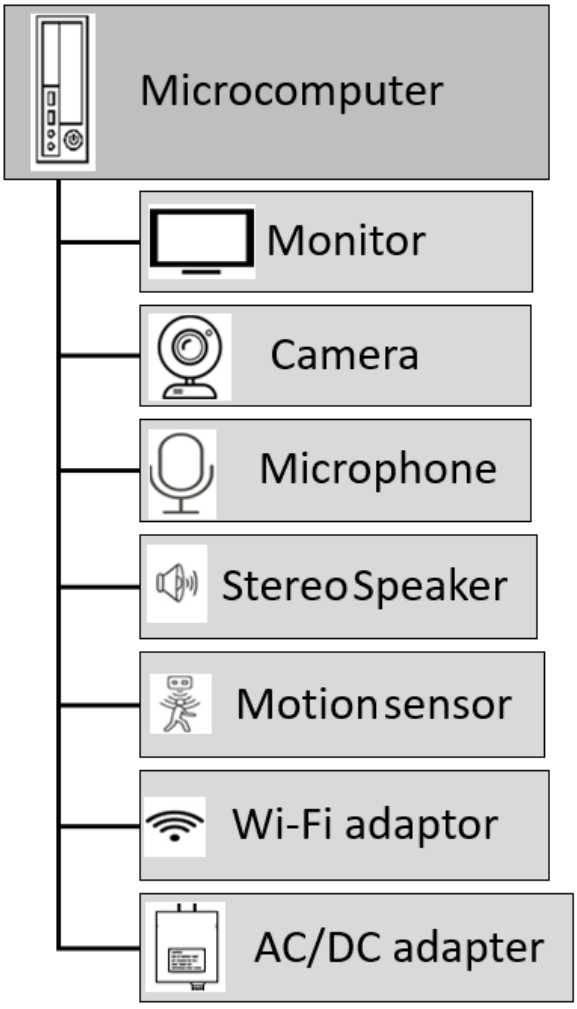


4. User Interfaces

- The user interface shall be implemented using any tool or software package like React, TypeScript, Chromium, Google widgets, Progressive Web Application, web hosting and cloud storage, Amazon Web Services.
- The user should be able to interact with the mirror through Voice Command and through the web application using any web browser on a PC or mobile device.

5. Hardware Interfaces

5.1 Hardware Configuration



5.2 Hardware Requirements

HR-1: Microcomputer
- ❖ HDMI output port, with embedded audio
- ❖ 3.5mm Analog audio output port
- ❖ USB ports (2-4)

HR-2: Monitor
- ❖ Size: 32”
- ❖ Resolution: 1080p60
- ❖ HDMI input port
- ❖ Stereo audio output port
- ❖ Max depth: 2.5” inches
- ❖ Regulator: UL listed

HR-3: Camera
- ❖ Field of view: 78 degrees
- ❖ Minimum resolution: 720p; 1080p recommended
- ❖ Connector: USB

HR-4: Microphone
- ❖ Connector: USB

HR-5: Speaker
- ❖ Power required: No
- ❖ Configuration: Stereo
- ❖ Connector: 3.5mm Stereo jack
- ❖ Connects to the microcomputer's or monitor's analog output port

HR-6: Motion Sensor
- ❖ Sensor Type: PIR
- ❖ Detection range (min): 4 feet.
- ❖ Field of view: 120 degrees

HR-7: Wi-Fi Adaptor
- ❖ Wireless Standards: IEEE 802.11n (draft), IEEE 802.11g, IEEE 802.11b
- ❖ Data Security: 64/128-bit WEP Encryption
- ❖ Security Standards: WPA, WPA-PSK, WPA2, WPA2-PSK. TKIP/AES
- ❖ Connector: USB

HR-8: AC/DC adaptor
- ❖ 110V 60Hz to 5V 2.5 Amp USB Power Supply
- ❖ Connector: Micro USB Connector
- ❖ Regulator: UL listed

5.3 Hardware Constraints

HC-1: Computational device must have at least 12 GB of RAM
HC-2: Computational device must have at least 2 GB of storage
HC-3: Computational device must have video output.
HC-4: Computational device must have audio output.
HC-5: Computational device must have microphone input.

6. Product Functions

PF-1: The core application, which will:
- ❖ Allow the user to link external accounts (such as Google). This will allow the user to access their own individual information such as their calendar, among other things to show the user on screen.
- ❖ Display widgets on the screen such as weather, calendar, a clock...etc. These widgets will be customized to the user. The weather app among others may need access to a WiFi connection in order to function properly for instance.
- ❖ Display a page on a mobile device which easily lets the user adjust their settings and rearrange the widgets on their smart mirror to positions of their choosing.

PF-2: Interacting with the camera/motion detector:

- Facial recognition which will allow the user to log in to their profile, and the widgets and settings will change according to that user's profile. If the camera doesn't recognize the user, it will ask them to become a new user and make their own account.

PF-3: Interacting with the microphone/speakers:

- Will allow the user to talk to and listen with voice commands. Thus, allowing the user to ask to hear their schedule, what the weather's like, play music...An example would be similar to voice commands on your phone or with your Alexa.

7. Use Cases

UC-1: Smart Mirror logs in a known user in based on facial recognition.

- Description - The Smart Mirror will use facial recognition to identify and log a user in to the Smart Mirror.
- Pre-Conditions - A user is not currently logged in and the Smart Mirror is in the powered-on mode.
- Normal Flow of Events:
    - When the Smart Mirror is in the powered-on mode, it will actively be looking to detect any users' face. If the Smart Mirror identifies the user has an account on the Smart Mirror, their custom configurations will be loaded.

UC-2: Smart Mirror logs in an unknown user in based on facial recognition.

- Description - The Smart Mirror will use facial recognition to identify a new user log them into the Smart Mirror with a guest account.
- Pre-Conditions - A user is not currently logged in and the Smart Mirror is in the powered-on mode.
- Normal Flow of Events -
    - When the Smart Mirror is in the powered-on mode, it will actively be looking to detect any users face. If the Smart Mirror identifies the user does not have an account, it will load a default guest configuration.

UC-3: Smart Mirror logs in a known user into their Google account based on facial recognition.

- Description - The Smart Mirror will use facial recognition to identify and log a user in to their Google account
- Pre-Conditions - A user is not currently logged in and the Smart Mirror is in the powered-on mode.
- Normal Flow of Events:
    - When the Smart Mirror is in the powered-on mode, it will actively be looking to detect any users' face. If the Smart Mirror identifies the user has an account on the Smart Mirror, their custom configurations will be loaded.

UC-4 User can log is as guest using voice commands.

- Description – the Smart mirror shall have an option for guests to log it and use the widgets that don't require an account such as clock, calendar, weather.
- Pre-Conditions – voice command shall be active, and a specific command should trigger guest log in.
- Normal Flow of Events:
  - User comes up to a mirror and wants to get basic information while in front of the mirror.
  - User tells the mirror to log in using the guest account
  - The mirror will respond to the user that he is being logged in as a guest and mirror will display simple widget

UC-5 User shall be able to create new account from the guest account

- Description – The Smart mirror shall have an option for a new user to create an account with smart mirror.
- Pre-Conditions – there should be a predefined application process which the user can use to inter their information ether via voice commands or the keyboard (if available)
- Normal Flow of Events:
  - New user come to the mirror; the facial recognition does not recognize him.
  - Mirror will respond to the user that he is not recognized and asks the user if they want to create new account.
  - If the user affirms that they would like to create account, then the create new account page will display and user will be prompted with questions, and a picture will be taken for facial recognition.

UC-6 Smart Mirror shall have default layouts

- Description – The smart mirror should have a
  - home page,
  - log in page,
  - Face recognition demo page
  - Hand command demo page
  - Voice command demo page
  - Devotion page
  - Inspiration page
  - Wikipedia search page
  - Photo Gallery page
  - Mirror mode page
  - French Demo page
  - Russian demo page
- Pre-Conditions – Smart mirror should have the means for navigating back and forth between these pages possibly with voice commands
- Normal Flow of Events
  - User in front of a mirror wants to change to a different layout

- The key word that they will use is "Mirror Mirror on the wall" or the short version "Mirror Mirror" followed by a specific command that will be recognized by the PWA and trigger the layout change.

UC-7 User shall be able to log out of their personal account or guest account

- ❖ Description – the smart mirror will use voice command to log the user out.
- ❖ Pre-Conditions – Voice command must be functional
- ❖ Normal Flow of Events
  - Once the user is done using the smart mirror they could want to log out from their account.
  - In order to log out they will use voice command to let the mirror know that they need to log out via command "Mirror Mirror on the wall log out"

UC-8 Smart Mirror shall have a Devotion page.

- ❖ Description – Devotion page will update the verse every time user will divert to it
- ❖ Pre-Conditions – mirror must have an internet connection and voice command must be functional
- ❖ Normal Flow of Events
  - At any time, the user should be able to ask for devotion page and be diverted to it

UC-9 Smart Mirror shall be able to find out my mood.

- ❖ Description – The mirror will ether ask how users' mood is or will use facial recognition to figure out what the users' mood is.
- ❖ Pre-Conditions – Voice commands should be functional, and camera must be set up
- ❖ Normal Flow of Events
  - At any time, the user should be able to activate the mood verification using voice commands. Mirror will try to figure out what your mood is or ask for it if it cannot figure it out.

UC-10 Smart Mirror shall be able to take and store pictures.

- ❖ Description – This is a feature that should give the user to take their selfies with the help of voice commands
- ❖ Pre-Conditions – Camera must be set up and voice controls functional
- ❖ Normal Flow of Events
  - At any time, the user should be able to ask the Smart Mirror to take their picture.
  - The mirror should display the picture for review with the user and then ask if it shall be saved.

UC-11 Smart Mirror shall have a Wikipedia search option.

- ❖ Description – Mirror should be able to search Wikipedia just by activating it via voice commands and specifying what to search for
- ❖ Pre-Conditions – Mirror must be connected to the internet and have voice controls functional
- ❖ Normal Flow of Events

- At any time, the user shall be able to tell the mirror to search for something and the mirror should activate the search and display the results to the user.

UC-12 Smart Mirror shall support multiple languages.

- Description – Mirror shall be able to transition between different languages for users who speak different languages to use the mirror in their native language.
- Pre-Conditions – Mirror must be connected to the Internet and have voice controls functional
- Normal Flow of Events
  - User shall be able to ask the mirror to change the language to one of the supported languages and the mirror should respond with a confirmation that the language has been changed.

UC-13 Smart Mirror shall have Motivational and Inspirational quotes

- Description – These quotes shall be connected to the mood of the user, and be displayed accordingly
- Pre-Conditions – Must be connected to the internet and have voice controls activated and functional
- Normal Flow of Events
  - Anytime the user checks his/hers mood, the mirror shall give the user an option for a motivational quote according to users' mood.

UC-14 Smart Mirror shall be able to play music.

- Description – Mirror shall have a media player that will play music to the user upon request
- Pre-Conditions – Must have internet connection and voice control functional
- Normal Flow of Events
  - The user shall be able to ask the mirror to play music and mirror should acknowledge and follow with some music.

UC-15 Smart Mirror shall have a Inspiration page.

- Description – Inspiration page will update the verse every time user will divert to it and the quotes will be read to the user via voice
- Pre-Conditions – mirror must have an internet connection and voice command must be functional
- Normal Flow of Events
  - At any time, the user should be able to ask to be inspired and be diverted to Inspiration page

UC – 16 Smart Mirror shall have weather animation

- Description – weather animation should be turned on via voice command and should display desired animation of weather
- Pre-Conditions– mirror must have an internet connection and voice command must be functional
- Normal Flow of Events

- At any time, the user should be able to ask for weather animation and it should be displayed as on overlay on the screen.

UC – 17 Smart Mirror shall have IoT Integration

- Description – IoT devices should give the mirror the ability to turn external devices on or off or control then in any other way.
- Pre-Conditions – smart mirror must be able to communicate with IoT device via USB Bluetooth or the internet. Mirror must have an internet connection and voice command must be functional
- Normal Flow of Events
  - At any time, the user shall be able to use voice command to control any configured external device.

UC – 18 Smart Mirror shall have French Demo page

- Description – French demo page shall give the user an opportunity to try their skills in controlling the mirror using French language
- Pre-Conditions - Mirror must have an internet connection and voice command must be functional
- Normal Flow of Events
  - User shall be able to use voice command to take them to French demo page and test their French skills

UC – 19 Smart Mirror shall have Russian Demo page

- Description – Russian demo page shall give the user an opportunity to try their skills in controlling the mirror using Russian language
- Pre-Conditions - Mirror must have an internet connection and voice command must be functional
- Normal Flow of Events
  - User shall be able to use voice command to take them to French demo page and test their Russian skills

UC – 20 Smart Mirror shall have Accent selection

- Description – Voice that is used to respond to the user shall be configurable to different accents
- Pre-Conditions - Mirror must have an internet connection and voice command must be functional
- Normal Flow of Events – user shall be able to go into configuration settings and change the accent that they would like to use for their mirror voice.

UC – 21 Smart Mirror shall have news feed

- Description – News feed shall be displayed from the home page where the user can easily read most current news
- Pre-Conditions – Internet connection must be present
- Normal Flow of Events
  - The user shall be able to toggle the news feed on/off

UC – 22 Smart Mirror shall have a help page

- Description – Help page shall be available to the user at their request via voice command. The help page shall display all possible options that the mirror can do and help the user to navigate to them
- Pre-Conditions – Voice command must be functional
- Normal Flow of Events
  - User can ask for help page using voice command and help page should be displayed

8. Target Users

TU-1: Adults

- It can display the weather, which can reveal road conditions for traveling to work, or planning your weekend.
- It can also reveal your schedule, thus allowing the individual to keep track of their tasks or add to their tasks. This could also be very useful in the workplace.
- The mirror could be set up in the kitchen or spare room, as it could display recipes, etc.
- The widgets are visible features that can display your information, the weather, etc. This allows the blind to still interact with the mirror.
- The potential for a multitude of widgets could allow the user to customize the mirror to help make their day the most efficient, with easy access to information and resources.

TU-2: Children/Teens

- The parents could set up an account for their kids as a potential to help their kids stay on track for tasks or chores.
- Using voice commands this could help with homework, such as searching for what something is and allowing the mirror to speak back.
- Potential to take a photo with the mirror and share it to the social media of their choice.

9. Milestones

Milestone	Description	Wks	Start	End
MS-1	Team creation, Project ideation, SRS creation and release	0	10/11/2019	10/11/2019
MS-2	Tech stack research and tool familiarization	2	10/11/2019	10/25/2019

MS-3	Progressive web app core creation	2	10/25/2019	11/8/2019
MS-4	Smart Mirror hardware assembly (Demo unit + additional setups for developers)	2	11/8/2019	11/22/2019
MS-5	Basic functionality (Basic app/ core integration with the Smart Mirrors hardware)	2	11/22/2019	12/6/2019
MS-6	Holiday	4.5	12/6/2019	1/6/2020
MS-7	Basic Voice control, context, routing, and Layouts	1	1/6/2020	1/13/2020
MS-8	Adv routing, Voice Control Demo and Mirror Mode Layouts, Smart Mirror SW/HW integration testing, Home Page, Guest Login w/ voice, Create account	2	1/13/2020	1/27/2020
MS-9	Login w/ existing account, Initial Wikipedia search	1	1/27/2020	2/3/2020
MS-10	Users Mood, Take & store pictures, Multi-language support, Motivational / inspiration quotes, Play music, Voice control of ext. hardware devices	2	2/3/2020	2/17/2020
MS-11	Smart Mirror integration / regression testing and bug fixing	3	2/17/2020	3/16/2020
MS-12	Get Smart Mirror talking to AWS IoT	2	2/24/2020	3/09/2020
MS-13	Improve Smart Mirror UI	1	3/03/2020	3/09/2020

10. Limitation

The Smart Mirror will possibly have the following limitation:

LM-1: The prototype will have hardware attached to the back of the mirror and thus make it heavy and bulky.

LM-2: The brightness of the screen may not be sufficient enough in bright daylight to show the image through the mirror.

LM-3: The camera may not be able to take a clear enough image for facial recognition during low light situations.

LM-4: The motion detector may detect motion from animals or other moving objects thus triggering facial recognition without anyone in front of it.

LM-5: Los of power will shut down the raspberry pie and the system will have to be restarted in that case.

LM-6: The Smart mirror prototype is not going to be waterproof, so contact with water may damage the hardware.

LM-7: Facial Recognition will only work within four or 5 feet.

LM-8: Ambient noise may interfere with the voice command.

LM-9: Smart Mirror will only be able to recognize one person at a time and only after it goes into standby mode.

LM-10: Raspberry pie may not be powerful enough to run all widgets at once.

LM-11: Raspberry pie may be slow to connect the network.

LM-12: Applications that require network will not function offline.

LM-13: If the microphone fails you will not have controls over the mirror functionality unless through the App.

11. Assumptions and Dependencies

AD-1: The display screen will show through the mirrored material with sufficient brightness and resolution.

AD-2: A cheap and small form factor computer will have sufficient processing power to run a Progressive Web App (PWA)

AD-3: The Appliance will be at a location with an available continuous power supply. (No battery operation)

AD-4: The Appliance will have internet access.

Appendix A: Definitions, Acronyms, and Abbreviations

PWA - Progressive Web Application

SMC - Smart Mirror Core

RPi - Raspberry Pie

HW - Hardware

SW - Software

NW - Network

CLD - Cloud

FR - Facial Recognition

VC - Voice Command

SB - Stan-by mode

OFL - Offline