**Periphery Deliverable 3**

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**Technical Benchmarking**

**\*Table 1:** General technical benchmarking of SmartGlass hardware

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Product** | **Type** | **Tint** | **Power Consumption** | **Key Features** | **Applications** | **Reliability** | **Usability** |
| SageGlass | Electrochromic | 3-10 minutes | 0.2 W/m² | Automatic tinting, energy efficiency | Commercial buildings, schools | High | User-friendly control options |
| View Dynamic Glass | Electrochromic | 5-10 minutes | Low when inactive | Integrates with smart systems | Offices, hotels | High | Easy integration with systems |
| Smart Tint | PDLC | <1 second | 1-2 W/m² | Instant privacy | Windows, conference rooms | Moderate | Simple switch control |
| Horizon Glass | Electrochromic | 5-10 minutes | Minimal | Manual/automated control | Commercial, residential | High | Intuitive controls |
| Kinestral Halio | Electrochromic | 3-5 minutes | Low when inactive | Automatic adjustment | Homes, offices | High | Seamless operation |
| Privacy Glass | PDLC | Instant | ~1 W/m² | Versatile, quick switch | Offices, medical facilities | Moderate to High | Simple control mechanisms |
| Eink Glass | Electronic Paper Display | Varies | Low in standby | Displays information | Retail, kiosks | Moderate | User-friendly interface |
| Switchable Glass | PDLC | Instant | 1-2 W/m² | Versatile applications | Offices, schools, healthcare | Moderate | Intuitive control |
| Apple Vision Pro | Mixed Reality Headset | N/A | ~20 W | High-resolution display, spatial audio | Augmented reality applications, entertainment | High | Intuitive interface, gestures |
| Ray-Ban Meta Glasses | Smart Glasses | N/A | Varies (battery powered) | Camera, audio capabilities | Social media, casual use | Moderate | User-friendly controls |
| Moverio BT-40 | Augmented Reality Glasses | N/A | ~2 W | High-resolution display, projection | Industrial, educational applications | High | Easy to use for various tasks |
| Navilense | Smart Glasses | N/A | ~1 W | Navigation, AR overlays | Logistics, fieldwork | Moderate | Intuitive navigation interface |

\*Consult the appendix below for an explanation of select advanced terminology/technology referred to in this table

**\*Table 2**: General technical benchmarking of SmartGlass software

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Product** | **Operating System** | **Software Features** | **Developer Tools** | **Connectivity** | **Compatibility** |
| SageGlass | Proprietary | Automatic tinting control, integration APIs | API for integration | Wired (building systems) | Compatible with building systems |
| View Dynamic Glass | Proprietary | Dynamic tinting control, building management integration | API for integration | Wired, IoT | Compatible with building systems |
| Smart Tint | Proprietary | Remote control via app, manual switch | API for developers | Wi-Fi, Bluetooth | Works with standard window controls |
| Horizon Glass | Proprietary | Manual and automated tinting control | Integration options | Wired (building systems) | Compatible with building systems |
| Kinestral Halio | Proprietary | Automated tinting based on light conditions | API for integration | Wired, IoT | Compatible with building systems |
| Privacy Glass | Proprietary | Instant switching, remote control | API for developers | Wired, Wi-Fi | Standard window controls |
| Eink Glass | Proprietary | Information display, user interface | SDK for developers | Wi-Fi, Bluetooth | Compatible with apps for display |
| Switchable Glass | Proprietary | Manual and remote control | API for integration | Wired, Wi-Fi | Standard window controls |
| Apple Vision Pro | visionOS | AR/VR applications, spatial audio support | ARKit, RealityKit | Wi-Fi, Bluetooth | Compatible with iOS apps |
| Ray-Ban Meta Glasses | Proprietary | Camera capture, audio playback | SDK for developers | Bluetooth | Facebook and Instagram integration |
| Moverio BT-40 | Android-based | AR applications, media playback | SDK for Android | Wi-Fi, Bluetooth | Compatible with Android apps |
| Navilense | Proprietary | Navigation, AR overlays | API for developers | Wi-Fi, Bluetooth | Compatible with logistics software |

\*Consult the appendix below for an explanation of select advanced terminology/technology referred to in this table

**Table 3:** Technical benchmarking for Focals By North non-hardware related specifications

|  |  |
| --- | --- |
| **Category** | **Details** |
| Reliability | - Information not available. |
| Usability | - Has access to Alexa smart assistant.  - Charges through a glass case  - Inability to pair with other inputs  - Uses lasers to reflect an image into the user eye, this acts as a user interface  - Control/interaction of system with a wireless control stick on a ring |
| Dependability | - Information not available. |
| Weight | - Weight distribution is poor |

**Table 4:** Technical benchmarking for Meta Quest 3 non-hardware related specifications

|  |  |
| --- | --- |
| **Category** | **Details** |
| Reliability | - Powered by Snapdragon XR2 Gen 2 for fast load times and seamless gameplay.  - Supports heavy applications, including high-resolution passthrough. |
| Usability | - High-fidelity views of surroundings with virtual objects.  - 3.5mm audio jack for external sound devices.  - Integrated stereo speakers with 3D spatial audio.  - Customizable (e.g., prescription lenses).  - 2 RGB cameras with improved passthrough resolution. |
| Dependability | - Accurate depth projection and room mapping for interaction with virtual objects. |
| Weight | - Lightweight design with customizable facial interface for comfort. |

**Table 5:** Technical benchmarking for NaviLens non-hardware related specifications

|  |  |
| --- | --- |
| **Category** | **Details** |
| Reliability | - Reading of markers is almost instantaneous.  - Detects multiple tags simultaneously.  - Effective communication with users in motion. |
| Usability | - No need for focusing, ideal for visually impaired users.  - Works when phone is pointed up; efficient in urban environments.  - Supports 15 languages.  - Customizable markers with personal comments.  - Handshake gesture for reading information. |
| Dependability | - Accurately detects distance and relative angle to tags.  - Can read labels from up to 15 meters away. |
| Weight | - Software-based; weight depends on the device used. |

**Design Specifications**

**Table 6:** Updated design criteria with target specifications, listed in order of descending priority

|  |  |  |
| --- | --- | --- |
| **Priority** | **Criteria** | **Quantification** |
| 1. User- Friendly Interface | The software should have an intuitive design that allows users to navigate easily. This includes clear icons, straightforward menus, and accessible controls. A well-designed user interface enhances user engagement and reduces the learning curve for new users. | A user will be able to comfortably use this product within 30 minutes of practice. |
| 2  Compatibility | The software must be able to seamlessly connect with existing systems such as building management systems, IoT devices, and other smart technologies. This ensures that users can control multiple systems from a single interface, enhancing functionality and convenience. | Access to cloud services. |
| 3  Reliability | Consistent performance is crucial for smart glass applications, particularly in commercial settings where downtime can lead to significant disruptions. The software should operate smoothly under varying conditions and be resilient to hardware failures. | Bandwidth range: 10-50MBs  Latency: 20-50 ms  Jittering: 5 ms |
| 4  Security | Given the potential for sensitive data transmission and control, robust security measures are essential. This includes encryption for data in transit, secure user authentication, and regular updates to protect against vulnerabilities. | Any sensitive data sent or received between the app and the API will be properly secured |
| 5 Customization Options | Users should have the ability to tailor settings to their preferences, such as adjusting tint levels, brightness, or display content. Customization enhances user satisfaction and makes the software more adaptable to different environments or tasks. | App has customization features to help users with utilizing it. |
| 6  Support and Maintenance | Ongoing technical support is vital for troubleshooting and resolving issues as they arise. Regular software updates should also be provided to enhance functionality, improve security, and address any bugs or performance issues. | App is designed with proper documentation so that any future maintenance is as smooth as possible. |
| 7  Scalability | The software should be designed to accommodate future growth. This means it can handle an increasing number of users, devices, or functionalities without compromising performance. Scalable software allows for additional features to be added as needed. | Modular design to facilitate easy scaling. |
| 8 Integration Capabilities | The software must be compatible with various hardware configurations and operating systems. This ensures that it can be deployed across a wide range of devices, from smartphones and tablets to different types of smart glass hardware, making it accessible to more users. | Must be compatible on and functional with the system we display it with, as well as Android. |

**Reflection on Development of Design Specifications**

Ultimately, it was determined that having a user-friendly interface should take greatest precedence over the original priority of showcasing Shabodi’s API. This change resulted from the realization that having a functional product with a User Interface that is easy to use and understand would be the best way to highlight the practical uses of Shabodi’s NetAware API. Creating a tangible product with real-world applications and impact will showcase the possibilities of Shabodi’s NetAware API in a way that resonates with them more than something that feels like a tech-demo. Moreover, compatibility was given greater importance due to the need for the product to be able to interface with multiple APIs and networks. The product will need to do this in order to assist users with daily tasks such as navigation and banking in real-time without delays. Furthermore, a concern not previously discussed was security. Since our product have could have access to sensitive data such as personal addresses, banking information, medical records and so forth, this data must be protected and secure at all times. Previously, it was decided that the software should be modular and easily adaptable to different use-cases to make it attractive to a wider range of potential users. This has been made a lower priority due to the decision to primarily focus on users with visual disabilities and not the marketability of the product. Overall, many of the design specifications and their priorities have changed due to the fact that we believe showcasing a product that has a mission behind it – to aid the visually disabled by making daily tasks easier for them to perform – will showcase Shabodi’s NetAware API in a way that people will be able to empathize with. We all know someone who struggles due to a disability beyond their control and we want to use Shabodi’s NetAware API to help.

**Appendix**

Augmented Reality (AR)

AR systems function by overlaying virtual display elements and objects into the real world via screens or image projectors.

### Polymer Dispersed Liquid Crystal (PDLC)

PDLC technology consists of liquid crystal droplets dispersed within a polymer matrix. Commonly, this material is used to control light transmission and is frequently found in smart glass applications (i.e., privacy).

Electrochromic

Electrochromic technology involves materials that change colour or opacity when an electrical voltage is applied. This process is controlled either manually or automatically and is used to help regulate heat and glare. As a result, this technology is utilized to improve energy efficiency in buildings, smart glasses, vehicles and consumers electronics.

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