**Concept Generation**

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**Concept Generation**

Concept generation refers to the developing of various possible solutions for a specific topic. Within concept generation, there are tools to help enable thoughts. The importance of having a successful concept generation leads to the best overall product. By using some of the methods mentioned below, Team 522 was able to yield 105 feasible ideas.

**Concept Generation Tools**

In order to facilitate the brainstorming process, specific methods of concept generation are used. Brainstorming, biomimicry, and the morphological chart were all used within our concept generation to come up with various ideas. Brainstorming is the main concept generation tool that we had used to gather ideas, during which each team member writes as many ideas as possible disregarding their overall quality or feasibility. This method is quick and efficient but requires the team to go back to revise each concept and verify if they are feasible or not.

Biomimicry is used to develop innovation that is inspired by nature, through the analysis of different animals, plants, ecosystems, etc. Most of these, such as bats, use echolocation thanks to their highly adapted bodies, while some, such as the star-nosed mole and the naked mole-rat, use highly sensitive tactile tissue. From this, the team considered a variation of radar or a device that enhances the user’s sense of touch (much like the standard white cane). Developing ideas from what occurs naturally can extend the thought process and create efficient systems.

Another tool used in the brainstorming process is a morphological chart. Morphological charts list out the functions for the desired design and lists possible solutions for that function. This allows mixing of different system solutions and produce a greater number of plausible concepts. For example, the critical functions included alerting of elevations, determining locations, and alerting of physical objects; the ideas that can achieve these incorporate a cane or sensor, as well as a GPS device. Many of the ideas were derived from the morphological chart, seen in Table 1.

## Table 1: Morphological Chart

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Alert of Elevation | Determine Location | Alert of Physical Object | Inform of Possible Threats | Interpret Sensory Information |
| Sensor | GPS Through Wi-Fi/Internet Signal | Distance Sensor | Heat | Camera |
| Stick/Cane | GPS w/ Maps Downloaded | Velocity Sensor | Vibrate | Text Conversion |
|  | Camera to Read Street Signs and Other Landmarks | Lidar | Noise | Live Imaging Scanned to PDF |
|  | Memory Storage of Previous Paths |  | Poke | Text to Braille |

By combing all the functions and resolutions we were able to come up with over 50 plausible concepts. Although some of them are similar, we were able to eliminate the ones that served no purpose. For example, having a cane that could memorize paths and send you messages in braille. More morphological chart concepts can be seen in the concept generation list.

Another process used throughout the brainstorming process was getting into the perspective of our user. As our primary market is for people who are visually impaired, it is very difficult for us to naturally find ways to make something work. One way to come up with something new was by physically attempting to be our user. In somewhat of a form of biomimicry, we would try to navigate in our surrounding space with our eyes closed, completely detaching ourselves from our sense of sight. By trying to navigate in this sense, we were able to grasp what seemed important in a device. We quickly realized that it is beneficial to have some form of physical device in contact with the ground. By being able to feel things, we could get sense of what was there. Going off that principle, we were able to further develop that idea into a fully functioning device.

Our high fidelity and medium fidelity ideas are determined after the brainstorming has been completed. From this point, it was determined that these ideas seemed to be the most fitting for our customer needs. This will be tested and determined in concept selection. The decision to move these ideas from the general population to either high or medium fidelity are discussed and reasoned in a group effort. The medium fidelity ideas are ones that incorporate the needs of the customer but are lacking in some areas. The high-fidelity ideas are the most realistic and implementable ideas.

**High Fidelity:**

1. LIDAR/ RADAR sensor that can be pinned or chipped to shirt or breast pocket, sensors connected to others in hand grips of white cane. Haptic feedback provided through vibrations on cane. (Brainstorming)
2. Handheld technology with 3x3 pin system on the hand and LIDAR, which alerts the user of relative distance depending on which pin is pressed down and how intensely. (Brainstorming)
3. Watch with LIDAR/RADAR sensor and computer/GPS to indicate direction and location of user. Haptic feedback through sensors encompassing wristband. Watch connected to white cane like product with connection wrist strap like a Wii Controller (Brainstorming)

**Medium Fidelity:**

1. Smartphone application using Lidar and feeding user information through haptics, computer and GPS incorporated to track and locate user. (Brainstorming)
2. Watchwith sensor and computer to indicate where the user is, haptic feedback provided through vibration on wrist. (Brainstorming)
3. Smart cane – haptic feedback, voice-activated, and phone compatible (Brainstorming)
4. Eyeglasses that have a sensor and computer /GPS to indicate where user is, haptic feedback is provided through sensors on frame of glasses (contact points like bridge of nose and grips on the ends) - or haptic feedback provided through contact on cane (Brainstorming)
5. Smart cane – audio feedback, manual or voice-activation, phone compatible, ability to interpret the environment (Brainstorming)

**Ideas**

**Brainstorming**

1. Watch with LIDAR/RADAR sensor and computer to indicate where the user is, haptic feedback provided through vibration on wrist.
2. Watch with LIDAR/RADAR sensor and computer/GPS to indicate where the user is, haptic feedback provided electrical stimulation of sensors under face of watch and encompassing wristband.
3. Watch with LIDAR/RADAR sensor and computer/GPS to indicate where the user is, audio feedback provided through volume/ speakers in the watch. Volume adjustable via knob or smartphone.
4. Watch with LIDAR/RADAR sensor and computer/GPS to indicate direction and location of user. Haptic feedback through sensors encompassing wristband.
5. Watch with LIDAR/RADAR sensor and computer/GPS to indicate direction and location of user. Haptic feedback through sensors encompassing wristband. Watch connected to white cane like product with connection wrist strap like a Wii Controller.
6. Eyeglasses that have LIDAR/RADAR sensor and computer /GPS to indicate where user is, haptic feedback is provided through sensors on frame of glasses (contact points like bridge of nose and grips on the ends)
7. Eyeglasses that have LIDAR/RADAR sensor and computer/GPS to indicate where user is, audio feedback provided through speaker on frame of glasses.
8. Eyeglasses with LIDAR/RADAR sensors and computer/ GPS to indicate where user is and what is near them, haptic feedback provided through electrical stimulation of sensors located on various parts of body.
9. Hat with LIDAR/RADAR sensor and computer/GPS to indicate direction and location of user. Haptic feedback provided through sensors in contact with skull from the inside of the hat.
10. Hat with LIDAR/RADAR sensor and computer/GPS to indicate direction and location of user. Audio feedback provided through speakers in hat.
11. Shoes with LIDAR/RADAR sensor and computer/GPS to indicate direction and location of user. Haptic feedback through sensors in soles of the shoe.
12. Shoes with LIDAR/RADAR sensor and computer/GPS to indicate direction and location of user. Haptic feedback through electrically stimulated sensors elsewhere on body.
13. LIDAR/ RADAR sensor that can be pinned or chipped to shirt or breast pocket, sensors connected to others in hand grips of white cane. Haptic feedback provided through vibrations on cane.
14. LIDAR/ RADAR sensor combined with computer and GPS to indicate location of user. These systems are integrated into a white cane with haptic vibration feedback through grip on handle.
15. Sensors with computer and GPS integrated into a watch, the watch will provide haptic feedback through intensity of temperature change.
16. White cane attachment with distance sensor on middle of shaft and near handle, which then triangulate objects at a distance
17. White cane attachment with camera connected to neural net, analyzing objects in proximity
18. White cane attachment with camera connected to neural net, meant to identify objects
19. Harness with sensors on shoulders and hip, providing 360 area coverage through sensors.
20. Gauntlet with camera attachment connected to analysis tool
21. Glasses attachment with camera; therefore, enable people to easily aim at object in front of them.
22. Application on mobile device utilizing Lidar
23. White cane with built in GPS and route tracking, feeding information to user via audio
24. White cane with built in GPS and route tracking, feeding information to user via haptic feedback
25. White cane with built in GPS and route tracking, feeding information to user via braille pad
26. Smartphone application using Lidar and feeding user information through haptics
27. Smartphone application using Lidar and feeding user information through audio feedback
28. Trackers on wrists
29. Lidar scanner on handheld attachment, actively scanning for quick object movements
30. Lidar scanner but with distance sensor to maximize range and efficiency
31. Hat with attachable headphone for audible feedback
32. Hat with pressure point feedback
33. Robot that strolls alongside the person (hold hand)
34. Drone that flies ahead to predict future walking path
35. Smell-induced feedback
36. Autonomous wheelchair
37. Temperature related feedback
38. Product identifier by barcode
39. Product identifier by label
40. Voice-activated technology
41. Smart cane – audio feedback, voice-activated, and phone compatible
42. Smart cane – haptic feedback, voice-activated, and phone compatible
43. Audible stop for pouring liquids
44. Short stick that does all the same functions of a smart cane, except does not extend to the ground (more discrete)
45. Audible street signs for pedestrians
46. Smart glasses for low light situations
47. Smart glasses that read currency
48. Smart glasses that interpret manuscript
49. Watch that has multiple rhythmic beats indicating the height difference in front of the user
50. Getting help from surrounding people
51. Device with camera that translates text scanned into braille on small screen
52. Clip-on device for the hat that uses LIDAR

**Morphological Chart**

1. Sensor GPS with internet with distance sensor that alerts the user through heat differentials and uses a camera to identify objects
2. Sensor GPS with internet with distance sensor that alerts the user through heat differentials and uses scanning and image to text conversion to interpret items
3. Sensor GPS with internet with distance sensor that alerts the user through vibration and uses scanning and image to text conversion to interpret items
4. Sensor GPS with internet with lidar that alerts the user through poking the user’s hand softly and uses a camera to identify objects
5. Sensor that uses GPS with internet that uses a distance sensor and informs the user of possible threats through vibrations and interprets sensory information with a camera.
6. Stick/cane that uses a camera to read street signs and interpret sensory information with a velocity sensor to alert for physical objects and uses a heat sensor to inform user of possible threats
7. Cane with offline GPS using velocity sensors to find physical objects and makes noise to alert user of possible threats.
8. Cane with a GPS that uses downloaded maps, a distance sensor to alert the user of physical objects, uses noise to inform user of possible threats, and interprets sensory information with a camera.
9. Sensor, GPS with internet, velocity sensor, uses noise to inform of possible threats, text to braille for interpret sensory information.
10. Cane with internet connectivity for orientation, detection of short-range objects with distance sensors, altering using noise and utilizes scanning to turn text into user-friendly output.
11. Cane with internet connectivity for orientation, detection of short-range objects with distance sensors, altering using heat and utilizes scanning to turn text into user-friendly output.
12. Cane with internet connectivity for orientation, detection of short-range objects with distance sensors, altering using haptic touches and utilizes scanning to turn text into user-friendly output.
13. Sensor with camera and lidar that vibrates to inform user of objects, while scanning certain objects to PDF to identify text on it
14. Sensor with GPS through internet that has a distance sensor to alert for physical objects, vibrates to inform user of possible threats, and live imaging scanned to pdf for interpreting sensory information.
15. Sensor, camera to read street signs, Lidar, noise to inform of possible threats, live imaging scanned to pdf.
16. Cane with path storage that alerts user of objects found by lidar using vibration, while surveying the area with a camera.
17. Cane with path storage, using velocity sensors, vibrates to inform user, converts information through camera
18. Cane, camera that reads street signs, Lidar, pokes user to inform of possible threats, text to braille to interpret sensory information.
19. Cane, memory storage of previous paths, distance sensor, makes noise to inform of possible threats, text conversion for interpreting sensory information.
20. Sensor, GPS through internet, distance sensor, inform of possible threats by heat, interpret sensory information by text to braille.
21. Cane, GPS through internet, LIDAR, heat to inform of possible threats, interpret sensory information by text to braille.
22. Cane, GPS through internet, LIDAR, heat to inform of possible threats, interpret sensory information by live imaging scanned to pdf.
23. Cane, GPS through internet, LIDAR, heat to inform of possible threats, interpret sensory information by text conversion.
24. Cane, GPS with maps downloaded, LIDAR, heat to inform of possible threats, interpret sensory information by text to braille.
25. Cane, GPS with maps downloaded, LIDAR, heat to inform of possible threats, interpret sensory information by live imaging scanned to pdf.
26. Cane, GPS with map downloaded, LIDAR, heat to inform of possible threats, interpret sensory information by text conversion.
27. Cane, GPS through memory of storage of previous paths, velocity sensor, pokes to inform user of possible threat, camera to interpret sensory information.
28. Cane, GPS through memory of storage of previous paths, velocity sensor, uses heat to inform user of possible threat, camera to interpret sensory information.
29. Cane, GPS through memory of storage of previous paths, velocity sensor, vibrates to inform user of possible threat, camera to interpret sensory information.
30. Cane, GPS through memory of storage of previous paths, velocity sensor, uses noise to inform user of possible threat, camera to interpret sensory information.
31. Cane, GPS through memory of storage of previous paths, velocity sensor, pokes to inform user of possible threat, text conversion to interpret sensory information.
32. Cane, GPS through memory of storage of previous paths, velocity sensor, pokes to inform user of possible threat, live imaging scanned to pdf to interpret sensory information.
33. Cane, GPS through memory of storage of previous paths, velocity sensor, pokes to inform user of possible threats, text to braille to interpret sensory information.
34. Cane, GPS through memory of storage of previous paths, Lidar, pokes to inform user of possible threat, live imaging to interpret sensory information.
35. Cane, GPS through memory of storage of previous paths, Lidar, pokes to inform user of possible threat, camera to interpret sensory information.
36. Cane, GPS through memory of storage of previous paths, Lidar, uses heat to inform user of possible threat, camera to interpret sensory information.
37. Cane, GPS through memory of storage of previous paths, Lidar, vibrates to inform user of possible threat, camera to interpret sensory information.
38. Cane, GPS through memory of storage of previous paths, Lidar, uses noise to inform user of possible threat, camera to interpret sensory information.
39. Cane, GPS through memory of storage of previous paths, Lidar, pokes to inform user of possible threat, text conversion to interpret sensory information.
40. Cane, GPS through memory of storage of previous paths, Lidar, pokes to inform user of possible threat, live imaging scanned to pdf to interpret sensory information.
41. Cane, GPS through memory of storage of previous paths, Lidar, pokes to inform user of possible threats, text to braille to interpret sensory information.
42. Cane, GPS through memory of storage of previous paths, distance sensor, pokes to inform user of possible threat, camera to interpret sensory information.
43. Cane, GPS through memory of storage of previous paths, distance sensor, uses heat to inform user of possible threat, camera to interpret sensory information.
44. Cane, GPS through memory of storage of previous paths, distance sensor, vibrates to inform user of possible threat, camera to interpret sensory information.
45. Cane, GPS through memory of storage of previous paths, distance sensor, uses noise to inform user of possible threat, camera to interpret sensory information.
46. Cane, GPS through memory of storage of previous paths, distance sensor, pokes to inform user of possible threat, text conversion to interpret sensory information.
47. Cane, GPS through memory of storage of previous paths, distance sensor, pokes to inform user of possible threats, text to braille to interpret sensory information.
48. Sensor, GPS through memory of storage of previous paths, distance sensor, pokes to inform user of possible threat, live imaging scanned to pdf to interpret sensory information.
49. Cane, GPS through memory of storage of previous paths, distance sensor, pokes to inform user of possible threat, live imaging scanned to pdf to interpret sensory information.
50. Sensor, GPS through memory of storage of previous paths, distance sensor, pokes to inform user of possible threats, text to braille to interpret sensory information.

**Biomimicry**

1. Bats: Blind, use sonar. Dolphins use sonar to communicate through water. Sonar
2. Mexican Blind Cavefish: Measures through shouting.
3. Star-nosed mole: Feels way around using nose. Much like the white cane is used to feel around but has limited range. Could use a laser ruler

Appendix A

Table A-1: Morphological Chart

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Alert of Elevation | Determine Location | Alert of Physical Object | Inform of Possible Threats | Interpret Sensory Information |
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|  | Camera to Read Street Signs and Other Landmarks | Lidar | Noise | Live Imaging Scanned to PDF |
|  | Memory Storage of Previous Paths |  | Poke | Text to Braille |