A drawing of a front view and back view

Description automatically generatedMechatronics Initial Designs

Battery Power Pack

Strapped Connections

Vest, sitting on the users shoulders

Camera

RGB-D Sensors

Weight, giving user instructions for navigation

Design description

* This is a wearable vest device design that can scan and process its surroundings and map out a safe pathway for the user to walk
* It provides haptic feedback to guide a blind or visually impaired individual safely through their surroundings and reduce the risk of a collision with an obstacle
* Haptic feedback is provided in the form of the weight relays the instructions of the direction that the user has to turn in. If the user needs to turn left then the weight will move to the left
* This doesn’t force but encourages the user to turn left and avoid the obstacle that is in their original pathway, this is an assistive device but also in some ways leads the patients
* Vest it made of synthetic material that can adjust to fit with a variety of users
* RGB-D cameras are positioned along either side of the patients torso, this allows the maximum amount of coverage within the shots
* Camera is positioned on top of the users shoulder, this ensures the widest shot and therefore to best chance of capturing any obstacles in the users pathway
* The strapped connections between each side of the vest ensures a tight fit and that the vest is secure, reduces the risk of movement or the vest becoming dislodged whilst in use
* Battery Power pack in located on the back of the device, providing the necessary power to ensure that the device can function properly for a prolonged period of time

A diagram of a bridge

Description automatically generated

Design Description Script

“This design is a wearable vest device that sits on the users’ shoulders and extends down onto their chest and back. It has strapped connections which ensure that the vest remains tight and secure. It is powered by a battery pack, which is located on the back of the device to ensure even weight distribution. It users a camera and RGB-D sensors to scan the surroundings to identify any potential obstacles in the user’s pathway and map out a safe pathway for the user. The number of sensors seen on the device ensures that the entirety of the users’ surroundings are scanned, avoiding any potential obstacles not being detected. Navigation instructions are given through the weight in the centre. When the user is required to turn to the left the weight moves in this direction informing and prompting the user to move in this direction. The same happens when the user is required to turn to the right. This feature is used to ensure that the safe pathway that has been mapped out is followed, ensuring that the user can be navigated safely.”

Mechatronics Design 3

A drawing of a person's shirt

Description automatically generated

Camera

Vibration motors

RGB-D Sensors

Wired Connections (power to camera)

Wired connections (power to sensors)

Wired Connections (power to vibrating motors)

Power and processing components

Design Description

* This is also a wearable vest device that is a blind walking aid for the visually impaired population
* It uses a camera to gain a picture of its surroundings
* RGB-D sensors are used to scan the surroundings and identify any potential obstacles in the users pathway
* The sensors and camera combine to map out a safe pathway for the user to be guided along, the sensors continue to scan the surroundings as the user moves
* 4 RGB-D sensors are used, 2 on shoulders and 2 at the mid torso level
* This ensures that a wide angle is covered ensuring as high a proportion of the surroundings are scanned as possible, reducing the risk of
* As the surroundings always are changing and some obstacles are moving
* Communication between the device and user is through haptic feedback and specifically vibrations
* Vibration motors are found on the left and right arms of the device
* These relay the information and navigate the user through their safe pathway
* When the user is required to turn left the vibration motor on their left arm will vibrate, this is the instruction to turn left
* The vibration motor on the users right arm will vibrate when they are instructed to turn to the right
* Vibrations for when relaying navigation instructions will occur with time intervals in-between them, each vibration will have a 1 second gap between them and will continue until the user has turned in that direction to the required degree
* Different vibrations will occur when the user is required to stop as there is a direct obstacle in their way, these vibrations will be continuous until the user has stopped, surroundings will be scanned again and a new safe pathway will be mapped out
* The back of the device does not show any of the wiring and covers the whole of the users back, this provides protection for the electrical components of the device whilst also increasing the discreetness of the device (this is shown with the dotted lines on the back view sketch of the device)
* A diagram of a person's body

  Description automatically generatedThis is an assistive device that informs the user of their surroundings and instructs them where the go and what direction to move in

Mechatronics Design 4 notes and ideas

* Sticking with the idea of a discreet wearable device, with the aim of having a device that leads the patient
* Want to identify a way of actually physically moving the patient or putting resistance in to stop their movement in the direction of where there are obstacles
* The method of force control has not been used on the previous designs
  + This is the method of resisting the users movement in direction
* This method of haptic feedback can be used in parallel with the use of other haptic feedback methods
* Have not implemented the adjustable sizing or audio feedback
* Audio feedback is good as a backup and another form of feedback, maximise the different methods of feedback available

Idea

* Exoskeleton device
* Designed to be worn like a coat
* Device operates using the audio and vibrations to provide instructions like previous devices
* Also uses the force feedback, when the user is required to turn left the right side and actuators that are connected to the users arm will not allow the users arm to move to the right and only to the left
* This will force the user to turn in the required direction to ensure they don’t come into contact with the obstacle that has been identified as being in their pathway
* The methods for scanning and detection remain the same as the other devices using a camera in combination with RGB-D sensors
* This device could be extended to include the actuators sat on the user’s legs to even further manipulate their movement

A drawing of a person's body

Description automatically generatedMechatronics Design 4

Vibration motors

Processing components

Battery

Wired Connections (processing and sensor)

Movement control actuators

Force control component

Wired Connection (battery and actuator)

Camera

Strap connections

Straps

RGB-D Sensors

Design description

* This is a more complex device than the previous designs
* It is an exoskeleton device that leads the patient as opposed to the assistive technology that the other devices are
* The design is aimed to be similar to a backpack as shown with the use of the backpack straps and the battery and power components being held on the patients back
* This design enables the fit to be adjustable which ensures that the same device can be used for multiple different sized patients/users
* Design contains one camera and four RGB-D sensors which are connected to the battery and processing components via wires
* Camera produces images which are scanned by the sensors and allows for obstacles to be identified, only issue is the positioning of the camera and sensors as they are low down on the user
* When an obstacle is detected the vibration motors are activated and the if the patient is required to turn to the left then the vibration motor on the left arm will vibrate
* As well as the vibrations the force control actuators will be activated on obstacle detection, the sensors will recognise where the obstacle is relative to the patient and only allow movement in the opposite direction away from the obstacle
* Example:
  + Obstacle detected to the left of the patient
  + Vibration motor on the left arm will vibrate
  + Force control components activated
  + Left arm force control wont allow the patient to move their arm to the left and therefore reduce their ability to turn to the left
  + Force control will move the patients arm to the right signalling to the patient to move to the right
  + Once obstacle is avoided the patient will then be moved by the force control back onto the safe pathway

A diagram of a person's body

Description automatically generated