

## FORESIGHT

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### ABSTRACT

*Foresight is a medical device primarily aimed at providing assistance to the visually impaired people. Foresight does this in a unique way that will bring a new area of development in this subject. Along with its unique navigational assistance it comes with safety features and AI based interface to suit complex lifestyles at its best.*

**Keywords: Touch, Subconscious, Feel, Smart, Assistance.**

### I. Introduction

Foresight is a wearable clothing device which was started as an offering to humanity, and an aim to help people around the world. About 250 million people in the world are visually impaired and according to the World Health Organization this number will be tripled by the year 2050.

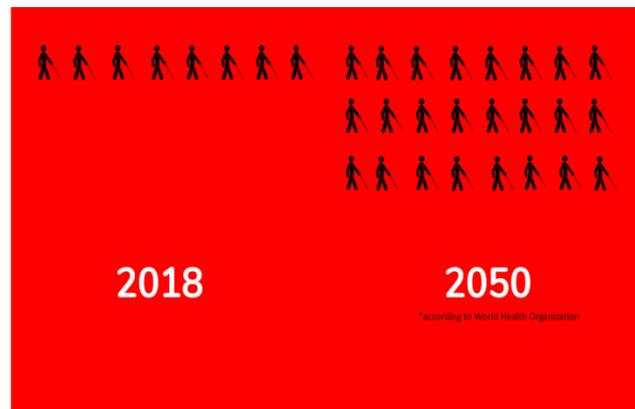


Fig. 1 Statistics: Visual Impairment tripled by 2050

People who have kids or someone with a mobility disability as well have a harder time and require the presence of a person nearby at all times, making it harder for family members to go for work or for a middle-class family to pay for nursing. It comes with no surprise that people have been attempting at helping those who have this disability for a long time, multiple innovative solutions have been designed in an attempt to create something that bridges the gap between the normal and the disabled and fills up the gap of dissimilarity. The reason why we still don't see people use those innovations often tend to fall in the same circle. Thus, the requirement for something that actually serves the purpose. It is quite possible that we have been at it with the wrong "perspective". It is also possible that, we need to do something else entirely.

## II. Literature Summary

First most, what comes to mind when we think of a person who is visually impaired? A navigating stick, glasses, braille, etc. It can be understood easily why the developments have been revolving around these concepts, a smart cane to help navigate, smart spectacles to help people who still have a little bit of sight left, etc. When it comes to navigation all the latest developments tend to aim at replacing sight with artificial vision, which in a way seems like the right thing to do, but it has never worked in helping these people to a larger extent. WHY?

Maybe if we could actually give people vision that would have been so much better, but since we cannot, we try to use artificial vision to guide them. The point to be noted here is that our computers see the artificial vision, and only help guide them, it does not give this sense to them, it remains something foreign.

To be particular about the other issues, we notice them being either bulky, uncomfortable, inhabitable or heavy but most importantly expensive and partial. Everything being developed large firms tend to have peaky prices especially when high quality tech is involved and partial as in, it only serves a part of the problem. Navigation is not the only issue visually impaired people face and if a person has to pay a handsome amount to get an aid for his navigation, why should he/she again have to pay for an assistance in education, locating his/her things, calling for help when lost, etc.

- Braille
- Eye cane
- Robotic Glove
- Assisted Vision Smart Glasses

These are few of the latest developed innovations and fall under most of the categories mentioned.

## III . Solution

Foresight provides multiple forms of assistance, the primary one being the navigation, followed by various forms of smart assistance. Foresight is a form of clothing embedded with technology, along with its other attachments that include a spectacle frame. The clothing device is as light weight as any other clothing material would be and with no disturbances of temperature fluctuations.



Fig. 2 Solution in different stages

### 3.1 Navigation

When it comes to navigating around an area without sight, using a cane has always been the go-to approach, developments have been made for smart canes as well which inform the person of an obstacle before approaching it. Although, the main drawback here is that the cane tells about the obstacles in the direction it is pointed towards, and until the height at which the other end of the cane is, this still leaves a lot of area as a blind spot which does not get covered, artificial vision using cameras and then indicating through some means and guiding has been under development but never a success since a person without sight trusts his/her instincts the most rather than willing to rely to on an AI which may also falter at some time.

Foresight tackles this with a unique approach. People who are blind are able to detect tactile information faster than people with normal vision, according to a study in the Oct. 27 issue of the Journal of Neuroscience. The research was supported by the National Eye Institute and the Natural Sciences and Engineering Research Council in Canada. With the help of this study it can be understood that the sense of touch is prime for visually impaired people. With Foresight's novel approach, we use the sense of touch to give the person a subconscious sense of the complete surrounding. The way to do this is by

- Measuring the distances of objects from different parts and locations of the body independently from one another.
- Then using slight vibrations in the clothing to give a perception of how close a particular object is from a particular part of the body; the intensity of the vibrations increase as the object gets closer and decreases as it goes further away.

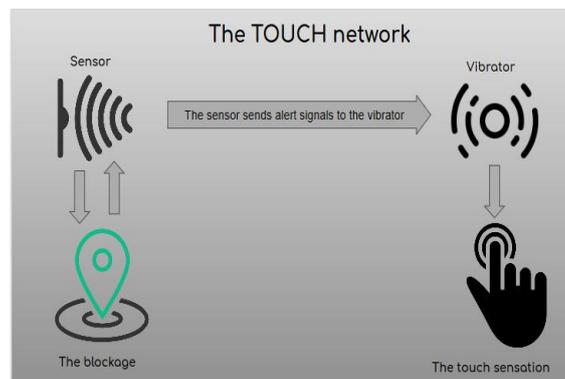


Fig. 3 Navigational network for touch

The main idea is to send out rays from 12 prime locations of the body at set angles and height, to cover all objects at different heights and of different structures laying around at different angles from the person, or if another person is approaching from the side, etc.so as to cover the overall area near and around the body. This is done by incorporating a combination of high precision ultrasonic sensors, IR sensors, lidar sensors, placed individually as per the need on these 12 prime locations that measure the distances of things around at all times.

The 12 prime locations are:

- 2 shoulders
- 2 wrists

- 2 elbow area
- 1 chest
- 1 back
- 2 thighs
- 2 knees

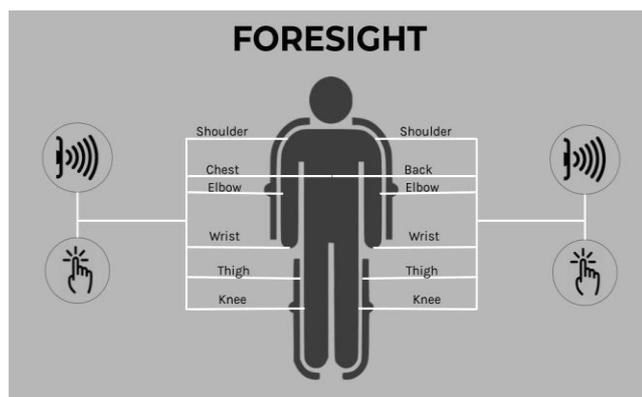


Fig. 4 The 12 prime locations

These locations have sensors attached that are then used to control vibrators in that location to translate the distance using vibration intensity. Depending on the location, the sensors each have one or two independent vibrators for a more complete sense of perception of the surrounding.

The concept of using the prime sense of the visually impaired people to give them a sense of their surrounding in a complete manner has been untouched so far. It might not be as mesmerizing to a person with functional eyes as we have all grown to rely on them entirely, but for a person trying to move, slowly and gently around unknown surroundings without the knowledge of objects around and if they be a little unaware they could collide, it ought to be of great help.

For a deeper analysis of the concept, it can be understood that with practice a person will come to know of things and be able to identify them in a known environment, for example when a person is trying to enter a doorway, and only their right arm and right leg receive a vibration sensation, it will mean only that side of their body might collide, and they can adjust their position accordingly. Similarly, if they are in a room where it is known that there is a table in the center, when they feel vibrations only on the lower part of their body, they can understand it is the table they are approaching. Of course, that will be a helpful case in a known place. Except for this one advantage, it will still be completely helpful in unknown places as well.

### 3.2 Smart Assistance

The other forms of assistance required to visually impaired people, that we are providing with the help of our sophisticated AI which is named "Ghost". This AI helps the person in the form of an assistive person for a variety of tasks. It is attached to the person in the form of spectacles, which hold a camera in the center at the bridge and two earphones attached at the end of both temples of the spectacle to communicate with the person, with a mic at one of the end pieces.

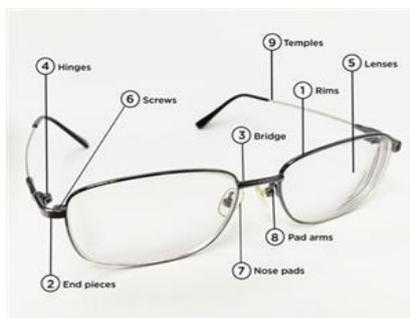


Fig. 5 The parts of a spectacle

The assistance this will provide are as follows:

### 3.2.1 Facial recognition (detecting who is in front)

In a work environment where a person comes across many faces regularly, the camera in this can be programmed to read faces and then save them in memory on command. Similarly, the user can command the AI to save the required face as boss after having a conversation with him/her. The next time the boss comes in front the AI tells the person “your boss is in front of you”. Foresight provides a database to store as many as 50 faces individually. For people who are always only around their known people, if a stranger comes in front, foresight informs them there is a stranger in front.

### 3.2.2 Object recognition and tracking

Misplacing objects and looking for it on your own can be a nightmare as a person with visual impairment, in a household with multiple people, others could also misplace things, even by accident, things could fall off a table. In case of finding something, visually impaired people could just touch it and identify, but for locating it, the camera will identify the objects lying around in its sight and recognize the object it is commanded to look for, then will guide the user step by step to it. Like if a person’s phone has fallen down, the AI can locate it via the camera and guide the person like, x degrees to your left/right and y steps ahead. Apart from this, with the help of machine learning, the AI can track the location of some selected items as well, like a phone or a remote control or keys. The AI sees it in a place and updates its new location every time it sees it again. In case a person forgets where he/she places something earlier, or if the camera even sees someone else moving it around, it can inform the user of the same. If it knows the location it will guide the person all the way.

### 3.2.3 Education- reading/writing

For the people to learn braille and master it, it can take years, and for the to complete their education with their disabilities, many more. By pointing the camera towards a book or paper, the AI can be commanded to read it and will do it using text-to-speech. The reverse can also be done for a person to take notes. A file with a particular title can be created and whatever the person speaks about, will be written as text in the file, which will end and be saved with a specific command which will tell the AI that it does not have to record any text any further and just end the file and save it. A recording of the file will also be saved if in case a word is misheard by the AI, the person can ask to play the audio and listen to it, the audio is temporary and is deleted after a while to free space. The saved text files can be searched using their titles or the date on which they were made.

```
Speak:
You said:who are you
Ghost Said:Sir, I am a machine
Speak:
You said:who made you
Ghost Said:Sir, I was made by Mr.Supravo Ghosh on 16th April 2019
Speak:
You said:take me to the grocery store
Ghost Said:Yes Sir, I can open the map and guide you to the
store, shall I mark it as important?
Speak:
You said:what can you do
Ghost Said:Sir, I can help you in navigation, read and write for
you, find lost objects for you, help you contact with people, and
assist you in your daily chores
Speak:
```

Fig. 6 The Ghost (AI) answering to the user's command

### 3.3 Mobile app

With the use of an app, the visually impaired person's family or friends can take a lot of information. Foresight has an embedded GPS module which will upload its location up to the app by Wi-Fi module. In case the person gets lost in a crowd, or somewhere in the city, they can send a notification to their family/friends asking for help who can see their location and help reach the user. For people with kids mainly and also for others, in case a family member wants to check on them, they can get a picture of whatever the camera on their spectacles is pointing at, for people above 7 years of age the AI will give a notification 5 seconds before sending the picture to not violate a person's privacy. Along with this the app will contain a section where the person's heart rate readings will be shown and based on that the current mood will also be getting predicted, sudden increase in heart rate will be reflected in the notifications tab. Blind people have a higher tendency of getting excited, when they are in some kind of difficult situation, which is forecasted in their increased heart rate, thus it is beneficial to keep track of it. This will be done by a simple biosensor attached in the Foresight clothing.

The app will also receive in case of sudden change in heart rate of the person for their safety and assistance from their family.



Fig. 7 The Foresight1 app available to the user's family

### 3.4 Safety Features

Safety in terms of unexpected potholes or stair cases, walking into a wall, etc. is very essential. The knee area of the clothing comes with a set of straps for each knee. The sensors measuring the distance at the knee will be placed right above the bending portion of the knee. An extra set of sensors will be installed here, angled at pointing towards the floor in front of the person by the distance of a couple of steps. Keeping in mind that while walking the leg will move up and down, a range of data is kept as a threshold to be maintained, in case of an obstacle, the data of distance will decrease from the threshold and in case of a hole or stairs going down the data of distance increases than the threshold. In both cases, the straps in front of the knees get stretched to create resistance in walking. It happens like the vibrations, increasing in intensity as the person gets closer to danger. Sudden resistance might cause a person to trip so it starts with a mild resistance just to give a sensation and then increases with the person approaching the danger.

The clothing of Foresight will come with an embedded biosensor which will serve multiple purposes. People with blindness tend to suffer from anxiety more often. In case they are in a state like that or in a state of panic their heart, rates race up. The biosensor will keep track of their normal resting heart rate and in case of sudden increase or decrease in the heart rate an alert signal will be sent to the app as in to the family who can check on the person. With this feature, if the user is lost or needs someone and goes into panic or anxiety then his/her family will get an alert about it.

### 3.5 Control Panel

This is a small pocket friendly unit with basic controls given to it that the user will carry, while sitting in a location where objects are surrounding them, the sensors may keep sending vibrational alerts, to avoid that it can be just switched off, for a person who is more sensitive or less to vibrational alerts, they can increase or decrease the intensity. Also controls for maintaining the volume of the AI earphones from the spectacles. It will also have the battery of the system and a port for it. Along with the battery cable port, there will be a data transfer port for the saved files to be accessed manually by other people externally. The system will be powered by a set of batteries which will be provided in pair, while one is in use the other could charge and while the other is in use the first one could be charged. With each battery lasting up to 8 hours approximately.

### 3.6 Manual

There comes a manual with Foresight which will contain step by step instructions for a person to get used to it, it will come in audio as well as in text for user's family and friends which will be a part of the app. It will also contain information about how to manipulate the settings of the device for own comfort. Since it can very hard to move from the primitive methods to a new one, people that have done it for a long time might not trust something new at the start. For this scenario, the manual will contain specially designed exercises by professionals, mental and physical exercises both, to get a person accustomed with Foresight and use it with ease.



Fig. 8 Testing model for the hand for touch sensations indicating the obstacles ahead

#### IV. Application

Foresight finds immense application in the medical industry. It is capable of being used by the visually impaired to help navigate their daily lives and bring ease in performing routine tasks. Foresight in its later stages can be combined with other medical rehabilitation devices to help people with multiple disabilities such as those who are both visually impaired and paraplegic (cannot walk).

In the early stages it is preferable to start with schools teaching visually impaired children, because it is at a young age where the mind is more flexible to acquire new things. Schools and hospitals will be the places which will primarily use it and distribute along with an online portal which will distribute directly to the common people.

#### V. Conclusion

It is often that we see a new product in the market for the visually impaired but every one of them turns out to be helping them only in a single manner and comes with excess luggage, is expensive or is hard to adapt. Foresight is a solution to all those issues, coming as a complete setup for assisting in their every need, with lessons for initial adaptation, minimum luggage mostly just clothing and a pocket friendly device and affordable lower-class families. Foresight helps in the basic need of navigation using the disabled's most heightened sense, the sense of touch. It helps keep track of their most important belongings and helps in finding them. It also keeps track of people's faces who might be frequent to come across the person. It helps in education and also has a mobile application to make things a lot easier for the person's family members.

The safety features included in Foresight are meant to keep them from obstacles harm and also help them when they cannot find their way and feel lost. It has a control panel for personal customization and also a manual with lessons to be followed for the initial month to get accustomed to the entire system.

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