Hwa Chong Institution

《Project Lifesaver》

Group 11-04

Written Report

Group Members:

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Abstract:

Accidents that happen by collisions may be due to inability to detect incoming threats or distraction from threats by their mobile devices .This may happen to groups like the visually impaired or mobile phone addicts. Awareness of threats may be increased by invoking the sense of touch. A coded raspberry pi that uses cameras and is coded so that it is able to differentiate between dangerous objects hurtling towards you or normal people you are passing by in a crowd. It is encased in a custom pair of glasses which is wearable and provides charging and the wiring of the raspberry pi 3b+.It has a few flaws, such as the process to start the program is lengthy and the calculations of the processor is sometimes not accurate . These flaws could be fixed if we were given more funds and time. This would be able to save more lives.

Introduction:

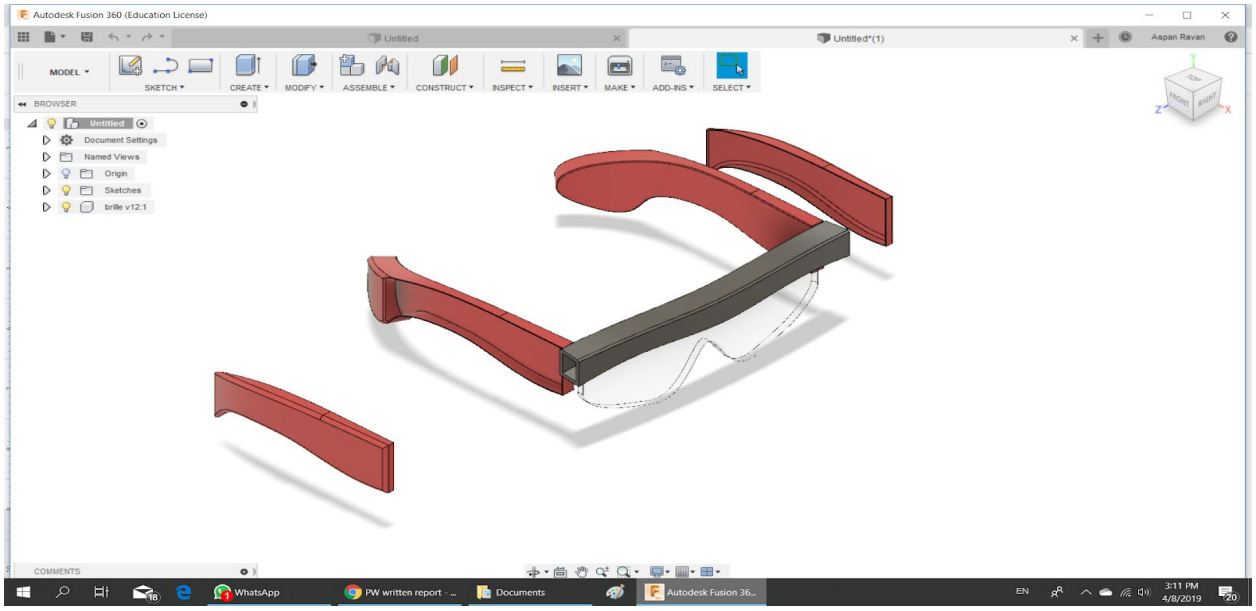
Since mobile phones have become a huge part of our lives, texting-while-walking has become something that we see on a daily basis. Researchers have found that, over a decade's time, texting and walking have caused more than 11,100 injuries. In fact, according to the National Highway Traffic Safety Administration, pedestrian deaths numbered increased to 5,376 due to texting and walking. 78 percent of American adults believe that distracted walking is a serious issue—but only 29 percent owned up to doing it themselves. While many people recognize that texting while walking is not a great idea, they are still not able to detach the two activities. Another piece of evidence would be that from 2013 to 2018, the number of accidents from using phones has skyrocketed. More than 1,500 pedestrians landed in emergency rooms in 2010 because of accidents sustained while texting and walking at the same time — up nearly 500% since 2005, according to an Ohio State University study. Rushdi Alsaleh, a PhD candidate in civil engineering at UBC had said that phones account for 10% of pedestrian injuries, and a half-dozen deaths a year. So far, there had been no similar small scale products similar to this, only, huge and major projects such as a lane only for phone users, a stretch of sidewalk in Chongqing, China, where there is a lane specifically designed for people to be using their phones while walking. Other pedestrians and vehicles are not allowed on this lane. Thus, this project would be one of a kind as it is one which would alert the user when he is approaching danger. This would definitely also be immensely helpful in saving people's lives.
Furthermore, this is also useful for the Blind. It is a way to notify them if there is something in front of them in which they are going to walk into or if there are dangerous objects such as cars and walls in which they would knock into if they keep walking. Thus, we hope with this, that fewer accidents will happen involving the blind knocking or getting knocked because they were unable to see what is in front of them. Official

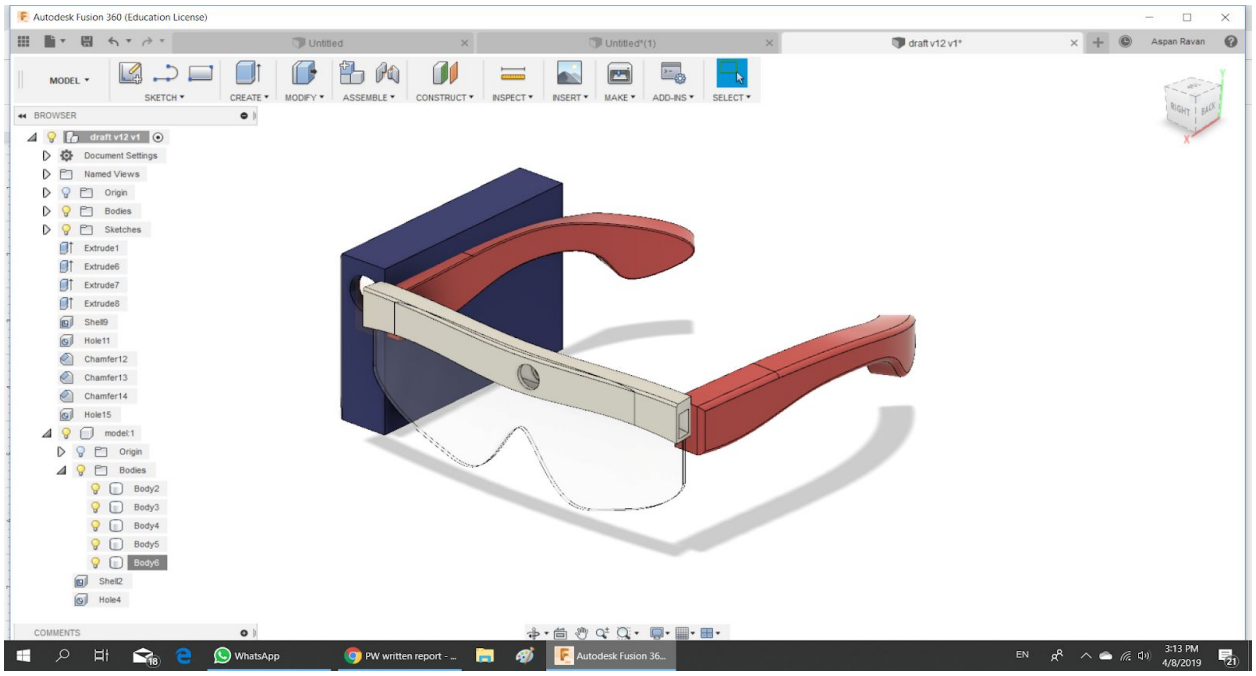
statistics from the World Health Organization states that there are about 285 million visually impaired persons in the world up to the year of 2011, about 39 million are completely blind and 246 million have weak sight. However, there are already a few similar objects in the market such as the There a few similar solutions available, such as OrCam MyEye, which is an intuitive portable device with a smart camera mounted on the frame of a person's eyeglasses. The device uses the power of Artificial Vision to assist people who are living with vision loss. They are interactive glasses for blind people to "see" their surroundings in daily life. It can read texts, recognize faces, and identify products. However, this cost around $5000 USD, which is much more than what people can usually afford. Another example, of smart glasses, called eSight3, help people suffering from eye conditions to "see". However, the eSight3 glasses are also really costly, with a price tag of about $10,000. The current project we have made has only cost us around $250 SGD, which is not cheap but reasonably priced as compared to the other examples stated above. This is also a price that people should be able to afford.
Both target audiences are facing the same problem and project lifesaver is going to solve it. The current solutions for the mobile phone addicts are huge and unapproachable while the current solutions for the blind are definitely costly. With project lifesaver, we would be bringing you a cheap, small-scaled project that would solve the problems of both the mobile phone addicts and the blind.

4. Solution Design:

4.1 intended solution for the problem

Firstly, a pair of glasses would be the best choice as this would be more convenient and easier than placing it on a hat or attaching it to your clothes. Another advantage of this would be that users would be able to alter the degree of the glasses to match their own. For those who are not wearing glasses, they can just have a transparent piece of glass there. However, for this project, there were a few difficulties, such as deciding to 3-dimensions printing the custom shell of the glasses or moulding it. Another challenge was choosing the right material for the frame and also finding a way to attach the raspberry 3b+ , camera and buzzer, etc onto the glasses frame. At first, 3-dimensional printing the shell of the pair of glasses and then wiring the inside seemed like the best way to go about doing this project.

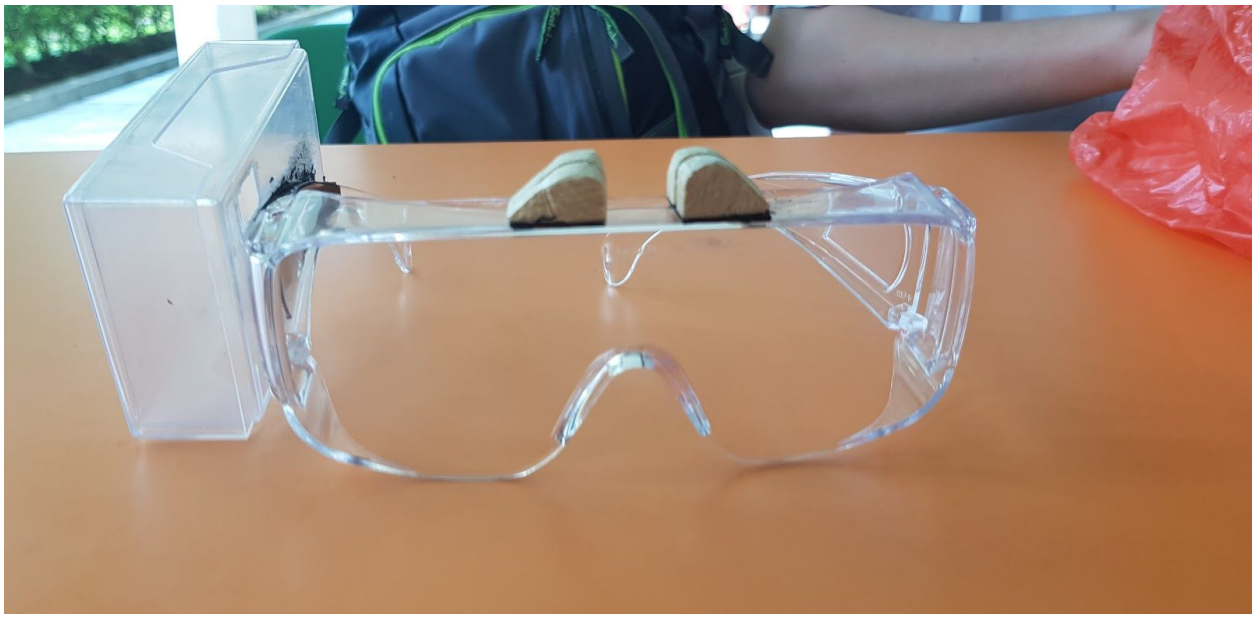


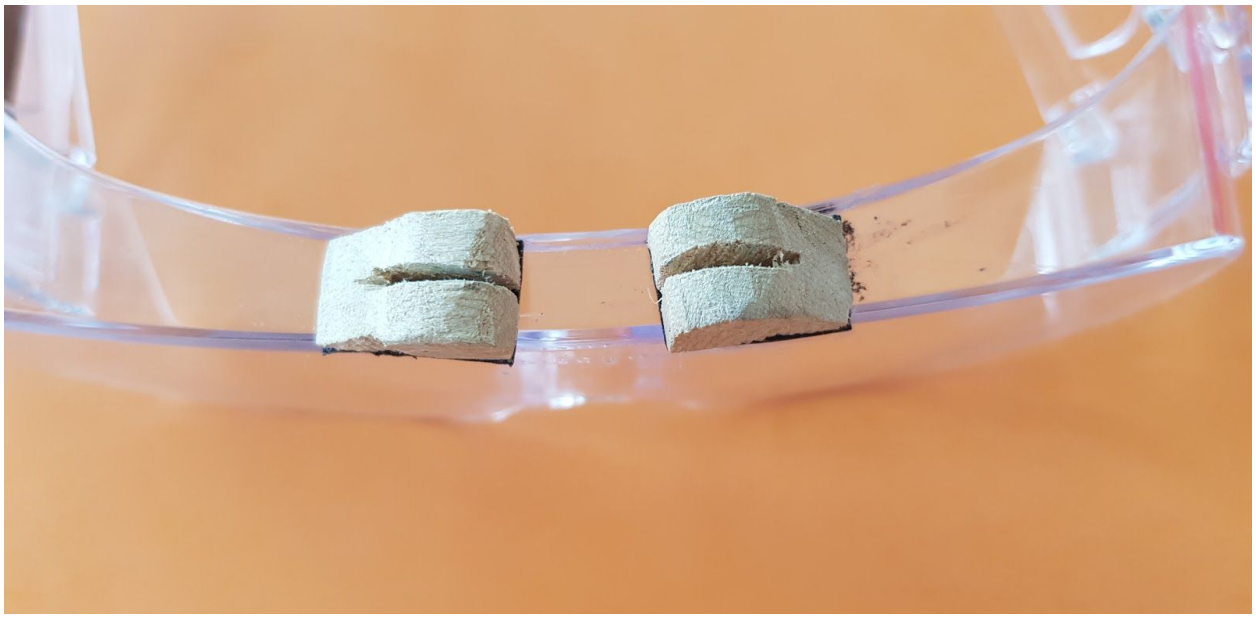


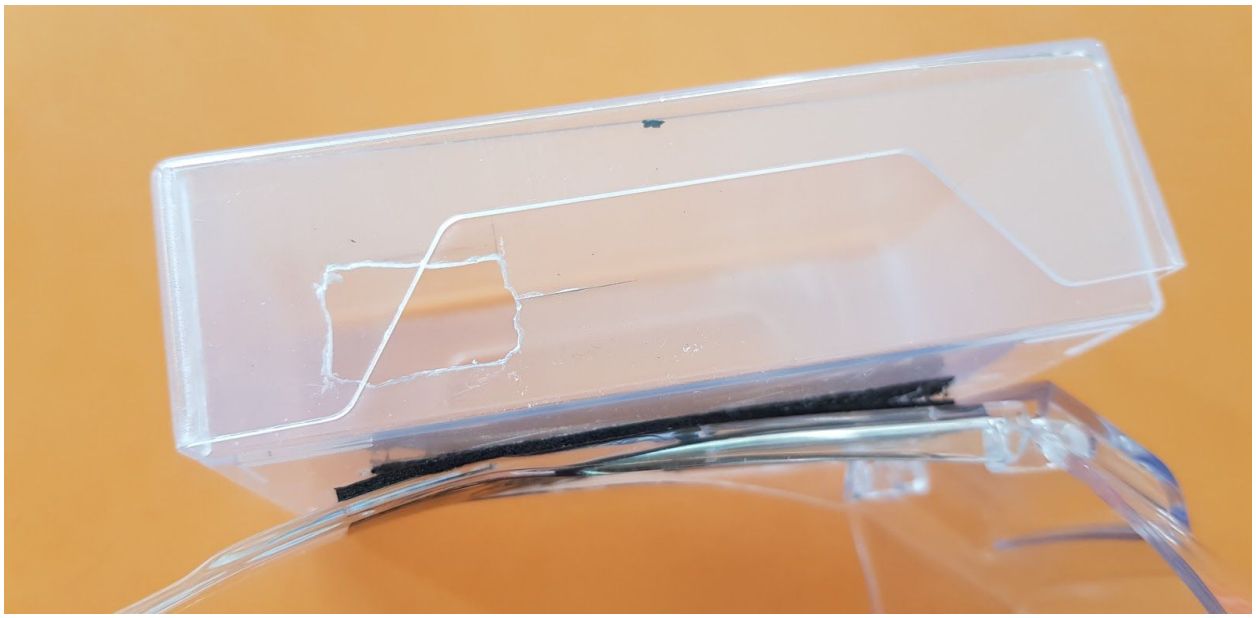
(drafts of our original ideas)

However, this is not feasible as firstly, it is not possible to 3D print a transparent material for the lens of the glasses. If we were going to 3d print it, we would have needed to mould a piece of glass to fit the dimensions and size of the lens and then 3d print the shell of the glasses without the lens. Furthermore, because of the streamlined shape of the custom pair of glasses, a lot of extra stabilizers and support beams would be needed to be printed so that the pair of glasses would be printed correctly. This

would be a huge waste of materials. Thus, in the end, using a moulded pair of glasses with custom modification seemed the best. We needed to make sure that it has the functions that we originally need from the pair of glasses. A pair of science lab safety glasses was modified according to our needs. A small box about the size of the raspberry pi 3b+ ,which had two holes drilled, one for the wires of the camera and buzzer, and the other for the charging wire. This box would be placed on one side of the pair of glasses. The box was just the right size that the raspberry pi 3b+ could be placed inside without the processor shaking or moving around too much, which might affect some of the coding or functions. We also made two holders out of wood that had a slot in the middle ,that was placed on the top of the pair of glasses to hold the camera in place so it functions properly and would not drop. I think this is a great design that solves many of the problems that we had at the start of the project. However, one criteria that we set which we did not manage to solve was the ability to switch out lens so that user could alter the pair of glasses to whatever degree they are. However, this is generally solved as we used a pair of science lab glasses which is generally bigger than the normal glasses size so people would be able to wear their normal spectacles under our model.





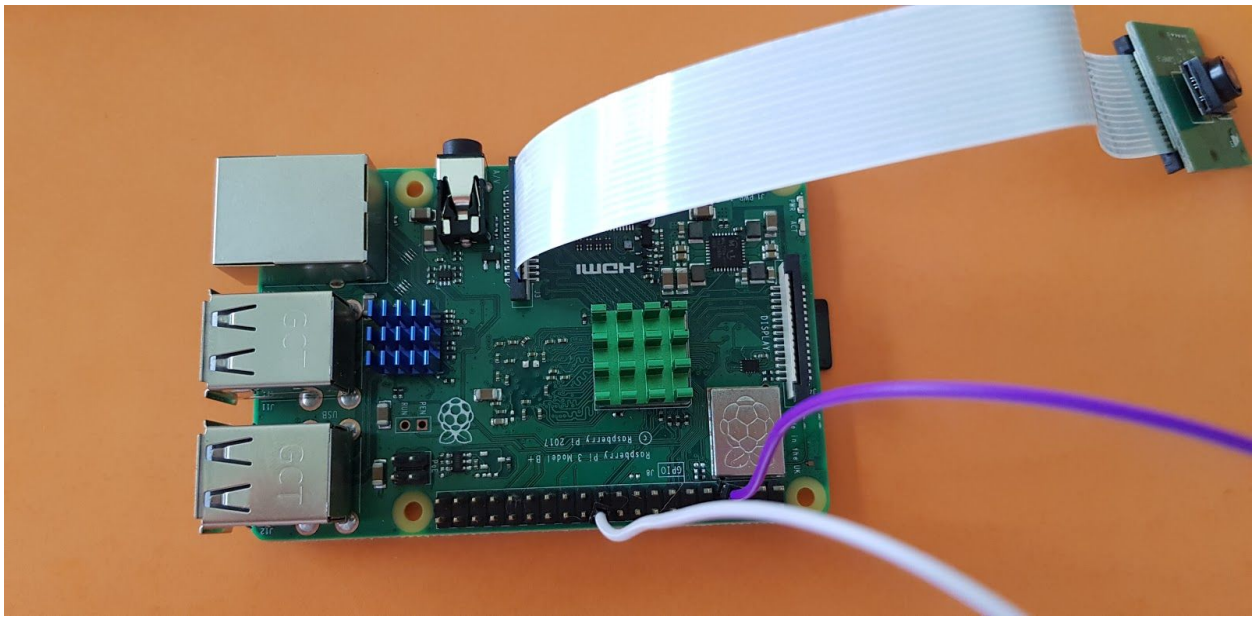


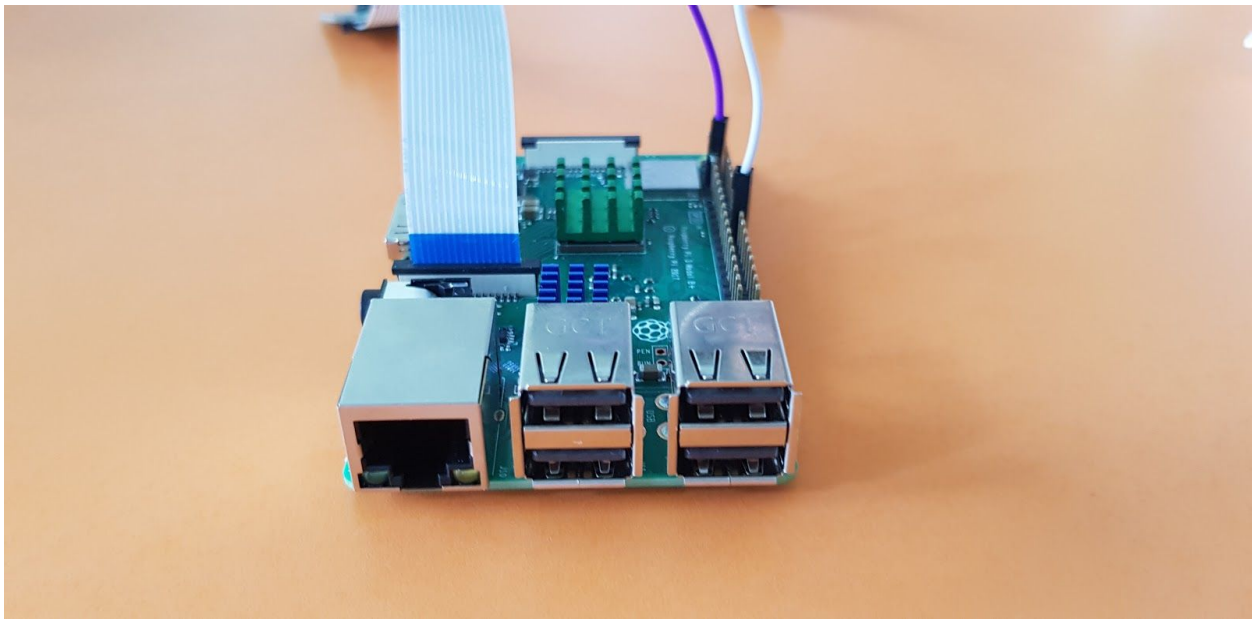
(our current and finalised design)

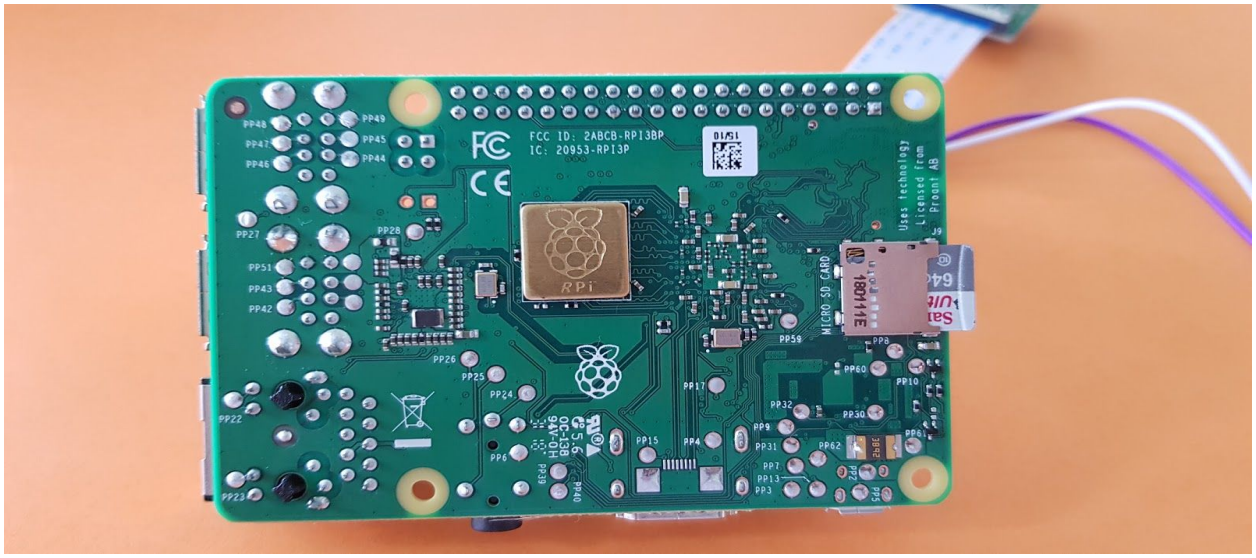
4.2 Technical Description

Project Lifesaver is a pair of glasses integrated with cameras, a processor and a vibrator to identify threats for potential collision and alert the user the direction of the threat through the sense of touch.
A raspberry Pi 3b+ was used as a processor for the Project Lifesaver. Cameras attached to the raspberry Pi would serve as the input sensors. A code would be written to identify potential targets that are approaching the camera. The processor would then be able to detect objects. So far, we have taught the Raspberry Pi 3b+ to recognise up to 30 different objects.The processor would then calculate the average human reaction

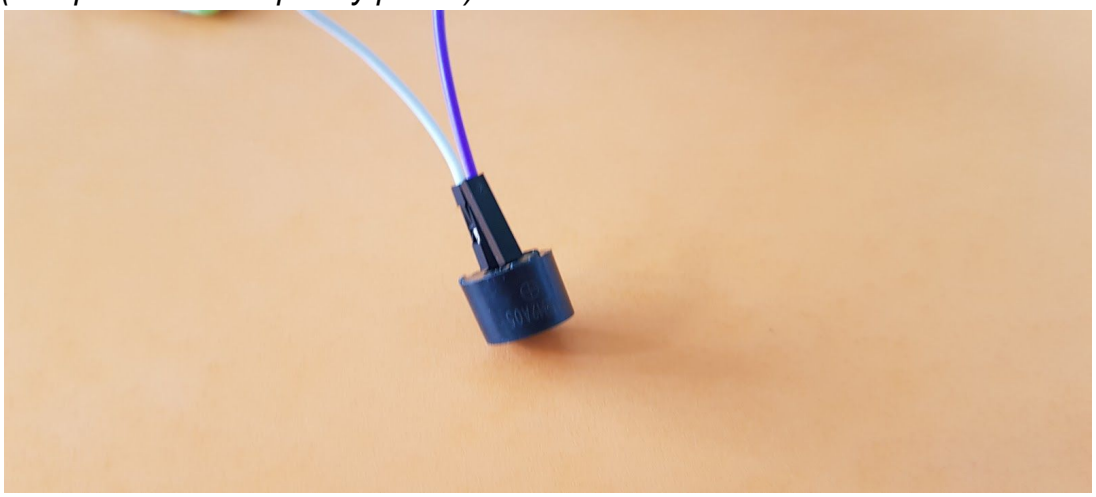
time + the time needed for the wearer to react + the velocity of the object going towards the wearer or the speed of the wearer who might be walking into an object. Based on the result received, when potential collision is ascertain, the processor would send out a signal to vibrator and activate it.
There should be a total number of 4 cameras and 4 vibrators installed on the front, left, right and back of the glasses. A 4 port camera adaptor would be needed to allow more than 1 camera to be attached to the raspberry pi 3b. Power unit for the raspberry Pi would be an external unit like a power bank. This was our original plan. However, due to the shortage of funds and times, as well as the processor not being able to process such complicated codes, we have decided to only have 1 camera with one buzzer at the front of the pair of glasses.



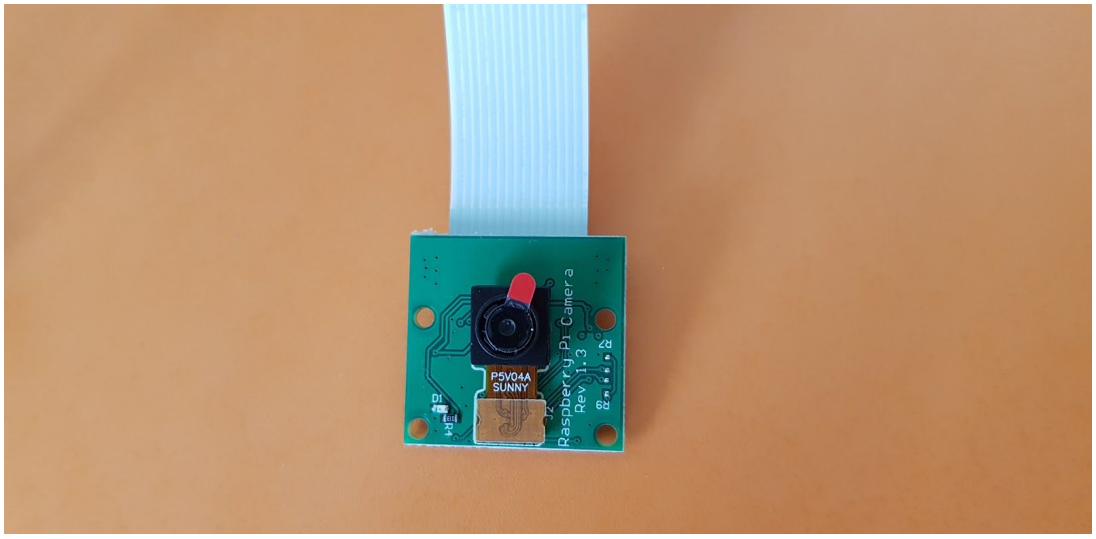




(The processor: raspberry pi 3b+)



(the buzzer)



(the camera)

4.3 Method of testing and Implementation.

Testing for positive
- Switch on Lifesaver
- Object approaches Lifesaver from the front.
- Front vibrator activates.

Testing for negative
- Switch on lifesaver
- Object remains stationary / moves away
- Vibrators does not activate

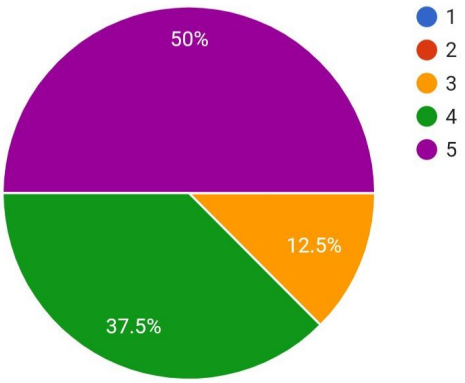
Volunteer test subjects to put on the pair of glasses and be blindfolded, letting their sense of touch to guide them.
They would walk around the school campus, going through a variety of different obstacles, such as through narrow corridors, dark rooms and even down the stairs.
A survey form was filled out at the end, firstly letting then rate the project from 1-5, then letting them answer and give reason for why they liked or disliked it.

Results and discussions:

5.1 Test results based on 4.3, the method of testing

Maybe make it be able to see in the dark
Does not sensor multiple objects, maybe make bussibg louder
Does not buzz sometimes
No improvements needed, it is already a great project that works well!
-NIL-
No night vision- did not get alerted in the dark
Maybe make it look nicer
Sometimes it does not work

(answers to the question:what are some places that could be improved?)



(Answers to the question: how would you rate this project from 1(lowest) to 5(highest))

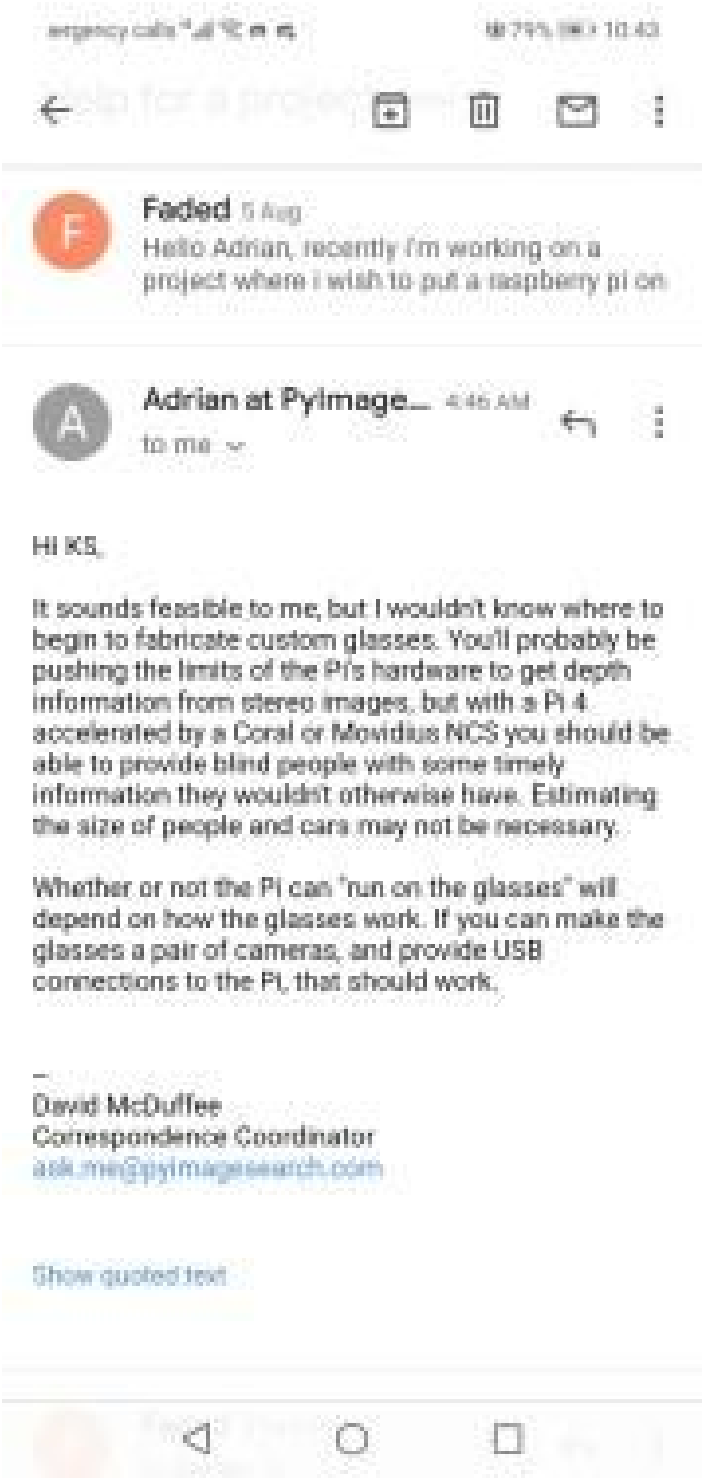
Based on the results above, project lifesaver is quite successful, with 50% of the people giving it 5/5and 37.5 % of the people giving us 4/5. Unfortunately, there are 12.5% of the people that only gave us 3/5. However, something to take note is that we only tested this on 16 people, as each test already requires quite some time to do. Above is a picture of some of the comments when we asked them if there was any aspect of this project that needed improving. Some of the results we got include buzzer not sounding or malfunctioning, and the fact that this does not work well in the dark. Regarding the comments, one of the most major problems that we are facing would be that the buzzer does not work some of the time. This is a huge problem that we hope to be able to solve as the user would not be able to get alerted without the buzzer and this would make it quite dangerous for users. However, one of the main reasons that the buzzer did not work was because of the large code file required for the project and the system would sometimes crash when it is on that step. The processor and buzzer is not able to process such a large file and crashes some of the time. However, the coding does work on a virtual but exact processor to the one we are using as there are unlimited resources and space on the virtual raspberry pi 3b+. To solve this problem on the actual model, we can either get a new processor that can cope with larger files, or shorten and cutting down some parts of the file by removing some elements of it. Both does not seem possible in such a short period of time and would require more resources to achieve, so unfortunately we would have to let this element go for now. Other than this, most of the coding is finished and the project is working fine.

5.2 Limitations to Project Lifesaver

- Setting up the programme takes a lot of time
- Accuracy of the calculations

Firstly, the system runs on Convolutional Neural Network (CNN), which is an image classification system that takes an input image, process it and classify it under certain categories (Eg., Dog, Cat, Human,tree). Computers sees an input image as an array of pixels and it depends on the image resolution. This system requires the user to charge the raspberry pi, connect it to a computer which has HDMI connectability, and then enter a few lines of code before the processor can even start starting up. This means that it is a lengthy process to start the program for object detection. Another limitation that would be that the calculations of the distance between the object and the user may not be very accurate as we are using only a camera to detect the speed of the object,without any professional sensors,with only 1 fps, thus it will be workable, but not really top quality stuff.

Attached below is a screenshot of a gmail we sent to a professional coder regarding the feasibility of this project. He recommended using raspberry pi 4 as it has a faster processing speed and faster ram,coupled with the Movidius Intel Compute Stick, can give the GPU a faster processing time, thus reducing lag and delaying of reaction. A faster ram on the raspberry pi would also mean that the results could be calculated faster and more accurately. However, since the raspberry pi 4 has not been released in singapore yet, we could only use the next best option, a raspberry 3b+. Thus, if we have the newest raspberry pi , raspberry pi 4, releasing in September, we would be able to solve many of the problems we are facing. This may even solve our problem with the buzzer as the faster processor might be able to run the programme faster and more efficient without crashing.



Faded 5 Aug

Hello Adrian, recently I'm working on a project where i wish to put a raspberry pi on

Adrian at PyImage... 4:46 AM

to me

Hi KS,

It sounds feasible to me, but I wouldn't know where to begin to fabricate custom glasses. You'll probably be pushing the limits of the Pi's hardware to get depth information from stereo images, but with a Pi 4 accelerated by a Coral or Movidius NCS you should be able to provide blind people with some timely information they wouldn't otherwise have. Estimating the size of people and cars may not be necessary.

Whether or not the Pi can "run on the glasses" will depend on how the glasses work. If you can make the glasses a pair of cameras, and provide USB connections to the Pi, that should work.

–
David McDuffee
Correspondence Coordinator
ask.me@pyimagesearch.com

Show quoted text

(the email to professional coder, David McDuffee)

Conclusion:

In conclusion, this project would really be helpful and would really make life easier and safer for a lot of people. Hopefully, fewer people will get injured. No matter if it is the people using their phone while walking or the blind, life is precious, so we will try to save as many lives as possible. Although we only have a coded raspberry pi 3b+, a camera and slightly malfunctioning buzzer at this point of time, with more time and more funds, we hope to be able to have a working camera and buzzer on all 4 sides of the glasses so the respectable buzzer on each side would be able to inform the user which direction the threat is coming from instead of only in the front.

Some recommendations: it should not be dropped, and should not be partially or fully submerged in water. It should also not be placed in locations that are too cold or too hot
Some limitations: of course, so far, it only detects objects right in front of you and does not detect objects as well during the night or in dark rooms. It also does only detect up to a certain speed and does not do well in crowded conditions.

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Acknowledgements:

Firstly, we would like to thank our project mentor, Mr Fong, for always being patient with us along this long way we have come; for tolerating us no matter how many disagreements and arguments we have; and of course, for agreeing to mentor this project at the start of this year. Without Mr Fong, this would not have been made possible

We would also like to thank our parents, for their immense patience with us, and also funding this project even though it was not cheap and when we were not even sure if it would work.

Of course, we would also like to thank the judges for their valuable feedback which made our project improve, as well as the students who had helped us test and given us feedback

We would also like to thank the school for giving us this opportunity to do this project, as well as everybody from the school who has helped us in this one way or another-the science research centre staff which helped us formulate,and even our form teacher and classmates who had been extremely supportive along the way.

A big thank you to everyone