نموذج تفاصيل المشروع

Project Detail Form

عنوان المشروع بالعربي

Project Title in English

تحذير Warning

الرجاء عدم تضمين أي معلومات شخصية عنك

Please do not include any personal information about yourself

ويشمل ذلك الصور الفوتوغرافية والأسماء

including photographs and names

القسم 1: مقدمة
SECTION 1: INTRODUCTION

(على سبيل المثال، المشكلة ومدى تأثيرها على المجتمع)
(e.g., The problem and the impact of the problem)

Blind people suffer from many troubles, one of which is difficulty in finding small objects. They cannot locate household items without frantically searching and feeling everywhere, and it is a major disturbance to their lives. The impact is large, as they cannot live in normal surroundings without losing valuable belongings, and instead live in places they specialized for this function.

Across the world, more than 253 million people are visually impaired, including 36 million people fully blind (as of 2015).[1] That's 3.45% of the total world population (population was 7.33 billion in 2015). Similar percentages are visible in Saudi Arabia; 7.8% are visually impaired and 1.5% are blind.[2] The effort it takes to lead their lives with this common impairment is very large, not only in searching for small objects but other daily occurrences such as walking, eating, and working.

For a more personal result than the scientific sources, I decided to look at the personal experiences of a blind person suffering from this issue. The best place for this was Quora, an online question and answer website, where I found blind people chatting about the topic. In a question, "What are the difficulties in being blind?" Aaron James answered:

"Transportation is something I find difficult. Staying employed is something I find difficult. Keeping a roof over my head and food in my fridge. Finding and staying in a relationship.
The thing is, I am not having trouble with this because I am blind.
I'm having trouble with this because of a system that treats disabled folks like nothing.
I cannot keep a steady job because sighted persons don't always give me a chance. They think it'll take a lot to make jobs accessible to blind folks. They think that we'll mess things up, or get in the way." [3] Another response to the same question was written by a user named Blue. [4]

"

My mother was a nurse. She helped people around her.

When I was small, one summer day, she came home with a kid same age as me, asked me if I could 'spend sometimes with this friend,' I said sure, and before she went back to work, she told me: 'your friend couldn't see anything, so you need to be creative playing with him'.

A bit awkward silence, then he told me: 'You don't have to stick around me, I'm here just because my mom and your mom think you will be my friend, but I'm no fun, nobody wants to be stuck with me, I know. You can go to do whatever you want, don't mind me.' He seemed sad, so I told him, 'Why don't we try to be friends first?', so we did.

It wasn't easy. We couldn't watch TV, we couldn't run around, we couldn't draw. All the games I knew, he couldn't join. I decided I read to him.

He asked me about literally every single thing in the book. What's an ant? What's different between red and blue? What's a rainbow? I explained to him. Then, after that, I tried to close my eyes and imagine if I could pretend to be him to "view" things as him, and I realized, I couldn't because I already had vision of things.

I asked him, 'what's it like, not being able to 'see'?'. He told me, he didn't see. He didn't understand what 'see' means. He knew he got eyes on his face, but for nothing, 'just for decoration' - he said. I asked him if it's difficult living his life? 'My life has been always the same. It's not difficult for me, but seems difficult to my mom having a blind kid, and seems difficult to other kids to be friend with me'

I read to him the whole summer. By the end of the summer, he told me: 'I think I can see now. I can see your voice reading to me. It's the best voice'

He moved away with his mom after that. I've never seen him again, but I believe he is living a good life somewhere.

"

Another conversation highlights the specific problem at hand, difficulty in finding possessions. Janice Strange and Igino Cafiero, two people suffering from blindness, chatted about their 'feeling methods' and how they specialized their home to accommodate this issue.[5] In a question on Quora, "How do blind people find objects they've lost?" Janice Strange answers:

""

I start yelling for my husband LOL

But seriously. When searching or cleaning, the blind are taught to use a grid pattern. This may explain why I clean as I search.

For example:
I start in the upper left hand corner of the living room by the fireplace. I work my way across the back wall. I then move 2 feet down and work my way back to the right towards the fireplace again. I go left to right, then right to left until my living room is covered.

Of course, I only do the grid pattern after I have searched all the normal places for the object. Even then, I do a smaller grid with my hands.

Most blind people have a spot for everything. I personally have bins and baskets around my house for small objects (even in drawers). Large objects are always put back in the same place. Everyone who knows me knows to put the objects back where they found them because even 6 inches can cause me to lose things.

Therefore, if you ever go to a blind person's house or office, do not move anything.

"" Igino Cafiero responds to her answer, asking her if she "does a spiral pattern or other sort of search pattern," to which she responds:

""

I only spiral outward when there is an object to spiral out from. But generally it is easier to do a grid search.

""

While the experience of a few individuals lacks the scientific accuracy found in formal research papers, it is vital in the process of reviewing the problem and its impact, and in any review process that involves a user experience. It gives us valuable insight on the emotional and practical experiences of users from a rare first person point of view, and helps us understand the potential impact of the research on the users' lives. Here, we understand Janice Strange's troubles that she shares with Igino Cafiero, specifically in locating small objects, and the inconvenience with the current 'feeling methods' they use. This inconvenience is not just existent in Strange's and Cafiero's lives, but also in the lives of the 253 million visually impaired people all over the world.

القسم 2: مراجعة الأدبيات
SECTION 2: Literature Review

(على سبيل المثال، مراجعة الأدبيات والخلفية العلمية)

(e.g., Literature Review and Scientific Background)

I will start off by saying there are no papers regarding technology for the assistance of the visually impaired in finding small (handheld) possessions, or anything somewhat similar, however a different concept that uses similar mechanism is walking guidance for the visually impaired. This technology is already heavily researched, engineered, and produced, as any blind person can purchase a walking guidance system online. Some examples of these systems are the WeWalk Smart Cane and Biped.[6] However, research on guidance for the search of small objects has been completely neglected, although it is a daily struggle for these people.

For a more personal result than the scientific sources, I decided to look at the personal experiences of a blind person suffering from this issue. The best place for this was Quora, an online question and answer website, where I found blind people chatting about their “feeling methods” like inward spiral, outward spiral, and grid, and which one that they preferred.

What they called a “feeling method” was how they move their hand across a table to feel for the object (did they prefer moving their hand in an inward spiral movement or an outward spiral movement?). The blind people on Quora also spoke about how they specialized their surroundings to their assistance.

A common method is separating often used objects with a large space, or putting each object in the corner of the room so it is easy to locate, like putting their bottle in a corner and their AC remote in another.

A conversation between blind people chatting about their ‘feeling methods’ and how they specialized their home occurs between users named Janice Strange and Igino Cafiero.[5] In a question on Quora, “How do blind people find objects they’ve lost?” Janice Strange answers:

“

> *I start yelling for my husband LOL*
>
> *But seriously. When searching or cleaning, the blind are taught to use a grid pattern. This may explain why I clean as I search.*
>
> *For example:*
>
> *I start in the upper left hand corner of the living room by the fireplace. I work my way across the back wall. I then move 2 feet down and work my way back to the right towards the fireplace again. I go left to right, then right to left until my living room is covered.*
>
> *Of course, I only do the grid pattern after I have searched all the normal places for the object. Even then, I do a smaller grid with my hands.*
>
> *Most blind people have a spot for everything. I personally have bins and baskets around my house for small objects (even in drawers). Large objects are always put back in the same place. Everyone who knows me knows to put the objects back where they found them because even 6 inches can cause me to lose things.*
>
> *Therefore, if you ever go to a blind person's house or office, do not move anything.*

” Igino Cafiero responds to her answer, asking her if she “does a spiral pattern or other sort of search pattern” to which she responds:

“

> *I only spiral outward when there is an object to spiral out from. But generally it is easier to do a grid search.*

”

While the experience of a few individuals lacks the scientific accuracy found in formal research papers, it is vital in the literature review process, and in any review process that involves a user experience. It gives us valuable insight on the emotional and practical experiences of users from a rare first person point of view, and helps us understand the potential impact of the research on the users’ lives.

I’ve found similar results on other sources such as Reddit, Twitter, and an interesting personal blog; lifeofablindgirl.com.[6]

القسم 3: الأهداف

SECTION 3: Objectives

(على سبيل المثال، أسئلة البحث، والغرض من البحث والأصالة و/ أو الفرضية)

(e.g., Research Questions, Purpose, Novelty, and/or Hypothesis)

The research question is:
How can the blind person's difficulty in locating handheld possessions be reduced/eliminated using object recognition, object size relativity and computer vision?

The end objective is to reduce the blind person's difficulty in searching for small objects and allow the blind person to live in normal surroundings. The user/blind person would be assisted completely so that the user can find the object immediately. This will be done by building a device consisting of a microphone/speaker fitting in the ear as an earbud, and a camera fitting either on the bicep of the person's right arm or as glasses. 100 of these devices will be built. Then, a 'study' will be performed as an evaluation of the device on 100 blind people, recieving feedback and survey answers from each person.

I hypothesize that this will reduce the person's difficulty in searching for possessions as well as allow the user to live in normal surroundings. I hypothesize that the user will be able to orient himself/herself with the surrounding possessions comfortably using the device.

The surprising fact is its novelty. As previously emphasized in the first paragraph Section 2: Literature Review, there is no or negligible research on assistance in locating small object for the visually impaired to be found. It, quite simply, has never been thought of before. This gives the gives the project 100% novelty, researching in an area not pioneered ever before.

القسم 4: المنهجية
SECTION 4: METHODOLOGY

(على سبيل المثال، المتغيرات والضوابط والمواد والإجراءات وطريقة التقييم/النموذج الأولي)
(e.g., Variables, Controls, Materials, Procedures, and evaluation method\prototype)

The entire design consists of two parts with multiple components:
- An earpiece consisting of a microphone and earbud.
- A wide view camera and processor fitting either strapped on the user's bicep or as glasses.

The internal system is designed to provide the user with directions formatted as military clock direction (12 o'clock would be up, 3 o'clock would be left) and centimeters forward as a response after hearing the commands through microphone at the earpiece. Before getting into the more complex technological aspect of it, the user point of view will be demonstrated first.

USER EXPERIENCE POINT OF VIEW

*** The device has a name (like Siri or Alexa) that we'll call Finding Buddy for now.*

I say, "Finding Buddy, where is my bottle?"

The device hears the keyword 'Finding Buddy' and begins to run a transcription model on the following dialogue, "where is my bottle?"

From there it removes all the words except nouns in the string, leaving "bottle" and runs an OR model. If it is not identified, it returns the audio "No bottle in this perimeter" to the user.

If it is identified, it runs another OR model specialized for the user's right hand. Calculations are run (described in Advanced Device System I posted previously) and it returns this audio every 3 seconds:

"7 o'clock, 40 cm," I hear from the earbud/microphone piece. I move my hand in a downward, slightly to the left, and forward motion.

3 seconds pass...

"5 o'clock, 10 cm." I grab it.

The device now calculates the distance between the user's right hand and the object as 0 (or less than 5 is fine). It now breaks the loop, stopping the audio that was repeating every 3 seconds.

It is now pending for the next "Finding Buddy."

Advanced Device System

The way it works is it finds the direction (as coordinates on the grid of the camera's frame) and the distance (using the average length/width per distance method) of both the object called and the user's right hand. It will use an OR (object recognition) model, such as YOLOv5 [6], to find the four corner coordinates of a rectangular border drawn around the identified object, relative to the center of the camera's frame as (0, 0). It will then run another model (more advanced) specialized for the user's right hand, and find the same corner coordinates of it. Some basic algebra does the trick for finding out the midpoint of both the object and the hand, as well as the length and the width, which we can use to figure the depth from the camera using trigonometry and the average size of the object.

Then, and this is the advanced technological part, is it "changes point of view" from the camera to the hand, figuring the distance and direction between the hand and the object, as it now already has the midpoint of both and the distance between them and the camera.

Once it reformats the values (distance between eachother and coordinates) as military clock direction and centimeters forward, it will send it to the earbud component using an MQTT [6] server, or any other iOT method of the like (this must be done since there will not be a wire connecting the camera component and earbud component, for the sake of the user's head mobility).

The performance of the device and how it aligns with the problem and hypothesis will be evaluated through a study of 100 blind people using the device for an entire month, and how their life has been impacted by it. When the month is completed, they will fill out a survey and the evaluation will start from there.

القسم 5:النتائج
SECTION 5: RESULTS

(على سبيل المثال ، الجداول والرسوم البيانية وتحليل البيانات و/ أو الإحصائيات)

(e.g., Tables, Graphs, Data Analysis, and/or Statistics)

ضع النص الخاص بك هنا إما باللغة العربية **أو** الإنجليزية- إن وجدت نتائج -

Put your text here in Arabic or English - if you have results-

القسم 6: التفسير والاستنتاجات
SECTION 6: INTERPRETATION & CONCLUSIONS

(على سبيل المثال ، المساهمات والقيمة المضافة والتأثير و/أو التطبيقات)
(e.g., Contributions, Value Add, Impact, and/or Applications)

ضع النص الخاص بك هنا إما باللغة العربية **أو** الإنجليزية- إن وجدت نتائج -

Put your text here in Arabic or English - if you have results-

القسم 7: المراجع
SECTION 7: REFERENCES

ضع قائمة بأهم المراجع (كتب ، مقالات علمية، ...)

List the most important references (books, journal\conference articles, …)

1. Bourne RRA, Flaxman SR, Braithwaite T, Cicinelli MV, Das A, Jost B. et al., on behalf of the Vision Loss Expert Group. Magnitude, temporal trends and projections of the global prevalence of blindness and distance and near vision impairment: a systematic review and meta-analysis. *Lancet* 2017;**5**(9): e888–e879

2. Tabbara, K. F. (1986, June 27). *Blindness in Saudi Arabia*. JAMA. https://jamanetwork.com/journals/jama/article-abstract/405025

3. James, A. (2018, November 22). *What are the difficulties of being blind?*. Quora. https://www.quora.com/What-are-the-difficulties-of-being-blind

4. Blue. (2023, July 29). *What are the difficulties of being blind?*. Quora. https://www.quora.com/What-are-the-difficulties-of-being-blind

5. Janice Strange. (2013, February 4). *How do blind people find objects they've lost?* Quora. https://www.quora.com/How-do-blind-people-find-objects-theyve-lost

6. *Not a reference, only external linking:*
   - *6.1. WeWalk Smart Cane - https://wewalk.io/en/*
   - *6.2. Biped - https://www.biped.ai/*
   - *6.3. Reddit - https://reddit.com/*
   - *6.4. Twitter - https://twitter.com/*
   - *6.5. Life of a Blind Girl - https://lifeofablindgirl.com/*
   - *6.6. YOLOv5 - https://github.com/ultralytics/yolov5*
   - *6.7. MQTT - https://mqtt.org/*


good luck
to you