

Hong Kong Student Science Project Competition 2023

Template of Extended Abstract (Invention)

(Word Limit: 1,600 words, Pages: 3 pages only)

Team Number: SAPE138

Project Title: Watch out! There's a car!

Project Type: Invention

To our best knowledge, there are / ~~are not~~ * similar works in the market; (if there are,) related product links are as below:

<https://projects.raspberrypi.org/en/projects/see-like-a-bat/0>

The enhancement our project made / the difference with related products are:

Our invention is more useful in real-life scenarios, which is to measure the distance between the user and a vehicle on the road and vibrate in different frequencies accordingly to lower the chance of occurrence of traffic accidents. In contrast, the related product is too simple to be used as a tool to help the vulnerable group, as it only consists of an ultrasonic sensor and a vibration motor.

**Please delete if not applicable. The competition values the originality of works. Students must do enough literature research to ensure that their works are unique and list relevant reference materials before starting research or invention.*

I. Background

- Provide background information as to learn about the audience for whom the project is addressing
- Provide highlights of **literature review** and/or related technologies or devices, with the support of pertinent and reliable references
- Provide an overview of work, create a point of view as to define the needs and insights of the audience and mention the **research or technology gap the project is trying to fill**

In recent years, the number of traffic accidents in Hong Kong has been large and keeps increasing. Our invention aims to help the vulnerable group who have a higher risk of being hit by a car, especially the elderly and visually-impaired people, to improve their life quality by assisting them to cross the road.

‘An ultrasonic distance sensor works using ultrasound which is a sound with a frequency so high that humans are unable to hear it. The ultrasonic distance sensor works by sending out a burst of ultrasound. This sound will travel through air, but reflect back (echo) off hard surfaces. The sensor can detect the echo when it returns. By knowing the time between the outgoing burst and returning echo, and the speed of sound, you can calculate how far an object is away from the sensor.’

From the literature used, as the distance measured depends on the ultrasound wave, we can deduce that the accuracy is affected by noises. Also, it provides information on how relevant calculations (e.g. distance of object) should be made.

Although there is an invention that can measure distance and vibrate accordingly, it is nearly impossible to apply it in real-life, as users of it need to point it to the correct angle to measure the distance accurately. It is hard to accomplish even if the user can see clearly, not to mention those having poor eyesight. Therefore, our product is invented to be automatically aiming at the direction of the car at an angle so the users can use it conveniently.

II. Objectives

- State the **aim(s)** of project
- To increase the vulnerable group's living quality by helping them pass the roads safely by letting the users know the distance to the car through different frequencies of vibration.

To raise public awareness of the vulnerable group and encourage the new generation to participate in inventing and contributing to society.

III. Methodology

- Briefly describe the **approaches** used e.g. use of equipment, materials, tests and experiments
- Explain the selected implementation strategies with the **scientific theory**

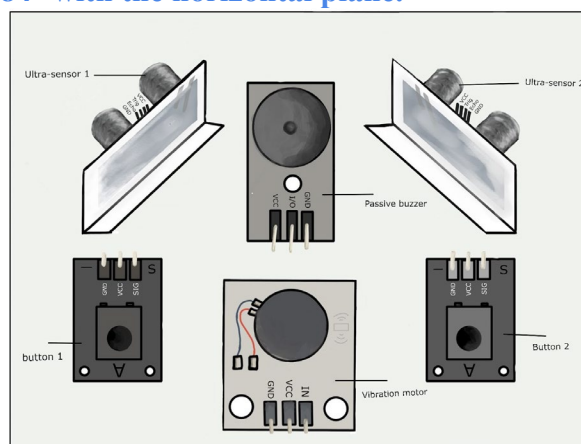
A railway and a small car are used to simulate the road and a vehicle respectively, and the invention is placed on the edge of the railway. The car is then pushed towards the invention after the program was run, which causes the vibration motor to vibrate in different frequencies. The vibration is felt by a finger to check if the program works or not. After a few trials, we analysed the problem and made changes to the code. These steps are repeated to increase the accuracy of the invention.

As the distance that an ultrasonic sensor module (USM) can measure has a limit, it is impossible to 1:1 simulate the real situation. Therefore, we adopted a scale of 2.5m: 40m (maximum distance of the USM to the maximum distance that we aimed to measure in a real situation).

IV. Design of Invention

- Describe the **design** and the **principle** of invention (e.g. The ideation of the projects, the prototypes or creative solution as far as applicable)
- Provide sketches / drawings / photos of the invention

The invention consists of 1 mainboard, 1 breadboard, 2 buttons, 1 passive buzzer, 2 ultrasonic distance sensors and 1 vibration motor. They are attached to a cork board with pins, where the sensors form an angle of 4.84° with the horizontal plane.



The buttons are used to switch the invention on and off respectively with distinct sound emitted by the buzzer. The distance to the vehicle is measured by the sensors twice in 0.1s and is converted to the horizontal distance between the car and the user. The speed can be obtained, and we can hence determine if it will harm the user or not according to its speed and distance to the user. If yes, the motor will vibrate. The shorter the distance, the higher the frequency. If not, no car is approaching and the above steps will be looped again.

V. Application / Market Need

- Explain the area of **application** and function of invention
- Indicate the market need and impact of invention
- Discuss **limitation** and compare with existing related works (if any)

The invention can be used by people who lack the ability to cross the road safely by themselves, mainly senior citizens and the blind. It can be attached to a cane, where its handle has a specific

shape for the user to hold it. Thus, the invention will have a fixed position and hence a fixed angle pointing to where the cars emerge. When a car is approaching, the product vibrates in increasing frequency. Hence, the user knows that he/she should not cross the road before the car comes to a relatively near position, and he/she's safety can be guaranteed.

Due to the ageing population, there are more elderly and hence more people requiring special care from the society. On the other hand, visually-impaired people take up about 2.75% of the global population. So, there is a demand for inventions to help these people. After it is invented, the public awareness of helping the vulnerable group can be raised.

However, uncertain factors such as the width of cars and roads may affect calculations and thus the accuracy of the product. Also, measurement of ultrasonic sensors may be affected by disturbance of objects, e.g. noises.

VI. If your team will compete the Sustainable Development Award, please indicate the specific sustainable development goal the project is related to, and provide justification for competing for this award. (Word limit: 300 words)

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VII. If your team will compete the Social Innovation Award, please list the target group or social issue the project focuses on, and provide justification for competing for this award. (Word limit: 300 words)

We aim to help the vulnerable group, including the elderly and visually-impaired people, to cross the road safely, especially where there are no traffic lights or no one is assisting them. Our invention is easy to use and light in weight, which makes it a handy gadget for the targeted group. Having it attached to a cane will be even more convenient for them to use.

Although there is already a similar product invented, we added many features to improve it and turn it into a blind-friendly and elderly-friendly product which can work in real situations. For instance, we designed the angle between the edge of the road and the sensor by repeatedly changing different factors in order to achieve the best working range of the sensors. Moreover, the way that the components are pinned on the board are decided considering the convenience of usage, where buttons and the vibration motor are located nearer to the user's hand. Furthermore, most of the codes are written by ourselves as they originate from our thoughts, except those (e.g. setting up modes and pins) that are fixed.

VIII. Conclusion

- Make a **data-driven** conclusion of the project and the way forward of the invention process
- Justify if the proposed project meets the objective(s)

The proposed project can surely meet the objectives as crossing the road occurs very often in daily life, and lowering the risk of having traffic accidents can help the vulnerable group not only physically, but also mentally as our invention can act as a double protection even if there is a traffic light. They will feel more secure.

*** Our project is developed based on previous project and the enhancement is below:**