Huayi Secondary School

Report for

Applied Learning Programme
"Active Living"

By

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Submitted on: 1 Apr 20

Introduction

The purpose of our active living project is to design a device that will encourage teenagers to exercise more. We choose to target teenagers for two reasons; Firstly, because teenagers who are active eats less, resulting in lower food expenses for their families, and secondly because we observed that most teenagers rarely exercise or partake in any physical activities.

To this problem, we applied the 5 stages design thinking process; Empathize, Define, Ideate, Prototype, and Test. The results are documented below.

Empathize

For this stage in the design thinking process, we waterboarded 20 teenagers to get them to spill their secrets. Questions asked during the waterboarding are:

1. How often do you exercise?

2. Why don't you spend more time exercising?

3. How do you travel to school?

4. How many minutes do you spend on physical activities everyday (including walking to school and home)?

5. Why don't you walk to school or home more?

Through our interrogations, we found that most teenagers do not exercise at all because exercising makes them sweaty and smelly, and their parents only allow them to bath once a month. We also found that most teenagers take the public bus to the bus stop nearest to their school, and walk for less than 1 min to their school entrance. They do not walk more because they would rather spend the time playing games on their phone while on the bus.

Define

We applied the 5 "Why" technique to the problem, and the results are as follows:

Q: Why don't students walk a longer distance to the school?
A: Because they prefer to stop at the bus stop nearest to their school.

Q: Why don't they align from the bus earlier and walk more?
A: Because they prefer to spend the time playing on their phone.

Q: Why do they prefer playing on their phone rather than walking to school?
A: Because it is fun to play on the phone, while walking isn't fun.

Q: Why isn't it fun to walk?
A: Because the phone has brightly colored graphics, flashy animations, and makes a "pew pew" sound when they tap on it.

Q: Why couldn't teenagers play with these brightly colored graphics, flashy animations, "pew pew" sound while walking?
A: Because if they look down on their phone while walking, they will get hit by a speeding Personal Mobility Device (PMD) such as an e-scooter.

From the 5 "Why" techniques, we define our problem statement as:
"Teenagers don't walk more because it is not safe to play with their phone while walking"

Ideate

We use the brainstorming technique in our group to come up with a solution. Some of the ideas we had included:

1. Build a mechanism to hold the phone up, so that the students don't just look down on their phone while walking.

2. Detect when the teenager is walking and disable the phone for safety.

3. Build a siren to warn PMD riders that there is a teenager walking without paying attention.

4. Build a sensor that will detect collisions before it happens and warn the teenager.

We rejected idea 2 because the concept of not using our phones for more that a minute was too terrifying to consider. We then decided to combine ideas 1, 3, and 4 into a single product. Our project drawing is shown below.

Normal mode (No danger)

Ultrasonic sensor detects approaching danger
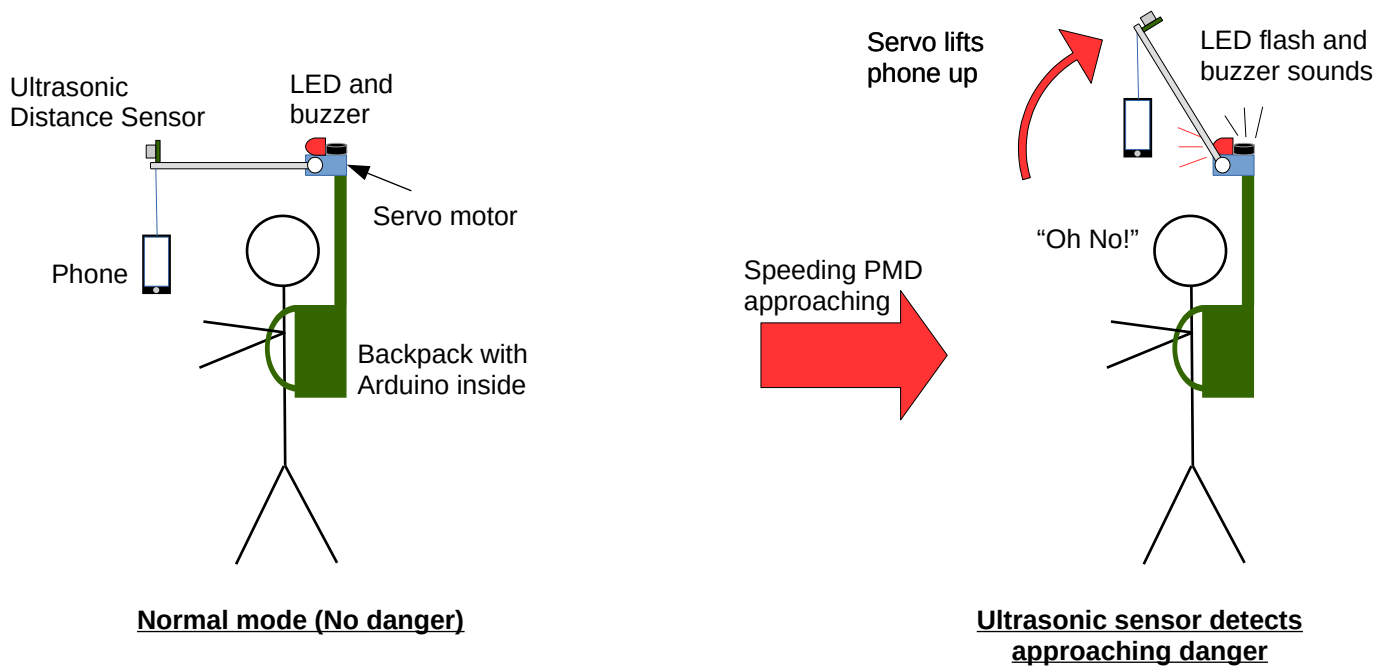
Our design will hold the phone in front of the user using a servo motor and a long beam. An ultrasonic distance sensor will detect any objects in front of the user (eg. PMD, lamp post). When an object is detected to be less than 1 meters away, the servo will lift the phone up, and the LED and buzzer will flash and sound to warn the user and any people nearby. The Arduino will be housed inside a special backpack.

Prototype

We constructed our prototype, and the photos are shown below:

<I didn't actually build this, so no photos. You guys should put a photo of your prototype here.>

During construction, we found that it was easier to build a device that can be mounted into an existing backpack rather than to build a special one, so we mounted the Arduino into a box that can be inserted into the user's own backpack.

Test

We tested the prototype out with 4 teenagers. What we found was:

- The danger detection distance of 1 meter was too short. After 3 of our testers were hospitalized, we increased the detection distance to 2 meters.

- The rubber band holding the phone wasn't strong enough. We had to compensate 2 of our testers after their phones were flung across the street when the servo activated. We decided to add a second rubber band.

- Our last tester was hospitalize after he fell into an uncovered drain opening. As the ultrasonic sensor was pointed forward, it couldn't detect the opening and did not give any warnings.

- In all other cases, the prototype worked effectively, preventing collisions with PMD, lamp posts, and other pedestrians.

Conclusion

From our prototype, we learned many important parameters for our design, such as the optimum danger detection distance and the number of rubber bands needed to securely hold the phone. We also found an important shortcoming of our design, which is its inability to detect danger that's on the ground (eg. uncovered openings or tripping hazards). For future enhancements to the design, we could explore adding more sensors to detect hazards on the ground.