A SAFER ROAD FOR CHILDREN

CREATING AN IMPROVED SCHOOL ZONE.

BY PEDESTRIAN PLUS

PROJECT BRIEF

PROBLEM STATEMENT:

Every year, roughly 1.24 million deaths occur worldwide due to road traffic accidents, and 22% of these fatalities are pedestrians [16]. It has fast-tracked itself to becoming the 'leading cause of death for young people', with school zones being a highly scrutinised area [16]. Yet despite the current road facilities to implement traffic safety in school zones, it has overall continued to show no significant signs of improvement in recent years.

Currently, there are no mainstream solutions to effectively address the visibility of pedestrian activity.

THEREFORE, OUR VISION IS TO:

*Facilitate better engagement for **school students and drivers**, through interactive technologies, in order to maximise their awareness, and reduce unsafe behaviours to improve safety, by encouraging them to use safe crossing facilities in a school zone.*

KEY GOALS:

1. To help **reduce unsafe road behaviour and risks** around school zones.

2. To develop a more **usable crossing that creates more engagement** with students to prevent the temptation to Jaywalk for a safer experience.

3. To **enhance the experience of current crossings** so that the risk from distracted walking can be reduced

WHY IS THIS IMPORTANT?

Whilst young students often do understand and are educated about the basic rules of staying safe when crossing the roads, they are still quite limited in both their physical size and experience. Therefore, they are severely vulnerable due to their lack of perception in 'interpreting roadways and making safe decisions within the dynamic traffic environment around schools' [6].

However, as the World Health Organisation (2019, p.2) outlined in their report, it is concerning that there is a 'tendency to favour motorised transport' and neglect focusing on the needs and experiences of pedestrians to improve their safety. This reflects an important problem space in empowering and safeguarding young students as they continue to learn and grow in life.

BACKGROUND RESEARCH: INTRODUCTION

It has been found that the decreasing use of walking as a student's choice of travel mode for their school day is due to pedestrian safety issues [1]. From 1971 to 2003, there was more than a 50% drop in the amount of children that walked to school in New South Wales alone. Additionally, since 2013, there has been a '13% increase in pedestrian death rate for 12-19 year olds' [15]. Furthermore, only 14% of parents agree that they can depend on drivers to drive safely near schools in a conducted online survey for South Australia [8].

This led to investigating why the current pedestrian environments and/or facilities are ineffective around school zones, and highlights the **priority to better address pedestrian needs.**

RESEARCH & ANALYSIS METHODS:

6 Interviews
3 parents
2 high school students
1 day care worker

1 Observation
In front of a Wollongong private school

Academic Articles

Affinity Diagram

TARGET AUDIENCE:

Primary School Students

They are vulnerable due to their physical size, making them less visible. Their cognitive awareness of road safety is lacking and they move unpredictably.

High School Students

Highly at risk as they exhibit high amounts of unsafe behaviours like jaywalking and distracted crossing such as phone and headphone distractions. They can often be rash and daring.

Drivers/Parents

They need to be considered in the design as they have an impact on pedestrian safety and experience. They have been found to often speed in school zones and can be distracted.

BENEFITS & LIMITATIONS OF METHODS USED:

	Limitations	Benefits
Interviews	**Heavy demand in time:** the time required to conduct interviews and find interviewees posed a qualitative limitation.	**Can gain deep insight into experiences of users:** allows us to develop the empathy needed to effectively design for them.
Observations	**Data limitation:** the insights gained are limited to what we visually see of people's behaviour.	**Better understanding of design problem:** we can discover aspects of behaviours and existing services.
Academic Articles	**Static data:** the way data is measured changes over time, which makes comparing over time potentially inaccurate.	**Making comparisons over time:** official stats allow us to understand the nature of the problem and are freely available
Affinity Diagram	**User confusion:** unless properly kept on track, it is easy to lose track of which note came from which user.	**Easy to process large amounts of data:** allows us to easily analyse and form meaningful insights.

DATA SYNTHESIS

Using affinity diagrams to compile our data and findings, we discovered 4 main problem areas that gave us insight into the current issues of school zones. This allowed us to understand our user needs and current gaps with the crossing facilities/system to better assist us in developing concepts for our design. Through this we identified a common theme which became our problem statement:

There are no mainstream solutions to effectively address the visibility of pedestrian activity.

01

Jaywalking: the easier choice
Crossings can often be seen as a burden on time, making jaywalking the preferred choice currently.

02

Distractions:
There is a need to focus on pedestrian distraction, particularly phone use, to better address our problem statement.

03

Lack of Awareness:
There is a need to better inform drivers of school zone times, which can lead to less accidental speeding.

04

Unpatrolled crossings
More monitoring services around schools is lacking to improve safety annd pedestrian visibility.

BACKGROUND RESEARCH & MARKET ANALYSIS

We further explored these 4 areas using academic articles and market analysis, to deepen our chosen context understanding and to identify key gaps for the development of our concepts.

01 JAYWALKING & COUNTDOWN TIMERS

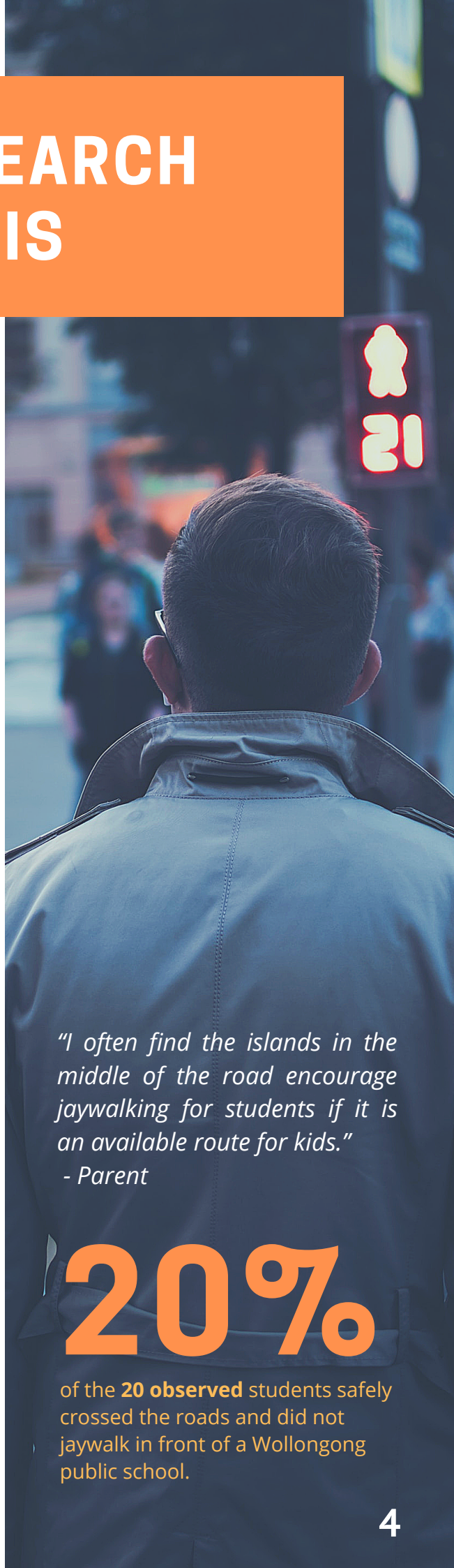
Jaywalking is not only very dangerous to pedestrians, but it also causes disturbances to drivers despite it being illegal in NSW. In 2017-2018, a total of 6,597 people in NSW were fined for jaywalking [9]. In our observation, only 4 out of 20 observed students did not run across to jaywalk in any of the 3 roads out the front of the school. Jaywalking has seen an increase in road traffic deaths, with a projected 65% increase between 2000 and 2020 [15]. This led to implementations of countdown timers to reduce jay-walking by helping people understand when is the right time to cross.

Benefits:

Increased pedestrian compliance in using the correct crossing facilities [3]

Drawbacks:

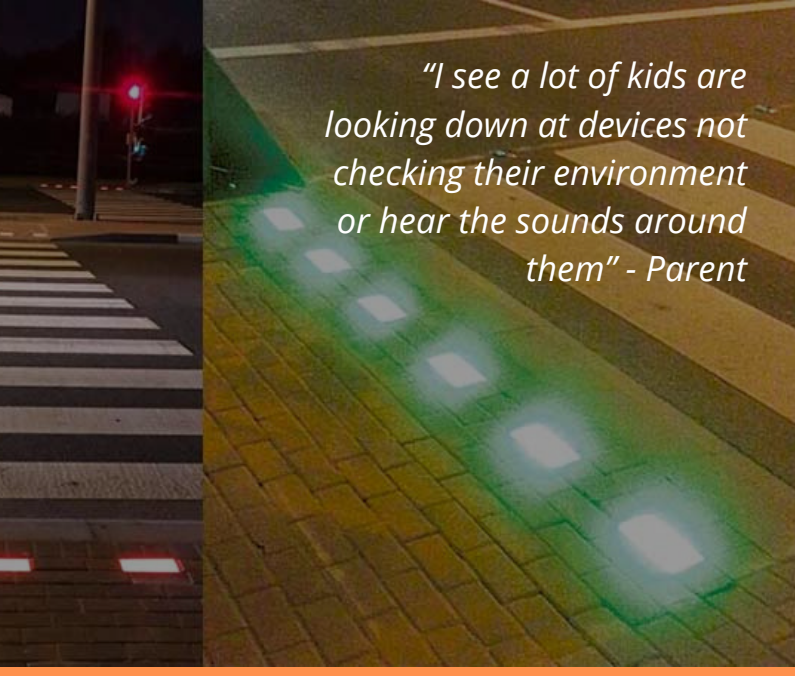
Other studies around school zones have suggested that the countdown may actually assist in unsafe road behaviours by encouraging jaywalking. For example, in an observational study involving 39,000 middle and high school students in school zones with timers, **80% of students crossed the roads at undesignated spots** to beat the countdown [8]. This reflects a need to better cater crossing facilities for pedestrians and enhance their experience, rather than rushing them to be safe.



"I often find the islands in the middle of the road encourage jaywalking for students if it is an available route for kids."
- Parent

20%

of the **20 observed** students safely crossed the roads and did not jaywalk in front of a Wollongong public school.



"I see a lot of kids are looking down at devices not checking their environment or hear the sounds around them" - Parent

02 DISTRACTIONS & INGROUND LIGHTS

Distractions displayed by pedestrians are one of the biggest contributors to unsafe outcomes, particularly around school zones. In an NRMA trial, only 33% of the 26,390 observed pedestrians crossed correctly while on their phones **[3]**. Further, in just three years, distracted walking increased from 20% to more than 25% for high school students **[11]**. All 6 of our interviewees mentioned that they often see other students engaged in their phones and not paying attention to the roads. Phone use whilst crossing has also been linked to reduced judgement **[3]**. Therefore, with young people having the highest mobile use level, NSW tested in-ground lights that are able to notify phone users when to safely cross.

Benefits:

Pedestrians claimed that they were able to better orientate themselves due to the lights **[7]**.

Drawbacks:

More recent studies have shown that the in-ground lights did not have a significant impact **[12]**. UNSW ruled the method to be ineffective, observing that some people are so focused on their phones that they didn't even notice the lights **[12]**. Additionally, it is extremely expensive to implement, costing almost $250,000 at one intersection **[10]**. Therefore, there is room to better cater to or avoid distraction when crossing roads at a lower cost.

03 LACK OF AWARENESS & FLASHING SPEED SIGNS

Speed has remained to be the most detrimental factor in pedestrian accidents. Yet a lot of drivers accidentally speed due to the confusion of school zone times. 2 of the parents we interviewed expressed that accidental speeding was a result of not knowing when school zones were active after a holiday. This is a high issue area, with the Sydney Morning Herald announcing that 78.8% of vehicles exceeded the 40km/h school zone limit [2]. Having variable speed limits & signs have lead to a 45% drop in vehicles exceeding the school zone limit [5]. This saw the NSW Government implementing 500 flashing school zone signs in the hope to address lack of school time awareness [5].

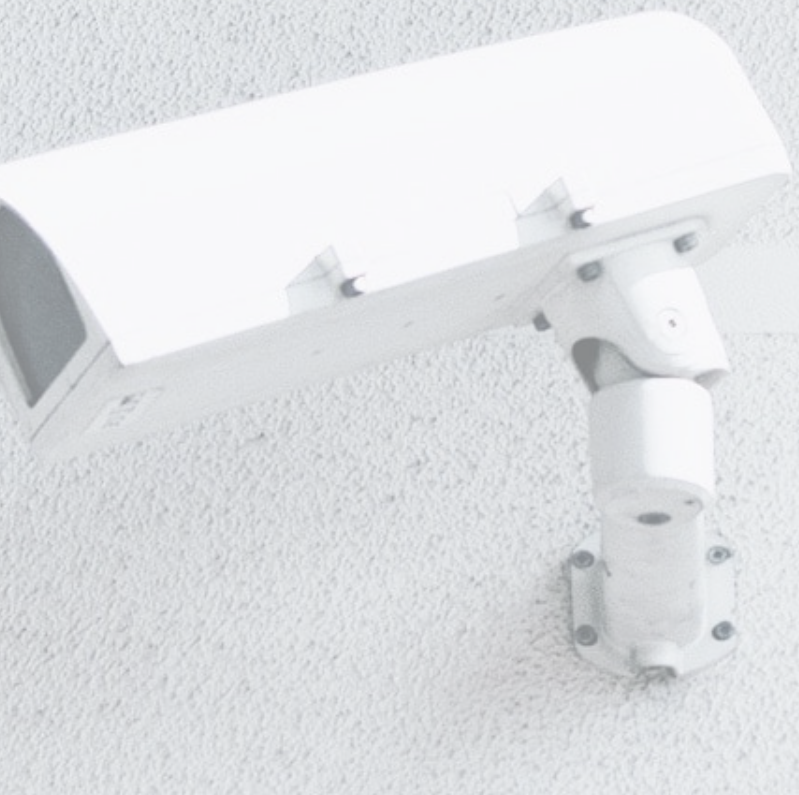
Benefits:

98% of 600 QLD motorists agreed that 'flashing school zone signs help them determine when lower speed limits apply' in a survey [5]

Drawbacks:

There are results suggesting that flashing signs only offer a small impact on travel speeds. In QLD, the signs led to only a 1. km/h mean speed reduction [5]. Further, these flashing signs can lead to "Sign Blindness" for drivers if overused [5]. Hence, there needs to be a more forgiving way to help drivers understand the school zone limit.

"At the first few weeks of school, a lot of people accidentally speed in school zones." - Parent



04 UNPATROLLED CROSSINGS & SPEED CAMERAS

Patrolled school crossings have seen fewer accidents occurring [4]. As our interviewees reflected, "When there is a crossing officer it does tend to be a lot safer". Yet in 2017-2018, NSW police issued 7811 fines in school zones while 55 cameras issued 83,760 fines [13]. This shows that school zone areas are not as patrolled as they should be. Hence, in unpatrolled school areas, speed cameras have been introduced in an attempt to better monitor school zones. The reduction in speed hopes to consequently address issues of obstruction, whereby driving slowly will allow more time to better see unpredicted pedestrian activity.

Benefits:

A study for a New York public school found that traffic deaths around the installed school speed cameras dropped by more than 50% [14].

Drawbacks:

Drivers still exhibit unsafe driving as they are not always attentive enough to identify speed cameras, which reduces the effectiveness of it acting as monitoring support for school zones. This has led to some schools having to use their own students to patrol their school crossings [17]. Therefore, there is a current need to provide better monitoring services in favour of pedestrians rather than relying on drivers to identify obstructive views for pedestrian safety.

> *"When there is a crossing officer it does tend to be a lot safer" - student*

SUMMARY

Overall, it is evident that there is an abundance of problems to the current system of how school crossings operate. With problems such as jay-walking, distraction, unpatrolled areas, and lack of driver awareness, improvements are required to better prevent them. All these areas reflect a gap in designing for pedestrian experiences and to safeguard them through clearer visibility of their actions.

Currently, the crossing experience mainly focuses on driver needs, through analysing products such as speed cameras, countdown timers and flashing speed signs. We are starting to see a change in this design direction, as evident with the in-ground lights.

With this in mind, Pedestrian+ aims to solve this problem area with an innovative and permanent solution that is able to empower and focus on safeguarding and enhancing young students walking experience.

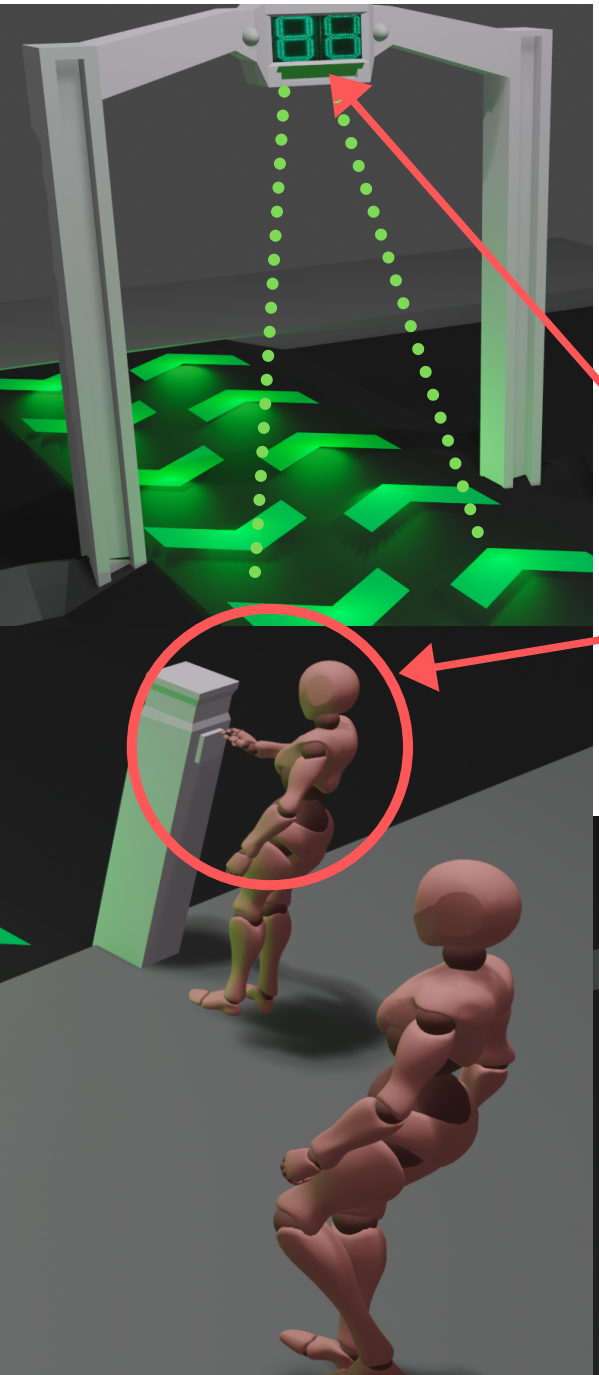
CONCEPT 1: FLOW

Designed for:

School zones on main roads. Designed to ensure pedestrians receive adequate time to safely cross whilst ensure traffic flow is disturbed as little as possible.

What it does:

Flow aims to provide more enjoyable walking experience for pedestrians through using a facial tracking camera to calculate the amount of people crossing and adjusting the time the light takes to change (speeding it up significantly if a lot of people need to cross e.g. start & end of school) and how long the crossing time allows according to that. This aims to provide a safer, faster experience when crossing the road compared to normal crossing in hope to reduce jaywalking.



Projection

The Flow concept uses projection to show the two way walking path for when you are allowed to cross.

Designed to direct the flow of foot traffic more smoothly across the road.

Projector

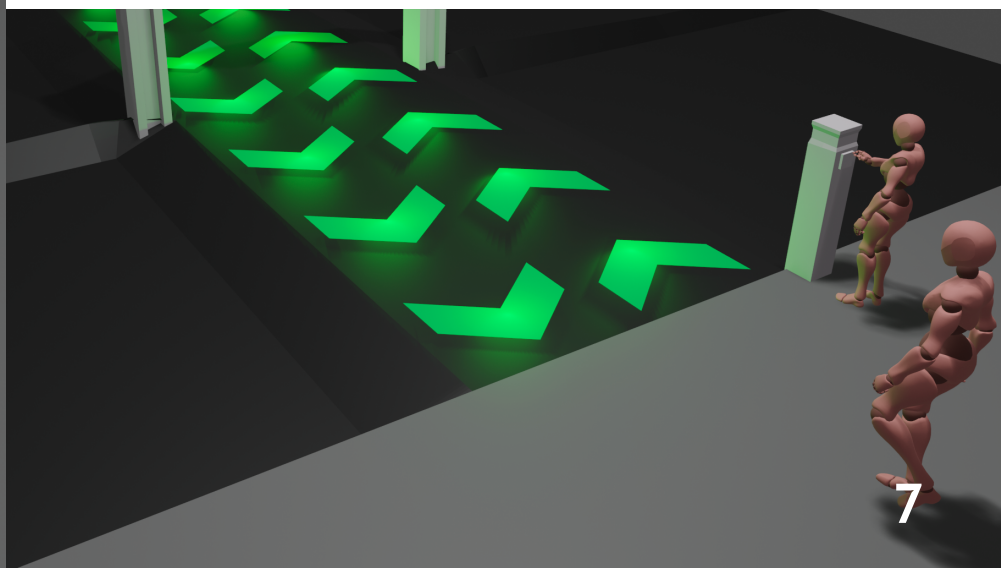
Enables the projections onto the road based on lights status.

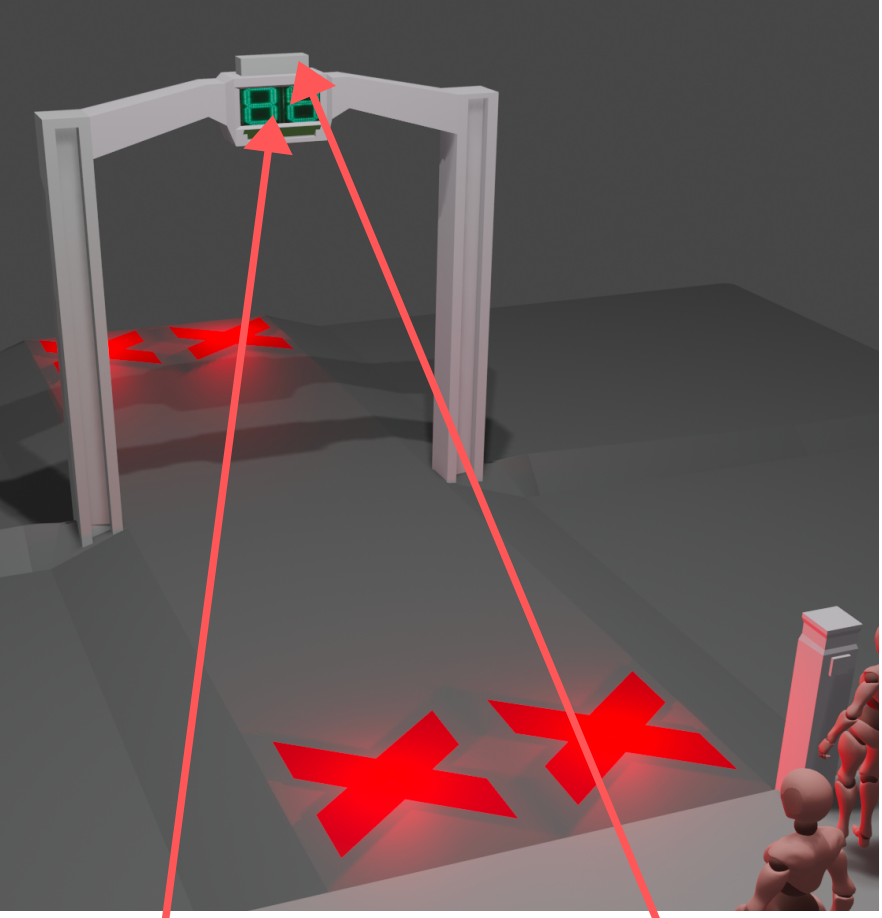
Raised Crossing

Allows for better visibility for drivers and naturally causes them to slow down in the area.

Pedestrian Button

Provides feedback and familiarity to users who are not used to the automation.





Why?

Having times adjusted to the amount of people cater then to the needs of pedestrians over the traffic. Should pedestrians need more time as their is a large group the system will allow for that. Though in cases where only one child waiting, the traffic light will go at a normal speed, disrupting cars as little as possible.

Cons of this design:

- Expensive to implement
- Projections might not be extremely visible in the day (may require a different method)
- There is minimal interactivity in the way it is designed for engagement. Interactivity will be introduced in the next iteration.

Countdown Timer

States the remaining amount of time given to the pedestrians to cross when crossing is allowed.

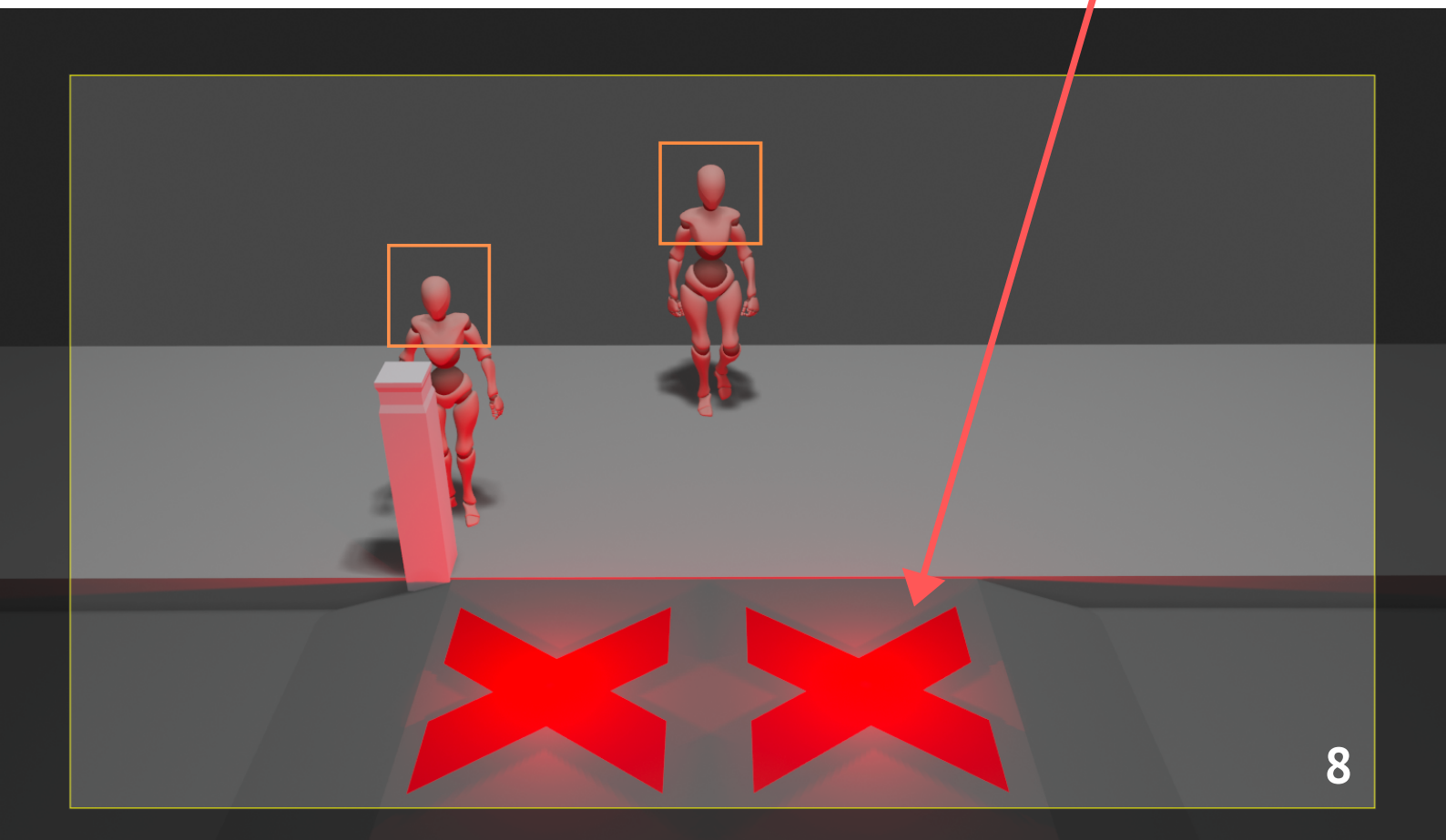
Facial Detection Camera

Used to capture the amount of people attempting to cross the street at one time.

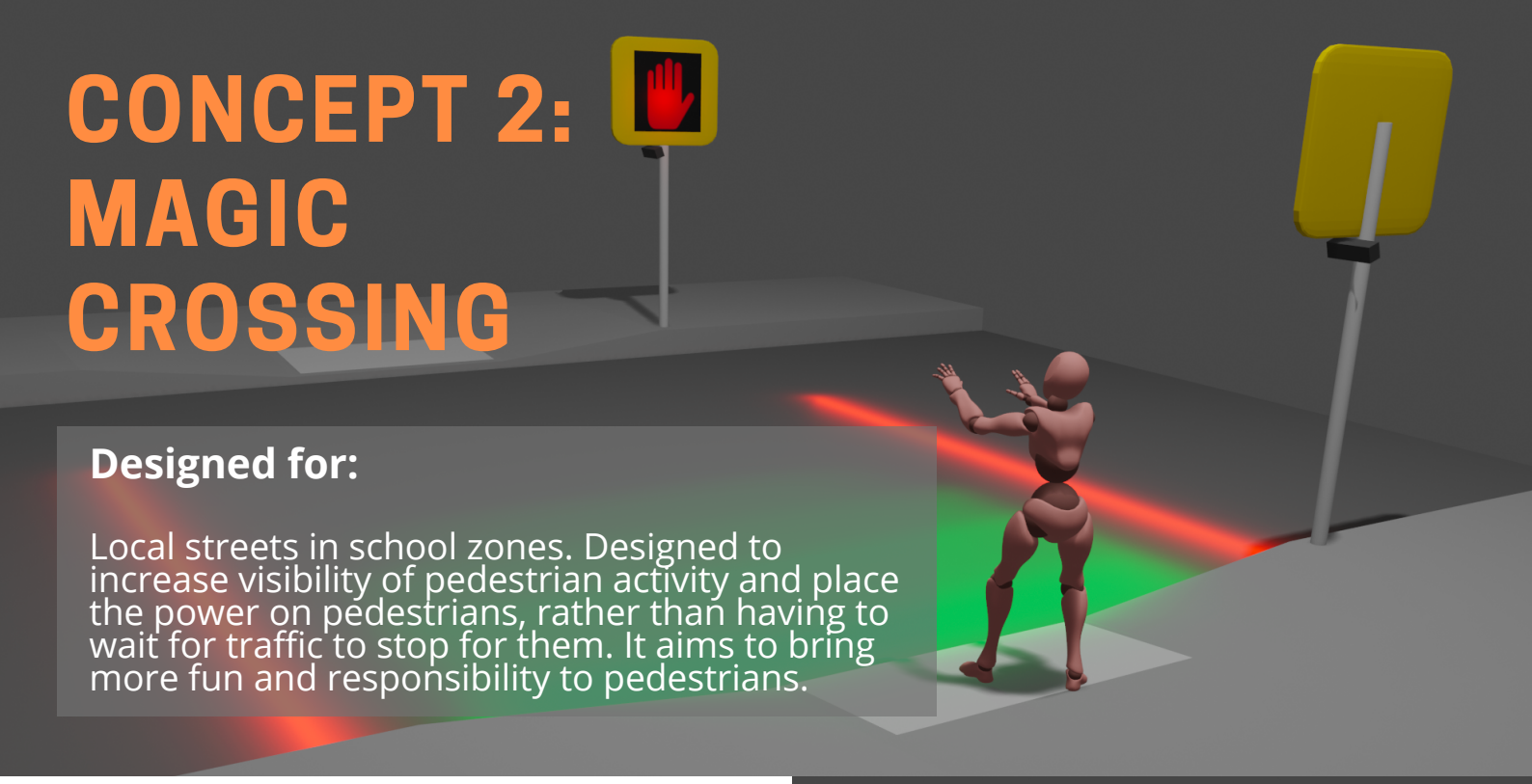
Crosses

Projected crosses will flash to alert users not to attempt to cross.

Facial Detection Camera's Point of View



CONCEPT 2: MAGIC CROSSING



Designed for:

Local streets in school zones. Designed to increase visibility of pedestrian activity and place the power on pedestrians, rather than having to wait for traffic to stop for them. It aims to bring more fun and responsibility to pedestrians.

How does this work?

1 LED Strip

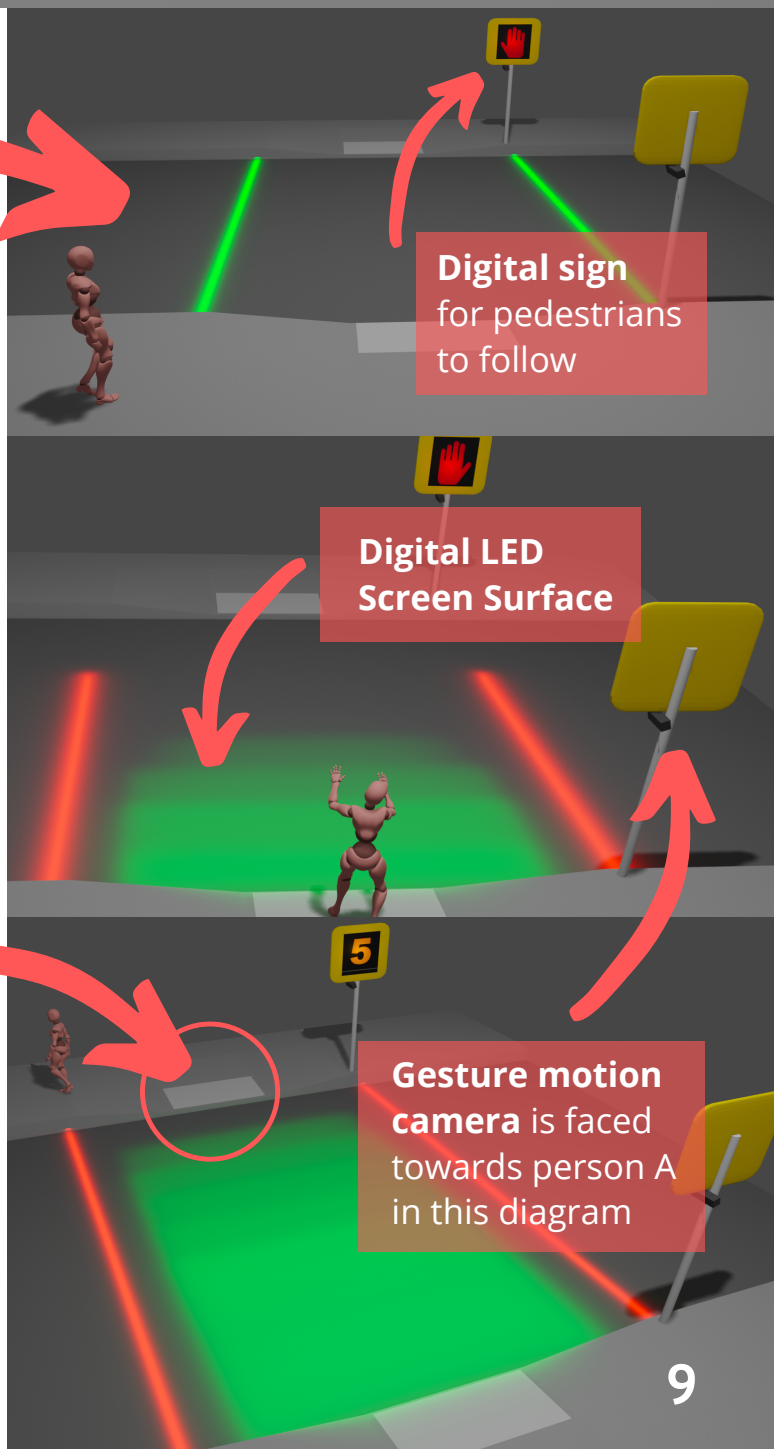
Before a pedestrian approaches the crossing, there's a clear green LED strip to let cars know they can safely pass.

2 Gesture motion

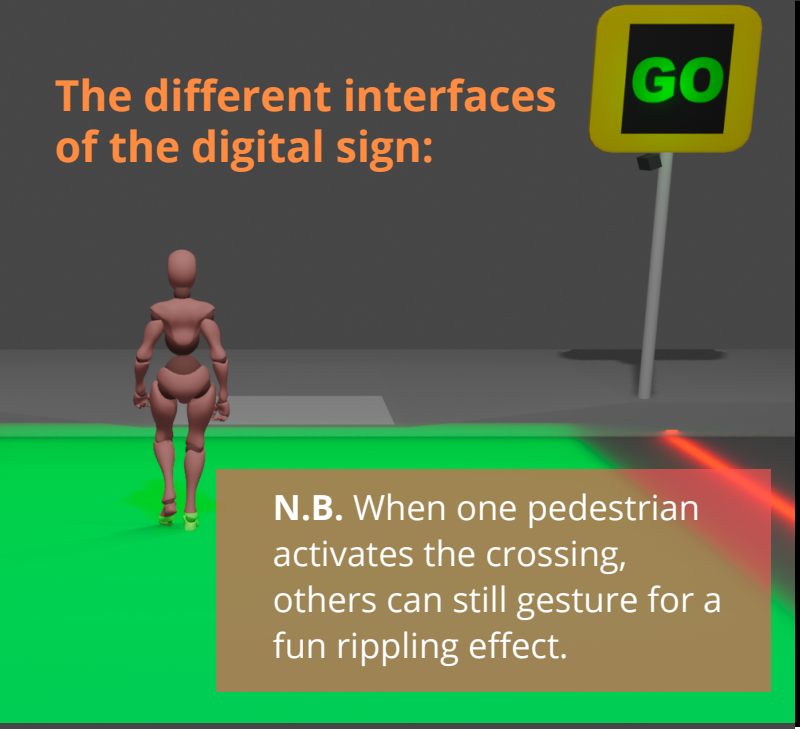
When the student walks to the crossing they'll use a forward pushing motion for a clear digital pathway to flow out, which also enhances visibility of oncoming pedestrian activity and the green strips will turn red to provide feedback for cars to stop.

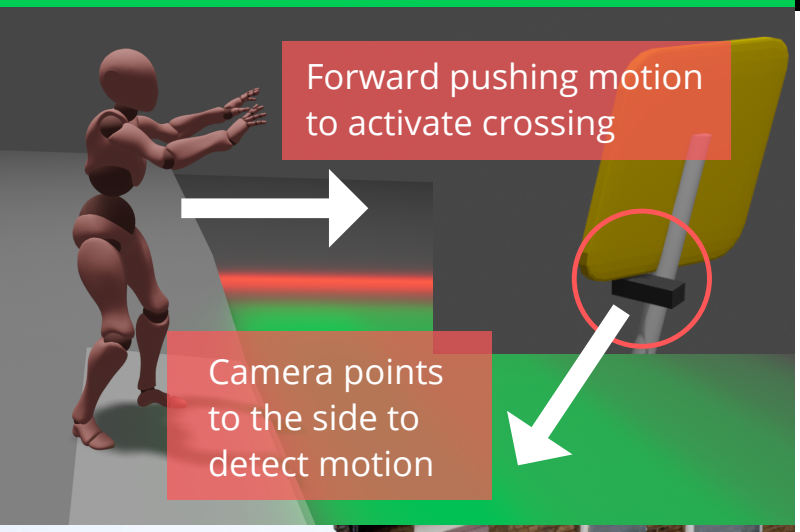
3 Weight sensors

The weight sensors on either side of the sidewalk assesses the break point of pedestrian activity, leading to a 5 second countdown on the adjacent sign aiming to provide a safety buffer so that the cars won't accidentally miss any undetected pedestrians.



The different interfaces of the digital sign:





Before gesture motioning, the red hand tells pedestrians not to cross

GO

After the pedestrian path fully flows out, GO will appear to let them know it is safe to cross

5

When the weight sensors detect a break, a 5 second countdown will appear

How does this concept solve our problem?

The fun interaction of using a forward pushing gesture forces pedestrians to have to stop before actually crossing. It also allows school students to feel like they are superheroes with powers, which is able to make them feel autonomous and responsible for using the crossing facilities, rather than jaywalking or crossing while being distracted.

How does it compare to other solutions?

The smart zebra crossing uses surface features LEDs that light up to alert drivers when a pedestrian is on the road. While it promotes the safeguarding of pedestrians, it may lead to pedestrians relying too much on vehicles to look out for them, and hence unsafe crossing behaviours may increase and see pedestrians at more risk. It also doesn't encourage pedestrians to use the crossing facilities.

Magic Crossing aims to better address this gap in the market, and encourages the use of the walking facility, whilst simultaneously alerting oncoming vehicles.

HOWEVER, there is a risk of it being overused for play by kids which may put them at more of a risk on roads. It is also expensive to implement.

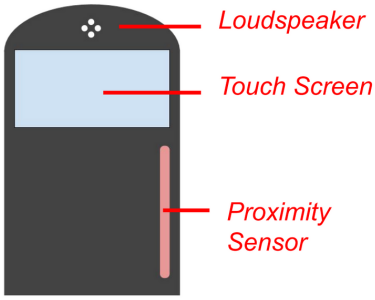
CONCEPT 3: THE DUCK

Designed for:

Pedestrian Crossings in school zones. This concept aims at preventing students from jaywalking at crossing by using audio form of warning to draw their attention.

What is it?

The design is basically a 1.6m high device consists of (from top to bottom)a loudspeaker, a touch screen, and a vertical proximity sensor which could monitor if anyone has jaywalked(detected to pass through the sensor while the traffic light is still red).



How it works?

	Steps users would follow	Screen Display
1	If no one crosses the road while the traffic light is on red or during the time traffic light is green, the screen will normally display a message to remind the pedestrians to follow the traffic light. In these circumstances, nothing will happen if someone attempts to play with it.	**Please follow the traffic light :)**
2	However if the sensor has detected that someone crosses the road while the light is still on red, the loudspeaker will immediately make a sound of quack and the screen will turn red with conspicuous text to warn him to get back. The sound will keep lasting until the pedestrian is detected to go back.	**PLEASE GET BACK!**

3

When the pedestrian gets back, the screen will remind him that jaywalking is dangerous and make sure he understands.

Crossing at red is extremely dangerous, please don't do this again!

OK

4

Then, the screen will pop up with a list of sound for the pedestrian to choose, the chosen sound will be played for the next one who does not cross the road properly.

Well done! Now choose a sound for the next one :P

Quack	Growl	Siren
Alarm	Engine	Record one

5

After completing, the pedestrian will need to wait until the light turns green.

Now waiting for the light to turn green.

6

When the traffic light turns green, the loudspeaker will play a pleasant bell sound to tell the pedestrian to go.

Thank you!

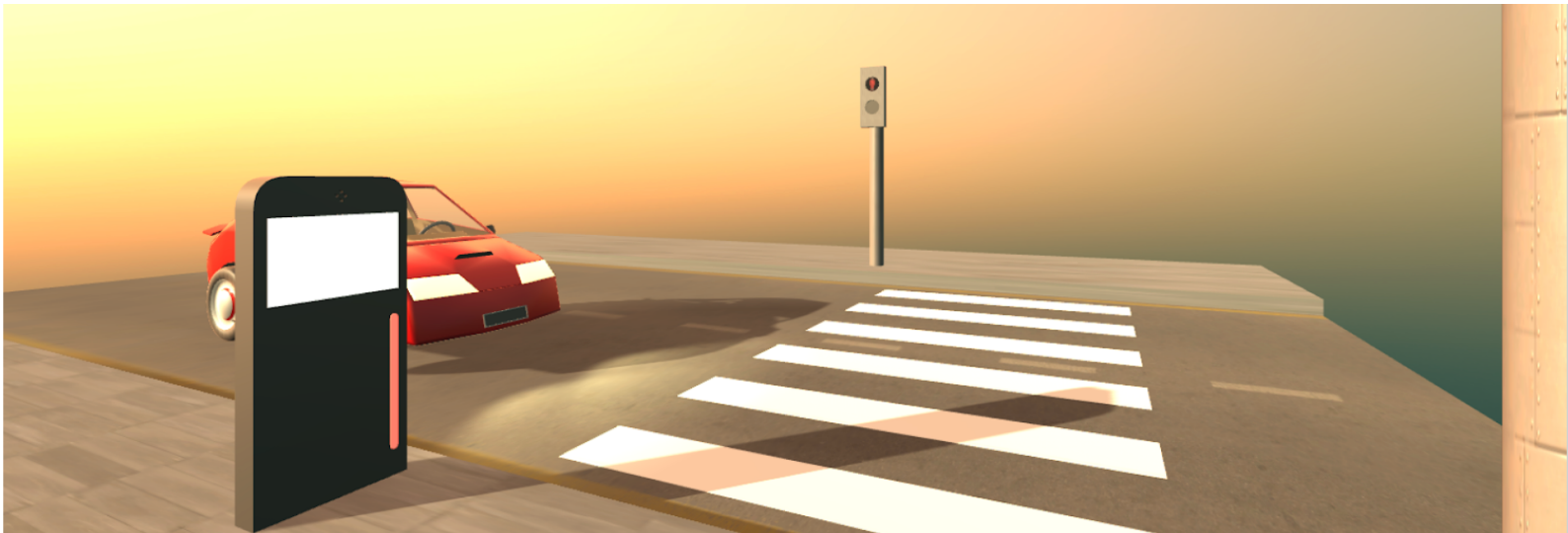
Target audience:

Student's who are wearing headphones whilst walking.

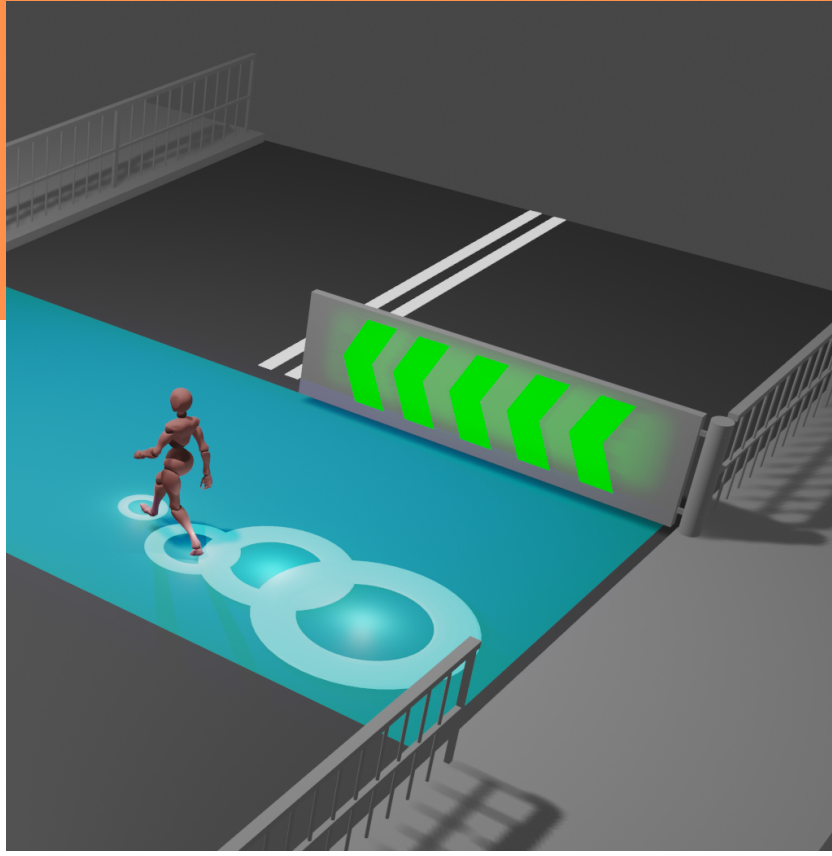
In terms of the students with their headphone which has Active Noise Cancellation function, the system will only play sounds with a frequency above 2000 HZ so that most ANC headphones won't cover and below 12000 HZ in which older people could also smoothly hear, to make sure every user could notice the sound warn except those who are completely deaf.

How it compares to existing products in the market:

In some cases, people won't notice the traffic light or upcoming vehicles due to distraction or visual impairment. Audio will work much more effectively than a visual guide in these cases. Furthermore, compare to existing products like in-ground lighting, this method has a relatively lower cost and would be much easier to implement.



CONCEPT 4: PENGATE



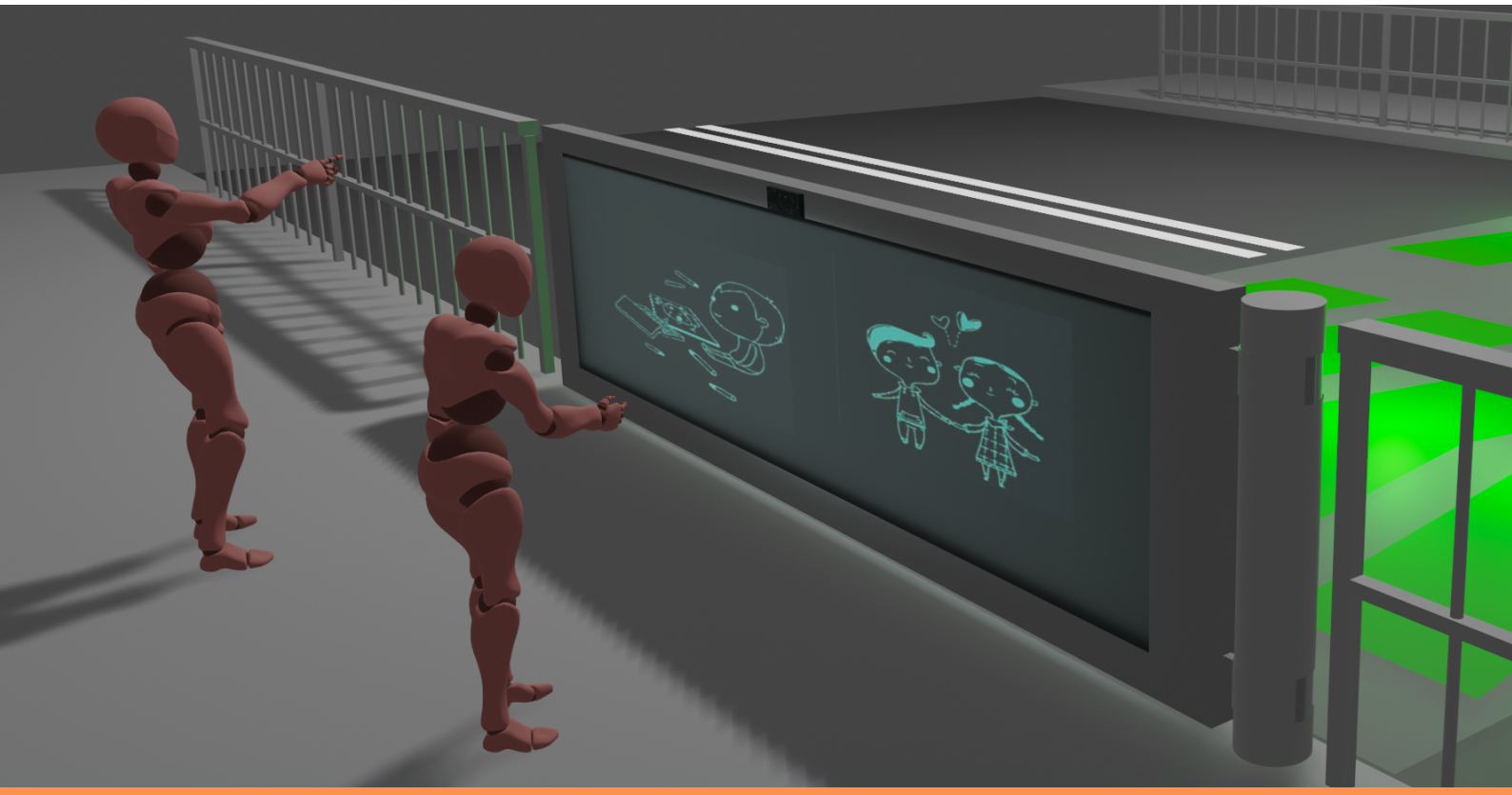
Concept Description:

Pengate is an infrastructural design that is aimed to stop children from jay-walking their school crossings. As the name implies, it is a pivot gate controlled at timed intervals when the pedestrian-crossing light is pressed. The gate itself is an interactive wall that provides the children fun as they wait for the lights to turn green for them to cross.

How it works:

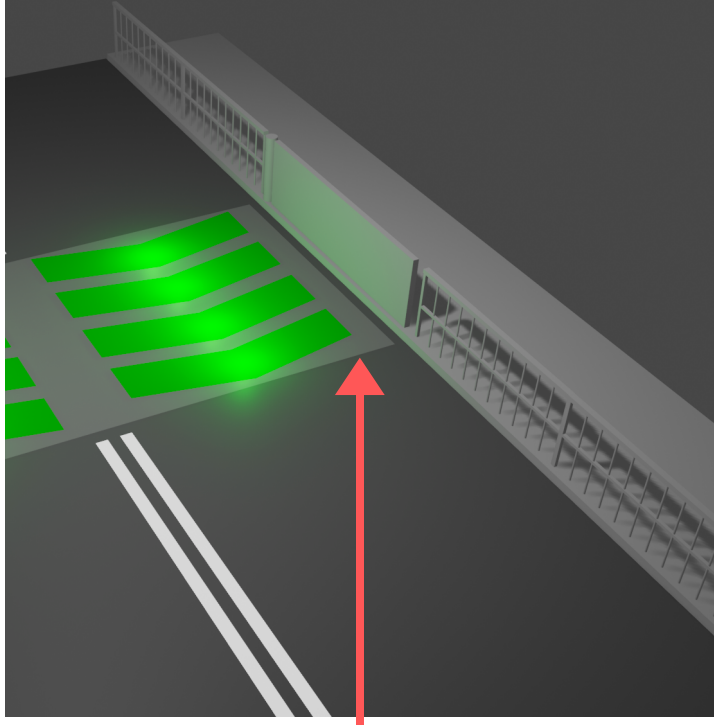
The gate will be blocking pedestrians as cars go by. Until on a timed signal cue, the gate will pivot on one side and block the cars on the road from going forward, allowing the children/pedestrians to cross the road safely without the fear of being hit by an inattentive driver. After the time for pedestrians to cross has passed, the gates will pivot back to block the pedestrian crossing, thus allowing the cars to continue accelerating forward.

The gate itself will have a motion activated screen on one side so that the children/pedestrians are able to entertain themselves as they draw art themselves or be entertained by captivating drawings of others. These would be wired through Arduino and a Kinect Sensor. However, when it's time to cross, the screen will turn into directional arrows so that children/pedestrians do not still play the games on the gate and are able to cross safely without creating problems.



How does it solve the problem:

With 80% of the students not crossing the roads at dedicated crossing lights, it causes many accidents to happen yearly at school roads. With the implementation of Pengate, it is able to fence most of the road off, which encourages children/pedestrians to cross appropriately at the correct location. The fence blocks them from jay-walking as it'll take a large amount of effort to climb over to cross the road. In return, the interactivity that it provides will entertain the child/pedestrian for however long they will be waiting until they are able to cross.



How it works:

Interactive Motion Activated Screen

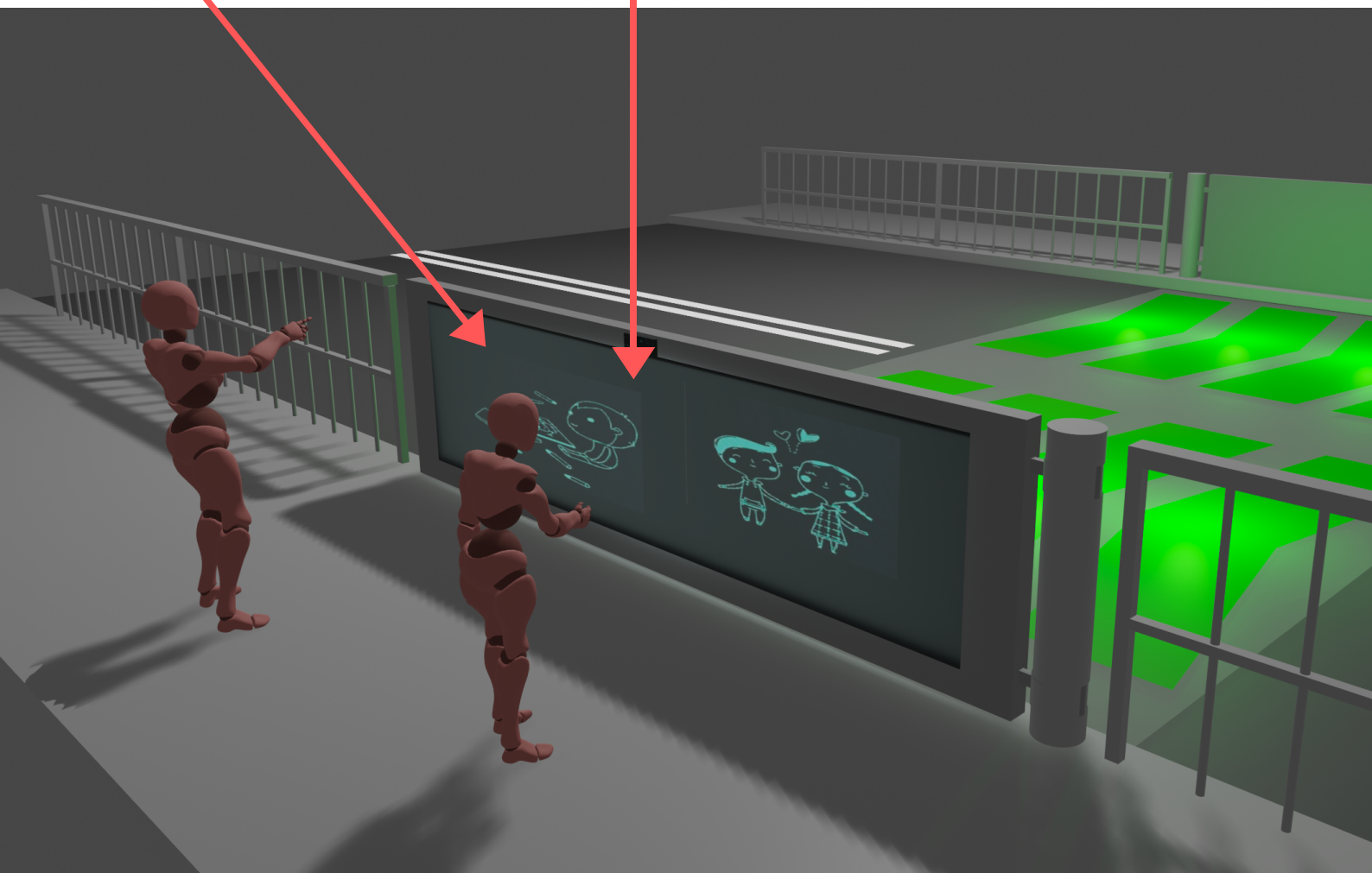
This screen allows for gestures and finger painting style interactions as the Kinect detects the movement of the hand.

Motion Capture Camera

This screen allows for gestures and finger painting style interactions as the Kinect detects the movement of the hand.

Shut Gate Position

When the gate is shut, pedestrians are blocked from entering the road. When the gate is shut the road's screen lights up green to let cars know they can go.



Touch Sensor Screen

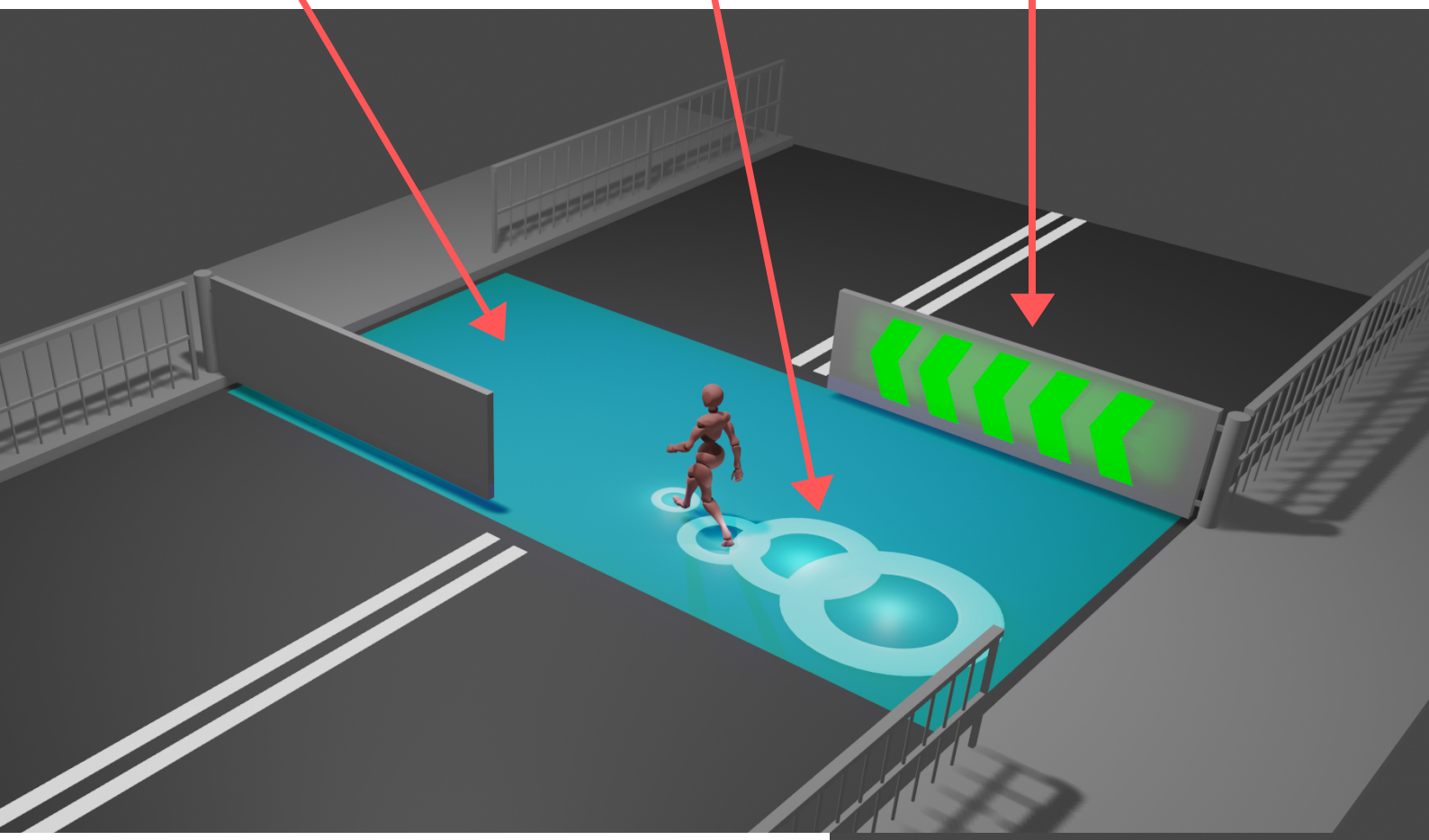
There is a screen on the road with built in touch features that interact with the user when walking.

Ripple Effect

When you are able to cross the floor becomes like water and the surface that ripples when some steps on it.

Open Gate Position

When the gate is open, pedestrians are free to walk across the road while the cars are physically blocked.



How it compares to existing products in the market:

This solution compares much better in comparison to the fence that is integrated in the middle of the road. Pengate makes sure that children pedestrians can't even have the possibility of jay-walking whereas the current pedestrian fencing only stops them mid-way during the jay-walk. Another product it can be compared to is the jet-water stream used in China. It is clear that Han's Gate does not ruin the clothing of the pedestrian, and it also allows their use of sensory to be more interactive for the pedestrian. Overall Pengate provides a much more entertaining and safe wait-time for children as they wait to cross the road at their school.

SOFTWARE & HARDWARE NEEDED:

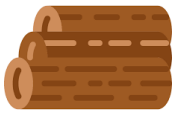
HARDWARE

LED Diodes

Arduino

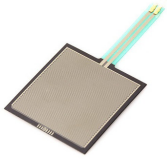
3D Printer

Xbox Kinect

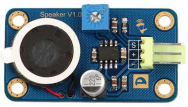


Wood

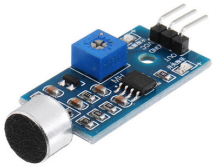
Metal



Weight Sensor



Speaker



Microphone

Wires

SOFTWARE

Arduino IDE

3DS Max

Blender

Unity

Ilustrator

Final Cut Pro

Github

Atom

THE UNIVERSITY OF SYDNEY

Architecture, Design and Planning

GROUP CHARTER

Project Group | Interactive Product Design Studio

Group Name: Pedestrian +

Stream: Stream B

Members:

Joshua Townsend-Long	jtow5239	3D Modeller, Researcher & Programmer
Victoria Tran	vtra7777	Researcher, Programmer, Content Creator
Jared Capili	jcap4996	Existing products and market analysis, Researcher
Han Yi Peng	hpen9134	Researcher, Prototype-tester, Designer
Gao Xi Jun	xgao2191	3D Modeller, Visual Designer

Task:

Complete the attached exercise and return a **scanned** copy (including this cover page) to your tutor.

BIBLOGRAPHY:

[1] Andreou, M. (2019). *Planning for Pedestrian Safety around Schools.* Sydney, Australia: UNSW. Retrieved from https://www.be.unsw.edu.au/sites/default/files/upload/pdf/schools_and_engagement/resources/_notes/5A3_27.pdf

[2] Barlass, T., Browne, R. (2012). *No longer such a safe zone, especially in the afternoon. The Sydney Morning Herald.* Retrieved from https://www.smh.com.au/national/nsw/no-longer-such-a-safe-zone-especially-in-the-afternoon-20121006-275xe.html

[3] Cleaver, M. et. al. (2011). *An evaluation of pedestrian countdown timers in the Sydney CBD.* Retrieved 29 August 2019, from http://casr.adelaide.edu.au/rsr/RSR2011/6EPaper%20011%20Cleaver.pdf

[4] D., A. (2019). *125: Effectiveness of School Crossing Patrols - Travelwest.* Retrieved 29 August 2019, from https://travelwest.info/project/ee-125-effectiveness-school-crossing-patrols

[5] Department of Transport and Main Roads. (2013). *Evaluation of flashing school zone signs in Queensland.* Retrieved from QLD Government: https://www.tmr.qld.gov.au/-/media/Safety/roadsafety/Road-safety-research-reports/evaluation-flashing-school-zone-signs.pdf?la=en.

[6] Express News. (2017). *Scientists say THIS is the age your child is safe crossing the road.* Retrieved from https://www.express.co.uk/news/uk/793862/crossing-the-road-age-children-scientists

[7] Fotios, S., & Gibbons, R. (2018). *Road lighting research for drivers and pedestrians: The basis of luminance and illuminance recommendations.* Lighting Research & Technology, 50(1), 154–186.

[8] Garrard, J. (2017). *Walking, riding or driving to school: what influences parents' decision making?* South Australia: DPTI. Retrieved from https://www.dpti.sa.gov.au/__data/assets/pdf_file/0015/513510/Walking_riding_or_driving_to_school-what_influences_parents_decision_making-Key_findings_and_recommendations.pdf

[9] Giarratana, C. (2018). *Back To School: 7 Ways To Make School Zones Safer For Students & Pedestrians*. Traffic Safety Resource Center. Retrieved from https://www.trafficsafetystore.com/blog/back-to-school-7-ways-to-make-school-zones-safer-for-students-pedestrians/?fbclid=IwAR0AsVAybDXTNvZRBWEDqIw1pBI_64kbv-uxvbi64L5Vv3m37drLWHTpUdU

BIBLOGRAPHY:

[10] NRMA. (2019). *Look Up: Keeping pedestrians safe.* Retrieved from https://www.mynrma.com.au/-/media/documents/advocacy/look-up-keeping-pedestrians-safe.pdf?la=en&hash=83AF22A582EF35C901E303FE7B6A2BFD

[11] Safe Kids Worldwide. (2016). *Alarming Dangers in School Zones.* Washington, D.C. Retrieved from https://www.safekids.org/sites/default/files/alarming_dangers_in_school_zones.pdf

[12] The Daily Telegraph. (2019). *Pedestrian safety lights targeting phone users a waste of money*. Retrieved from https://www.dailytelegraph.com.au/news/national/a-nsw-trial-of-inground-lights-to-prevent-pedestrians-from-illegally-crossing-the-road-while-using-their-phone-wont-go-ahead-after-a-unsw-report-found-it-was-not-an-effective-way-of-preventing-accidents/video/2ac7cab2f716cc35b38cdc1da6b130a3?fbclid=IwAR2l6pXwuQ0zu-MpLp_1mnbO_hWBlr10ZWBBF4nkUazTc20D_koQUrp34Ng

[13] The Sydney Morning Herald (2018). *The school zones barely patrolled in some parts of Sydney.* Retrieved from https://www.smh.com.au/national/nsw/the-school-zones-barely-patrolled-in-some-parts-of-sydney-20180503-p4zd2d.html

[14] Wang, V. (2019). *Speed cameras will surround every New York City public school. The NY Times.* Retrieved from https://www.nytimes.com/2019/03/19/nyregion/speed-cameras-schools-nyc.html

[15] World Health Organisation. (2004). *World report on road traffic injury prevention.* Geneva, Switzerland: Peden et. al. Retrieved from https://apps.who.int/iris/bitstream/handle/10665/42871/9241562609.pdf;jsessionid=7AD4A114F416F2853859F9AED5A8C804?sequence=1

[16] World Health Organisation. (2019). *Make walking safe again: a brief overview of pedestrian safety around the world V.3.* Retrieved from https://www.who.int/roadsafety/decade_of_action/plan/global_plan_decade.pdf

[17] Zhao, X., Li, J., Ma, J., & Rong, J. (2016). *Evaluation of the effects of school zone signs and markings on speed reduction: a driving simulator study.* Springerplus, 5(1). doi: 10.1186/s40064-016-2396-x