SASTA OLIPHANT
SCIENCE AWARDS

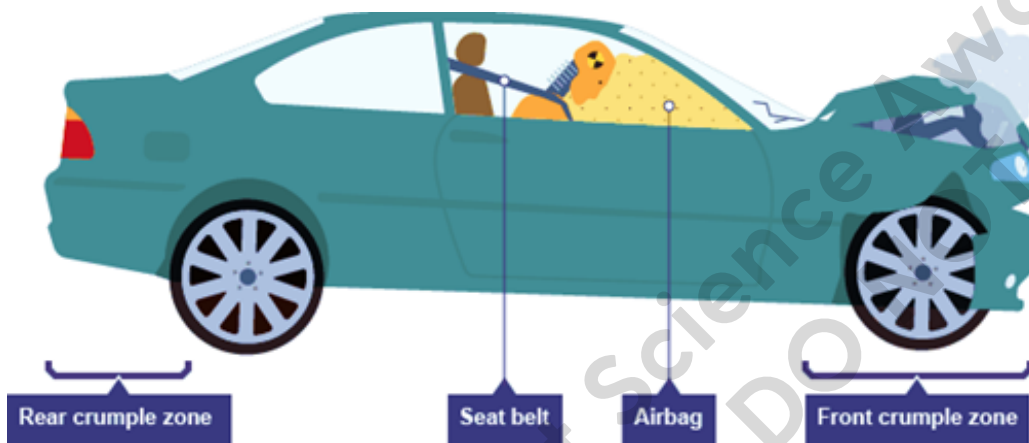SOUTH AUSTRALIAN SCIENCE TEACHERS ASSOCIATION

Encouragement Award

Programming, Apps & Robotics

Year 11-12

Savin Dissanayake

Glenunga International High School

Safety Zone

Rear crumple zone   Seat belt   Airbag   Front crumple zone

Computer Programming and Robotics

Savin Dissanayake
Year 11

Glenunga International High School

Introduction

The primary vector of vehicle related deaths and injuries is the disproportionate mass and velocity of an automobile (*Dekker, 2019*). Automobile safety ensures scientific principles are considered in the design and construction of automobiles in order to minimise the occurrence and consequences of automobile accidents. I developed a simulation program to demonstrate the innovative safety features of current day automobiles.

Aim of the entry

This entry aims to demonstrate the various safety elements that can be altered to prevent adverse vehicle crashes. The vehicle crash is simulated in the program by using and avoiding the use of safety mechanism in a vehicle. The program aims to disseminate scientific knowledge of vehicle safety design elements, their uses and correct usage.

Scientific purpose

Scientific purpose of this program is to teach safety elements of automobiles through an interactive computer game. It explains the physics behind the safety elements which should be followed in order to avoid a car crash.

During a collision, there is a change in momentum. The force of the collision is equal to the rate at which this change of momentum occurs. The safety features of a vehicle decreases the rate of change of momentum by increasing the time of collision which also contributes towards decreasing the force of the collision impact on its passengers (*Moravčík, Jaśkiewicz, 2018*). Therefore, this clearly demonstrates how Newton's laws of motion work (Figure 1). My program therefore serves the purpose of evaluating and building awareness around automotive design safety and safety innovation using scientific principles.
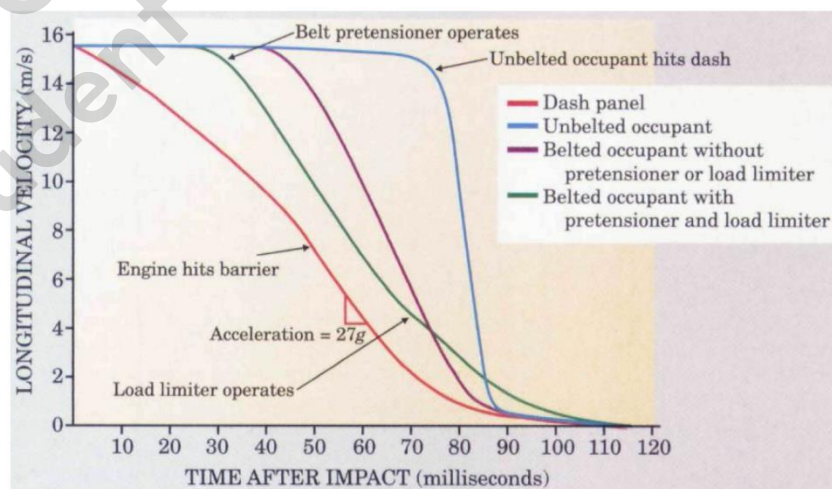

Figure 1: Velocity history of a dummy

Potential applications

The most suited application of this program is for a driver awareness program to achieve safety goals. Prior to getting on the road, a prospective driver can go through this application to ensure they are aware of the safety elements of a vehicle thereby prevent themselves from encountering a hazardous crash.

Required computer to run the program

This program can be run using any computer with internet access.

Clear instructions on loading or using the entry

1. Visit the following URL: www.safetyzone.club
2. Select the type of safety method
3. Select the weather condition

Explanation of sections

There are several sections within this program. When the program is started a launching page is shown. Users can then select their safety mechanism for the game. Users also have the option to gain further information about the program by clicking the button at the bottom of the screen. The safety mechanism is a key section of the program as different safety mechanisms result in different results after a collision.

Once a safety mechanism is chosen, users can then select their desired weather condition, either wet or dry. Once the preference is selected, user is able to witness the respective scenario and consequence. Once the simulation is complete, users will be directed to an information page that displays further knowledge on the desired safety function.

In this program, the car exerts the force in the direction of the wall but the wall, which is static and unbreakable, exerts an equal amount of force back on the car (Newton's third law of motion). This force during the collision determines the impact. Vehicle safety features such as airbags, seatbelts and crumple zones help to reduce the impact. The driver's safety is at its best when all safety devices are being utilised. Most of the automobiles in the current day use patented technology (Figure 2). Crumple zones are designed to distribute the collision energy over the entire car body in order to absorb forces as effectively as possible and reduce personal injury to the occupants. Crumple zones act during the defamation. Crumple zones are designed using different grades of steel, making the outer zone softer than the inner zone and ensuring that the collision forces are absorbed in a controlled and efficient manner in order minimise intrusion in to the passenger compartment. Seatbelts and airbags are passive safety devices that are installed in automobiles to protect passengers in an accident. Airbags which started as simple front bags have now been developed to envelope the entire cabin. Many vehicles now are equipped with under dash airbags to prevent knee and shin injuries in a frontal impact.
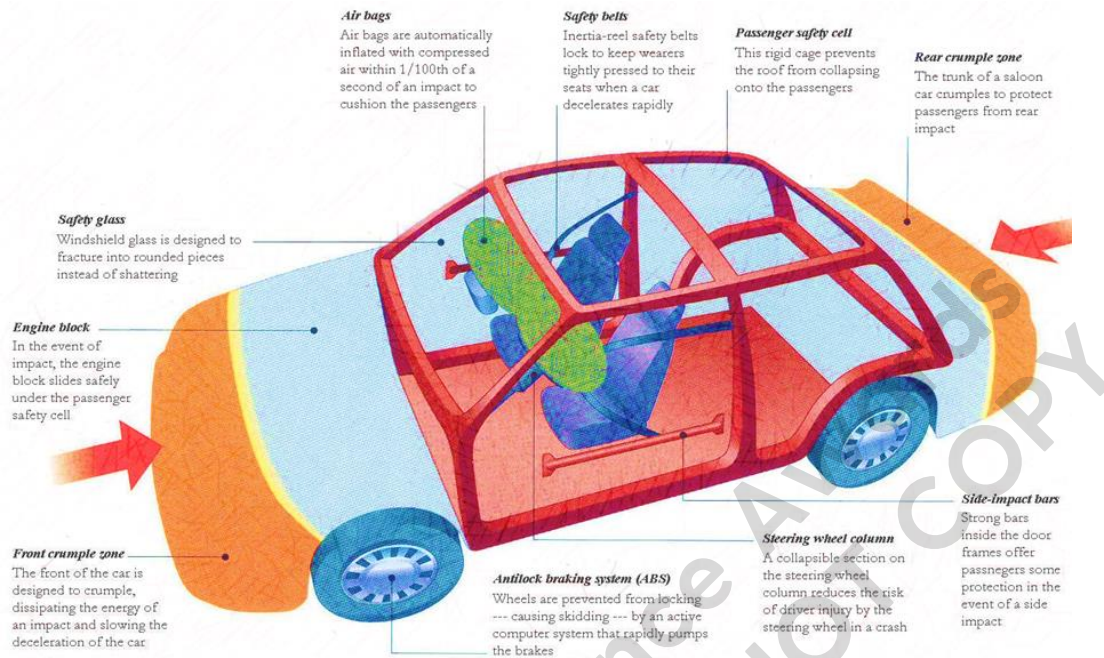
Figure 2: Safety elements of a modern-day car

Technology and Code

The program used the following coding platforms:
- Scratch
- JavaScript
- HTML and CSS

The simulation was developed using Scratch and JavaScript. It was then hosted on a website and was embedded using HTML/CSS.

The following is a code snippet of JavaScript:

```
1   /*
2   Author: Savin Dissanayake
3   */
4
5   jQuery("#backtotop").click(function () {
6       jQuery("body,html").animate({
7           scrollTop: 0
8       }, 600);
9   });
10  jQuery(window).scroll(function () {
11      if (jQuery(window).scrollTop() > 150) {
12          jQuery("#backtotop").addClass("visible");
13      } else {
14          jQuery("#backtotop").removeClass("visible");
15      }
16  });
```

Figure 3: Site navigation

The following is a code snippet of HTML and CSS:

```
1   <!DOCTYPE html>
2   <!--Author: Savin Dissanayake-->
3   <html lang="">
4   <head>
5   <title>Safety Zone</title>
6   <meta charset="utf-8">
7   <meta name="viewport" content="width=device-width, initial-scale=1.0, maximum-scale=1.0, user-scalable=no">
8   <link href="layout/styles/layout.css" rel="stylesheet" type="text/css" media="all">
9   </head>
10  <body id="top">
11  <!-- ################################################################################################## -->
12  <div class="wrapper row0">
13   <div id="topbar" class="hoc clear">
14    <!-- ############################################################################################# -->
15    <ul class="nospace">
16     <li><a href="index.html" title="Home"><i class="fas fa-home"></i></a></li>
17     <li><a href="#" title="Contact"><i class="far fa-envelope"></i></a></li>
18    </ul>
19   </div>
20  </div>
21  <!-- ################################################################################################## -->
22  <div class="wrapper row1">
23   <header id="header" class="hoc clear">
24    <!-- ############################################################################################# -->
25    <section>
26     <div>
27      <h1 id="logo"><i class="fas fa-car"></i> <a href="index.html">Safety Zone</a></h1>
28     </div>
29     <div>
30     </div>
31    </section>
32   </header>
```

Figure 4: HTML structure

```
34  <!-- ################################################################################################## -->
35  <div id="pageintro" class="" style="background-image:url('images/safetybg.png');">
36   <figure class="hoc clear">
37    <!-- ################################################################################################## -->
38    <figcaption class="heading">Scientific Principles of Automobile Safety Innovation</figcaption>
39    <iframe src="./simu.html" height="480" width="80%"></iframe>
40   </figure>
41  </div>
42  <!-- ################################################################################################## -->
```

Figure 5: Embedding the simulator

```
47    <div class="sectiontitle">
48      <h6 class="heading">Scientific Principles of Satefy Innovation</h6>
49      <p>Methods of reducing the force of collision</p>
50    </div>
51    <ul id="services" class="nospace group">
52      <li class="one_third">
53        <article>
54          <h6 class="heading"><i class="fas fa-cloud"></i> <a href="#">Airbag</a></h6>
55          <p>In a vehicle, the airbag is automatically inflated with compressed air to cushion the passenger in the event of a collision.</p>
56        </article>
57      </li>
58      <li class="one_third">
59        <article>
60          <h6 class="heading"><i class="fas fa-lock"></i> <a href="#">Seatbelt</a></h6>
61          <p>Seatbelts restrain passengers during the rapid deceleration experienced in a collision.</p>
62        </article>
63      </li>
64      <li class="one_third">
65        <article>
66          <h6 class="heading"><i class="fas fa-ban"></i> <a href="#">Crumple Zone</a></h6>
67          <p>Front crumple zones are designed to distribute the collision energy over the entire car body in order to absorb forces effectively.</p>
68        </article>
69      </li>
70    </ul>
```

Figure 6: Displaying scientific principles

The following is a code snippet of Scratch:

Figure 7: Displaying the chosen safety mechanism

A photo, screenshot or video of your project.

A video demonstrating "safety zone" can be accessed using this link: https://youtu.be/Htn8jZG_aKc

Acknowledgment of any external support

At some points, my sister did assist me when I was stuck on the coding elements, other than that, all work on this program is mine.

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