# AS91887 – Iterative Processes for a digital outcome

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Teacher:

# Outcome Development

Please state your outcome here: a working model railway crossing

## Relevant Implications

Examples are social ● cultural ● legal ● ethical ● intellectual property ● privacy ● accessibility ● usability ● functionality ● aesthetics ● sustainability and future proofing ● end-user considerations ● health and safety.

|  |  |  |  |
| --- | --- | --- | --- |
| **Implication** | **Description of a relevant implication and how it is relevant.** | **Explain why the implication is important and how you plan to address it.** | **How you have met the implication.** |
| Aesthetics | Aesthetics is making the outcome in this case a game visually appealing to the end user. | It is important for the train crossing to look visually appealing because more people will want to play with it for longer. I will ensure that I am using good shapes choices and seeking feedback on design and prototypes | I met this implication but making the wires run through the project instead of around or over the crossing i.e. The wires aren’t visible |
| functionality | Does the final project confirm with the main idea/ min project that was proposed at the beginning of the design process, and have it been a functional thing that you could do something with it | So that the marker knows what project you are making and not get confused what project you are making and so that | By making it very obvious what it is and not having to ask questions like what is that |
| Intellectual property | What is mine is mine and what someone else’s is there. This is just to protect everyone from getting their work stolen and get credit for it | So that no one's property gets stolen even if they do not have a physical version of the object/project. | By making a water mark on the bottom of my 3D CAD design where you wouldn’t normally look so that no one can easily take it out |
| cultural | Inclusive. Not just made for one person or one culture but that it can be used by everyone or made by anyone | So that everyone can use it without needing to do extra things or by more and spend more money than other people | By looking at normal crossings and modelling it after that so that in the train enthusiasm community it is included |

## Planning and Project Management tools

List the project/planning tool that you used and describe it. Describe how often you used it and give evidence as to its use (Screenshots)

|  |  |
| --- | --- |
| Project Management Tool: Gant chart | |
| Description: | A chart that shows when a specific element of a project/thing starts how far along you are on that element and finally when the element is set to finish |
| How often did you use it: | Every period to update and track how my progress is coming along |
| Evidence 1: |  |
| Evidence 2: |
| Evidence 3: |

|  |  |
| --- | --- |
| Project Management Tool: Backup files | |
| Description: | Having a double of the same file for if something happens your progress does not get deleted, this can also be like having it saved under the same email and that email 9is saved onto the school “cloud” |
| How often did you use it: | After every day/time iterations have been made to the CAD design |
| Evidence 1: |  |
| Evidence 2: |
| Evidence 3: |

|  |  |
| --- | --- |
| Project Management Tool: Version Control Github | |
| Description: | I’m using GitHub to0 save each version of my project so that if I want to go back to a certain version of it |
| How often did you use it: | After each change that I made, after each iteration I made and if I deleted something going back to GitHub and saving that file so that if I need the deleted stuff that I still would have it |
| Evidence 1: |  |
| Evidence 2: |
| Evidence 3: |

## Smaller Components

Break your outcome into smaller components and list them here:

e.g. Storyboard, Intro, Drone footage, interview footage

|  |  |
| --- | --- |
| Component | Description |
| Track | Road for train to go on |
| Crossing | Sloped Road for cars/vehicles to pass over the track with ease |
| Lights | 2 flashing red lights on either side of the track for when the train comes near to warn the road users |
| Crossing booms | A boom on either side of the road to stop people from physically crossing the road |
| Ultrasonic sensors | 2 ultrasonic sensors along the train track for when the train comes a certain distance from the crossing it sends a signal to the Arduino to close the boom (lower them) starting flashing the red lights (to stop the p[people from crashing into the car and when the train passes the opposite sensor it sends a signal to the Arduino and says hey the train has passed open the boom(lift them) and stop flashing the lights |
| Power source | A few batteries top power the system |

## Component Selection

Select a component such has story board, trial different techniques or other components and select which one you will use:

Component: track line connector pins

|  |  |  |
| --- | --- | --- |
| Component/Technique | Component/Technique | Component/Technique |
|  |  |  |
| Selected Component: one on the far right | | |
| Why: because the way that the printed part was made was not perfect where the actual LEGO piece and the printed part meats so when there is a hole/halo block placed where they connect it creates a gap and protects both pieces from damaging and those pins breaking off. | | |

Component: servo covers

|  |  |  |
| --- | --- | --- |
| Component/Technique | Component/Technique | Component/Technique |
|  |  |  |
| Selected Component: right | | |
| Why: the servos being used where their part is where they connect to things (the end of the servo) are not in the centre their more to the bottom | | |

Component: ultra sonic sensor holder

|  |  |  |
| --- | --- | --- |
| Component/Technique | Component/Technique | Component/Technique |
| Right |  |  |
| Selected Component: right | | |
| Why: the tolerances are bigger (the holes are wider and more refined especially the round holes for the cylinders) and there is now a hole cut into the bottom for the wires to easily pass through | | |

## Iterative Development of Components

List the component, do testing and seek feedback, then make changes to the component, repeat this process 4 times for each component.

**Component 1: ultrasonic sensor case**

|  |  |  |
| --- | --- | --- |
| Component Link/ File Name | Testing/Feedback | Changes to be made |
| <https://www.tinkercad.com/things/bAT4ZzPKgrb-ultra-sonic-sensor-case-proto-1> | Add a slit so that the hard wires on sensor can pass through the upper case.  Make the cover thinner so that it can go into the casing | Square needs to be cut out of the bottom to make space for wiring and cover needs to be smaller |
| <https://www.tinkercad.com/things/fSmVZHrHVZg-ultrasonic-sensor-case-proto-2> | Make the holes in the upper casing bigger so that its easier for the sensor can go in | Holes need to be refined |
| <https://www.tinkercad.com/things/aXfba46vnxA-ultrasonic-sensor-case-final-proto> | It just a manufacturing error there is not much that can be done to prevent that, but it can be grided a bit so that the sensor can easily go into the upper casing | Some grinding for perfection |

**Component 2: track/raised crossing**

|  |  |  |
| --- | --- | --- |
| Component Link/ File Name | Testing/Feedback | Changes to be made |
| <https://www.tinkercad.com/things/927x6zX12U9-track-proto-1> | Add holes in the centre so that the actual LEGO tracks can go in without having to mod it | Space for the clips to go in |
| <https://www.tinkercad.com/things/cPBIT61T1Iw-track-proto-2> | The equipment used to print it cannot go that accurate get rid of the middle clip and make the hole bigger. And add a hole on the side so that there can be a little clip made to hold everything together. | Bigger space this does not work |
| <https://www.tinkercad.com/things/anRSf5Vhq8f-track-final> | Maybe add a brick on the bottom that has the same dimensions as the track and pieces attached to it cause the grooves that was made are too small and it cannot be made bigger for the height of the piece does not allow it, and still some grinding | Some grinding for perfection and the brick on the bottom |

**Component 3: servo covers**

|  |  |  |
| --- | --- | --- |
| Component Link/ File Name | Testing/Feedback | Changes to be made |
| <https://www.tinkercad.com/things/jidotF01zto-servo-covers-proto-1> | Maybe have the hole the shape of the servo for a better a look | Hole shaped like the servo |
| <https://www.tinkercad.com/things/d9zsfCksV4i-servo-cover-proto-2> | The hole where the servo is not in the centre | Move the hole to the side not the centre |
| <https://www.tinkercad.com/things/4Z6O2iUXQrD-servo-cover-final> | Better but still some grinding | Some grinding for perfection (manufacturing error) |

**Component 4: boom cases**

|  |  |  |
| --- | --- | --- |
| Component Link/ File Name | Testing/Feedback | Changes to be made |
| <https://www.tinkercad.com/things/hCDmbvGBzJy-case-for-boom-proto-1> | On an actual railway crossing the light are over the boom you already have the hole for the wires so just add something on top so that the lights can be on top and make space for the wiring at the back of the servo hole | Space in the back for wiring and the lights on top |
| <https://www.tinkercad.com/things/iJFNfVPFWZl-case-for-boom-proto-2> | Maybe add a hole on the bottom so that a clip can hold the pieces together  And Some grinding especially in small areas and high friction zones | Space for a tension piece to hold other pieces together |
| <https://www.tinkercad.com/things/eLoVs99DN9Y-boom-cases-final> | Better just in the tight spaces some grinding needs done | Some grinding especially in small areas and high friction zones |

## Testing Final Outcome

Please provide a link to your outcome here:

## Testing

|  |  |  |
| --- | --- | --- |
| Test | Description | Changes to be made |
| electronic components | Testing if the electronic components that are being used are suitable for what is being built | Mg90 servos to Sg90 servos. |
| Are there sharp edges | Will the edges of the individual pieces harm a child if the hit on of their limbs against it | Sand the sharp edges especially the ramp |
| Does the pieces fit | Can the pieces slide into each other and the studs hold onto the original LEGO bricks without a problem | Sanding on the manufacturing errors |
| Power problems | Is the amount of power required suitable for the average consumer/ can the wires be handled easily | A bottom layer that allows the wires to be run under the railway easily and unseen. |
| Movement problems | Is there a problem with the pieces that can move i.e. The servo boom | Some sanding especially for the servo to go into its slot and its cover to go over without breakages |
| Understandable: | Is it easy to use | None so far |
| Aesthetics: | Does it look goo | Some painting and sanding |
| Accuracy of model | Does this model have a good accuracy to what it looks like in real life | Some sanding in specific and key area that the 3D printer can’t easily do (overhangs/sagging part) |

### Outcome after Testing

Please provide a link to your outcome after testing has been completed.



Include a couple of statements supporting how the functionality has been improved due to testing and trialling: the way the functionality of my project was improved through testing and trialling is before i did the trialling and testing is that there was a lot of problems with the functionality especially the fact that the bottom of each part wasn’t really compatible with the tops of Lego pieces (the studs couldn’t go Into the bottom) but through testing and trialling I was able to design a bottom section of the pieces that allows the studs of the Lego pieces to go into the bottom of the project of each piece and able to collaborate with a normal Lego brick

Another way how the functionality of the project was improved through testing and trialling was with the servo boxes, this was due to the fact that the CAD programme I was using had available models of servo already there but I originally used the wrong one (there were multiple that looked a lot like each other), so through this testing and trialling I found that I had to use a bigger servo model (they did have the specific one I needed so I didn’t have to remodel the servo which can prove to be difficult) and after I did that the servo was able to slide in with a “press fit” but still able to get replaced if needed (wh8ich would prove useful for if in the future the servo needed to be replaced it could easily be done) and the owner/operator wouldn’t need to replace the entire piece which can get quite expensive over time. This helps save time resources and less frustration from the operator who would’ve need to take the project apart of reprint the entire project.

# Final Analysis:

**Planning:**

Discussion points 1: tracks

Explanation of point 1: Why the diverse types of tracks?

Discussion around point 1: I researched the way that LEGO tracks look and how they function, I made multiple different tracks, I got feedback from these designs be testing it and found that the 1st one didn’t have gaps that allow for the clips on the actual LEGO the hold it together. The 2nd one is too tight or too loose of a fit no matter what orientation its printed in that is where the 3rd one comes in where there is a cutout of where the clips of the actual LEGO can just slide.

Discussion points 2: servo covers.

Explanation of point 2: why do the servo covers need to have a cover?

Discussion around point 2: I researched the way that normal crossings look like and the motors that lift the boom up are covered up and unexposed from the elements. The feedback that I got was to just make something that just slide over the servos that lift the boom. The 1st trial cover had a big hole in the front that did not “cover” much. The 2nd trial covers hole that allows the servo to go through was in the center, but the servo is not in the center for it is on the side. The 3rd and last hole were to the side and fit around the servo and covered it up to such an extent is that the only thing that is not covered is that which should not be covered.

**Trailing:**

Discussion points 3: ultrasonic sensor holder

Explanation of point 3: why the holder?

Discussion around point 3: I have researched ways that trains get detected on normal railway line but none of them showed any way of not having then to modify the actual pieces of LEGO but if I use a ultra sonic sensor that can not only detect when a train comes along but if anything comes along. The way that the sensor would then be held ius by going in a box with a backing (so that it is perfectly enclosed. The 1st trial box had 2 problems with it. The first was that the pins on the sensor cannot pass through the bottom of the box. The second was that the holes in the box were too rough and the sensor could not go through the holes. The 2nd trial was then made with a hole in the bottom but the way the holes were made was still too rough and the sensor still could not pass through/ was too tight and the sensor was crushed (in the sense of the software ons the internals were damaged). During the 3rd and last trial, the holes were then refined, and they enlarged to a point where the sensor would fit snug and would not move around.

Discussion points 4: sensor block.

Explanation of point 4: Why do you need a block to hold the ultrasonic sensor?

Discussion around point 4: the sensor block is the bottom of the sensor box. From the research of the box I have found that the box has to stand on a “pedestal” type of structure to hold it up and stable for the sensor to work as well as a channel that can be attached to the main piece where the wires are able to run to the sensor and big enough hole for it to not be squished. The 1st part of this piece was to attempt was to have the pedestal come closer to the railway. There is 1 problem and that is the train that does not have enough space/ it will come remarkably close to the sensor and there is a big possibility that it can damage the internals. In the 2nd trial it was moved a bit further from the rail, which opened more space for the train to pass through.

**Testing:**

Discussion points 5: motor box

Explanation of point 5: why the motor block?

Discussion around point 5: Like the sensor cover on a real crossing, the entire motor block is covered, and the lights that warn the drivers in the road vehicles are on top of (or close to right on top of) the motor block. The 1st trial component’s feedback was that the minimal availability of tests was du to the fact that the top (the place for the lights) broke off due to the walls being too thin. The 2nd trial the walls on the cylinder walls were thickened and due to the availability of testing to do in this trial we found that the casing for the lights worked well, but the wires go down to where the servo is located and in because of the 1st test not being viable this was not foreseeable and a hole on the top of and back of the servo hole that than goes down. The last “problem” on this trial test was that like on the track there is channels for the wiring as well as this test, but the location of the hole is off and needs to be moved. Lastly the 3rd trial were the walls of the cylinder walls is thick enough to not break easily and a wall was made to fit into the back of the led casing to protect it from jumbling around and moving too much, and the channels were moved to be parallel to the track’s channels.

Discussion points 6: solid piece

Explanation of point 6: why not separate pieces

Discussion around point 6: the reason to have a solid piece instead of 3 separate pieces Is because of the manufacturing process which is 3D printing from if it was form pressing, I were be able to make it separate with multiple pieces but since it is 3D printed the integrity of the pieces is greatly affected for it is weaker than normal pieces. Still, if I make all of it one piece and have it raised the height of one LEGO brick which is super helpful as well for under the tracks themselves-there are channels. Still, those channels are too small because the number of wires that there are supposed to run through it is too much but with this extra space that is created with it being lifted there is no trouble with the wiring. Another positive way of having the pieces lifted is that we can have the bottom of everything is that we can have holes which the top of normal bricks (the studs) is able to slide into and hold onto.