

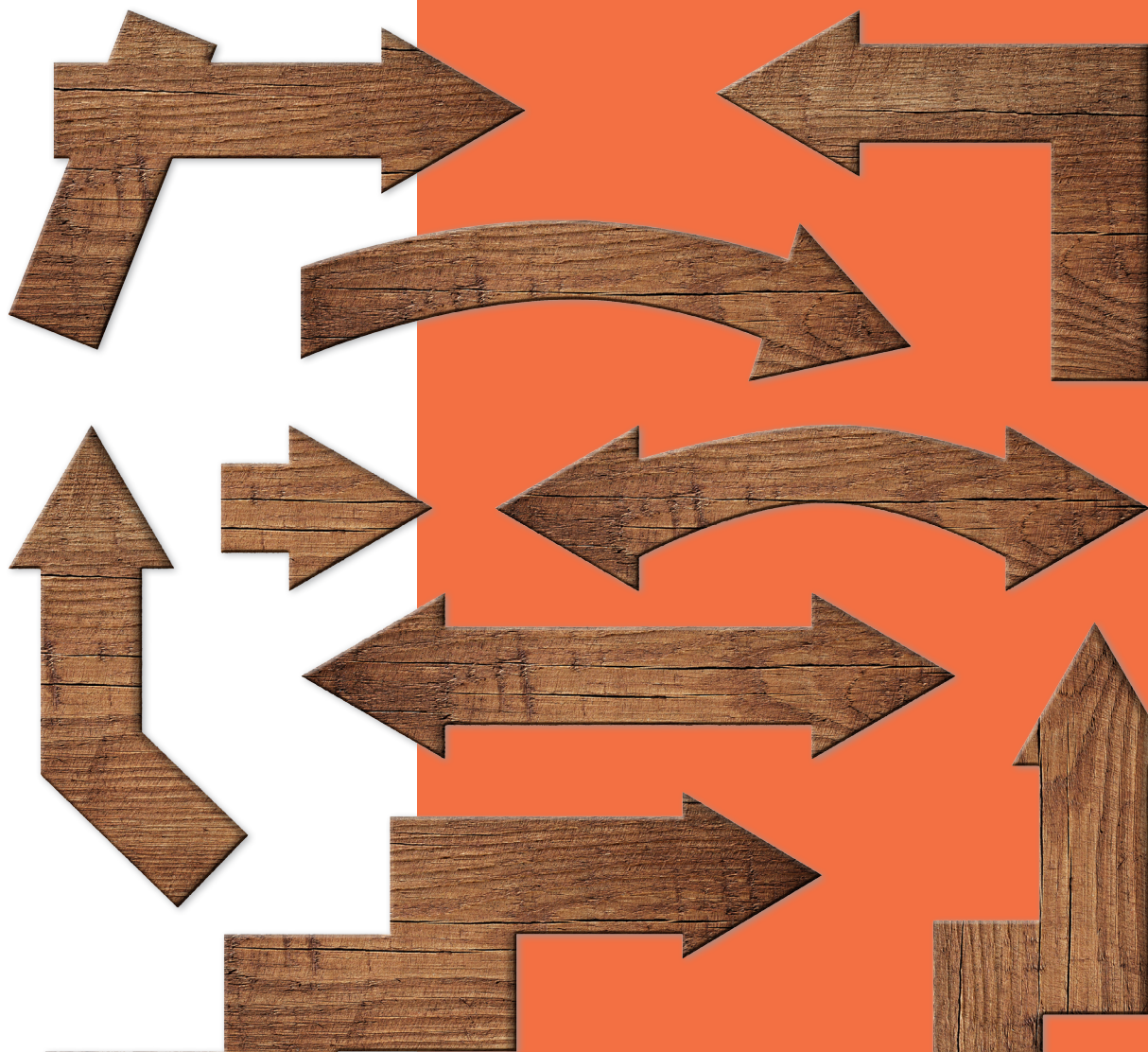
GCSE
DESIGN AND
TECHNOLOGY

(8552)

NEA Example response 2 with commentary
Contemporary Home

NEA
EXAMPLE
RESPONSE

Version 1.0 May 2018



Design Brief and Context Analysis –Children’s Learning & Play

Problem

Children get easily distracted and require something interactive to keep them engaged and continuously learning. For example an electronic game.

Design Brief

I am going to design and manufacture an electronic game for children aged 14+ to help develop their hand eye coordination but also to keep them occupied in the home.



These are the things I need to think about in my project:




- How much space will it take up?
- How hard will it be?
- Is there a power outlet nearby?
- What's the scoring system?
- How will you make it fun?
- How durable is it?
- Component cost?
- What are the available materials?
- How safe is it?
- What is the set up time?
- Is it replayable?
- What are the key game aesthetics?
- What is the cost to use the game?
- What are the tools required to make the game?
- How much power is required to run?
- What is the theme of game?
- What is the Weight?
- Is it Skill/luck based?
- Will you get a prize?
- What are the Colour schemes?




Design Specification:

- The electronic game must have a circuit board that works and it is used to hold all the components together and the circuit board must be made as small as possible this will then allow me to use less materials.
- The game must have a case and it must look cool and attractive to attract the users, the colours must be based around red or blue as they are the most popular colours out of both genders also it must each the target audience of the ages between 14 or 18 as most of the students in this school are at that age.
- It should be easy to use and understand so the user can get on with the game as soon as possible
- My product must be safe, have rounded edges and no open wires, so all of this can protect the user.
- If the game uses batteries the battery compartment must be easily accessible. It must be made out of MDF or acrylic as MDF because it is durable and you can paint any pattern you want on it or you could use acrylic because it is strong and is recyclable
- The game definitely must be competitive as multiplayer is a key point so making it 2 player is an option
- The product must cost between £10-£15 pound or about 50p a go do make it affordable for the user.
- The product must have a theme of the house and its charity to show the users what they are paying for also it must have lights and sounds to draw the competition in therefore making it more popular.
- If I use batteries it must be portable and small so it can be moved around very easily,
- I could have two alternate power sources like having batteries and a mains power supply so if there are no mains power sources nearby you can use the batteries.
- The case should not show any of the circuit so it doesn't ruin the aesthetics of the product.
- The Switches must be easily accessible and the output components such as a LED or a 7 seg display should be easily seen from a descent distance of about 3m.

Detailed Analysis of Existing Electronic Games:

- Rate out of 10 for:
- Build quality
 - Playability
 - Replay ability
 - Aesthetics
 - Affordability
 - Function
 - Environment
 - Customer
 - Overall

	Input	Process	Output
 Bop-it	There are 5 total inputs in the product and are all sensors or switches, one is used as both an on/off switch and a switch that starts the game and also you have to press it when the game tells you and the other 4 sensors and switches are only used when the game tells you to.	As you activate the switch or sensor it will send a pulse to a PCB located in the centre of the case with most likely a control circuit in it, once it receives the pulse it will send a pulse to the output (the piezo). The circuit will most likely be a microcontroller.	Once the pulse has come from the input and into the microcontroller it then sends the pulse to the one output (the piezo) this plays a tune saying if you have lost or what button you should activate next.
 Simon Says	There are 7 total inputs in the product and they are all PTM switches, one is used to start the game and the other two circular PTM switches are to select the difficulty. The other 4 semi circle switches are used to copy what the game tells you.	As you activate the switch it will send a pulse to a PCB located in the centre of the case with most likely a control circuit in it, once it receives the pulse it will send a pulse to the output (the LED). The circuit will most likely be a microcontroller.	Once the pulse has come from the input and into the microcontroller it then sends the pulse to the one output (the LED) this shows which switch you need to activate next.
 Don't touch the wire	There are only two total inputs in this product, one is the on/off switch which is a slider and also the wand and wire which when the both make contact it sends a pulse.	As you activate the switch it will send a pulse to a PCB located in the centre of the case with most likely a control circuit in it, once it receives the pulse it will send a pulse to the output (the Buzzer). The circuit will most likely be a microcontroller.	Once the pulse has come from the input and into the microcontroller it then sends the pulse to the one output (the Buzzer) which makes a noise to indicate the player has failed.

Product	Build Quality	Playability	Replay ability	Aesthetics	Affordability	Function	Environment	Customer	Overall
 Bop-it	9/10 This is because the product is made out of abs and abs is very tough which means that it will be resistant to bumps and collisions so overall it will last a long time.	9/10 This can be played very easily because it is tough and the rules are simple and straight forward so it can be easily played by many types of people. Also it can be enjoyable because it is very competitive and challenging as well. Also the product is very safe as it is build quality is good so there are no sharp edges and it is ok for younger children as there are no small parts to choke on.	9/10 It can be replayed easily because it is made out of a strong material (abs) so I can be used many times with no breakages. Also the input devices are also made out of abs so overall it will hardly ever break.	7/10 It is a very simple but attractive design because it doesn't lean to one side of the market place e.g. it is not blue to appeal to boys. But the only thin hat marks it down it is a bit too plain because there are no designs on the product. The size is just right for what it is as a hand held device.	7/10 Overall the Bop-it is fairly expensive for what you get but they last for a long period of time but a new bop-it is released every couple of months, also it requires batteries so you have to pay to replace the batteries.	9/10 To start the game there is a slider switch to turn the system on then you press the large PTM button to select the mode and the other switches are to cycle through the game modes, once you start the game you get action spoken out and you have to repeat that action and you have to see how long you can hold the streak.	5/10 As it is made out of plastic it would help if it could be recycled but it is non-recyclable so it will take up more landfill space, however it contains batteries that can be recycled if you do it in the correct way, also it is mass produced so lots of CO2 therefore causing global warming.	8/10 Pretty much anybody can play bop-it from the ages of about 8 to 40 and for any gender as the colour scheme is not just on one side, the client can use it anywhere on the go but they will need a large-ish bag, it attracts the customer by having a cool design as well as having a catchy name.	8/10 Overall I think it is a fun product and very addictive which also makes it very competitive the design is really cool but the colours can be improved a bit, I would buy the game myself but other people will get bored a waste a lot of money on it as it is expensive.
 Simon Says	9/10 This is a product that is meant to last a long period of time, it is most likely made out of ABS as it is a strong which means it can protect itself from bumps, also it is well put together as the seams have no gaps or sharp edges	7/10 you do not get much enjoyment out of this game it is mainly based on skill but it is played very simply, you don't really need any instructions, all it is is one push of a button the repeat what it does. On the other hand the game could be made enjoyable by playing multiplayer to see who can get the best score, as it is challenging more and more people will want to beat each other score. As it is built well the product is very safe with no sharp objects.	9/10 The replay ability is the main part of this game that makes it so addictive because every time you get a score you want to try and beat that score so you try over and over again, its not so much it's a good game it is a addictive game. Also because it is made from ABS it will last a long time.	7/10 It is very much like the bop-it, it has a simple but attractive colour scheme but unlike the bop-it it has a simple design but goes well with the shape of the buttons. It is not one sided to either boys or girls as it has a range of colours that both boys and girls like. Overall they could of change the background colour to white to make it stand out more and make the shape more attractive.	5/10 It is fairly expensive for what you get because it is about £15 and you can get games that you get a lot more enjoyment out of for cheaper. Also it requires batteries which adds to the overall cost, but you can always go back to it to play and you can take it anywhere.	9/10 The product is very easy to function, to turn it on all it is is a PTM switch and another PTM switch to start the game or select the difficulty/speed. One you have started the game it is just 4 PTM switches which are used to copy the AI's actions. Also at the end once you have got your score it displays it on some 7 segment displays and it will show yours for a few seconds and then show you the high score.	6/10 Also as it is made out of plastic I cannot be recycled and also plastics is made using oil and oil is burned which releases CO2 into the atmosphere causing global warming. The reason it has a higher score is that it wasn't produced as much as the bop it was so it will use up less landfill space and will produce less CO2. this also contains batteries which can be recycled if you do it correctly.	7/10 This is mainly based for people who are looking for a challenge or they need to pass by time, it can be used by a whole range of ages from 8 to 50 also it can be used by either boys or girls as the colour scheme suggests that it is for both genders. You can use it anywhere on the go or even is home as it is portable because it takes batteries. It attracts the customer mainly with the colours but as it is competitive other people can encourage other people to buy it	7/10 Overall I think it is not such a fun game but is very addictive and competitive, the design is simple and effective but there is no theme, I wouldn't buy the game myself as it gets boring after a while.
 Don't touch the wire	6/10 This product does probably not use ABS for the base, I think it uses a cheaper plastic as it is flimsy and breaks easily, also the wire is made of metal but is not secured on to the base properly as it is cheap plastic, however the stick and hoop is very well made and fits in well.	8/10 This is another skill based game that is easy to play as after a few minutes of play you clearly know the rules without looking at the instructions. This is best played with two or more people meaning it is a competitive game. The game could be more enjoyable is physically making the game two player by having two wires and doing a race, this product is kind of safe but as you lift the product sometimes there may be sharp edges on the plastic meaning you can cut yourself but everything else is safe.	7/10 Again this game is about trying over and over again and requires great precision and once you fail you will always want to get to the end no matter what. Over time the product may become unplayable because the plastic will snap which will expose the electronics which means you cannot use it again.	8/10 Overall this product is attractive because it has a theme to it and a good design and colour to fit the theme, the theme is space which is more aimed at boys so I would change the theme that both genders will like. Also they have made the wire maze look challenging which attracts the people who are looking for a challenge.	9/10 This product is very cheap retailing at £6 which pretty much anybody can afford but you get the down side of the cheap plastic, this product also requires batteries which you have to pay even more for, the thing you pay for in this is the looks and the competitiveness.	5/10 the function can often be affected due to the build quality of the base as it falls of its base, making you unable to complete the game. As the on/off switch is at the base there is a chance it may break. All there is as inputs is the on/off switch but as you turn it on the wire becomes active and if you touch the wire with the metal hoop it will activate the buzzer, there are not many components in this build.	6/10 This product is made out of plastic and metal and can also not be recycled. Because it is made out of plastic which is made from oil which is burned and this then releases CO2 into the atmosphere causing global warming. However this product is not mass produced so it does not fill up as much landfill but it does require batteries so they can be recycled but many people don't recycle them so more and more batteries are used.	6/10 this product is for the people who want to pass by time or want to practice their hand to eye coordination, anyone can play from almost any age or gender it but they need the skill to reach the end, the theme of this product mainly points towards boys as it is space but girls can like space too. It is not portable as it is quite large and not able to play in hands but it does have batteries so cost may rise, the main thing that attracts the customer is the packaging as it is colour full and attractive	6/10 Overall I think it is a fun game but it is not built correctly and also it is addictive, I also like the theme but the function and the environmental effects just let it down also the build quality is not up to standards. I wouldn't buy the game myself because it does get boring after a while.

User information:

Questions:

What is your favourite genre of game?
 What games do you own? Are there any issues with the games?
 Do you play games often?
 How long do you play for a day?
 What features of the games do you like?
 How much do the games you play usually cost?
 Do you play single or multiplayer games?
 Do you enjoy having sounds in games?
 Do you enjoy having flashing lights on games?
 Rank these colours 1-6 .1 as best 6 as worst:
 -Red
 -Blue
 -Green
 -Yellow
 -Orange
 -Purple
 Do you like your products to stand out or be dim?
 Rank in order from best to worst:
 Jenga,Marbles,Cards
 Rank in order from best to worst:
 Pokemon,Mario kart,Super Mario bros

Answers: 1

Adventure
 FIFA, it freezes
 Yes
 1-2 hours
 Storyline
 £40
 Single player
 Yes
 Yes
 -Red -2-
 -Blue -1-
 -Green -3-
 -Yellow -6-
 -Orange -5-
 -Purple -4-
 standout
 Jenga,Marbles,Cards
 1 3 2
 Pokemon,Mario kart,Super Mario bros
 1 1 1

Answers: 2

Strategy
 Battlefield, occasional bug
 Yes
 8 hours
 Multiplayer
 £20
 Multiplayer
 No
 No
 -Red -3-
 -Blue -1-
 -Green -6-
 -Yellow -5-
 -Orange -4-
 -Purple -2-
 standout
 Jenga,Marbles,Cards
 2 3 1
 Pokemon,Mario kart,Super Mario bros
 1 2 3

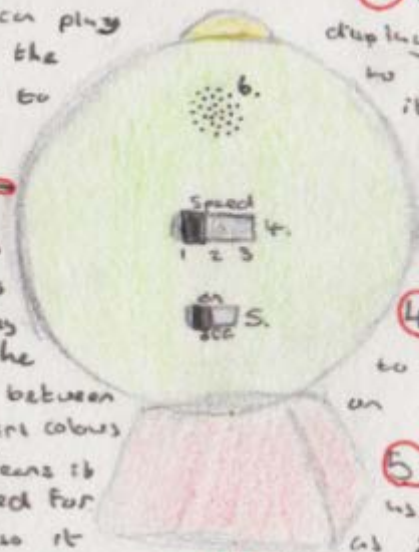
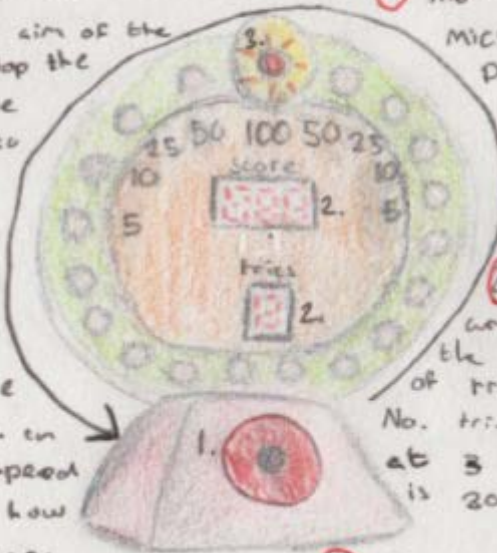
Answers: 3

FPS
 Battlefield, Few bugs
 Yes
 5 hours
 Multiplayer
 £40
 Multiplayer
 Yes
 Yes
 -Red -2-
 -Blue -1-
 -Green -3-
 -Yellow -4-
 -Orange -5-
 -Purple -6-
 standout
 Jenga,Marbles,Cards
 1 3 2
 Pokemon,Mario kart,Super Mario bros
 3 1 2

I have found out through research that I may need to consider the comfort of my product because I have found that people like to play for a long period of time, also I found that the most popular colour was blue this means that I will aim to make the main colour of my product blue with a few bits as red and green because they were the next best colours. Most people like the multiplayer of games so I need to make my product competitive or make it compatible for two or more players. Also I will have to look into the design as many people like their product to stand out which also means that I will have to use brighter variants of the colours that I have chosen. So overall the target market will be younger people from the ages of 14-19 with any gender allowed.

Reaction Game

This game is all about reactions, the aim of the game is to stop the light as close as you can to the yellow circle, it can track your score and it can also tell you how many tries you have left. Also you can change the speed depending on how skilled you are also you can play tunes in the background to distract you.



I have chosen these colours because they are on the borderline between boy and girl colours so this means it is designed for anyone also it may have to be made out of a hard material like abs because it is free standing and you do not want it to snap.

1. The button can either be a micro switch or a large DTM switch but a micro switch could probably be better because it can be activated quicker but you would have to attach something to it.

2. The 7 seg displays are used to display the score and the amount of tries you have, the No. tries you have is set at 3 and the max score is 200.

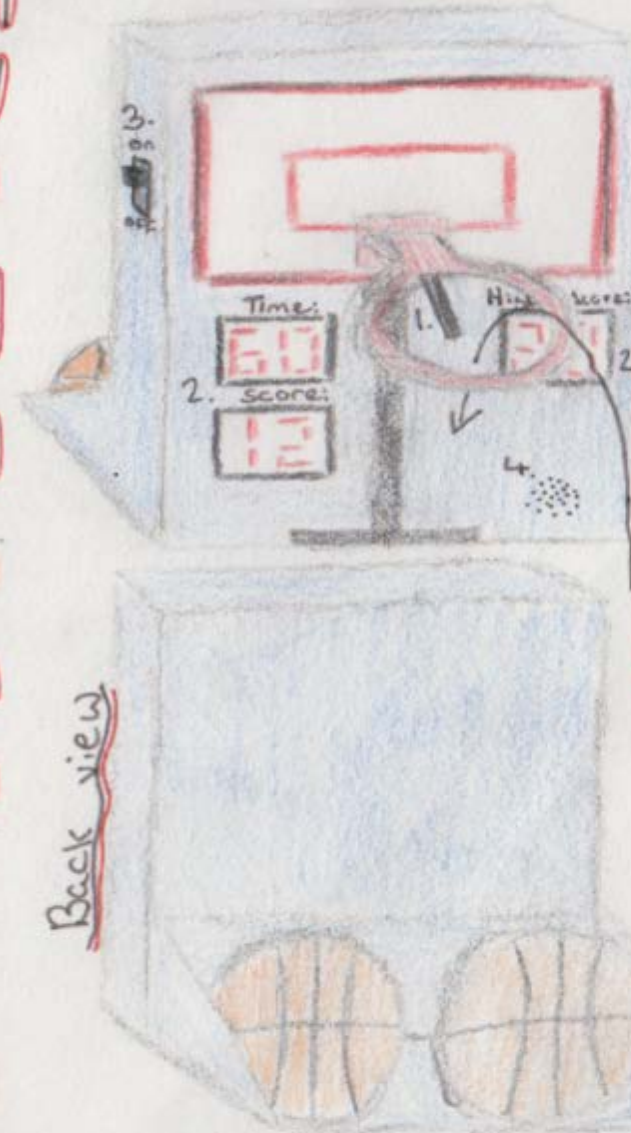
3. The leds are used to display how close you get to the centre and if it stops 5 or less before the centre it will send a signal to the 7 seg display and add on the correct score.

4. This is a 2 way slider to determine the speed on which the leds flash.

5. The slider switch is used as an on/off switch as it is easy to determine whether it is on or off.

6. This can either be a distraction like abs because it is free standing and you do not want it to snap. or a winning tune because you could either use a buzzer to distract the person every time a LED flashes or you could use a piezo to play a winning tune at the end, or you could use both.

Shoot Dem Hoops



This is a simple, fun game where you have to score as many hoops as you can in a minute also it has a tune playing as you 'shoot dem hoops'.

1. The microswitch is used because it can be easily activated so once a ball hits it it will activate it, also it will be lowered to allow the ball to roll through.

2. The dual 7 seg displays are used to display the score, time and highscore. The time counts down and the others count up and as the time reaches 0 the score will reset and so will the time but the highscore can change if someone gets a better score.

3. Again the on/off switch is a slider so the user can easily distinguish whether it is on or off.

4. The piezo is used to make the game more fun as you can listen to the tune it plays, also the tune can be changed.

I have chosen red and blue as the main colours because it is mainly aimed at boys more than girls. The basket balls are stored in the back to make the product more portable.

Electronic game designs:

Design

decal
HOT SHOT

Slip for easy access.

8

1. A microswitch is placed just below the hoop so that when it is activated the ball can still pass through the hoop.

2. The hoop is made big enough so that it can fit 1 and a half table tennis balls in. (about 6cm)

3. The 7-segment displays are placed in the middle of the case so that they are easily visible and can display both time and score.

4. There is a printed design on the bottom front of the case which is bright and colourful which will attract a wide range of consumers. Also the surface is sloped so that if the ball does go through the hoop then it will roll the ball back to the user.

5. An on/off slider switch is used on the side so that it is easy to access and as it is a slider switch you can clearly tell what state it is in (either on or off)

6. The reset PDM switch is also placed on the side for easy access and I used a PDM as it is easy to press and gives a distinctive click which can tell you that you have reset the circuit.

7. The edges and corners are smoothed off so that it does not hurt/injure the user and also to make sure that the table or surface you play the game on does not get scratched.

8. On the back of the case is where the battery is located and they are accessible by a pill off cover which is easy to access and takes less time, effort and equipment to open than for a screw tight cover.

SIZE of hoop = $4 \times 1.5 = \underline{\underline{6\text{cm}}}$

2. $\leftarrow 4\text{cm} \rightarrow$

Circuit design 1

Distraction:

This is the circuit I first started off with which is why it is so simple. It uses a 555 monostable and a -ve pulse switch connected to the monostable with a LED as a input.

This is the simple battery system for this circuit as there is no on/off switch or anything to limit the voltage however it will still be portable.

This is the negative pulse switch connected to pin 2 of the 555 monostable. The input in this circuit is the PTM switch, it is used to activate the 555 monostable with a negative pulse, this means the pulse goes from a 1 to a 0 which means it goes down.

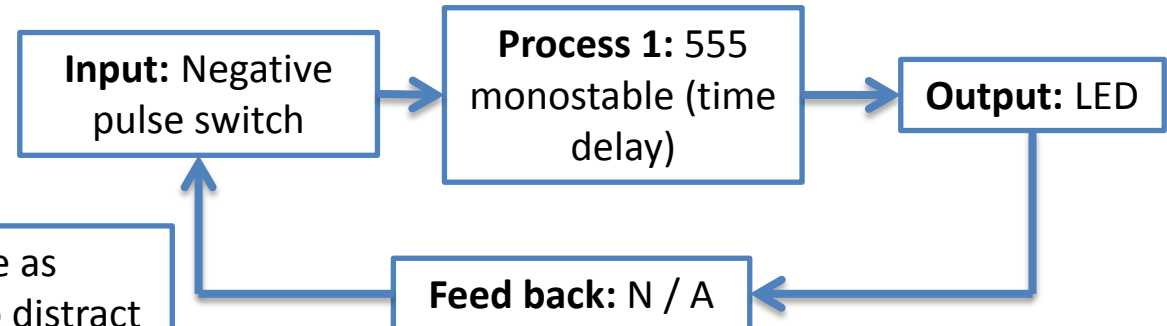
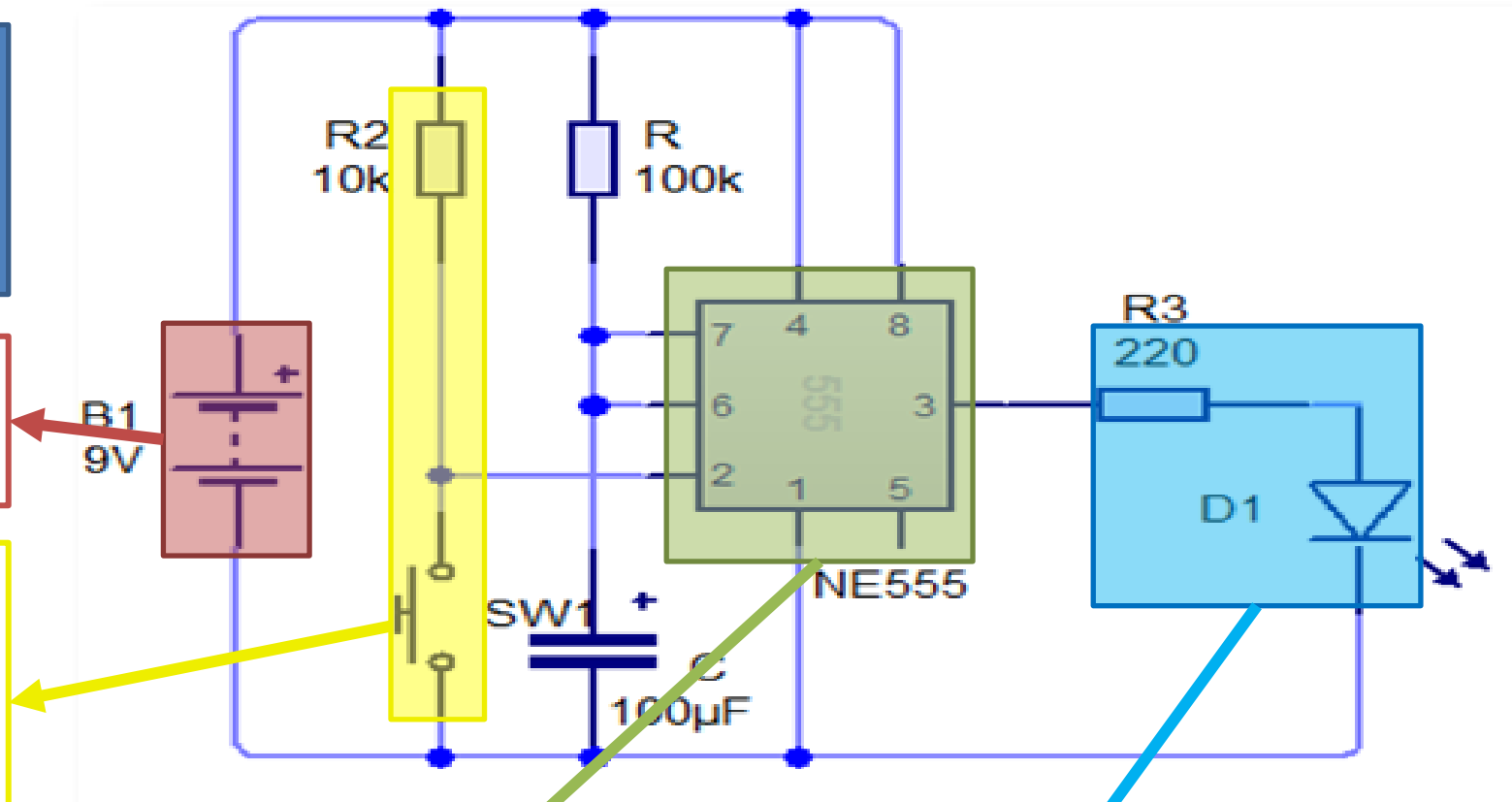
The process in this circuit is done in the 555 monostable which causes a time delay in the pulse so the LED can stay on for a set amount of time depending on the resistance and the capacitance.

The output in this circuit is the LED which indicates it is receiving a positive pulse by displaying a light.

This circuit works when you activate the PTM switch it activates the 555 monostable which adds a delay to the activation of the LED so you can raise the resistance and the capacitance to increase the delay, the LED turns off when the capacitor fills up which then resets the circuit back to its normal state.

I could use this in my game by using it to distract some one in a reaction game as when they start the game it will be a certain amount of time until it flashes to distract the player, I could also have it on a repeat so it doesn't only do it once.

This met the design criteria and the customers expectations because it was portable and also had a small circuit size and it had an LED that could clearly and brightly display it when it is powered.



Circuit design 2

Counting idea 1:

This is a simple counting circuit that can count up to 99 on the dual 7-seg display using a monostable 555 and 2 4026B's and a simple PRM switch and the battery controlling it all.

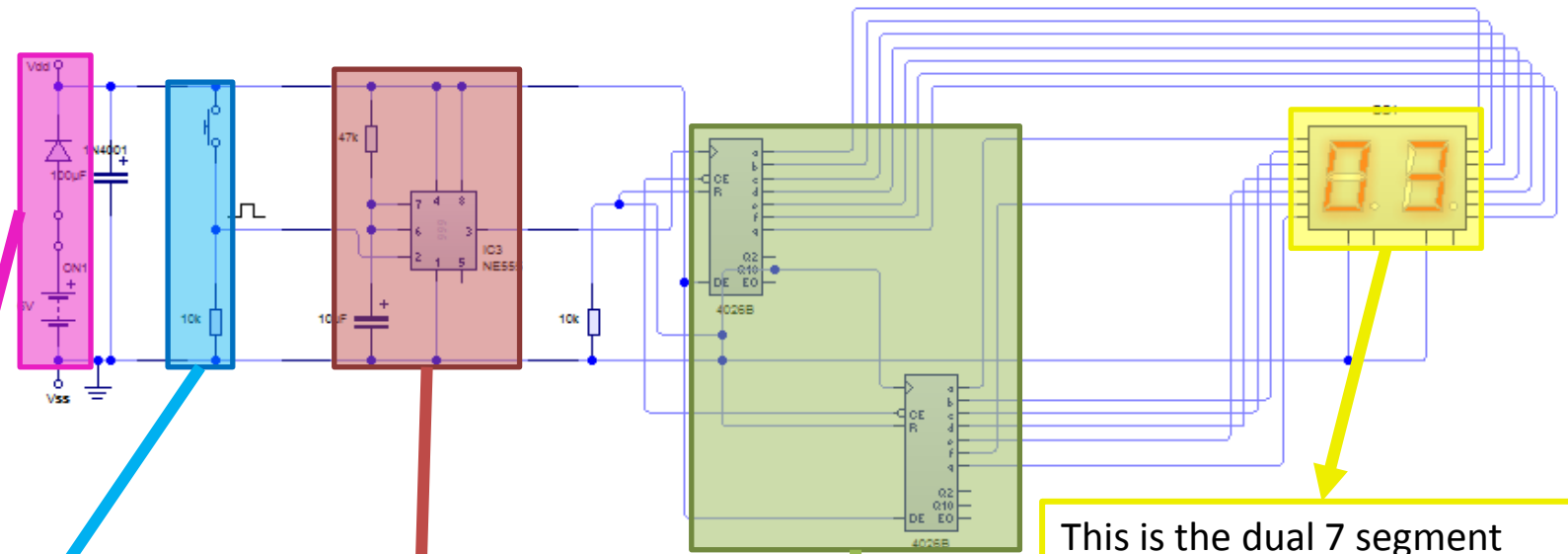
To power the circuit I have used a simple battery and on/off switch, this will make my circuit portable and the diode regulates the voltage so things don't get damaged.

This is the input switch to start the timer that has a pull down resistor making it a positive pulse switch that is used to activate the monostable time delay and the switch that is used is a PTM switch.

This would work in a game because it can be used as a timer that counts up to 99 and that would be how long you would get to play before the timer runs out and the reset could be connected to the scoring system.

This meets the design criteria because it uses batteries so it is portable and also it uses a 7 segment display so that it can clearly display the time so that users can see it.

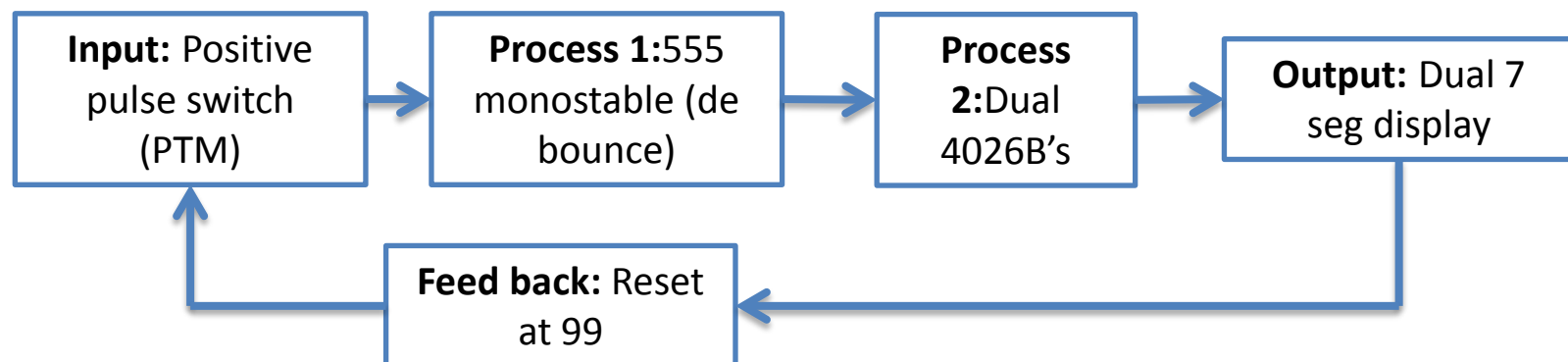
This would meet the demands of the customer because it uses a 7 segment display so that it can clearly display the time so that users can see it.



This is one of the main processes of the circuit which is used as a debounce, it is the 555 monostable that is used as a time delay as decided by the capacitor at the bottom left, this is set as 10 micro farads so it will pulse to the clock of the 4026B every 1 second.

These are the dual 4026B's that are the second main process of the circuit as they control the dual 7 segment displays, once the first 4026B receives a pulse to the clock it will start the count and once it gets to 9 and nearly reached 10 it output Q10 which enables the clock on the second 4026B which counts up 1 every 10 seconds and then resets when it reaches 99.

This is the dual 7 segment display this is controlled by the two 4026B's and is used to display the time as it counts up.



Circuit design 3

Simon says idea:

This is a more complex circuit design as it uses a program which is on the genie E18 (unfortunately I could not obtain the program). The aim of it is to repeat what is shown on the LED's and is reset manually.

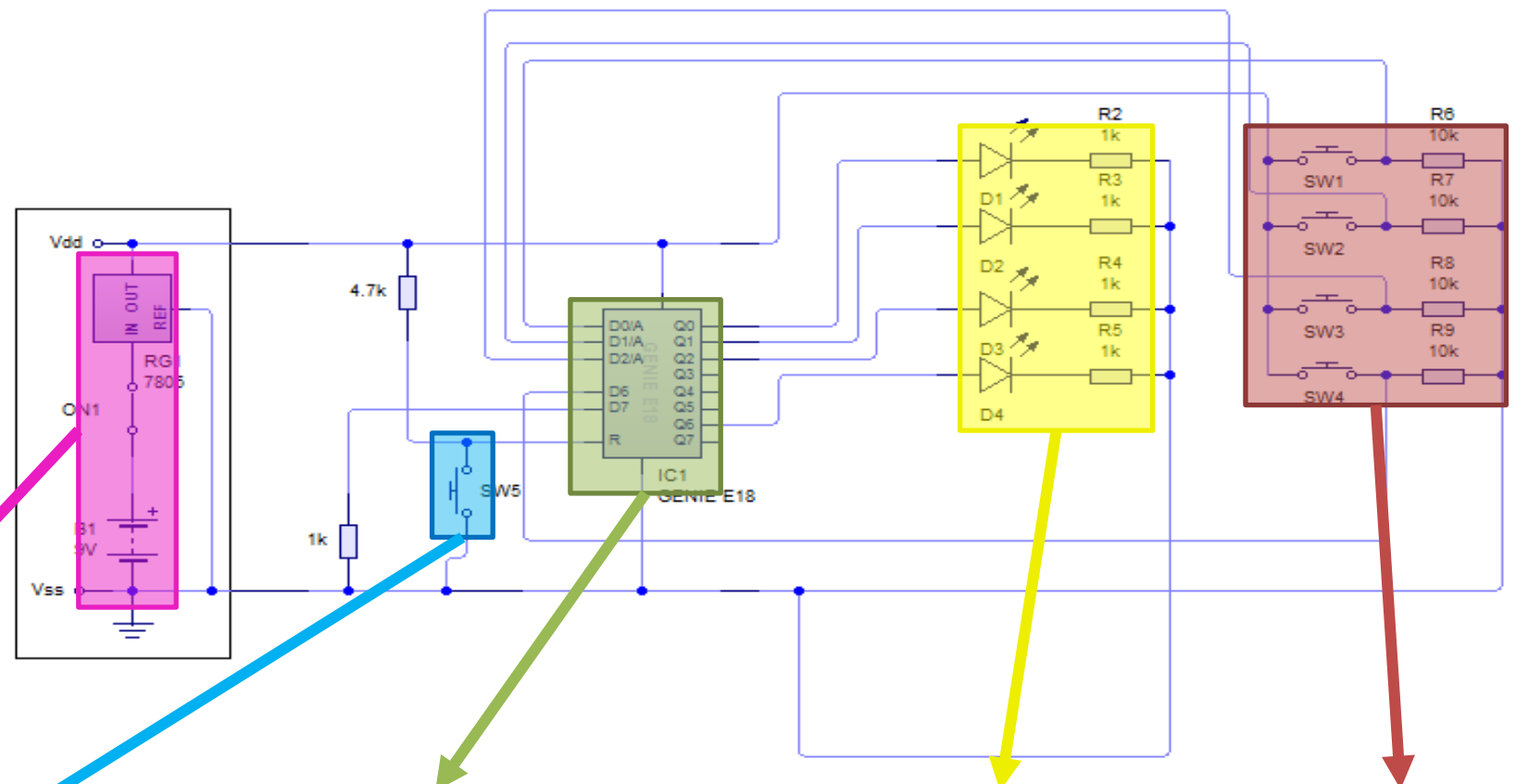
To power the circuit I have used a simple battery and on/off switch, this will make my circuit portable and it also has a voltage regulator because the battery supplies 9 volts and this voltage can damage the microcontroller so it regulates the voltage so that it does not damage it.

This is the reset switch so when it is pressed it will reset the genie , in real life this would probably be a PTM switch.

This would work well as a game as I know already Simon says if popular so that people would like to play it and challenge other people.

This meets the design criteria because it uses batteries so it is portable and also it uses a LED's so that it can clearly display the replication so that users can easily see it.

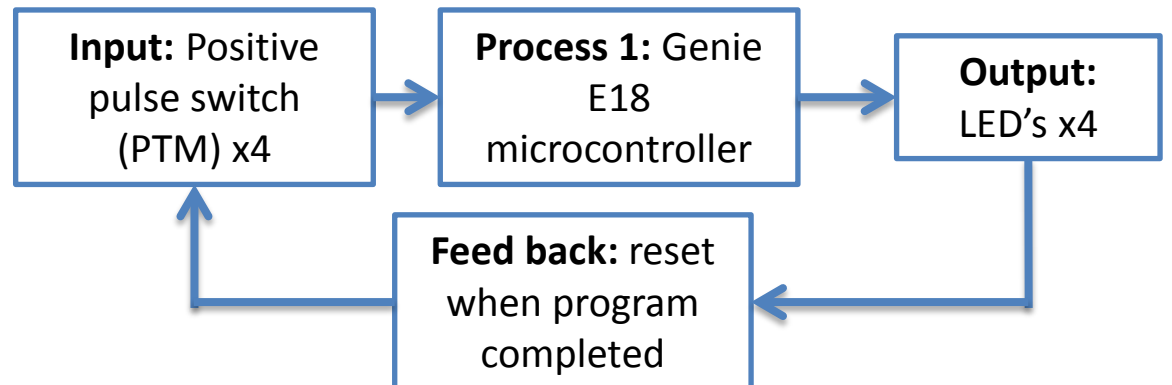
This would meet the needs of the customer as it would be fun and challenging and could even be used a multiplayer game which is what most users requested.



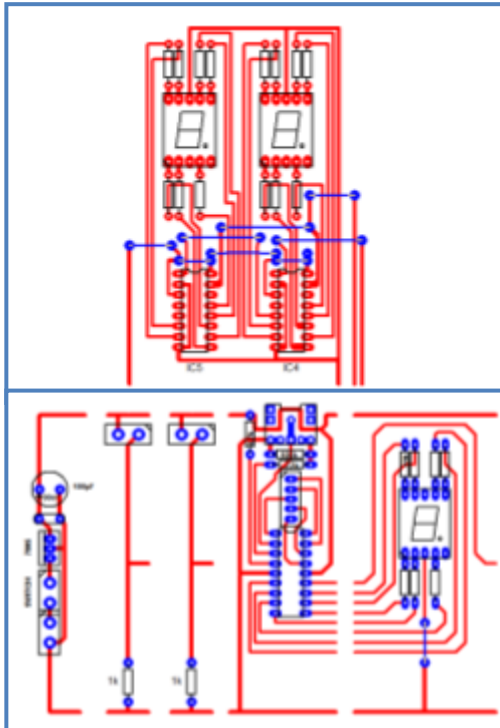
This is the main process of the circuit, the genie E18 microcontroller has a program inside that controls all of the inputs and outputs. In the program it first makes a random sequence of 4 different flashes on the 4 LED's and if the switches are pressed in that same order it will flash all LED's on and off to symbolise you have done it correctly.

These are the outputs of the circuit, the LED's are used to display the sequence brightly and clearly so that the user can acknowledge what has been lit up.

These are the main inputs, the PTM switches are fed into the genie and used in the program to see if you can replicate the formula correctly or if they didn't replicate it properly.

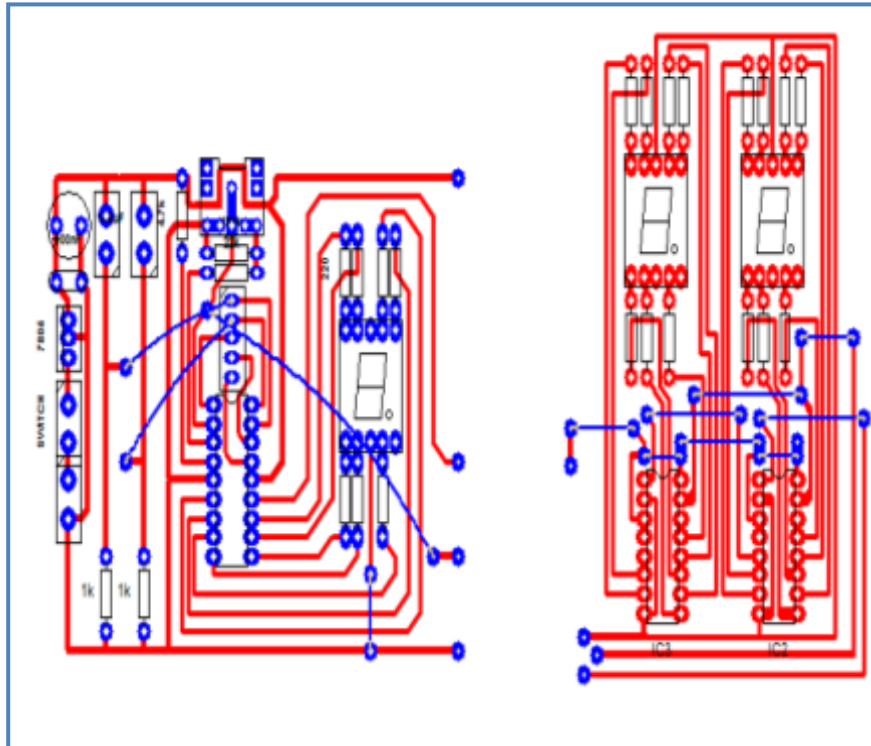


Screenshots of PCB



Step 1:

First I got all the blocks I needed and lay them out in the order I wanted for the circuit to work properly. I had to make sure that the blocks fitted together and that they all had the same function as on the circuit diagram, this was to ensure that the circuit works

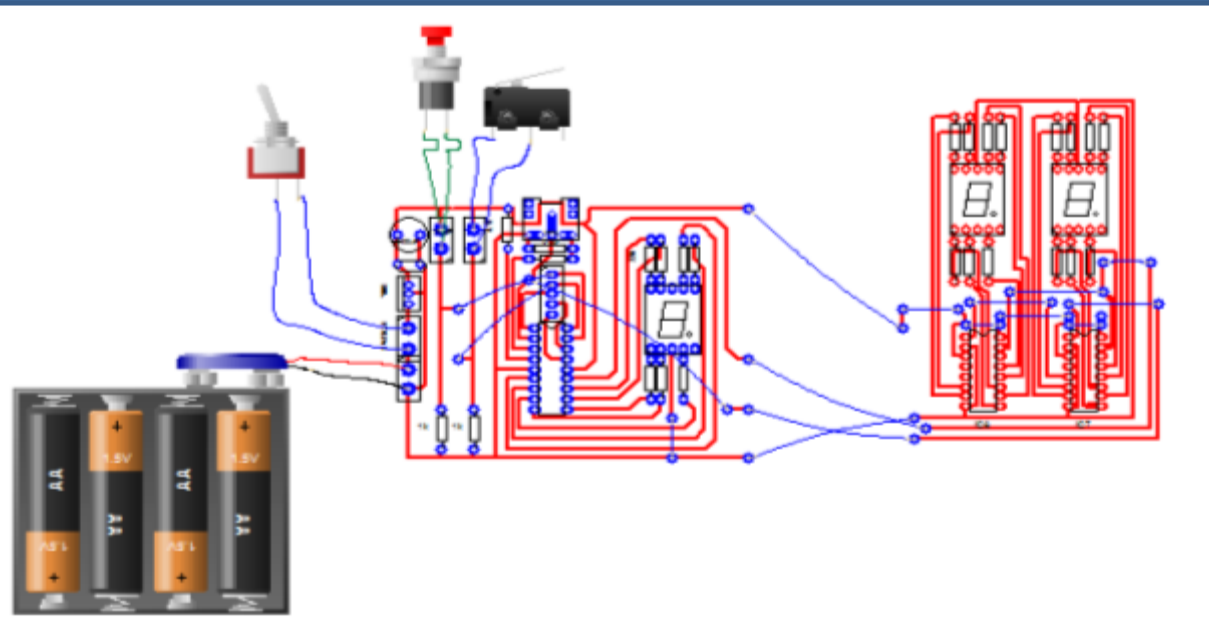


Step 2:

After I had lay out all of the blocks I needed I then joined them together then I realised if I had all the blocks together the circuit would become too big and we would waste material so I split one bigger block up from the others so I could save more space. As I had split them up I added pads for off board flying wires so that the two can stay connected. When they were connected I compressed all the blocks together as much as I can so I can save more material for the circuit board.

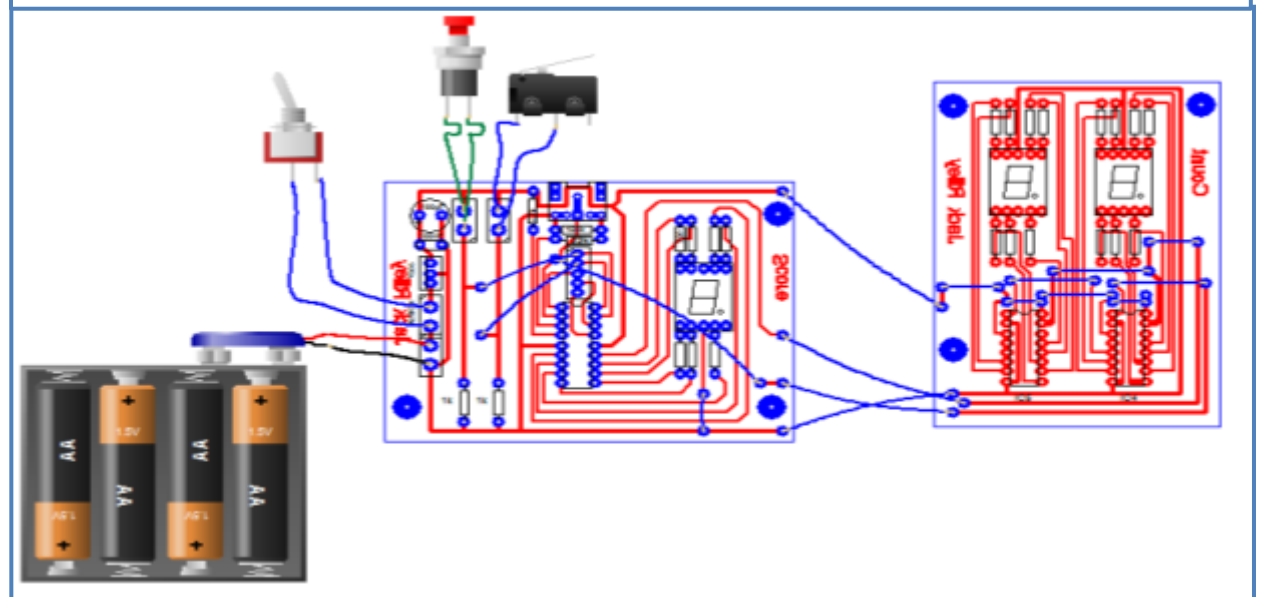
Step 3:

After the two were wired up I then added the flying wires on the circuit board and also the off board components which enabled me to fully test the circuit to see if it works exactly like the circuit diagram, when I added the batteries I had to make them below 5V or else the genie microcontroller wouldn't be able to handle it and it would blow. But instead of using a 5V battery I used a voltage regulator so that the 7 seg displays would be brighter. I also had to make sure that when I attached the batteries and switches that the wires were the right way round or else the circuit wouldn't function properly.



Step 4:

Finally once all the components and wires were connected up and the circuit was working I drew a rectangle around the two circuits which simulated where the edge of the circuit boards would be, I also had leave a bit of room for mounting pads so the circuit could be held securely in the casing of my game so it does not break, I also had to leave space for my name so that my circuit would not get mixed up with others. Finally I changed the sizes of the pads for the resistors, microcontrollers and the 7-segs, this made it much easier to solder to and also meant that when I was drilling it reduces the chances of too much of the copper pad being removed. Once everything was completed I asked a partner to double check my circuit, checking for any short circuits or problems. Then I could print it off and start the manufacture.



Final circuit

This is my final circuit. This circuit has a timer that can count up to 99 and a scoring system with 2 inputs and two processes.

This is the power supply of the circuit and to power the circuit I have used a simple battery and on/off switch, this will make my circuit portable .

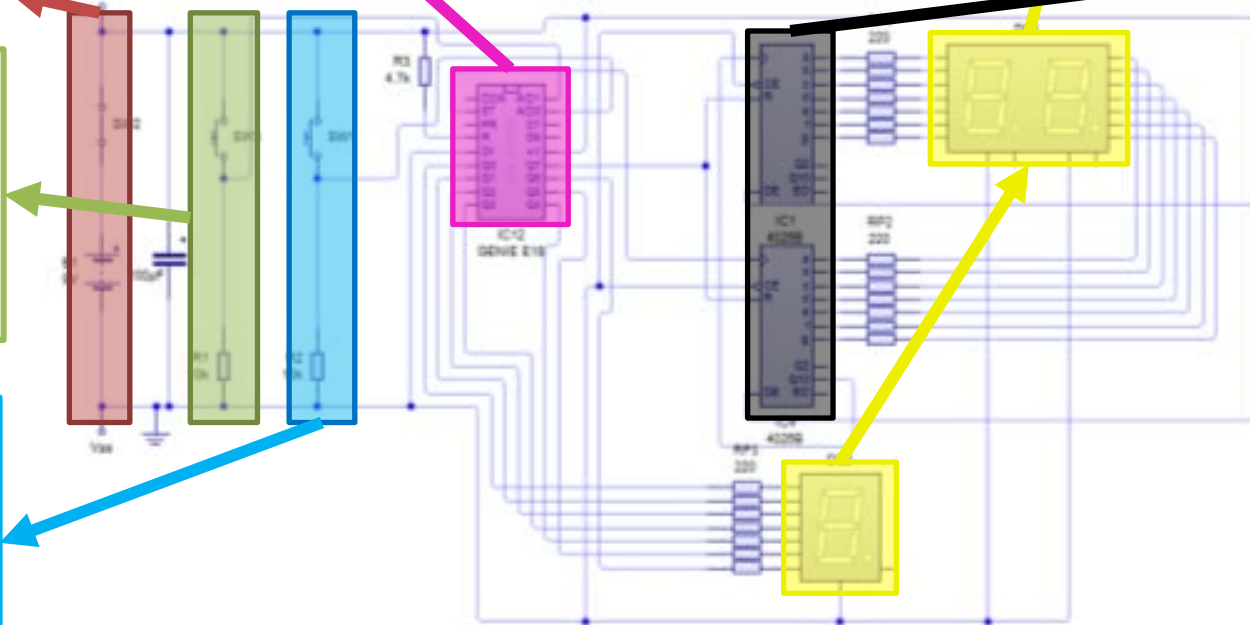
This is process 1, this is a genie E18 this controls most of the circuit. First it takes in both inputs D1 and D0 and then in the programme it controls the score on the single 7 seg display and also controls the pulses to the 4026B using ST so that it can count the dual 7 seg display this makes it the main process of the circuit.

These are the outputs of the circuit they are the dual 7 seg display and the single 7 seg display, the dual 7 seg display is controlled by both 4026B's and also by the genie and the single it controlled by the genie.

This is the second process of the circuit, these are both 4026B's that control the dual 7 seg display the clock is enabled through the genie using ST and using a subroutine in the program called ST pulse and ST count.

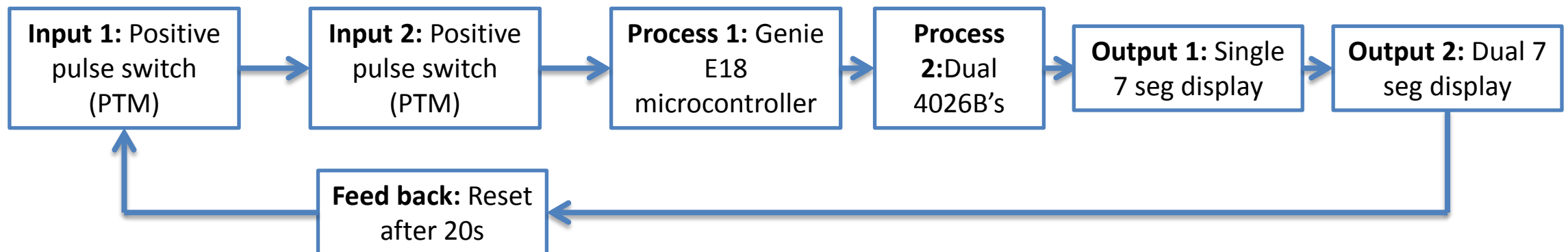
This is input 1 of the circuit this also uses a PTM and is a positive pulse switch that activates D1 on the genie. In real life the switch is a microswitch. This is used as the scoring system

This is input 2 of the circuit this also uses a PTM and is a positive pulse switch that activates D0 on the genie. In real life the switch is a PTM switch. This is used to start the whole program



This circuit is good because as it uses the genie it uses at little components as possible and just by looking at it is easy to tell what each component does.

This meets my design criteria because it uses a 7 segment display so that it can clearly display the time so that users can see it. And it reduces circuit size due to the genie.



program

This is the start of the program this is where variables are set and IC's are reset. In this section A, B and C are all set to 0 to reset the values so that no score is carried on from previous games that have been played also it sets Q7 high and low again to reset the 4026B's to make sure nothing is carried over.

These are even more subroutines in my program that serve a more important purpose as they control the main functions of my game like the reset of the program and the count. To make the 7-seg display count up I used ST in the genie E18, to make the count first I had to make the pulse, to make the pulse I made ST high then 1 second later I made ST low this makes 1 count so to make the subroutine ST count I used the 'for' command and 'end loop' to choose how much I wanted it to count up to. To make the Q7 reset I first made the variable B equal 10 so that everywhere else on the program knows that it is being reset then I made ST low so that it no longer counts and made Q7 high and then low to reset the 4026B's which will stop the dual 7-seg from displaying anything.

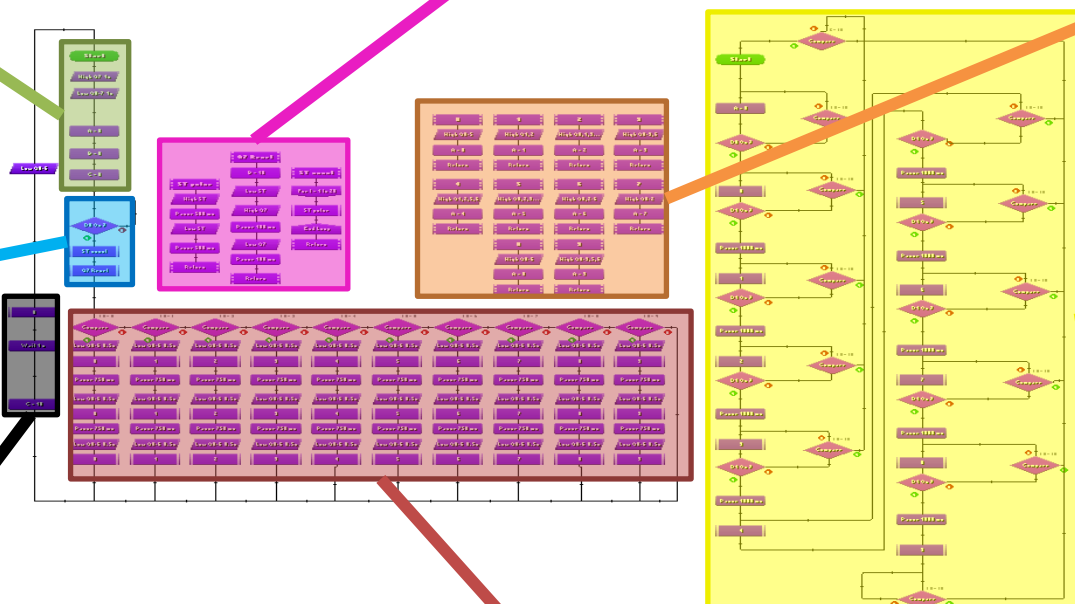
This part of the program are the subroutines making the values for the scores from 0-9. to do this it sets the outputs to display the number on the 7-seg display e.g 8 would be 1,1,1,1,1,1,1. also along with setting the outputs it also sets the value of A so it can be used to flash the number at the end of the program. This subroutine is used various times throughout the programme to display different scores

The decision in this part in the program is used to start the game (PTM switch) and it constantly checks to see if D0 has been activated or not and if it has it activates ST count as describes in the pink section, this lasts for 20 seconds and when the 20 seconds are up it activates Q7 reset where it then goes on to flash the score (see red)

Near to the end of the programme the C variable is set to 10 so that the second program on the right has to wait for the programme on the left to finish before it can reset itself. Also it displays 0 on the score so that no score is carried on from the program on the right so that it is instantly ready to play.

In this part of the program is completely dedicated to the flashing of the score at the end of the game. Once the time is up and the score is displayed it then compares multiple times to find out the value of A and depending on the value of A it chooses a certain path to take. There are 10 paths for it to take from digits 0 to 9 and once it goes down the selected path it will flash the selected number 3 times with a pause of $\frac{3}{4}$ of a second before resetting. For example if you score 5, A will equal 5 therefore at the end it will flash 5 three times.

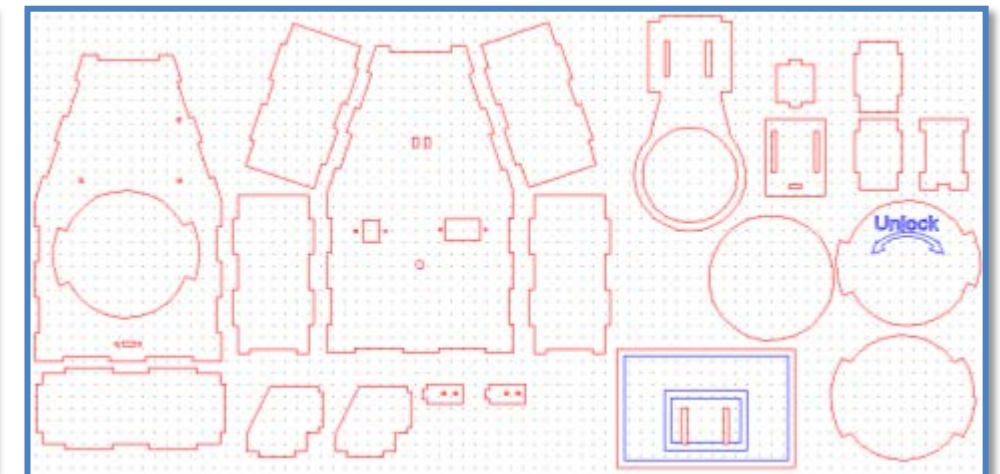
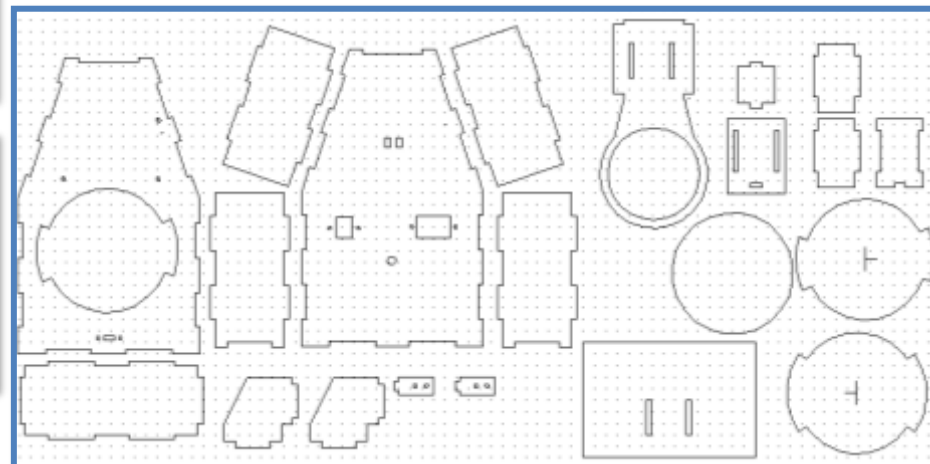
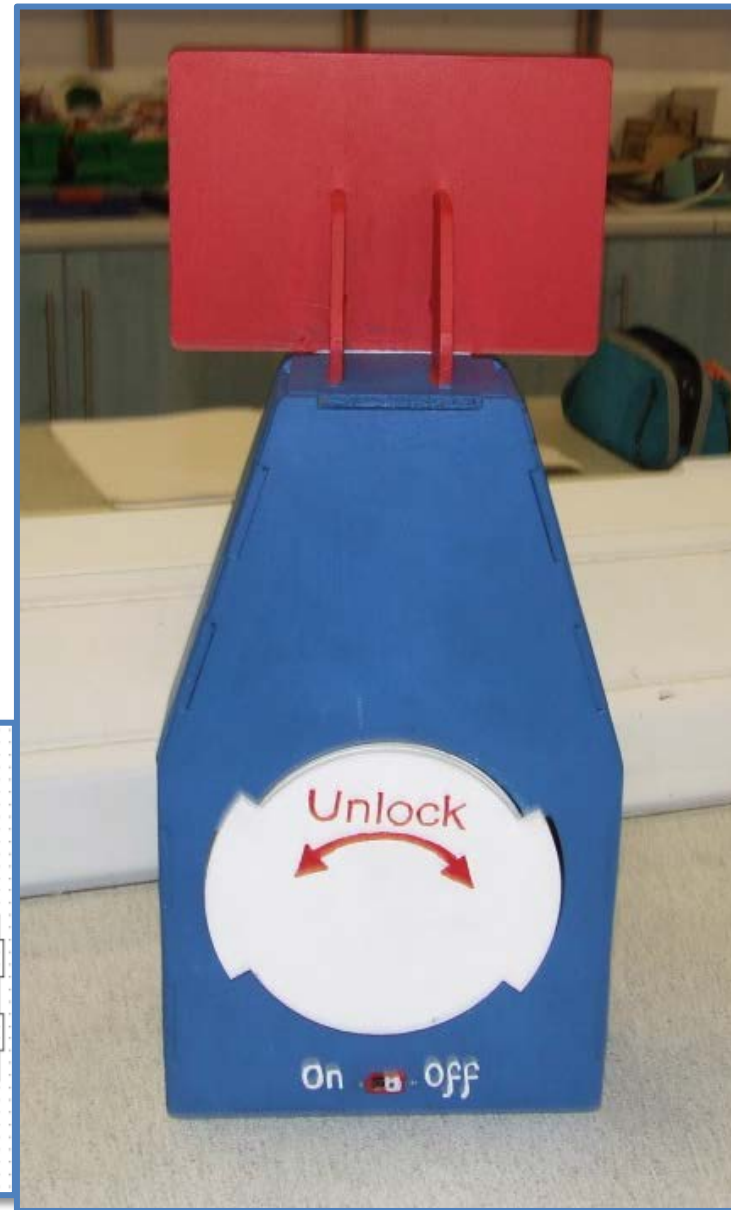
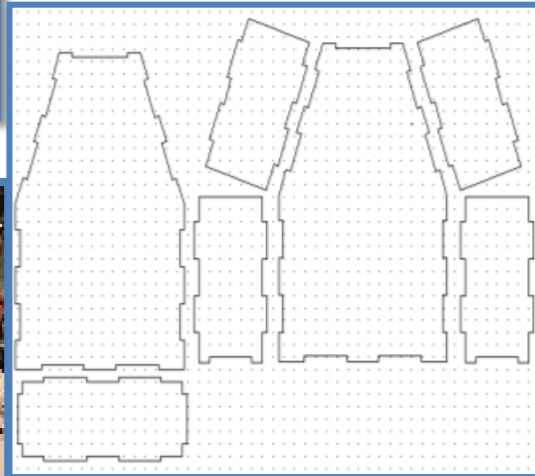
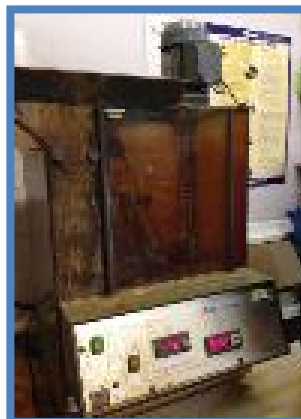
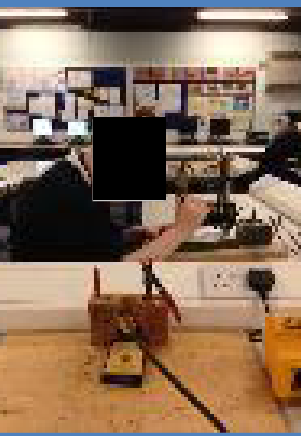
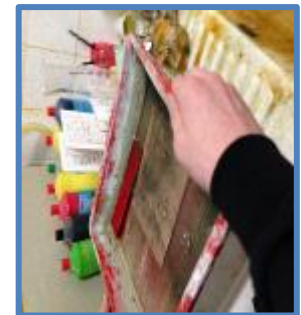
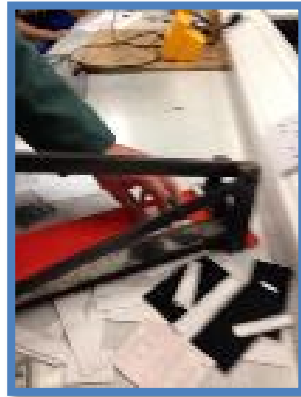
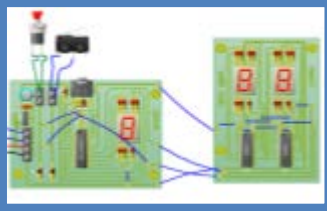
In this part of the program is where the scoring takes place. To start with it sets the variable A to 0 to make sure it is not carried over from the last score acquired. Then it checks to see if D0 switch has been pressed (PTM) and if it has then it will then start the scoring process and sets the score to 0. After this all the switch presses are accounted for by the microswitch. When D1 (microswitch) is activated it will then change the score by 1 each time it is pressed with a 1 second delay between each switch press to prevent switch bounce. Very time it checks to see if D1 is pressed it checks to see if variable B=10 because when the game is over and it resets the B value is set to 10 so that this circuit can be set back to the start and reset the score.



Input: In this program there are two inputs, D0 and D1. D0 is the PTM switch that is used to start both sides of the program and D1 is the microswitch that is used for the score that is used for the right hand side of the programme.

Output: In this program there are two outputs that I use on the genie microcontroller the Q1 2 3 etc and ST. The Q1 2 3 are used to control the score 7-seg display and Q7 is used to reset the 4026B's that control the dual 7-seg display and I used ST to count for the dual 7-seg display using ST pulse and repeating it for how long I wanted it to count for.

Evidence of Making & Final Product



User profile

In this section is where I ask users to evaluate and rate my product to get feedback to see where I can improve I've asked 6 users to test my game:

Name of user	Overall rating /10	Would you play the game again? Y/N	What you like about it?	What needs to be improved?
Brandon	8/10	yes	The competitiveness of the game	Something to keep your high score over the 3 goes, sound
Jackson	9/10	yes	The programme how it resets	Something to keep your high score over the 3 goes
Will	7/10	yes	The overall design and aesthetics	More than 1 ball to play with
Ben	8/10	yes	The playability and the ease of use	More balanced case, sound
Mike	9/10	yes	The competitiveness of the game	Something to keep your high score over the 3 goes
Tom	7/10	yes	The overall design and aesthetics	More than 1 ball to play with, sound

Overall the main thing I found from users is that I got 6 people test my game and all six of them said that they would like to play my game again. and the main thing people like about my game is the aesthetics and the competitiveness of the game however the main thing about my game that needs to be improved is something to keep your high score over the course of your three go's so that you don't have to wright as much down, also another main thing that needs to be improved is that there needs to be sound added to the circuit so that it becomes more intriguing.

Evaluation

Problems:

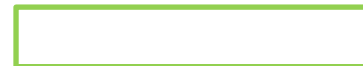
These are a few of the problems I encountered during design and manufacture and how I corrected them:

- The first problem I encountered was that my circuit was reversed. This happened because I put the acetate the wrong way round in the light box meaning that it would not work however I did not notice this till later meaning valuable time was lost. To correct this I had to get another PCB and repeat the manufacturing process again.
- The second problem I had was that I had missed out the strain relief holes on the final CAD drawing of my circuit, this meant that when I went to add them back in I had to do them with no guidance making it look un neat.
- Another problem I encountered was that I had made 2 short a short circuit as a piece of copper attached two tracks together this meant that the circuit wouldn't function properly. To fix this I scratched the copper off using a Stanley knife. Also the other short circuit was caused on the other side as two solder joints had joined together, again this meant that the circuit didn't function properly. To fix this I had to re-heat the solder and draw a line through the middle of the two joints using the soldering iron to separate them.
- Also another problem was that the flying wires on the circuit were not straight this meant it obstructed other components from being placed. Thankfully as I had to re do my PCB I redesigned it so that they lined up straight and did not obstruct any components from being placed.

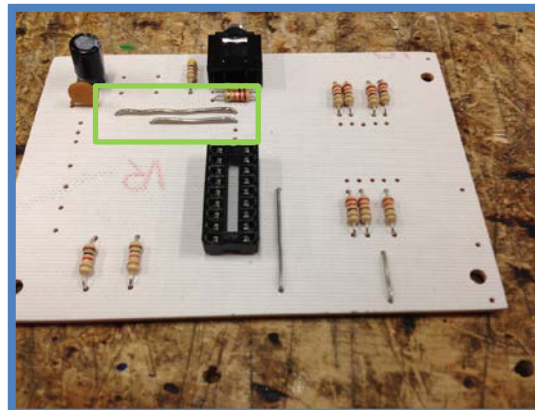
These are a few more of the problems I encountered during design and manufacture and how I corrected them:

- In the design I also made mistakes because during the case design I made the error of not putting any mounting holes in however later on I found the sticky mounts that got rid of the need for using mounting holes.
- As well in the design of the case I made an error in not adding holes for the microswitch mounts to go on so I had to re-do the whole front section which wasted a lot of MDF.
- The final error I made is that I did not take into account where the download socket would be placed and facing, this meant I could not glue the hoop on the top on as it was the only way I could get to it so this meant that it came wobbly in games and sometimes fell off and I had no fix for this.

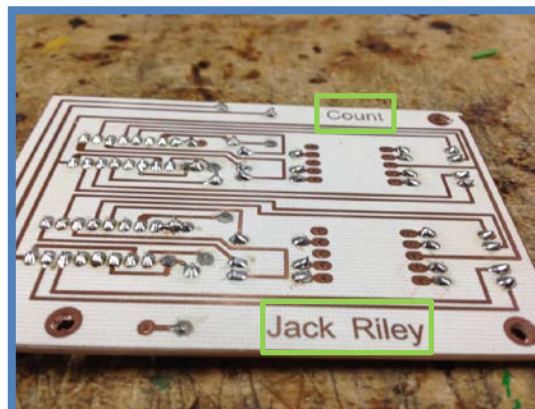
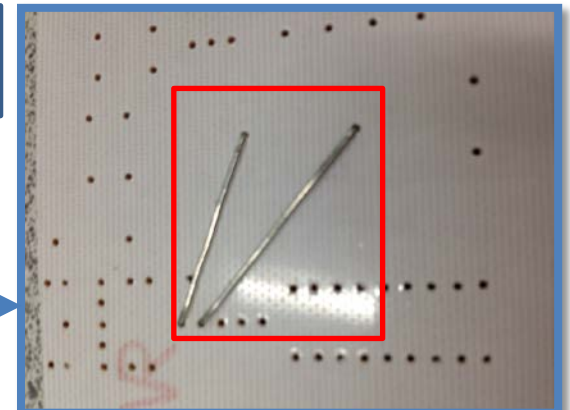
Improvement =



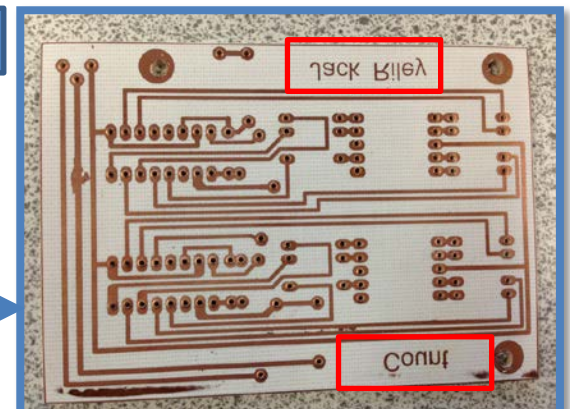
Error =



Straightening of wires



Reversed circuit



Testing & Evaluation

Specification	Pass/Fail	Comment
The electronic game must have a circuit board that works and it is used to hold all the components together and the circuit board must be made as small as possible this will then allow me to use less materials.	✓	My circuit is made and works fine according to the programme and in real life and it is also made as compact as possible which saves both space and materials.
The game must have a case and it must look cool and attractive to attract the users, the colours must be based around red or blue as they are the most popular colours out of both genders also it must each the target audience of the ages between 14 or 18 as most of the students in this school are at that age.	✓	My case had a cool and attractive design which can attract the user and I had a red white and blue colour scheme which will attract most people as they are mainly neutral colours as I found out a lot of both boys and girls like the colour blue and that the colour that takes up the most of my case but the red and white colours help it fit in to the basketball theme. Also to add to the design there is a multi-coloured logo on the front which will also attract people to come over and play
It should be easy to use and understand so the user can get on with the game as soon as possible	✓	In my opinion I think that I have passed this as I believe that from my own testing and from other users testing my product first time that they found it easy to understand and could easily get on with the game and the instructions also helped them understand if they didn't.
My product must be safe, have rounded edges and no open wires, so all of this can protect the user.	✓	My case had rounded edges on all points and all wires were connected properly , and the only thing that was sharp on my product was the microswitch.
If the game uses batteries the battery compartment must be easily accessible. It must be made out of MDF or acrylic as MDF because it is durable and you can paint any pattern you want on it or you could use acrylic because it is strong and is recyclable	✓ / X	The battery compartment was made out f MDF which allowed me to paint on the way it had to be turned to be unlocked which made it easily accessible. However there was one flaw, even though it opened fine one way It didn't open correctly if you turned it to the right.
The game definitely must be competitive as multiplayer is a key point so making it 2 player is an option	✓ / X	I found that through testing with other people that the game very quickly came complete as multiple people were challenging each other to beat there high scores . However it can only be played by one person at a time so that multiplayer is not an option.
The product must cost between £10-£15 pound or about 50p a go do make it affordable for the user.	✓	I would make the game 60p to play purely from my user profile with the average being 60p throughout all the prices they gave me. And o sell the whole thing for about £10-£15 would be ok because the total manufacturing cost was about £8.50 so I would make some profit.
The product must have a theme of the house and its charity to show the users what they are paying for also it must have lights and sounds to draw the competition in therefore making it more popular.	X	There was little to none resemblance to the house colour and that there was no lights or sounds purely used to attract the user.
If I use batteries it must be portable and small so it can be moved around very easily,	✓	My case is fairly small and can be placed in many different places and it also very light and also uses a battery so need to be near a plug socket.
I could have two alternate power sources like having batteries and a mains power supply so if there are no mains power sources nearby you can use the batteries.	X	My product has only 1 power source which are batteries so you will have to keep replacing them.
The case should not show any of the circuit so it doesn't ruin the aesthetics of the product.	✓	My case covers the circuit well with no parts of it showing unless you remove the battery cover and the aesthetics are not affected by it.
The Switches must be easily accessible and the output components such as a LED or a 7 seg display should be easily seen from a descent distance of about 3m.	✓	All the switches are clearly highlighted and are easily accessible and the 7-seg displays are highlighted also and are not obstructed by anything so they can easily be seen from 3m away and even more. This is because I used the correct voltage to make them bright enough.

Evaluation during manufacture

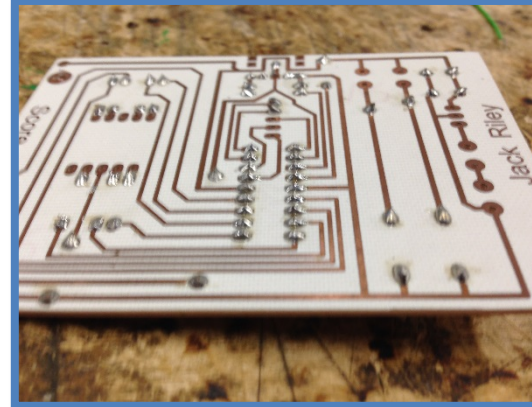
During the manufacture I found some things **easy** and some things **hard**:

Easy:

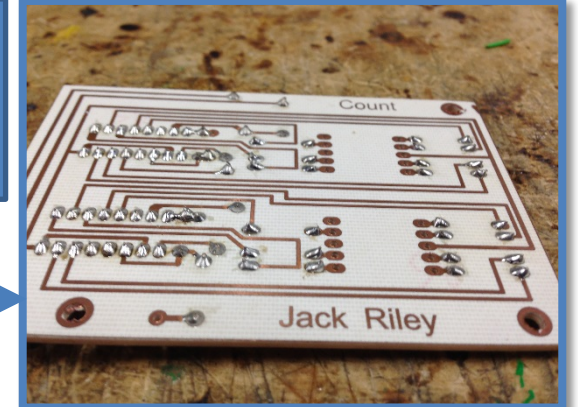
- One of the easy things to do in the process of manufacturing my case was **designing the circuit** diagram as I am knowledgeable of all the components so I know what des what to put together.
- Another easy thing I found was the **drilling** of the holes for the PCB as pretty much all of the holes I drilled were accurate and had no problems with the drill and all the components fitted in as they were supposed to do.
- The **soldering process** was another thing that I found rather easy as most of my solder joints had the nice volcano shape and no tracks were burnt off
- **Installing the external components** to the case I found easy because it was a simple task and they fitted perfectly with no errors with damaging the case.

Hard:

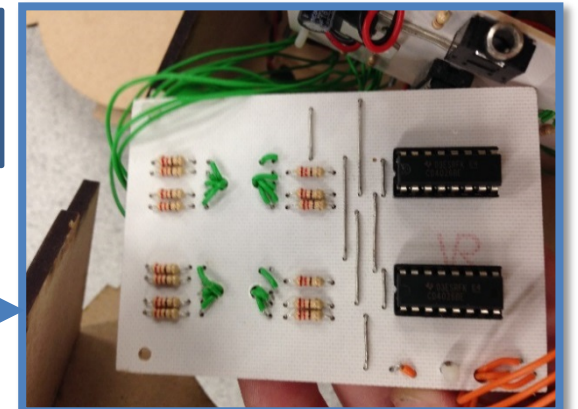
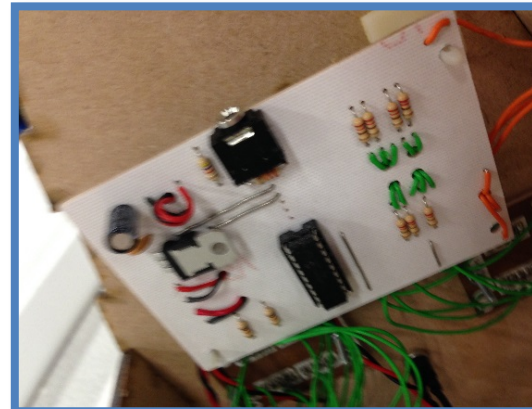
- The main thing I found hard to do was **soldering the off board 7-segment displays** as when I when to solder the wires in some fell out as I could not hold them, this lead to some wires barely being soldered to the separate PCB.
- Another hard thing I found was that making the **circuit diagram into a PCB layout** was hard because you couldn't overlap tracks so I had to re direct a lot of paths so in the end I found it easier just to use blocks.
- Also I found **painting** the case was hard because it was difficult to make the logo as accurate as possible ad when painting near components I didn't want to get any paint on them.
- The final thing that I found hard during manufacture was that **designing the case** so that it would all fit together because I had angled edges so that it was hard to align the slots so it took time to get it to fit properly.



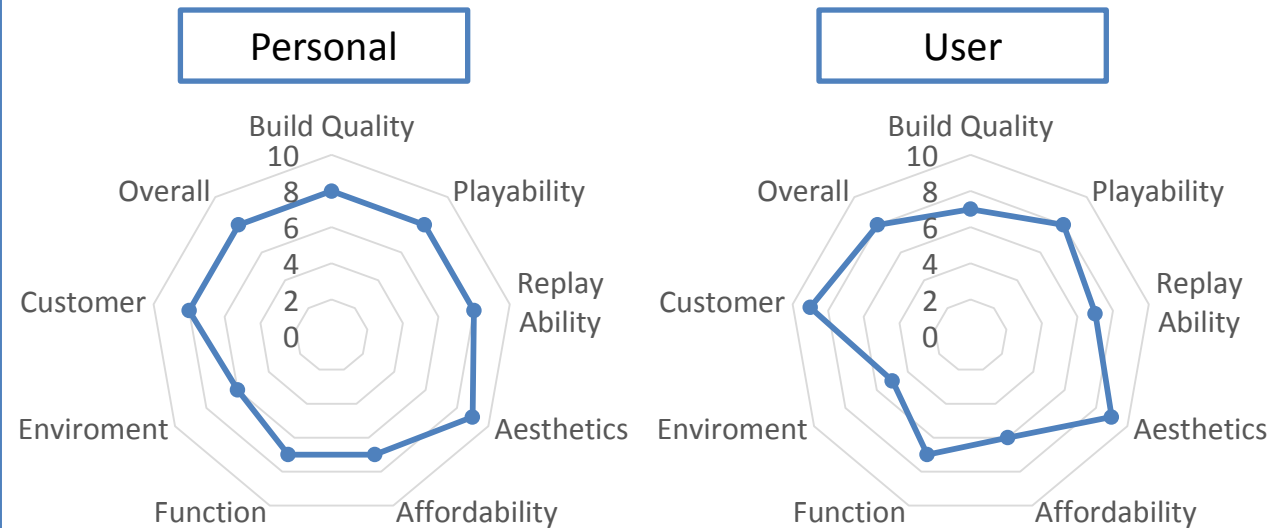
The solder side of my PCB (without external components added)



The component side of my PCB (completed)



Radar Diagrams:



Rate out of 10 for:
 Build quality
 Playability
 Replay ability
 Aesthetics
 Affordability
 Function
 Environment
 Customer
 Overall

Testing:

Throughout the manufacture and design f the product I had to keep testing things so that I would encounter as little problems as possible. In the design section every time I made a change to the layout or components of the circuit I had to keep running a tests to check to see if the circuit still worked correctly. Also when designing the case I had to keep putting the imported pictures of my PCB in t check to see if it still fitted every time I made a change. And testing was especially important in the manufacture because if anything went wrong there I cant just 'undo' like I can on CAD programs, so as I went through the manufacturing stage I kept checking for short circuits etc and once it was complete I constantly checked it when installing the programme to see if it worked in parallel with the program on the computer.

Personal evaluation

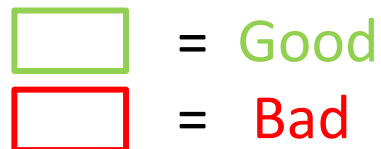
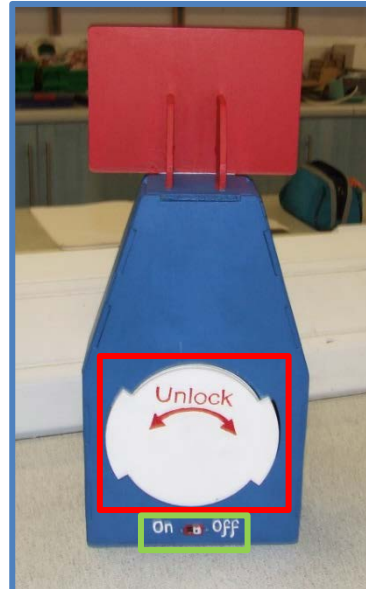
Personally I think that my product turned out good because I had a functioning product at the end of it that is aesthetically pleasing and works as I would like it too with a complex but understandable programme and reviews from users say the same thing. Along the way I did have some errors and the product has some bad things but they don't affect the product as much to ruin it so overall it is good.

However in my product there were some bad things about my product as listed below:

- The first and main bad thing about my product was that there was **no sound** in the game, this annoyed both me and the users as sound or music would make the game a whole lot better as it would make the game more immersive meaning that more people would want to play it.
- The second bad thing about my game is the **structure of the case** as I found out in testing that sometimes my product fell over and as the top hoop was not glued on it occasionally fell off but this was essential so that I could access the download socket. This meant that some games had to be restarted meaning some people weren't satisfied after playing my game.
- Another bad thing about my final product was the **playability of the game**. The playability of the game didn't always turn out good as the microswitch occasionally didn't detect the ball when it went through the hoop so it could affect the users score and also it affects the playability as sometimes the ball will get stuck which could ruin the users turn by wasting time.
- The final bad thing about my product was the **battery unlock system** as when you went to unlock it you could only turn it right even though you were meant to be able to turn it both ways but it got stuck when turning to the left. Also another bad thing about it is that the battery is not held well as the remove function that holds it in often falls off.

In my product there are a lot of good things to reflect on and to see:

- The first good thing you see when you look at my product are the **aesthetics** of it, the colour scheme is red, white and blue because these are neutral colours as they are like by all ages and genders as I gathered from my user profile. Also to add to the aesthetics I put a logo for the game on the front to attract users and to make it stand out more to make it look less bland. Also for the aesthetics I highlighted the external components and labelled them to make them more clear as to what they are this then leads on to the next good thing about my product.
- **Ease of use**. The labels on the 7 segment displays and the switches make the product easy to use and first time users can quite easily understand what the concept and the aim of the game is so that more people will be able to play. If the labels on the product don't make the game clear enough to play I have also made a detailed but also clear set of instructions so that if users don't know how to play they can read the instructions and hopefully fully get how the game works.
- Another good thing about my product is the **programme**. The programme is good because it is clearly layout on circuit wizard so people can clearly read it and I can identify problems easily. Also the function of the programme is good because I have removed the need to having a reset switch as it does it automatically which can reduce the space needed on the circuit board for it and therefore reducing the cost as well. Also it is good because I found out during testing that the score is not displayed for long enough so I made it so that once the game has ended the score s flashed so that the user can clearly identify what score they got.
- One more good thing about my product is the **layout inside the case**. The layout inside the case is good because there are not wires going all over the place and the circuit board and download socket are easily accessed so if I want to make any changes to the circuit I easily can. Also some wires are held down by masking tape so that it does not get in the way of the battery unlock system so that it does not cause any functional errors.
- The final good thing I found about the game when playing with multiple people is the **competitiveness of the game** as when I personally played it with other people I found the game getting tense as I was trying to beat other people scores showing that is competitive and fun.



Evaluation

Improvements for the future

In the future if I was able to improve my product I would change these things:

- The first major thing about my product that I will change would be to **add sound or music** to my game as it would make the game overall better and appeal to more people as it would make the game more immersive and make people feel more rewarded when they score a point.
- Another thing that I would change in the future would be the **aesthetics** of the product, even though my product already looked good I could have made it so that the logo looked better and had more of a theme and the main base could have had designs like basketballs etc to make it look more aesthetically pleasing so that it would draw more people in making them want to play the game just by the aesthetics of it.
- Another way I would improve my product is that I would make the **wires** connecting the two circuit boards together and the wires connecting the off-board components **longer** so that I had more lenience to move the components around and would of got rid of the error of the unlock system only being able to be unlocked when turned right.
- In the future I would **add supports to the base** as that I found out in testing that it wobbled quite a bit when the ball was thrown at it so this lead to it toppling over a couple of times. However this would be an easy fix all I would have to do is add a small extension on the back so it acted as a counter weight, also this could have been as use for a battery storage system.
- Also one more way I would change my product is that I would **redesign the case**. This is because the way I have it now it is that there is only just enough to fit all of my PCB's and external components so if I was going to redesign it I would probably make the case wider or get rid of the slanted edges so that there is more room for the PCB's.
- The final thing I would do to improve my product is that I would add a **high score function** the game by adding a extra 7-seg display and changing the program on the microcontroller. I needed to do this as I was highly requested from the users and also from testing it my self having 3 tries each I realised it would be better to have that instead of trying to remember your high score yourself.

Commercial use:

If I was going to make this product for commercial use I would...:

- To make it so that my product is eligible for commercial use I will first tweak the circuit board and components, in doing this I will exchange components to make them surface mounted components so that it will reduce circuit size and will remove the need of soldering them on which will drastically reduce the manufacturing time. Also I could replace the two IC's in my second circuit with a second genie so that I have more control and options on what to do with the dual 7-seg display which could increase the functions of the circuit. It would also to be a must to add the high score function in as it would increase the function of the game and ease of use, plus as discussed in the user profile a lot of people wanted it so it would attar more people to buy the product.
- Another way I would make it suitable for commercial use is that I would make the case have a more durable material on the outside rather than cheap MDF like a plastic that would be easier and quicker to manufacture this would make it so that it can be a higher quality and more people would buy it and would also reduce the manufacture time. Also another change I would make to the case is that I would improve the aesthetics of it and add a well known, noticeable theme so that people would be attracted to it and more people would buy it.
- Also I would have to change the manufacturing process as the one I used was to slow and there was a high chance for human error meaning that this was not a commercially viable option. This is because if I need it to be for commercial use it has t be mass-produced so there has to be as little and as cheap manufacturing process as you can get.
- The final thing I would do to make my product commercially viable is that I would have to make a box for the product to make it so that it can be shown off with all of its features and I would also have to make advertisements for it so that my product can be shown off by many different types of media so that more people can see my product making it more noticeable meaning more people would buy it.

2019 candidate record form

GCSE Design and Technology Unit 2 – Non-Exam Assessment

Please attach the form to your candidate's work and keep it at the centre or send it to the moderator as required. The declarations should be completed by the candidate and teacher as indicated.

Centre number 1111	Centre name AQA Centre
Candidate number 1234	Candidate's full name AQA Candidate – Example 2

Work submitted for assessment **must** be the candidate's own. If candidates copy work, allow candidates to copy from them, or cheat in any other way, they may be disqualified.

Candidate declaration

Have you received help/information from anyone **other than** subject teacher(s) to produce this work?

No Yes (give details below or on a separate sheet if necessary).

Please list below any books, leaflets or other materials (eg DVDs, software packages, internet information) used to complete this work **not** acknowledged in the work itself. Presenting materials copied from other sources **without acknowledgement** is regarded as deliberate deception.

Microsoft Office, Google images, Argos.co.uk, 2D Design, Circuit Wizard

From time to time, we use anonymous examples of candidates' work (in paper form and electronically) within our guidance materials to illustrate particular points. If your work appears in AQA materials in this context and you object to this, please contact us and we will remove it on reasonable notice.

I have read and understood the above. I confirm I produced the attached work without assistance other than that which is acceptable under the scheme of assessment.

AQA Candidate – Example 7

Date 01 May 2019

Teacher declaration

I confirm the candidate's work was conducted under the conditions laid out by the specification. I have authenticated the candidate's work and am satisfied (to the best of my knowledge) that the work produced is solely that of the candidate.

AQA Teacher

Date 01 May 2019

Candidate number

Candidate's full name

To be completed by the teacher

Marks must be awarded in accordance with the instructions and criteria in the specification.

Assessment criteria	Maximum mark	Mark awarded	Teacher/assessor's supporting statement
1 Identifying and investigating design possibilities	10	6	<p>The Contextual Challenge has been identified and possible solutions have been explored through a task analysis in the form of a mind map. Evidence slide 1</p> <p>A client has been identified and investigated in the form of a questionnaire Evidence slide 3</p> <p>A product analysis (existing products) has taken place to see what products are on the market. Evidence slide 2</p> <p>Investigation work has been completed throughout the portfolio to ensure the correct decisions have been made when working towards a final prototype. Evidence slides 4 - 13</p>
2 Producing a design brief and specification	10	5	<p>An adequate design brief has been produced outlining the key points. Evidence slide 1</p> <p>A range of design specification points have been created and justified. More analysis would be desired. Evidence Slide 1</p>
3 Generating design ideas	20	15	<p>A range of initial case designs have been produced along with circuit diagrams of potential circuits. All ideas have been annotated and justified and clearly links to any investigation work. Evidence slides 4-5 & 7-9</p>
4 Developing design ideas	20	18	<p>Development has taken place taking into account investigation work and all decisions have been explained throughout through drawings (including CAD) and written annotation. Evidence slides 7-12</p> <p>Formal development work has taken place and decisions why have been explained. Evidence slide 7-12</p> <p>A final case design has been produced and explained in detail. Evidence slide 6</p> <p>A manufacturing specification has been produced in the form of a parts list. Evidence slides 13</p> <p>CAD files have also been developed to inform the manufacture stages. Evidence slide 14</p>
5 Realising design ideas	20	18	<p>The student has used the correct tools and equipment to produce a high level prototype.</p> <p>The case has been drawn on 2D design and laser cut. This has been glued using PVA and sanded and sealed to a very good standard. This has then been painted to a good standard with clear instructions on the prototype. Evidence slides 14</p> <p>The Circuit board has been designed on circuit wizard, etched and soldered. This has been done to a very good</p>

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			standard. The board is well presented and functions as expected. Evidence slides 14 Evidence of manufacture can be found on slides 14.
6 Analysing and evaluating	20	18	Good testing of the prototype has taken place against the design brief and specification. Each point has been clearly justified and explained. Evidence slide 17 Users have tested the prototype and feedback has been analysed. Evidence slide 15 Manufacture has been analysed and future modifications have been discussed. Evidence Slides 18-20 A wide range of analysis throughout the portfolio including; Design brief & specifications Evidence slide 1 Conclusions throughout Evidence All slides
Total mark	100	80	

- Photographic evidence of the prototype **must be included** in the work submitted. This must clearly support the marks awarded. The quality and quantity of photographs provided must be sufficient to judge the quality and detail of the work undertaken. Failure to provide such evidence may result in moderators being unable to confirm the marks you have awarded. Please tick/select the box to confirm this has been included.

Details of additional assistance given

Record here details of any assistance given to this candidate who is beyond that given to the class as a whole and beyond that described in the specification (*continue on a separate sheet if necessary*).

N/A

Concluding comments

NEA Example Response 2 Commentary

Criteria	Positive Features	Further development
<p>1 Identifying and investigating design possibilities</p>	<p>The student has done some analysis of the context and started to make some initial conclusions.</p> <p>A detailed product analysis has taken place to inform the design specification.</p> <p>The user has been identified. The student has used a basic questionnaire to support this.</p> <p>The investigation work has been concluded throughout and informs the brief and specification.</p> <p>Investigation work happens throughout the portfolio; however it isn't always explicit but must have happened for certain conclusions to have been drawn.</p>	<p>Some primary research would show a better understanding of investigations.</p> <p>The analysis is quite basic; a more detailed analysis into the contextual challenge could take place at the beginning of the portfolio to identify further possible problems before deciding on one.</p> <p>Even though investigation work happens throughout it isn't always explicit.</p>
<p>2 Producing a design brief and specification</p>	<p>The design brief is basic but does outline most of the key criteria.</p> <p>The design specification has been produced in the form of a list and the majority of points have been justified.</p>	<p>More justification is required and specific details on how the brief could be achieved.</p> <p>The design specifications well-presented but some points are not easy to measure.</p>
<p>3 Generating design ideas</p>	<p>A range of design ideas have been presented and explained to a good standard.</p> <p>A range of media has been used including CAD – circuit designs and sketches.</p>	<p>More user feedback throughout this section would support the evaluating stages.</p>
<p>4 Developing design ideas</p>	<p>The student has used a variety of techniques to develop their final prototype. Clear decisions have been made.</p> <p>A virtual PCB model has been produced.</p>	<p>It would also be good to see some user feedback.</p> <p>Even though a wide range of techniques have been used it would be good to see some</p>

Criteria	Positive Features	Further development
	<p>Investigations continue to happen throughout this section.</p> <p>A manufacture specification has been produced to conclude this section in the form of a parts list.</p> <p>A final solution has been created for both the case and circuit.</p>	<p>physical modelling eg a card model of the case or bread boarding.</p> <p>The manufacturing specification is adequate but may need more justification for third party manufacture.</p>
5 Realising design ideas	<p>A final prototype has been produced using a range of appropriate tools and processes.</p> <p>The student has evidenced making and clear pictures have been included.</p> <p>2D CAD files have been evidenced to support the manufacture mark.</p>	<p>It is clear that quality control has taken place. However, this isn't clear within the portfolio.</p>
6 Analysing and evaluating	<p>The final evaluation includes an analysis of the design specification.</p> <p>Users have tested the prototype and conclusions have been made.</p> <p>A detailed prototype evaluation has taken place including:</p> <ul style="list-style-type: none"> • strengths and weaknesses • improvements and modifications • manufacture analysis • commercial production. <p>Analysis throughout has taken place. This isn't explicit but can be seen throughout the design section where decisions have been made.</p>	<p>The analysis and evaluation throughout could be more explicit.</p> <p>More user testing at different stages would be desired.</p>

Get help and support

Visit our website for information, guidance, support and resources at aqa.org.uk/8552

You can talk directly to the design and technology subject team

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