ESPIONAGE

60’s Spy Escape Room

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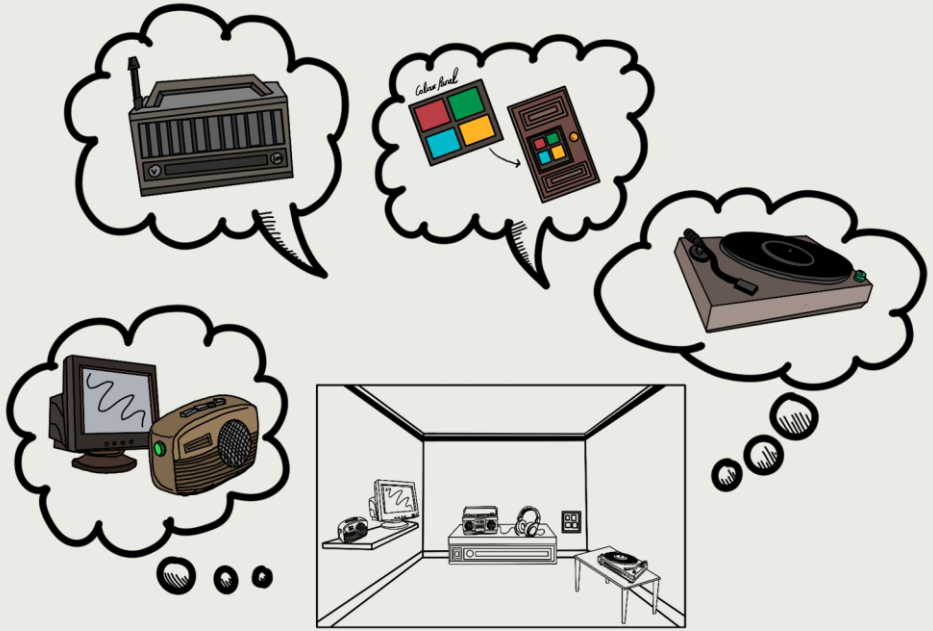
Contents



Introduction

- The puzzle is to be part of a larger scale spy villain themed escape room inspired by the 60’s.
- It requires multiple players to work as a team.
- Objects used to create the puzzle were existing in the 60’s.

Research

and Planning

Inspiration, Espionage

- Practice of spying, normally to obtain political or military information (Britannica, 2021).
- Cold War, between 1946 - 1991 Soviet Union and United States.
- Russia gifted “The Thing” to United States on 1945. It was not found until 1952 (Crypto Museum, 2015).

Images from: https://www.cryptomuseum.com/covert/bugs/thing/index.htm

Research, 60's items

- 60's objects that show clear functionality between user and item.
- Spying is implied by using a surveillance device; players need to discover that they are being spied on to complete the puzzle.

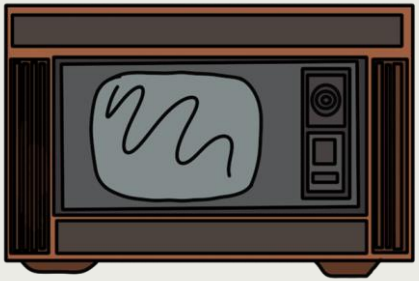
Koss PRO/4, 1962
Image:
https://www.koss.com/history/

Dansette, 1952
Image: https://www.dansette.com/blog

60's Philips TV
Image: https://www.nfsa.gov.au/latest/colour-tv-part-1

Planning, Chosen Objects

- The objects were chosen based on their main functionality.
- Affordances create the possibility of action to be taken. Each of these objects affords actions that benefit from behavioural processing - skills we have learned previously (Norman, 2013, p.51).
- Objects can be changed as long as they have similar functionalities that afford the same simulations.

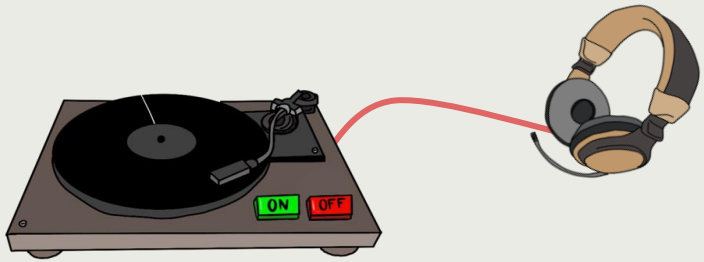


Designing the Puzzle

Layout and Connection

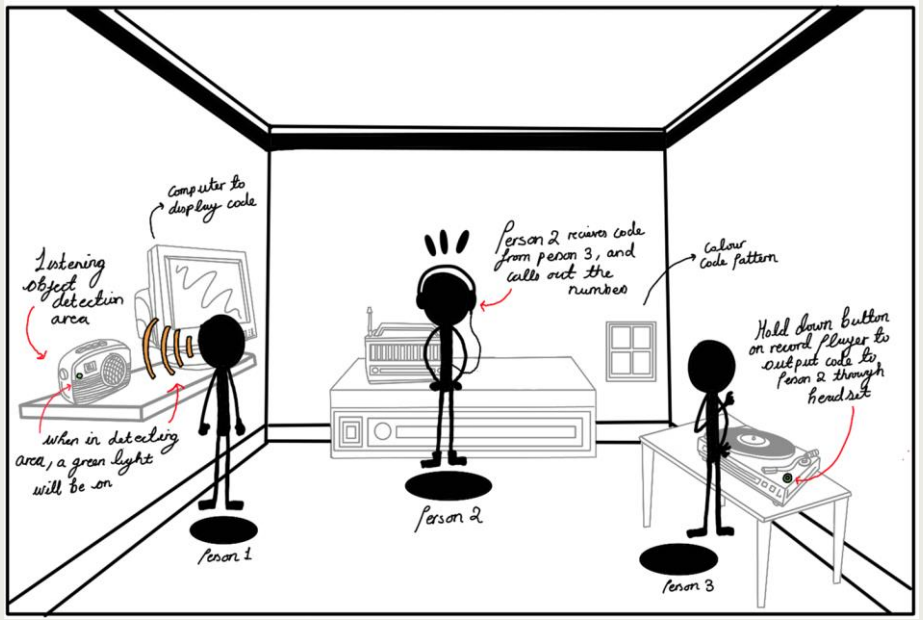
Design, The Connection

- Designing a connection between each object.
- Added signifiers offer the players extra guidance.
- Key is to keep signifiers subtle enough, so player can get the rewarding feeling of success when they figure out the connection.



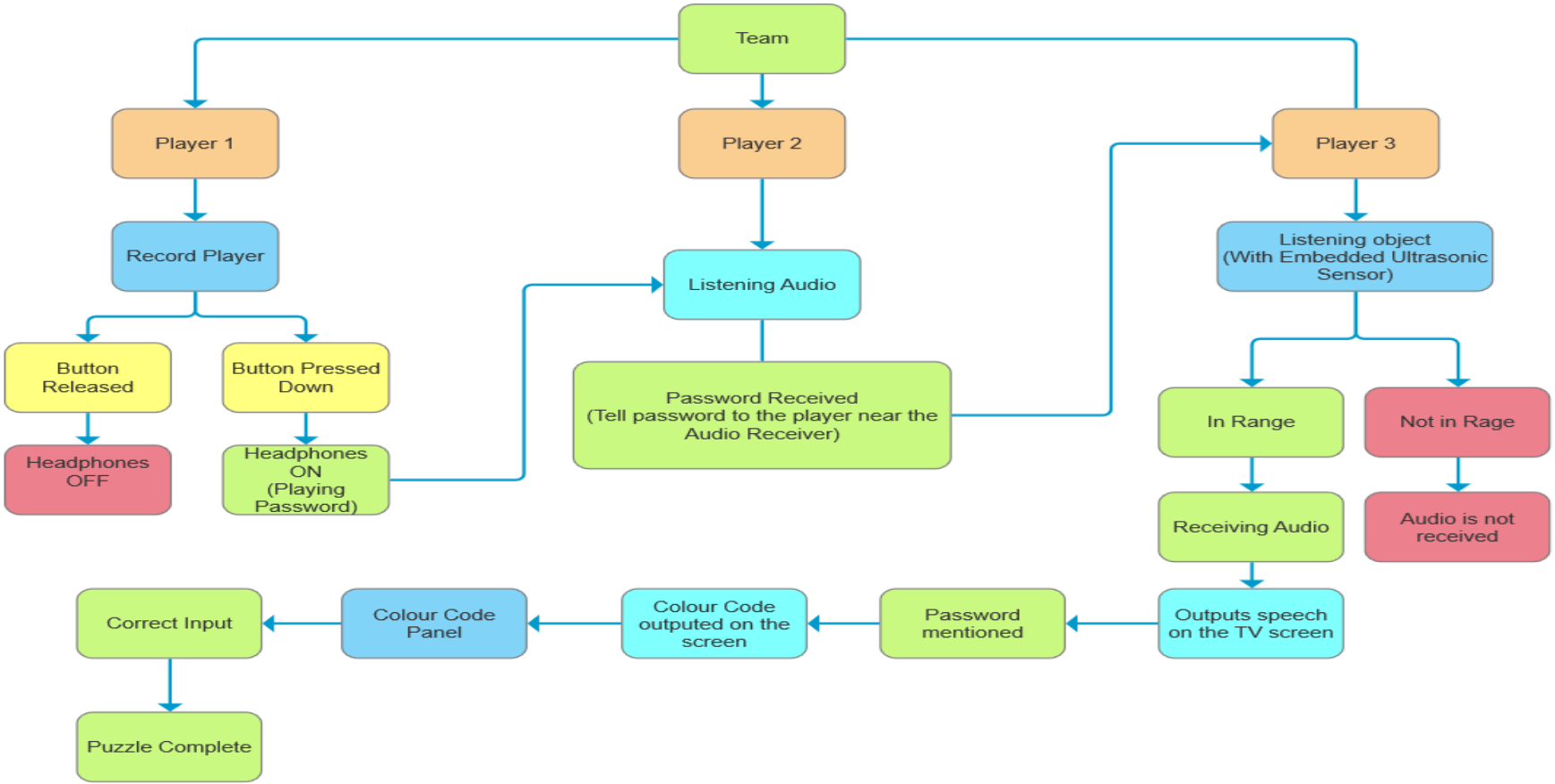
Design, Placement

- The puzzle utilises anti-affordances, such as fixed placing for normally detachable objects (Norman, 2013, pp. 10-13).
- These constraints create unwritten rules (Salen and Zimmerman, 2004)



Final Design

Poster on the wall: Spy in your Eye (Sala, 1965).


Team
Player 1
Player 2
Player 3
Record Player
Listening Audio
Listening object (With Embedded Ultrasonic Sensor)
Button Released
Button Pressed Down
Password Received (Tell password to the player near the Audio Receiver)
In Range
Not in Rage
Headphones OFF
Headphones ON (Playing Password)
Receiving Audio
Audio is not received
Correct Input
Colour Code Panel
Colour Code outputed on the screen
Password mentioned
Outputs speech on the TV screen
Puzzle Complete

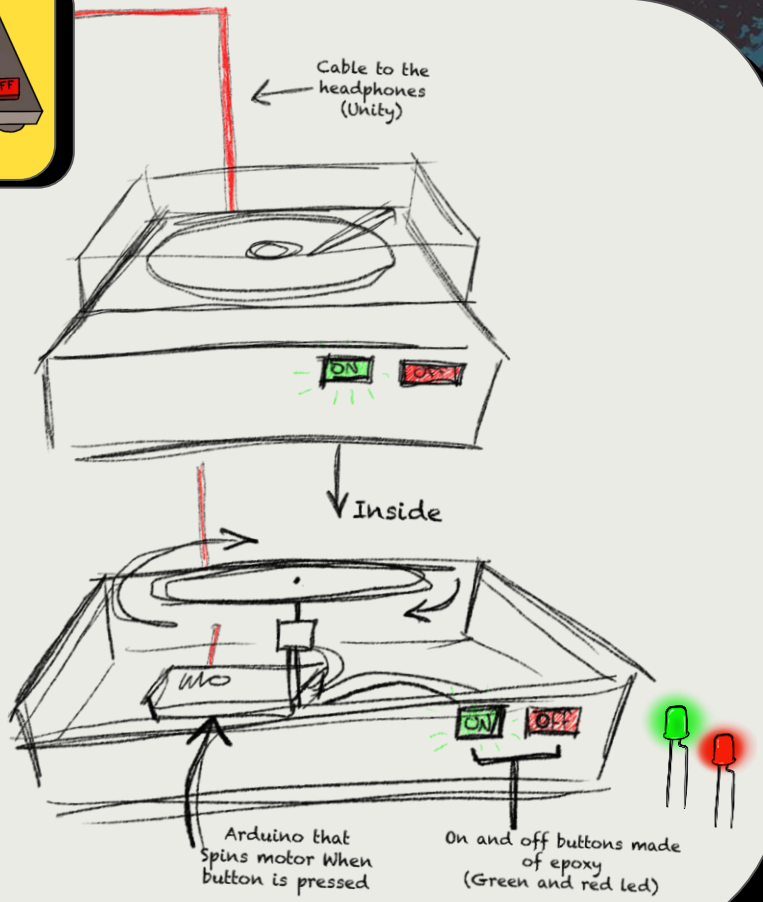
Designing the Functionalities

How each object will be used

Record player

Audio Input

- Only two visible signifiers outside of dust cover, ON and OFF buttons.
  - Red and green leds makes them less ambiguous.
- Dust cover locked in place.
  - Anti-affordance that limits players actions.
- While button is held, the record spins.
  - Signifies that audio output is played.
- Cable on the wall shows the connection to the headphones.

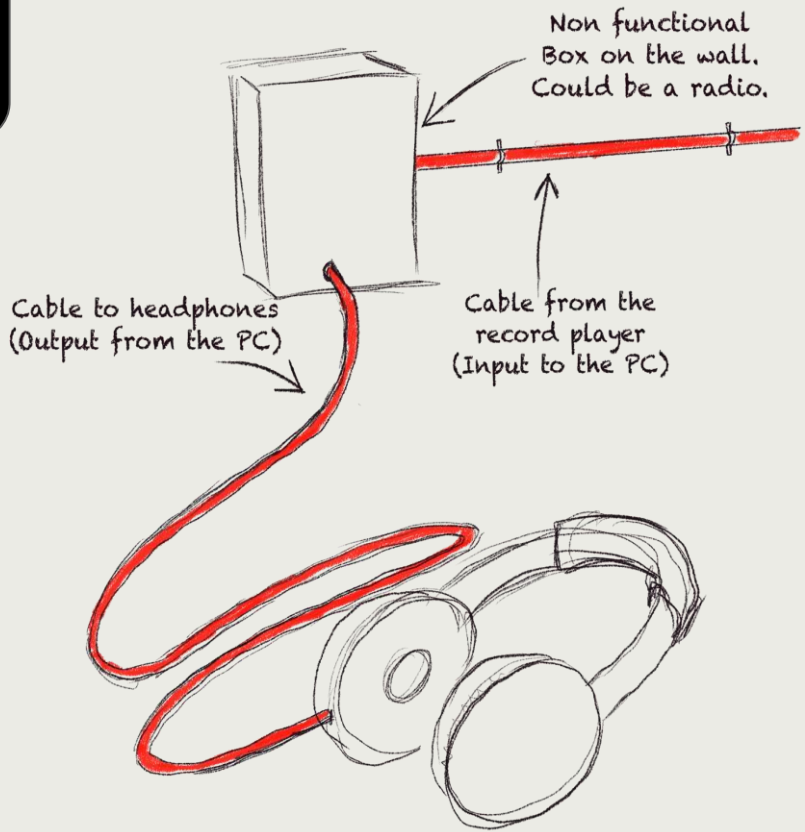


3D Model

Headphones

Audio Output

- Headphones provide an audio output.
  - Player can lift them and place them over their ears.
- Audio is played only when record player’s ON button is held.
- Box on the wall provides hidden connection to the PC.

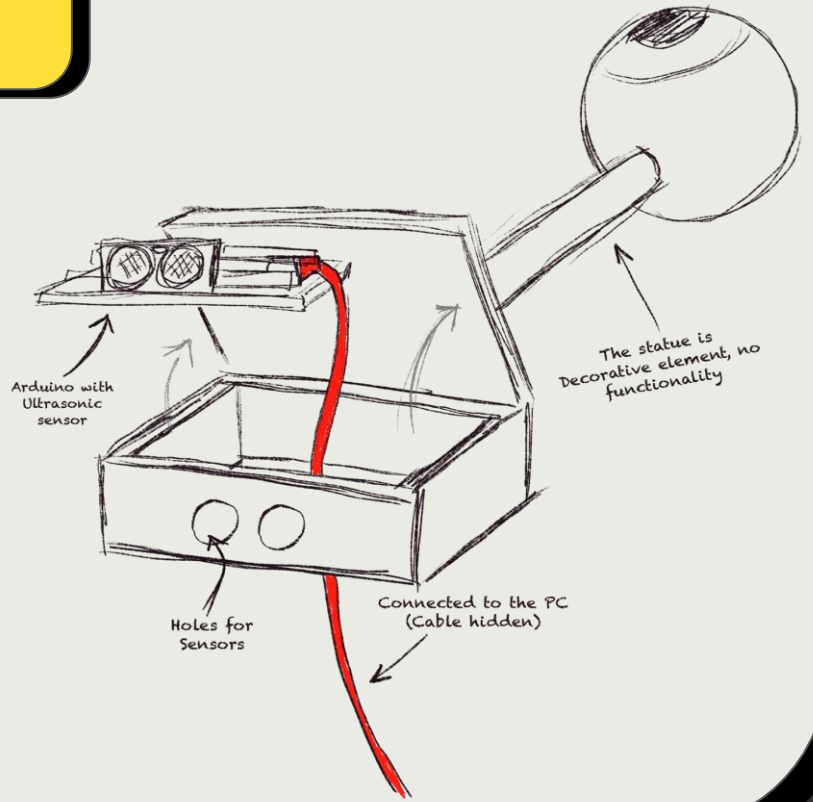


3D Model

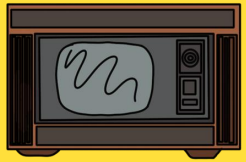
Spying Object,

Audio Input

- A spy villain inspired decorative object.
- The object has an Arduino with an ultrasonic sensor planted in the base.
- The object has no visible signifiers, but it can provide small audio feedback when activated.



TV cabinet



Visual Output

- A 60’s style TV cabinet can be used to place a hidden computer monitor that is connected to the PC.
- The TV offers visual feedback. This object does not require additional signifiers as it is not functional for the player.
- FORTRAN IV (Backus, 1962) is used as an inspiration for the text output.

Example code - FORTRAN IV or 66

```
THE TPK ALGORITHM
FORTRAN IV STYLE
DIMENSION A(11)
FUN(T) = SQRT(ABS(T)) + 5.)*T**3
READ (5,1) A
FORMAT(5F10.2)
DO 10 J = 1, 11
   I = 11 - J
   Y = FUN(A(I+1))
   IF (400.0-Y) 4, 8, 8
       WRITE (6,5) I
       FORMAT(I10, 10H TOO LARGE)
   GO TO 10
       WRITE(6,9) I, Y
       FORMAT(I10, F12.6)
CONTINUE
STOP
END
```

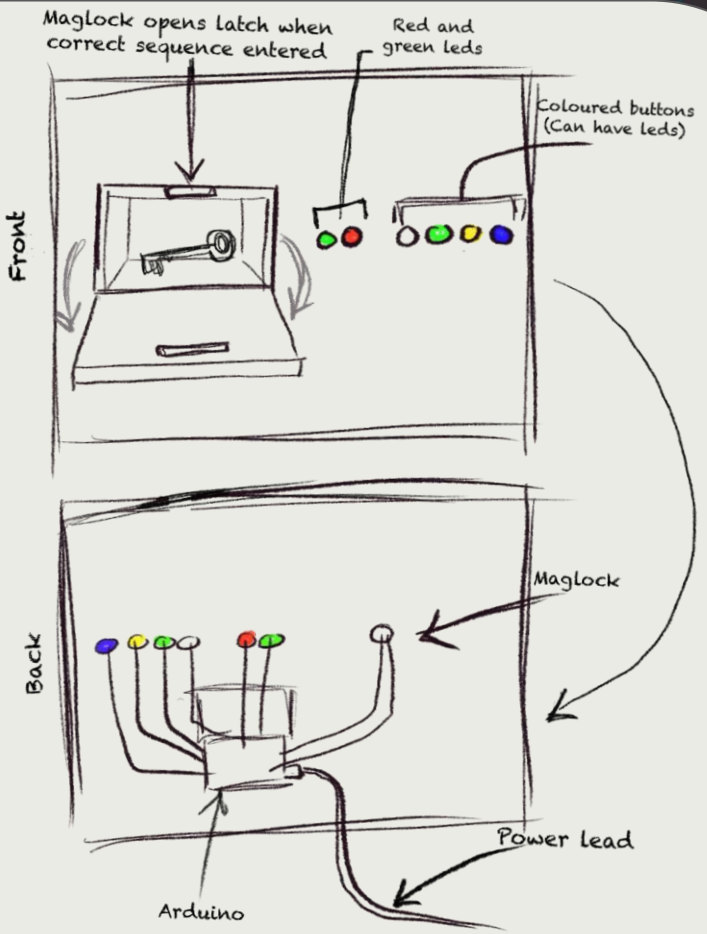

Fortran IV Example: http://www.mikanet.com/museum/item.php?item=1031

3D Model

Color Puzzle,

Manual Input

- Last piece of this puzzle.
  - Can be the final puzzle or provide a piece to the next puzzle.
- The colour code is given once correct password received by the spying object.
- Once the correct colour sequence is entered, a maglock releases a latch.



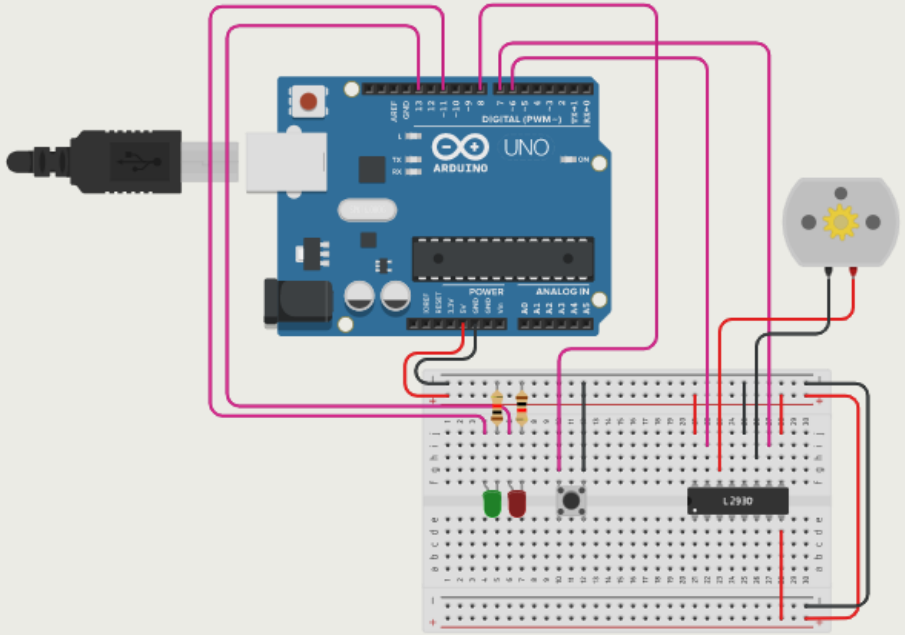
Building the Puzzle

Physical Prototypes

Record Player and Headphones

Circuit - First Version

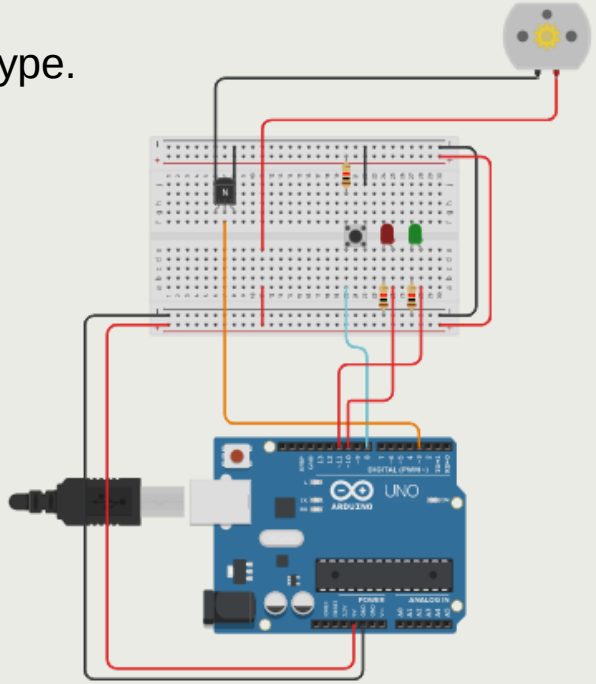
- Original project created for testing the system.
  - Link to the Tinkercad project
- Prototype worked in Tinkercad but not with physical Arduino.



Record Player and Headphones

Circuit - Final Version

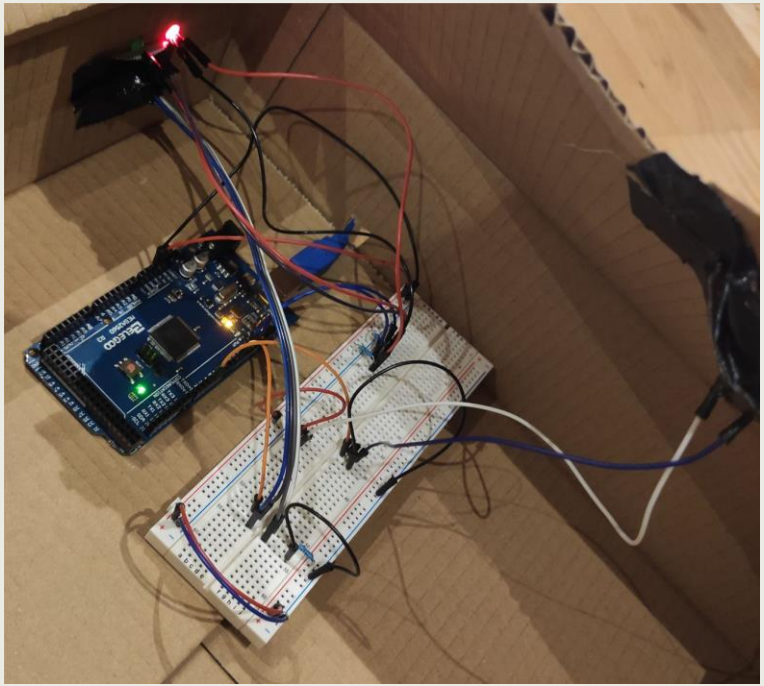
- Final working virtual prototype.
  - Link to the Tinkercad project




```
int motorPin = 3;

int ledG = 11;
int ledR = 10;

int motorSpeed = 150; //Recommend min speed 50

int buttonP = 8;

int buttonState = 0;


void setup() {

  Serial.begin(9600);
  pinMode(buttonP, INPUT_PULLUP);
  pinMode(ledG,OUTPUT);
  pinMode (ledR, OUTPUT);

}

void loop() {


  buttonState = digitalRead(buttonP);

  if(buttonState == LOW) {

    analogWrite(motorPin, motorSpeed);
    digitalWrite(ledR,0);
    digitalWrite(ledG,1);
  }

  else{
    analogWrite(motorPin, motorSpeed == 0);
    digitalWrite(ledR,1);
    digitalWrite(ledG,0);
  }

   Serial.println(buttonState);
}
```

Record player and Headphones

Circuit - Built Version



- Arduino Mega 2560
- NPN transistor PN2222
- 3-6V DC Motor
- Button
- Green and Red LED

Record Player and Headphones

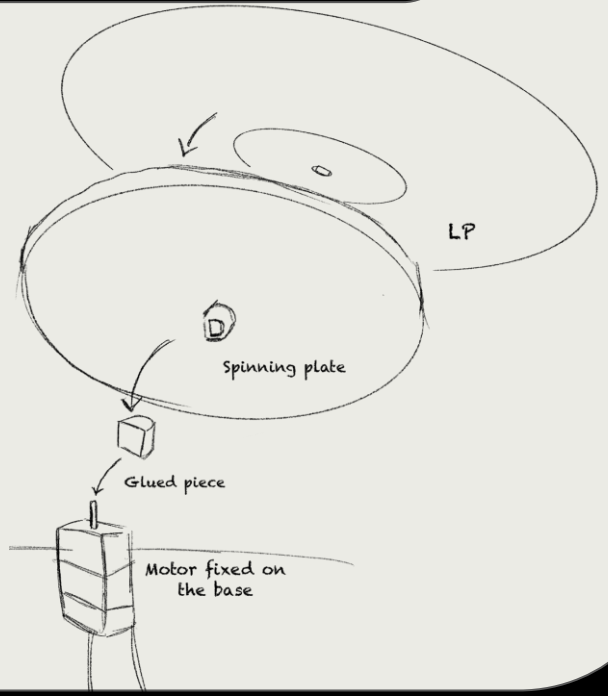
Video Demonstration

Headphones Audio Output

Record player and Headphones

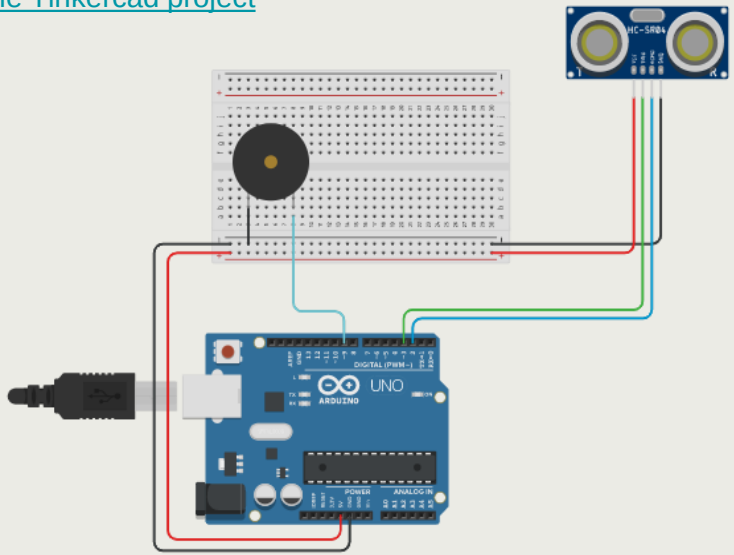
Evaluation and Further Development

- The vinyl takes some time to stop but sound does not - mixed feedback.
- Stabilising the plate so vinyl can be rotated.



Spying Object and TV,
Circuit - First Version

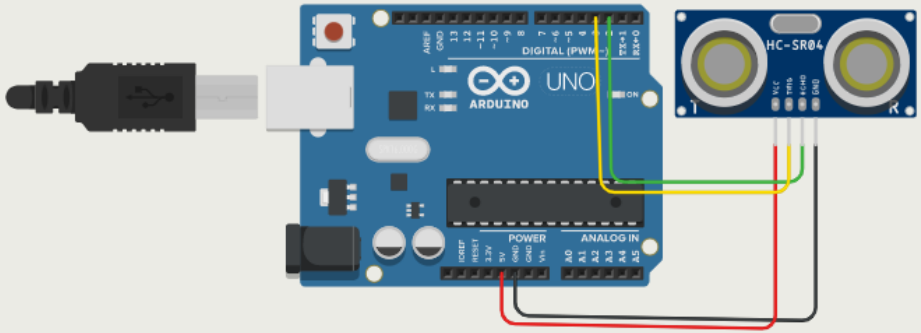
- First virtual project created for testing.
  - Link to the Tinkercad project




```
#define echoPin 2
#define trigPin 3
const int buzzer = 9;

long duration; int distance; boolean isRecognised; boolean firstDetection;

void setup() {
  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);
  Serial.begin(9600);
  }

void loop() {
  pinMode(buzzer, OUTPUT);
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);

  duration = pulseIn(echoPin, HIGH);
  distance = duration * 0.034 / 2;

  //Serial.print("Distance: ");
  //Serial.print(distance);
  //Serial.println(" cm");

  if (distance <= 50)
  {
    Serial.println("True");

    if (firstDetection == true){
      RecognisePlayer();
      }
  }

  if (distance >= 51)
  {
    firstDetection = true;
    Serial.println("False");
  }

  }

void RecognisePlayer(){
  tone(buzzer, 30);
  delay(10);
  noTone(buzzer);
  delay(100);
  noTone(buzzer);

  firstDetection = false;
}
```

Spying Object and TV,
Circuit - Final Simplified Version

- Cleaned up version, only the required components kept.
  - Link to the Tinkercad project




```
#define echoPin 2

long duration; int distance;

void setup() {
  pinMode(echoPin, INPUT);
  Serial.begin(9600);
  }

void loop() {

  duration = pulseIn(echoPin, HIGH);
  distance = duration * 0.01 / 1;

  if (distance <= 50)
  {
    Serial.println("true");
  }

  if (distance >= 51)
  {
    Serial.println("false");
  }
 }
```

Spying Object and TV,
Unity

```
void Update()
{
    if (sp.IsOpen)
    {

        try
        {
            sp.ReadLine();
            string value = sp.ReadLine().ToString();

            if (value == "active")
            {
                checkState.text = "RECEIVING : ON";

                if (!busy && !_isPlayed)
                {
                    StartCoroutine(PlaySound());
                    busy = true;
                }

                playerDetected = true;
            }

            else if (value == "inactive")
            {
                checkState.text = "RECEIVING : OFF";
                _isPlayed = false;

                playerDetected = false;
            }

        }
        catch (System.Exception)
        {
            throw;
        }

    }
}
```

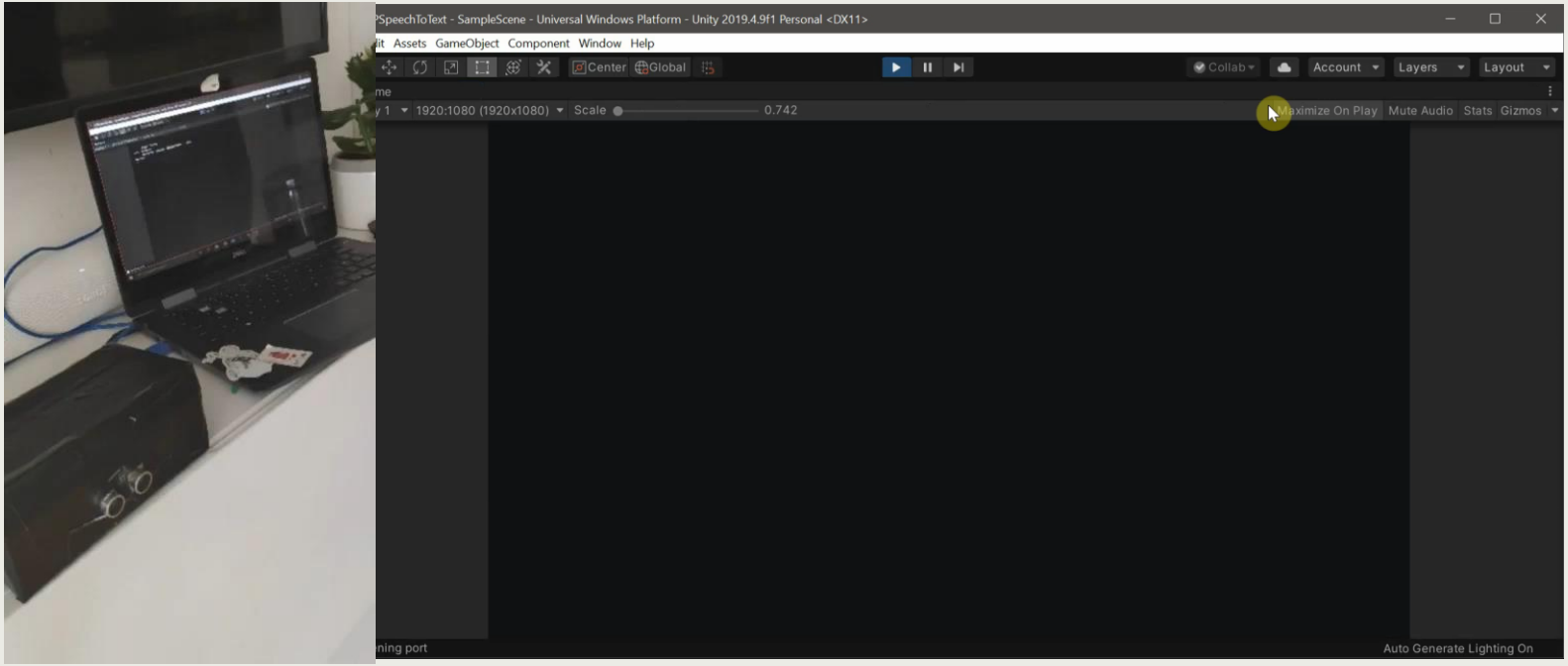
```
private void DictationRecognizer_DictationResult(string text, ConfidenceLevel confidence)
{
    Debug.LogFormat("Dictation result: {0}", text);
    speechTxt.text += text + "  // VALUE NOT RECOGNISED" + "\n";
}

private void DictationRecognizer_DictationHypothesis(string text)
{
    Debug.LogFormat("Dictation result: {0}", text);

    if (text == "skydance")
    {
        Debug.Log("GetCode");
        recordText.SetActive(false);
        codeText.SetActive(true);

        rState = RecordingState.disabled;
    }
}

private void DictationRecognizer_DictationComplete(DictationCompletionCause cause)
{
    if (cause != DictationCompletionCause.Complete)
    {
        Debug.LogErrorFormat("Dictation completed unsuccesfully: {0}.", cause);
        rState = RecordingState.waiting;
    }
}

private void DictationRecognizer_DictationError(string error, int hresult)
{
    Debug.LogErrorFormat("Dictation error: {0}. HResults = {1}.", error, hresult);
    rState = RecordingState.waiting;
}
```

```
    READ INPUT
101 FORMAT
    RECEIVE VALUE: RECEIVING : ON
WRITE
+
     IDP output window  // VALUE NOT RECOGNISED
```

```
    READ INPUT
101 FORMAT
    RECEIVE VALUE: RECEIVING : OFF
WRITE
+
     VALUE RECEIVED =
     (CODE), SKY DANCE
     BEGIN SEQUENCE +
     BLUE, YELLOW,
     YELLOW, GREEN,
     YELLOW, GREEN,
     GREEN, WHITE, WHITE
     STOP
     END
```

Spying Object and TV,

Video demonstration

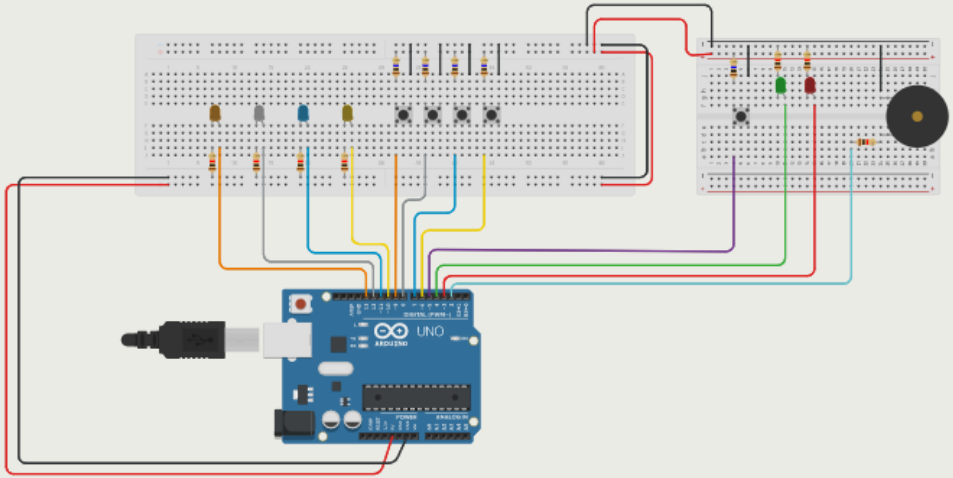


Spying Object and TV,
Evaluation and Further Development

- Universal Windows Platform (UWP) build version requires further research.
- Consideration using existing speech recognition programmes.
- Consideration of Bluetooth, speakers and microphone.
- Unity’s Dictation Recognition outputs the speech as whole sentences which creates delay of feedback (Norman, 2013, p. 23).

Colour Puzzle,
Circuit - Virtual Version

- Virtual project created for testing before actual development.
  - Link to the TinkerCad project



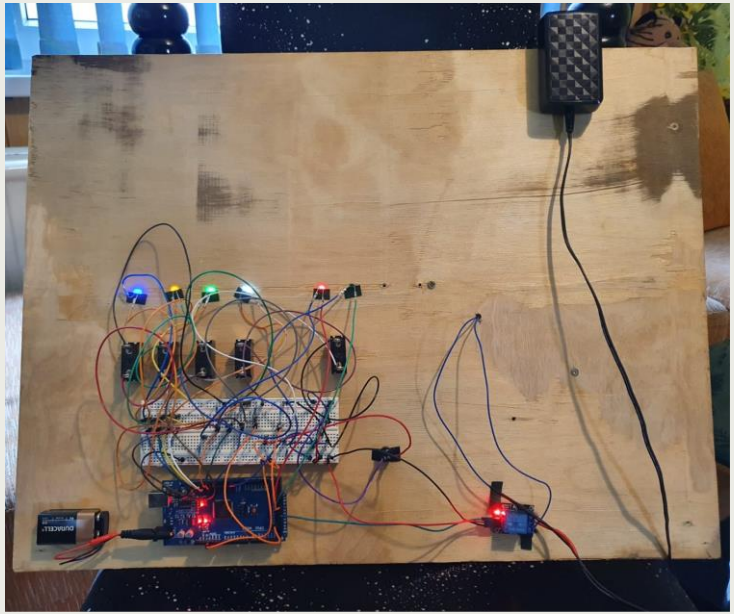
```
39
40  // Panel button counter
41  int counter = 0;
42
```

```
112
113    // BUTTON 1
114    if (buttonState1 == LOW)
115    {
116      digitalWrite(LED1, HIGH);
117
118      if(firstTimeButton1)
119      {
120        counter++;
121        firstTimeButton1 = false;
122      }
123    }
```

```
185  void MasterButton()
186  {
187    buttonState0 = digitalRead(BUTTON5);
188
189
190    if(buttonState0 == LOW && counter == 6){
191      digitalWrite(LED5, HIGH);
192      digitalWrite(LED6, LOW);
193      unlocked = true;
194
195    }
196
197    if (buttonState0 == LOW && !unlocked){
198      digitalWrite(BUZZER, HIGH);
199      tone(BUZZER, 1000);
200      delay(500);
201      noTone(BUZZER);
202      counter = 0;
203    }
```

Colour Puzzle,

Circuit - Built Version



- Arduino Mega 2560
- 9V Battery for Arduino
- 12V AC/DC Adaptor
- 12V Electromagnet
- 5V Relay
- LED’s
- Tumble Switches
- Piezo / Buzzer

Colour Puzzle,

Video Demonstration

- Locked Box
- Master Button
- Colour Inputs / Switches
- Sound Feedback
- Visual Feedback
- Labelling

Colour Puzzle,

Evaluation and Further Development

- Design improvements
- Consider to use a stronger electromagnet
- Add more labelling / instructions
- Consider to add more visual and sound effects

Summary

- All of the individual parts of the puzzle are functional and tie together.
  - Further development by research and resources.
- To determine the required signifiers and difficulty of the puzzle could be done by testing.

Thank You!

Questions?

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