



Team Sonic

Pattern Unlock using Ultrasonic Sensors

Vinit Doke

190260018

Mihir Agre

190260030

Vignesh Tongaria

190260046



Motivation

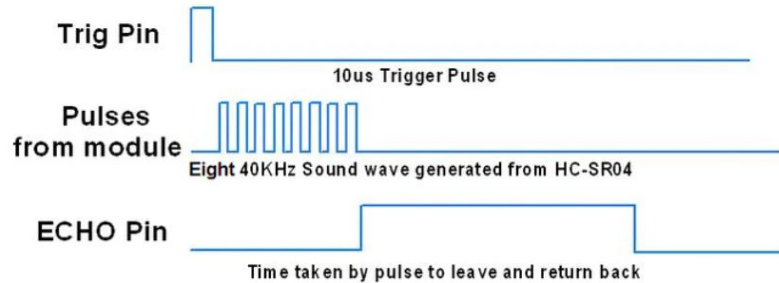
- Input Device : Writing Pad
- Possible Sensors :
 - IR Emitter-Receiver Pair
 - Ultrasonic Distance Sensors
- Resolution Consideration
 - Discrete Grid
- Applying Tracking to different scenarios:
 - **Pattern Unlock**
 - Numeric Keypad
 - Arrow Keypad



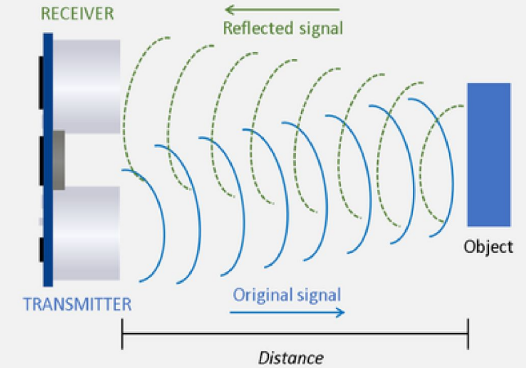
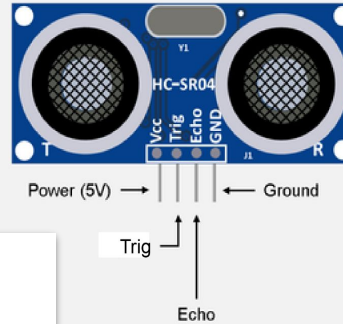
Detection

$$\text{Distance} = (\text{Time}) * 0.034 / 2$$

Ultrasonic HC-SR04 module Timing Diagram



Ultrasonic HC-SR04 timing diagram



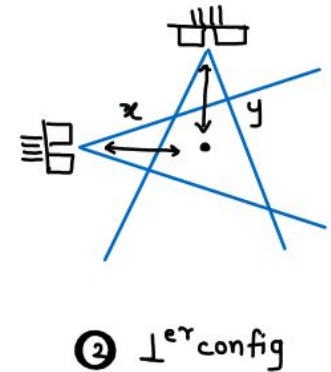
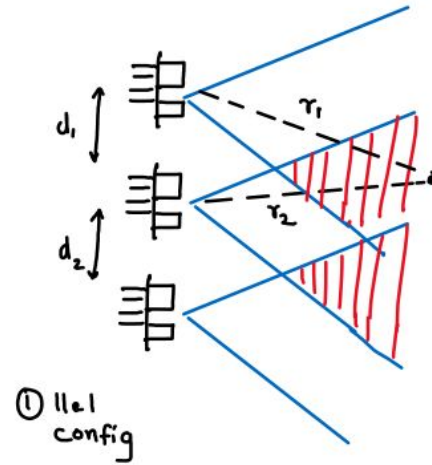
Demo 1: 1D : Link :

<https://drive.google.com/file/d/1UiAzfFep8ZMWixCf7VmyrAb9u5MnFTcL/view?usp=sharing>



2D Detection

- Parallel Configuration
- Perpendicular Configuration





Demo 2 : 2D Tracking

https://drive.google.com/file/d/1nyw5tvDfqVSkvSpS6v4cZXV_7Urpcbb/view?usp=sharing

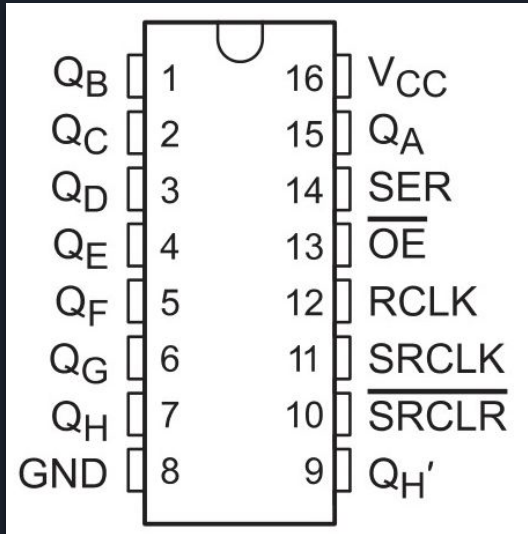




Displaying Detections

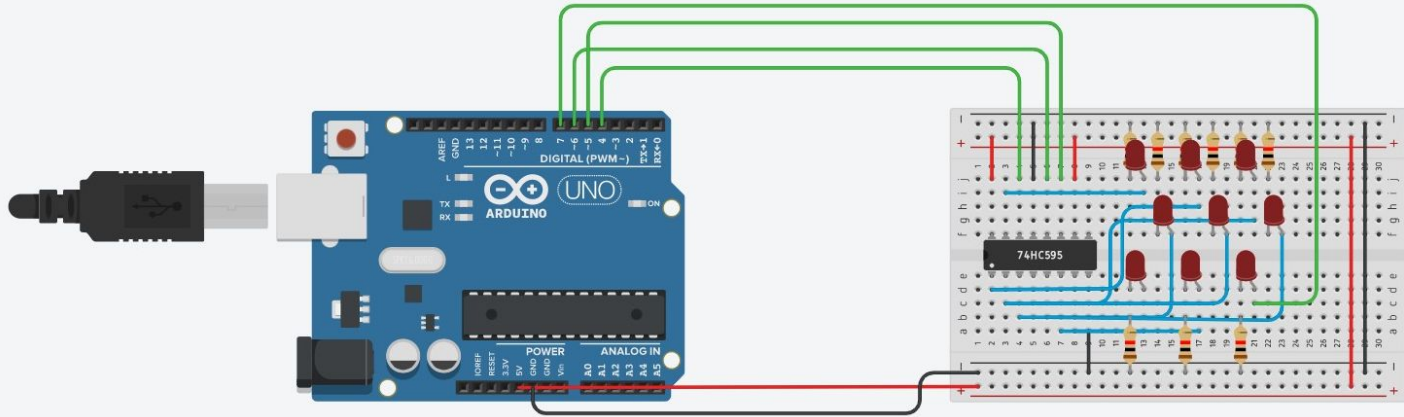
- To Address 9 LEDs individually
- Lesser GPIO Pins available for connecting more Sensors, Buttons & Indicators

74HC595 Shift Register



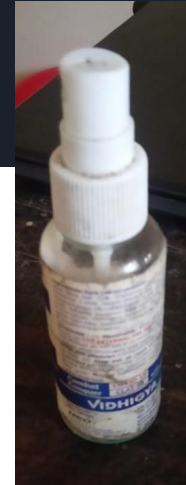
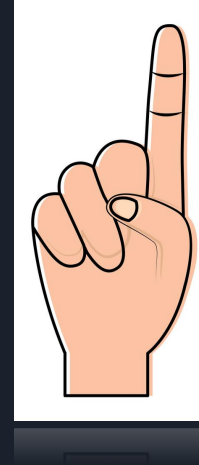
- Serial Data IN
- Parallel Data OUT
- 8 LEDs controlled using IC
- Last LED directly controlled using Arduino GPIO Pin
- NET PINS Utilized for LED Matrix :.
 - $4(3 + 1)$

Displaying Detections



Objects

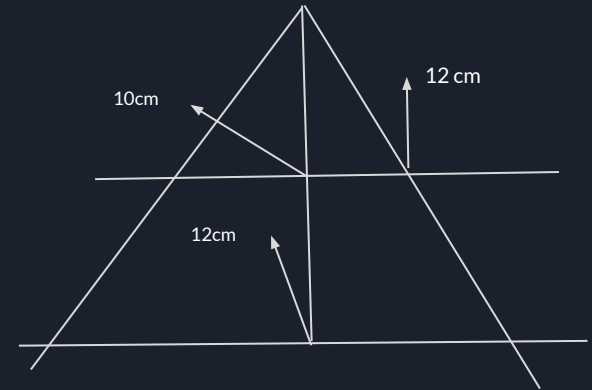
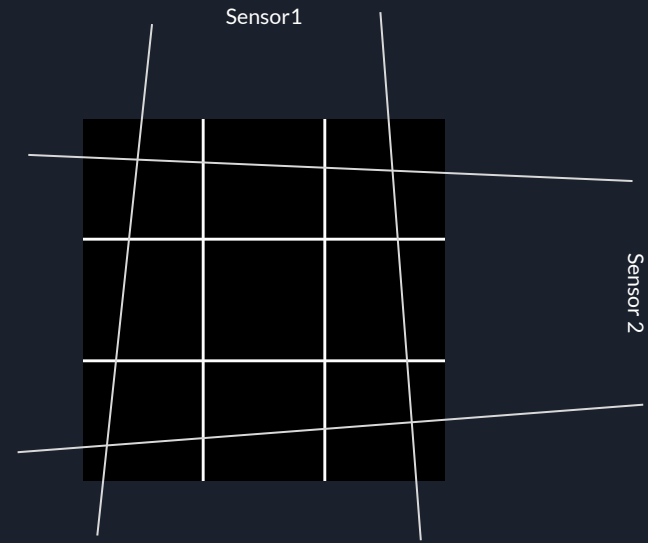
- Thin objects like pen, pencil etc. were not being detected properly by the sensor
- Inconsistent objects with irregular area may not be detected consistently.
- Objects with consistent and uniform surface area like cuboid and cylinder worked best



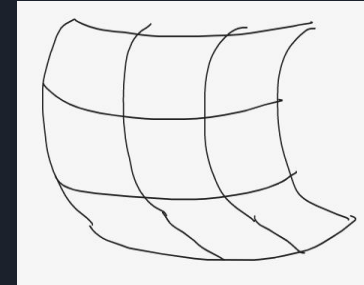
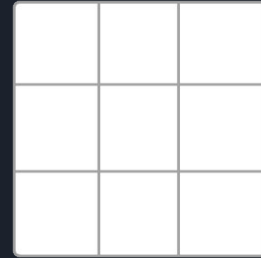
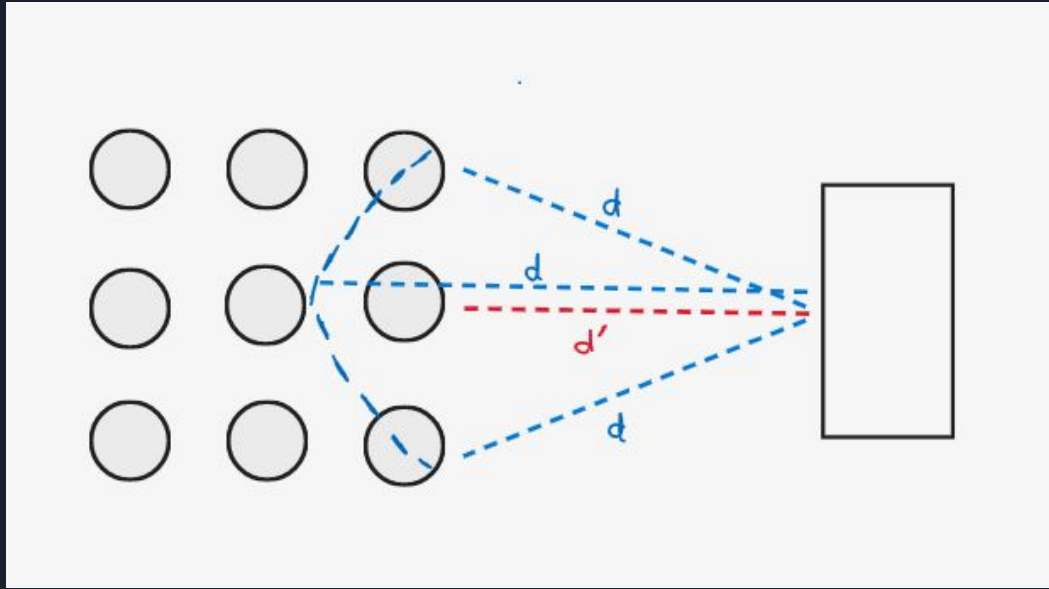
These are the objects we used

Consistent Detection

- Max. side length of square will be when object just starts to get out of range.
- Consistent detection on the central block from the sensor
- Deviation from center to right and left blocks.
- Error from the deviation sometimes results in mixing of the regions.



Exact Mapping v/s Thresholded Grid

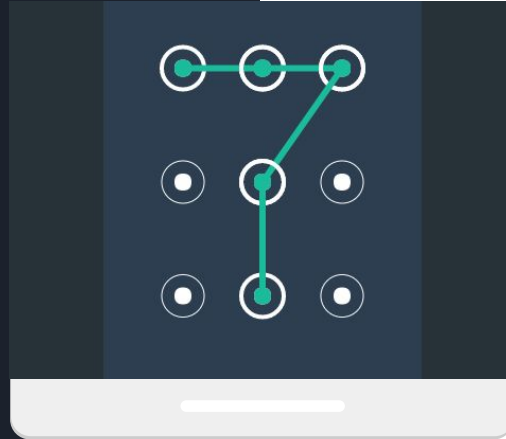


Data Processing

Detecting presence on
Grid Points

- Average
- Mode

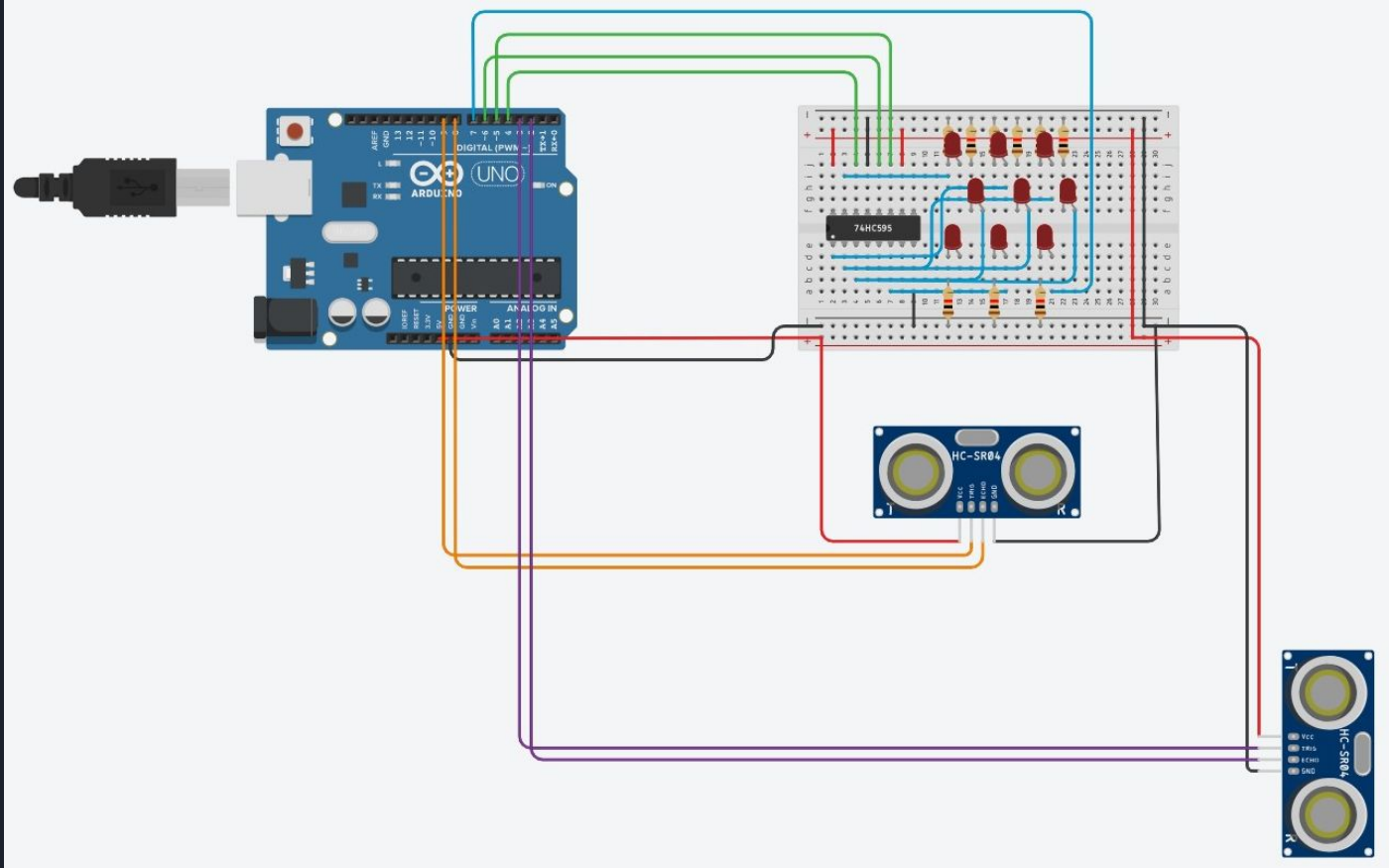
Buffer and the consistency



What to do with the Grid Points?

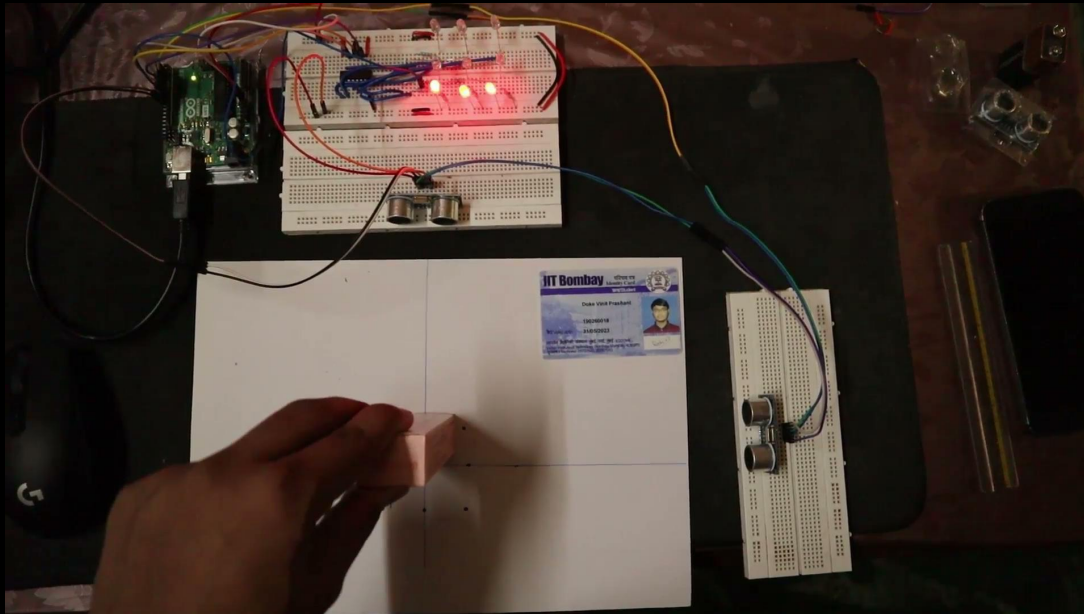
- Pattern formation
- Password Check

Final Circuit Diagram



Demo 3 : With Password Unlock Logic

<https://drive.google.com/file/d/1M8PiSF9vZuO6FvGbcaP93Q42yPUGwBdV/view?usp=sharing>





Thank you!