

Brief



To design a hand held object tracking system.

This device must be able to track objects at a range of 50cm to 1M.

The device must make use of a 4 inch screen. A Pimorini PIM370 is provided.

The device should be housed in a suitable housing.

Wiring inside the housing should be secured using provided materials such as tie wraps and cable tidies.

The device must make use of both an Arduino Nano and a Raspberry Pi 3+ (provided)

Communication between devices must be a wired interface, such as i2c.

The device should emit an audible tone that is of varying note duration which indicates the range of the object. This should be a short duration for a target that is close and a long duration for a target that is far away. This should be synchronized with the image below.

The device must scan an azimuth of approximately 120-90 degrees making use of at least three ultrasonic sensors.

The device must visually indicate by means of a ranged grid the target position.

You should render all images on the Raspberry Pi by use of a library such as pygame.



For the purposes of this event it is not necessary to use any batteries to power the device, the device should be powered by USB and provided power supplies.

As this challenge is open to all streams then you may pick from either Manufacturability or Security

Manufacturability

A design report should be prepared. This report should include schematics of the item. It can also include 3d drawings, hand drawings or designs that have attributed to the final product. The report should also lists a Bill of Materials. This should include estimated costs. The design report should include future scalability potential. The design report should also investigate the possibility of further enhancing the range of the device

reading to 10M and beyond by means of improving the ultrasonic sensors and sensor receiving circuitry. It should also identify a suitable battery

Security

If the team dynamic allows for the entry of a security element then the transmitted data between the two devices should be viewed as secure. The use of handshaking or encrypted data transfer could also be achieved.

Non optional challenges

Creativity

The team should design a creative interface to visually track the moving objects. If an object is seen to be moving to display a “Snail-Trail” to display its previous position.

The team should endeavour to create a housing that is suitable for the tracker and may need to redesign the front fascia to house the rectangular screen. This maybe the form of 3d printed models, both digital and the possibility of printing an item physically.

The team could endeavour to create a newly designed PCB that houses an improved ultrasonic circuit.

Presentation

A presentation should be carried out to showcase the above and demonstrate functionality of the item.

Judging criteria

Presentability – Keep as expected.

Possibility of Security if there are elements involved from a computing stream then this can be

Manufacturability Report – Focus on the ability to make BOM,
Parts sensors

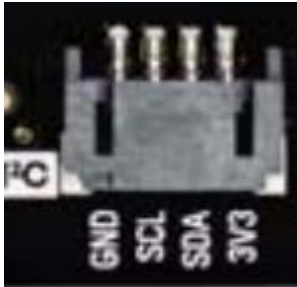
Grid follows on next page.

Datasheets/Pinouts provided below also.

DEFINITION / CRITERIA (WEIGHTING)	EXCELLENT Outstanding Performance	COMMENDABLE/VERY GOOD Meritorious Performance	GOOD Highly Competent Performance	SATISFACTORY Competent Performance	BORDERLINE FAIL Failure Open to Condonement	UNSATISFACTORY Fail
Design Report	<p>A system is defined very clearly.</p> <p>All the relevant components studied and explained.</p> <p>Schematics, Drawings, BoM and future objectives fully discussed.</p>	<p>A system is defined clearly, there maybe errors in the drawings which are minor and shouldn't affect functionality</p> <p>All the relevant components studied and explained.</p> <p>Schematics, Drawings, BoM and future objectives discussed and show good insight.</p>	<p>A system is defined but there maybe small errors in the drawings which may affection function.</p> <p>Most of the components studied and explained.</p> <p>There maybe deviation in the expected requested documents such as Schematics, Drawings, BoM and future objectives</p>	<p>A system is defined but there maybe significant errors in the drawings which may affection function.</p> <p>Not all objectives are well chosen/relevant. More specificity needed.</p> <p>Demonstrates some level of understanding of the objectives, though not all relevant background information discussed.</p>	<p>Sparse evidence of the understanding of the objectives and sensors.</p> <p>Very few of the objectives are measurable, achievable and tangible.</p> <p>Very few of the relevant components studied and explained.</p>	<p>None of the objectives are measurable, achievable and tangible.</p> <p>None of the relevant components identified and discussed. No evidence of critical analysis of the theories, limitations and simplifications. No evidence of understanding of the applicability of theories to the current study. No evidence of the identification and application of engineering design methods and manufacturing using appropriate design processes.</p>
Creativity	<p>Team displays innovative ideas and makes use of 3d printing, modelling or advanced PCB designs.</p> <p>Team Creates a visual interface that makes us of trailing object that shows motion history</p>	<p>Team displays innovative ideas and makes use of 3d printing, 3d modelling or advanced PCB designs.</p> <p>Team Creates a visual interface that makes us of trailing object that shows motion history</p> <p>These may have minor errors and may in minor cases not always provide the expected result.</p>	<p>Team displays innovative ideas and makes use of 3d modelling or printing or advanced PCB designs.</p> <p>Team Creates a visual interface that makes us of trailing object that shows motion history</p> <p>These may have a single major error or a few minor issues.</p>	<p>Team displays innovative ideas and makes use of 3d modelling or printing or advanced PCB designs.</p> <p>Team Creates a visual interface that makes us of trailing object that shows motion history</p> <p>These however may have many errors but show a potential to be functional.</p>	<p>Team makes a limited attempt to provide a creative element or element is limited in functionality.</p>	<p>Team makes no attempt to provide a creative element.</p>

https://mm.digikey.com/Volume0/opasdata/d220001/medias/docus/856/PIM370_Web.pdf

HyperPixel 4.0 Screen contains an I2C breakout on the back. This should be used to connect to the Arduino Nano.



Ground -> GND on Arduino

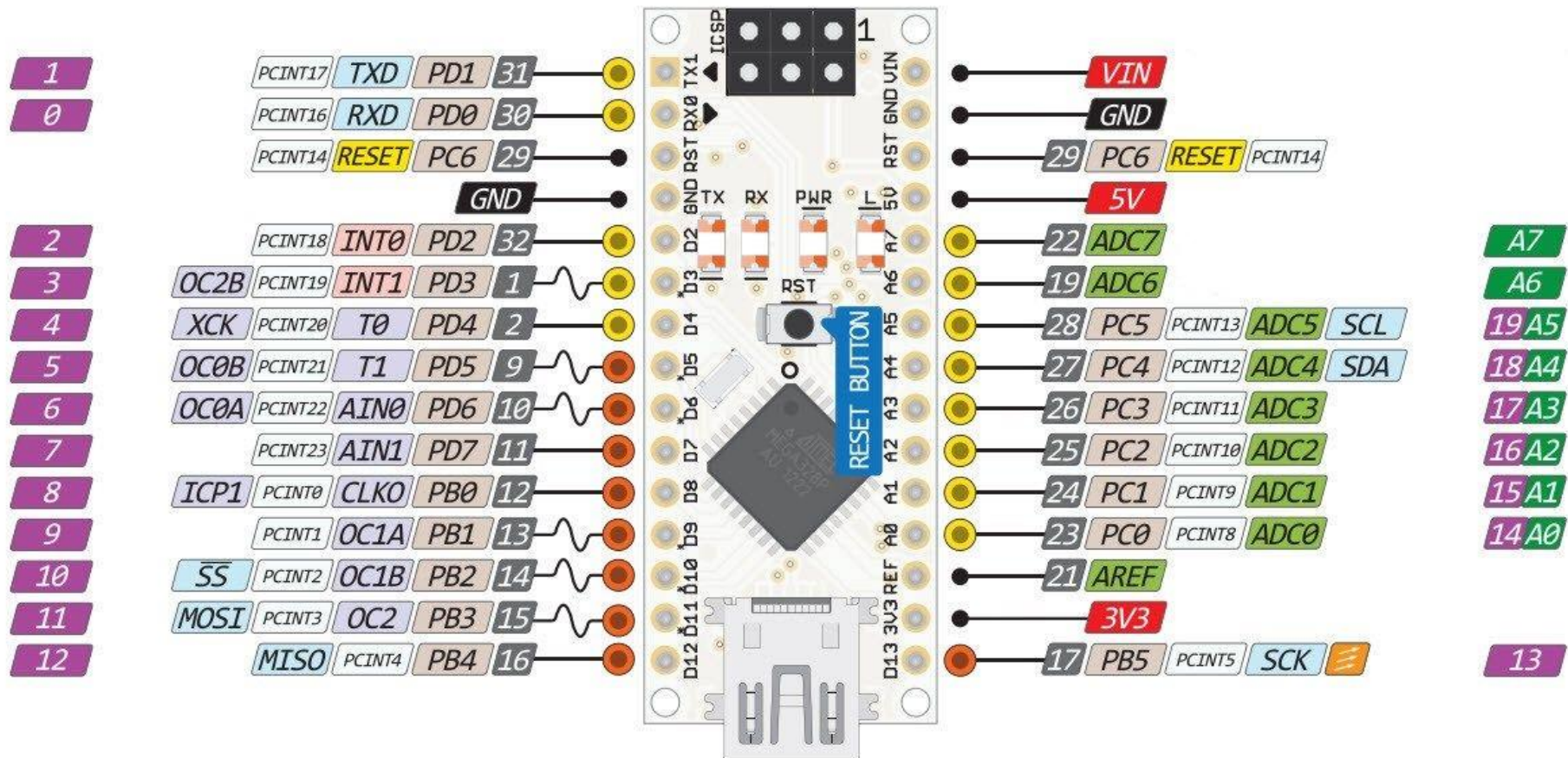
SCL -> SCL A5 on Arduino

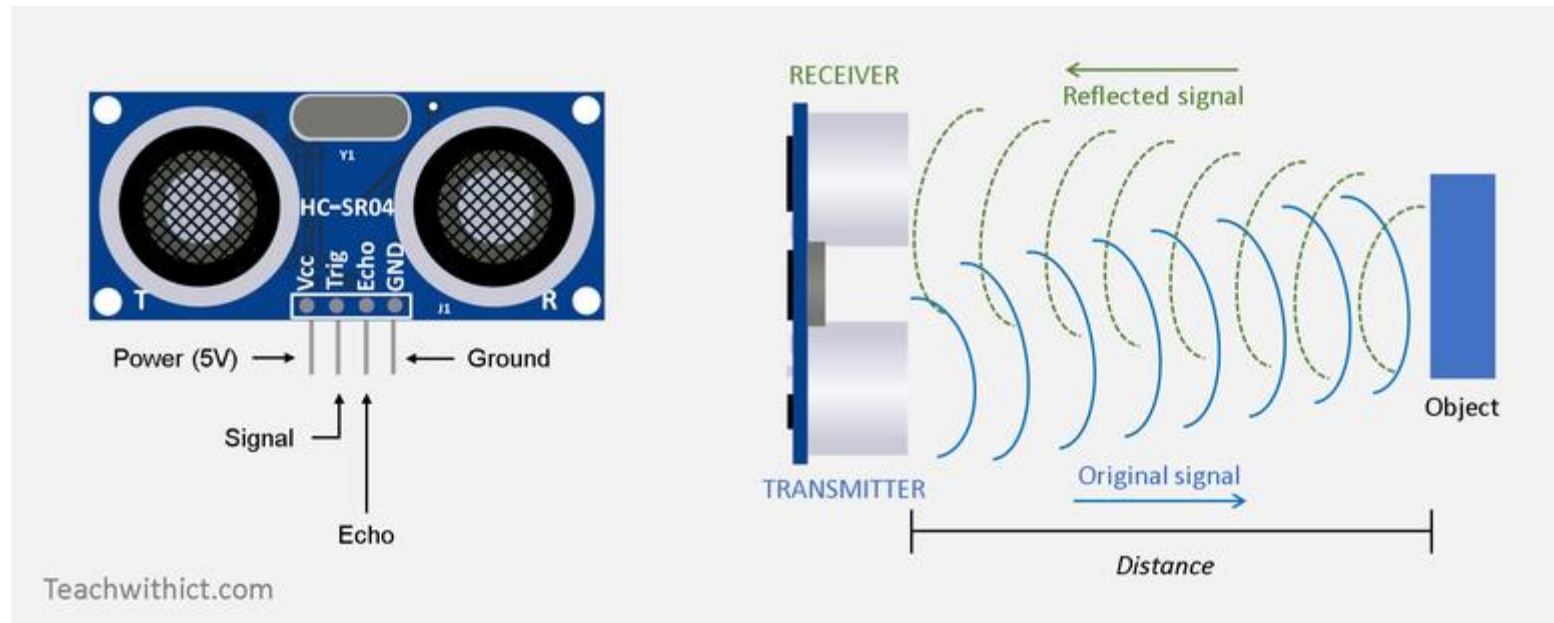
SDA->SDA A4 on Arduino.

Jumper cables are provided.

NOTE THAT THE I2C PORT ON THE BACK OF THE SCREEN IS A VIRTUAL PORT AND IS /DEV/IC2-11 so is the 11th i2c device on the pi. The screen requires i2c itself and manages that itself. **DO NOT. DO NOT. DO NOT. ENABLE I2C ON THE RASPBERRY PI SETTINGS.**

Arduino pinout continues:





As there is only one 5V pin on the Arduino 4 pin headers are provided to allow you to tap onto and provide power for all 3 of the HC-SR04 sensors.

Information on the usage of the ultrasonics and the buzzer will be provided in the sensor workshop on Saturday

Suggested links

[Ping Ultrasonic Range Finder | Arduino Documentation](#)

[tone\(\) | Arduino Documentation](#)

[Sensor Kit](#)

[Emil's Projects & Reviews: Making a better HC-SR04 Echo Locator](#)

[HyperPixel 4.0 - Hi-Res Display for Raspberry Pi](#)

[Alien Isolation Motion Tracker](#) (MUST VIEW – note screen is different to one in this code)

[Alien Motion Tracker by bradstormer | Download free STL model | Printables.com](#) (PROVIDED HOUSING)

[Master Writer/Slave Receiver | Arduino](#)

[I2C Between Arduino & Raspberry Pi](#)

[Pygame Front Page — pygame v2.6.0 documentation](#)

[Pygame – Drawing Objects and Shapes - GeeksforGeeks](#)