**Course:**
188.461 Multimedia Interfaces
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# Distance calculation using Ultrasonic detection when a key on a keyboard is pressed

Project idea

## Needed devices

- Arduino UNO R3
- Ultrasonic Sensor HC-SR04
- USB cable
- Jumper Wires
- Mini bread
- Computer with Ubuntu 18.04 OS
- Keyboard

## Project idea compliance with the requirements

The idea should include:

1. ### Arduino and at least one sensor and/or actuator

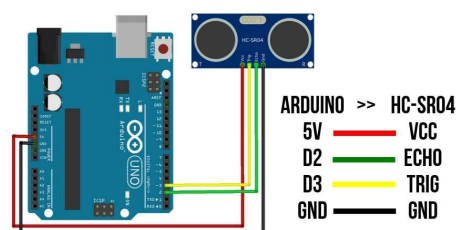   Arduino and Ultrasonic Sensor HC-SR04 will be used. They will be connect using the following scheme.



*Figure 1 Connection of Arduino UNO and HC-SR04 (create.arduino.cc)*

2. ### Use other devices too

   Keyboard will be used for distance measurement activation. One "d" (d-istance) key press on computer – one message to measure the distance once.

   Keyboard package downloaded from GitHub.

   Integer equal to 1 will be published to a new topic, when the key is pressed.

3. ### Have at least one computation node

   Integer equal to 1 will be published to a new topic, when the key is pressed.

   Also, computation made to calculate the distance. Distance formula:

$$distance = \left(\frac{travel\ time}{2}\right) \times speed\ of\ sound$$

# Report of project finished

## Supplementing the project idea

Another node, which subscribes the topic of distance, and publishes the range to which the distance belongs to:

- If the distance is below 5 cm, the node publishes *string* "close";
- Between 5 and 10 cm – "mid-range";
- More than 10 cm – "far".

## Work done

### Sensor and Arudino UNO connection
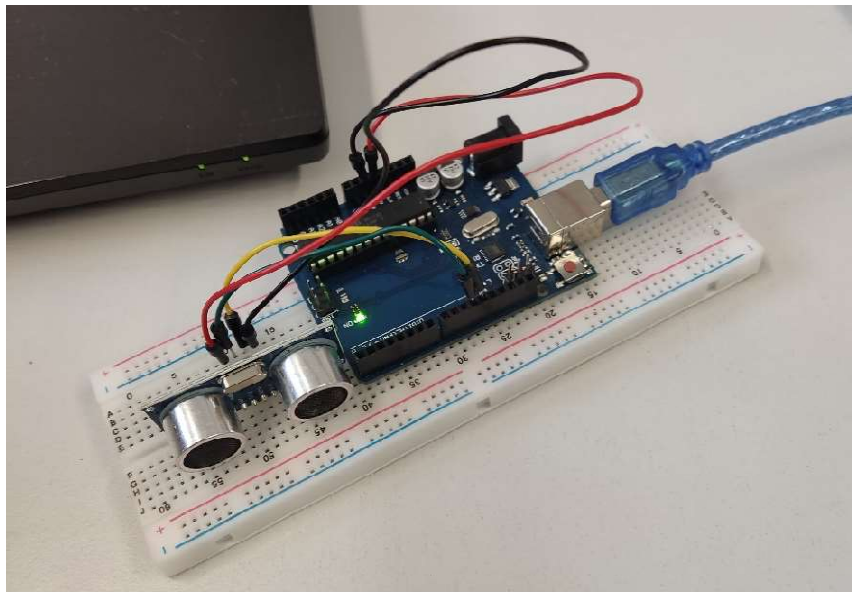
Connection was based on *Figure 1*.



*Figure 2 Connection of Arduino UNO and HC-SR04 sensor*

### During the work process, libraries were used:

Keyboard library downloaded from GitHub.

Its' node publishes to topic "/keyboard/keydown" (UInt16). The code of the pressed key on a keyboard is published.

Code of key "d" is 100.

The code of a library was changed slightly: it used to publish data of type *key*, it was changed to only the code of the key.

### Nodes were written:

1. keypressed (file: mmi_package/scripts/keypressed_node.py)

   The node subscribes to topic "/keyboard/keydown" (type – UInt16), and publishes topic "/dkey" (type – Int8).

   Topic "/dkey" forwards 1's, when a "d" key on the keyboard is pressed (when code of the key is equal to 100).

2. **nh (file: publisher.ino)**
   The node subscribes to topic "/dkey" (type – Int8), and publishes topic "/chatter" (type – Float64).

   If a one is received from the topic "/dkey", *nh* node publishes the distance in centimetres between the ultrasonic sensor and an object in front of it.

3. **distancerange (file: mmi_package/scripts/keypressed_node.py)**
   The node subscribes to topic "/chatter" (type – Float64), and published to topic "distrange" (type – String).

   The node checks the value of a received distance and publishes strings "close", "mid-range" or "far" depending on the size of the distance.

## Results

Four topics publish information:

- /keyboard/keydown: code of the key pressed;
- /dkey: 1, when "d" key is pressed;
- /chatter: distance between sensor and an object in front of it;
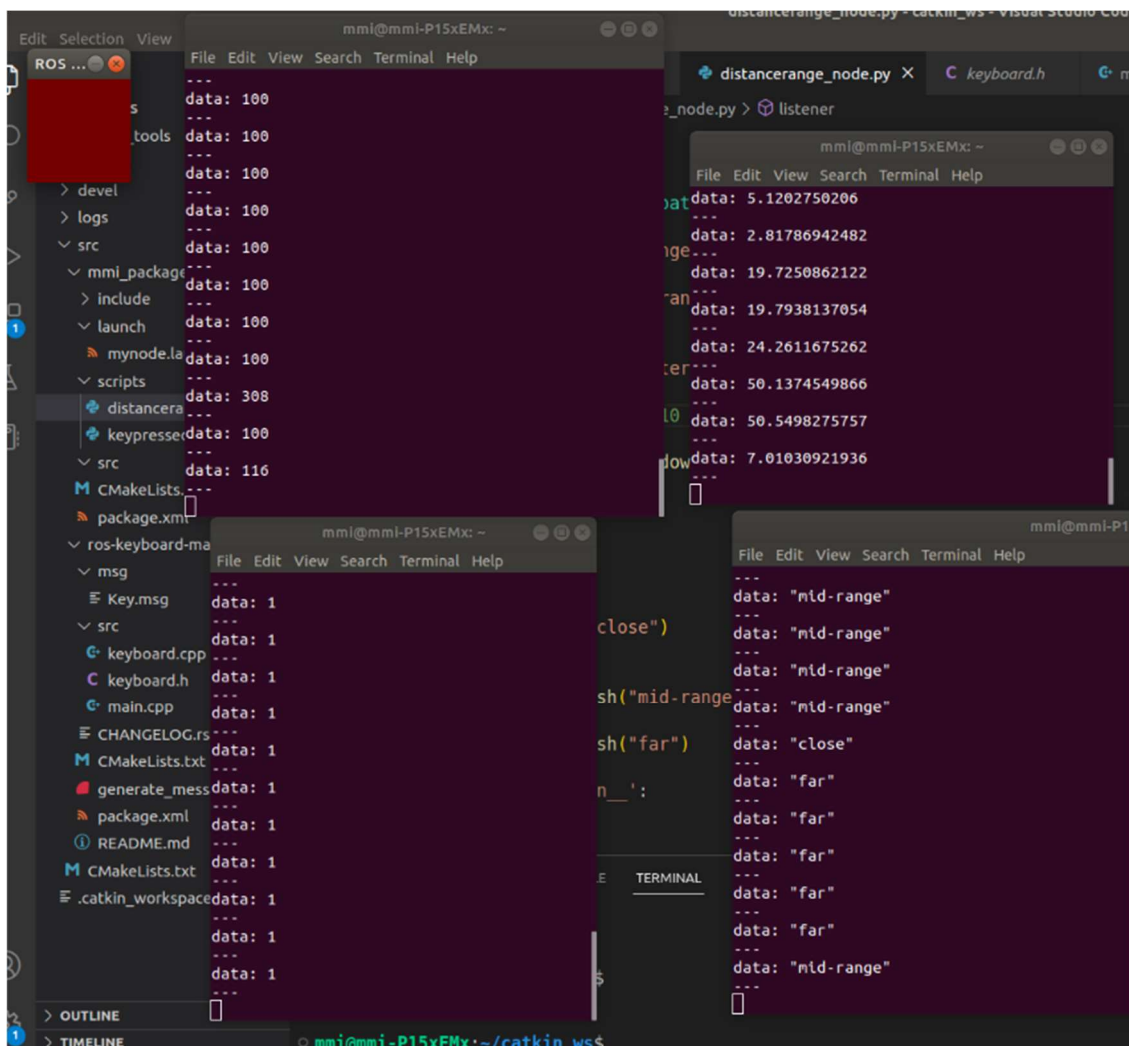- /distrange: range of a distance, to which the distance belongs to.
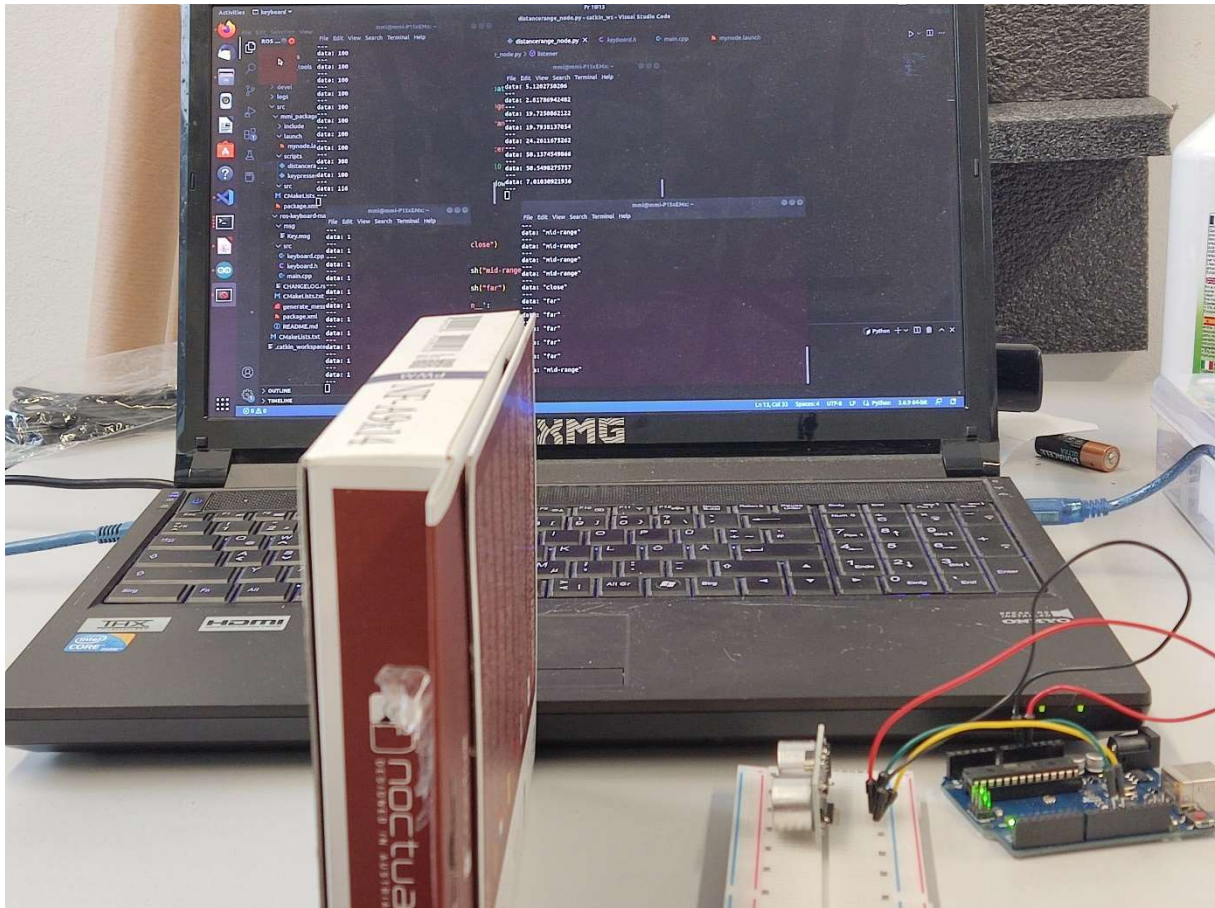


*Figure 3 Results when all topics are echoing*

*Figure 4 Results when all topic are echoing*