Ultrasonic-Accelerometer Demo Video

Team A1

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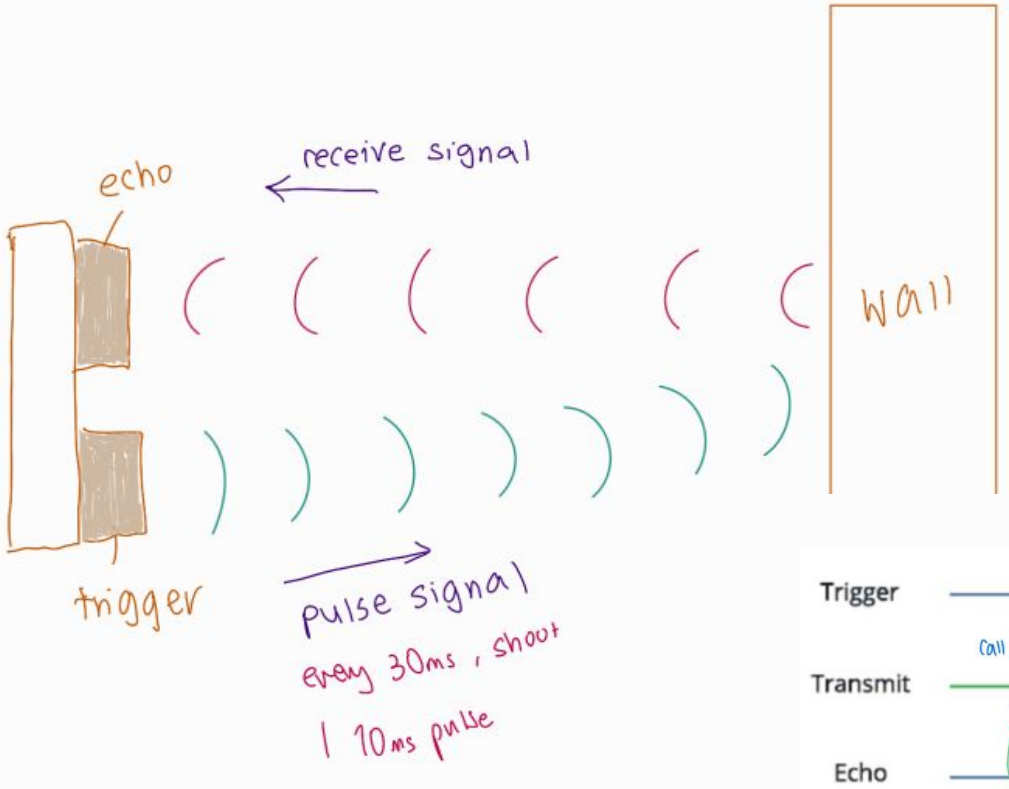
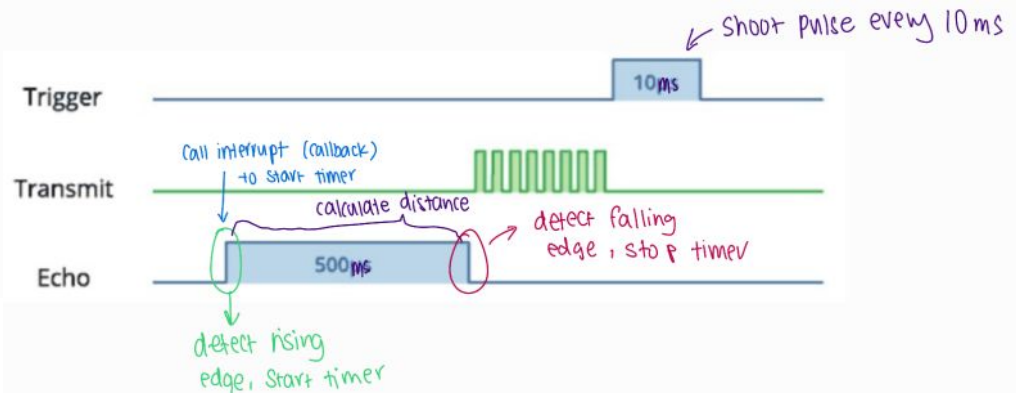
Ultrasonic Sensor


echo
receive signal
wall
trigger
pulse signal
every 30ms, shoot
1 10ms pulse

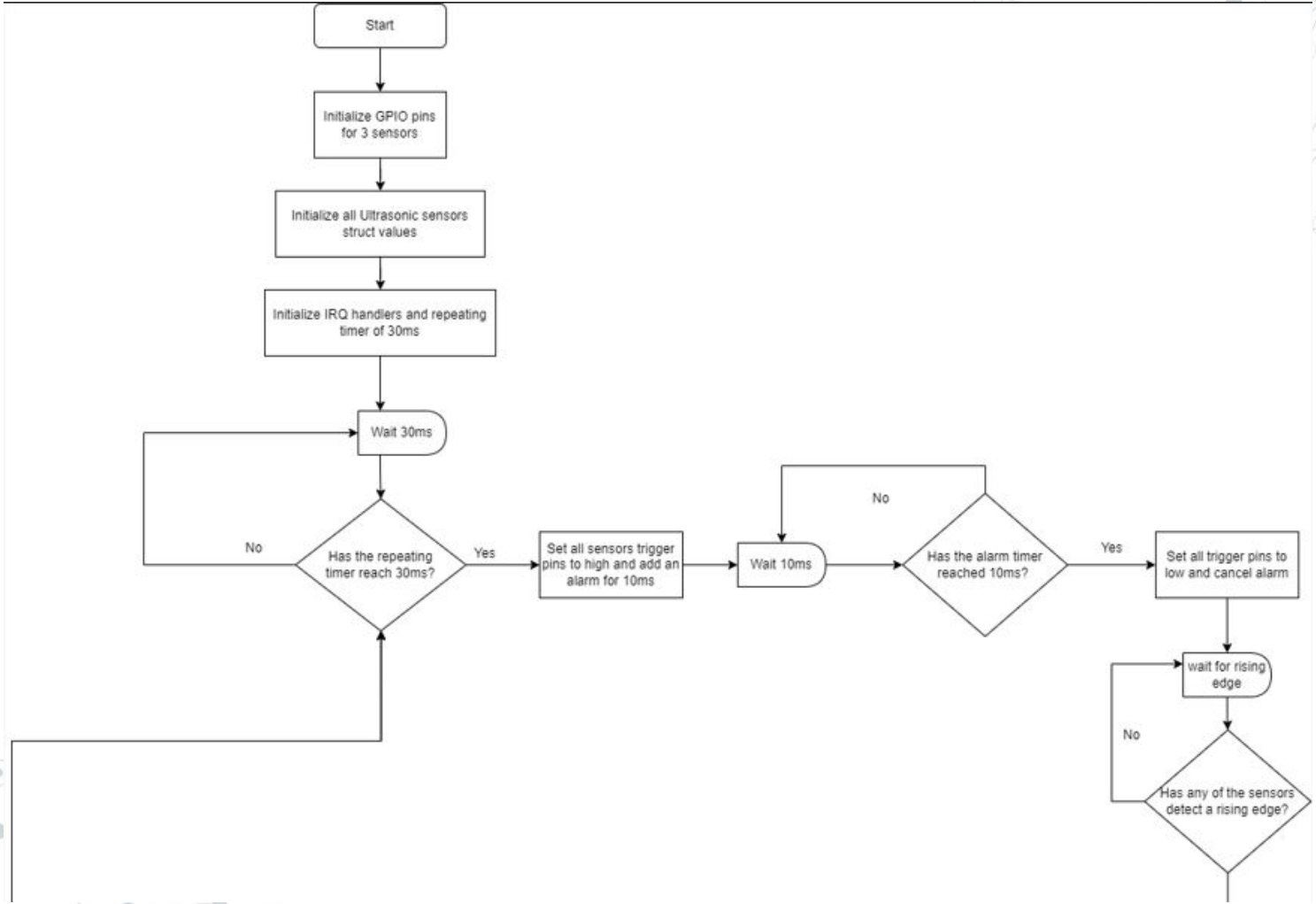

shoot pulse every 10ms
Trigger
10ms
call interrupt (callback)
to start timer
Transmit
calculate distance
detect falling
edge, stop timer
Echo
500ms
detect rising
edge, start timer

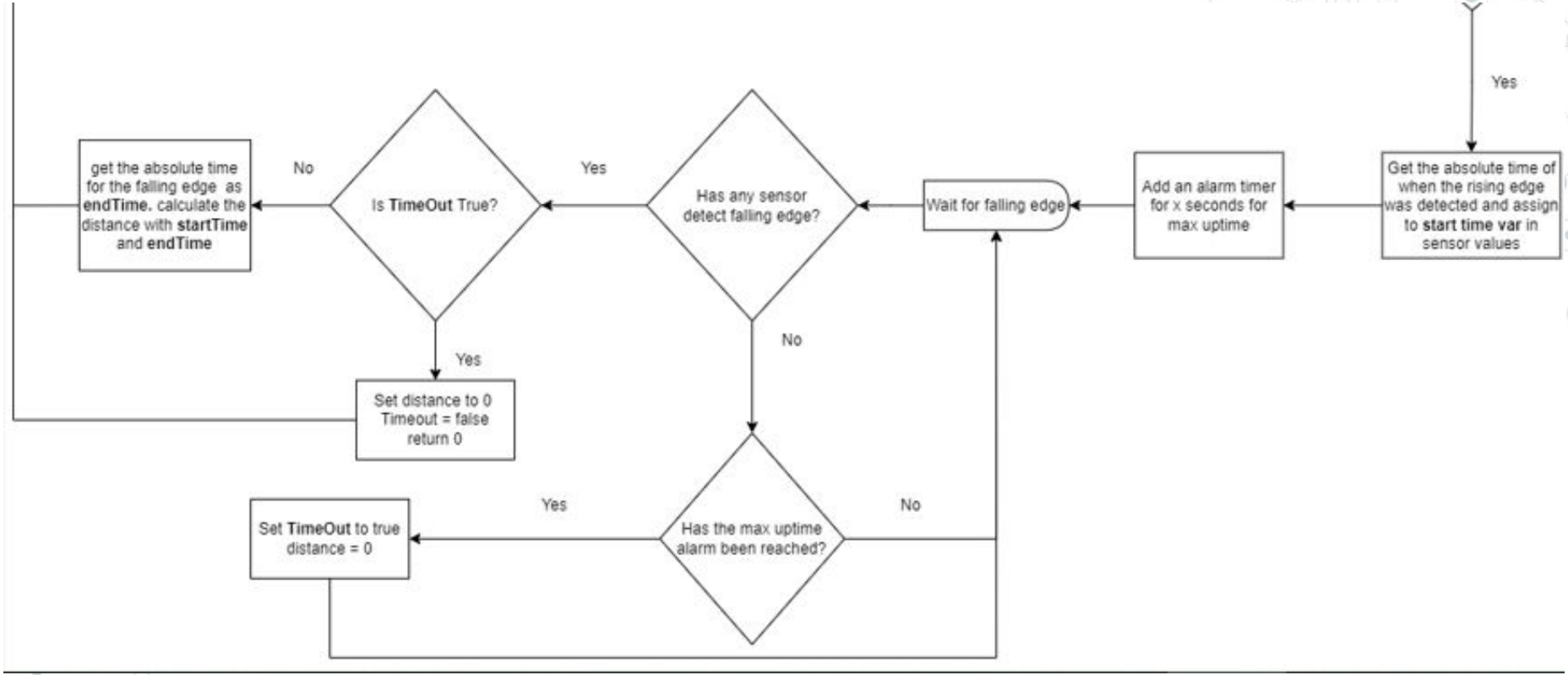
After 3ms, if still rising edge, call timer interrupt to force falling edge

→ limit how far sensor can read the readings

→ Save power for sensor.

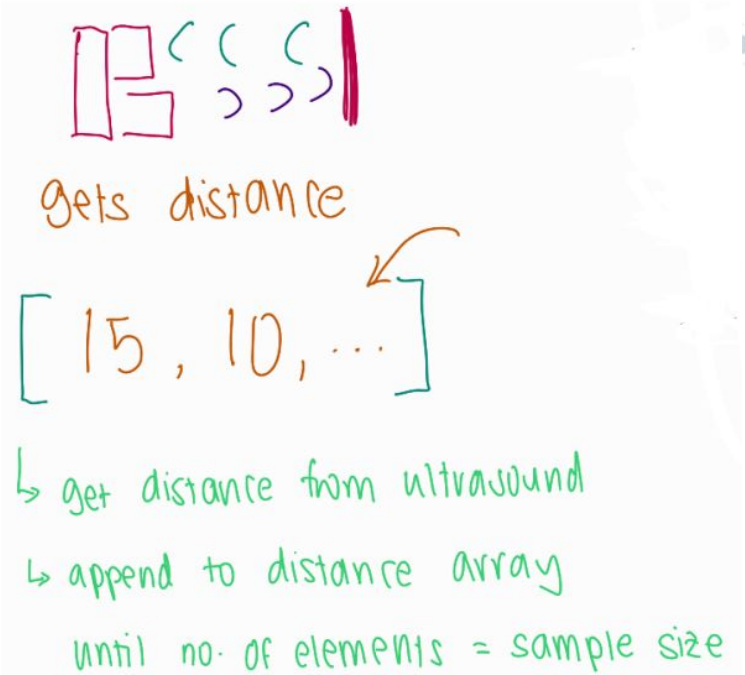
∴ timeout = true

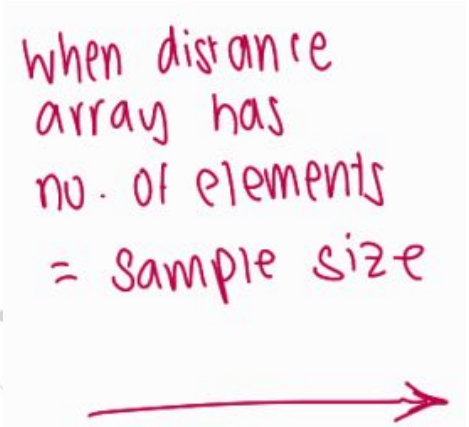

Start
Initialize GPIO pins for 3 sensors
Initialize all Ultrasonic sensors struct values
Initialize IRQ handlers and repeating timer of 30ms
Wait 30ms
Has the repeating timer reach 30ms?
No
Yes
Set all sensors trigger pins to high and add an alarm for 10ms
Wait 10ms
Has the alarm timer reached 10ms?
No
Yes
Set all trigger pins to low and cancel alarm
wait for rising edge
Has any of the sensors detect a rising edge?
No

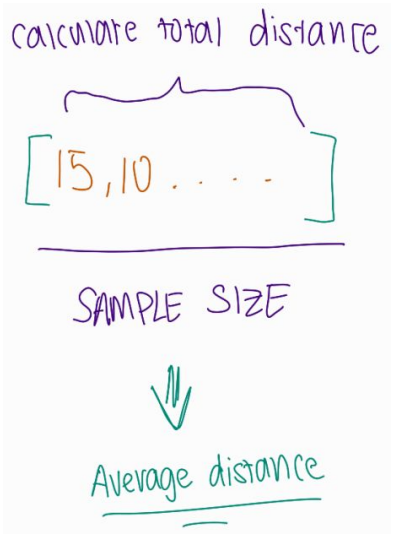

Yes
Get the absolute time of when the rising edge was detected and assign to start time var in sensor values
Add an alarm timer for x seconds for max uptime
Wait for falling edge
Has any sensor detect falling edge?
Yes
Is TimeOut True?
No
get the absolute time for the falling edge as endTime. calculate the distance with startTime and endTime
Yes
Set distance to 0
Timeout = false
return 0
No
Has the max uptime alarm been reached?
Yes
Set TimeOut to true
distance = 0
No

Smoothing Algorithm

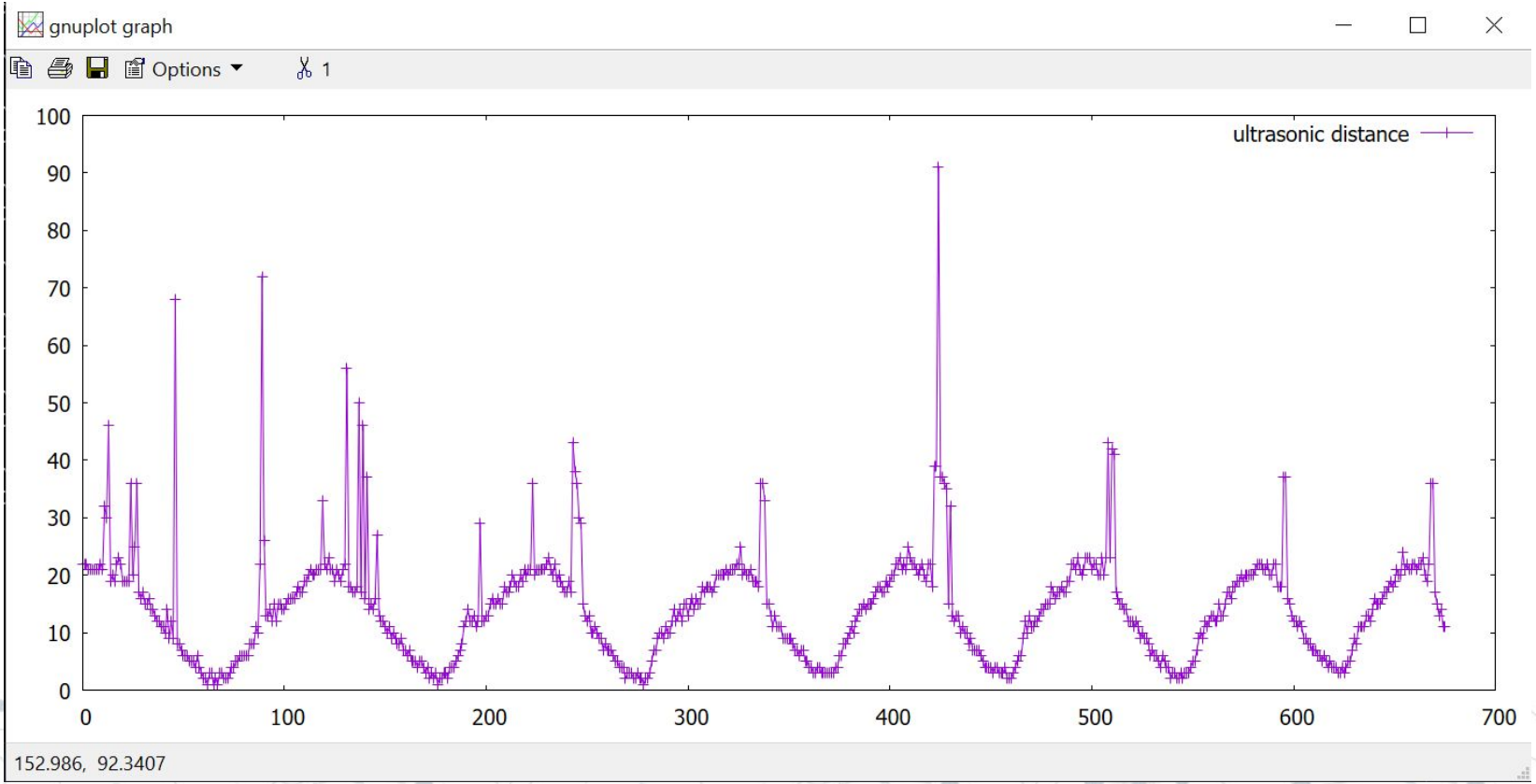
no. of elements
depends on sample size


gets distance
15, 10, ...
get distance from ultrasound
append to distance array
until no. of elements = sample size

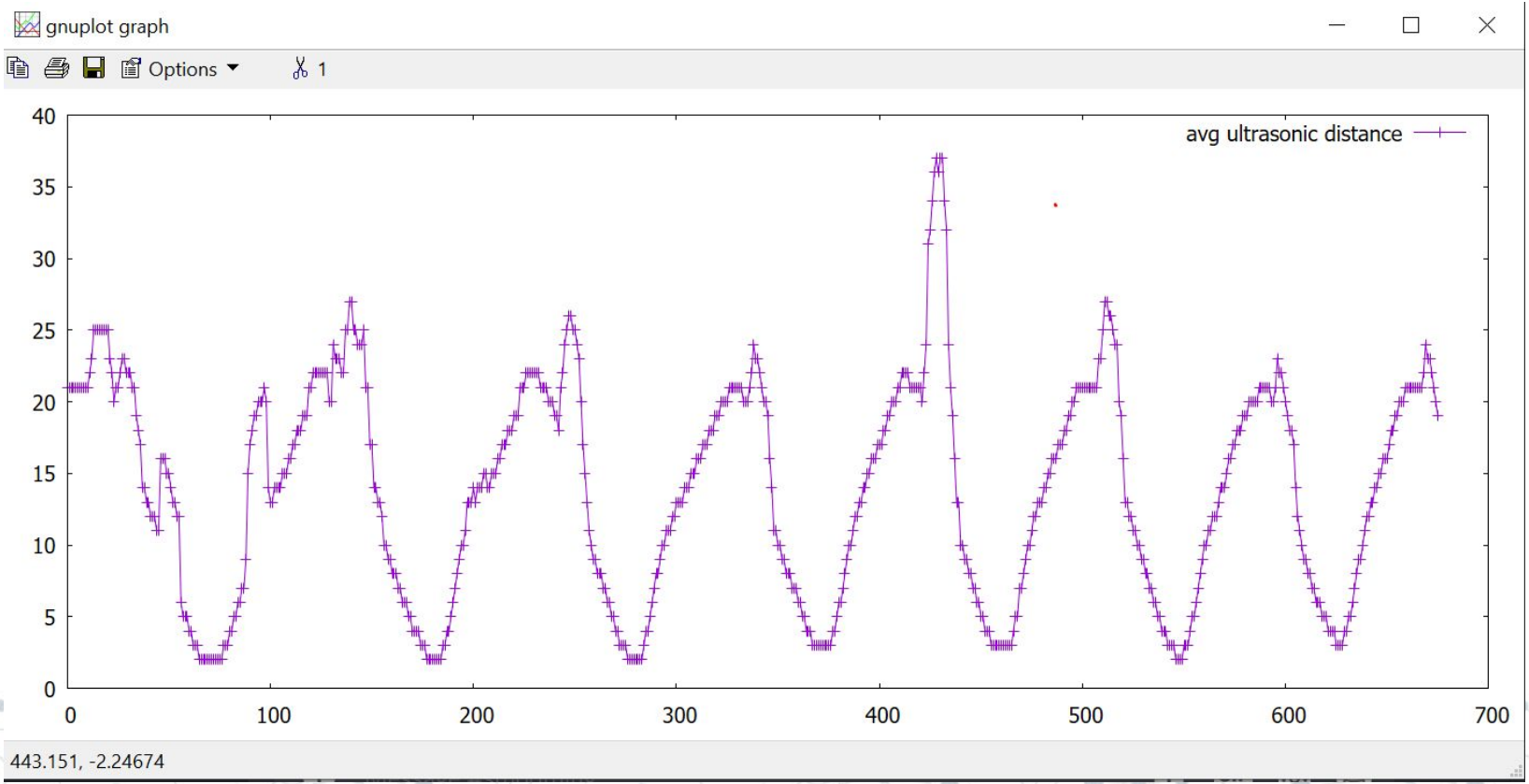

when distance array has no. of elements = sample size


calculate total distance
15, 10 . . . .
SAMPLE SIZE
Average distance

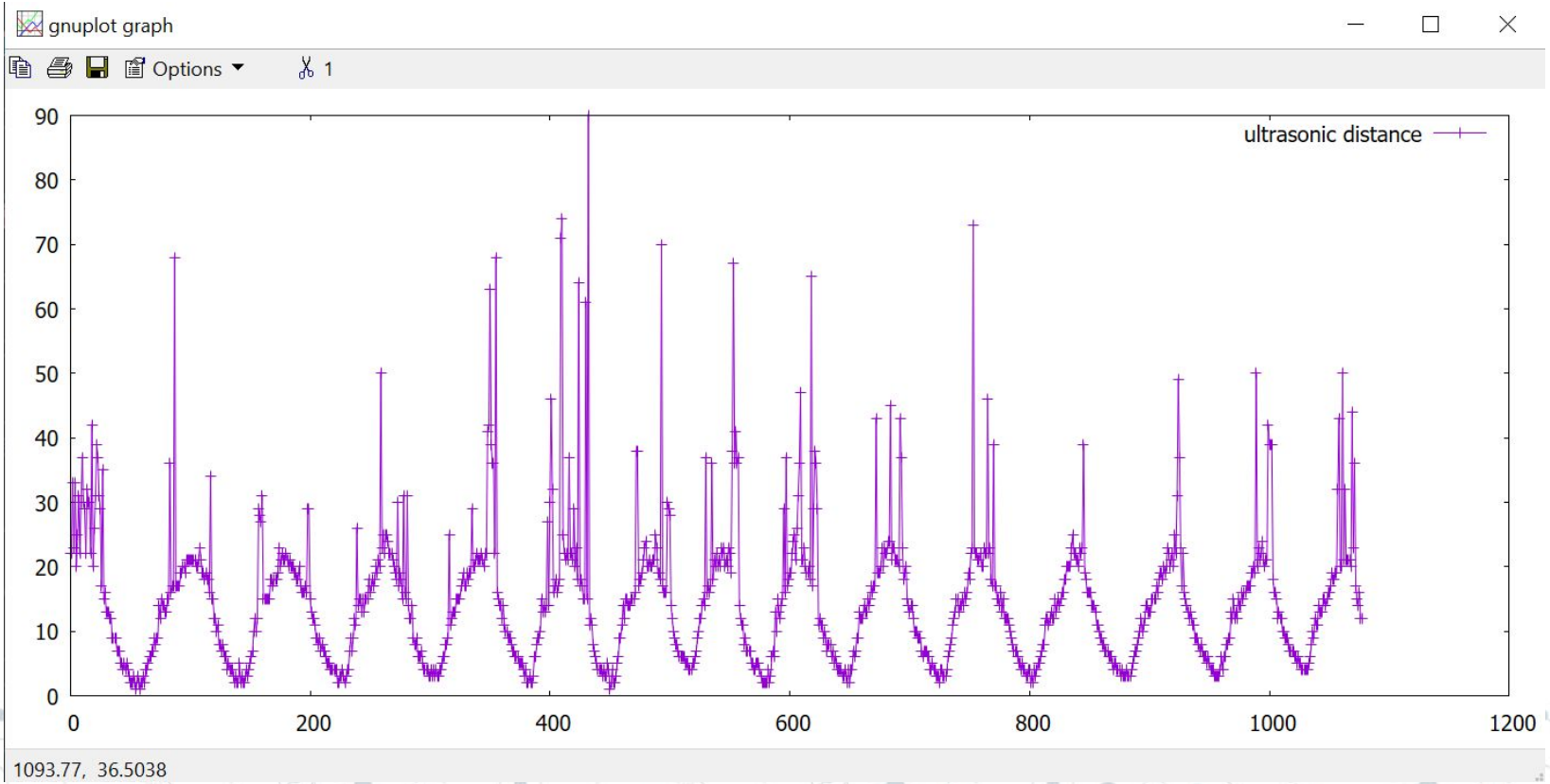
SAMPLE SIZE 10 (Ultrasound Distance)



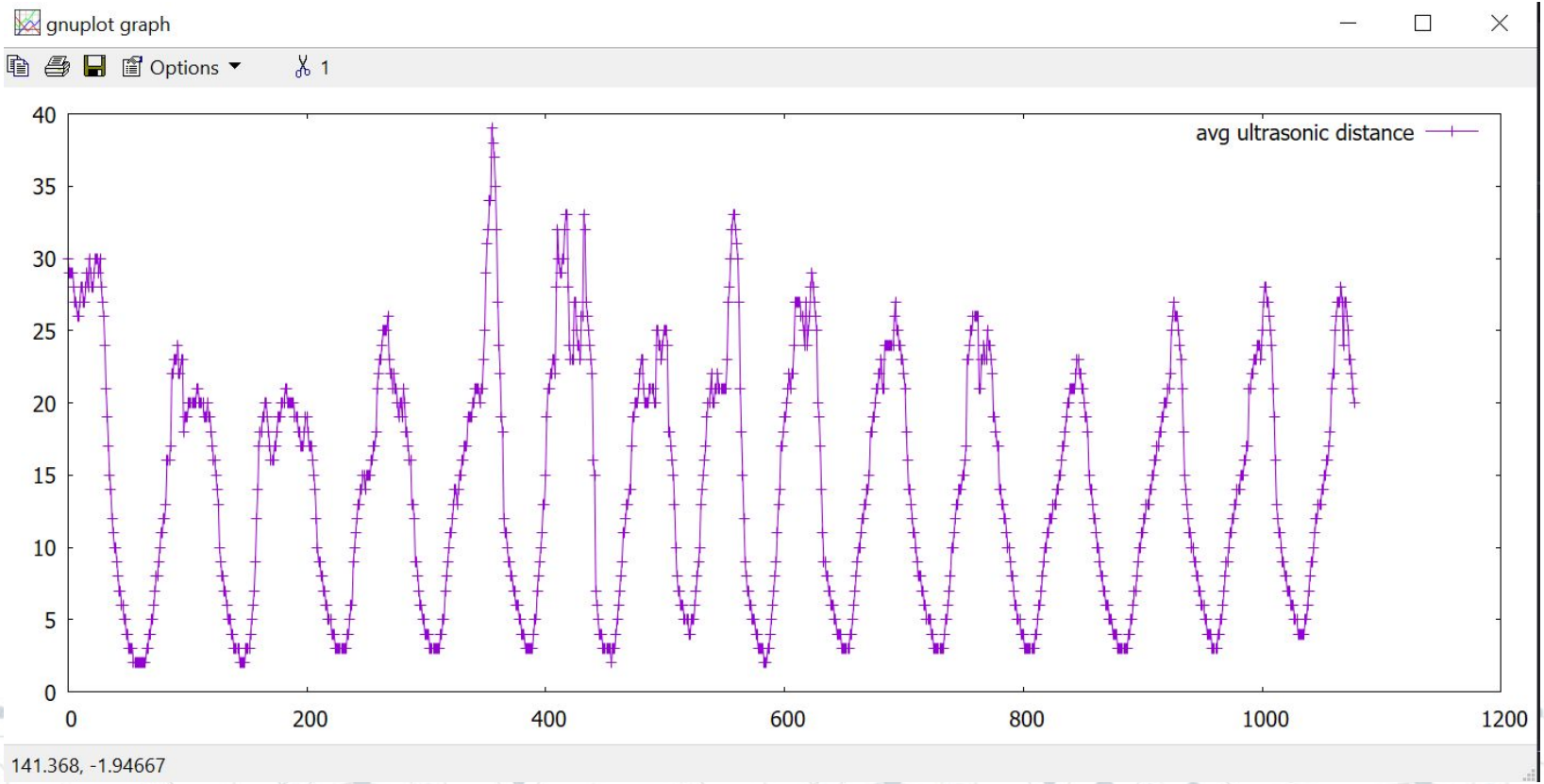
SAMPLE SIZE 10 (Avg Ultrasound Distance)



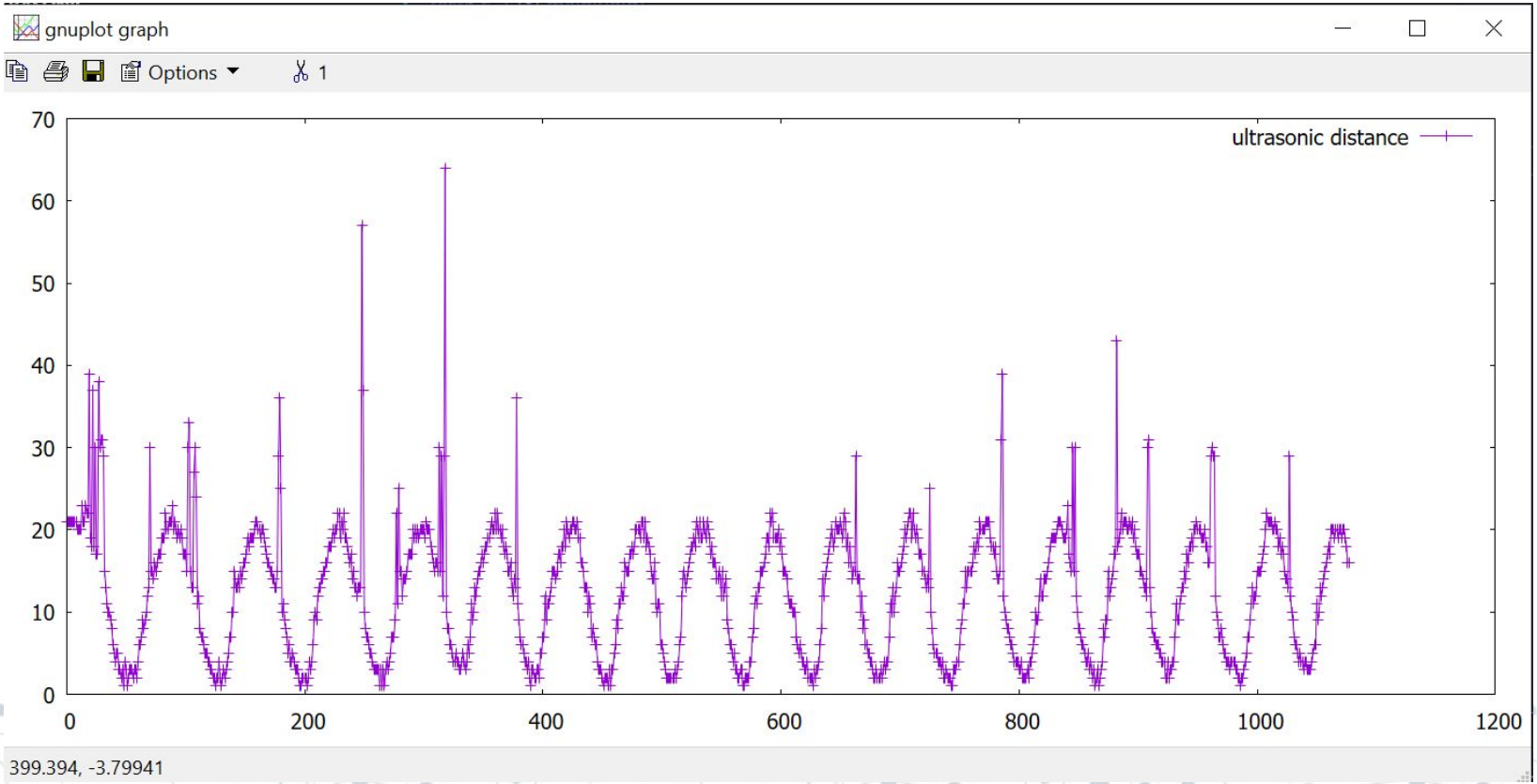
SAMPLE SIZE 20 (Ultrasound Distance)



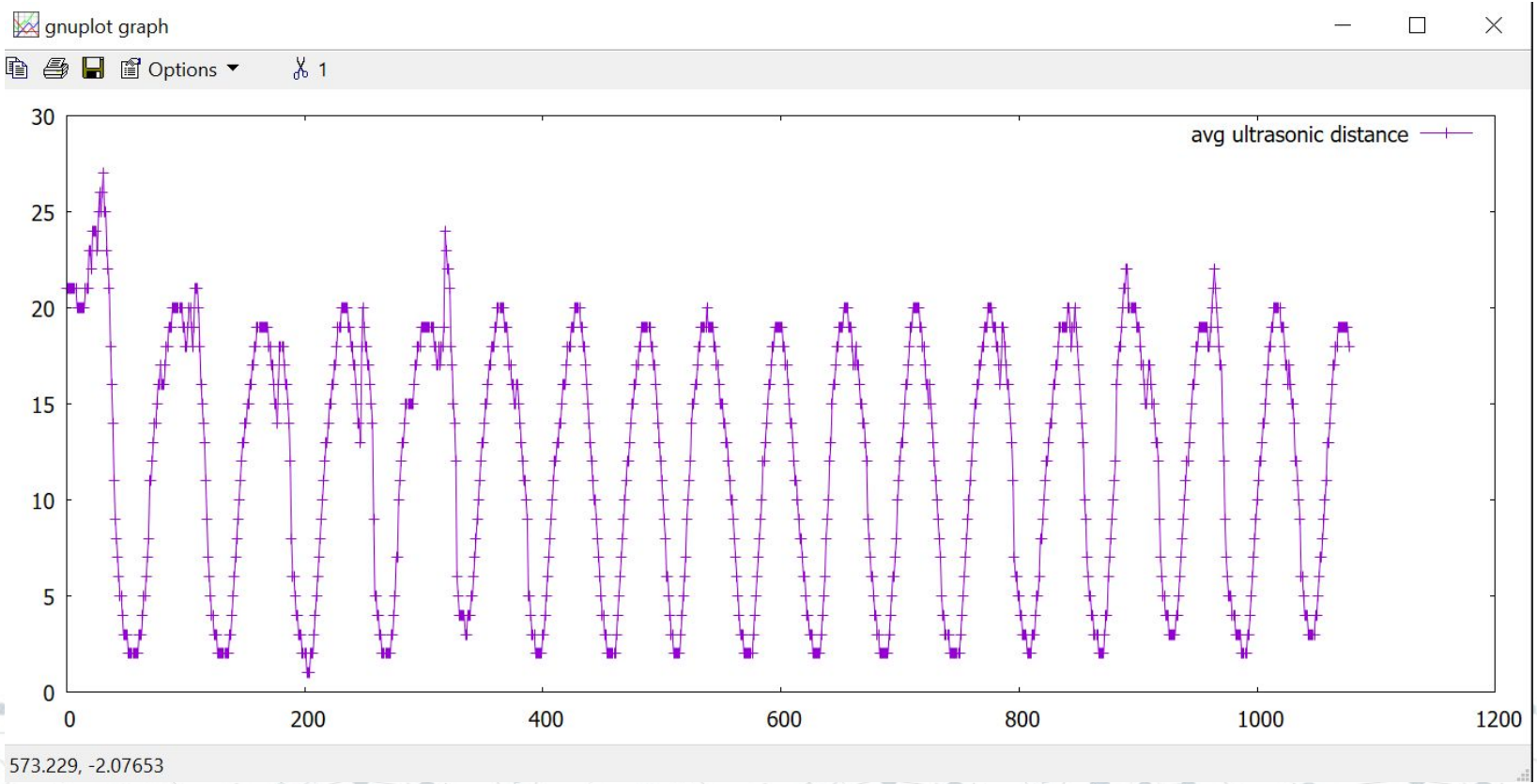
SAMPLE SIZE 20 (Avg Ultrasound Distance)



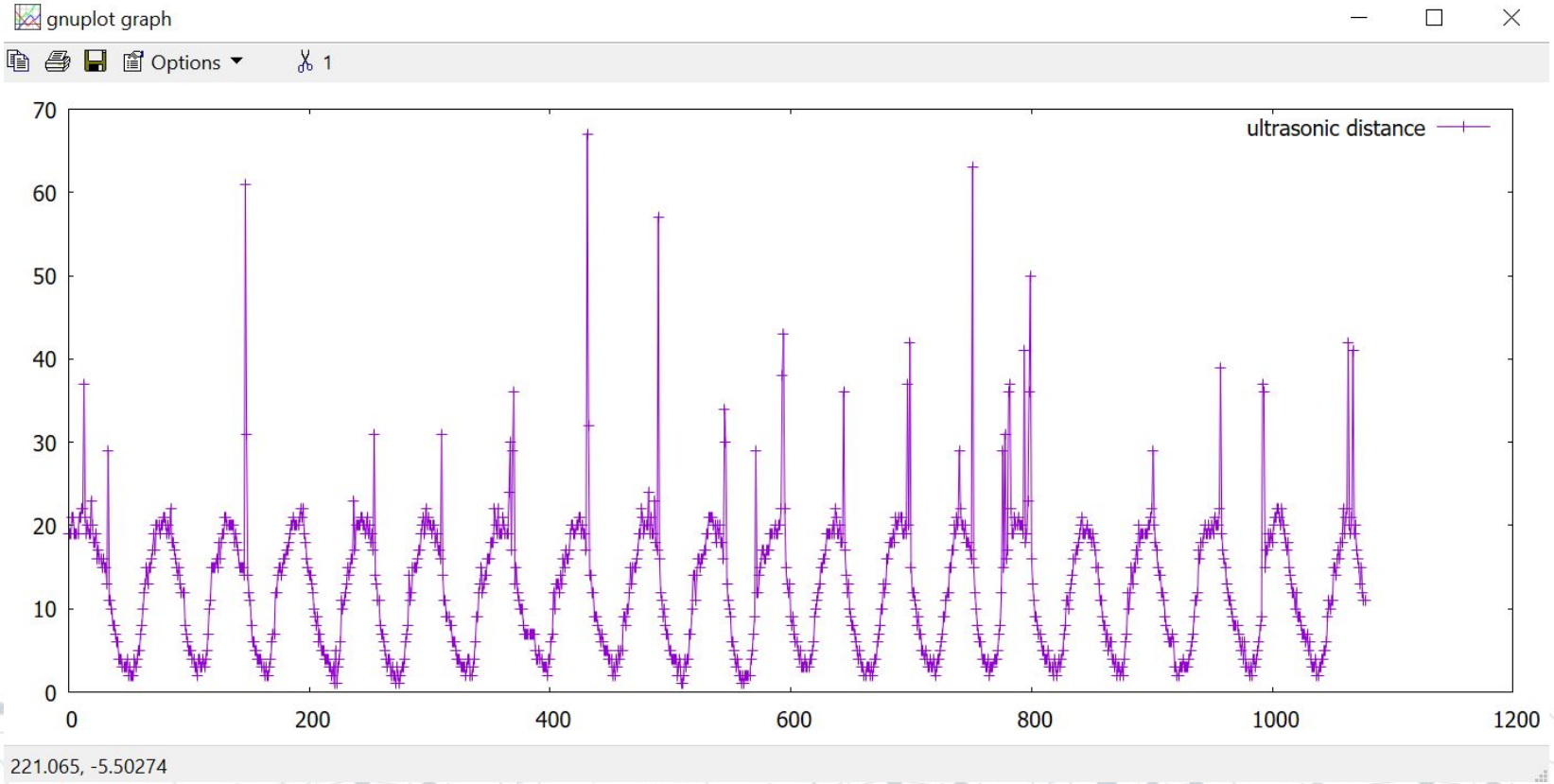
SAMPLE SIZE 30 (Ultrasound Distance)



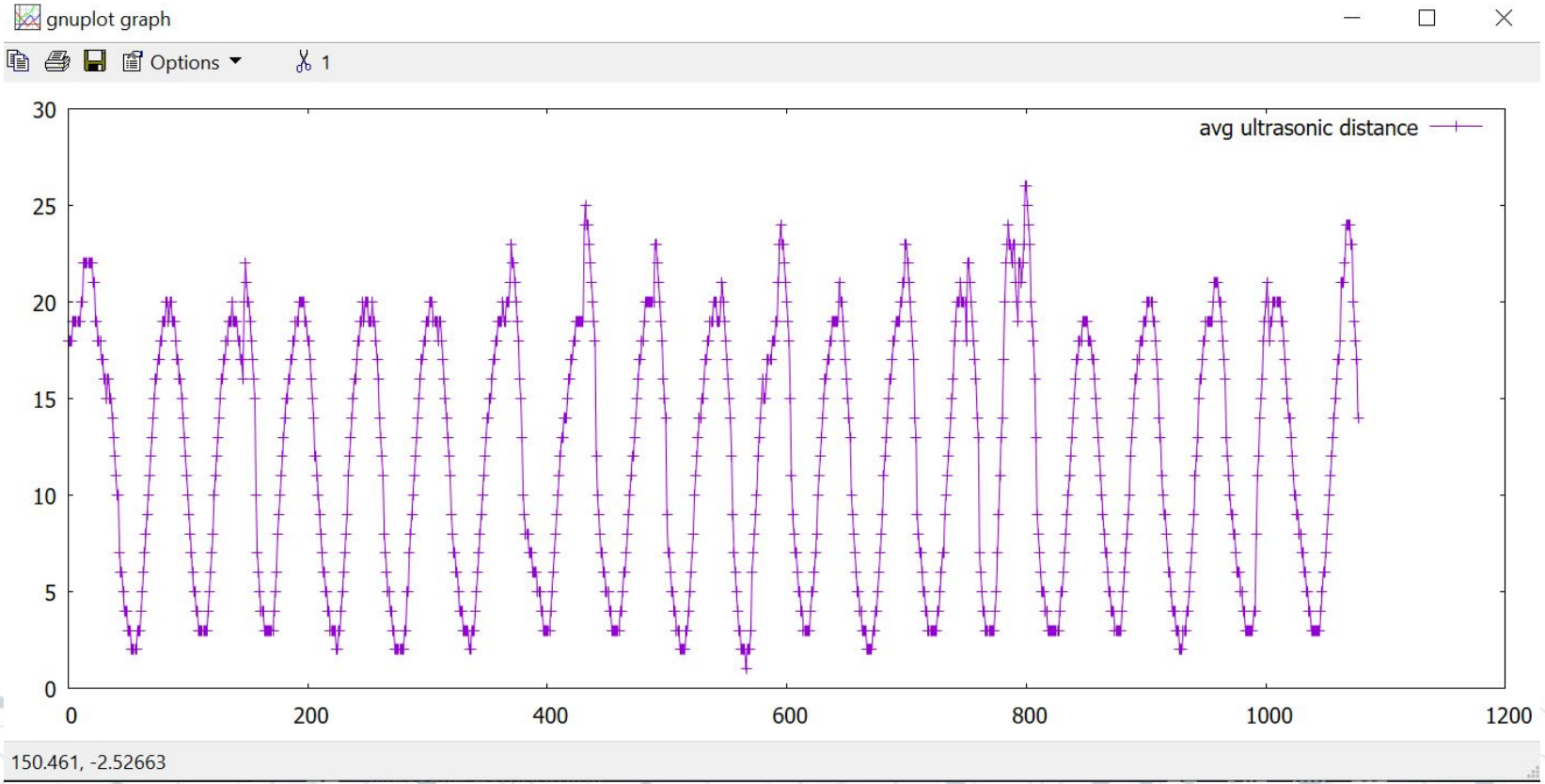
SAMPLE SIZE 30 (Avg Ultrasound Distance)



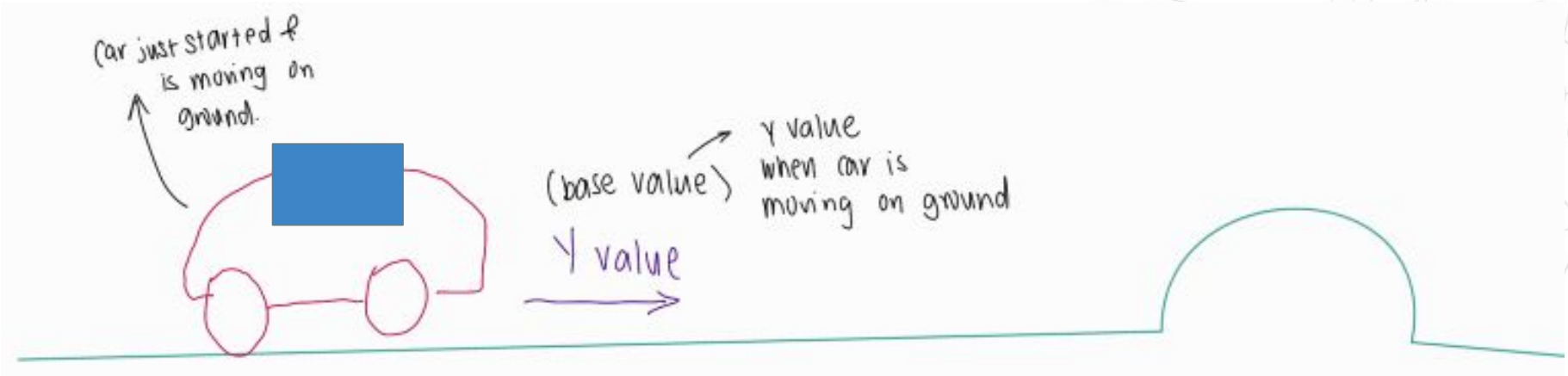
SAMPLE SIZE 40 (Ultrasound Distance)



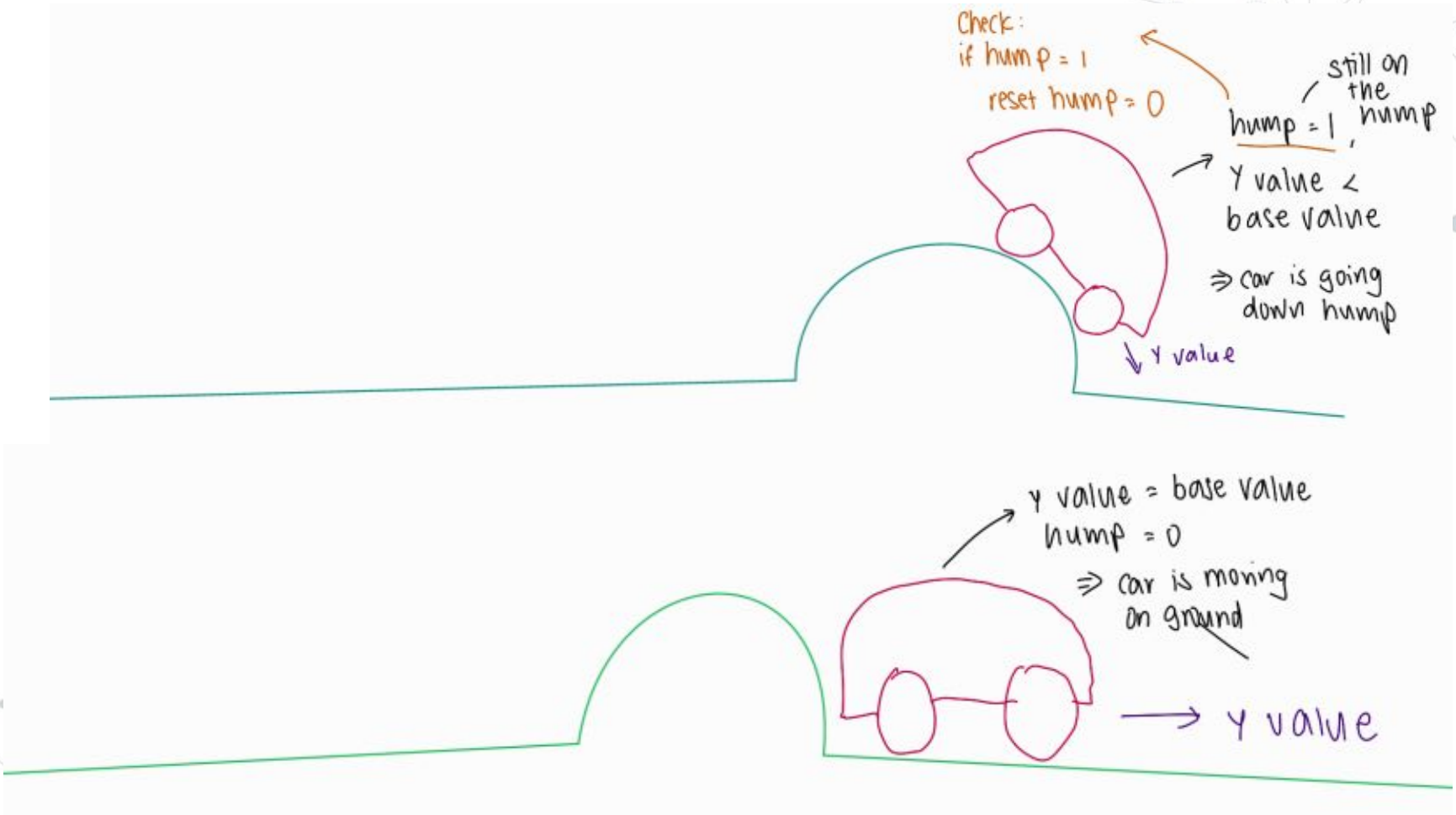
SAMPLE SIZE 40 (Avg Ultrasound Distance)

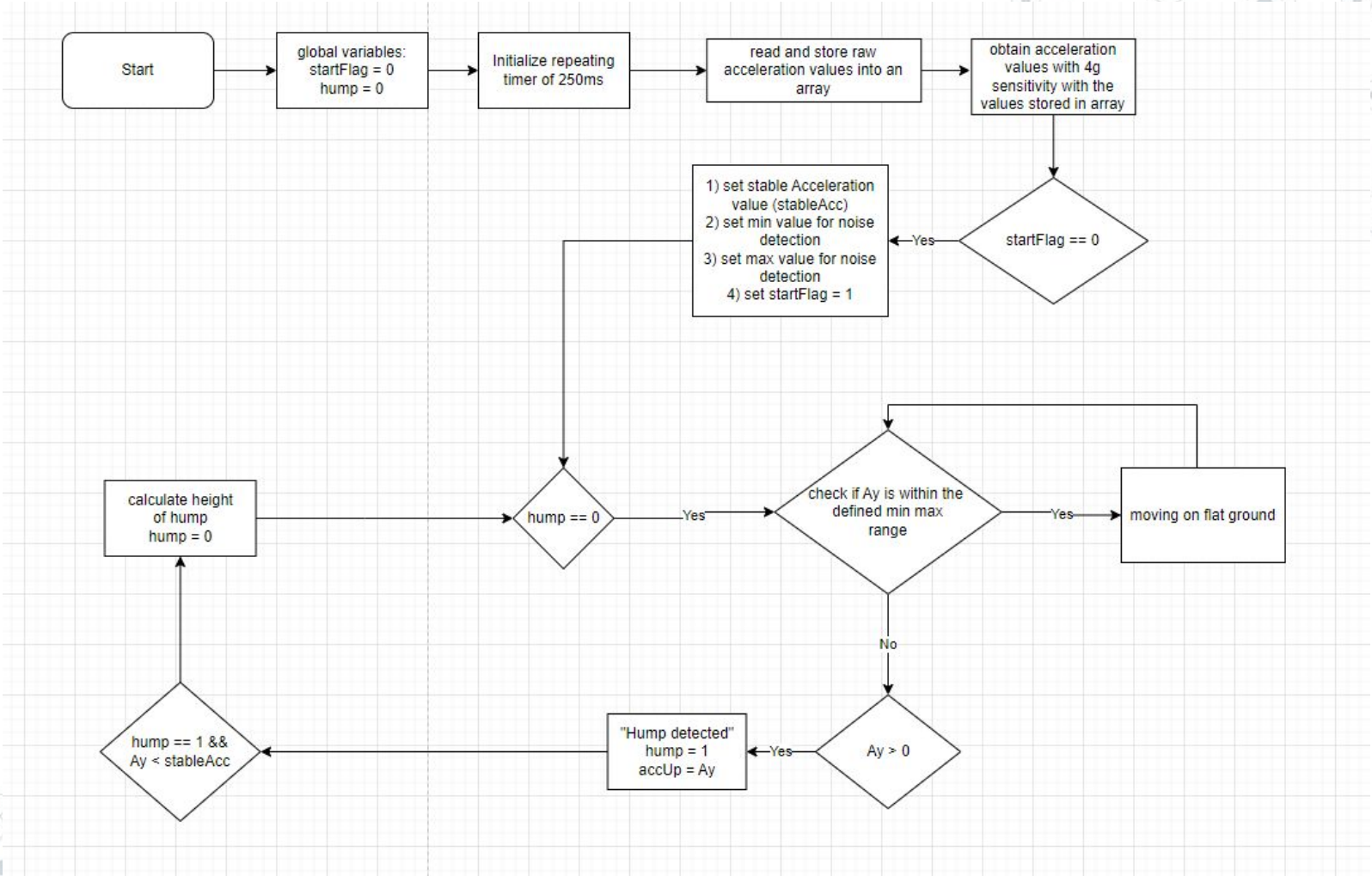


. Accelerometer Sensor


Car just started & is moving on ground.
(base value)
Y value when car is moving on ground
Y value

Y value > base value
hump = 1
⇒ hump is detected
Y value
⇒ car is going up hump


Check:
if hump = 1
reset hump = 0
still on the hump
hump = 1
Y value < base value
⇒ car is going down hump
Y value
Y value = base value
hump = 0
⇒ car is moving on ground
Y value


Start
global variables:
startFlag = 0
hump = 0
Initialize repeating timer of 250ms
read and store raw acceleration values into an array
obtain acceleration values with 4g sensitivity with the values stored in array
startFlag == 0
Yes
1) set stable Acceleration value (stableAcc)
2) set min value for noise detection
3) set max value for noise detection
4) set startFlag = 1
hump == 0
Yes
check if Ay is within the defined min max range
Yes
moving on flat ground
No
Ay > 0
Yes
"Hump detected"
hump = 1
accUp = Ay
hump == 1 &&
Ay < stableAcc
calculate height of hump
hump = 0