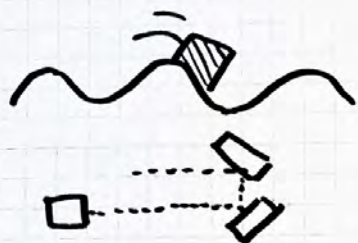COGS 300   control 02   Jan 29/26   ①
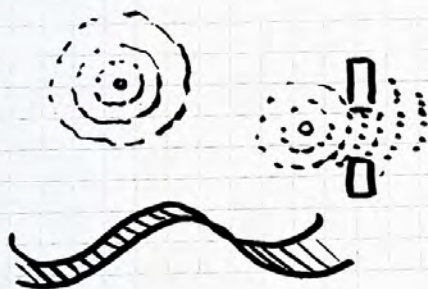
warm up: moving waves. Draw
waves that move.
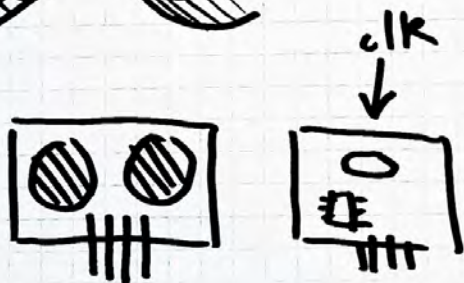Tiny reflections.

box on moving wave

laser reflection
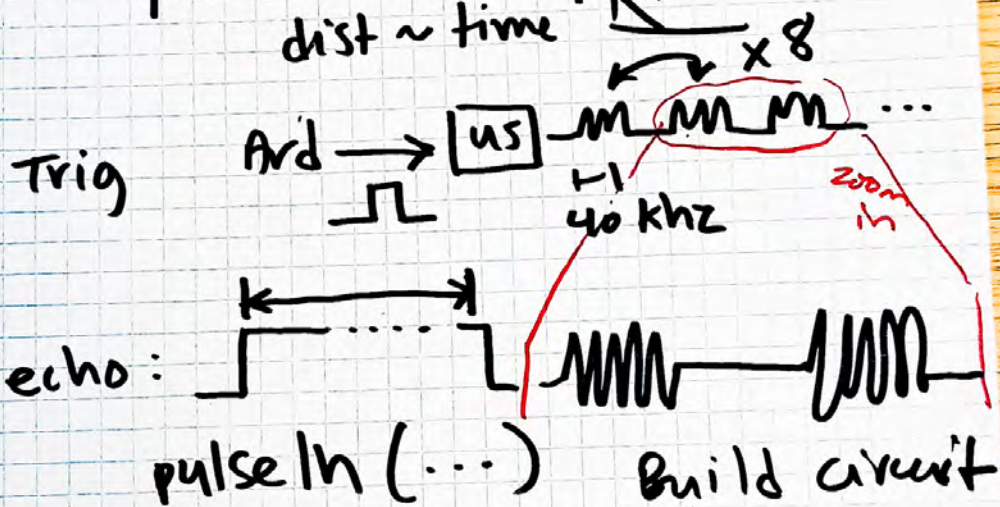
pebble in water
diffraction

wave in 3D
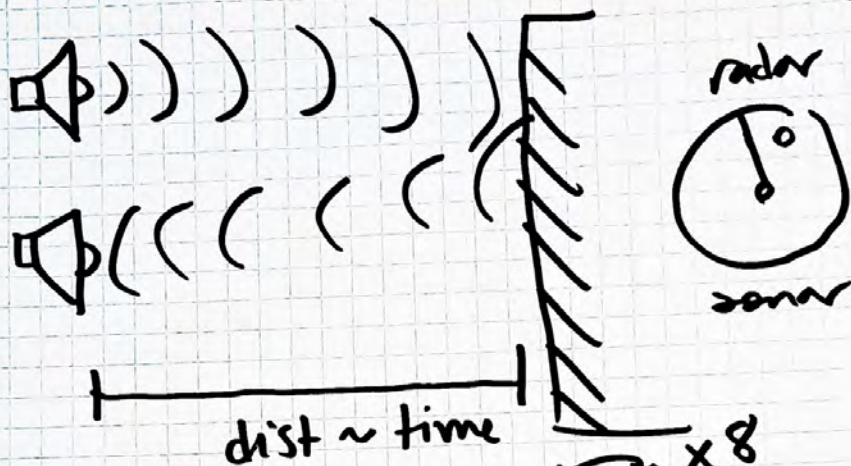
clk

ultra sonic

↑

echo location devices

long
range
distance
sensor

②

radar

sonar

dist ~ time

×8

Trig   Ard → [us] ⌐⌐⌐ M M M ...

⊢1
40 khz

Zoom in

echo: ⌐...⌐

pulse In (...)   Build circuit

Threshold filter

$$\tau = 30\,cm$$

- - - - - 30cm

→ make noise

Average filter   Median   Male

Signal + noise

long history$[n] = \{\emptyset\};$

n=100

0 1 2 3 ... 99
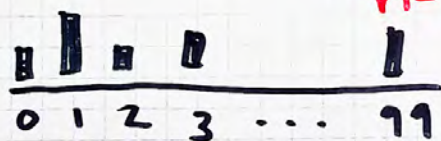
```
long acc = ∅;
for (int i = ∅; i < n; i++) {
    acc = acc + history[i];
    long avg = acc/n;
```
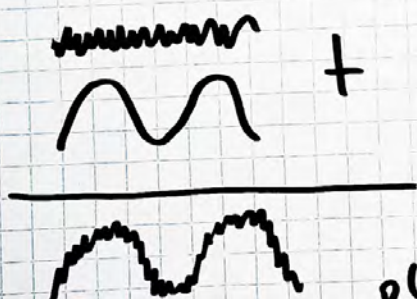
3

+
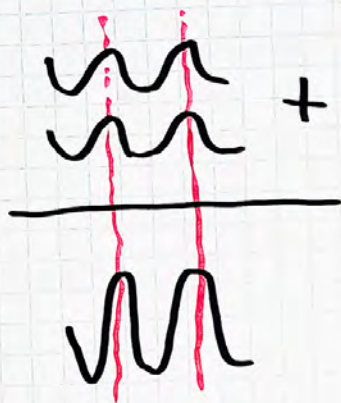
superposition
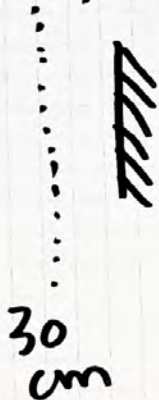constructive
interference
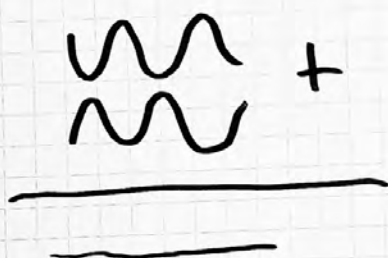
destructive
interference

noise
signal

random
↓
$p(x_i) =$ white noise
$1/100$

0 100

gaussian
bell
normal

⑤

Arduino
ctrl. loop

motor
driver

30
cm

alter
sonic

ω
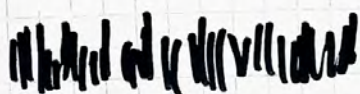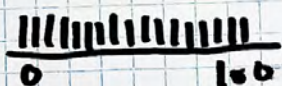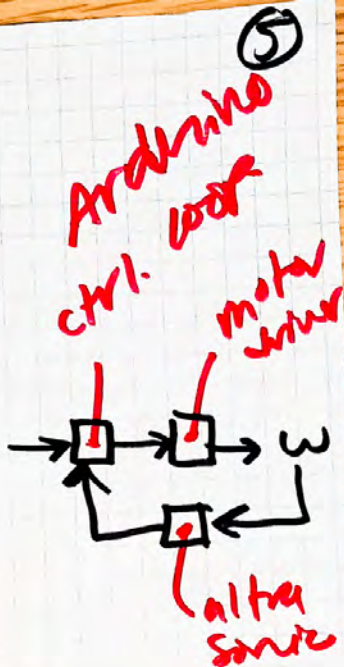
How do you drive the
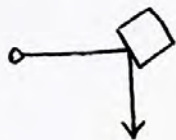robot to 30 cm ?

```
if ( dist > 80   and dist > 30 ) {   ⑥
        drive ( 255 );
    3
              30
```
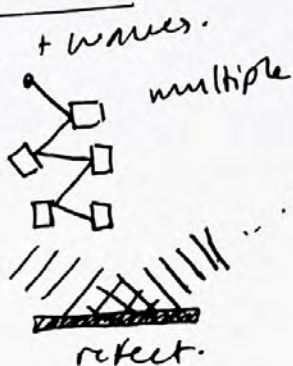
control 02

warm up: Reflections. + waves.

laser

multiple

reflect.

straight
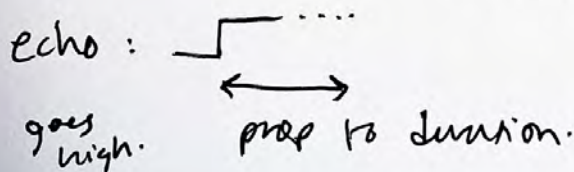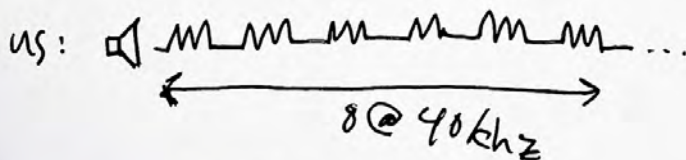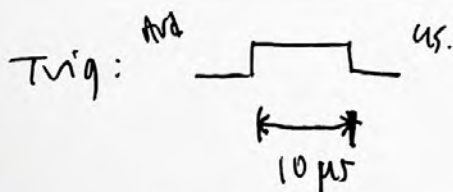transverse

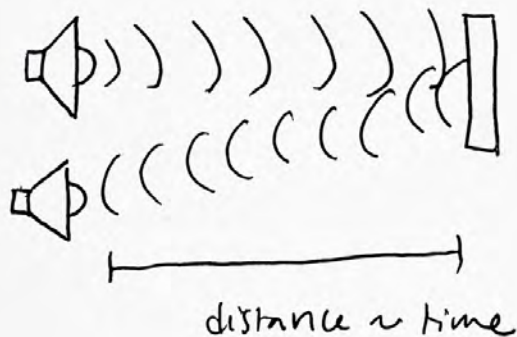diffraction

layers.

complex
reflections.

The final piece of hardware
(basically) is your ultrasonic.

 The ultrasonic is your
long-distance range
finger. It uses sound.

Just like sonar on echo location:

distance ~ time

Trig: us.

10 µs

us: ...

8 @ 40khz

echo:

goes high.   prop to duration.

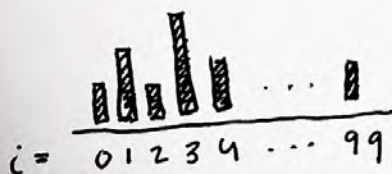✳ Build circuit

✳ play with filter

Filtering paradigms.

hi frequency noise

lo frequency noise

✳ Examples.

Think about a signal as
an array:

$$n = 100;$$

$$\text{long history}[100] = \{\emptyset\};$$

$$i = \quad 0\ 1\ 2\ 3\ 4\ \cdots\ 99$$
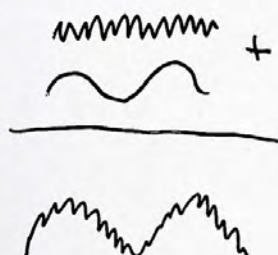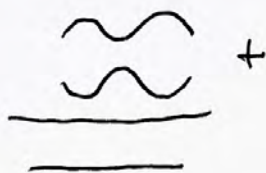
$$\emptyset + \boxed{} + \boxed{} + \boxed{}$$

```
long acc = ∅;
for (int i=∅; i<h; i++) {
    acc = acc + history[i];
}
```
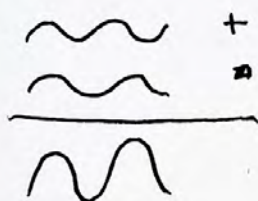
Adding waves or signals:

is it
noise
or
is it ?
signal

short window
Running Avg.

long window R. Avg.

do an experiment. ✩

using servo's plans come up ⑤
with a way to maintain
a distance from the
wall.

→ set pos.
→ measure.
→ error
→ output