



Minos 2017

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What I will Cover this year

- What we want from a sensor
- Different Sensor types
- Pros and Cons of each
- Conclusion
- My Arduino Conversion
- Amazing Capacitors

What we want from a sensor

- Repeatable results
- Distance to target
- Linear measurement
- Speed of measurement
- Measurement overhead
- Not affected by target reflectivity
- Not affected by ambient lighting

Different Sensor types

- Ultrasonic
- Visible reflected light
- IR reflected light
- IR PSD
- Visible PSD with laser
- CCD line scan sensor
- Vision systems
- Time of Flight

Different Interface types

- Analogue
- Pulse Width Modulation
- I2C
- SPI
- Video

<u>Ultrasonic</u>

- Speed High
- Overhead Need to time to 3uS / mm
- Reflectivity Not affected
- Ambient light Not affected
- Linear output Yes (2x distance = 2x time)
- Not very focused can detect outside maze

Visible Reflected Light

- Speed High
- Overhead 1 or 2 ADC conversions
- Reflectivity Affected
- Ambient light Affected
- Linear output No ?

IR Reflected Light

- Speed High
- Overhead 1 or 2 ADC conversions
- Reflectivity Affected
- Ambient light Affected
- Linear output No ?

<u>IR PSD</u>

- Speed High
- Overhead 2 or 4 ADC conversions
- Reflectivity Not affected
- Ambient light Not affected
- Linear output No

Visible PSD With Laser

- Speed High
- Overhead 2 or 4 ADC conversions
- Reflectivity Not affected
- Ambient light Not affected
- Linear output No

CCD Line Scan Sensor

- Speed -
- Overhead -
- Reflectivity Not affected
- Ambient light Not affected
- Linear output No

Vision Systems

- Speed Low (50 frames/Sec = 20ms)
- Overhead Very high
- Reflectivity Not affected
- Ambient light Not affected
- Linear output ?

Time of Flight Sensor VL6180X

•I saw this on the Adafruit web site and thought this is what we need. It does 0-100mm, is this the Holy Grail ?



Time of Flight Sensor VL6180X

Time of Flight Sensor VL6180X



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Time of Flight Sensor VL6180X

- Speed Not fixed, varies each time
- Overhead Low I2C interface
- Reflectivity Not affected
- Ambient light Not affected
- Linear output Yes gives output in mm
- Repeatability Not at all

Time of Flight Sensor VL6180X

•Wall 39mm away, output 36 - 42mm @30Hz



Conclusion

- There is no perfect sensor available to us
- Stick with the simple IR reflective sensors they are used by all the best mice in the world
- A CCD line scan sensor may be a viable option in the future using 3D printing

My 3 CCD sensor solution



My Test Rig Project



My Test Rig Project

- Designed to move wall away from sensor
- Will be able to send data to PC ready to plot
- Mouse will be able to control it for calibration
- Built with Arduino and ready made boards

My Arduino Conversion

- Now Atmel owned by MicroChip they are brilliant
- I use Nano V3 for about £3 each
- Great for quick prototyping or tests
- Fast code unlike PIC Basics
- Lots of Libs available so code writing is minimal
- TOF sensor test rig built/working in 30 mins

Ultra Capacitors

- Maxwell Technologies
- 2.85 volt
- 3,500 Farads
- 0.22 mOHms
- 2,000 Amps
- 10,000 Amps Short Circuit