Advanced material processes and die design
DSL 732

Topic 4
Input and Output Devices

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19th August 2019

Announcements

- Assignment 2: Project Proposal deadline: 21st August
- Project development till minor test 1: One slide and one video of up to 1 minute on your project page. Video editing with Kdenlive or Adobe Premier Pro or Quik mobile phone app or others. Start developing your project on the project page of your website. [Slide](#) [Video](#)
- Date: 5th September is the presentation with the link to the slide (jpg image) and youtube video on your final project webpage on the top with the heading of Project Development till Minor Test 1. [Example](#)

Input Devices

- Sensors
- Different types of sensors to measure temperature (thermistor), distance (ultrasonic sensor), force (strain gauge), light, sound
- Do you know of any sensors that you use in your everyday life?
- What makes your smart phone so smart? Link

Sensors in your phone

- Download [Sensoduino](#) app (FREE) for Android
- SensorLog for iOS users
- Find what sensors

your phone has and

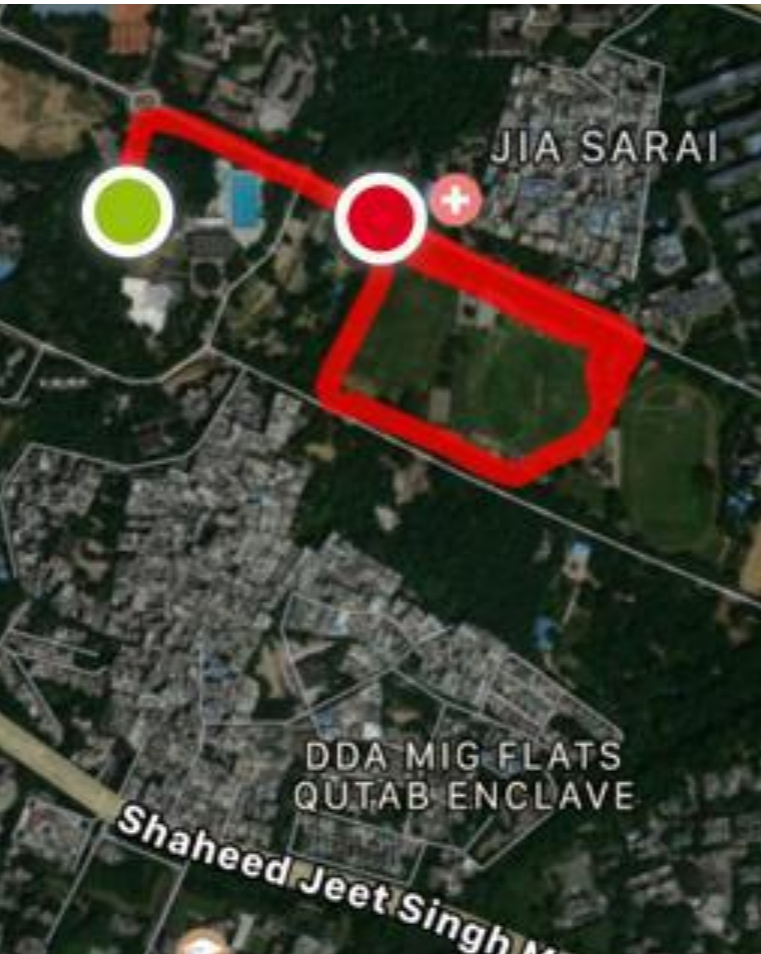log sensor data

- [Techbitar](#) [instructable](#)

SensoDuino

Hazim Bitar   **Tools**

Map My Ride GPS Cycling Riding

MapMyFitness, Inc.   **Health & Fitness**

1.78	**13:27**	**64**
DISTANCE (KM)	DURATION	CALORIES

GPS sensor

- Sensoduino data

- Read csv file (latitude, longitude, time) into GPS visualizer.

- [Arduino GPS data to google maps](#)

GPS Visualizer: Do-It-Yourself Mapping

GPS Visualizer is an online utility that creates maps and profiles fr
powerful and extremely customizable. Input can be in the form of
addresses, or simple coordinates. Use it to see where you've beer
geographic data (scientific observations, events, business location

Get started now!

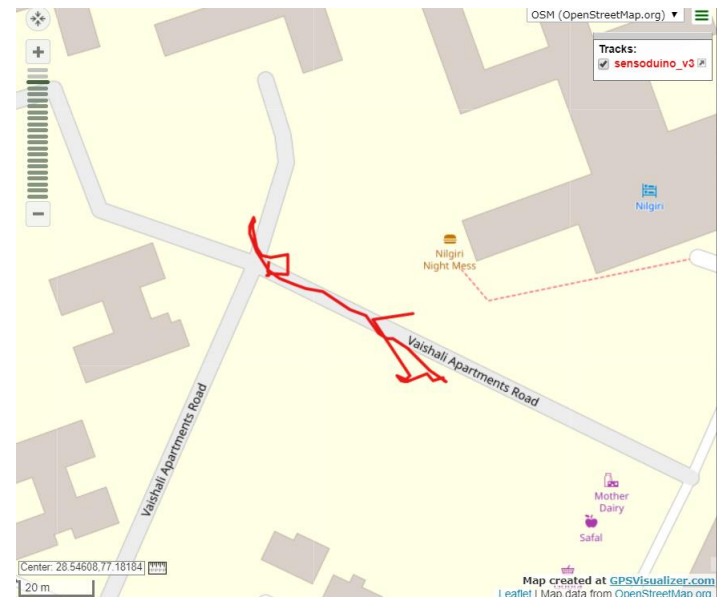Upload a GPS file: [Choose File] sensod...3.csv

Choose an output format: [Leaflet HTML ▼]

[Map it]

To set more options
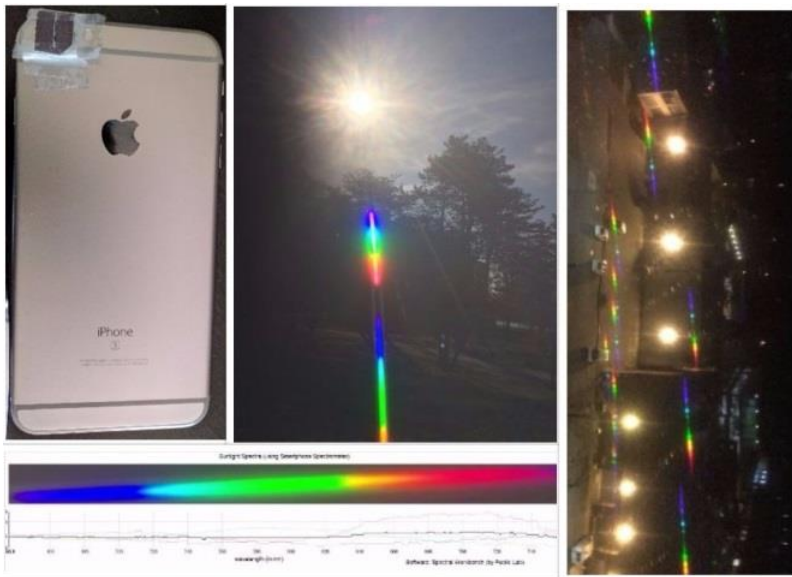- **Google Maps** /
- **Google Earth KI**
- **JPEG/PNG/SVG**
- **Plot data points**
- **Profiles (elevat**

Design solutions for Mobile phones

- Mobile apps, add-ons to connect digital and physical worlds

- [Thermal imaging attachment for smart phone](#)

[DIY Smart Phone Spectrometer using CD as diffraction grating](#)

Innovating for billions

- Ramesh Raskar, Camera Culture group, MIT Media Lab – innovating for billions
- eye-NETRA REDX.io
- INK talk: Idea Hexagon for innovation
- Scaling up of design solutions?
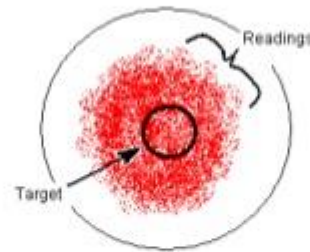- Mobile phone users in India

Sensor features

- Sensor vs transducer

- Sensor resolution, range, speed of response, cost, reliability (datasheet)

- Sensor calibration
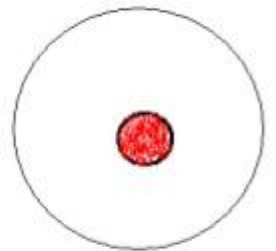
Accuracy vs. Precision
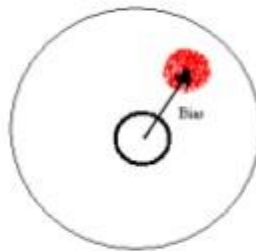
Precision without accuracy

Accuracy without precision

Precision and accuracy

Announcements

- How to find feedback for your grades

- Feedback is kept open for the benefit of all.

- You will get two more weeks from the time we let you know your grades to improve your grade. [Google Form](#) for re-evaluation

- We should work in cooperation instead of competition mode here. Thank you for helping each other out. Please keep doing so. Learning should be more important than grades.

- Please feel free to discuss and work with each other but write your assignment in your own words, with your own images and videos.

- Some of you are still using epizy. Before you run out of space please move to iitd web server. This should be seamless.

- Makerspace basic orientation whoever is left please book a slot on Wednesday?
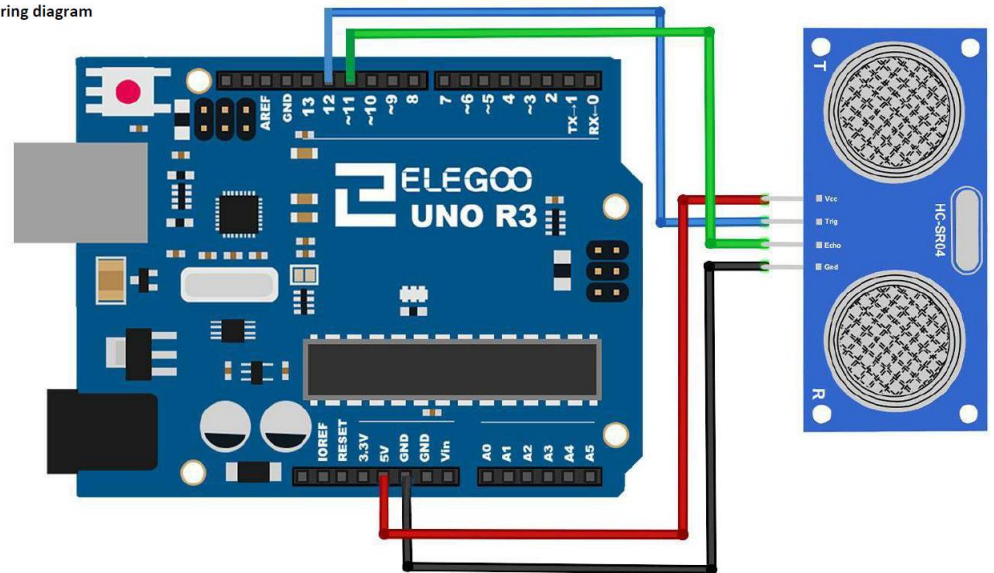
Distance Measurement

- Ultrasonic sensor module (Lesson 10)

- Read datasheet (2 cm- 400 cm range)

- Lesson 1 (install library)

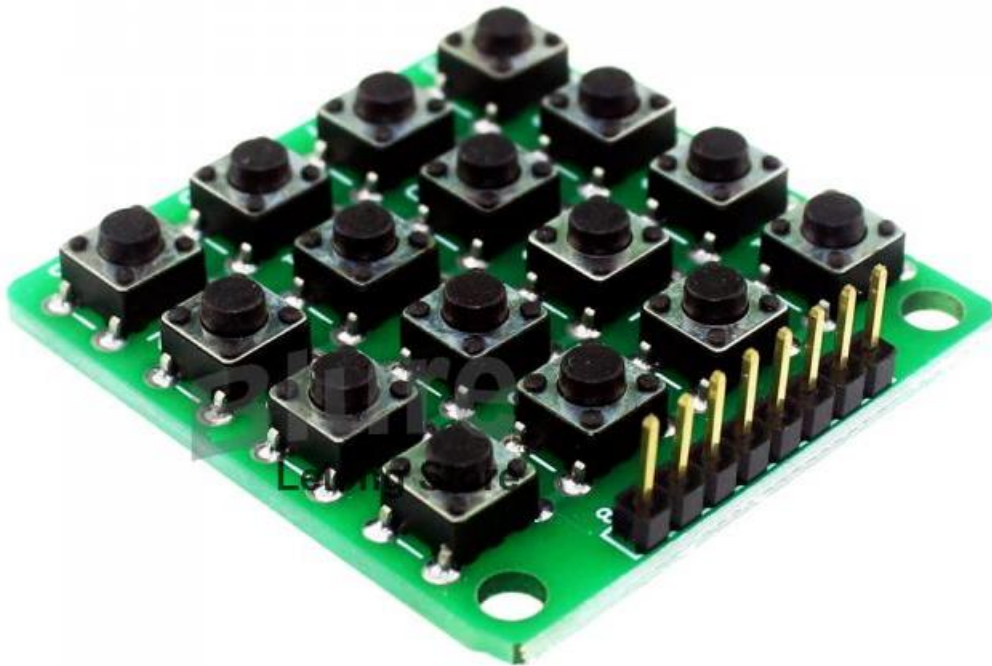- Reading library

- Smart cane, other

applications

Documentation

Wiring diagram

4X4 Keypad module

- Lesson 11
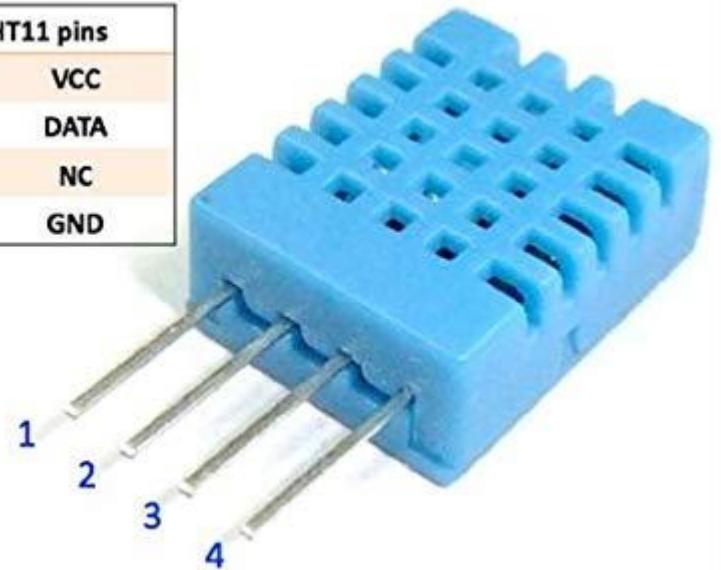
- Applications: cell phones, ovens, door

Locks, keyboards

Temperature, RH measurement

- DHT11 sensor (Lesson 12)
- DHT22 sensor
- Datasheet

Announcements

- No class tomorrow, Friday as Monday timetable

- Thursday, 29th August: We will be there from 4-5 pm for questions.

- Please work on your assignments and the project presentation and let us know for questions

Output Devices

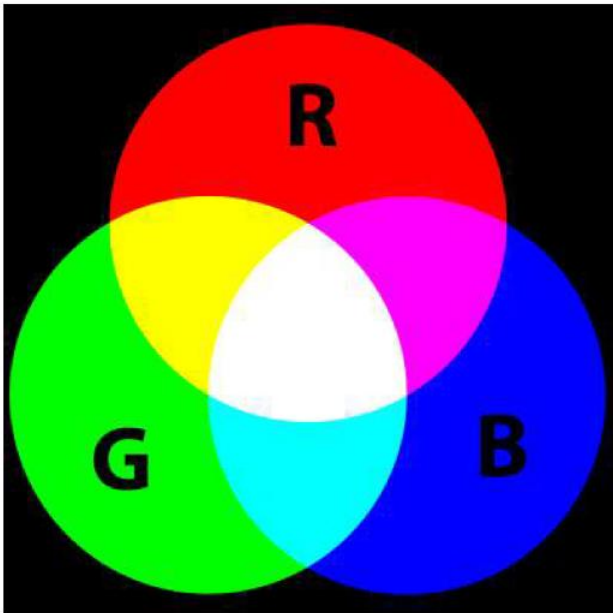- LEDs, Displays, Speakers, DC/Servo/Stepper Motors, Relays, Dataloggers
- Sensor vs Actuator

LCD display

- Lesson 22
- Adjusting Contrast with a screwdriver.
Connections:
SDA pin to A4 (Uno)
SCL pin to A5 (Uno)
[Arduino code](#)
Other examples

RGB LED

- PWM with RGB LED with common anode (Lesson 4). NOTE: Longest leg of RGB LED goes to 5V pin.

- RGB_basic RGB_favorite_color RGB code

Stepper Motor

- Stepper motor rotates in steps, Torque
- Basis for many machines
- 28BYJ-48 stepper motor
- ULN2003 Driver Board
- Lesson 31
- Applications: XY plotter

nema 17 motor with a4988 driver

Assignment 4

In groups of two:

A. What are the different sensors in your phone and what do they do? Conduct an experiment to measure and analyze the data for a sensor in a log and report your findings.

B. Measure something: add a sensor to a microcontroller board and read it. Document the process. Find an application for it in the real world around you and report your findings.

C. Add an output device to a microcontroller board and program it to do something

D. Extra credit: Combine the input and output device together.

Deadline: 8th Sept

Examples

- Developing a heat stress index [Formula](#) (If hot then LED is RED, If cool LED is BLUE.)
- Dustbin – full vs. half vs. empty, LED is RED, YELLOW, GREEN.
- Display the sensor value on the LCD display.

Summary

- Smart phone sensors
- Sensor characteristics
- Examples: Ultrasonic sensor, Temp/RH, Keypad module
- Input devices: Fab Academy [webpage](#) [video](#)
- Output devices
- Examples: LCD display, Stepper Motor, RGB LED
- Output devices: Fab Academy [webpage](#) [video](#)
- Many codes/libraries available freely online
- Think of applications as a designer