Special Topics in Design I (IoT Prototyping) DSL 810

Topic 0
Overview of the course

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Assistant Professor,
Department of Design
IIT Delhi

4th August 2022

Introductions

- Myself
- TAs: QuEST Lab (Prasannaa, Bavath, Gulshan, Harshit, Pooja, Saran)
- Yourself (google form to know your expectations and skills)

What is this course about?

- This course would provide a hands-on introduction to internet of things prototyping to aid in the design and fabrication of smart systems. The students should be able to build IoT based products or experimental setups for their research through the skills learnt in this class.

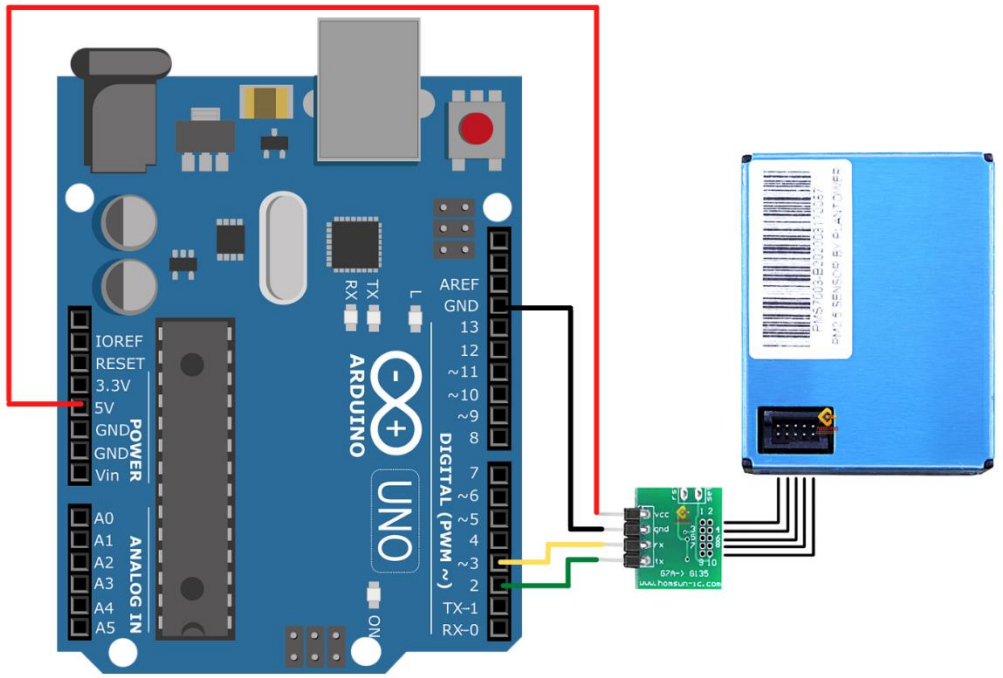
What is this course about?

- Design pedagogy of studio based learning, hands-on experiential learning
- Design thinking – solving the right problem vs. solving the problem right?
- From "**What** to learn to make?" To "**How** to learn to make?"
- Peer to peer learning (helping each other, each one with different strengths, very diverse class)
- Course website, curriculum and grading scheme
- Submission format, moodle, WhatsApp
- Instructables, DIY sites for making
- How to Make Almost Anything

Low cost sensors for PM2.5 monitoring

What is my motivation?

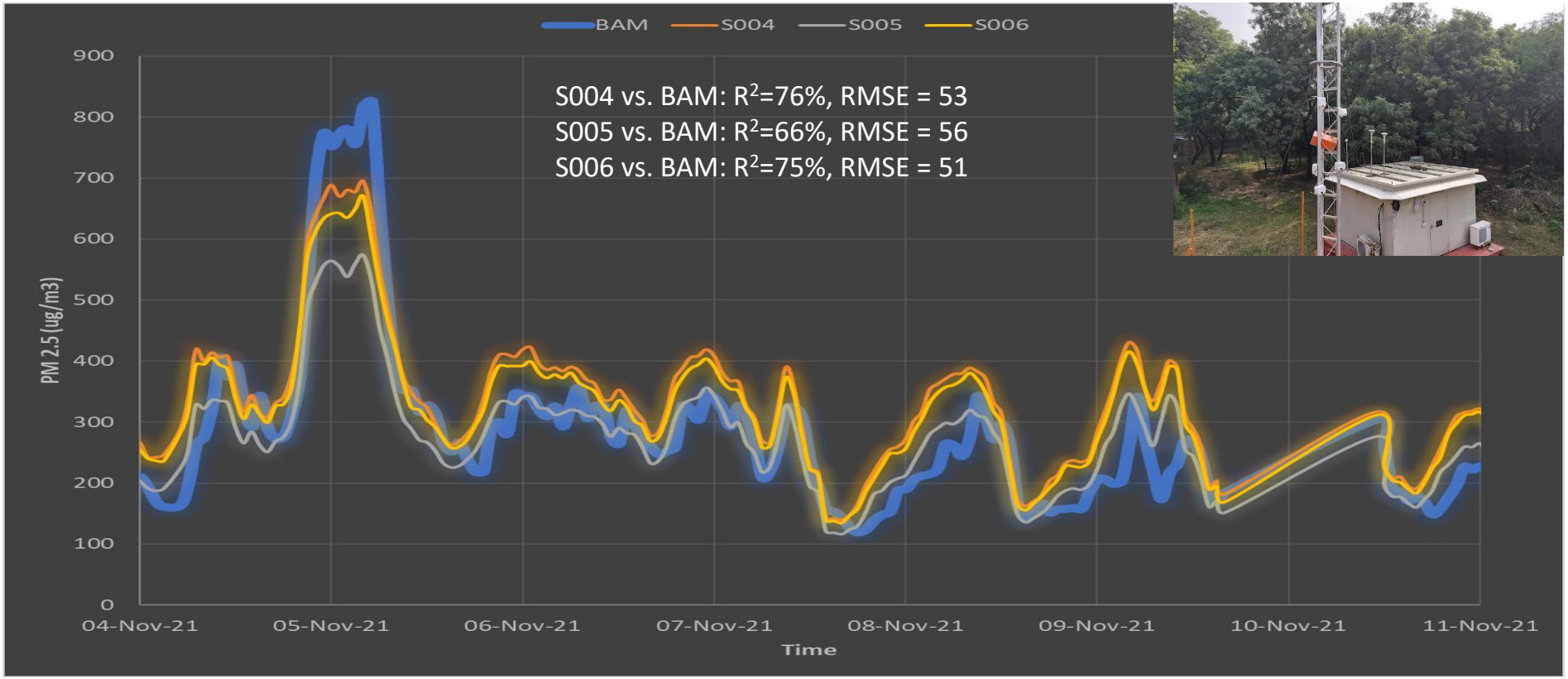
UNO	PMS7003
3.3v	3.3v
GND	GND
2	Tx
3	Rx



https://github.com/vyomaniitd/PM2.5---PMS7003

Invited talk at CERCA, IIT Delhi: A breath of fresh air

Low cost PM sensors vs. BAM



Indoor air quality: CO2 monitoring

https://www.edx.org/micromasters/curtinx-internet-of-things-iot

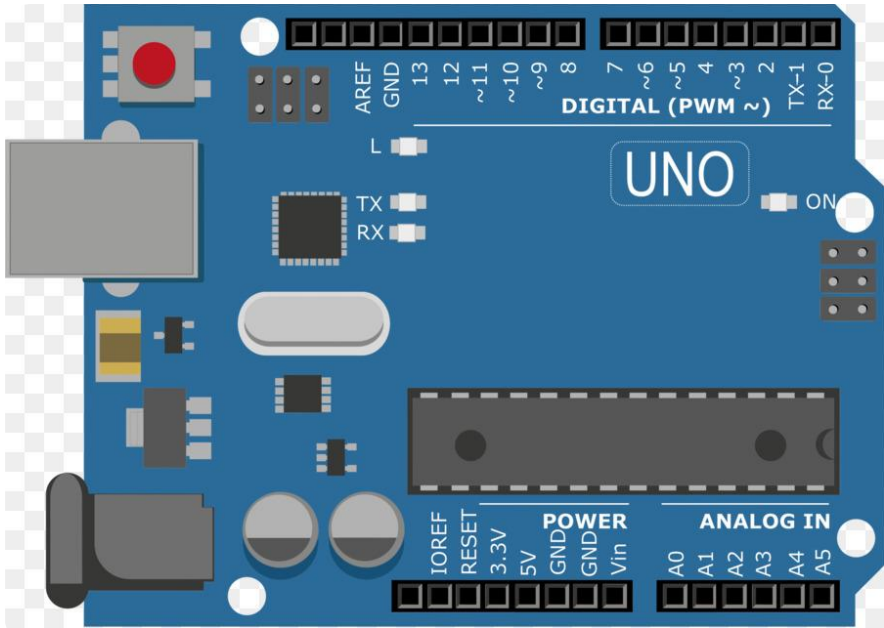
Topic 1: Website Design for Course Mgmt

- Portfolio, digital repository for others
- html
- html, css template provided by us Smart Fan
- html, css template of your choice Self stabilizing box
- Anything else (Javascript, Markdown, PHP)
- Image compression, Video editing.

Topic 2: µC programming

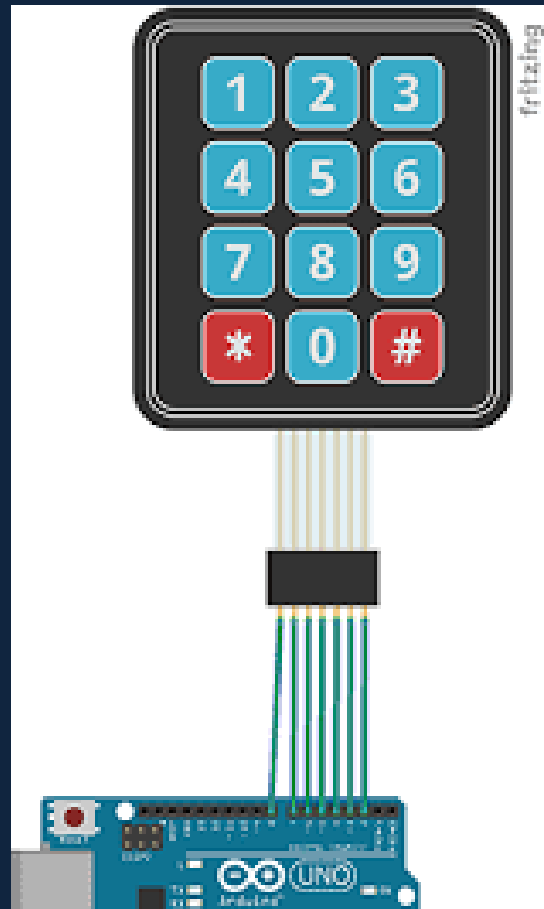
- Basics of programming, algorithm, flowcharts.
- Arduino hardware, IDE, libraries
- Arduino kit with examples
- LEDs, RGB LEDs.
- Push buttons, Buzzers.
- Electrical safety and handling
- LED name
- Basic musical instrument
- Tinkercad Simulations – Cdr Venkat Aditya
- AVR series uCs

(Atmega 328p, ATtiny44)



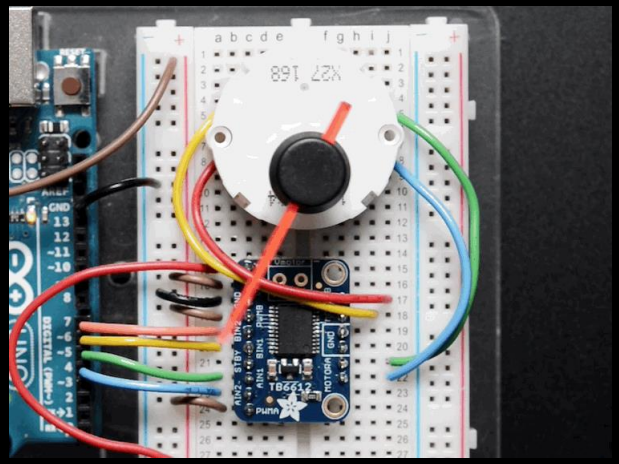
Topic 3: Input devices

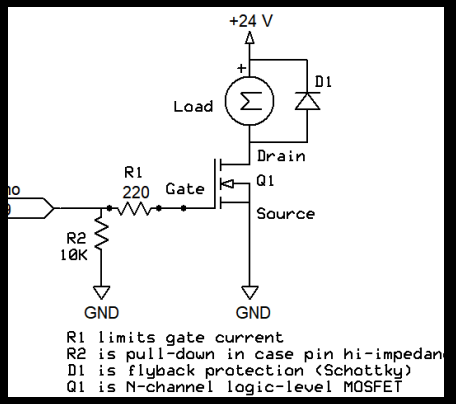
- Sensor features, datasheet
- T+RH sensor, proximity sensor, keypad module with µC
- Sensors in your smart phone?

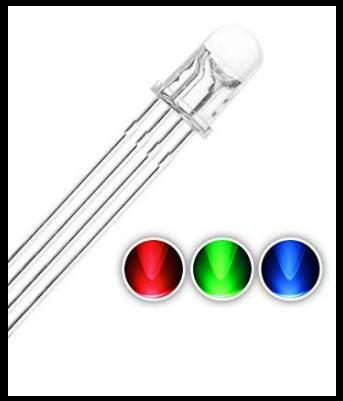


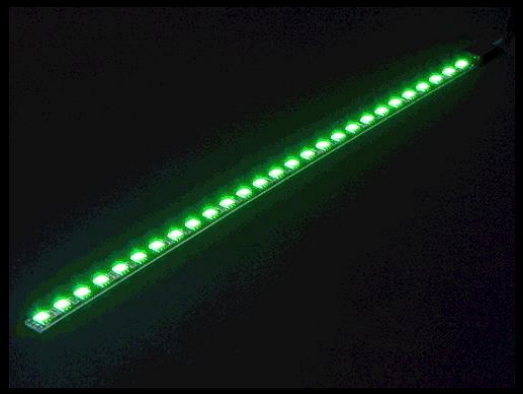
Topic 4: Output devices

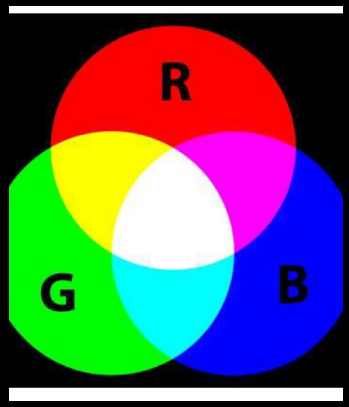
- RGB LEDs, Displays, Speakers, Servo/Stepper Motors, Relays, Dataloggers
- High power electronics
- Ultrasonic + LED display
- Pressure sensor + speakers
- All terrain robot





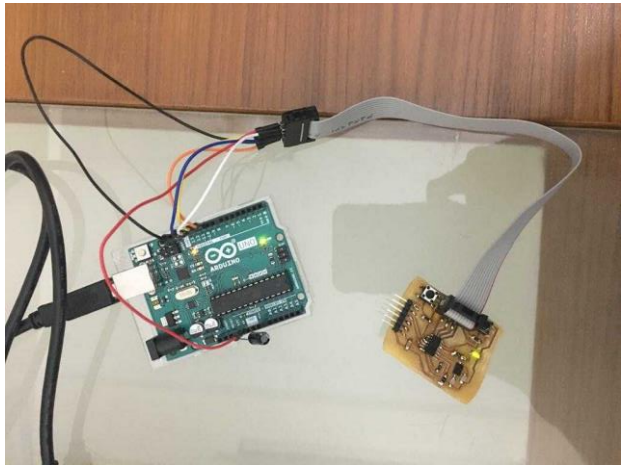


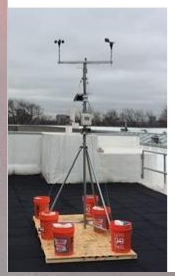


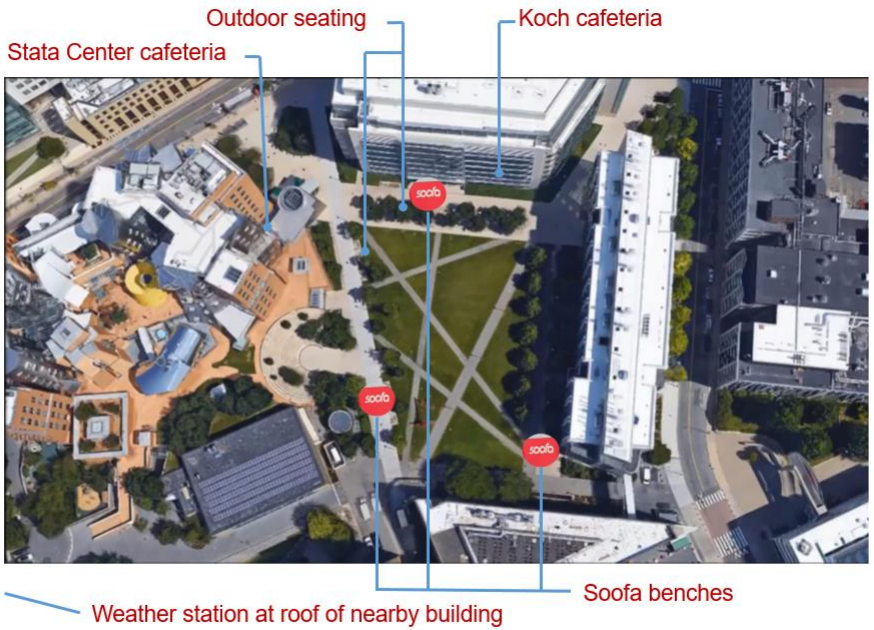


Topic 5: Networking and communications

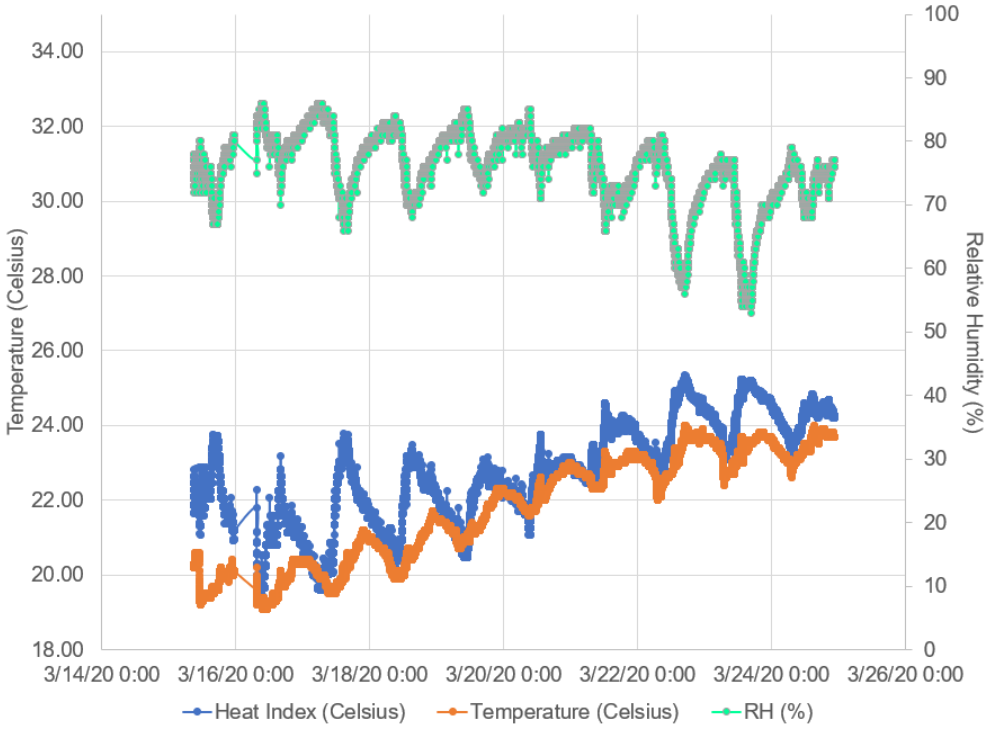
- Wired - SPI, I2C
- Wireless – Bluetooth, WiFi







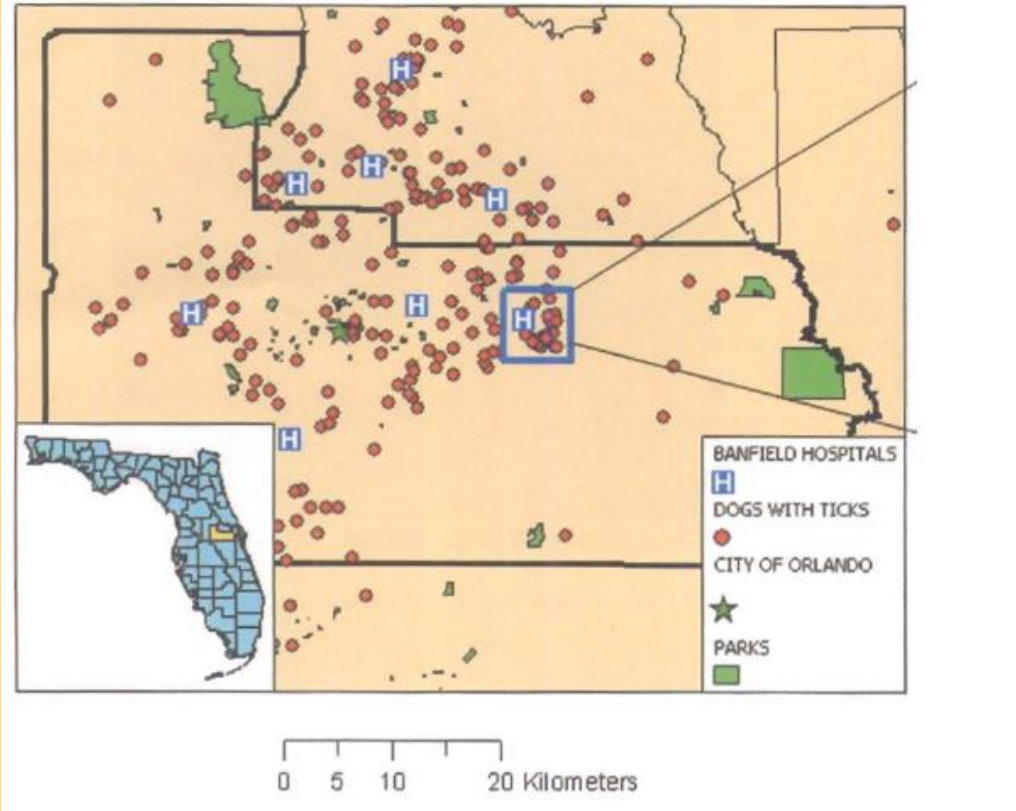
Topic 6: Experimentation and data analysis
Heat Index profile for my room
NodeMCU + DHT11 + ThingSpeak



Observations

1. 48500 data points
2. T, Rh every 18 sec for 10 days
3. Cyclical pattern
4. Daily temperature increase
5. In the context of COVID-19, this analysis helps to know what Temp, Rh to avoid which is conducive for the virus
6. Thermal comfort in the hostels

Introduction to Data Science

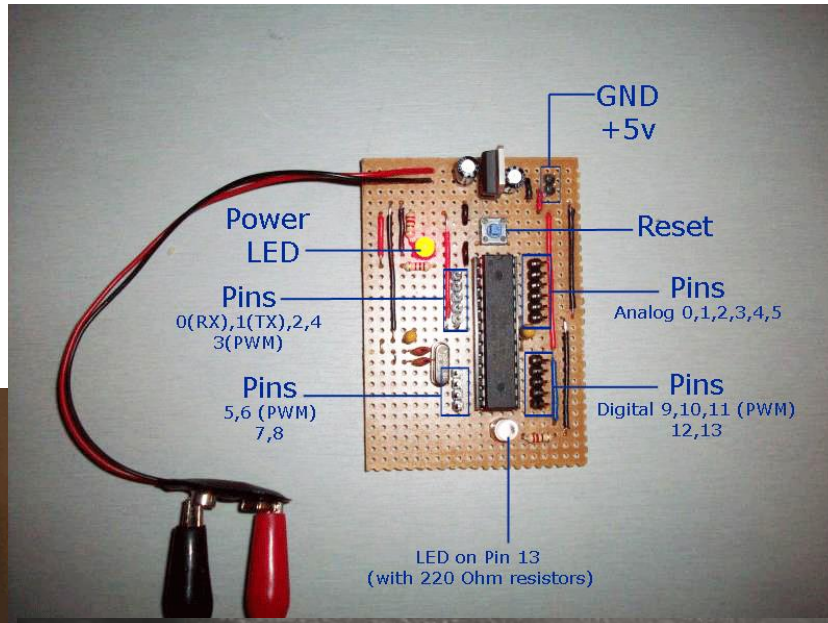


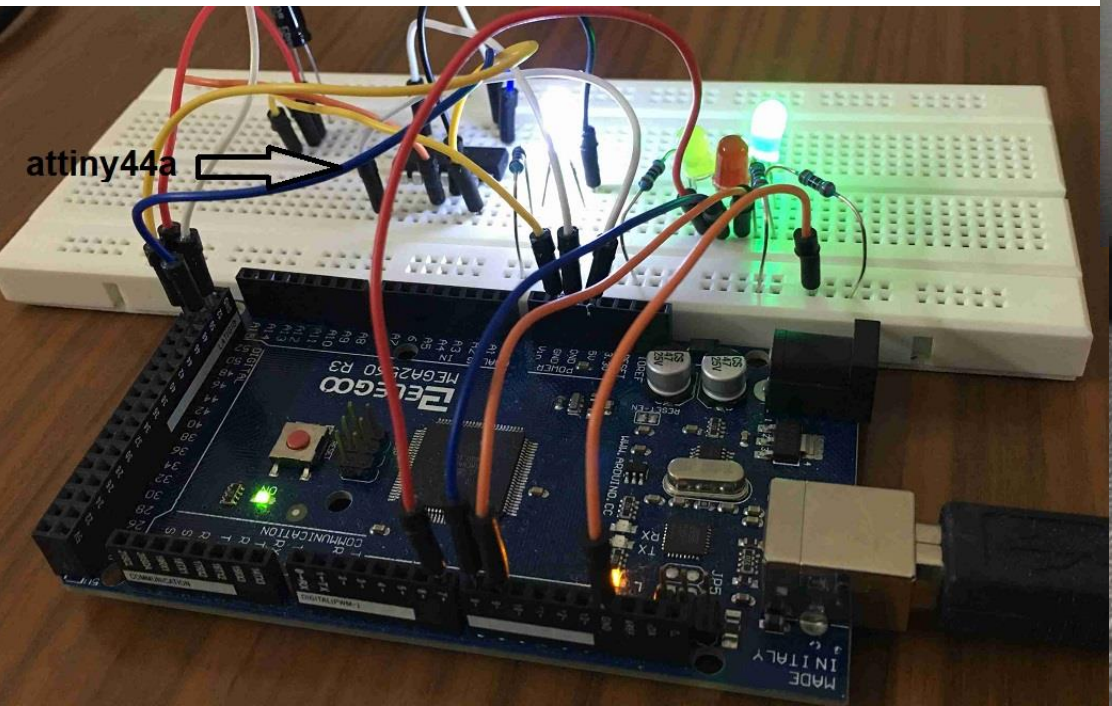
- Big Data from MIT North Court study
- SAS data warehouse inventory management
- Spatio-temporal clusters for early epidemic detection
- Marta González - Mobile Data for Urban Transformation
- Handling data from sensors, smart phones in MATLAB

Understanding congested travel in urban areas Serdar Çolak, Antonio Lima & Marta C. González *Nature Communications* **volume 7**, Article number: 10793 (2016)

Topic 7: µC programming 2

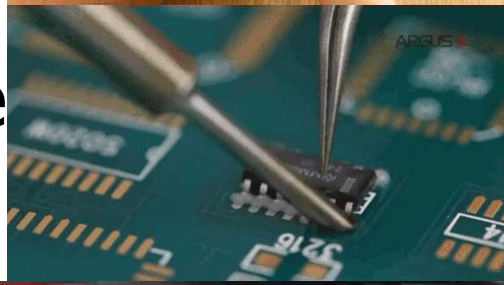
- Atmega328p, ATtiny44
- Soldering
- Protoboard

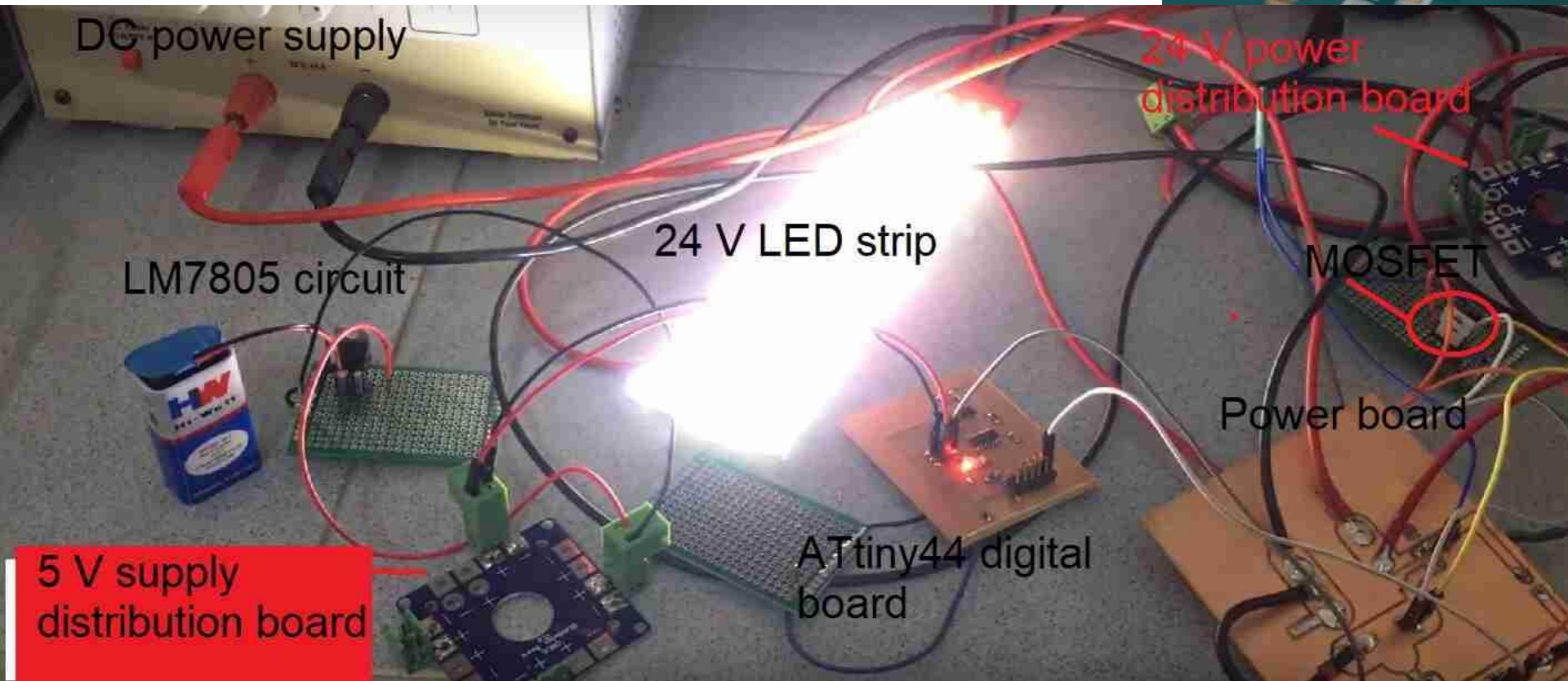




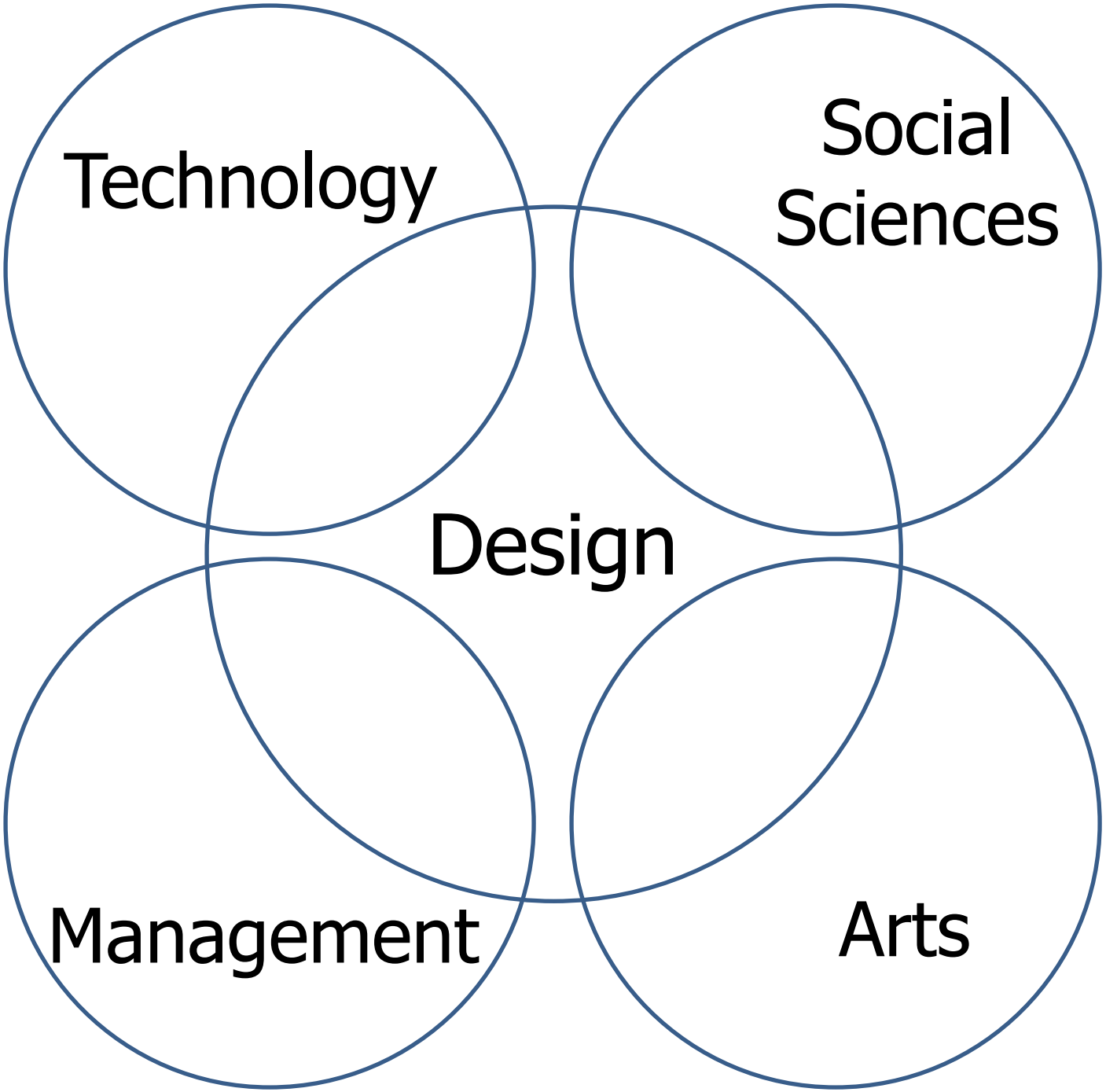
PCB design & fabrication

- Procedure for PCB design, Eagle, Kicad
- PCB milling, Outsourcing to board house
- Electric bike controller

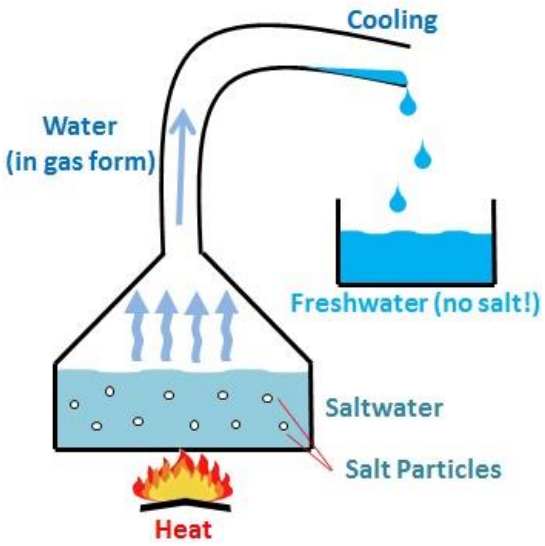




Change.Makers



One science, science for impact

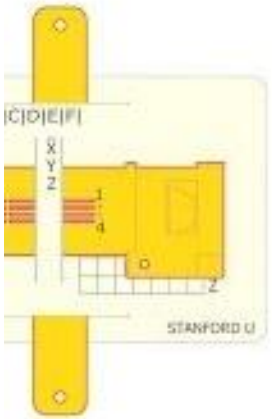


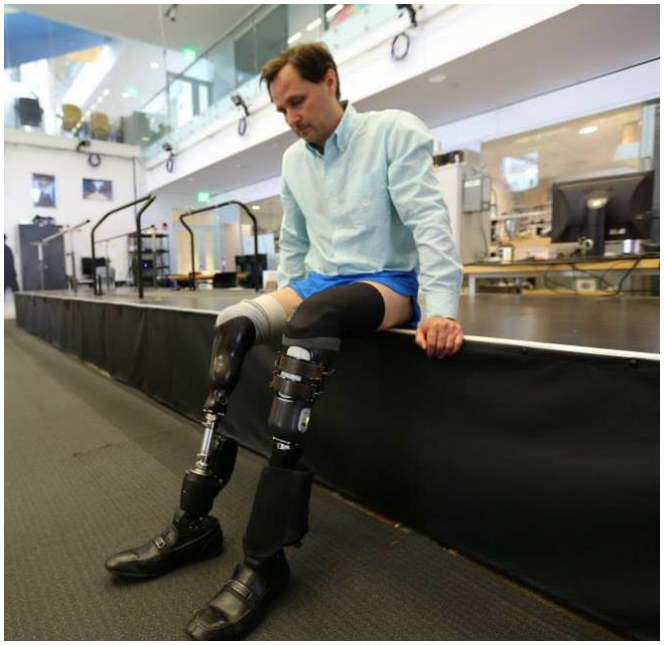
Water filter – plant xylem

Waste-water treatment

Biology, Chemical engineering, Mechanical engineering, Nano-technology, Social science

Examples of One Science: SOLVE water





Science for impact