Summer 2020- WINLAB Internship

ML for IoT group (Maestro)

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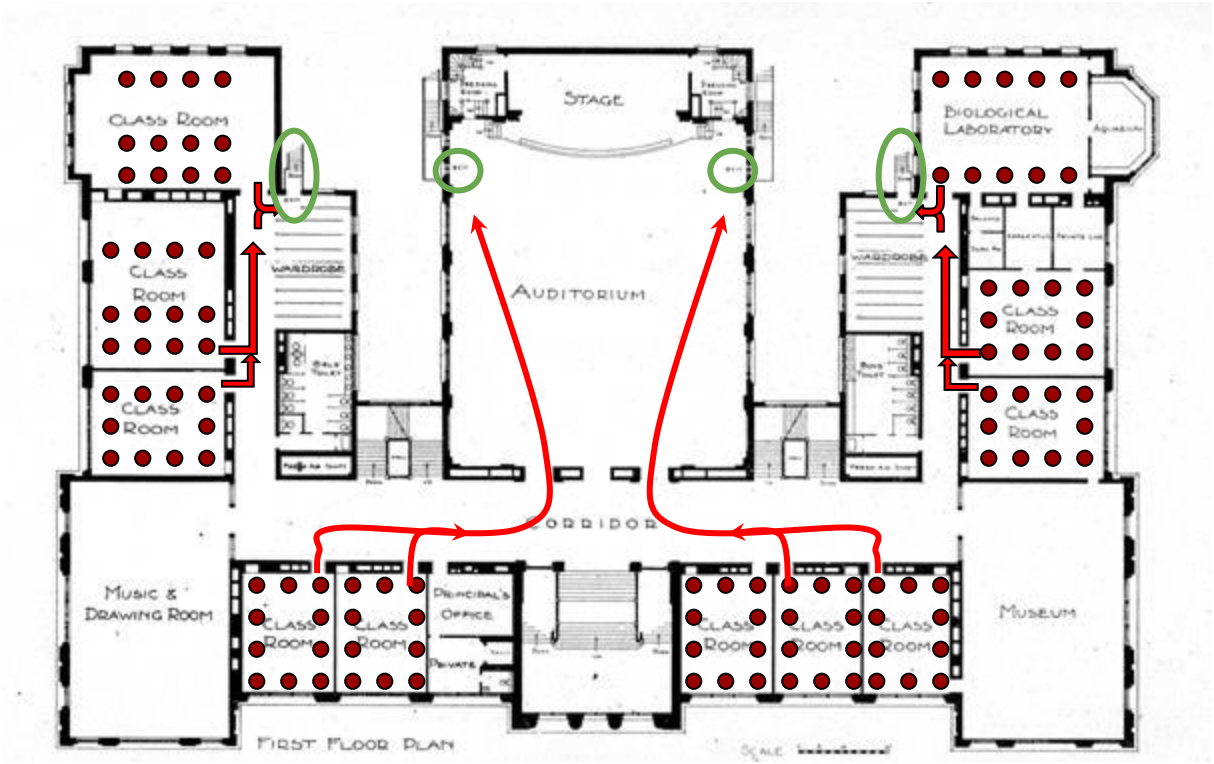
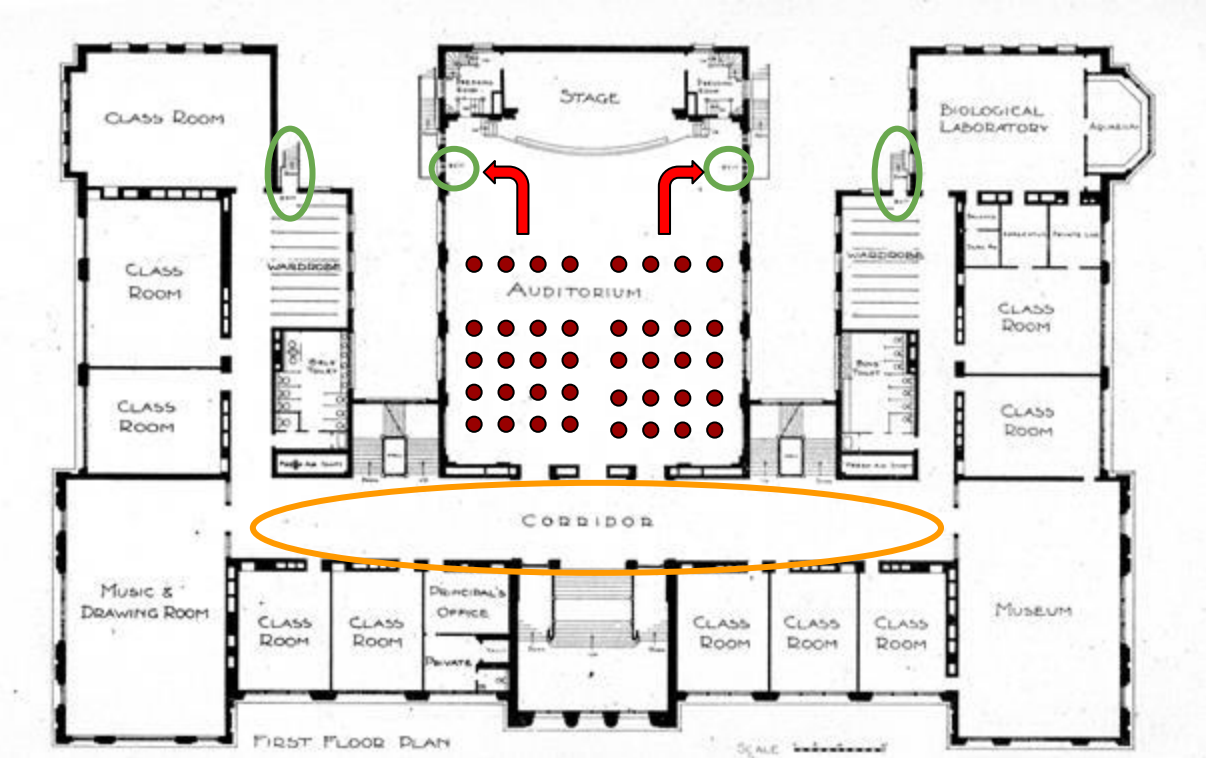
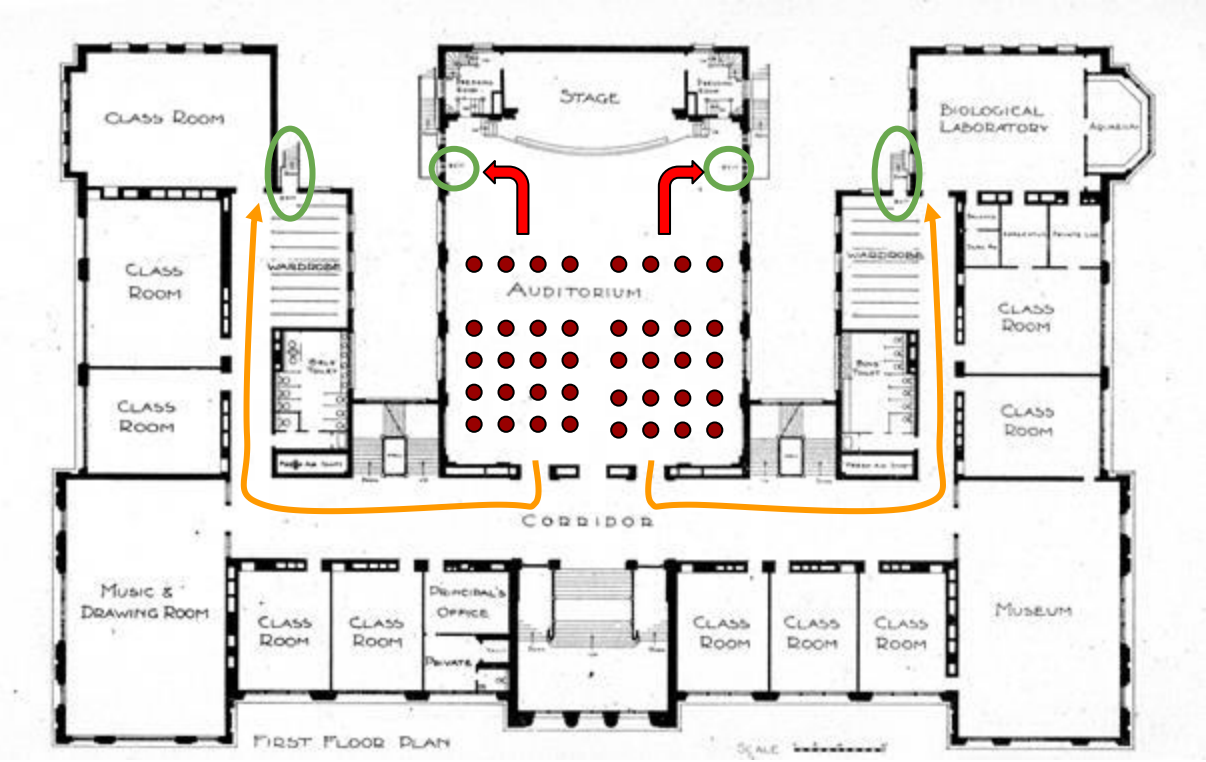
Advisors: Shantanu Laghate,Prof. Jorge Ortiz



Weekday 9am-10am Occupancy Distribution



During a school assembly, the distribution changes significantly
Static evacuation routes remain unchanged



A more efficient evacuation route would take advantage of empty hallways

How do we enable such a system?

- Current occupancy distribution
- Hallway capacity measurements
- Quick information dissemination system
- Location of Emergency

Current Occupancy Distribution

- Do a deployment of non-intrusive sensors
- Ensure sensors readings are accurate
- Collect and analyze data in a central hub

Hallway Capacity Calculation

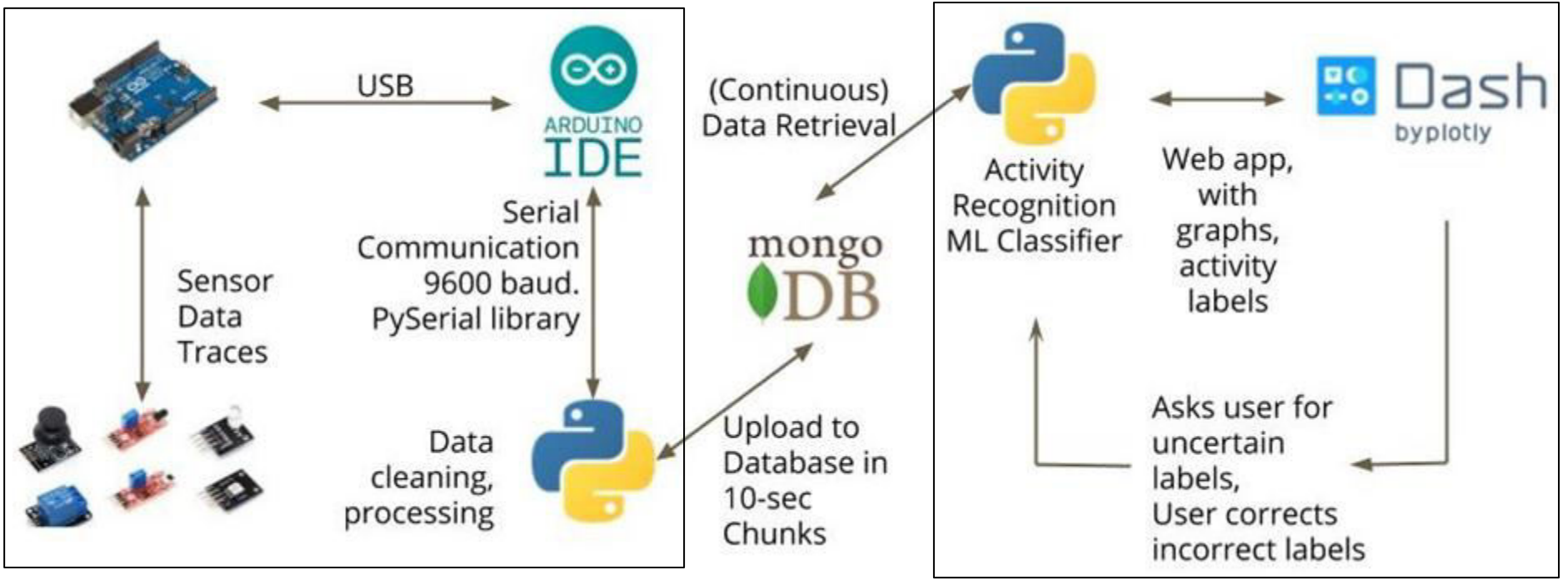
- Measure the speed of human movement in corridors during class, lunch hours, entrance/exit times.

Information Distribution

- Place lights on hallway floors
- Give smartphone apps to Fire Marshals connected to sensor system

Introducing SmartBox and SmartDash

System Design



SmartBox

SmartDash

Non-Intrusive Sensors Allow for Easy Indoor Data Collection

- Passive infrared motion detection
- Magnetometer
- Color and Illumination
- Audio Sensor
- Temperature/Humidity/Barometer
- GeoPhone
- WiFi Transceiver

This combination of sensors is affordable!

```
127.0.0.1 - - [09/Jul/2020 12:21:46] "POST /visualizer/_dash-update-component HTTP/1.1" 200 -
127.0.0.1 - - [09/Jul/2020 12:21:47] "POST /visualizer/_dash-update-component HTTP/1.1" 200 -
127.0.0.1 - - [09/Jul/2020 12:21:48] "POST /visualizer/_dash-update-component HTTP/1.1" 200 -
PIR
Audio
Color Temp (K)
Lumosity
R
G
B
C
Temperature
Pressure
Approx. Altitude
Humidity
Accel X
Accel Y
Accel Z
Magnet X
Magnet Y
Magnet Z
127.0.0.1 - - [09/Jul/2020 12:21:51] "POST /visualizer/_dash-update-component HTTP/1.1" 200 -
found  ['x2']
getting pictures Box0 2020-05-29 19:13:49.2785 2020-05-29 19:14:40.9241
returning  # frames =  1
gif_name------> ./assets/gifs/1594311718.3138812.gif
127.0.0.1 - - [09/Jul/2020 12:21:58] "POST /visualizer/_dash-update-component HTTP/1.1" 200 -
127.0.0.1 - - [09/Jul/2020 12:21:58] "GET /visualizer/assets/gifs/1594311718.3138812..png HTTP/1.1" 404 -
found  ['x2']
start_time 2020-05-29 19:13:49.2785 end_time 2020-05-29 19:14:40.9241 label test
127.0.0.1 - - [09/Jul/2020 12:22:00] "POST /visualizer/_dash-update-component HTTP/1.1" 200 -
```

Other Applications of SmartBox/SmartDash

Activities of Daily Life Monitoring

- SmartBoxes in homes of elderly people allows us to monitor their health.
- Classify what they are doing e.g. using a microwave or stove, vacuuming, walking.

HVAC System Fine-Tuning

- Active learning can help understand occupancy schedules and comfort preferences of occupants
- Allows energy savings by keeping occupants comfortable, turning off HVAC when no occupants.

Future Goals

- Deploy SmartDash publicly
- Simplify interface for multiple SmartBox connections
- Start with SmartBox deployment on campus