Project Ideas

Day 1: 6PM

Smart Building: Ambient Indoor Display & Control

Mentor: Tanuja

- In various real-world applications, it is important to give instant feedback to the end consumer in a simple and succinct manner.
- One of such methods involves ambient display, wherein the color of the ambient display signifies the state of the real-world phenomenon.
- In a solar plant, such an ambient display can be used to represent the energy generation on a particular day. If the generation is low due to weather conditions (solar irradiation and temperature), it would turn green but if the generation is low inspite of having good weather conditions, the display would turn red.
- Ambient displays can be developed for tracking temperature and humidity conditions in a house. These can be displayed to users, or used to trigger a fan or a light, etc.

Mentor: Suman, Vyshak

Smart Building: Indoor Building Safety

- Detect the safety of an indoor space using ambient temperature and gas sensor
  - When temperature goes up, to detect fire
  - When noxious gases are detected
- Trigger a buzzer/alarm/emergency lights
- Send targeted notifications to users asking to evacuate

Mentor: Rashmi, Rajrup

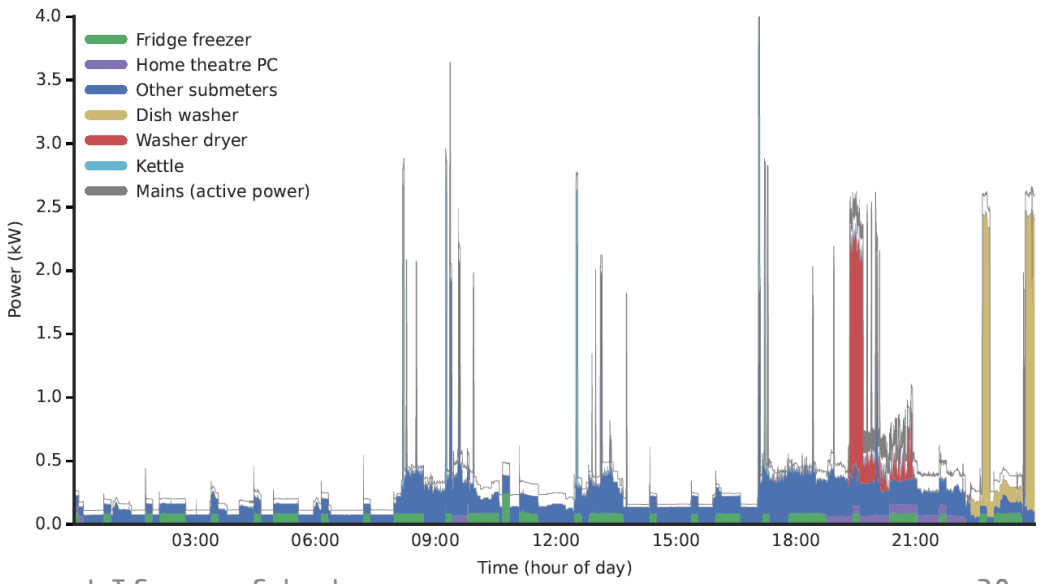
Smart Building: Indoor Access Control

- Use PIR sensor to detect presence of a person
- Trigger camera module to take a picture
- Use image recognition to identify person
- Trigger a welcome message with person's name
- Or an alert if unauthorized person is present

Mentor: Rashmi, Rajrup

Smart Energy: Disaggregating load dats?

- Suppose there are multiple loads connected to the joule jotter/jPlug, we still obtain a single set of data/plot.
- How can we disaggregate the data?
- Is it also possible to show individual profiles for the collective load?



Mentor:
Abhirami, Rajrup

Smart Energy: Identifying wastage of electricity and malfunctioning

- A significant amount of energy is wasted by electrical appliances such as heating and cooling systems (HVAC) when they operate inefficiently due to anomalies, incorrect usage or idling. It is possible to **detect such inefficiencies by collecting the benchmark appliance signatures and learning the normal behaviour pattern of various appliances and comparing them with appliances' day-to-day consumption.**
- It is also useful for comparing energy consumption of appliances across various brands, models and age. It can be used in early detection of faults and preventive maintenance of various appliances.

Mentor: Tanuja

Smart Energy: Reducing electricity bills

Mentor: Tanuja

- Power utilities face a major challenge of peak deficit and energy deficit. Some utilities provide differential pricing or demand response programs. These encourage end-use customers to alter their power consumption in response to DR events such as change in real-time electricity prices.
- However, manually tracking energy prices and deciding on how to schedule home appliances can be a challenge for residential consumers.
- Hence, it is important to have an automated system that can learn the existing patterns of energy usage (when and for how long appliances are used) and optimally reschedule the appliances to reduce overall electricity bill and the inconvenience to the end consumer.
- Additionally, with integration of solar, it is important to understand how much of the existing energy consumption that can be offsetted by renewable energy and what capacity of solar needs to be installed.
- **Learning patterns of existing energy consumption helps to plan renewable energy deployment.**

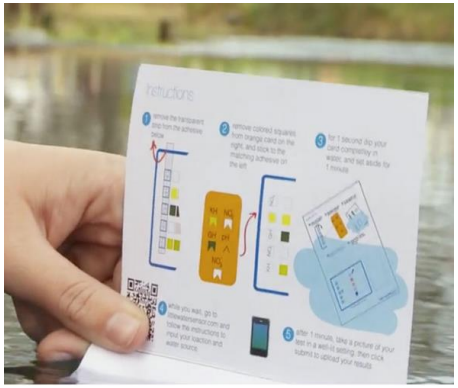
Mentor: Vishnu

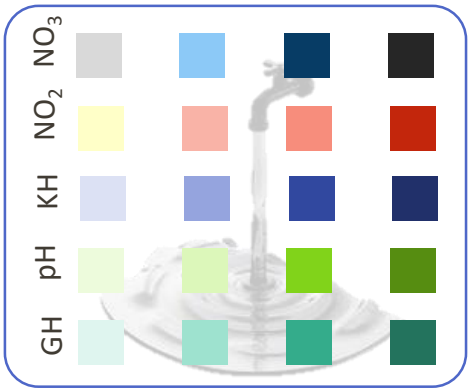
Smart Transportation

- The aim is to design an IoT box that can be deployed inside a vehicle allowing continuous fine-grained measurements without any human intervention. We use camera for visual feeds of traffic and driving behavior, inertial sensors such as accelerometer and gyroscope for movement tracking, GPS for location, and OBD for vehicle monitoring.
- Your aim is to build a box using Raspberry Pi that collects video feed from a camera module mounted on the vehicle dashboard. The camera is either pointed outwards to capture what the driver is seeing or inwards at the driver. Video feeds consume a lot of compute and storage, so we would like to capture only when the vehicle is in motion.
- You can use accelerometer, GPS, and OBD sensors to detect that the vehicle is in motion, and only then turn on video capture. The video feed and other sensor logs need to be stored locally, and later uploaded to the Azure cloud backend when the IoT box is within the range of a known WiFi Accesspoint. The key success metric in the project is automated end-to-end operation without requiring any human intervention.

Smart Water: Crowd-sourced Water quality monitoring

Mentor: Abhilash





- **Cost-effective** quality sensing thru' Crowd Sourcing
  - Paper-based design allows diverse users to test water
  - Report via photo of card & Smart Phone App
  - A simple colorimetric, diagnostic developed by MIT to test *pH, calcium (Ca2+), magnesium (Mg2+), carbonates (CO32-), bicarbonates (HCO-3), and nitrites (NO-2 and NO-3)*
- Goal: Use smart phone libraries to perform color dection based on baseline color card, and report using MQTT. Visualization on a map interface, notification to users in the vicinity.

Smart Water: Crowd-sourced Water meter monitoring

- Detect analog water meter reading using smart phone or camera module on Pi.
- Do OCR and report the current value.
- Determine schedule of users to guarantee reliable and periodic sensing
  - Model user pattern
  - Model user inclination to help
  - Determine proximity of user to sensor

Mentor: Ashish, Rajrup

Smart Agriculture: Watering schedule

- Use soil moisture sensor, ambient temperature and humidity data, and weather forecasts to notify when a farmer has to water his/her farm
  - Could this be customized for the type of crop, and its age? Type of soil?

Mentor: Akshay, Vyshak

Health & Fitness: Activity Tracking

- Use pulse rate monitor to detect current heart rate
- Use accelerometer to monitor activity
- Use combination to correlate activity with heart rate
- Detect “heart attack” situations (e.g. no fitness activity but heart rate higt)
- Correlate accelerometer from smart phone and sensor

Mentor: Akshay, Vyshak