As part of your task you have to develop a set of protocols/messages and build a reference implementation that simulates the operations of a **smart automated environment.** As a result, your environment could consist of smart services and devices that inter- communicate with each other.

Your devices/services must **publish** themselves and **discover** each other. Your devices/services should communicate via **gRPC**.

You should begin by devising your own scenario. There must be a minimum of 3 separate services that would simulate the operations of smart-automated environment. It is key to specify what operations are supported on each “service/device” in a corresponding proto file.

Finally, to demonstrate your implementation a simple client GUI should be developed, operating as a main controller that discovers and uses your **devices/services.**

Services:

Lighting and energy – sensor in the room activate lights with the presence of people / lights change intensity according to the natural light present (gives conform to people) / after hours – all lights and non necessary devices are turned of if theres nobody working there, problems can be informed via app and maintenance is contacted

HVAC – controls temperature (can be changed and checked on the app), but it has its own pre configuration, control CO levels and fire detection (message to the fireman and building managememnt

Occupancy - People counter when tag at door, cameras film according to motion detection, keep track of building occupancy and visitors security breach call police

lightning, temperature and people counters.

‍

**2. Workplace occupancy**

‍**3. Meeting room usage**

Heating, ventilation and air-conditioning systems (HVAC) use more than 60% of a building’s total energy consumption and up to a third of that energy is often wasted due to HVAC malfunction

The platform provides real-time accurate measures of your systems and equipment performance, including chiller and HVAC, enabling you to rapidly identify optimisation opportunities,

number of intelligent energy efficiency systems built in, including an energy recovery wheel system in its air-conditioning unit, which allows cool air to be recovered to maintain the chillers’ efficiency. Motion detectors installed at the lift lobby and toilets conserve energy, while double-glazed glass windows reduce heat penetration and minimize energy consumption.

Devices monitor carbon dioxide and carbon monoxide, ensuring optimal air

the building.LED lighting systems reduce energy consumption and maintenance, while rooftop solar panels harvest energy from the sun.Cross-flow ventilation and zoned motion-detecting lighting also improves energy efficiency, while vertical green walls enhance indoor air quality.

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 controls all electrical and mechanical systems in the building, including its heating, cooling and ventilation systems, lighting, and solar thermal hot water system.

which uses smart algorithms to identify anomalies and maintenance issues. Facility managers can use this information to improve building maintenance and asset reliability.

The types of IoT sensors used in facilities management, building automation and smart building applications are limited only by your imagination. Prevalent use cases include:

* Climate control, including temperature, humidity, vibration, etc.
* CO monitoring
* Electrical usage
* Fire detection
* Heating, ventilation and air conditioning systems (HVAC)
* Lighting control
* Occupancy
* Predictive maintenance
* Security and access control
* Structural health
* Water monitoring

The main data that is temperature,

humidity and luminosity

that was used to create a

monitoring system entrance/exit to the premises.

Also we were monitoring incoming and

outgoing people using the webcam for accuracy check by

ourselves.

Also we developed a way to determine who is inside the room

This is also how we determined the number of people inside

the room and also a person recognition by device mac address

Regarding humidity trend, the ideal value should be 40-50%

which causes discomfort and can lead to illness,

For the light sensor

bot to Telegram messenger to

gather feedback from students in terms of comfort temperature

and humidity in the auditorium.

to control lights and power sockets in the room that will be

activated either automatically or manually through a central

control system. In the longer term, we also envision monitoring

outside areas, such as the building parking spaces [14],

outdoor and indoor vegetation [13], and also connecting with

social-driven recommendation systems to create customized

hospitality tours in large buildings [7

#### Motion Sensors:

I have placed motion sensors in every room of my house as well as at the entrance to my property (facing the front door) and a few at the rear. I use external sensors as motion light sensors they turn on the front and rear lights upon motion detect. The interior ones in the playroom, laundry and bathrooms are also used to turn lights on and off with motion as I found my family just leave these lights on all day. I also use them for unauthorized motion detection once the alarm has been set to trigger TTS to warn intruder that alarm has been triggered and to get the f\*\*\* out as police have been notified, as well as set in motion the alarm sequence. I hope to start to also utilize these in conjunction with other methods to introduce room detection/presence.

#### Door & Window Sensors:

I have placed Door & Window Sensors on everything that opens & shuts that I want to know the status of. I use these tell me if there is an open door/window when we are trying to arm the alarm, if there is, a notification is played over the speakers to tell me "X" window is still open would you still like to set the alarm. They are also used to alert of unauthorized access and set in motion alarm sequence if its armed.

#### Smart Switches:

I have a few of these around the place and a bunch more waiting to find a use for. The reason I got these was once I connected the ceiling fans to a 4ch Sonoff (more on these later) I disconnected the wall switch for the fans. This drove my wife crazy having to turn the fans on and off via her phone (lots of swearing and you need to rip this f\*&^%$# smart home crap out), so I purchased about 10 or so of these Xiaomi Smart Switches. I use them to on single click cycle which upon a single click, it cycles through increasing the fan speeds and last one turns it off. I also use one at the entrance as a door bell which is used in several automations one for recording of ip camera and displaying it on the alarm panel screen by the front door. If we are watching TV/Movie it pauses what we are watching (Cable or Kodi) and turns the lights up displays who is at the front door from a snapshot taken with the camera recording. I also have one in the entertainment area for manually turning the (20) Edison bulbs on/off and fairy lighting modes. These switches have single click, double click and long press modes so can be used to trigger several automations of the one unit.

#### Temperature & Humidity Sensors:

I have one of these in every room of the house as well as one located in the entertaining area out the back of the house. I use them mainly to tell me the temperature but do use them to trigger automations around when to turn on the bathroom heating and with a moisture sensor in the shower to trigger the exhaust fan. These are also used to control the climate in the bedrooms of a night time, not really for the main living areas.

### Fan & Lighting Control

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I like many others use Sonoff single, daul and 4ch switches to control the power to my lights over Wi-Fi. These units need to be flashed with firmware (plenty of info out there on how to do it, I used Tasmota Firmware). I have placed all of my switches behind the wall plate (Gyprock walls) had to make fairly large holes to accomodate the 4ch model but can always plaster it back up afterwoods(took me about 2 months of nagging to sand the patches and re paint walls).

| [**Sonoff Basic**](http://sonoff.itead.cc/en/products/sonoff/sonoff-basic) | [**Sonoff Dual**](http://sonoff.itead.cc/en/products/sonoff/sonoff-dual) | [**Sonoff 4CH**](http://sonoff.itead.cc/en/products/sonoff/sonoff-4ch) | [**Sonoff RF Bridge 433**](http://sonoff.itead.cc/en/products/appliances/sonoff-rf-bridge-433) |
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#### Light Switches:

I use the Sonoff Basic & Dual for single and dual wall switches respectively and these are pretty straight forward flashed with Tasmota Firmware and added to HA via the MQTT Switch component. I installed all of these switches behind the existing wall plates and connected the original switch to the available gpio pins on the board.

#### 3 Speed Ceiling Fans:

I use the Sonoff 4Ch again flashed with the same firmware and I connected first ch to the high speed of the fan, 2nd & 3rd ch are connected to the med and low via a 6uf capacitor. The last channel is connected to the light switch again I used the gpio pin to connect the board to the wall plate, so the light can still be controlled via the wall switch. These can now be voice controlled via Alexa turn fan on/off turn fan speed to low, medium & high.

#### Garage Door:

I have an RF controlled relay connected to my garage door opener and I use the Sonoff RF Bridge to control it. I also have a Xiaomi Door Sensor to tell me whether the garage door is open. At the moment I use a Xiaomi smart switch located in the garage to control the door whilst I’m in there "Single Click" up, down and stop, "Double Click" Garage Light, Long Click manual up and down this way I can adjust how open I would like the door to be if I’m working in there. I wish to add a Bluetooth beacon to introduce geofencing to have the door open automatically when we are arriving home but atm there isn't enough room to fit the car due to my abundance of toys I no longer use.

### LED Lighting

I have a few RGBWW strips around the house used mainly for mood lighting aswell as practical lighting on the staircase. These are all controlled by MiLight Wi-FI LED controllers with appropriate power supplies.

| [**5m RGBWW LED Strip**](https://www.banggood.com/5M-RGBW-RGBWW-4-In-1-SMD5050-300LEDs-Strip-Light-Non-waterproof-Indoor-Use-DC12V-p-1155159.html?rmmds=myorder) | [**LED Power**](https://www.banggood.com/AC100-240V-To-DC12V-6A-72W-Power-Supply-Adapter-for-LED-Strip-Light-p-1111858.html?rmmds=myorder) | [**Mi Light Wi-FI Controller**](https://www.banggood.com/Mi-Light-24A-DC12-24V-2_4G-RF-4-Channel-RGB-LED-Remote-Controller-p-968820.html?rmmds=myorder) | [**LED Diffuser**](https://www.banggood.com/3050CM-XH-U1-U-Style-Aluminum-Channel-Holder-For-LED-Strip-Light-Bar-Under-Cabinet-Lamp-Lighting-p-1142676.html?rmmds=myorder&cur_warehouse=CN) |
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#### Staircase Lighting:

I have 80cm LED strips on the underside of each step installed with a LED Diffuser the steps are split by 2 Mi Light Wi-Fi controllers. I have all odd stairs on one controller and all even on the other so I can have the colours alternate when it’s a special occasion or seasonal holiday. Their standard setup is to turn on (warm white) 30mins after sundown and turn off with the activation of the bed time script. Once the bed time script kicks in the Staircase LED strips are set to turn on only during motion detection of the motion sensor at the top of the stairs, they turn off again 5 mins after last motion detection. Each alternate strip is soldered together and placed into a channel countersunk in to the step which is then covered by bamboo floor boards. The strips themselves are installed on the underside of the step overhang so they face back towards the step below it was a massive job (lots of swearing) and now all cabling is hidden it looks great and effect when stairs are light is awesome really makes the staircase a feature of the house. Each strip works out to be around 5.6m in length so I decided to power them sufficiently with 12v 6A 72W PSU.

#### LED Back Lighting:

I purchased 3 x 5m LED strips to do the staircase mentioned above and had about 3.5m left after the project was complete so rather than let them go to waste (like they were ever going to be) I decided to place a few strips behind my PC Monitor, Media TV, Bedroom TV and Entertaining TV. Each strip is controlled by the Mi Light Wi-Fi LED controller and on normal nights they just give a soft blue glow from behind the screens. When music is playing I found a project where they had a script which would change the LED colour to match that of the Album artwork that was playing at the time. I also aim to port this across to work with Kodi and the TV Show/Movie Poster colours.

#### Entertainment Lighting:

I have 20m festoon lighting with different sized Edison bulbs, it came with 20w bulbs (when turned on it light up not only the entertainment area but the whole suburb) I replaced them with 2-4w bulbs but I fear the damage to my retinas may be permanent. I also have 3 x 10m lengths of LED fairy lighting which run off USB 5V. To power them I use a Xiaomi Power Strip which has 3 Power and 3 USB points.

### Appliances and Smart Power

I am slowly replacing my Appliances with smarter connected devices as they need replacement, in the mean time I am installing Xiaomi ZigBee power strips and plugs to give me the ability to add them into my automations. These power switches also monitor power consumption which is an added bonus but I am yet to fully take advantage of this feature by graphing my consumption and finding out my biggest areas for saving on my bill.

| [**Xiaomi Robot Vacuum**](https://www.banggood.com/Original-Xiaomi-Mi-Home-Smart-Robot-Vacuum-Cleaner-LSD-and-SLAM-1800Pa-5200mAH-with-APP-Control-p-1098131.html?rmmds=myorder&cur_warehouse=CN) | [**Xiaomi Smart Mop**](https://www.banggood.com/New-Arrivals-Xiaomi-Handheld-Stay-Upright-Electric-Mop-Long-Grip-Handle-Mopping-Robot-Clean-Machine-p-1171073.html?rmmds=myorder&stayold=1&cur_warehouse=CN) | [**Xiaomi Wi-Fi Pedestal Fan**](https://www.banggood.com/Original-Xiaomi-Mi-Smart-DC-Frequency-Electric-Stand-Fan-with-APP-Remote-Control-Natural-Wind-p-1156931.html?rmmds=search) | [**Xiaomi Smart Power Switches**](https://www.banggood.com/Original-Xiaomi-Mijia-Four-Digit-Individual-Control-Power-Strip-Socket-with-3-x-USB-Quick-Charge-p-1253472.html?rmmds=myorder&cur_warehouse=CN) |
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#### RoboVac:

This vacuum actually does a pretty good job of the day to day pickups of random crumbs my boys seem to generate at will. We still use the Dyson stick for a weekly clean or a big spill, but the RoboVac is set to clean twice a day and it just goes about its business we have lots of obstacles which it navigates with ease including the large dining table with 6 chairs. There is a new zone cleaning feature which I would like to take advantage of but in order to do that I would need to upgrade my app version and I'm still adding devices to HA which I lost this ability moving to newer versions of the app.

#### Smart Mop:

This mop is not our main one as we have a steam mop for the tiled and bamboo flooring which is needed with two boys rampaging throughout the place. The thing I like about this mop is it has a built in light and is easy to whip out on those liquid spills that haven’t dried hard yet. As for smart features it really only has battery level indicators and alerts when it’s time to change over the mop pad.

#### Smart Fan:

I was excited to get this fan as it was to go into the playroom for the kids the room has no windows or is quiet closed off so airflow isn't the best. When it arrived I went to integrate it with HA to realise that it is one of the few Xioami devices that didn't have auto discovery or a custom component for it. I reached out to the community and our very own [@syssi](https://github.com/syssi) had a component for me to do testing with in the matter of hours. We are actually only about 50% through this as it is waiting for me to finish testing the remainder of its functions and it will be added in future release. [Smart Pedestal Fan](https://community.home-assistant.io/t/mi-smart-pedestal-fan/49998/52).

#### Power Switches:

I have lost count of how many of these things I have around the place, I use single plugs for those higher power consumers like the washer/dryer & fridges. The rest I have a heap of smart power strips powering everything else to give me insights into power consumption but mainly to control when devices are allowed to be on and consuming power. I have a strip setup in the laundry that all my battery appliances plug into (all the mentioned above) and this only turns during between 1-4am and only for long enough to charge all connected devices to 100%. I also do the same for my outdoor lighting they are all connected back to these strips and I then automate them to turn on x time after sunset for x amount of time and turn off again. Once bed time script is enabled they are then set to turn on upon motion in their areas. I also use one for my Christmas lighting to ensure they are on for the kids to enjoy (as I used to forget to turn them on until after they are in bed) and turn off by midnight.