

Distributed System

Smart Building  
  
  
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# Introduction

This proposal outlines gRPC system for a smart building solution in an office setting. The purpose of the system is to provide energy and cost efficient solution in management of the building resources while ensuring safe and comfortable environment for occupants.

Wide range of existing technologies can be implemented in a smart building and it is feasible to achieve automated control of the real-time functioning of a building thanks to the capability acquired by Internet of Things devices to gather, process, and analyse data from various elements and locations.

The below services may be offered as standalone packages and consist of services regarding climate control, desk occupancy and cleaning heatmap.

* Climate control service works with existing heating, ventilation, and air conditioning (HVAC) system to ensure that temperature and humidity are set to a desired level to ensure low operation costs in areas that are not utilised.
* Desk usage service ensures that the management is informed about the current usage of office desks in the building. This service is particularly important in the light of the working from home movement and it is estimated that approx. 30% of desks are not utilised throughout the day.
* Cleaning heatmap service provides monitoring of high traffic areas ensuring that cleaning of toilets is scheduled depending on the actual usage.

# Service 1: Climate control

This service deals with adjusting heating, ventilation, and air conditioning system according to the desired settings, and current room conditions including temperature and humidity.

## Methods

### RPC Method 1 - DesiredHVAC

**Unary -** This method accepts desired values of temperature and humidity for each room in the building set by the system admin and saves the requested adjustment for that particular room. The method returns confirmation for each room that the conditions were set.

**rpc** DesiredHVAC(DesiredRoomConditions) **returns** (Confirmation){};

### RPC Method 2 - HVACstatus

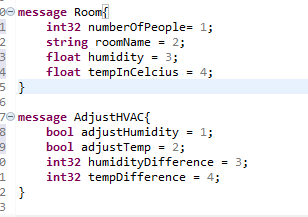
**Client-Side Stream** - This method accepts stream of values of temperature and humidity for a particular room in the building provided in real-time by sensors and stores the data for that particular room.

**rpc** HVACstatus(**stream** CurrentRoomConditions) **returns** (Empty){};

### RPC Method 3 - RoomStatus

**Server-Side Stream** - This method will accept a user request to check the current conditions for a particular room and the method will compute and return in real-time the difference between recently stored values to and ideal room values and inform about the values to adjust the HVAC system.

**rpc** RoomStatus(Room) **returns** (**stream** AdjustHVAC){};



# Service 2: Desk Usage

This service deals with monitoring Desk Usage in a particular room.

## Methods

### RPC Method 1 - DeskStatus

**Bidirectional Stream** - This method accepts value to adjust desk height (increment or decrement by 1 value) to enable a user transformation from sitting to standing desk and returns adjusted height. The method also performs a check whether the requested height is within the given range for that desk object.

**rpc** DeskStatusHeight(DeskDetailsRequest) **returns** (DeskAdjustedResponse){};

}

**message** DeskDetailsRequest{

**int32** deskNumber = 1;

**string** roomName = 2;

**int32** desiredDeskHeight = 3;

**enum** Operation{

DESKUP =0;

DESKDOWN=1;

}

Operation operation = 4;

}

**message** DeskAdjustedResponse {

**int32** deskHeight = 1;

**bool** isHeightAdjusted = 2;

### }

### RPC Method 2 - DeskBooking

**Unary** - This method accepts office desk number, room, employee name and booking date and will return a confirmation whether the desk was booked successfully

**rpc** DeskBooking(DeskDetails) **returns** (BookingConfirmed){};

# Service 3: Cleaning heatmap

This service provides tracing service of toilets usage in real-time to enable more cost-efficient cleaning service. A cleaner will be able to ascertain, using a tablet, which toilets will require cleaning due to heavy traffic.

## Methods

### RPC Method 1 - EntersToToilet

**Client-Side Stream** - This method accepts stream of number of enters to a particular toilet in the building provided in real-time by sensors placed at the toilet entrances and stores the data for that particular toilet.

**rpc** EntersToToilet(**stream** ToiletDetails) **returns** (Empty){};

### RPC Method 2 - ToiletStatusInquiry

**Bidirectional Stream** - This method accepts inquiries on the status of usage of toilets and returns their status. This solution might assist in producing a heatmap assisting in cleaning in real-time.

**rpc** ToiletStatusInquiry(**stream** ToiletDetails) **returns** (**stream** Status){};

### RPC Method 3 – UpdateToiletStatus

**Unary** - This method accepts data regarding a toilet that was cleaned and confirms its receipts.

**rpc** UpdateToiletStatus (ToiletDetails) **returns** (Status){};