



MONITORING CO2 USING IoT TECHNOLOGY

State Bank of India, CBD Belapur, Navi Mumbai

Client Details

- *State Bank of India located in CBD Belapur, Navi Mumbai* is a Ground + Five (5) floors building divided into Four (4) wings. This building has data centre at Two (2) floors & rest of the floors are occupied as office spaces.
- The building is served by chilled water system and each floor has a separate AHU or a floor standing/Ceiling mount duct able unit per wing. The office is operational during the day and, regularly occupied spaces are served with separate dedicated air conditioners.
- It was observed that the AHU serving each office spaces was only recirculating the air with increased CO₂ concentration therefore affecting the Indoor Air Quality (IAQ). Indoor Air Quality parameters are not only directly related to occupational health but also have a huge impact on quality of life.
- In order to have a healthy environment for their occupants State Bank of India installed BuildTrack's IoT based **CO₂ monitoring and control system** that helps to ensure that the optimum amount of outside air flows into the conditioned space to manage the CO₂ to acceptable levels

BuildTrack System Overview

The BuildTrack's IoT system used to monitor CO2 level consists of largely the following:

- BuildTrack CO2 sensors
- BuildTrack Digital Direct Controllers
- BuildTrack Smart Server

Connecting the system together requires a combination of RS485 and CAT6 cabling with accompanying accessories.

- The CO2 Sensors and Damper Actuators are both connected to the DDC via RS485 cables. All the cables are passed through PVC conduits.
- The DDC controller takes the value from the installed CO₂ sensor and based on the CO₂ ppm level further actuates the damper actuator motor which will open/close the damper to allow sufficient quantity of fresh air into the AHU room.



CO2 sensors



Digital Direct Controllers



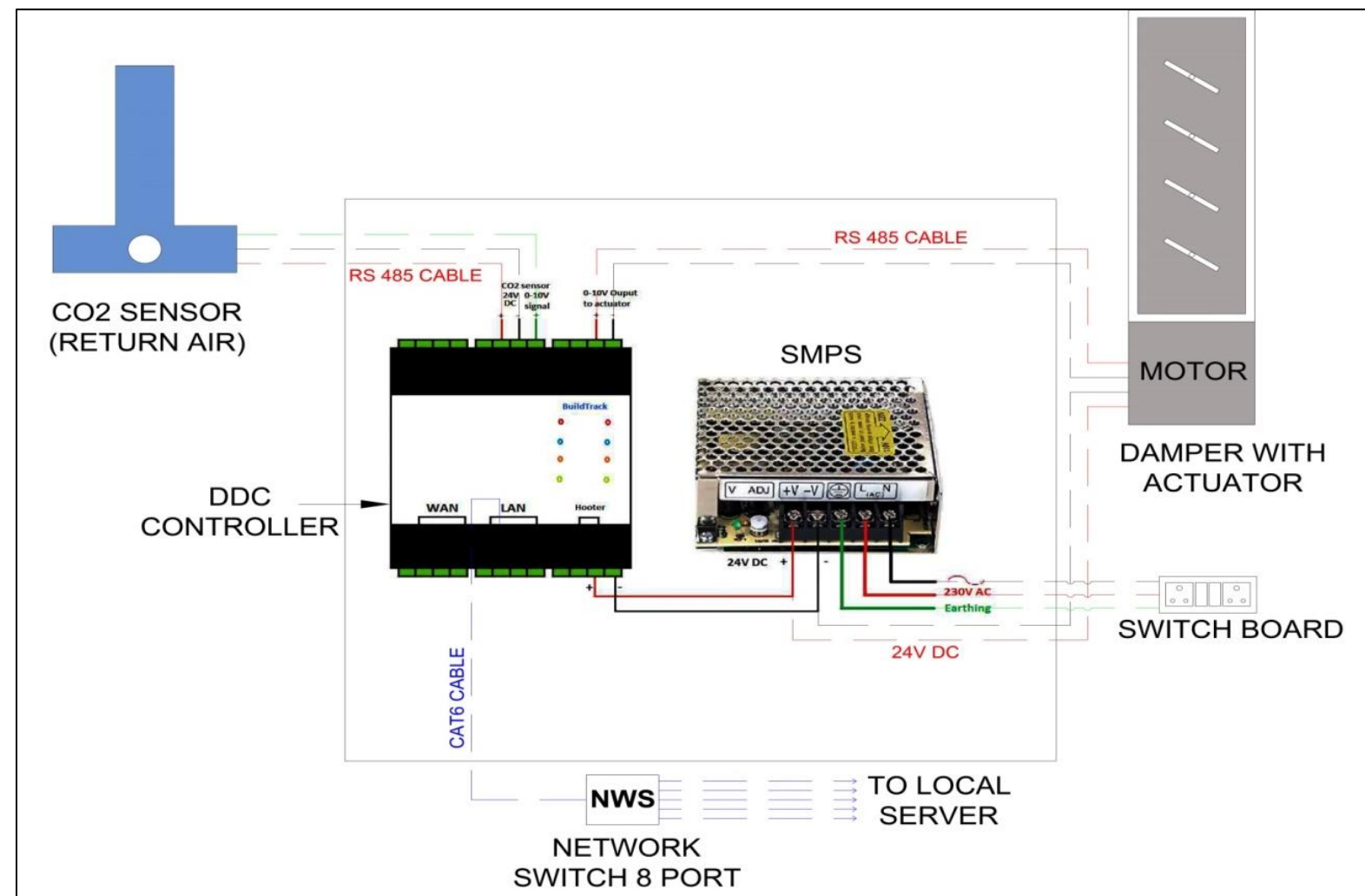
Damper Actuators



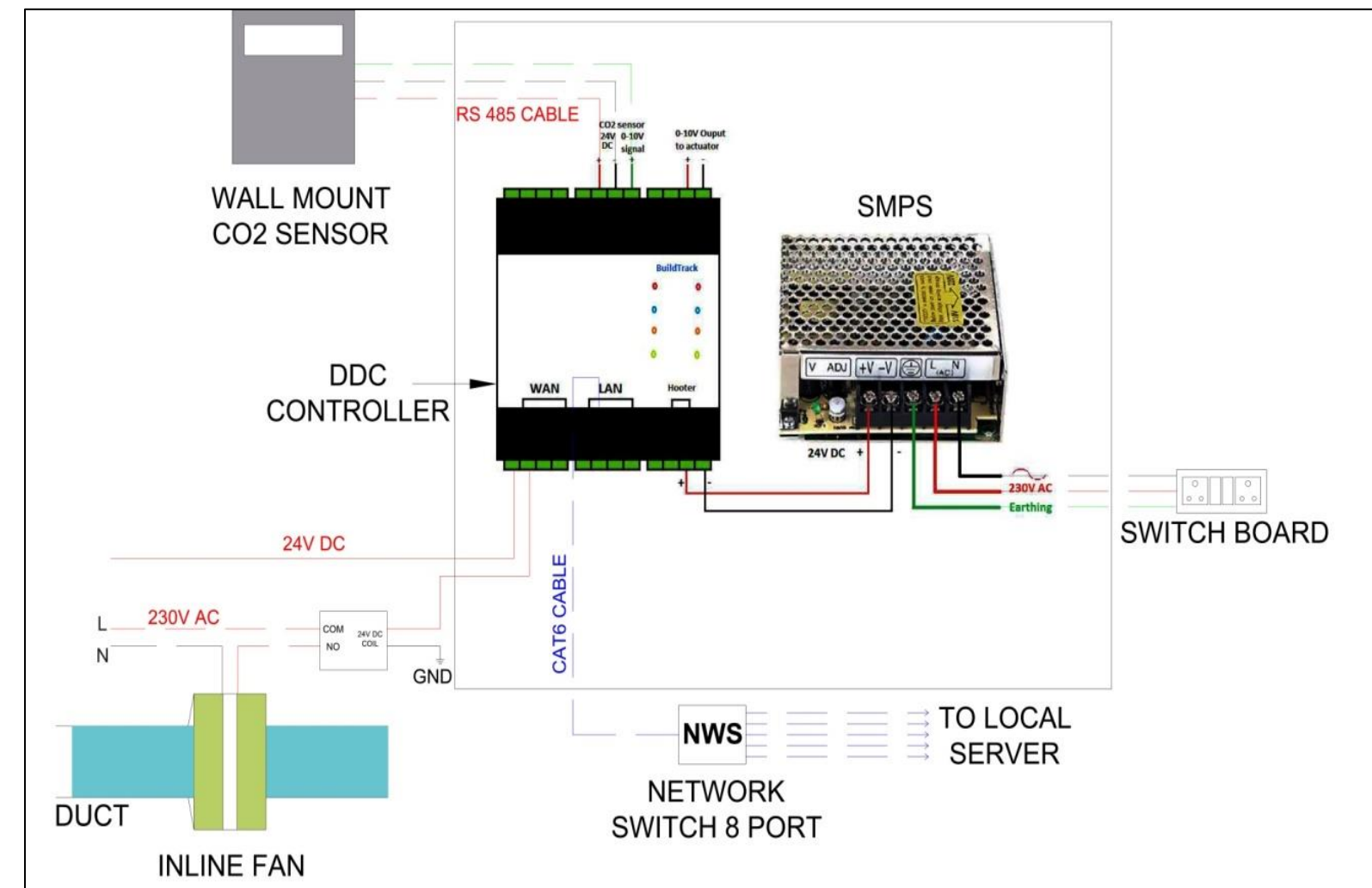
BuildTrack Smart Server

System Architecture

- The CO2 monitoring system is installed at 13 locations in the facility.
- Out of these 13 fresh air systems, 12 units had return air mounted CO2 sensor and a fresh air damper with actuator.
- At only one of the 13 locations VRF cassette and split units were in existence, for which a ducted inline fan was provided for the fresh air entry to the office space. A wall mount sensor was installed in this space with the inline fan being operated through the DDC controller.



DDC Controller with Return Air CO2 Sensor and a Fresh Air Damper with Actuator



DDC Controller with Wall Mount CO2 Sensor and an Inline Fan

System Operation:

- Atmospheric CO2 level ranges between 407-415 ppm. In the system, this value is set to 400 ppm. As the CO2 differential (i.e. difference between the measured return air CO2 level and atmospheric CO level) in a space should not exceed 530 ppm.
- DDC is programmed such that the damper will open to 20% once the system is initiated. When the CO2 differential reaches or exceeds 520 ppm value, the damper will further open up to 40%. In case still the CO2 differential does not reduce to 520 ppm the damper will keep on opening up further in increments of 20% till it opens up completely.
- Once the damper is open, it will purge in fresh air inside AHU room which will mix with the return air and help to bring down CO2 levels in the conditioned space.
- Algorithm is set with minimum CO2 differential value of 490 ppm and maximum CO2 differential value of 520 ppm. The damper will modulate based on these two defined values. Once the damper is open and CO2 value starts reducing, it will maintain its position till the CO2 differential value reaches 490 ppm. When CO2 differential value reduces below 490 ppm, the damper will start closing in decrements of 20%.
- In case the CO2 value is between 490 and 520 ppm then the damper will maintain its position which states that the correct amount of outside air is purged in to the system to maintain the CO2 levels in the conditioned space.
- In case of inline fan for fresh air control, the fan switches ON once the CO2 differential exceeds 520 ppm and is switched OFF once the CO2 differential reduces below 490 ppm.

BuildTrack App

The BuildTrack Application, installed on BuildTrack local server records the CO2 values in the spaces on a continuous basis.

- The application displays the Damper position at a particular instance and the corresponding CO2 values and also the CO2 differential.
- The display is separated out by individual rooms where the sensor and dampers are installed.
- The current values are displayed live and log reports for historical values can be generated as and when required.

The screenshot displays the BuildTrack App interface. At the top, there are navigation tabs for 'GROUND FLOOR(C)', 'FIRST FLOOR(C)', and 'GROUND FLOOR(A)'. Below these, a status bar shows 'LIST VIEW > GROUND FLOOR(C)' and 'Atmospheric Co2 : 400 ppm'. The main interface is divided into three sections: 'DAMPER', 'CO2 Sensors', and 'ACTIVITY LOG'. The 'DAMPER' section shows a slider control set to 17. The 'CO2 Sensors' section displays 'Room CO2 : 850 ppm' and 'Diff. CO2 : 250 ppm'. The 'ACTIVITY LOG' section is a table with columns for 'EVENT ID', 'EVENT NAME', 'STATUS', 'DAMPER POSITION', 'DIFFERENCE', 'PROPERTY NAME', and 'DATE & TIME'. A dropdown menu is open over the 'PROPERTY NAME' column, listing various building areas like 'E Wing [building]', 'Wing A [building]', 'Wing B [building]', 'Wing C [building]', 'Wing D [building]', 'Second Floor(c) [floor]', 'Fourth Floor(a) [floor]', 'First Floor(c) [floor]', 'Fifth Floor(a) [floor]', 'Ground Floor(c) [floor]', 'Fourth Floor(b) [floor]', 'Fifth Floor(d) [floor]', 'Fifth Floor(b) [floor]', 'Third Floor(d) [floor]', 'Fifth Floor(c) [floor]', 'First Floor(d) [floor]', 'Third Floor(c) [floor]', 'Ground Floor(a) [floor]', 'Main Office [area]', and 'Cabin [sub Area]'. The 'First Floor(c) [floor]' option is currently selected.

EVENT ID	EVENT NAME	STATUS	DAMPER POSITION	DIFFERENCE	PROPERTY NAME	DATE & TIME
54542	Co2 Level	892.578125	Open at 17	492.578125	F	ov 2019 11:56:50
54541	Co2 Level	890.625	Open at 17	490.625	F	ov 2019 11:55:23
54543	Co2 Level	894.53125	Open at 17	494.53125	F	ov 2019 06:27:24
54540	Co2 Level	888.671875	Open at 17	488.671875	F	ov 2019 06:22:08
54539	Co2 Level	1083.98437	Open at 17	683.98437	F	ov 2019 10:10:22
54538	Damper	ON at 17			F	ov 2019 10:06:21
54537	Co2 Level	888.671875	Open at 17	488.671875	Fifth Floor(d) [floor]	20 Nov 2019 10:06:21
54536	Co2 Level	867.1875			First Floor(c) [floor]	15 Nov 2019 09:20:45
54535	Co2 Level	888.671875			First Floor(c) [floor]	15 Nov 2019 09:20:42
54533	Co2 Level	1027.34375			Ground Floor(c) [floor]	15 Nov 2019 09:20:29

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