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Environmental Control System

Overview

The Environment Control System (ECS) will ensure a stable temperature and humidity while the facility is in use or operational, and lighting conditions will be managed to be appropriate for the time of the day. It will also monitor for fires or smoke in the premises and will activate the fire extinguishing system, while raising an alarm and alerting emergency services when fires are detected.

The ECS is split into three subsystems as there are three different groups of things to monitor and control. These three domains are:

- Temperature and humidity control system
- Lighting control system
- Fire and smoke alert system

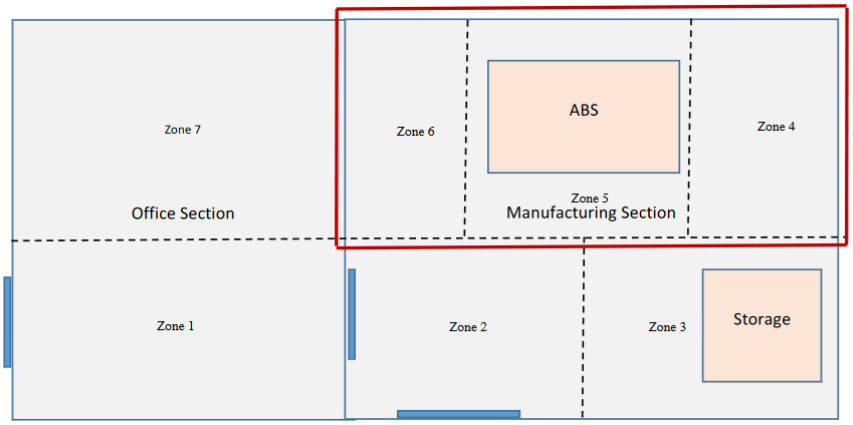

Figure 1. Manufacturing plant conceptual layout.

Temperature and Humidity Control System

The temperature and humidity control system will maintain the environment of the plant as three separate sections: zones 1 and 7, zones 2 and 3, and finally zones 4, 5, and 6. This means that each section will have their own temperature and humidity sensors, and a signal from the Safety and Access Control System (ACS) for each zone to receive information regarding the occupancy of each zone. An additional signal from a clock system is required to know the time of day, to account for the employee's work hours. Each of the three sections will also have their own heater, fan, and air conditioning unit. The corresponding actuators will be turned on/off whenever the sensors detect that the temperature or humidity are predicted to stray from the target levels, or whenever the sections are unoccupied, or whenever whether or not it is during working hours or not.

This system serves a dual purpose:

1. Maintaining a constant temperature and humidity for manufacturing.
2. Employee comfort.

These two purposes have different levels of strictness in regards to how far the temperature and humidity can stray from the target levels. People can stay comfortable in a range of temperatures and humidities, but the manufacturing process requires the temperature and humidity to stay at a constant

level. This means that the system should not deactivate itself for the manufacturing section because it is unoccupied and should also activate itself before work hours, so that the temperature and humidity are already at target levels when the manufacturing process begins.

Lighting Control System

The lighting control system is used to control the intensity of the lighting depending on the time of day, the presence of people, timers, and what time of the day/week it currently is. To achieve this, there is a lighting element that can be controlled by this system in every zone. The signal discussed above from the ACS will need to be used here to determine the presence of people.

There should be three levels of lighting intensity: high, low, and off.

- High: During working hours and while a zone has people within it, the lighting intensity should be set to high. The lighting intensity should remain high for a period of time after everyone within the zone leaves.
- Low: When there is no one within a zone for a period of time during working hours then the lighting intensity should be set to low. It should also be set to low shortly before and shortly after working hours.
- Off: This should be used where there is no one within a zone and when it is also not any time close to working hours.

Fire and Smoke Alert System

This system will monitor for fires within the premises and when fires are detected, activate the fire extinguishing system and raise an alert. This requires for there to be fire and smoke sensors in every zone along with sprinklers to douse any flames. The system will also be connected to alarms within the premises, which will activate regardless of whether or not there are any personnel within the building, and will also have a connection to outside of the system, to be able to alert relevant emergency services automatically.

The reason why the alarms within the building always activate is for safety reasons. It would be able to alert any personnel outside the premises due to the noise, and in the situation where the connection to the ACS has failed and the ECS does not know how many people are within the premises of the manufacturing plant, it would still alert any personnel still on the premises.

The fire and smoke alert system will also be connected to the Automated Bottling System (ABS) to suspend activities whenever a fire is detected.

Connection with the Whole System

The ECS is connected to other systems in three ways:

- Receiving information on how many people are in each zone from the ACS.
- Sending a signal to the ABS to suspend activities when a fire is detected.
- Sending a signal to the ACS to unlock all doors when a fire is detected.

As the ECS is mainly concerned with controlling the environment, there are not many signals that connect this system to other systems.

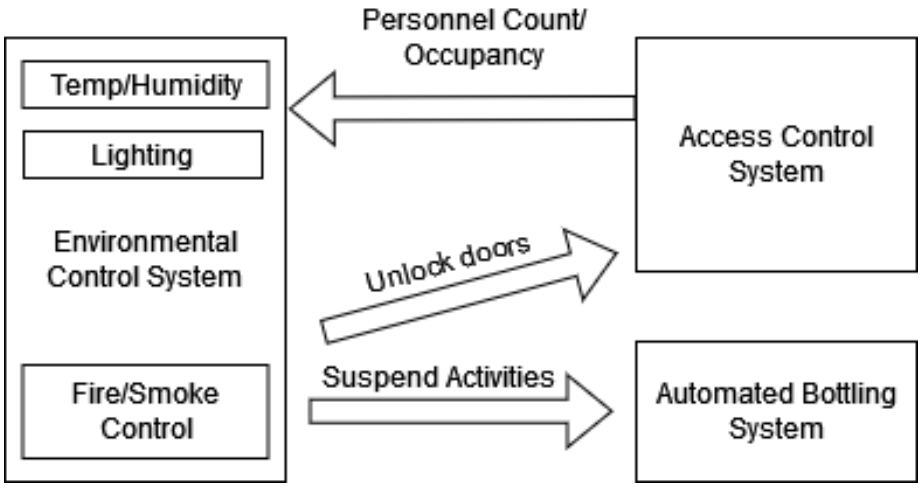

Figure 2. Diagram of connections between the ECS and other systems.