

Project and Laboratory Hotel Management and Safety System



Team: 51

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1 Introduction

Nowadays computerization is becoming the reference in each management and safety system. The Hotel management and safety system was realized in order to:

- Provide a simple and quick web management application to insert and remove customers into central Database.
- Guarantee a safety system able to detect fire or smoke inside each room, warning customers with mail service and central reception with an alarm message showed on Web Application.
- Provide an access control system with RFID reader where each customer owns its personal badge.
- Provide a room temperature monitor and regulation system for each customer.

2 System Overview

System is basically composed by an Ethernet network that works as a data connection between each component. It is important to guarantee a safety local Ethernet network in order to avoid unwanted attacks to the Central Server and Database. The system block diagram is showed in the following figure:

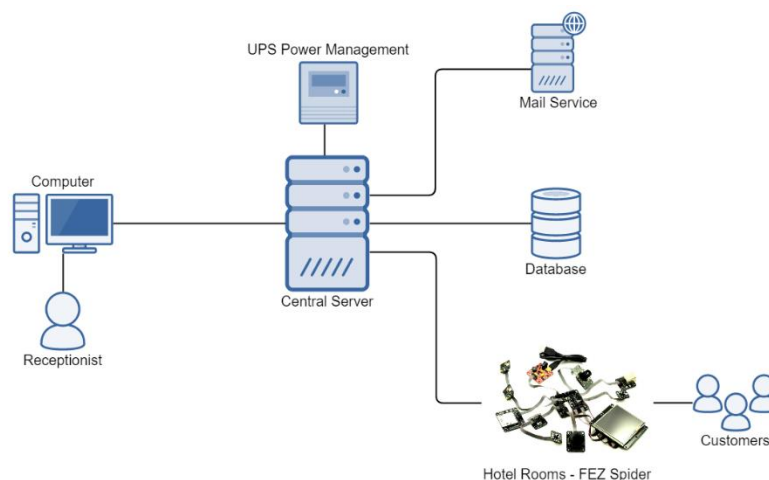


Figure 1: System Block Diagram.

- Central Server: is the core of the system. It provides the Web Application, Web Services and it is able to connect to a Mail Service and to the Database;
- UPS Power Management: provide the power supply to the server in order to avoid possible lost data;
- Mail Service: is a Gmail mail service used to warning customers in case of fire or smoke;
- Database: contains the main information of each customers and the state of their rooms;
- Hotel Rooms – FEZ Spider: FEZ Spider manages the temperature, detects the presence of smoke and control the room access through a badge.
- Computer: allow the access to the Web Application in order to manage the Database.

2.1 Central Server

The Central Server provides the Web Application and a set of Web Services used to guarantee all functionalities of the system.

2.1.1 Web Application

The Web Application can be used from a browser through a Personal computer, Tablet or a simple Smartphone. It has the following user interface:

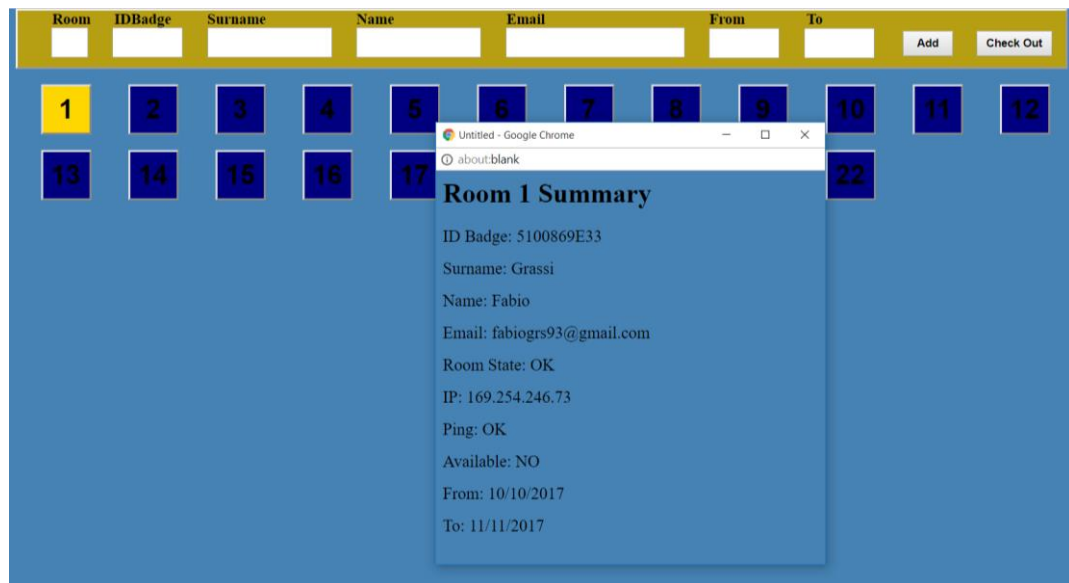


Figure 2: Web Application User Interface.

As we can see there are two buttons, a grid of square room buttons (one per room) and a set of seven text boxes where is possible to insert the data indicated by the label on the top of them. In particular, we have:

- Room Number: represents the room number inside the Hotel. If we insert an invalid number an Error Message is shown;
- IDBadge: is the badge code of Customer. In case of invalid code an Error Message is shown;
- Surname: is the Customer's surname. If we insert an invalid surname an Error Message is shown;
- Name: is the Customer's name. If we insert an invalid name an Error Message is shown;
- Email: is the Customer's Email If we insert an invalid email an Error Message is shown;
- From: is the starting date of the Customer. Here are allowed only date format as MM/DD/YYYY. If we insert an invalid date an Error Message is shown;
- To: is the ending date of the Customer. Here are allowed only date format as MM/DD/YYYY. If we insert an invalid date an Error Message is shown;

If we insert wrong characters in more than one field the application shows an error message.

There are also two button used for the insertion and removal of a customer inside the database.

Grid Room

Below the insertion part of the Web Application there is a set of square buttons, where each one is related to a specific room of the Hotel. Site is able to show the real available rooms of the hotel. Clicking on one square button appears a new window that shows us the room summary.

Each square button can have different color according to the room state. In case of:

- “BAD” Ping state the color will be Blue;
- “Alarm” State the color will be Red;
- “NO” Available state the color will be Yellow.

Instead, the default color is light grey. This type of indication is chosen because of its simplicity and immediacy in understanding the room state.

Customer Insertion

Customer insertion can be done simply filling correctly each field. After that, we can click on “Add New Customer”. Clicking “Yes” the Web Application sends a command to the Central Server that collects each inserted information and send them to the Database. The Central Server update also the corresponding FEZ Board with the IDBadge recorded inside the Database. Web Application receive a response from the Central Server useful to know if all operations are done correctly. In case of Database access error, FEZ Room connection error the Web Application shows a message.

Customer Removal

Customer removal can be done simply inserting the number of room that we want delete from the database. After that we can click on “Delete Customer”. Clicking “Yes” the Web Application sends a command to the Central Server that receives the inserted Room Number and reset the corresponding row of to the Database. The Central Server update also the corresponding FEZ Board with the default IDBadge “0000000000”. The Web Application receives a response from the Central Server useful to know if all operations were done correctly. In case of Database access error, FEZ Room connection error the Web Application shows a message.

2.1.2 Web Services

Web Services are a set of functionalities provided by the Central Server. They are used from the Web Application and FEZ Monitoring Systems. A brief description is given below in two different sections. First one is a list used by the Web Application while the second one is used by the FEZ Monitoring System.

Web Application Services

- **Update Database:** allows the Web Application to fill a row of the Database, and then updates the IDBadge code of the FEZ Monitoring System located in the right room;
- **Delete Database:** it allows the Web Application to reset a row of the Database, and then resets the IDBadge code of the FEZ Monitoring System located in the right room;
- **Read All Database:** it allows the Web Application to read all content of the Database.

FEZ Monitoring System Services

- **Alarm:** it allows the FEZ Monitoring System to update the state of the room inside the database signaling an “Alarm” state due to a possible smoke or fire inside it. When the service is invoked an email is sent to the customer to signal “Alarm” state;
- **State OK:** it allows the FEZ Monitoring System to update the room state inside the Database signaling an “OK” state. When the service is invoked an email is sent to the customer to signal “OK” state;

- **IDBadge:** it allows the FEZ Monitoring System to get from the Database its own IDBadge when it is reset or switched on. This service is mainly used to simplify the recovery of each IDBadge codes inside rooms after a black out of the AC Line inside the Hotel.

2.2 Mail Service

Mail service is outside of the Hotel Management System and it is provided by Gmail. For this reason we have associated a Google account to our Central Server with the following email: serverwebsvc@gmail.com. This service is used only to send email so the Central Server is not able to read email coming from customers.

2.3 FEZ Spider Monitoring System

FEZ Spider Monitoring System is based on a 32-bit ARM Microcontroller connected to some external device in order to provide the following functionalities:

- Temperature monitoring and regulation: FEZ Spider measures the room temperature and if the Heating or Cooling are switched on it can maintain it;
- Fire and smoke detection: FEZ Spider detect the presence of Fire or smoke using a sensor and it send an alarm message to the server activating an acoustic signal inside the room;
- Access Control: FEZ Spider check trough a RFID detector the presence of a badge outside the room. When the access is allowed the electric lock is unlocked;
- Central server connection: it is represented by the Ethernet connection used by the FEZ system to request all Web Services needed.

FEZ system is also connected to a Color Touch Display that allow the customer to set the desired temperature, activate or deactivate the Heating or Cooling.

3 Setup

Setup of the Hotel Management System require a Server where is installed SQL Server with an authentication given by Username and Password. Server must be connected to internet and all of room inside hotel needs of a FEZ System connected to the internal Ethernet network. Web Application can be used through a standard Computer, Tablet or Smartphone connected to the same network of the Central Server simply by typing:

Web Application: <http://IPAddressOfServer/Site/WebUI.aspx>

The creation of the Database is not done by the Web Application since it is only able to read or update it. For this reason, a simple program is used to create the desired number of room inside database. The IP address of a room can be assigned manually. The program is called “Database Loader”.

It has the following user interface:

Figure 4: “Database Loader” Window.

As we can see there are five sections:

1. Insert-Remove Room Section:
 - Rooms Number text box: here we can insert desired rooms number inside the Database. If we insert an invalid number an error message is shown in the Message Section;
 - Progress Bar: is used to view the progress of the program during the operation;
 - Load Button: it is used to create or update the database with the desired number of rooms. If the updated fails Message Section signals “Database or Format Error”;
 - Actual Number label: it indicates the actual number of rooms inside the Database.
2. Load IP Section:
 - Room Number text box: is used to insert the room number which we want assign the inserted IP. If we insert an invalid number an error message is shown in the Message Section;
 - IP Address text box: it is used to insert the IP Address associated to the room number inserted. If we insert an invalid IP an error message is shown in the Message Section;
 - Load IP Button: it is used to update the IP address of the Room.
3. Message Section: used to indicate the status of the operations or possible errors.
4. Exit Button: it is used to exit from the application.
5. Delete Section: there is a button used to delete the Database from SQL Server.

If the loading of the application is done correctly will be shown the message “Starting OK”. In case of incorrect Connection String or unreachable Database will appear the message “Database Error”.

Inserting and Removal Room Operations

If we want insert or remove room inside the Database, we can simply insert in the Rooms Number text box the desired number of rooms. If the number is lower than the actual one the program will

remove the rooms in excess otherwise it will add the required number of rooms. If we want to reset the Database, we can type the number 0. In this way the program will delete all rooms inside the Database filling them with the default values. After typing the rooms number, we have simply to click on Load button. If the operation will be done correctly the application will show the message “Database Updated.” and the progress bar will be filled.

In case of incorrect room number format will appears the message “Invalid Room Number.”

In case of Database update error will appears the message “Database Update Error.”

If the Database has been updated the Actual Room number will be updated.

Load IP Operation

If we want to assign the IP Address to a specific room, we have simply to type the Room Number and the IP Address inside the relating text boxes. Then we can simply click on Load IP button and the application will update the Database. The updating is visible using the Web Application from a browser. If the operation will be done correctly the application will show the message “IP Assigned.”

In case of incorrect room number format will appears the message “Invalid Room Number.”

In case of Database update error will appears the message “Database IP Assignment Error.”

Connection String

Since the Database can be inside a different SQL Catalog or the SQL Server can have different Username and Password, is possible to modify the Connection String inside a txt file provided in the same Folder of the “DatabaseLoader.exe”.

4 Applicability, Cost and Market Perspective

This system can make each structure more automatic, more innovative and safer and thus more desirable. Thanks to its flexibility it has a wide range of applicability, in fact it can be involved in any accommodation structure: hotels, touristic villages, camping villages with bungalows and aparthotels.

Receptionist can quickly and easily manage all rooms of the hotel with any device able to establish an internet connection.

System improve the customers comfort thanks to the intuitive control of temperature and the better portability and simplicity of badge with respect standard key. Also the safety is improved because of gas sensor which detect possible dangerous fire. In real time it communicates the alarm to the reception through web application, to customers through mail and an acoustic signal activated inside the room.

System cost depends on the number of rooms that we have to manage. The single room monitoring system has a limited cost lower than 100 euro. Database and the application instead, are setup inside the server and its cost is related on the performances required and on the number of customers that must be handled.

Possible future improvements can be a better graphical user interface and a database able to record each customer information to simplify each operation when it comes again in the hotel.