Workshop on Basic Electronics using Logical Gates (Percentage of Final Grades: 20%)

Objective

Design and implement a simple intrusion detection alarm system using logic gates. The system will detect unauthorized entry attempts through a main door or an exterior window, as well as movement inside the house.

System Description

A house requires an alarm system to detect when intruders attempt to enter without authorization. The system includes the following components:

- **Main Door and Exterior Window**: Each is equipped with an **open/close sensor** (digital).
- **Main Power Switch**: A **digital switch** to turn the system on or off.
- **Motion Sensor**: This sensor should activate the alarm **only when the system is powered on**.
- **Pet Mode Switch**: Since some households may have pets, the motion sensor can be disabled using an additional switch.

The **sensors will be simulated using DIP switches**, and the **alarm will be represented by an LED**.

Logic Implementation

To implement the alarm system, you must use **AND** and **OR** logic gates to satisfy the following conditions:

1. The alarm should be **activated if**:
    - The main door is opened **OR** the exterior window is opened **AND** the system is turned on.
    - Motion is detected **AND** the system is turned on, unless the **Pet Mode Switch is disabled**.
2. Use **AND** and **OR** gates appropriately to ensure the correct logic behavior.

Required Components

- DIP switches (to simulate digital sensors)
- LED (to represent the alarm)
- Logic gates: **AND** and **OR**
- Protoboard and wires
- Power source

Instructions

1. **Set up the circuit** on the breadboard following the logic described above.
2. **Connect the DIP switches** to simulate the sensors (door, window, motion, power, and pet mode).

3. **Implement the logic gates** to control the alarm activation based on the defined conditions.
4. **Test the system** by toggling the DIP switches to simulate different scenarios.

Expected Outcome

When the system is powered on:

- The alarm should activate when the **door or window is opened**.
- The alarm should activate when **motion is detected**, unless the **Pet Mode Switch is enabled**.
- If the system is off, the alarm should remain inactive regardless of other inputs

Grading rubrics

The grading rubrics will be as follows:

- An image (it can be a photo) with the implemented design (10%)
- The operative use cases:
    - The main power switch disabled and all the other sensors activated. The alarm must be powered off (15%)
    - The main power switch enabled, the door switch powered on, and all the other switches disabled. The alarm must power on (15%).
    - The main power switch enabled, the window switch powered on, and all the other switches disabled. The alarm must power on (15%).
    - The main power switch enabled, the motion sensor powered on, the pet switch sensor powered off, and all the other switches disabled. The alarm must power off (15%).
    - The main power switch enabled, the motion sensor powered on, the pet switch sensor powered on, and all the other switches disabled. The alarm must power on (15%).
- Clean code of wiring (15%)

This assignment will be graded on March 18th during class time. No prorogations allowed.