Experiment Title. 2

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Branch: CSE-AI/ML **Section/Group: 109-A**
Semester: II **Date of Performance: Feb 25, 2023**
Subject Name: Digital Electronics **Subject Code: 22ECH-101**

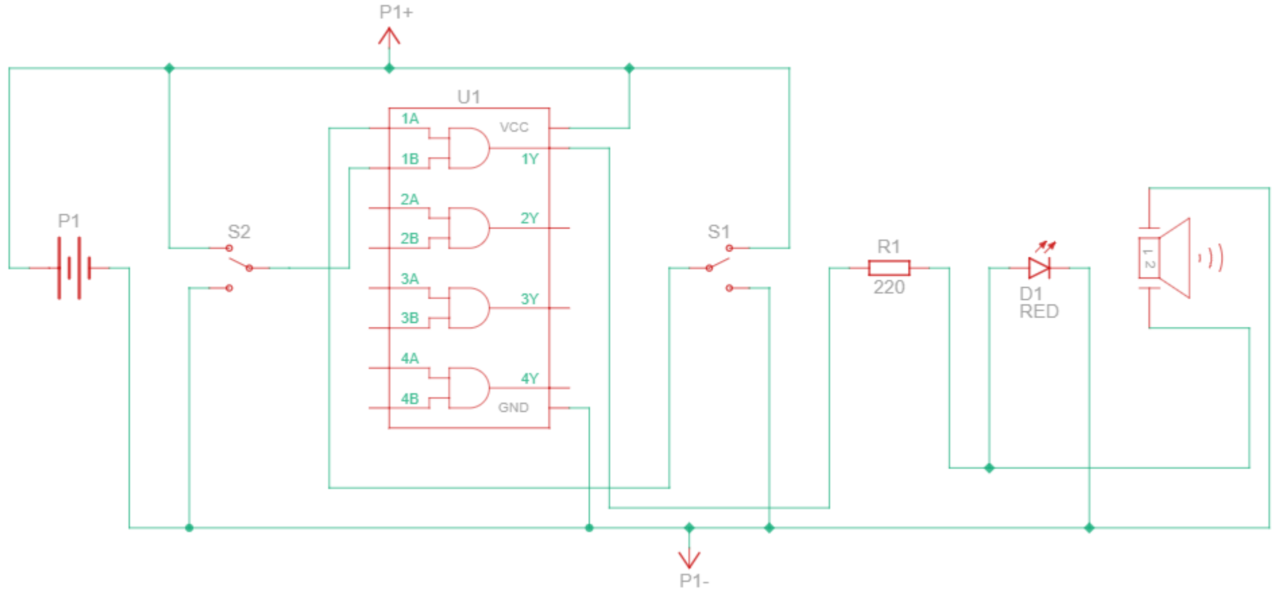
1. **Aim:** (a.) Design a Burglar Alarm using AND Gate
   (b.) Design a single doorbell ringer for both front and back doors using OR Gate
   (c.) Design an Automatic Fan Controller using NOT Gate

2. Requirements :

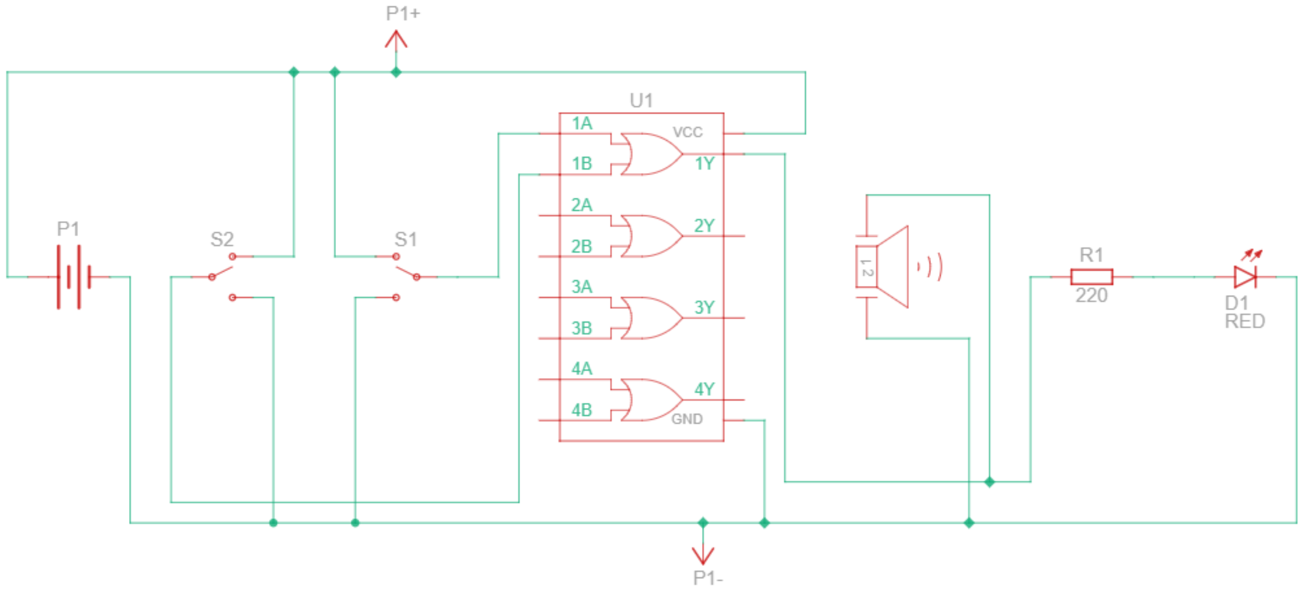
i. **Software :** TinkerCad
ii. **Hardware :** Breadboard, Connecting Wires, IC for 7408,7432,7404, Power Supply, Slideswitch , 220 ohm resistor, LED, piezo, DC motor.

3. Circuit Diagram:

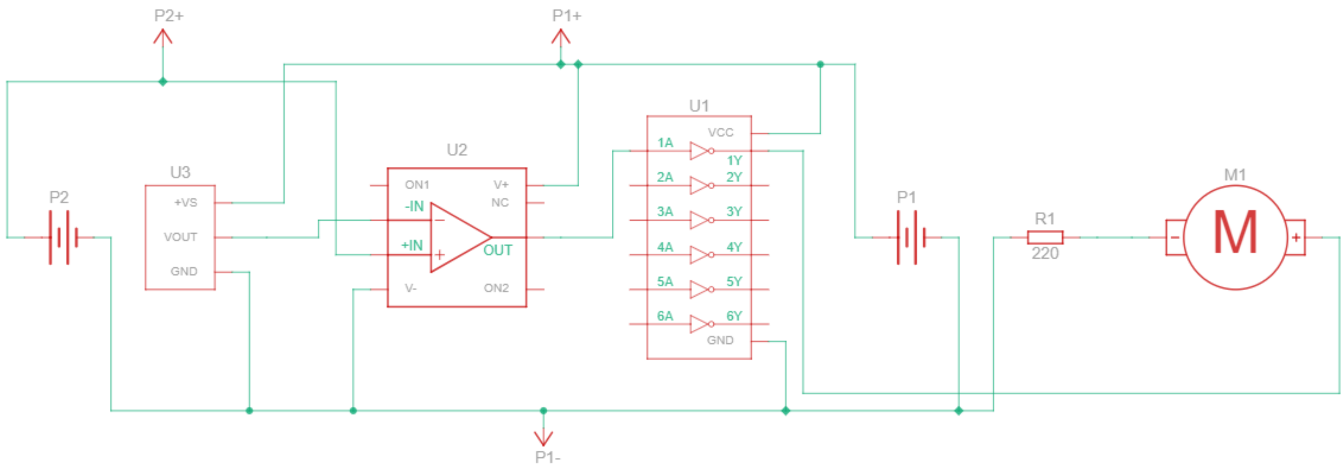
(a) Schematic Diagram for Burglar Alarm using AND Gate :



(b) Schematic Diagram for Doorbell Ringer using OR Gate :

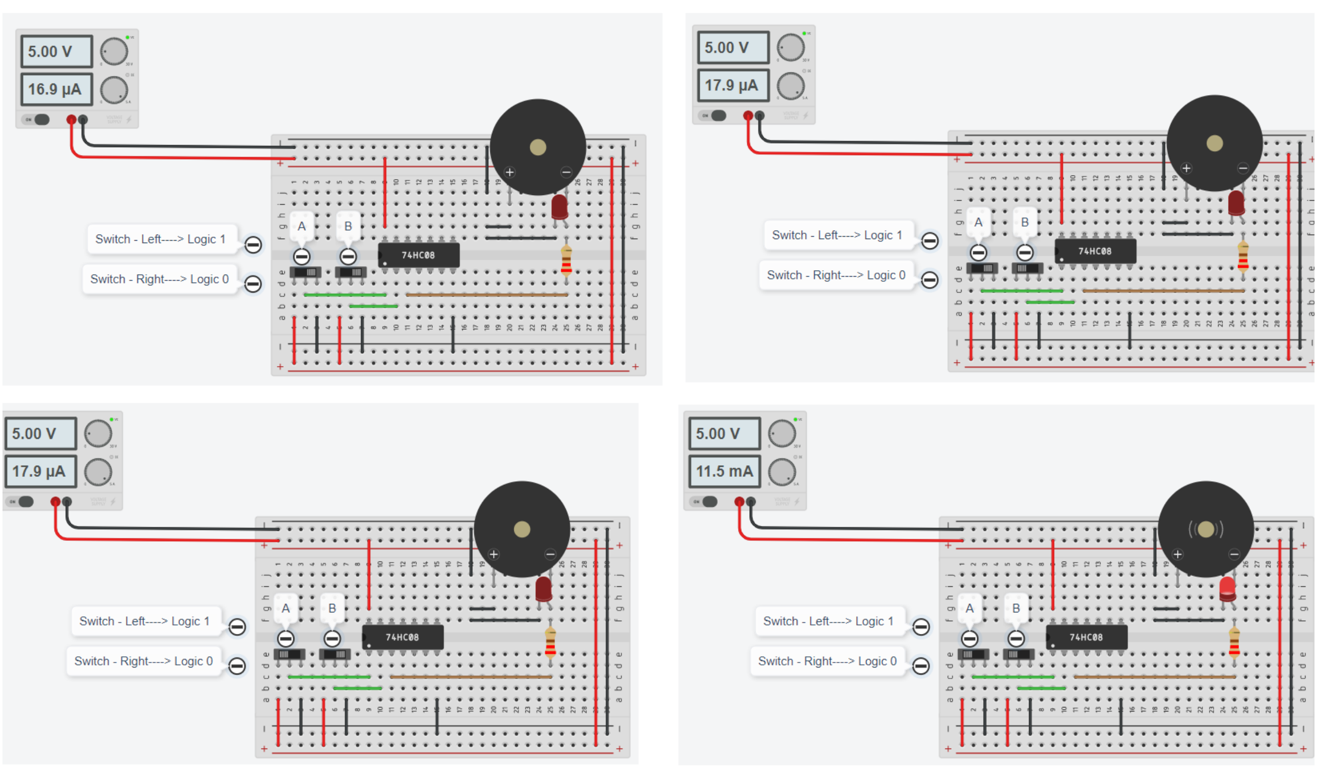


(c) Schematic Diagram for Automatic Fan Controller using NOT Gate :



4. Simulation Results :

(a) Burglar Alarm Using AND Gate

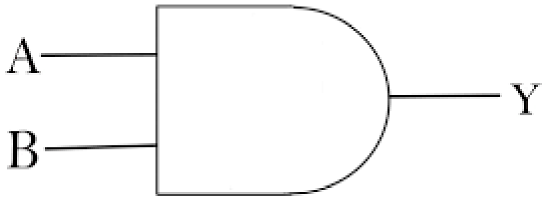


Concept Used : In a burglar alarm circuit using an AND gate, the concept of logic gates is utilized to produce an output signal when two input signals are present.

An AND gate is a digital logic gate that produces a high output signal (usually represented by a 1) only when both of its inputs are high (1). In the context of a burglar alarm circuit, the AND gate receives two input signals - one from a sensor that detects motion or a break-in and another from a switch that arms or activates the alarm system.

When the sensor detects motion or a break-in, it sends a high signal to the AND gate, but this signal alone is not enough to activate the alarm. The switch that arms or activates the alarm system also needs to send a high signal to the AND gate for the alarm to be activated.

Thus, only when both the sensor and the switch send high signals to the AND gate, the alarm is activated, and a signal is sent to the siren or other alarm device to sound an alarm. This allows for a reliable and secure burglar alarm circuit that can be easily implemented using an AND gate.



The output of AND gate is determined by the logical operation of multiplication. If both inputs are 1, the output is 1. Otherwise, the output is 0.
The truth table for an AND gate is as follows :

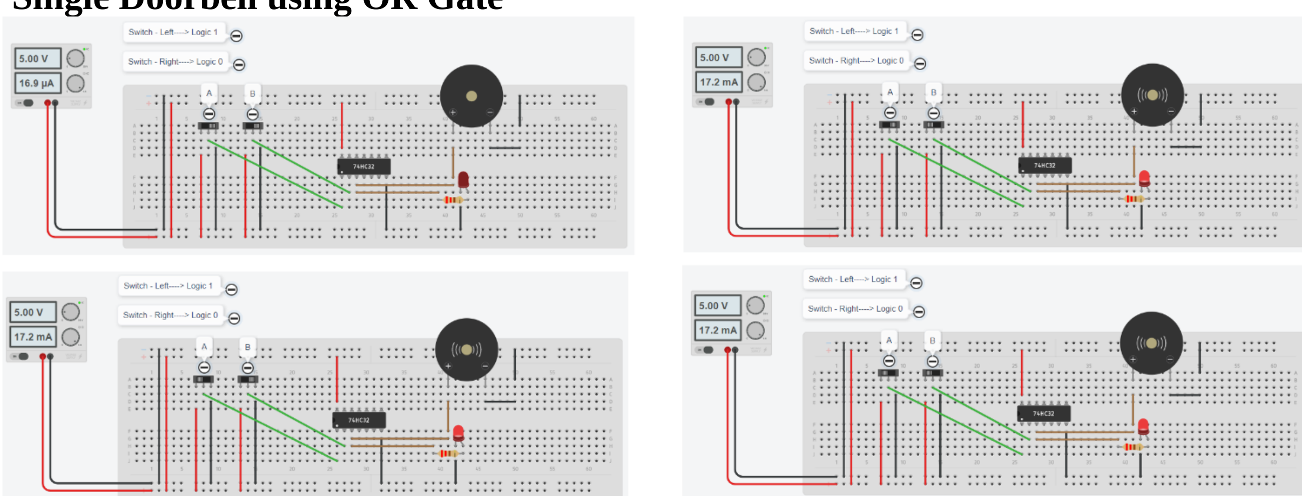
Truth Table :

Input		Output
A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

For example, if input A is 1 and input B is 1, the output Y is 1. However, if either input A or input B is 0, the output Y is 0.

The AND gate is a fundamental building block of digital logic circuit and is used in many applications, such as in design of the microphones, memory units and control units.

(b) Single Doorbell using OR Gate



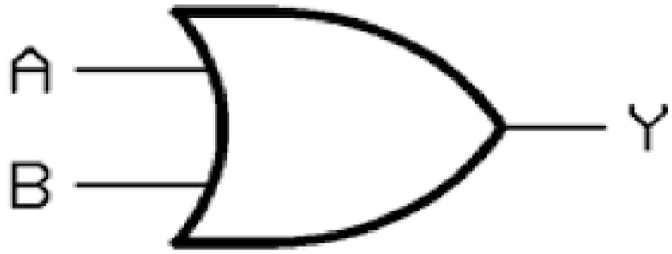
Concept Used :

The concept used in a Single Doorbell using OR Gate that uses a slide switch is logic gates and digital circuits.

The doorbell circuit uses an OR gate to combine two inputs, one from the doorbell button and the other from the slide switch. The OR gate produces a high output if either of the inputs is high. This output is then used to trigger a transistor switch, which in turn activates the doorbell.

The slide switch is used to control the doorbell's behaviour. When the switch is closed, it allows current to flow through the circuit, enabling the doorbell to ring. When the switch is open, the doorbell is deactivated, and it will not ring even if the doorbell button is pressed.

Overall, this circuit demonstrates how digital circuits can be used to implement logical operations, and how the behaviour of a system can be controlled using switches.



The output of OR gate is the logical sum of its input signals. In other words, the output is true if either of the input signal is true or if both are true.

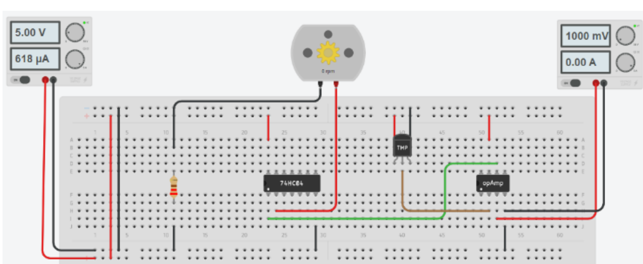
The truth table for an OR gate is as follows :

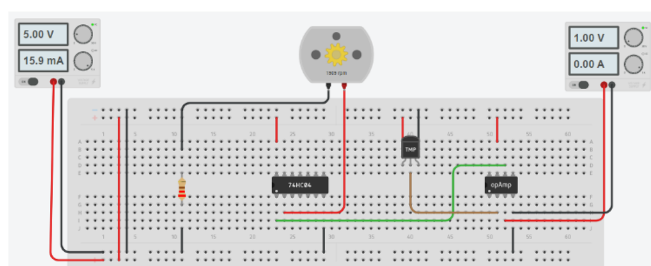
Truth Table :

Inputs		Output
A	B	Y=A+B
0	0	0
0	1	1
1	0	1
1	1	1

This makes the OR gate a useful building block in digital circuits where multiple inputs need to be combined in a way that it is sensitive to the presence of any of one of them. For example, OR gates are commonly used in the design of electronic circuits that control lightning, heating, and other household appliances.

(c) Automatic Fan Controller using NOT Gate





Concept Used : An automatic fan controller using NOT gate can be designed based on the concept of temperature sensing and logic gates.

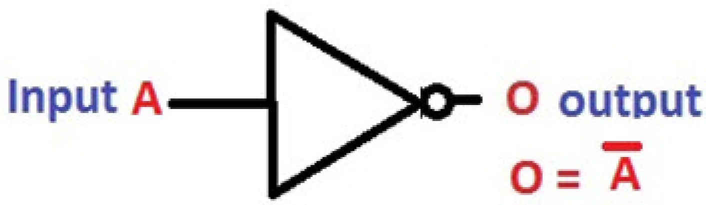
The basic idea is to use a temperature sensor to measure the temperature of the surrounding environment, and based on the temperature reading, control the speed of the fan using a NOT gate.

In this system, the temperature sensor provides an analog output, which is then converted into a digital signal using an analog-to-digital converter (ADC). The digital signal is then fed into a NOT gate, which inverts the input signal. The output of the

NOT gate is then used to control the speed of the fan, for example, by driving a transistor or a relay that switches the fan on or off.

When the temperature is below a certain threshold, the output of the temperature sensor will be low, which will be inverted by the NOT gate, producing a high output. This high output will then turn on the fan, increasing its speed. When the temperature rises above the threshold, the output of the temperature sensor will be high, which will be inverted by the NOT gate, producing a low output. This low output will then turn off the fan, reducing its speed.

Overall, the concept of using a NOT gate in an automatic fan controller is to invert the signal from the temperature sensor and use it to control the fan speed based on the temperature reading.



The NOT gate is sometimes referred to as an inverter because it “inverts” the input signal. The truth table for a NOT gate is shown below :

Truth Table :

Inputs	Output
A	O
0	1
1	0

It is a fundamental building block in digital circuits, used to compliment or invert a signal as needed. For example, NOT gates can be used to convert a positive logic signal (where “1” represents “true”) to a negative logic signal (where “0” represents “true”), or vice versa. NOT gates are also used in combination with other gates to perform more complex logic operations.

5. Observations : Here are some observations that can be made during this process:

1. **AND gate:** The AND gate produces an output of 1 only when both of its inputs are 1. When one or both inputs are 0, the output is 0. This behaviour is consistent with the AND gate's truth table.
2. **OR gate:** The OR gate produces an output of 1 when one or both of its inputs are 1. It produces an output of 0 only when both inputs are 0. This behaviour is consistent with the OR gate's truth table.
3. **NOT gate:** The NOT gate produces an output that is the opposite of its input. When the input is 1, the output is 0, and when the input is 0, the output is 1. This behaviour is consistent with the NOT gate's truth table.

Observing and verifying the output behaviour of logic gates using their truth tables is an important step in digital electronics, as it helps ensure that the circuits are functioning as expected and that the logical operations are being carried out correctly.

6. Troubleshooting:

1. Messy Circuit Connection & loose connection.

2. **Incorrect gate implementation:** Another error that can occur is when the gate is not implemented correctly. For example, if you are testing an AND gate and accidentally implement an OR gate instead, you will get incorrect results. Double-check your gate implementation to make sure it matches the logic symbol for the gate you are testing.

3. **Faulty equipment:** Finally, it's possible that the error is not related to the gate or the truth table, but rather to faulty equipment. Make sure that your testing equipment is working properly and is calibrated correctly.

7. Result: The integrated circuits and their connection on the breadboard were studied and implemented. The practical applications of logic gates(AND,OR & NOT) were studied and implemented.

Learning outcomes (What I have learnt):

1. Understanding the concept of logic gates.

2. Identifying the logical function of a gate.

3. Evaluating the performance of a circuit.

4. Verifying the correctness of a gate.

Evaluation Grid:

Sr. No.	Parameters	Marks Obtained	Maximum Marks
1.	Worksheet completion including writing learning objectives/Outcomes.(To be submitted at the end of the day).		12
2.	Viva		8
3.	Student Engagement in Simulation/Demonstration/Performance and Controls/Pre-Lab Questions.		10
	Signature of Faculty (with Date):	Total Marks Obtained:	
