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DESIGN OF AN AUTOMATED SINGLE AND MULTI-ACCESS DECODER LOGIC FOR MONITORING ROOM ACCESS.

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ABSTRACT

Today, the technological advancement in monitoring and security systems is simply awesome. It finds prominent applications in such areas as communication, education, banks, research and business. In this paper, room-access decoder logic was designed to monitor access to room(s), and promptly gives its status at any point. Two types of access were considered: - single access (SA) and multiple access (MA). Appropriate logic was designed for both cases using Digital counters, logic gates, and other discrete components. For the single access decode logic, the decoding process is triggered by two indispensable inputs, the push button (P), and the ray (R). When a person is about to enter the room, only the input (R) is triggered, where as when a person is leaving the room, both button and ray will be triggered. The decoder logic was built around a 74LS193 counter. It is a pre-settable 4-bit up/down counter with dual clocks. The status of the two clock inputs determines if the clock will count up or down. To achieve this without conflict, a tri-state gate was employed. For the multi-access decoder logic, the design was based on 3-core inputs; footmat (F), ray(R) and button (B). Access could be in or out. These two events (IN and OUT) were coded by sequencing the activation of these inputs. Truth tables of the logic were presented to show the various states and possibility to know how many people that have accessed a room, when and how.

Keywords: Room-access, single-access, multiple-access, footmat, ray, button.

INTRODCUTION

All over the world, rooms are used for various purposes, ranging from domestic to commercial. Sometimes, there might be need to monitor who accesses a room when, and how. At other times there might be need to know the status of a room. That is whether occupied or not (example in hotels).

This paper presents a design which swiftly answers all these questions. The logic helps to monitor and decode access to rooms in such a simple manner. Similar work has been done on this topic, but none employed a simple logic like this. None also counts the number of persons inside. In [4], a room access monitoring system, which integrates computer and microcontroller MOTOROLA MC68HC11A8 was designed to monitor and ensure that only authorized person gains access to a room. Assembly language was used to program the microcontroller and Visual Basic 6 (VB) was used to develop the monitoring system. [1] designed a guest room control and monitoring system for hotels. This monitoring system integrated room temperature controls, Lighting controls, dimming groups, lighting controls, on/off Curtain controls.

In this paper, two types of access were considered; single-access, and multi-access. Single access is for rooms where only one person is allowed to enter and on no account should the door be opened for another person to enter (example vault etc). Then, multi-access is a case where as many people as possible can access the room anyhow and anytime. In both cases the logic decodes the status of the room, counts and displays how many people inside the room. The design was built around a pre-settable 4-bit up/down counter with dual clock. The 74LS193, which is a mod-16 binary counter, was used.

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THE SINGLE-ACCESS DECODER LOGIC

This is a case where only one person accesses a room at a time, and on no condition should the door be opened for another person to enter. The decoding process is triggered by two indispensable inputs, the push button (P), and the ray (R).

When a person is about to enter the room, only the input (R) is triggered, where as when a person is leaving the room, both button and ray will be triggered. The decoder logic was built around a 74LS193 counter. It is a pre-settable 4-bit up/down counter with dual clocks [2]. The status of the two clock inputs determines if the clock will count up or down. For the counter to count up at certain times and automatically counts down at another time, some external logic is required. In order to count up, the counter's countdown clock pulse input (CP_D) must be held HIGH and the counter's count up clock input (CP_U) connected to a clock pulse. So if the same bus is assigned to the clock and the HIGH state, it means that one of them should be the bus master at a time to avoid bus conflict. To achieve this, a tri-state gate was employed [3].

A tri-state gate is a logic gate that has three terminals, input, enabling input, output. The enabling input of the tri-state gate can be active HIGH or LOW. Here an active LOW tri-state gate was employed. This means that whenever a LOW signal is applied at the input, whatever is at the input appears at the output.

The Single-Access Logic

The diagram of the single access decoder logic is as shown in figure 1.

The logic starts with the door closed. At this point, D flip-flop will contain data zero. Since this is input to AND3, output of the latter will be zero; this enables tri-state2 (since it is active LOW). At the same time, this data is inverted by NOT 5 whose output is an input to AND2. So when the ray (mounted across the door) is interrupted, the second input to AND2 goes HIGH which leads to its output being HIGH also. Consequently, TR1 is disabled or tri-stated which causes +5V of the gate to be denied access to a clock pulse while the clock pulse becomes the bus master. Since CP_U is has a clock attached to it and CPD HIGH, the counter automatically counts up, indicating an entrance.

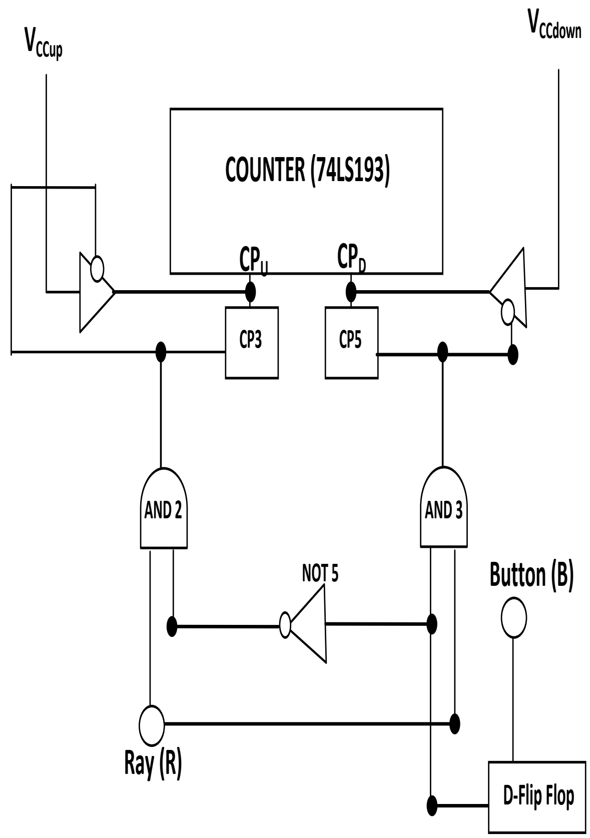

Figure 1: Logic Diagram for the Single Access Decoding (SAD)

The reverse takes place when the person is going out. To go out, the push button MUST be pressed, thus if the ray is interrupted, the two inputs of AND3 goes HIGH tristating the associated +5V and by means of a NOT gate one of the inputs of AND2 becomes LOW, forcing its output to go LOW. Consequently, TR1 is enabled and this eventually assigns the bus to the associated +5V denying CP3 the bus. Since CP_D has a clock and CP_U is held HIGH, the counter counts down, indicating an exit. The logic is summarized in table 1.

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Action	B	R	TRI 2	CP5	$\overline{B}$	TRI 1	CP3	Counter mode
Door Closed	0	0	Enabled	Disabled	1	Enabled	Disabled	No Count
In	0	1	Enabled	Disabled	1	Tri-state	Enabled	Counts up
	1	0	Enabled	Disabled	0	Enabled	Disable	No count
Out	1	1	Tri-state	Enabled	0	Enabled	Disable	Counts down

Table 1: Truth table of the Single access decoder

Multi-Access Decoder Logic

For a case where more than one person accesses the room, there is this tendency that one will press the button for another person to enter. If this condition is allowed to stay, it means that Button (B) =1, and Ray (R) =1 which corresponds to the last row of table 1 whose action is "out" and counters status is "count up". Bus as you can see the action here is "in" and the counter is going to count up. This is an anomaly that can be corrected using another logic called the multi-access decoder logic (MADL).

The correction of this anomaly led to the inclusion of a switching circuit on the foot mat at the entrance. When the foot mat is matched, it switches to logic 1. So the design was based on 3-core inputs; footmat (F), ray(R) and button (B). Access could be in or out. These two events (IN and OUT) were coded by sequencing the activation of these inputs. The access sequence code is presented in table 2. When the foot mat is activated, AND the ray obstructed, (FR) the circuit understands that one is going in. Also when the button is press AND foot mat matched (BF) the circuit also understands it as an entrance, thus the logic switches the counter to the appropriate count mode. On the contrary, when the button is pressed AND ray obstructed (BR), the circuit understands it as an exit, and the logic switches the counter to the appropriate count mode (count down).

Table 2: Input code sequencing

Action	**Access Sequence Code (ASC)**	**Logic level**
In	FR	1
In	BF	1
Out	BR	1

Following the word description above, the logic design was realized using AND gate and OR gate because of the action in 1 and 2 of table 2. These inputs are temporary switches which imply that when they are activated, their switching states changes instantaneously. As a result, registers were introduced between these switching inputs to hold their activated states until they are cleared. This was realized using D flip flops a one-bit register (74LS74). All the AND gates used where two input AND gates (74LS08) and thus each input contains a D flip flop. The D flip flops are all cleared immediately the door closes but the design was such that at some time D1, D3, D5, are cleared. The clearing is done to facilitate and authenticate the access code as stated earlier. The possible states and status of these devices and switches are presented in table 3.

Table 3: truth table of the Multi-access decoder

Input			Register status						
F	R	B	D 1	D 2	D 3	D 4	D 5	D 6	Counter Mode
1	1	0	0	X	1	1	0	X	Count Up
1	X	1	0	1	1	X	1	1	Count Up
X	1	1	1	1	0	1	0	1	Count Down

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"X"-means "Don't care"

"X" implies that it could be 0 or 1. For row one of the table if the foot mat is matched and the ray obstructed, definitely the button signal must be LOW and the logic switches the counter to count up mode. Row 2 of the table shows that if the button is pressed and foot mat matched (BF) the counter also switches to the count up mode whether ray R is obstructed or not in readiness to count up. If the ray is obstructed, then the counter increments by 1. Row 3 shows that if the button is pressed and raw cut (BR) the counter switches to count down mode and decreases by 1.

The counter when switched to a particular state remains that state as long as the door is open. The speed of the door is such that it does not stay open for a long time so as to help avoid possible milling around. The logic diagram is as shown in figure 2

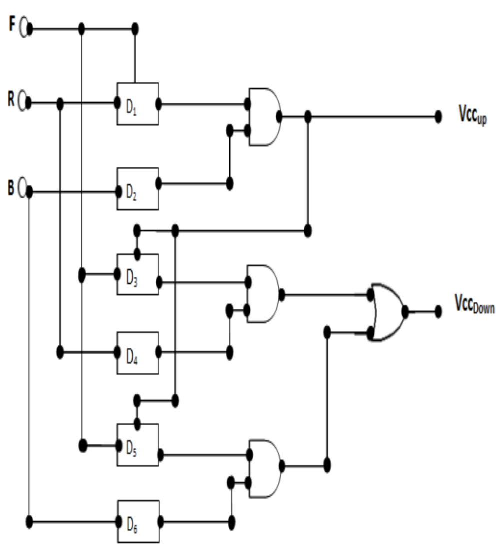

Figure 2: Logic Diagram of the Multi-access Decoder

CONCLUSION

In this paper, a single and multiple room access decoder was designed. The logic decodes how many people are inside a room at any point in time. The design was done using a counter (74LS193), tri-state gate, OR gate, AND gate and NOT gate. It can be applied in many places like hotels, banks and industries etc.

RECOMMENDATION

The logic can be expanded so as to display the status of the room (That is if it is still occupied or not) on a computer system. This can be achieved by writing a program that can read/write to the computer port and then the computer interfaced to the decoder. By so doing hoteliers for instance can always know the status of the various rooms at every point in time.

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