KULLIYYAH OF ENGINEERING
DEPARTMENT OF MECHATRONICS ENGINEERING

MCTE 2332
DIGITAL SYSTEM & MICROPROCESSOR
SECTION 1

DLD Project

Title: **Light Detector with a IC 7400**

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Reported by:

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Objective

-To detect the presence or the level of light.
-To build a light detector circuit.

How this light detector can be beneficial to the community?

- Security
When the night, let say there is no light when someone comes with a torchlight or other things that come light, this light detector will sense the presence of that light and make the LED and buzzer switch on.

- Agriculture
We know sunlight has important implications for agriculture. Various crops need varying quantities of sunshine, so it is important to know which plots of land are most vulnerable. This light detector will be helpful to the farmer to isolate their type of plant according to the proper level of light.

Design process

In this project, I use NAND gate chip which is 7400 series IC (Quad NAND gate) to create a light detector circuit. Another important component to detect the presence of light in this project is a photoresistor. A photoresistor's resistance changes in proportion to the amount of light it is exposed to make this project can be done. As we know there are a few types of photoresistor but the one that I use in thinkerCAD is when it is bright, it has low resistance. When it is in darkness, the resistance will be high. I also put another component like resistors, LED, Buzzer, LM7805 and 9V battery. Since the maximum voltage that can be feed for 7800 IC is 5V, I use LM7805 to restricts the output voltage of the 9V battery to 5V output. So that 5V can be input for this circuit without damaging 7400IC. There is a voltage divider in this circuit. By place fixed resistors in voltage divider, I can exploit this resistance-altering behaviour so that when connected to NAND gate. I can produce a logic HIGH output when the photoresistor is exposed to bright light and a logic LOW output when the photoresistor is exposed to darkness.

Components:
- 7400 Quad NAND Gate Chip
- Photoresistor
- Resistors
- LED
- 9V battery
- LM7805
- Buzzer

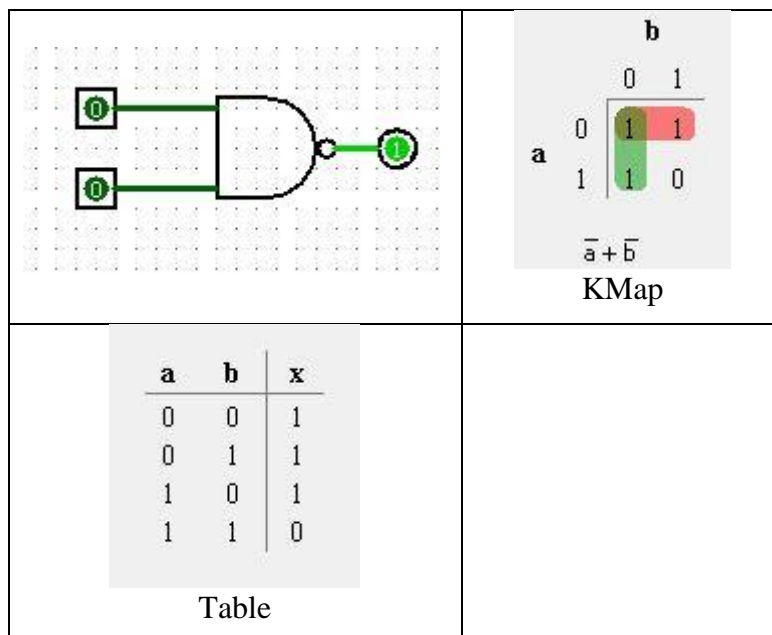# Detailed design

7400 Quad NAND Gate Chip
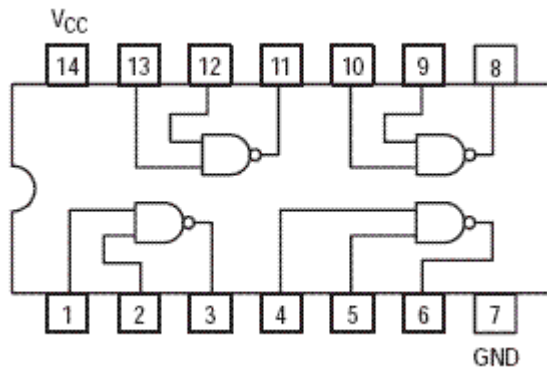
Since in this project I only use one NAND gate, so I use pin 1 & 2 as input and get the output of the NAND gate at pin 3. The 5V to be fed on this IC I put it at pin 14 and pin 7 as ground. The rest of the pin I let it not connected to anything.

The following shows the analyzation of NAND logic gate by Logisim

KMap

Table

We can see from the table when one of the inputs is 0, the output will be 1(HIGH) and when the inputs both 1 the output will be 0(LOW). As the output HIGH, V_{cc} will be drawn up and load will be powered. And as for the output LOW, V_{cc} will be drawn down and there is no power on the load.

Below is schematic of the circuit by multisim
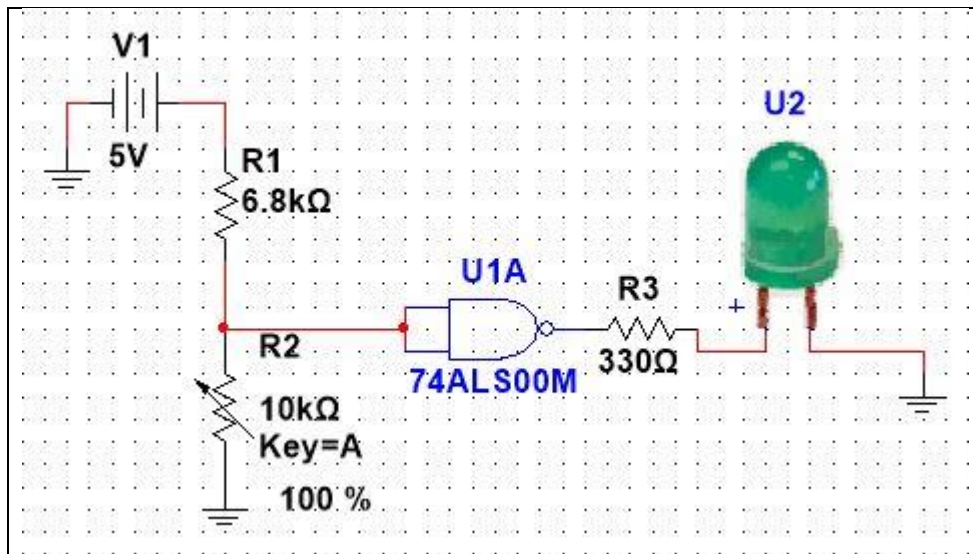
With the limitation of the components, In the multisim I do not put buzzer but in the ThinkerCad I put the buzzer. Also in ThinkerCad I do put photoresistor but in multisim I put variable resistor but the main idea is almost the same, the change of resistance values that are effect the output of the circuit. LED is connected to 330 ohm current-limiting resistor to protect the LED from excess current. For the fixed resistance I choose the value which is larger than photoresistor.

Below is the all of the connection in the ThinkerCad
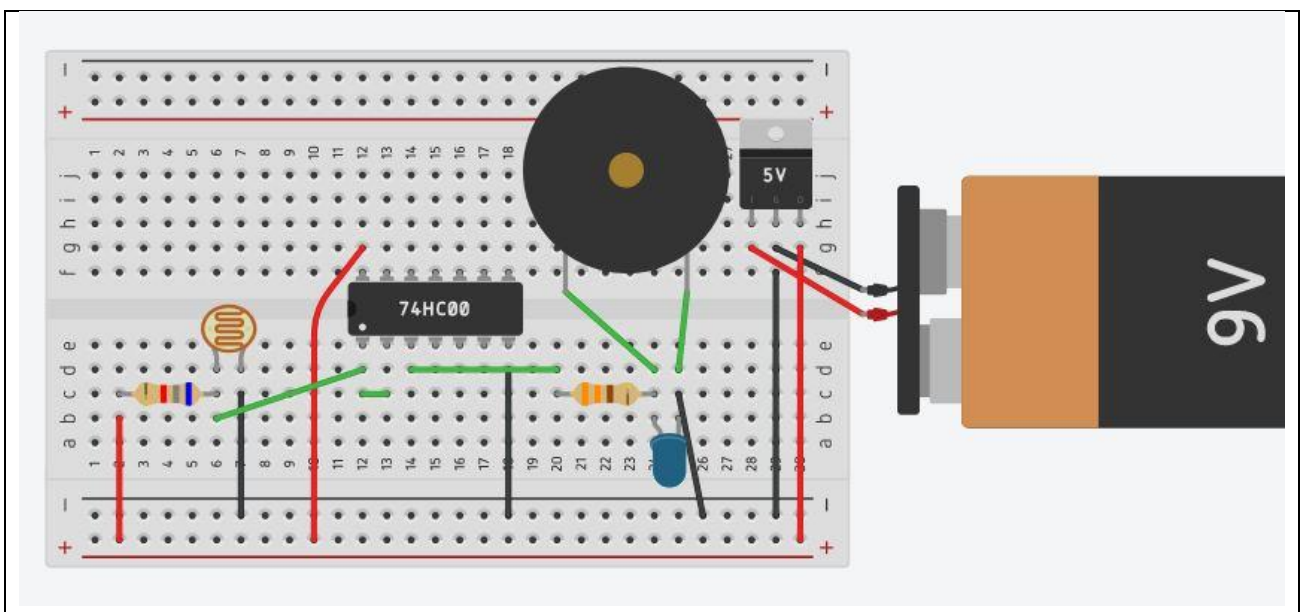
Conclusion

In conclusion, from what I have learned in the digital system, I managed to build one of the simplest circuits that might be useful to the communities. This circuit also can categorize as one of the cheapest connection to have such a light detector. I hope this project can be helpful to the communities that focus on security, agriculture and etc.