Infrared Alarm

College: Electronic Information

Name: Lingxiao Zhang(张凌霄)

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Student number:2014301200176

Requirement Analysis:

Function Requirements:

•Three infrared detectors are situated side by side.

•When some objects simultaneously shade the top two detectors or the bottom two detectors or all of three detectors, the machine alarms-red LED lighting.

•Except the three conditions, the machine normally works-green LED lighting.

Performance Requirements:

•The distance between Emitter diodes and Collector diodes is up to 30cm.
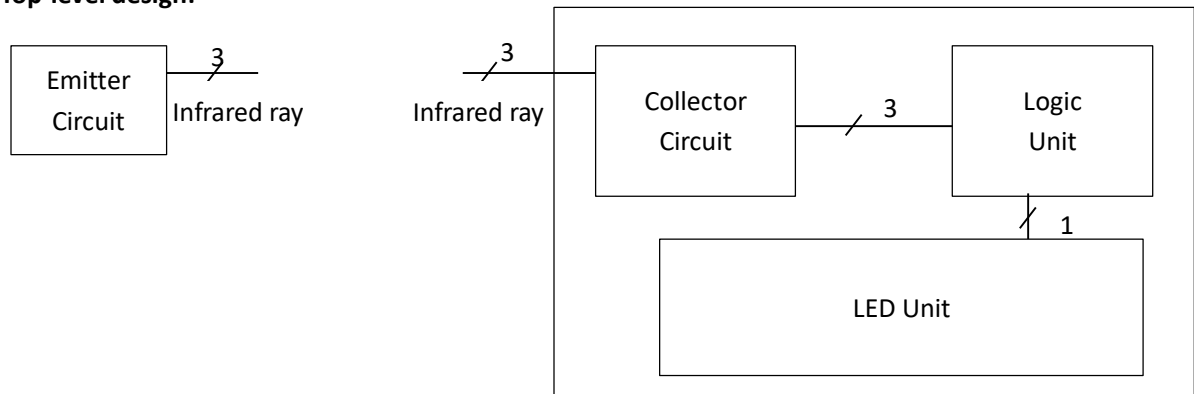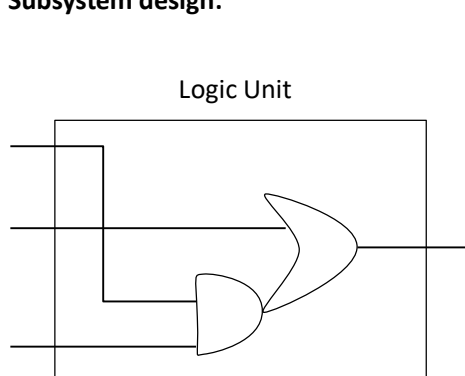
Design:

Top-level design:
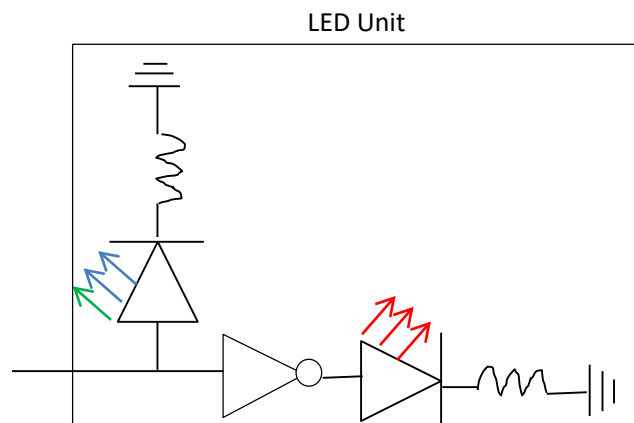

Figure 1

Subsystem design:

Figure 2

Figure 3

Emitter Circuit

Figure 4

Collector Circuit
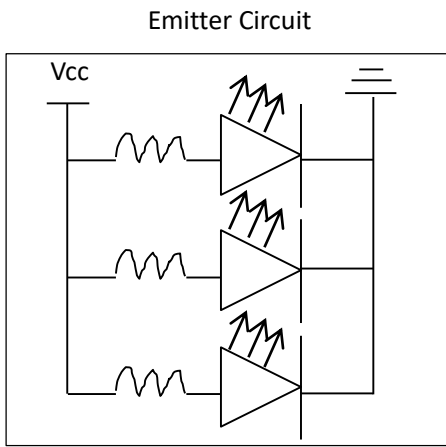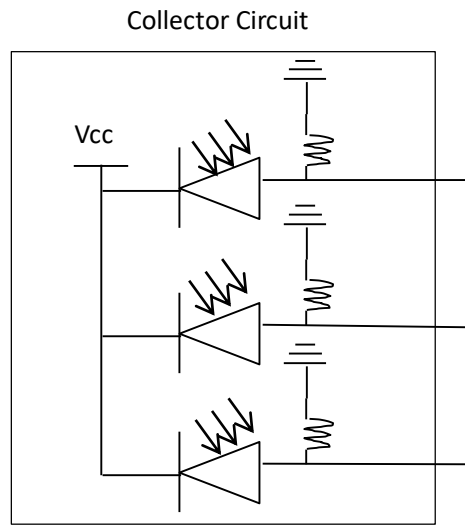

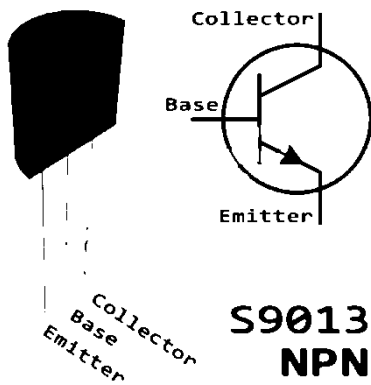Figure 5

Component:

•S013(NPN)

Figure 6

•Collector Diodes and Emitter Diodes

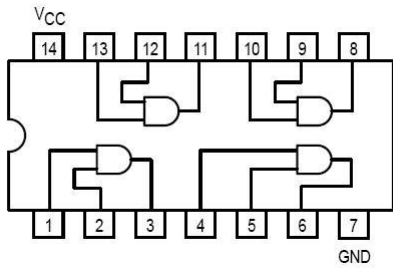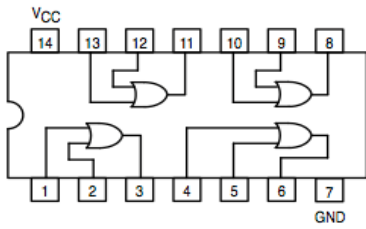Figure 7

• 74LS08

Figure 8

• 74LS32

Figure 9

Simulation:

Figure 10　　Simulation Circuit
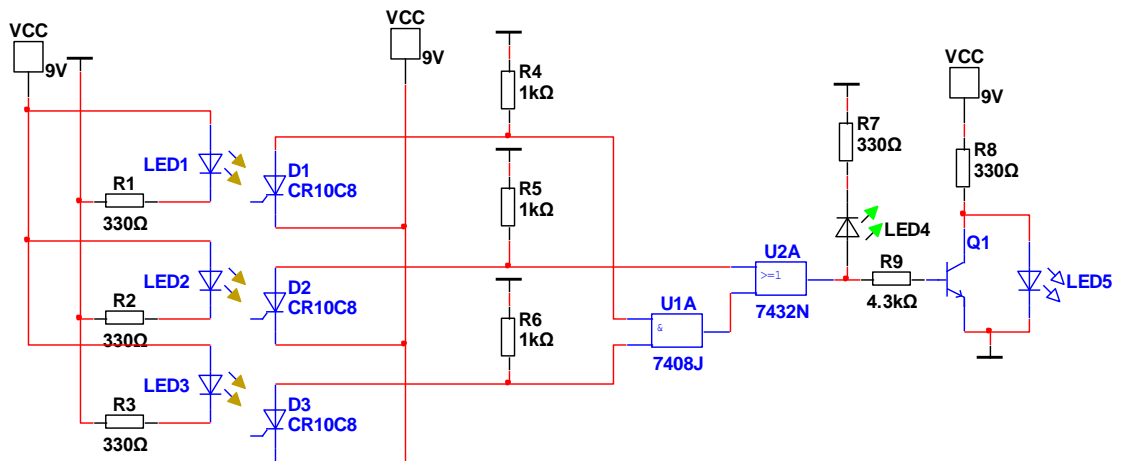
Experiment:

Procedure:

(1) Used a multimeter to check all components in order to make sure all of them can normally work.

(2) In a breadboard, Linked various components to some blocks in term of the circuit diagram, then combine all kinds of blocks to the machine and debug it.

(3) After validating the machine work normally, weld them into two PCBs (one is an emitter board,

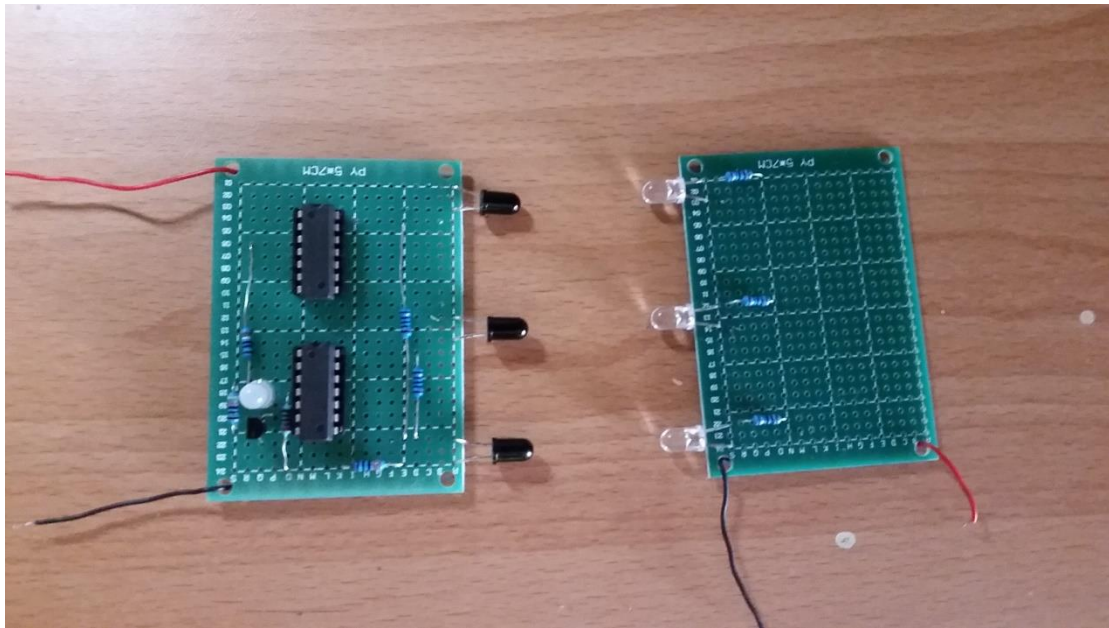the others is a collector board) and debug them.

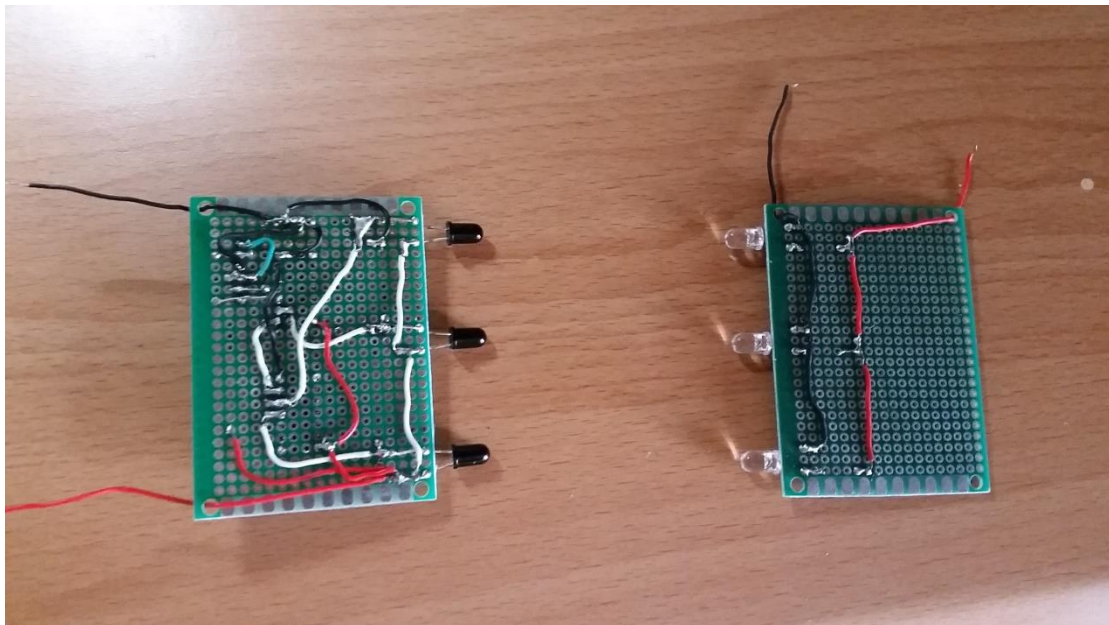**Picture of two PCBs:**

Figure 11   Front view of two PCBs

Figure 12   Back view of two PCBs

Result:

Table 1 shows the result of the experiment:

Tab.1 Input/Output Relationship of the Machine

Input			Output	
D1	D2	D3	Red LED	Green LED
0	0	0	1	0
1	0	0	1	0
0	1	0	0	1
0	0	1	1	0
1	1	0	0	1
1	0	1	0	1
0	1	1	0	1
1	1	1	0	1

Explain:

Input: 0 means that an object shades the detector;

1 means that there is not any object between emitter and collector.

Output: 0 means the LED lights;

1 means the LED is down.

Conclusion:

• Three infrared detectors are situated side by side. When some objects simultaneously shade the top two detectors or the bottom two detectors or all of three detectors, the machine alarms-red LED lighting. Except the three conditions, the machine normally works-green LED lighting.

•Maximum work distance of the machine is up to 20cm.

•Red LED and greed LED are replaced a common cathode combination LED, which make circuit more clearly.

Improvement:

Because two PCBs are a little bit small, so the distance between two emitter diodes or two collector diodes is short. When the work distance between two PCBs is long, the machine's work is instable. Meanwhile, infrared rays of adjacent diodes mutual interference causes that the machine is sensitive to deflection angle.

If the distance between adjacent two emitter\collector diodes is more long and powers of diodes are larger, the work distance will be longer.