PROJECT REPORT

ON

INTEGRATED SECURITY AND SAFETY SYSTEM

-Be secure always.

DHARMSINH DESAI UNIVERSITY
FACULTY OF TECHNOLOGY
DEPARTMENT OF ELECTRONICS & COMMUNICATION

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GUIDED BY:
Prof Pallavi G Darji
Prof.Thavallapill.Smith.S.

CERTIFICATE

This is to certify that the project on **INTEGRATED SECURITY AND SAFETY SYSTEM** and term work carried out in the subject of Term Project is bona fide work of **SHAH RUTVIJ PRITESH (EC-77)** of B. Tech. semester V in the branch of **Electronics & Communication**, during the academic year **2019-20**.

Prof. Pallavi G Darji
Project Guide, EC Dept.

Dr. Nikhil Kothari
HOD, EC Dept.

ACKNOWLEDGEMENT

Firstly, I offer my sincere thanks to my guide Prof. Pallavi G. Darji, Associate Professor, Electronics and Communication Department, Dharmsinh Desai University for her invaluable support, guidance and advice throughout the duration of this Project.

I express my deep and sincere sense of gratitude to Dr. Nikhil J. Kothari, HOD and Professor, EC Department, Dharmsinh Desai University, who has given me invaluable support and opportunities to learn and develop technical skills. He has been an unending source of inspiration to me. I am thankful to all the faculties members and university staff for their consistent support and guidance

ABSTRACT

The purpose of this project is to provide cheap and reliable safety and security to common people. We aim to provide security from theft and from strangers who approach your home. We also aim to provide safety from fire as well as safety for firemen rescuing us.

Our system consists of four independent yet interconnected modules. Individually they can be used to perform their designated tasks, while together they form one of a kind integrated system. Each module is simple to install and easy to use. We made this system as a integrated bunch of different basic circuits and practically tested them to confirm their smooth operation.

Our system can be used as a whole to bring security and safety to a building, house, factory, etc. While the individual modules alone have even a wider application. The anti-theft can be used to even secure belongings instead of just a door. The fire alarm meant to be fitted in our houses can be used even in vehicles, rockets for the same purpose. Person Counter can be used in a car parking lot for automatic counting of cars present. Thus our modules and the system have many applications.

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1) INTRODUCTION

Security and Safety is a primary concern for everyone. There is so much unpredict ableness in life. We don't know what is going to happen next. So, instead of being caught blind in a bad situation, it is better to be prepared. 'Prevention is better than cure'. Our System consists of modules which help you be safe and secure across various aspects of life.

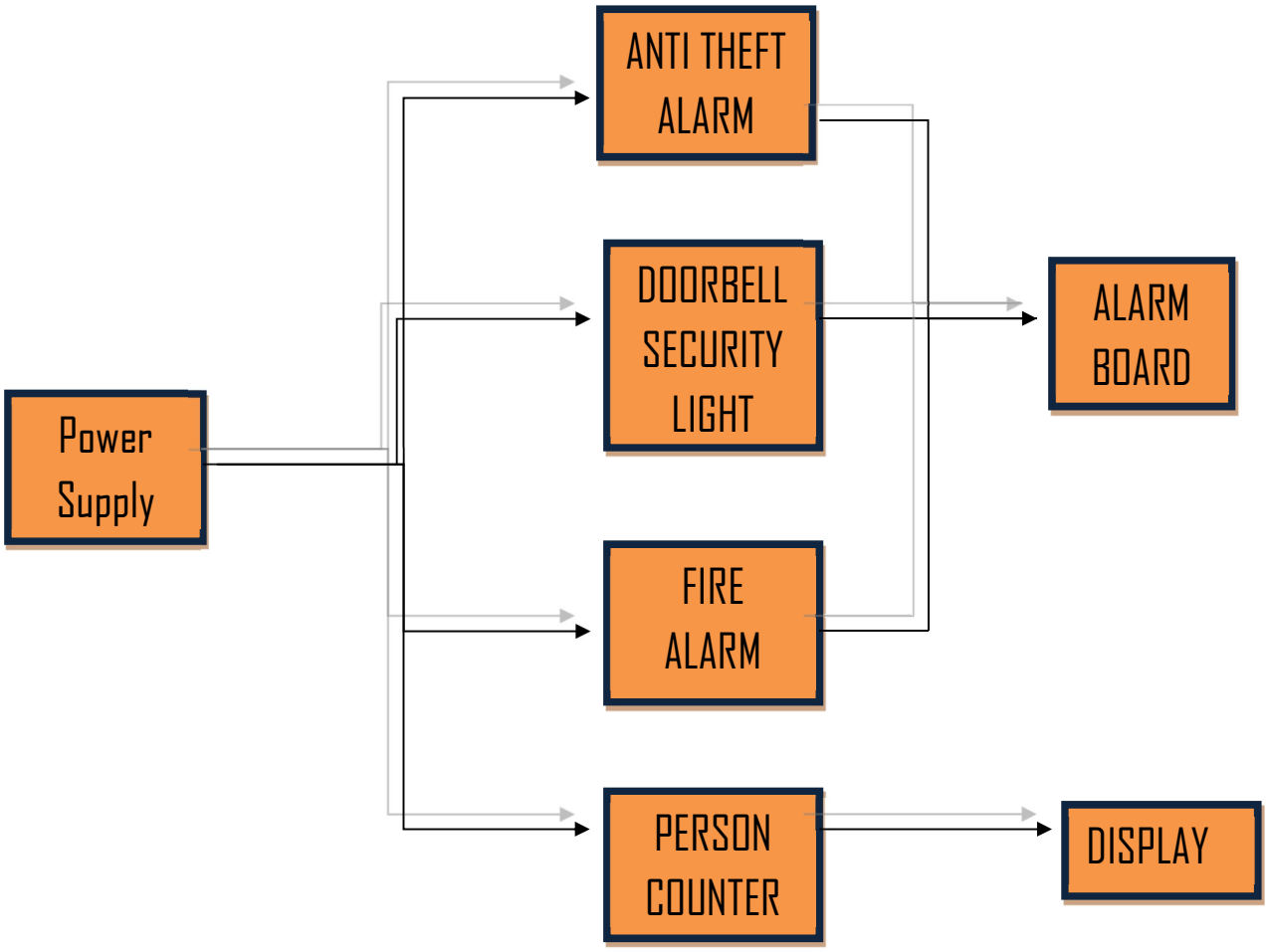
Nowadays, theft is a very common phenomena occurring everywhere. Due to the lack of jobs and the increasing frustration of people we aren't safe from anyone. Especially strangers. So, we have built two modules to counter this problem. Anti-theft Alarm is a loop-based safety alarm which helps you protect your belongings, home, farm, etc. in a very cheap and affordable way. The second module, Doorbell Security Light helps you detect and identify strangers that approach your house.

Fire safety is a very big concern to everyone. To be safe from fire, we need an early warning so that we can safely get away from the danger zone or extinguish the fire. If we are alerted too late, it can also cost us our lives. Our Fire Alarm module has a three-way fire detection system so that we can be alerted about fire as soon as possible. It can detect smoke, increasing temperature and flames of fire. It is adjustable to the type of surroundings we want to use it in.

Whenever rescuing people from a burning building, firemen face a major problem. They do not know the exact number of people inside. They may wander into a room with no people and face serious injury themselves, while a room full of people remains unattended. To solve this problem, we have made a Person Counter. This keeps count of the total number of people inside an enclosed area. This will be a major help to firemen and make their jobs easier and safer. Thus, their chances of carrying a safe and successful evacuation become very high.

Often such systems are very pricy and complex to use. We wanted our system to be easy usable and affordable to laymen. Thus, we have designed it accordingly.

2) BLOCK DIAGRAM



3) ANTI THEFT ALARM

-Be secure always.

3.1) INTRODUCTION

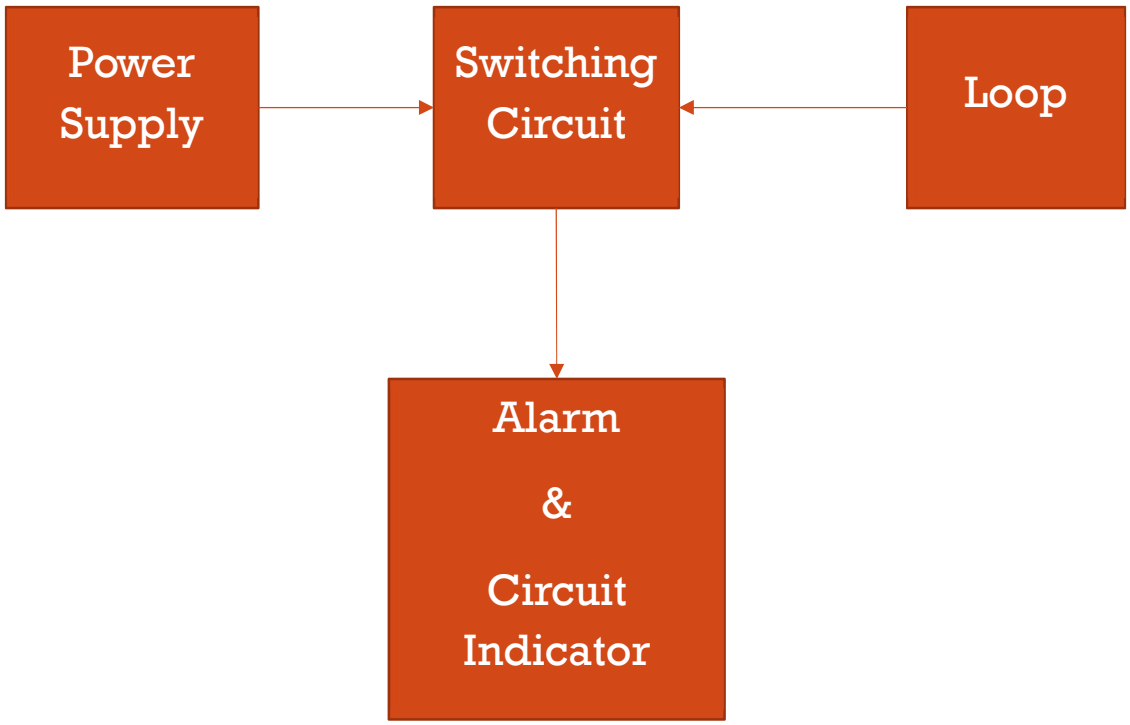
- **Inspiration:**

To build a reliable and low maintenance system which can be used for various purposes at various places to protect theft. A system which can be easily installed by the buyer himself and doesn't need any expert knowledge. For example, it can be used in residency, industry and rural areas. In farms it can be used to alert farmers whenever stray animals wander into their farm.

- **Aim:**

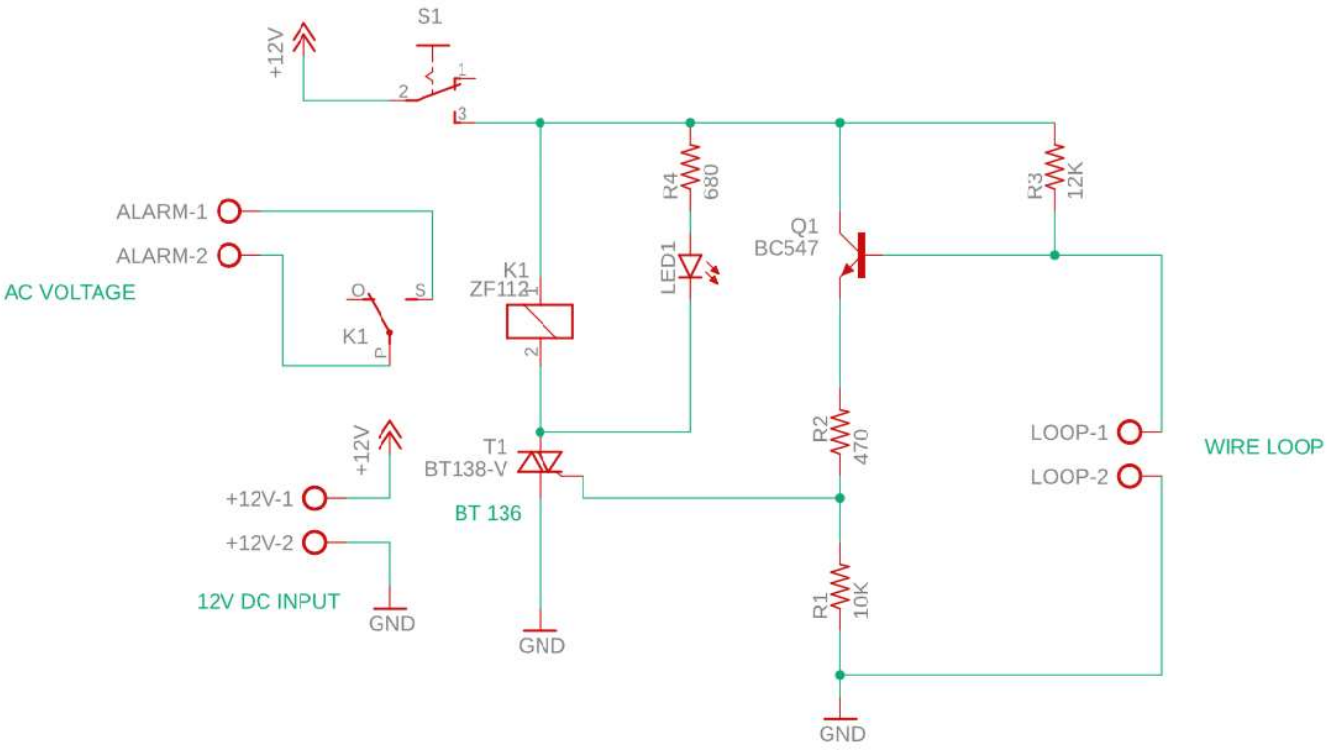
Our aim is to build a reliable and cheap alarm to detect unauthorized access into your property.

3.2) BLOCK DIAGRAM:



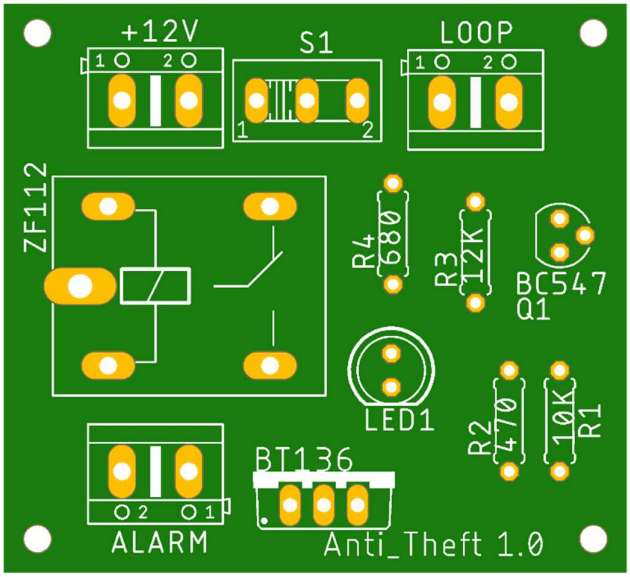
3.3) CIRCUIT DIAGRAM AND PCB LAYOUT:

- **Circuit Diagram:**

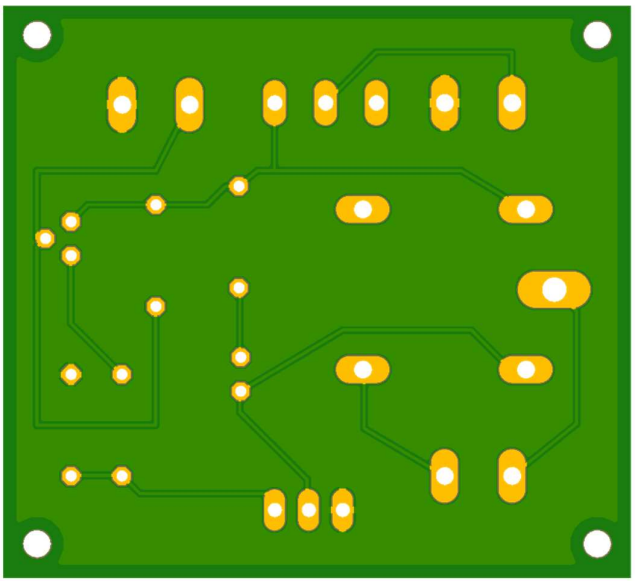


- **PCB Layout:**

Top View:



Bottom View:



3.4) CONCEPT AND WORKING:

- Presented here is an anti-theft alarm circuit using a simple wire loop as sensor. It can be used to protect any device against theft, or as a door opening alarm.
- Triac is used as the switching device. Transistor is used to drive the gate of Triac.
- If the sensing loop is closed, base of transistor is pulled down to ground. So, it is reverse-biased and its emitter current is zero. That is, triac will be in OFF condition when loop is closed. Hence, the alarm will be OFF.
- When an unauthorized person enters the premises under wire-loop protection, the loop breaks and it forward-biases the transistor. When it conducts, triac gets its gate current and the buzzer sounds.
- Here a triac is preferred because even if the thief manages to join the loop back, the alarm will not stop as triac still conducts even if its gate current becomes zero.

3.5) COMPONENTS:

1) **TRIAC [BT136]**
   - Triac is used as the switching device. Triac is preferred because even if the thief manages to join the loop back, the alarm will not stop as triac still conducts even if its gate current becomes zero.

2) **NPN Transistor [BC547]**
   - Transistor is used to drive the gate of Triac.

3) **5V Relay**
   - An alarm running on AC power is connected to the relay. It gets activated when Relay coil is activated by the TRIAC.

4) **Resistors**
   - To limit current to prevent damage to sensitive components.

5) **5mm Led**
   - To indicate whether loop is intact or not.

6) **5mm Screw terminal block**
   - To connect the AC Alarm, DC supply wires to the PCB.

7) **On/Off Switch**
   - To reset the Alarm or to enable/disable it.

3.6) CALCULATIONS:

- Applying **KVL** in the input loop:
  $V_{cc} - I_b*(R3) - V_{be} - (I_c + I_b)*R2 - 1 = 0$
- Here, taking $\boldsymbol{\beta = 110}$
  $\mathbf{I_c}$ = 20 mA
  $\mathbf{I_b}$ = 0.2 mA
  $$\mathbf{R2} = \frac{Vbb - Vbe}{Ib}$$
  $$\mathbf{R2} = \frac{Vbb - 470(Ib + 110*Ib)}{Ib} = \frac{12 - 470(0.0002 + 110*0.0002)}{0.0002} = 12.53\ K\Omega$$

- Therefore R2= 12 KΩ, then from the above equation, R3 = 500 Ω

3.7) APPLICATIONS AND FUTURE WORK:

Applications:

- As a door alarm at night.
- To protect farms from stray animals.
- To alert access to private property, eg cupboard, wardrobe, etc.

Future Work:

- Instead of a wire loop we can use a laser and LDR for the same purpose. This way we won't have to connect the loop again every time after it breaks.

3.8) LIMITATIONS:

1) Loop has to be refitted every time a break-in occurs.
2) In certain cases, it has to be fitted at a proper height to detect the intended intruder.

4) DOORBELL SECURITY LIGHT

-Be secure always.

4.1) INTRODUCTION

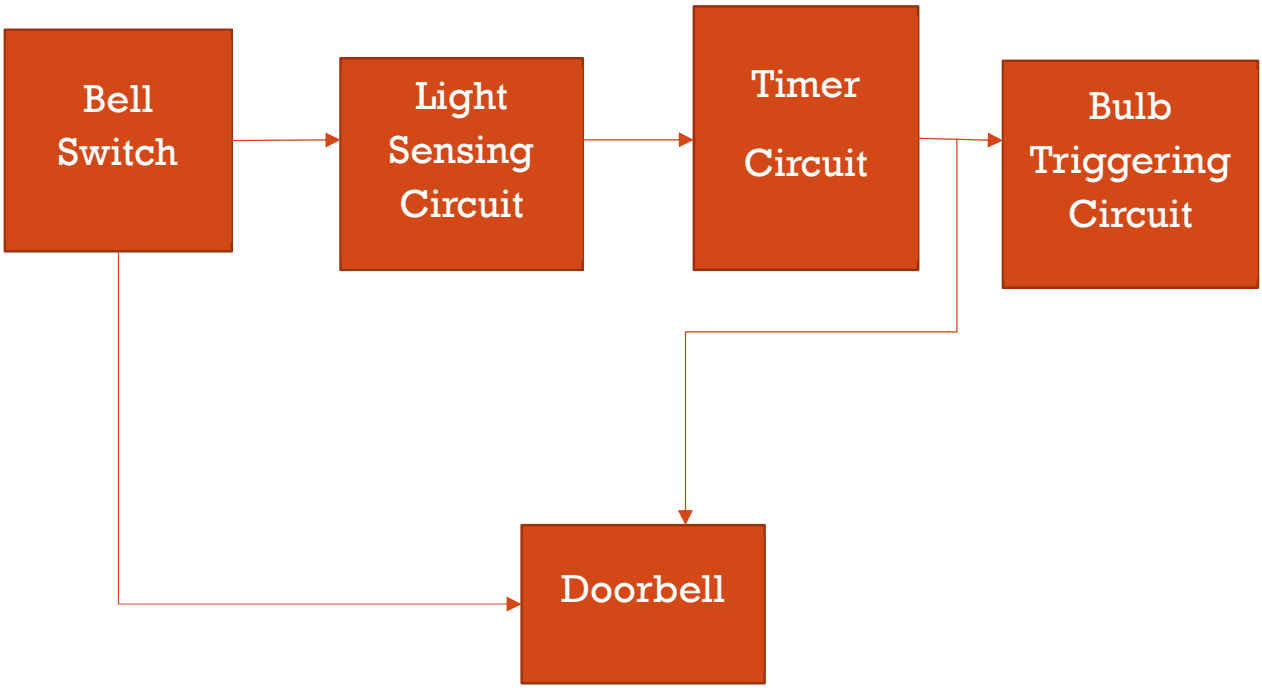
- **Inspiration:**

In this day and age, many people live alone and at lonely locations across the city. During night, if someone rings the doorbell, the person cannot see who it is outside. This system will help them recognize the person and see if any threat is present.

- **Aim:**

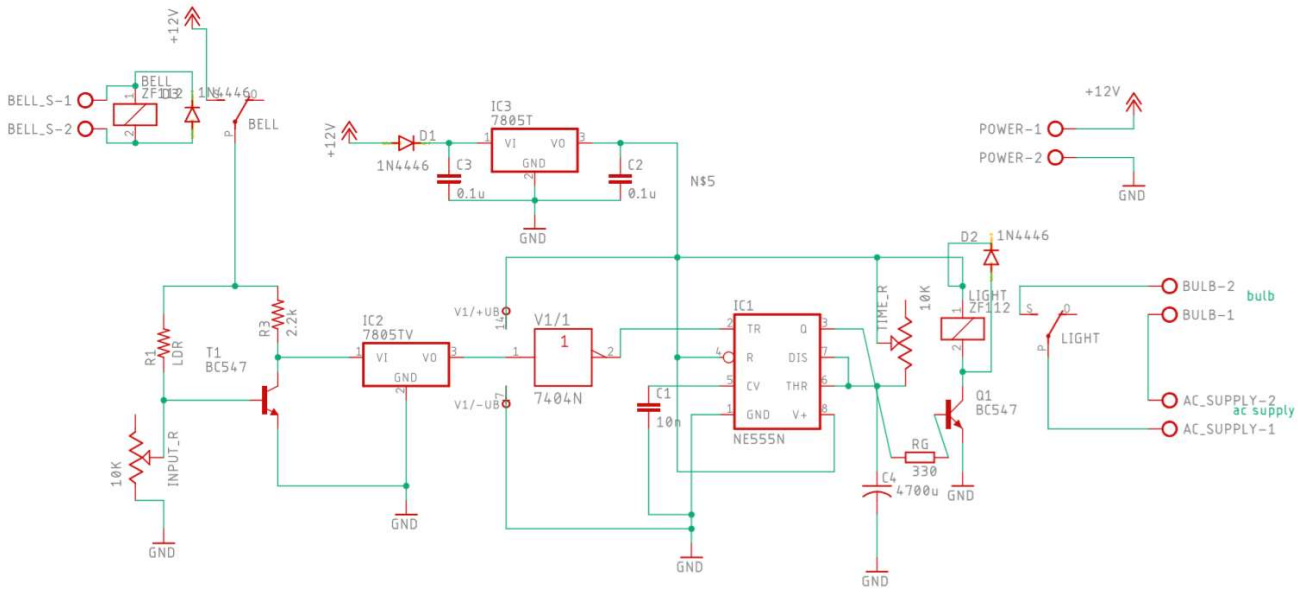
Whenever at night, doorbell is pressed the bulb outside glows for some time and helps the owner see the person outside and can reset the circuit to turn off the bulb. The bulb automatically gets off after a certain time if the owner doesn't respond and saves electricity.

4.2) BLOCK DIAGRAM:

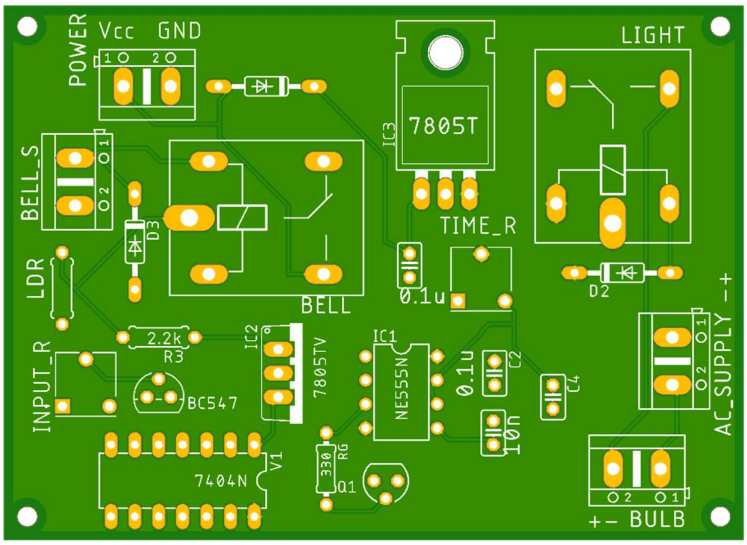


4.3) CIRCUIT DIAGRAM AND PCB LAYOUT:

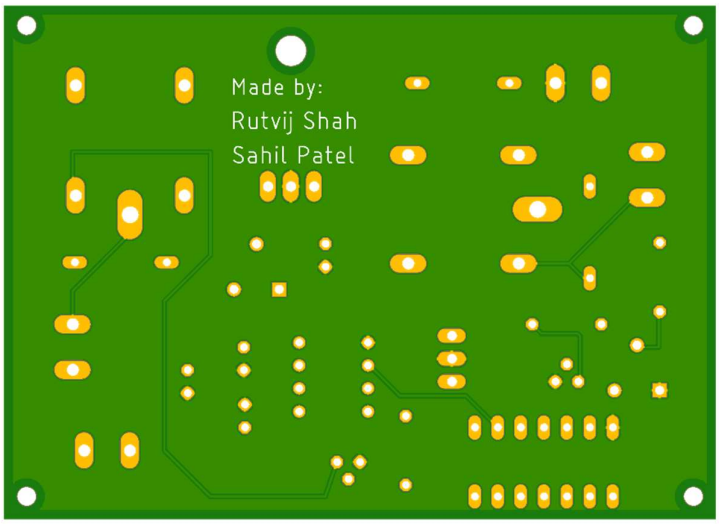
- **Circuit Diagram:**



- **PCB Layout:**
  Top View:



Bottom View:



4.4) CONCEPT AND WORKING:

- When bell switch is pressed during the night, not only the bell rings but the bulb connected to it also glows.
- During the day, resistance of the LDR is low, hence the transistor is in the saturation region due to enough voltage provided at its base by the voltage divider circuit.
- The trigger pin of the timer gets a continuous 5V supply. So, the timer is off and in turn the bulb is also off.
- When it is dark, the resistance of the LDR increases, hence when bell is pushed, BC547 doesn't get enough voltage at its base and hence we get 5V at its collector. Due to this a low pulse is supplied to the trigger of the Timer, which gets activated in its monostable mode.
- The timer activates the relay and thus the bulb glows for a fix preset time.
- The amount of time for the bulb glow can be set by the potentiometer provided.

4.5) COMPONENTS:

1) **7805: Voltage Regulator**
- To convert +12V input voltage to +5V for ICs.
- To convert the 0-12V output from collector of transistor into a 0-5V range.

2) **LDR**
- To detect the amount of darkness outside.

3) **Potentiometer**
- To adjust the sensitivity of the LDR
- To adjust the time period for which Bulb stays on.

4) **BC547**
- To drive the timer circuit from the output of the voltage divider.
- To drive the relay when bulb is to be glowed.

5) **Capacitor and Resistors**
- To set the delay of the Monostable Multi vibrator circuit.
- To smoothen the spikes in the input voltage.
- To limit current to prevent damage to components.

6) **555 Timer**
- Used in monostable mode which provides the delay for the bulb to light up.

7) **Silicon Diode: 1N4001**
- To ensure the proper functioning of the relay.

8) **7404: NOT logic gate**
- To invert the output from transistor and provide it to the trigger pin of the 555 timer.

9) **Screw terminal connector**
- To connect DC supply, AC supply, doorbell input and Alarm to the PCB board.

4.6) CALCULATIONS:

LDR Resistance Limits Used:
- DARK: 50 kΩ
- LIGHT: 1 kΩ

For transistor ON condition during day:

$V_b > 0.8$ V

Therefore, RPOT > 220 Ω

For transistor OFF condition during night:

$V_b < 0.6$ V

Therefore, RPOT < 3.5 KΩ

Hence POT of 10 KΩ used to set the sensitivity.

555 Timer Monostable Mode:

- T = 1.1 * R * C

For T = 1.5 mins, C = 1000uF and R= 100 k Ω

4.7) APPLICATIONS AND FUTURE WORK:

Applications:

- Can be used in applications where light sensitivity is to be detected.
- As warning when light intensity crosses a certain threshold.

Future Work:

- In automatic streetlight activation when it gets dark
- Can be used in solar energy applications to know when to switch-over from solar power to normal power consumption.

4.8) LIMITATIONS:

1) LDR is very sensitive and should be present at a specific place.
2) Only useful in certain conditions.

3) FIRE ALARM

-Be secure always.

5.1) INTRODUCTION

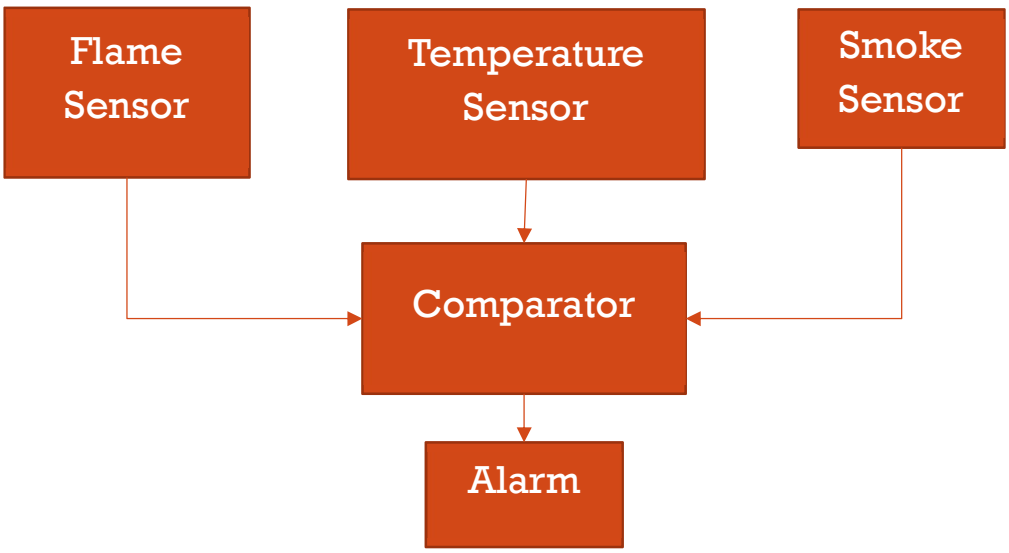
- **INSPIRATION:**

Most fire alarm circuits are microcontroller based and have a single sensor to detect fire, so they are costly and work in certain conditions only. We wanted to make a multi-sensor alarm without microcontroller which is both reliable and cheap.

- **AIM:**

To build a fire alarm which detects high temperature, smoke and fire flames and sounds an alarm if either of the three conditions are present. The sensitivity of the sensor should be adjustable for it to be installed in various places like home, factories, etc.

5.2) BLOCK DIAGRAM:



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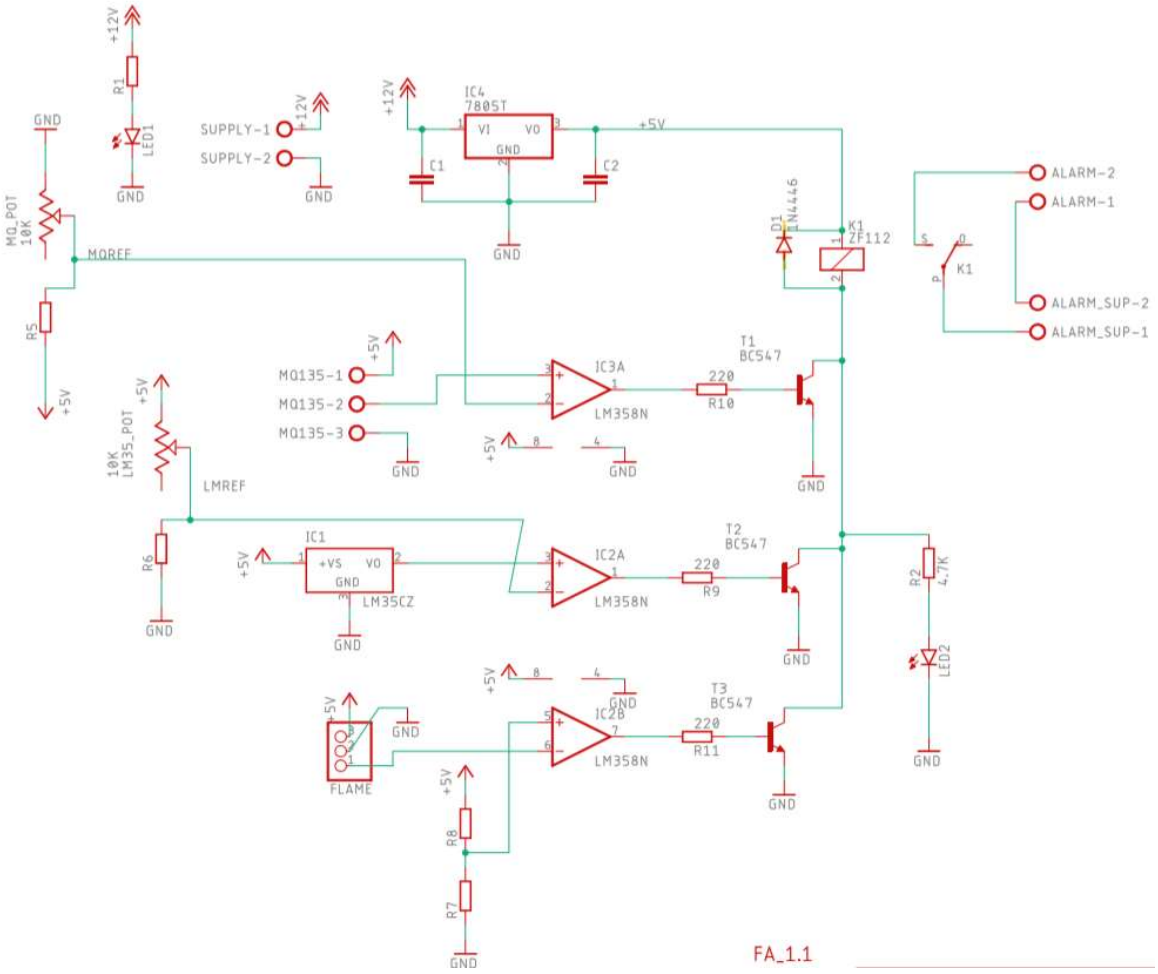

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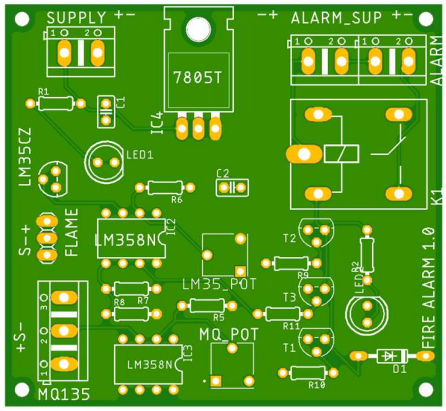
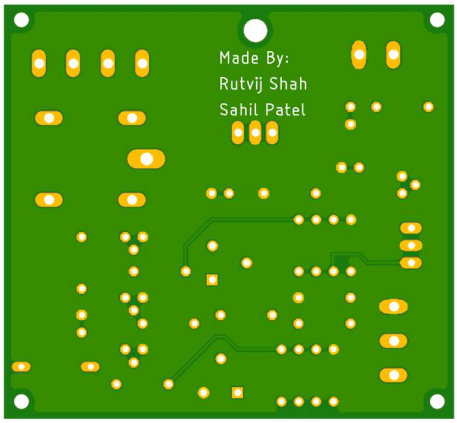


Bottom View:



5.4) CONCEPT AND WORKING:

- On detection of either flames or high temperatures or smoke, the output voltage of the respective sensor increases.
- When this voltage increases beyond the threshold level, Dual comparator LM358 triggers npn transistor.
- Transistor conducts and energizes relay to activate the alarm connected across it.
- We can adjust temperature and smoke threshold values using respective potentiometers.
- A Safety indicator led is present to indicate everything is okay.
- A Circuit functional led is present to indicate that the circuit is On.

5.5) COMPONENTS:

1. **MQ 135**
   - To detect harmful gases in the atmosphere and gives analog output as per concentration of harmful gases present. Hence, it helps us detect smoke.

2. **IR Flame sensor**
   - Detects red and yellow light as it is sensitive to that particular wavelength of light.

3. **LM35**
   - Detects the ambient temperature and gives corresponding analog output.

4. **LM358**
    - Dual comparator helps us compare values between the threshold set and the input voltage value from the sensor. It gives high output if input voltage is higher than the threshold value set.

5. **Relay**
    - Used to drive the AC powered alarm connected to it.

6. **Led**
    - To indicate current condition status of the circuit.

7. **Resistors**
    - To limit current to prevent damage to components.
    - For voltage divider circuit to set threshold voltage.

8. **Pinhead PCB Connectors**
    - To connect various sensors and supplies to the PCB.

5.6) CALCULATIONS:

V_{ref} :

1) LM35: 0.45 V (45 ℃) [Adjustable using POT]
2) Flame sensor: 2.5 V (Active Low Sensor)
3) MQ135: 3.5V (By practical testing) [Adjustable using POT]

5.7) APPLICATIONS AND FUTURE WORK:

Applications:

- As fire alarm in vehicles, buildings, rockets, etc.

Future Work:

- Using better industrial grade sensors, it's accuracy can be improved. Then they can also be used for scientific purposes.
- Using microcontroller and peripherals we can directly alert the fire station whenever fire is detected.

5.8) LIMITATIONS:

1) Flame sensor's sensing distance depends on the intensity of the flame.
2) LM35 takes some time to heat up .
3) MQ135 has 48 hours preheat time.

6) PERSON COUNTER

-Be secure always.

6.1) INTRODUCTION:

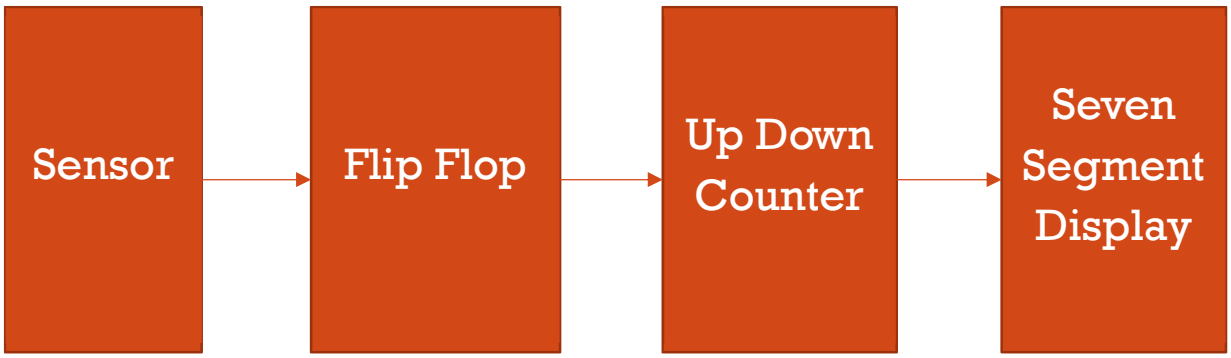
- **INSPIRATION:**

Firemen face a serious issue: while rescuing people out of a burning building, they do not know the exact number of people inside. This lack of information is harmful to them as well as others. So, if they knew the number of people present in a building, a room or on a particular floor, it would make their jobs easier and safer.

- **AIM:**

Our aim is to build a reliable and accurate counter which can count the total strength of entities currently present in a particular enclosed area.

6.2) BLOCK DIAGRAM:



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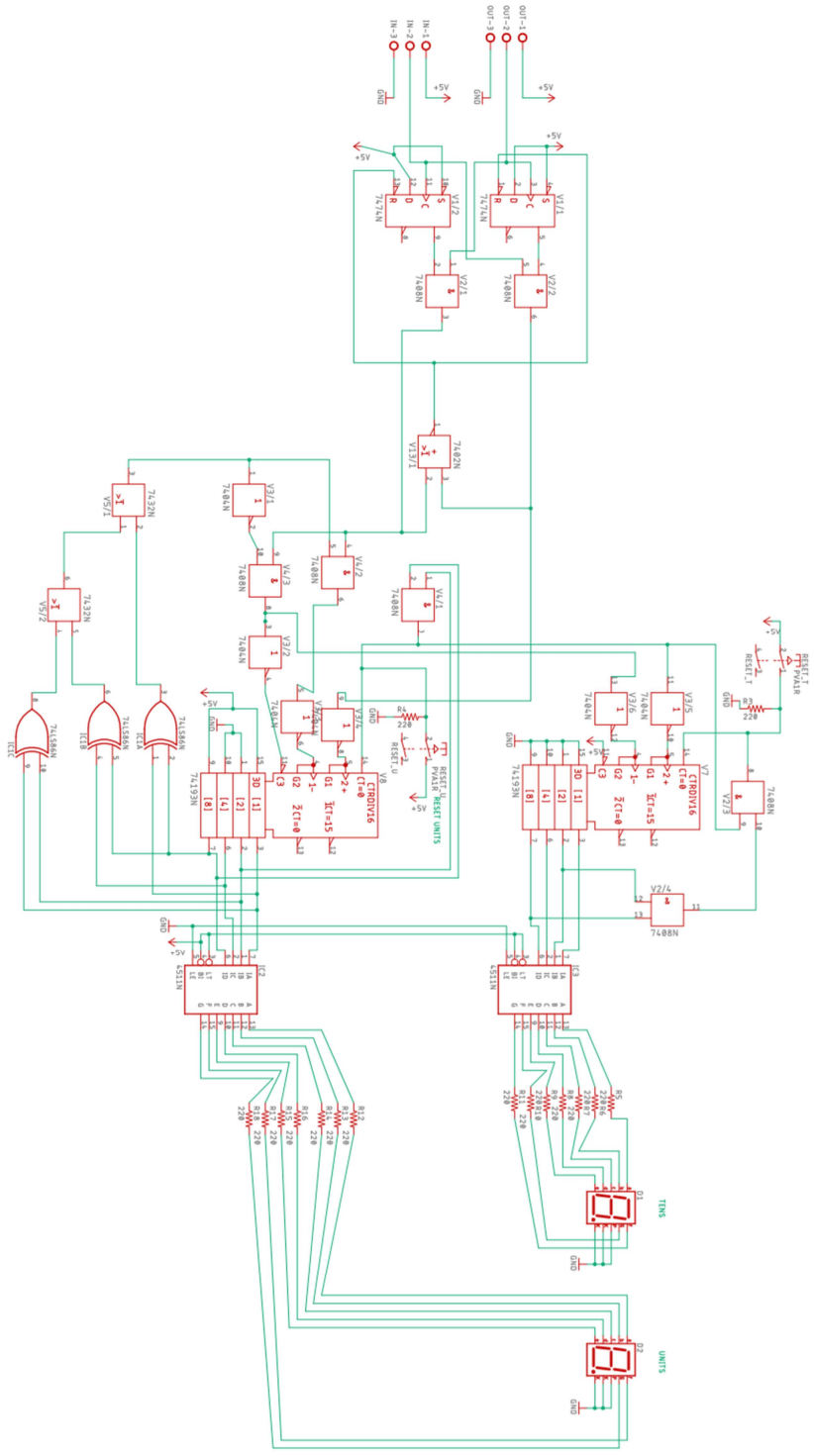
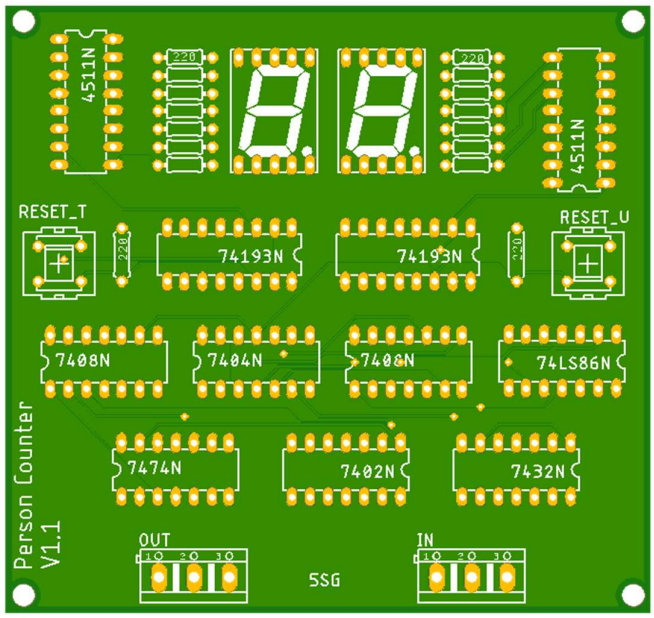
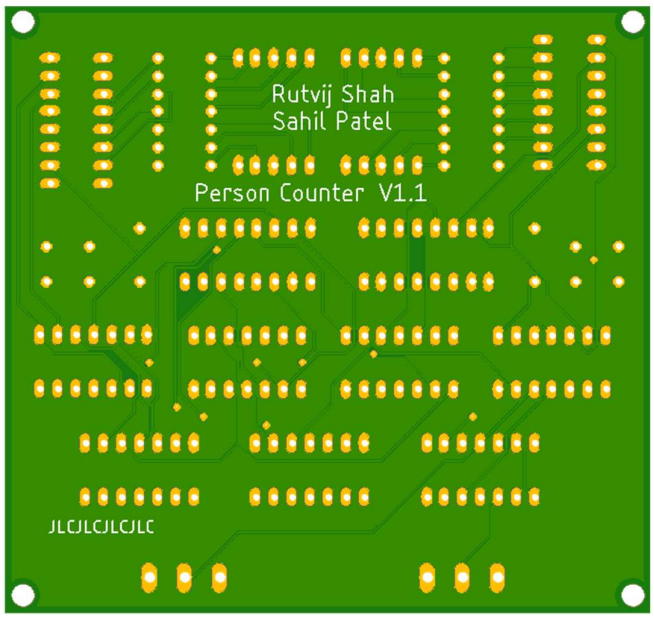


- **PCB Layout:**
  Top View:



Bottom View:



6.4) CONCEPT AND WORKING:

- One laser is present outside and one is inside the door. Both are focused on separate LDRs.
- As a person passes, laser is cut.
- Signal from the LDR circuit is given to the main circuit.
- This signal is stored in the flipflop till the signal from the next LDR comes. Once that arrives, appropriate action is taken (Increasing/Decreasing count) and then both flipflops are cleared.
- Two types of signal flows can be intercepted. Type 1 when person enters the room, and Type 2 when person exits the room.
- Depending on the signal flow, count is either increased or decreased.
- Thus, if person comes in, Type 1 signal flow is detected and count is increased.
- If person goes out, Type 2 signal flow is detected and count is decreased.

6.5) COMPONENTS:

1. Counter IC: 74193
- It is a bi-directional Up-Down Counter which helps us in counting the signals obtained at the input.

2. 7 Segment LED Display
- It displays the count of the total person present in the room.

3. LED Driver IC: 4511
- This IC decodes the binary values, converts them to suitable signals and drives the seven-segment display.

4. 74xx Logic Gates
- Logic gates 7404 (NOT), 7408 (AND), 7402 (NOR), 7486 (XOR), 7432 (OR) helped us perform different logic operations essential in functioning of the circuit.

5. D flipflop: 7474
- Used to store one input signal till the other one arrives.

6. LDR
- Helps in detecting the movement of a person/object. When person stops the laser on the LDR, its resistance increases instantaneously.

7. NPN Transistor BC547
- Acts as a switch, and gives high output to flipflop whenever laser is cut and LDR resistance gets high.

8. Laser
- Helps in detecting the movement of a person. It is constantly focused on the LDR.

6.6) CALCULATIONS:

- When Laser ON:
  R_{ldr} = 400 Ω
  So, Vb > 0.8 V
  Therefore, R > 80 Ω
- When Laser OFF:
  R_{ldr} = 25 KΩ
  So, Vb < 0.6 V
  Therefore, R < 3.5 KΩ

6.7) APPLICATIONS AND FUTURE WORK:

Application:

- Used at home, office buildings, factories to keep count of total persons inside.
- Used at Vehicle parking lot.

Future Work:

- Using Microcontroller, it can be modified to send the count over the internet directly to the fire station. Thus, they can deploy the required firemen for the job.

6.8) LIMITATIONS:

- Limitations in speed of sensing of the module.
- LDR are very sensitive to light, and may malfunction in extreme cases.

7) DATASHEETS

1. TRIAC [BT-136]

GENERAL DESCRIPTION

Glass passivated triacs in a plastic envelope, intended for use in applications requiring high bidirectional transient and blocking voltage capability and high thermal cycling performance. Typical applications include motor control, industrial and domestic lighting, heating and static switching.

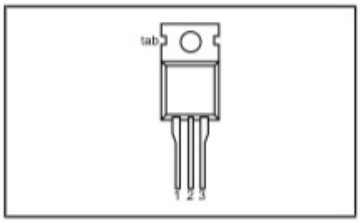
QUICK REFERENCE DATA

SYMBOL	PARAMETER	MAX.	MAX.	MAX.	UNIT
	BT136-	500	600	800	
	BT136-	500F	600F	800F	
	BT136-	500G	600G	800G	
V_{DRM}	Repetitive peak off-state voltages	500	600	800	V
$I_{T(RMS)}$	RMS on-state current	4	4	4	A
I_{TSM}	Non-repetitive peak on-state current	25	25	25	A

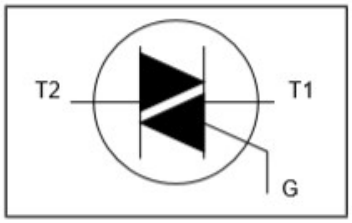
PINNING - TO220AB

PIN	DESCRIPTION
1	main terminal 1
2	main terminal 2
3	gate
tab	main terminal 2

PIN CONFIGURATION



SYMBOL



STATIC CHARACTERISTICS

T_j = 25 °C unless otherwise stated

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.			UNIT
		BT136-			...	...F	...G	
I_{GT}	Gate trigger current	V_D = 12 V; I_T = 0.1 A						
		T2+ G+	-	5	35	25	50	mA
		T2+ G-	-	8	35	25	50	mA
		T2- G-	-	11	35	25	50	mA
		T2- G+	-	30	70	70	100	mA
I_L	Latching current	V_D = 12 V; I_{GT} = 0.1 A						
		T2+ G+	-	7	20	20	30	mA
		T2+ G-	-	16	30	30	45	mA
		T2- G-	-	5	20	20	30	mA
		T2- G+	-	7	30	30	45	mA
I_H	Holding current	V_D = 12 V; I_{GT} = 0.1 A	-	5	15	15	30	mA
V_T	On-state voltage	I_T = 5 A	-	1.4		1.70		V
V_{GT}	Gate trigger voltage	V_D = 12 V; I_T = 0.1 A	-	0.7		1.5		V
		V_D = 400 V; I_T = 0.1 A; T_j = 125 °C	0.25	0.4		-		V
I_D	Off-state leakage current	V_D = $V_{DRM(max)}$; T_j = 125 °C	-	0.1		0.5		mA

2. NPN Transistor [BC 547]

Absolute Maximum Ratings T_a=25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CBO}	Collector-Base Voltage : BC546	80	V
	: BC547/550	50	V
	: BC548/549	30	V
V_{CEO}	Collector-Emitter Voltage : BC546	65	V
	: BC547/550	45	V
	: BC548/549	30	V
V_{EBO}	Emitter-Base Voltage : BC546/547	6	V
	: BC548/549/550	5	V
I_C	Collector Current (DC)	100	mA
P_C	Collector Power Dissipation	500	mW
T_J	Junction Temperature	150	°C
T_{STG}	Storage Temperature	-65 ~ 150	°C

Electrical Characteristics T_a=25°C unless otherwise noted

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
I_{CBO}	Collector Cut-off Current	V_{CB}=30V, I_E=0			15	nA
h_{FE}	DC Current Gain	V_{CE}=5V, I_C=2mA	110		800	
V_{CE} (sat)	Collector-Emitter Saturation Voltage	I_C=10mA, I_B=0.5mA		90	250	mV
		I_C=100mA, I_B=5mA		200	600	mV
V_{BE} (sat)	Base-Emitter Saturation Voltage	I_C=10mA, I_B=0.5mA		700		mV
		I_C=100mA, I_B=5mA		900		mV
V_{BE} (on)	Base-Emitter On Voltage	V_{CE}=5V, I_C=2mA	580	660	700	mV
		V_{CE}=5V, I_C=10mA			720	mV
f_T	Current Gain Bandwidth Product	V_{CE}=5V, I_C=10mA, f=100MHz		300		MHz
C_{ob}	Output Capacitance	V_{CB}=10V, I_E=0, f=1MHz		3.5	6	pF
C_{ib}	Input Capacitance	V_{EB}=0.5V, I_C=0, f=1MHz		9		pF
NF	Noise Figure : BC546/547/548	V_{CE}=5V, I_C=200μA		2	10	dB
	: BC549/550	f=1KHz, R_G=2KΩ		1.2	4	dB
	: BC549	V_{CE}=5V, I_C=200μA		1.4	4	dB
	: BC550	R_G=2KΩ, f=30~15000MHz		1.4	3	dB

h_{FE} Classification

Classification	A	B	C
h_{FE}	110 ~ 220	200 ~ 450	420 ~ 800

3. 5V Relay

1. MAIN FEATURES

- Switching capacity available by 10A in spite of small size design for highdensity P.C. board mounting technique.
- UL,CUL,TUV recognized.
- Selection of plastic material for high temperature and better chemical solution performance.
- Sealed types available.
- Simple relay magnetic circuit to meet low cost of mass production.

2. APPLICATIONS

- Domestic appliance, office machine, audio, equipment, automobile, etc.

(Remote control TV receiver, monitor display, audio equipment high rushing current use application.)

3. ORDERING INFORMATION

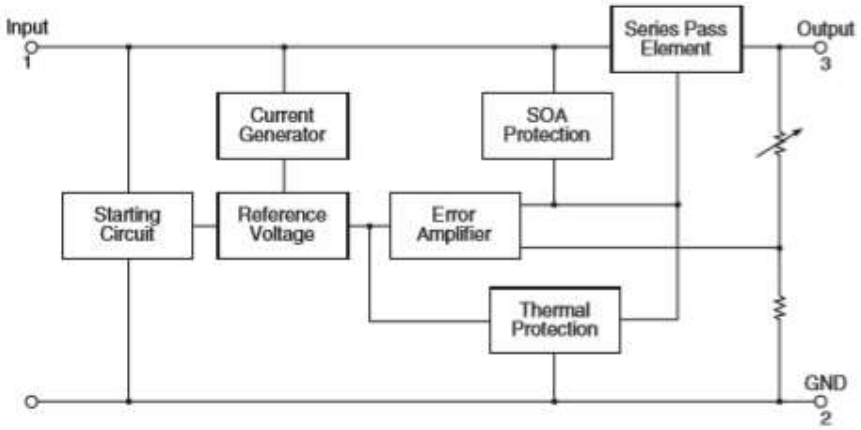
SRD	XX VDC	S	L	C
Model of relay	Nominal coil voltage	Structure	Coil sensitivity	Contact form
SRD	03、05、06、09、12、24、48VDC	S:Sealed type	L:0.36W	A:1 form A
				B:1 form B
		F:Flux free type	D:0.45W	C:1 form C

4. RATING

CCC	FILE NUMBER:CH0052885-2000	7A/240VDC
CCC	FILE NUMBER:CH0036746-99	10A/250VDC
UL /CUL	FILE NUMBER: E167996	10A/125VAC 28VDC
TUV	FILE NUMBER: R9933789	10A/240VAC 28VDC

4. LM 7805

Block Diagram



Electrical Characteristics (LM7805)

Refer to the test circuits. -40°C < T_J < 125°C, I_O = 500mA, V_I = 10V, C_I = 0.1µF, unless otherwise specified.

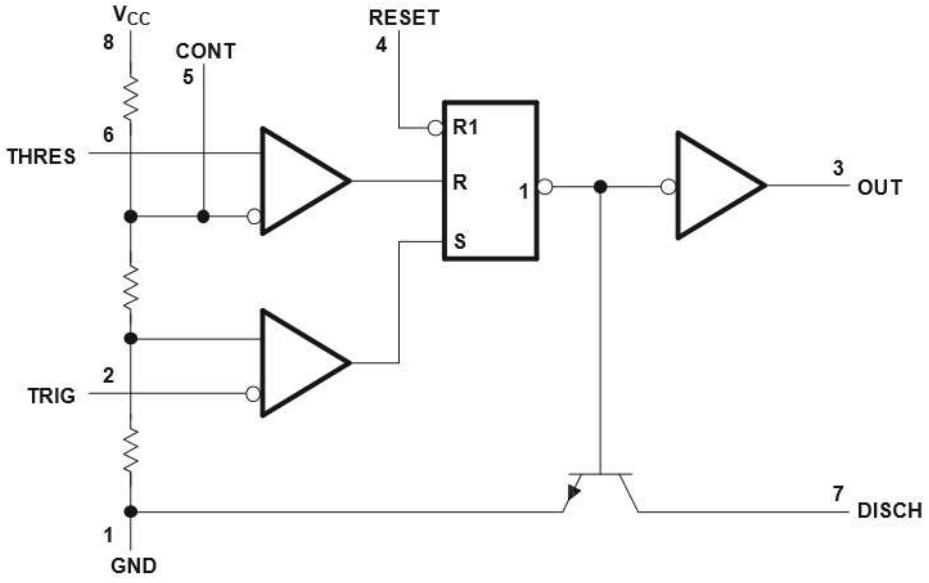
Symbol	Parameter	Conditions		Min.	Typ.	Max.	Unit
V_O	Output Voltage	T_J = +25°C		4.8	5.0	5.2	V
		5mA ≤ I_O ≤ 1A, P_O ≤ 15W, V_I = 7V to 20V		4.75	5.0	5.25	
Regline	Line Regulation(1)	T_J = +25°C	V_O = 7V to 25V	–	4.0	100	mV
			V_I = 8V to 12V	–	1.6	50.0	
Regload	Load Regulation(1)	T_J = +25°C	I_O = 5mA to 1.5A	–	9.0	100	mV
			I_O = 250mA to 750mA	–	4.0	50.0	
I_Q	Quiescent Current	T_J = +25°C		–	5.0	8.0	mA
ΔI_Q	Quiescent Current Change	I_O = 5mA to 1A		–	0.03	0.5	mA
		V_I = 7V to 25V		–	0.3	1.3	
$\Delta V_O/\Delta T$	Output Voltage Drift(2)	I_O = 5mA		–	-0.8	–	mV/°C
V_N	Output Noise Voltage	f = 10Hz to 100kHz, T_A = +25°C		–	42.0	–	µV/V_O
RR	Ripple Rejection(2)	f = 120Hz, V_O = 8V to 18V		62.0	73.0	–	dB
V_{DROP}	Dropout Voltage	I_O = 1A, T_J = +25°C		–	2.0	–	V
r_O	Output Resistance(2)	f = 1kHz		–	15.0	–	mΩ
I_{SC}	Short Circuit Current	V_I = 35V, T_A = +25°C		–	230	–	mA
I_{PK}	Peak Current(2)	T_J = +25°C		–	2.2	–	A

Notes:

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.
2. These parameters, although guaranteed, are not 100% tested in production.

5. NE555 Timer

FUNCTIONAL BLOCK DIAGRAM



Electrical Characteristics

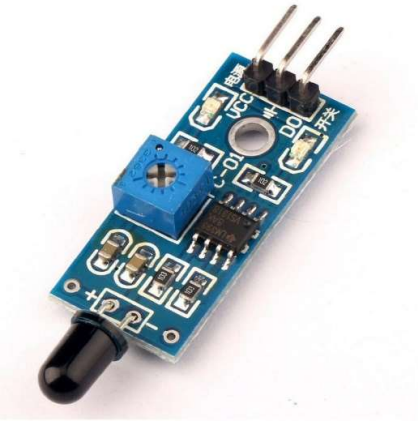
V_{CC} = 5 V to 15 V, T_A = 25°C (unless otherwise noted)

PARAMETER	TEST CONDITIONS		SE555			NA555 NE555 SA555			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
THRES voltage level	V_{CC} = 15 V		9.4	10	10.6	8.8	10	11.2	V
	V_{CC} = 5 V		2.7	3.3	4	2.4	3.3	4.2	
THRES current(1)				30	250		30	250	nA
TRIG voltage level	V_{CC} = 15 V		4.8	5	5.2	4.5	5	5.6	V
		T_A = –55°C to 125°C	3		6				
	V_{CC} = 5 V		1.45	1.67	1.9	1.1	1.67	2.2	
		T_A = –55°C to 125°C			1.9				
TRIG current	TRIG at 0 V			0.5	0.9		0.5	2	µA
RESET voltage level			0.3	0.7	1	0.3	0.7	1	V
	T_A = –55°C to 125°C				1.1				
RESET current	RESET at V_{CC}			0.1	0.4		0.1	0.4	mA
	RESET at 0 V			–0.4	–1		–0.4	–1.5	

6. Flame Sensor

A Flame Sensor is a device that can be used to detect presence of a fire source or any other bright light sources. There are several ways to implement a Flame Sensor but the module used in this project is an Infrared Radiation Sensitive Sensor.

The following image shows an Infrared type Flame Sensor.



This particular flame sensor is based on YG1006 NPN Photo Transistor. The black object at the front of the module is this Photo Transistor. The YG1006 Photo Transistor looks like a black LED but it is a three terminal NPN Transistor, where the long lead is the Emitter and the shorter one is the collector (there is no base terminal as the light it detects will enable the flow of current). This photo transistor is coated with black epoxy, making it sensitive to Infrared radiations and this particular Photo Transistor (YG1006) is sensitive to Infrared Radiation in the wavelength range of 760nm to 1100nm.

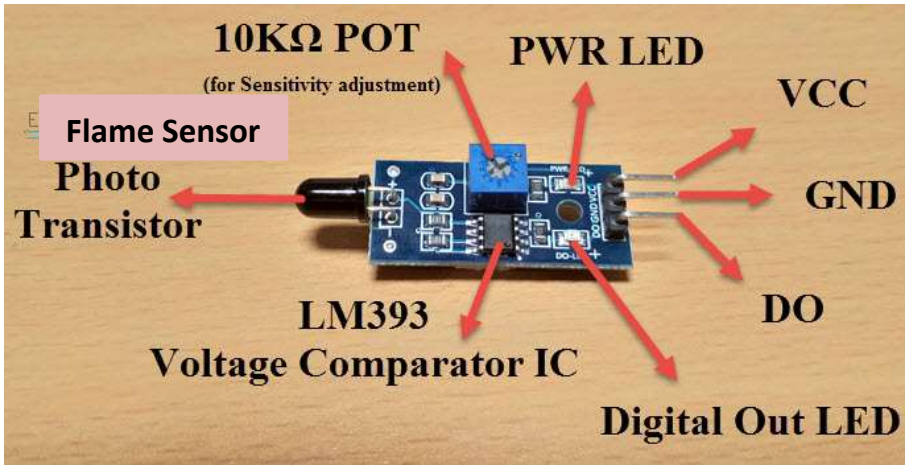
Using this particular type of Flame Sensor, you can detect Infrared Light up to a distance of 100cm within its 60 degrees of detection angle.

There are two types of implementations of Flame Sensors using YG1006 Photo Transistor: one is with both Analog Output and Digital Output while the other is with only the Digital Output. Both these implementations require same components but the difference is that one module (the one with the Analog Output) provides the Sensor output as Analog Output.

The Flame Sensor that I am using in this project has only Digital Output.

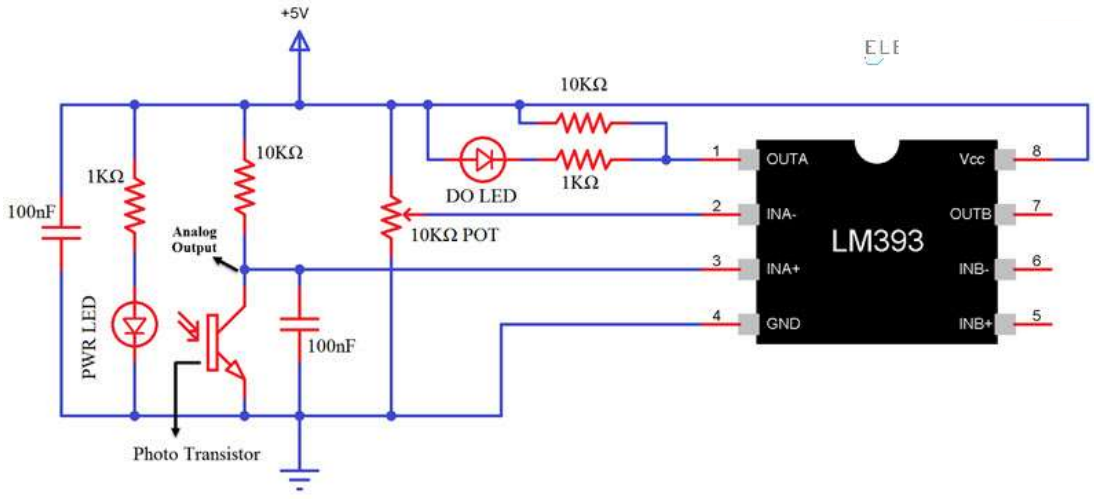
Components of Flame Sensor Module

The following image shows all the components of a typical Flame Sensor Module.



Circuit Diagram of Flame Sensor Module

If you want to know a little bit more about the Flame Sensor Module, then analyzing its circuit will probably help you. The following image shows the circuit diagram of a Flame Sensor.



7. LM 35

General Description

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ˚ Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±¼˚C at room temperature and ±¾˚C over a full −55 to +150˚C temperature range. Low cost is assured by trimming and calibration at the wafer level. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies. As it draws only 60 µA from its supply, it has very low self-heating, less than 0.1˚C in still air. The LM35 is rated to operate over a −55˚ to +150˚C temperature range, while the LM35C is rated for a −40˚ to +110˚C range (−10˚ with improved accuracy). The LM35 series is available packaged in hermetic TO-46 transistor packages, while the LM35C, LM35CA, and LM35D are also available in the plastic TO-92 transistor package. The LM35D is also available in an 8-lead surface mount small outline package and a plastic TO-220 package.

Features

- Calibrated directly in ˚ Celsius (Centigrade)
- Linear + 10.0 mV/˚C scale factor
- 0.5˚C accuracy guaranteeable (at +25˚C)
- Rated for full −55˚ to +150˚C range
- Suitable for remote applications
- Low cost due to wafer-level trimming
- Operates from 4 to 30 volts
- Less than 60 µA current drain
- Low self-heating, 0.08˚C in still air
- Nonlinearity only ±¼˚C typical
- Low impedance output, 0.1 Ω for 1 mA load

Electrical Characteristics

(Notes 1, 6)

Parameter	Conditions	LM35A			LM35CA			Units (Max.)
		Typical	Tested Limit (Note 4)	Design Limit (Note 5)	Typical	Tested Limit (Note 4)	Design Limit (Note 5)	
Accuracy (Note 7)	T_A=+25˚C	±0.2	±0.5		±0.2	±0.5		˚C
	T_A=−10˚C	±0.3			±0.3		±1.0	˚C
	T_A=T_{MAX}	±0.4	±1.0		±0.4	±1.0		˚C
	T_A=T_{MIN}	±0.4	±1.0		±0.4		±1.5	˚C
Nonlinearity (Note 8)	T_{MIN}≤T_A≤T_{MAX}	**±0.18**		**±0.35**	**±0.15**		**±0.3**	˚C
Sensor Gain (Average Slope)	T_{MIN}≤T_A≤T_{MAX}	**+10.0**	**+9.9, +10.1**		**+10.0**		**+9.9, +10.1**	mV/˚C
Load Regulation (Note 3) 0≤I_L≤1 mA	T_A=+25˚C	±0.4	±1.0		±0.4	±1.0		mV/mA
	T_{MIN}≤T_A≤T_{MAX}	**±0.5**		**±3.0**	**±0.5**		**±3.0**	mV/mA
Line Regulation (Note 3)	T_A=+25˚C	±0.01	±0.05		±0.01	±0.05		mV/V
	4V≤V_S≤30V	**±0.02**		**±0.1**	**±0.02**		**±0.1**	mV/V
Quiescent Current (Note 9)	V_S=+5V, +25˚C	56	67		56	67		µA
	V_S=+5V	**105**		**131**	**91**		**114**	µA
	V_S=+30V, +25˚C	56.2	68		56.2	68		µA
	V_S=+30V	**105.5**		**133**	**91.5**		**116**	µA
Change of Quiescent Current (Note 3)	4V≤V_S≤30V, +25˚C	0.2	1.0		0.2	1.0		µA
	4V≤V_S≤30V	**0.5**		**2.0**	**0.5**		**2.0**	µA
Temperature Coefficient of Quiescent Current		**+0.39**		**+0.5**	**+0.39**		**+0.5**	µA/˚C
Minimum Temperature for Rated Accuracy	In circuit of *Figure 1*, I_L=0	+1.5		+2.0	+1.5		+2.0	˚C
Long Term Stability	T_J=T_{MAX}, for 1000 hours	±0.08			±0.08			˚C

8. MQ 135

FEATURES

Wide detecting scope　　Fast response and High sensitivity
Stable and long life　　Simple drive circuit

APPLICATION

They are used in air quality control equipments for buildings/offices, are suitable for detecting of NH3,NOx, alcohol, Benzene, smoke,CO_2 ,etc.

SPECIFICATIONS

A. Standard work condition

Symbol	Parameter name	Technical condition	Remarks
Vc	Circuit voltage	5V±0.1	AC OR DC
V_H	Heating voltage	5V±0.1	ACOR DC
R_L	Load resistance	can adjust	
R_H	Heater resistance	33Ω±5%	Room Tem
P_H	Heating consumption	less than 800mw	

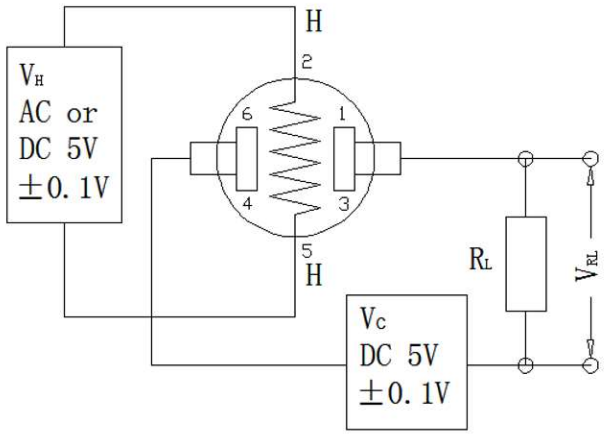
B. Environment condition

Symbol	Parameter name	Technical condition	Remarks
Tao	Using Tem	-10□-45□	
Tas	Storage Tem	-20□-70□	
R_H	Related humidity	less than 95%Rh	
O_2	Oxygen concentration	21%(standard condition)Oxygen concentration can affect sensitivity	minimum value is over 2%

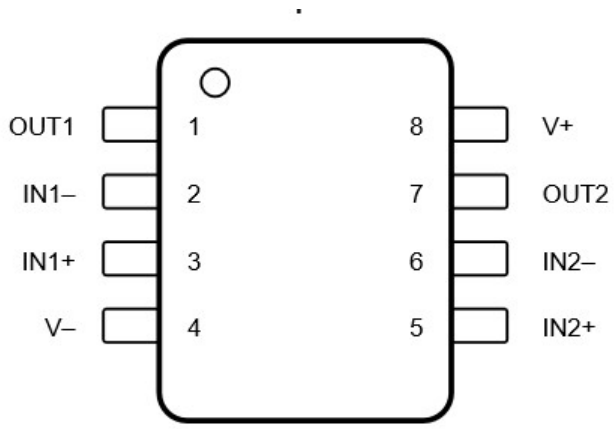
C. Sensitivity characteristic

Symbol	Parameter name	Technical parameter	Ramark 2
Rs	Sensing Resistance	30KΩ-200KΩ (100ppm NH_3)	Detecting concentration scope□ 10ppm-300ppm NH_3 10ppm-1000ppm Benzene 10ppm-300ppm Alcohol
α (200/50) NH_3	Concentration Slope rate	≤0.65	
Standard Detecting Condition	Temp: 20□±2□ Vc:5V±0.1 Humidity: 65%±5% Vh: 5V±0.1		
Preheat time	Over 24 hour		

Basic Circuit



9. LM 358



Pin Functions

PIN			I/O	DESCRIPTION
NAME	LCCC(1)	SOIC, SSOP, CDIP, PDIP, SO, TSSOP, CFP(1)		
IN1–	5	2	I	Negative input
IN1+	7	3	I	Positive input
IN2–	15	6	I	Negative input
IN2+	12	5	I	Positive input
OUT1	2	1	O	Output
OUT2	17	7	O	Output
V–	10	4	—	Negative (lowest) supply or ground (for single-supply operation)
NC	1, 3, 4, 6, 8, 9, 11, 13, 14, 16, 18, 19	—	—	No internal connection
V+	20	8	—	Positive (highest) supply

7.3 Recommended Operating Conditions

over operating ambient temperature range (unless otherwise noted)

			MIN	MAX	UNIT
V_S	Supply voltage, V_S= ([V+] – [V–])	LM358B, LM358BA, LM2904B, LM2904BA	3	36	V
		LM158, LM258, LM358, LM158A, LM258A, LM358A, LM2904V	3	30	
		LM2904	3	26	
V_{CM}	Common-mode voltage		V–	V_S – 2	V
T_A	Operating ambient temperature	LM358B, LM358BA	–40	85	°C
		LM2904B, LM2904BA, LM2904, LM2904V	–40	125	
		LM358, LM358A	0	70	
		LM258, LM258A	–20	85	
		LM158, LM158A	–55	125	

10. IC 74193

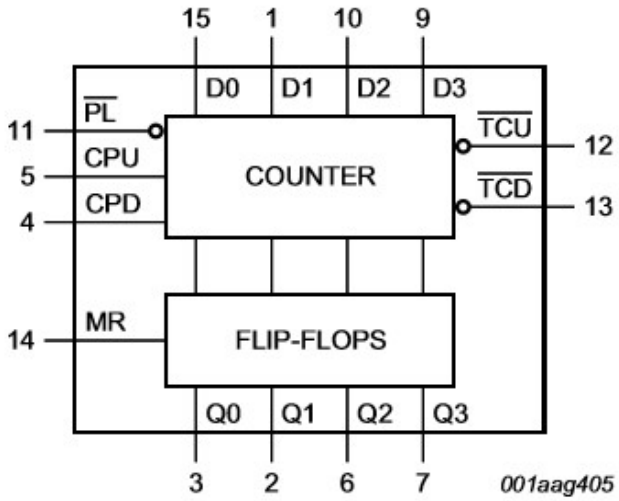


Fig 1. Functional diagram

74HC193
74HCT193

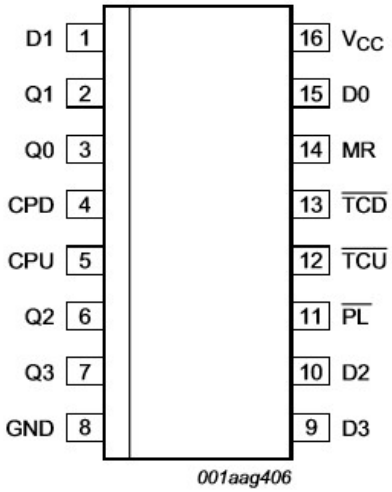


Table 2. Pin description

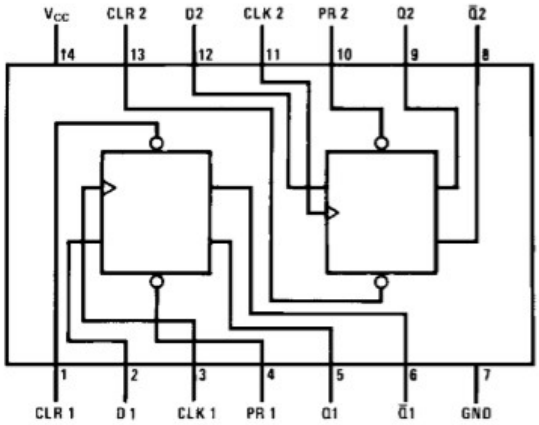
Symbol	Pin	Description
D0	15	data input 0
D1	1	data input 1
D2	10	data input 2
D3	9	data input 3
Q0	3	flip-flop output 0
Q1	2	flip-flop output 1
Q2	6	flip-flop output 2
Q3	7	flip-flop output 3
CPD	4	count down clock input[1]
CPU	5	count up clock input[1]
GND	8	ground (0 V)
$\overline{PL}$	11	asynchronous parallel load input (active LOW)
$\overline{TCU}$	12	terminal count up (carry) output (active LOW)
$\overline{TCD}$	13	terminal count down (borrow) output (active LOW)
MR	14	asynchronous master reset input (active HIGH)
V_{CC}	16	supply voltage

Table 3. Function table[1]

Operating mode	Inputs								Outputs					
	MR	$\overline{PL}$	CPU	CPD	D0	D1	D2	D3	Q0	Q1	Q2	Q3	$\overline{TCU}$	$\overline{TCD}$
Reset (clear)	H	X	X	L	X	X	X	X	L	L	L	L	H	L
	H	X	X	H	X	X	X	X	L	L	L	L	H	H
Parallel load	L	L	X	L	L	L	L	L	L	L	L	L	H	L
	L	L	X	H	L	L	L	L	L	L	L	L	H	H
	L	L	L	X	H	H	H	H	H	H	H	H	L	H
	L	L	H	X	H	H	H	H	H	H	H	H	H	H
Count up	L	H	↑	H	X	X	X	X	count up				H[2]	H
Count down	L	H	H	↑	X	X	X	X	count down				H	H[3]

11. D Flipflop [7474]

Connection Diagram



Function Table

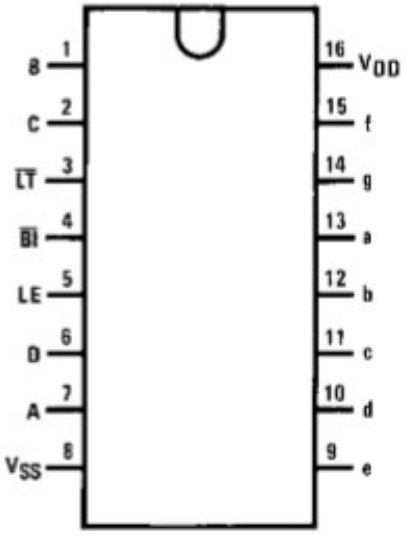
Inputs				Outputs	
PR	CLR	CLK	D	Q	$\overline{Q}$
L	H	X	X	H	L
H	L	X	X	L	H
L	L	X	X	H (Note 1)	H (Note 1)
H	H	↑	H	H	L
H	H	↑	L	L	H
H	H	L	X	Q_0	$\overline{Q}_0$

H = HIGH Logic Level
X = Either LOW or HIGH Logic Level
L = LOW Logic Level
↑ = Positive-going Transition
Q_0 = The output logic level of Q before the indicated input conditions were established.

Note 1: This configuration is nonstable; that is, it will not persist when either the preset and/or clear inputs return to their inactive (HIGH) level.

12. IC 4511

Pin Assignments for SOIC and DIP



Top View

Truth Table

Inputs							Outputs							
LE	$\overline{BI}$	$\overline{LT}$	D	C	B	A	a	b	c	d	e	f	g	Display
X	X	0	X	X	X	X	1	1	1	1	1	1	1	B
X	0	1	X	X	X	X	0	0	0	0	0	0	0	
0	1	1	0	0	0	0	1	1	1	1	1	1	0	0
0	1	1	0	0	0	1	0	1	1	0	0	0	0	1
0	1	1	0	0	1	0	1	1	0	1	1	0	1	2
0	1	1	0	0	1	1	1	1	1	1	0	0	1	3
0	1	1	0	1	0	0	0	1	1	0	0	1	1	4
0	1	1	0	1	0	1	1	0	1	1	0	1	1	5
0	1	1	0	1	1	0	0	0	1	1	1	1	1	6
0	1	1	0	1	1	1	1	1	1	0	0	0	0	7
0	1	1	1	0	0	0	1	1	1	1	1	1	1	8
0	1	1	1	0	0	1	1	1	1	0	0	1	1	9
0	1	1	1	0	1	0	0	0	0	0	0	0	0	
0	1	1	1	0	1	1	0	0	0	0	0	0	0	
0	1	1	1	1	0	0	0	0	0	0	0	0	0	
0	1	1	1	1	0	1	0	0	0	0	0	0	0	
0	1	1	1	1	1	0	0	0	0	0	0	0	0	
0	1	1	1	1	1	1	0	0	0	0	0	0	0	
1	1	1	X	X	X	X				*				*

Display

8) CONCLUSION

In this Term Project laboratory, we successfully designed and implemented our project: 'Integrated Security and Safety System'. This consists of four different modules, each doing a different task to make us safe. We successfully ran the Anti-Theft Alarm, Doorbell Security Light, Fire Alarm and Person Counter and implemented them practically. They worked satisfactorily and can thus be successfully used to fulfill their individual purpose.

9) REFERENCES

1) https://electronicsforu.com/electronics-projects/simple-multi-sensor-fire-alarm-2

2) https://electronicsforu.com/electronics-projects/loop-based-anti-theft-alarm

3)https://www.petervis.com/GCSE_Design_and_Technology_Electronic_Products/Transistor_as_a_Switch/using-a-transistor-as-a-switch-to-drive-a-relay/using-a-transistor-as-a-switch-to-drive-a-relay.gif

4) Digital Clock designed as Sem III Term Project.