NSS College of Engineering, Palakkad

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

2 DIGIT OBJECT/PRODUCT COUNTER

Course Name: ECT301: LINEAR INTEGRATED CIRCUITS

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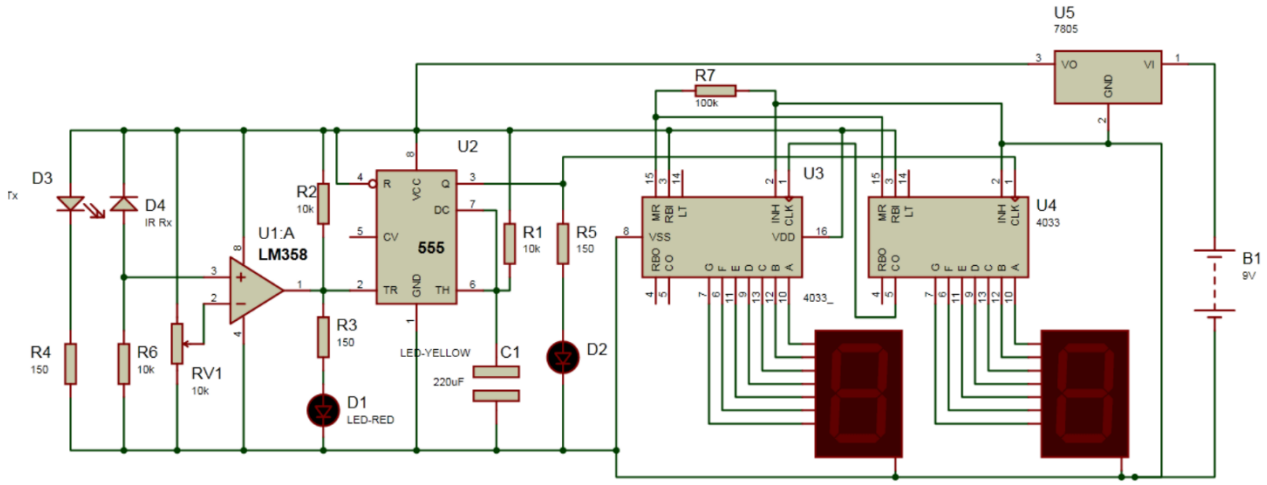
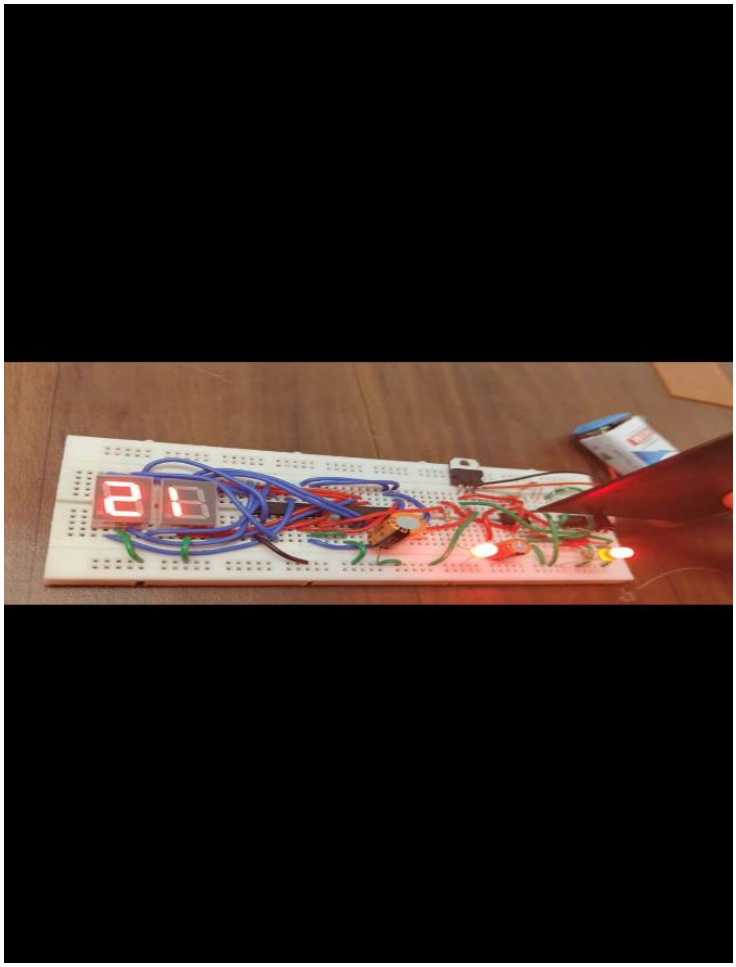
AIM

The aim of this report is to describe the design and implementation of a two-digit object counter using an IR sensor, focusing on the detection and counting of objects passing through a designated point.

CIRCUIT DIAGRAM



OUTPUT



COMPONENTS REQUIRED

1.LM358 IC - 1

2.555 timer IC -1

3.Voltage Regulator 7805 -1

4.150 Ohm - 2

5.CD4033 -2

6.10K resistor -2

7.100K resistor -1

8.10K POT -1

9.220uF capacitor -1

10.IR sensors-1

11.Bread board-1

12. 9 Volt Battery -1

13.Battery Connector-1

14.LED -2

WORKING OF EACH COMPONENT:

Function of the OP-AMP (LM358):

1. Signal Conditioning:

The IR receiver (D4) produces a weak and variable signal based on the presence or absence of infrared light. The op-amp compares this signal with a reference voltage to provide a more definitive output.

2. Comparator Function:

The op-amp compares the voltage coming from the IR receiver to a reference voltage (set by resistors and the potentiometer). When no object is present (IR light is received), the output of the op-amp remains low.

3. Noise Filtering and Stability:

The op-amp helps to filter out noise or small variations in the IR signal, ensuring that only significant changes (such as the presence of an object) trigger the circuit. This makes the detection more stable and reliable.

B1 (9V Battery): Provides the circuit with the main power source.

U5 (7805 Voltage Regulator): Regulates the 9V from the battery down to 5V to power the ICs and other components.

Infrared detection section:

D3 (IR Transmitter Diode): Emits infrared light, continuously sending IR rays.

D4 (IR Receiver Diode): Detects the IR light reflected back from an object. When an object interrupts the IR beam, it triggers the detection.

R4 (150Ω): Current limiting resistor for the IR transmitter, ensuring it doesn't receive too much current.

R6 (10kΩ): Pull-up resistor to stabilize the output from the IR receiver.

RV1 (10kΩ Potentiometer): Used to adjust the sensitivity of the IR receiver.

U2 (555 Timer): Operates in monostable mode. When the comparator (LM358) detects an object, it triggers the 555 timer to generate a pulse. The pulse width is determined by the combination of R1 (10kΩ) and C1 (220µF).

R3 (150Ω) and R5 (150Ω): These resistors are used in the timer circuit to control current flow.

D1 (Red LED): Indicates that the IR beam is interrupted.

D2 (Yellow LED): Blinks when the 555 timer sends a pulse, indicating object detection.

Counter Section:

U3 and U4 (4033 Decade Counter ICs): These ICs count the pulses generated by the 555 timer. Each pulse increments the counter. The 4033 IC is specifically designed to drive 7-segment displays and handle counting tasks.

U3 is used to count the ones (0-9).

U4 is used to count the tens (10-99).

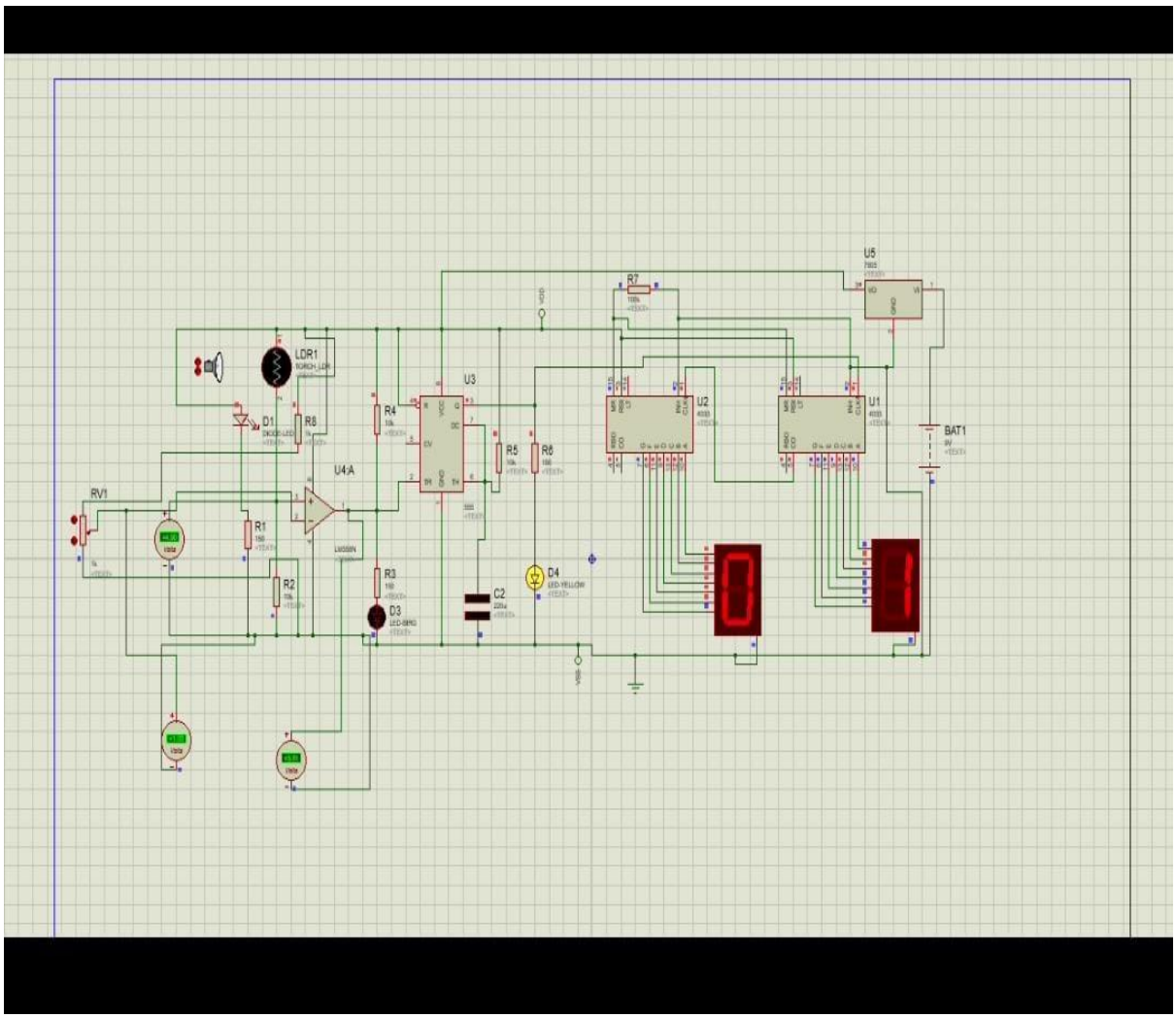
R7 (100kΩ): Pull-up resistor, used to ensure proper operation of the counter circuit.

Display Section:

7-Segment Displays: The outputs of U3 and U4 are connected to two 7-segment displays to show the count of detected objects.

capacitor: In a 555 timer configuration, a capacitor is often used to set the timing interval. The capacitor charges and discharges, determining the output pulse duration of the timer. This interval can be used to control the frequency or duration of the signal generated by the 555 IC, which might be responsible for the counting or triggering action in this circuit. The capacitor can also help stabilize the circuit by filtering out voltage fluctuations or noise that might cause erratic behaviour in the timer or counters (ICs U3 and U4).

SIMULATED OUTPUT:



APPLICATIONS:

1. Retail Analytics:
    - Counting customers entering and exiting stores to analyse foot traffic patterns and optimize staffing.
2. Sports Venues:
    - Counting spectators entering stadiums for event management and safety compliance.
3. Security Systems:
    - Monitoring restricted areas to ensure only authorized personnel are present.
4. Agriculture:
    - Counting livestock entering or exiting pens or barns for management purposes

CONCLUSION

The Dark-Activated Relay Circuit successfully demonstrates an efficient and adaptable solution for automating electrical devices in response to changing light conditions. Utilizing the 741 Op-Amp, LDR, and

transistor, this compact and cost-effective design provides automatic control, adjustable sensitivity, and energy efficiency. Suitable for various applications, including lighting control, security, home automation, and industrial control, this circuit offers a reliable and innovative solution for enhancing convenience, safety, and sustainability. Its potential for integration with IoT and renewable energy systems makes it a promising foundation for future developments in electrical engineering.

REFERENCES

- https://www.wikipedia.org
- https://www.electroschematics.com

WORKING:

This IR-based object counter circuit detects objects using an infrared transmitter (D3) and receiver (D4). The transmitter continuously emits infrared light, which reflects off an object when it comes close, allowing the receiver to pick up the reflected signal. The received signal then goes to an LM358 operational amplifier (U1) configured as a comparator, which outputs a high signal when it detects the reflected IR light. This high signal triggers the 555 timer (U2), configured in monostable mode,

to generate a single pulse of fixed duration, determined by capacitor C1 (220µF) and resistor R1. The pulse from the 555 timer acts as a clean signal for the counting ICs, U3 and U4, which are 4033-decade counters connected in cascade to form a 2-digit counter. Each time a pulse is received from the 555 timer, the counters increment by one, and the count is displayed on the connected 7-segment displays. This allows the display to show the number of objects detected, up to 99. The 7805-voltage regulator (U5) provides a stable 5V supply to the circuit components, ensuring consistent operation. In summary, the circuit increments the displayed count by one each time an object passes near the IR sensor, making it suitable for applications such as people counters or object tracking systems.