A Practical activity Report submitted

for Engineering Design Project-II (UTA-014)

by

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Submitted to

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Assignment - 1

Objective:

Design a microcontroller-based detection system for a proximity sensor with a neat circuit diagram.

Component Used:

1. **ATtiny85[1]**: ATtiny85 is an 8-bit AVR microcontroller that comes with 8-pin interface and mainly used in automation and Arduino projects. It is a high performance, low power 8-bit microcontroller based on Advanced RISC Architecture. It has 8 Kbytes of In-System Programmable Flash and is popular because of its compact size and its features. The ATtiny85 can be used as a bare chip on a breadboard as long as correct power is supplied to the device.

2. **IR Sensor[2]:** IR sensor is an electronic device, that emits the light in order to sense some object of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes, but infrared sensor can detect these radiations. There are two types of infrared sensors: active and passive. Active infrared sensors both emit and detect infrared radiation. Passive infrared (PIR) sensors only detect infrared radiation and do not emit it from an LED. LM393 IC is used as the base controller and voltage comparator for the IR sensor.

3. **LED[3]**: A Light Emitting Diode (LED) is a special type of PN junction diode. The light emitting diode is specially doped and made of a special type of semiconductor. This diode can emit light when it is in the forward biased state. Aluminum indium gallium phosphide (AlInGaP) and indium gallium nitride (InGaN) are two of the most commonly used semiconductors for LED technologies. Since light is generated within the solid semiconductor material, LEDs are described as solid-state devices.

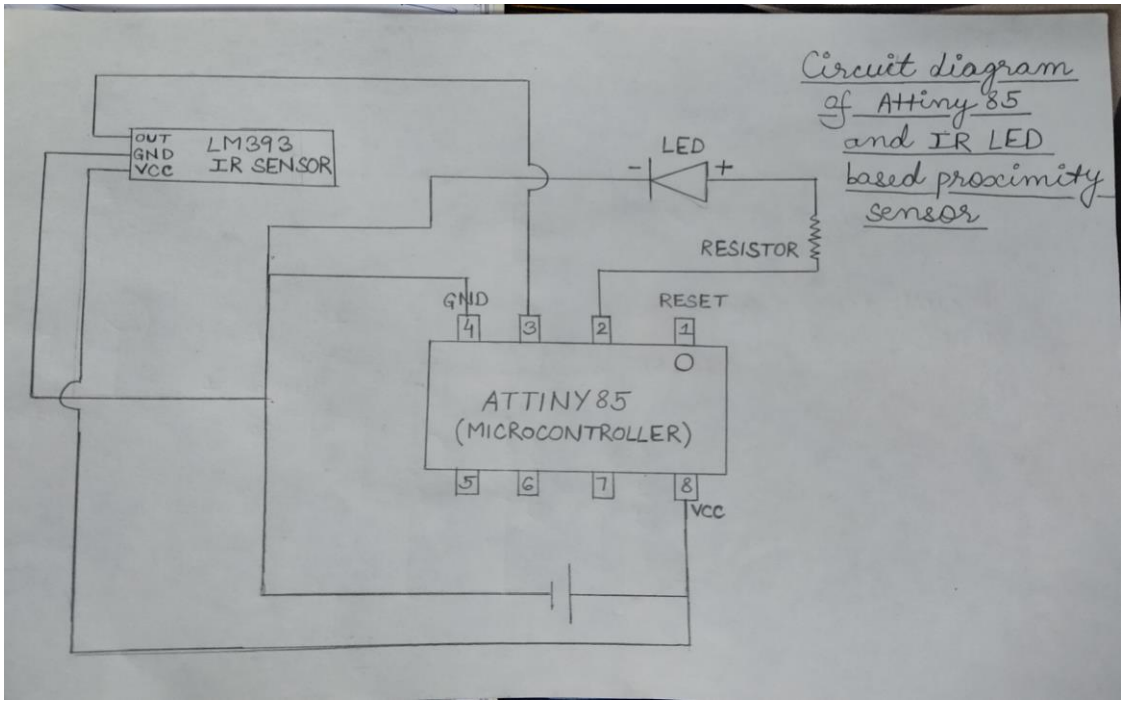
4. **Resistor[4]**: The resistor is a passive electrical component to create resistance in the flow of electric current. In almost all electrical networks and electronic circuits they can be found. The resistance is measured in ohms. An ohm is the resistance that occurs when a current of one ampere passes through a resistor with a one volt drop across its terminals. Resistors are used for many purposes. A few examples include delimit electric current, voltage division, heat generation, matching and loading circuits, control gain, and fix time constants.

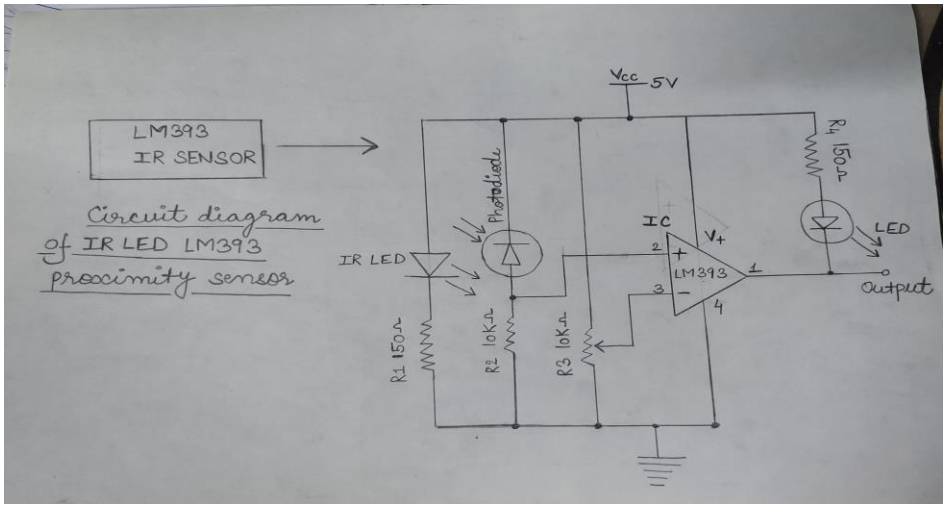
5. **Breadboard[5]**: A breadboard is a solderless device for temporary prototype with electronics and test circuit designs. Most electronic components in electronic circuits can be interconnected by inserting their leads or terminals into the holes and then

making connections through wires where appropriate. The breadboard has strips of metal underneath the board and connect the holes on the top of the board. A typical bread board layout consists of two types of region - bus strips and socket strips. Bus strips are used to provide power supply to the circuit and socket strips hold most of the components in the circuit.

6. **Connecting wires or jumper wires[6]**: Jumper wires are simply wires that have connector pins at each end, allowing them to be used to connect two points to each other without soldering. Jumper wires are typically used with breadboards and other prototyping tools in order to make it easy to change a circuit as needed. Individual jump wires are fitted by inserting their "end connectors" into the slots provided in a breadboard, the header connector of a circuit board, or a piece of test equipment. Jumper wires are easy and inexpensive to purchase.

Circuit Diagram:





Code:

```
/*
 IR Proximity Sensor interface code
Turns on an LED ON when obstacle is detected, else OFF.
*/

unsigned int IRpin = 3;                 // Pin 3 of ATtiny85 is connected to the LM393 IR Sensor
unsigned int Indicatorpin = 2;        // Pin 2 of ATtiny85 is connected to the LED

void blink_indicator(){                 // Used for blinking LED on proximity sensor activation
digitalWrite(Indicatorpin, HIGH); // Alternately set Indicator LED pin to HIGH and LOW
delay(200);
digitalWrite(Indicatorpin, LOW);
delay(200);
}

void setup() {
pinMode(IRpin, INPUT_PULLUP);
pinMode(Indicatorpin, OUTPUT);
}

void loop() {
if(digitalRead(IRpin) == LOW) blink_indicator(); // We check the output value coming from
else digitalWrite(Indicatorpin, LOW);                 // IR sensor and if it is LOW, blink LED
}
```

Working of the circuit: [7]

The IR LED is connected in forward bias in the sensor module. As 5V DC powers the module, the IR LED starts emitting IR radiations. An IR photodiode is placed parallel to the IR LED to detect the reflected radiations. The photodiode is connected in a voltage divider network, whose output goes to the inverting input of LM393 comparator IC. The non-inverting input of the same comparator is connected to a pot for adjustment of the reference voltage. The output of the comparator is taken as the output of the module.
When the IR detector receives reflected radiations, its resistance drops. As a result, a voltage higher than the reference voltage is applied at the comparator's inverting input, and the comparator output turns to LOW.

ATtiny85 is programmed to detect digital input from the IR module. As it detects a LOW logical signal from the IR sensor, it starts blinking LED connected at pin 2. When there is a HIGH logical signal from the IR module in the absence of any near approaching object, Arduino keeps the LED connected at pin 2.

Selection Criterion of LM393 based IR sensor: [8]

- LM393 IC is a low-power, single-supply, low-offset voltage, double, differential comparator.
- IR sensor uses less power.
- Do not need contact with the object for detection.
- No data leakage because of the ray direction.
- These sensors are not affected by oxidation & corrosion.

Selection Criterion of ATtiny85 microcontroller: [9]

- Easy to solder and occupies no more space on the board than most power connectors.
- ATtiny85 doubles the number of IO pins without making the package too much bigger.
- High performance and low power microchip.
- This is a low-cost and more compact Arduino alternative.

Tentative cost of project:

- **ATtiny85 microcontroller:** Rs. 103.76 [10]
- **IR Sensor:** Rs. 129 [11]
- **LED:** Rs. 3 [12]
- **Resistor:** Rs. 3 [13]
- **Breadboard:** Rs. 60 [14]
- **Jumper Wires:** Rs. 12.5 [15]

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Signature of Faculty member