DESCRIPTION

The Saleng – Tracker module is a compact reflective infrared sensor module designed for detecting the presence or absence of an IR reflective surface (e.g. light or dark line) in front of its optical elements. The module uses the TCRT5000 IR pair while its output is fed to a Schmitt triggered gate producing reliable digital output. It has a Digital Output pin labeled DO and another with an inverted output signal labeled ~DO. DO is high when a reflective surface (e.g. white surface) comes within range and thereby reflecting back the emitter's IR beam back to the IR receiver on the board. DO is low when no reflective surface (e.g. dark surface) is detected. ~DO's output is the inverse of DO. The absence of a sensitivity/calibration adjustment potentiometer makes this module easy to use with its digital outputs optimized for dark/light line detection in robotic applications. An Analog Output pin named AO is also available and is tied to the output of the photo diode. This may be useful for distance or obstacle sensing. The tracker module is part of Layad Circuits' Saleng series of innovation-starter products.

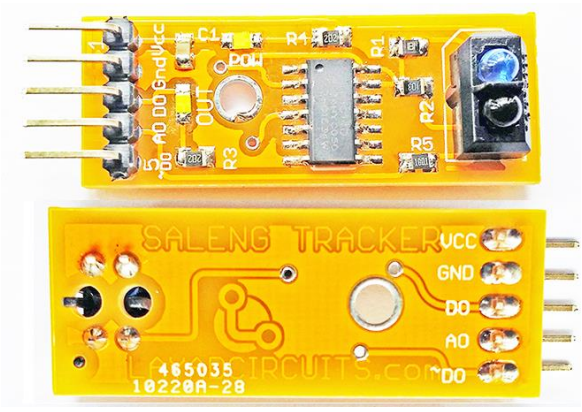

Figure 1: The Saleng-Tracker IR module top and bottom view

FEATURES

- Detector Type: Phototransistor
- Input Voltage: 3.3V - 5V
- Typical Current Consumption: <40mA
- Peak Current (Vin=5V): 80mA
- Digital Output Effective Distance Range: ~10mm
- Analog Output Effective Distance Range: ~100mm
- Emitter Wavelength: 950nm
- Daylight Blocking Filter
- Digital Output with Inverted Output
- Analog Output
- Small form factor, board dimensions: 15x38mm

TYPICAL APPLICATIONS

- Line Following Robot
- Limit Sensor
- Object Counter
- Speed Mater / Tachometer
- General Obstacle sensing
- Distance Sensing

PIN FUNCTIONS

Pin Label	Function/Operation/Remarks
Vcc	3.3 to 5V input power. A 100mA or higher power source is recommended.
Gnd	Ground pin.
DO	Schmitt-triggered digital output. High when a reflections are detected (e.g. white surface). Low when no return wave is detected (e.g. dark surface).
~DO	Inverse of DO. E.g. ~DO is high when DO is low.
AO	Analog Output of the photo sensor. The output voltage is between ground and Vcc and increases with distance of the reflective surface from the photo sensor

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APPLICATION NOTES

Line Tracing/Line Follower Robot

The Saleng – Tracker module may be used with a microcontroller based mobile robot to quickly detect light and dark surfaces. The module maybe installed under the chassis at a distance of about 1cm from the floor. Only the DO (or the ~DO if you need an inverted logic e.g. low when reflections are detected) is needed in this case. The AO may be left unconnected.

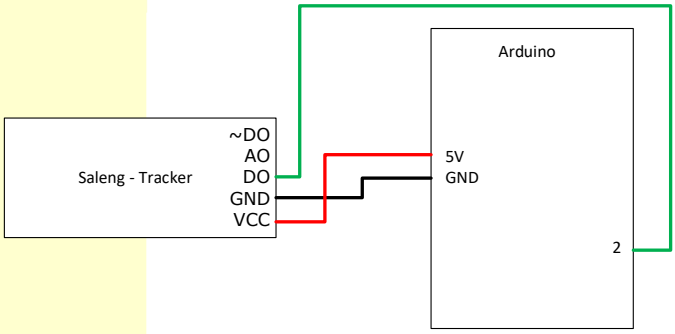

Figure 2: Example wiring as a line tracker with an Arduino board.

In actual tests, the typical maximum useable distance range is 15 to 20mm. To be on the safe side, a 10mm or lower floor-to-optical sensor distance is advised.

Because the digital output come from Schmitt triggered gates, DO and ~DO will readily work with a 5V or 3.3V microcontroller.

Example Saleng Uno/ Arduino Code following figure 2 wiring to demonstrate line tracking ability:

```
const byte salengTrackerDO = 2;
const byte led= 13;

void setup()
{
   Serial.begin(115200);
   pinMode(salengTrackerDO, INPUT);
   pinMode(led, OUTPUT);
}
```

```
void loop()
{
   if(digitalRead(salengTrackerDO) == HIGH)
   {
    digitalWrite(led,HIGH);
    // if a reflective surface is
    // detected then turn LED on
    Serial.println("Light!");
   }
   else
   {
    digitalWrite(led,LOW);
    // if no reflective surface is
    // detected then turn LED off
    Serial.println("Dark!");
   }
}
```

It goes without saying that if a mobile robot is involved, the above sketch will need to include the motor control algorithm.

Distance or Obstacle Sensing with the Analog Output

The Saleng-Tracker module has an analog output with a voltage that is approximately proportional to the distance of a reflector in front of the optical elements. Typically, the sensor is effective when the reflective surface is at around 100mm (10cm) of the optical elements. In actual test using an ordinary white paper as reflector and an Arduino, there are detectable changes in voltage up to around 200mm (20cm).

Take note though that the analog output voltage does not have a linear relationship with distance. It is advised to perform actual experiments to obtain a calibration curve or look up table.

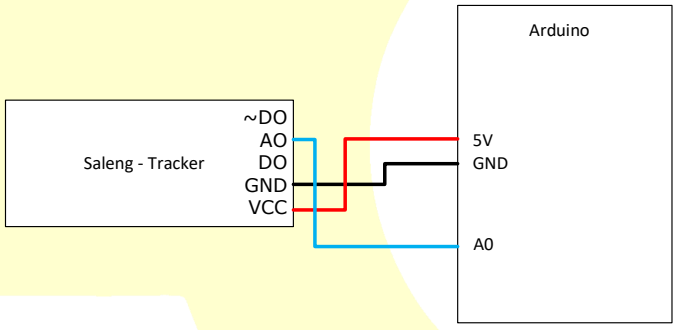

Figure 3: Example wiring as a distance or obstacle sensor with an Arduino board.

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Example Saleng Uno/Arduino Code following figure 3 – Upload and open serial monitor, set to 115200 baud rate.

```
const byte salengTrackerAO = A0;  // connect Saleng Tracker AO to pin A0 of the Arduino
int trackerValue;                 // store the analog output values here

void setup()
{
   Serial.begin(115200);
}

void loop()
{
   trackerValue = analogRead(salengTrackerAO);
   // The following approximates the distance of the object. Note that the
   // values in this code are approximate and may change with each
   // application. External factors like IR sources (e.g. sunlight) will affect these values.
   // Upload this code and test on your actual setup
   if(trackerValue <= 50) Serial.println("Object is around 1cm from sensor");
   else if(trackerValue <= 650) Serial.println("Object is around 2cm from sensor");
   else if(trackerValue <= 800) Serial.println("Object is around 4cm from sensor");
   else if(trackerValue <= 845) Serial.println("Object is around 6cm from sensor");
   else if(trackerValue <= 980) Serial.println("Object is around 8cm from sensor");
   else if(trackerValue <= 1000) Serial.println("Object is around 9cm from sensor");
   else Serial.println("Object is around 10cm or farther from sensor");
}
```

Simple tachometer / speed meter using Digital Output

A basic tachometer can be implemented using an external interrupt pin of the Saleng Uno/Arduino and DO output of the Saleng Tracker. The installation must be such that the Saleng Tracker comes in close contact with the rotating obstacle (not dark in color) one or more times per revolution. In the case of a fan for example, if the blades are dark , a light colored tape/paint may be placed on one of the blades. The sensor module should be positioned to come in range of the tape every revolution. See figure 4.

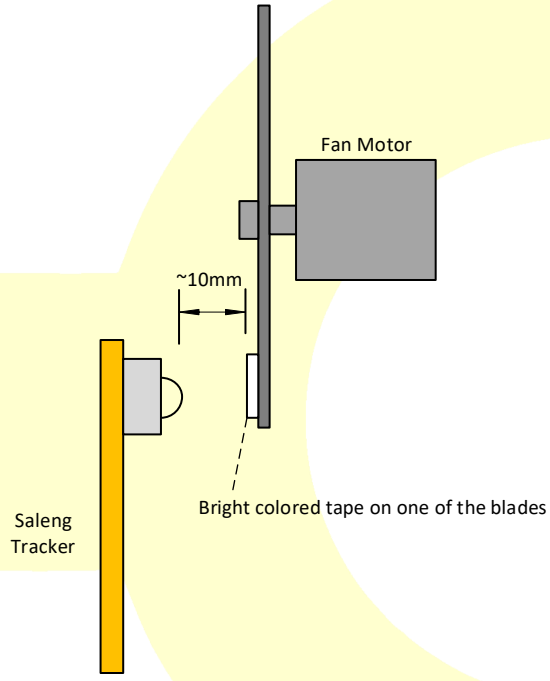

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Figure 4: Installation when used as a tachometer

Example Saleng Uno/Arduino Code for a tachometer application.

The wiring for this example follows figure 2 and the mechanical installation follows figure 4. If the blades of the fan are able to reflect IR, leave it as it is without tape but remember to divide the RPM with the total number of pulses (blades) per revolution. The code example only detects rising edges so the final RPM of a 3 bladed fan should be rpm = rpm/3; .

Care should be taken to ensure that exact number of pulses are produced per revolution. The following example assumes one pulse per revolution. Upload and then open the serial monitor at 115200 baud rate to view the results.

```
const byte salengTrackerDO = 2;
volatile unsigned long revCount;  // this saves the number of revs detected.
unsigned long rpm;                // holds the computed speed in revolutions per minute
unsigned long totaltime;          // saves the time interval from last calculation
unsigned long prevtime;           // saves last time we calculated

void revs()
{
  revCount++;                     //increment this everytime an obstacle is detected
  digitalWrite(LED_BUILTIN,!digitalRead(LED_BUILTIN)); // toggle the LED on board every rev.
}

void setup() {
  Serial.begin(115200);

   pinMode(salengTrackerDO, INPUT);         // set pin 2 as an input
  pinMode(LED_BUILTIN,OUTPUT);              // set the LED on board as an output

  // enable external interrupt on pin 2.
  // Set the ISR function (revs()) on every rising edge
  attachInterrupt(digitalPinToInterrupt(salengTrackerDO), revs, RISING);
}

void loop() {
  delay(1000);
  // temporarily disable the interrupt to allow computation
  detachInterrupt(digitalPinToInterrupt(salengTrackerDO));
  totaltime = millis() - prevtime;
  rpm = revCount*60000/totaltime;          // RPM = rev/1 minute. 1 min = 60000ms
  revCount = 0;                            // done computing so reset revs count
  prevtime = millis();                     // save last time we did the calculations
  attachInterrupt(digitalPinToInterrupt(salengTrackerDO), revs, RISING); // re-enable interrupt
  Serial.print("RPM=");                    // display results on screen
  Serial.println(rpm);
}
```

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