8 Channel Saleng Tracker Module User Guide

OVERVIEW

The 8 Channel Saleng Tracker Module is an array of 8 infrared sensors designed for line or simple color sensing and general purpose proximity sensing. An on board RISC processor takes care of all sensor processing and therefore lessens software load on the main host. There are two concurrent interface ports: a serial (UART) and parallel output ports, one for each sensor element. The module uses infrared elements that come with built-in sunlight filter providing improved performance in sunlit areas than traditional photodiodes.

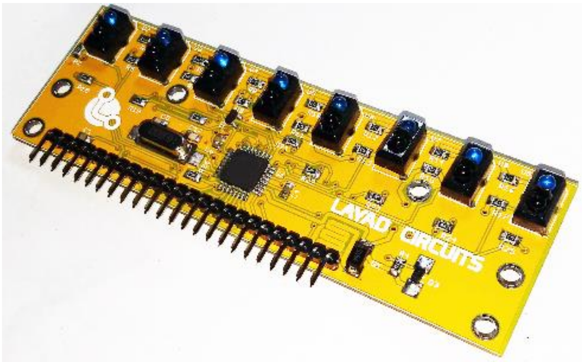

Figure 1 8CH Saleng Tracker

FEATURES

- Onboard RISC processor
- UART and Parallel interface
- Individual LED indicator per sensor element
- Reversible logic for parallel port and LED indicators
- Adjustable sensor threshold
- Multiple output modes using the UART interface
- On chip power saving feature resulting to <200mA consumption. Typical consumption with all LED on ~ 150mA.
- Standard headers
- Power indicator
- Designed primarily for Arduino users

PIN FUNCTIONS

The module has a 4 pin 2.54mm pitched header with the following functions.

Pin Label	Function/Operation/Remarks
VIN	+5Vdc. This is the power source for the module
GND	Ground pin.
RXD	Receive pin of the serial/UART port – connects to the transmit pin of the host microcontroller (Arduino etc..)
TXD	Transmit pin of the serial/UART port – connects to the receive pin of the host microcontroller (Arduino etc..)
I0 – I7	Parallel port pins. By default, white(reflective) surfaces will result to a HIGH and dark or non reflective surfaces will result to a LOW on each of these pins corresponding the sensor
All others	Do not use

PARALLEL PORT INTERFACE

Use this port (I0-I7) for simplified programming. Connect each of the pins to digital input pins on your host (Arduino etc..). I0 represents the status of sensor 0 while I7 represents the status of sensor 1. By default, each pin is HIGH if the corresponding sensor element detects a white/reflective surface in front of it. It is LOW if the sensor element does not see a reflective surface. The logic state may be reversed using the inverse command that may be sent via serial port. The LED indicators follow whatever is the actual logic state of the parallel port e.g. LED is ON when pin is HIGH.

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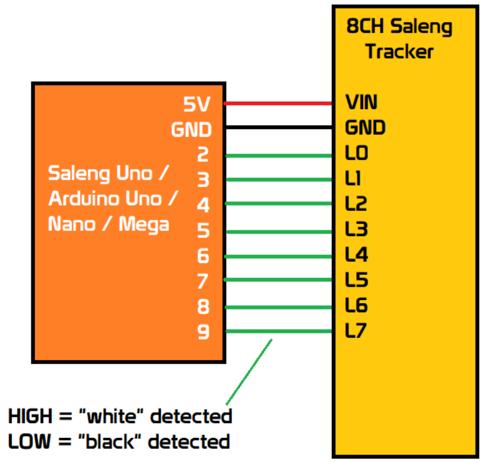

Figure 2 Example connection using the parallel port

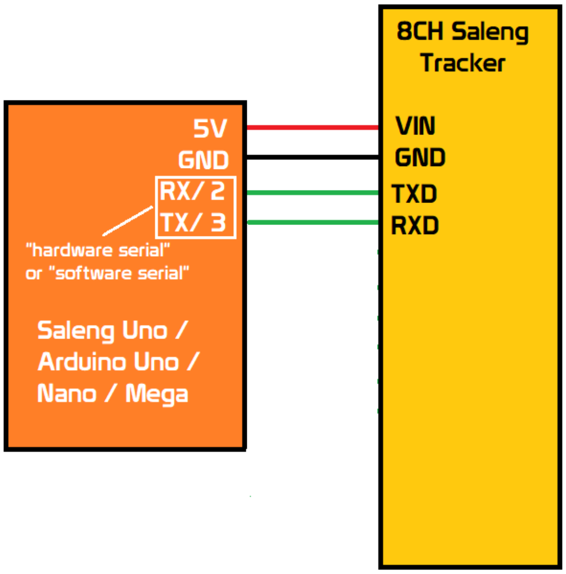

Figure 2 Example connection using the serial port

SERIAL PORT INTERFACE

To save input pins, the user may opt to use the serial port interface requiring only 2 pins (hardware or software serial port). The serial port interface allows the user to read each sensor element in 3 output formats and send configuration commands to the module. The serial port is set to the following UART parameters:

- 9600 baud rate
- 8 data bits
- No parity
- 1 Stop bit

SERIAL PORT COMMANDS

The following commands are sent from the host microcontroller to the sensor board.

In general, a command starts with an '&', followed by the command and then finally ended with a '\r' (Carriage Return) and optionally a '\n' (New line).

Command String	Function
&M0\r	Sets the output format to Mode 0. In this mode, the output string is formatted as follows: @xxxxxxxx#\r\n Where x is either '0' or '1' representing the state of each sensor element. For example, when the first 4 sensors detect "white" and the others detect "black",

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	expect to receive the string "@11110000#\r\n"
&M1\r	Sets the output format to Mode 1. In this mode, the output string is formatted as follows: @xxxxxxxx#\r\n Where x is a letter from a to h corresponding the sensor elements and where an upper case represents a "white" and a lower case, a "black". For example, when the first 4 sensors detect "white" and the others detect "black", expect to receive the string "@ABCDefgh#\r\n"
&M2\r	Sets the output format to Mode 2. In this mode, there is a single byte output. Each bit represents the state of the 8 sensor elements. For example, when the first 4 sensors detect "white" and the others detect "black", expect to receive the byte B11110000 or 0xF0 in hex.
&M3\r	Sets the output format to Mode 3. In this mode, the output per sensor element is a number from 00 to 99 representing the intensity of the reflected IR signal. Example: @,01,99,02,98,03,97,04,96,#
&Txx\r	Sets the threshold/sensitivity of the IR sensor elements. Set xx to any number between 00 and 99. Keep single digit numbers as 2 digits. Example: &T05#\r
&I0/r or &I1/r	Enable/Disable Inverse Setting - this command toggles the logic level of the LEDs and I0-I7
&FACTORY#	Reset to factory default settings

APPLICATION NOTES

SELECTING INTERFACE PORT AND MODE

Parallel Port Interface – use this for simplified programming at the expense of 8 digital inputs

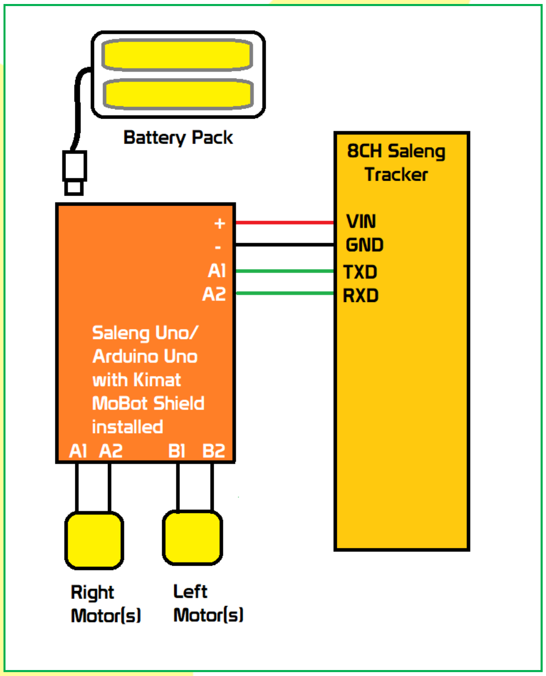
Serial Port Interface – use this to save pins. This port requires a free hardware or software emulated serial port.

- Mode 0 and 1 requires collection and parsing of string from the module
- Mode 2 – bitwise operation is needed to interpret the data but parsing errors are minimal given that there is a single byte to process
- Mode 3 – useful if the host will perform the processing of the data. This may be used as a crude distance or color sensor sensor.

BASIC EXAMPLE: LINE TRACING

This build uses the Kimat MOBOT Shield (mark 1) as its driver board. The objective is to create a line follower robot assuming the line is continuous without breaks. It is assumed the line is dark while the background is light.

Wiring



Code

```
#include <SoftwareSerial.h>

SoftwareSerial mySerial(A1, A2); // RX, TX

char SenseValue[8];
char ReadValue;
byte Index;
int LeftLevel,RightLevel,TurnValue;
int Toggle=1;

#define BLK LOW  // line
#define WHT HIGH // background

// speed setting based on movement
// 255=full speed
#define SPEED_ON_TURNS 120
```

```
#define SPEED_FORWARD 100
#define SPEED_BACKWARD 100

#define AIN1 2
#define BIN1 7
#define AIN2 4
#define BIN2 5
#define PWMA 3
#define PWMB 6
#define STBY 8
#define SENSOR_L A0
#define SENSOR_C 11
#define SENSOR_R 10

byte sensorL, sensorC, sensorR;


void speedSetting(byte val)
{
  analogWrite(PWMA,val);
  analogWrite(PWMB,val);
}

void forward()
{
  speedSetting(SPEED_FORWARD);
  digitalWrite(AIN1,HIGH);
  digitalWrite(AIN2,LOW);
  digitalWrite(BIN1,HIGH);
  digitalWrite(BIN2,LOW);
}

void backward()
{
  speedSetting(SPEED_BACKWARD);
  digitalWrite(AIN1,LOW);
  digitalWrite(AIN2,HIGH);
  digitalWrite(BIN1,LOW);
  digitalWrite(BIN2,HIGH);
}

void turnleft()
{
  speedSetting(SPEED_ON_TURNS);
  digitalWrite(AIN1,HIGH);
  digitalWrite(AIN2,LOW);
  digitalWrite(BIN1,LOW);
  digitalWrite(BIN2,HIGH);
}

void turnright()
{
  speedSetting(SPEED_ON_TURNS);
  digitalWrite(AIN1,LOW);
  digitalWrite(AIN2,HIGH);
  digitalWrite(BIN1,HIGH);
  digitalWrite(BIN2,LOW);
```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```
}
void motorstop()
{
  digitalWrite(AIN1,LOW);
  digitalWrite(AIN2,LOW);
  digitalWrite(BIN1,LOW);
  digitalWrite(BIN2,LOW);
}

void shortbreak()
{
  digitalWrite(AIN1,HIGH);
  digitalWrite(AIN2,HIGH);
  digitalWrite(BIN1,HIGH);
  digitalWrite(BIN2,HIGH);
}

void setup() {
  //pinMode(SENSOR_L,INPUT);
  //pinMode(SENSOR_C,INPUT);
  //pinMode(SENSOR_R,INPUT);
  pinMode(AIN1,OUTPUT);
  pinMode(AIN2,OUTPUT);
  pinMode(BIN1,OUTPUT);
  pinMode(BIN2,OUTPUT);
  pinMode(STBY,OUTPUT);
  digitalWrite(STBY,HIGH);//enable driver
  //we use a slow speed to avoid
  // overshooting lines
  // and conserve battery
  // full speed = 255
  speedSetting(64);
  mySerial.begin(9600);
  Serial.begin(9600);
  mySerial.println("&FACTORY#/r/n");
  delay(5000); // add 5s delay
}

void loop() {
  if(Toggle){//should be at setup but it seems doesnt send therefore temporary put in void loop
    mySerial.println("&M0/r/n");
    mySerial.println("&T04/r/n");//
    mySerial.println("&I1/r/n");
    Toggle=0;
  }
  while(mySerial.available()){
    ReadValue=mySerial.read();
    if(ReadValue=='@'){
      memset(SenseValue, 0, sizeof(SenseValue));
      Index=0;
      LeftLevel=0;
      RightLevel=0;
    }
    else if(Index<=1){
      if(ReadValue=='0'){RightLevel=RightLevel+2;}//outer right
      SenseValue[Index]=ReadValue;
      Index++;
```

```
    }
    else if(Index<=3){
      if(ReadValue=='0'){RightLevel++;}//inner right
      SenseValue[Index]=ReadValue;
      Index++;
    }
    else if(Index<=5){
      if(ReadValue=='0'){LeftLevel++;}//inner left
      SenseValue[Index]=ReadValue;
      Index++;
    }
    else if(Index<=7){
      if(ReadValue=='0'){LeftLevel=LeftLevel+2;}//outer left
      SenseValue[Index]=ReadValue;
      Index++;
    }
    else if((Index==8)&&(ReadValue=='#')){//when condition not met, received data are discarded
      Serial.print(SenseValue);
      TurnValue=LeftLevel-RightLevel;//strcmp used for situational like different line thickness,
parallel black line too close each other, and lessen erratic left and right turn
      if(((TurnValue>1)&&(strcmp(SenseValue,"11000001") < 4)&&(strcmp(SenseValue,"10000011") <
4))||(strcmp(SenseValue,"11111011") == 4)||(strcmp(SenseValue,"00110011") ==
4)||(strcmp(SenseValue,"01110011") == 4)){
        turnleft();
        Serial.println("LEFT");
      }
      else if(((TurnValue<-1)&&(strcmp(SenseValue,"11000001") < 4)&&(strcmp(SenseValue,"10000011")
< 4))||(strcmp(SenseValue,"11011111") == 4)||(strcmp(SenseValue,"11001100") ==
4)||(strcmp(SenseValue,"11001110") == 4)){
        turnright();
        Serial.println("RIGHT");
      }
      else if((LeftLevel=!0)&&(RightLevel=!0)){
        forward();
        Serial.println("FORWARD");
      }//else none
      break;
    }
  }
}
```


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DOCUMENT REVISION HISTORY

Revision:

v1.0.0 / 02 Dec 2019 / C.D.Malecdan

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