

"RoboFesta-OU in the Regions" Widening Participation Project

RoboLab 'RoboCupJunior Rescue' Mentor Notes: *Basic Program*

These notes are provided as background material for mentors looking after groups taking part in the RoboCupJunior rescue challenge. They provide a worked through description of a minimal program for a rescue robot.

The intention is not that you give the program described in these notes directly to the children involved in the challenge. There are many ways of tackling the program, and this is not necessarily the best. However, the notes do show you one way of resolving several of the programming issues raised by the challenge.

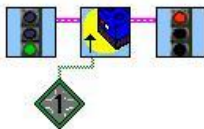
It is recommended that you introduce the children to the idea of an edge-following robot before looking at the complete challenge. Briefing notes are available that describe how to program a simple line follower using RoboLab Pilot level 4. The program described in this document requires the use of RoboLab Inventor level 3 or 4.

Requirements:

Lego Mindstorms buggy with downward facing light sensor connected to Input port 1 on the RCX brick
RCX with Lego firmware installed
PC running RoboLab Inventor Level 3 or 4 and with IR tower connected
A3 test pad #1 (half black/half white on one side, black line on white on other side), silver foil bodies ~1cm x ~5cm
(Optional) Test track with black line ~2" thick on white background and silver foil bodies
(Sample RoboLab program bundle)

Set-up:

The RCX brick should be configured with Input port 1 set to light sensor mode. Download and run the following program to configure the light sensor:



The red LED in the light sensor should glow brightly.

Activity:

The aim of the activity is to allow visitors to program a buggy to follow the edge of a black line on a white background. When the robot sees a silver foil body laid across the line, it should stop for two seconds, beep, and then move on to continue following the line.

The robot can be programmed to follow either side of the line. Though the particular program is different for each case, the principle is the same.

Phase 1: Press the View button repeatedly until the ^ is under Input 1 and the light sensor reading is displayed on the RCX screen.

Place the robot on the test pad with the light sensor over the black part of the test pad; record (or memorise) the light sensor reading. Now move the robot so that the light sensor is over the white part of the test pad. Record (or memorise) this second reading.

Define a *threshold* value approximately half-way between the two readings. For example, if you recorded 30 over black and 52 over white, define a threshold value of about 40.

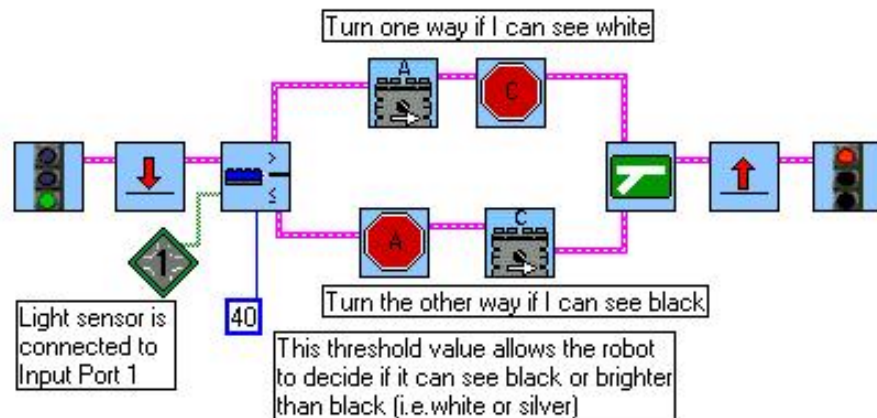
This first threshold value is the value that the robot will use to decide whether or not the light sensor can see something white or black.

Now place the robot on the test pad with the light sensor over a silver foil body; record (or memorise) the light sensor reading.

Define a second threshold value approximately half-way between the second and third readings. For example, if you recorded 52 over white and 66 over silver, set the second threshold value to about 60.

Value over black (B)	
Value over white (W)	
Value over silver (S)	
Black/white threshold (e.g. $(B + W)/2$)	
White/silver threshold (e.g. $(W + S)/2$)	

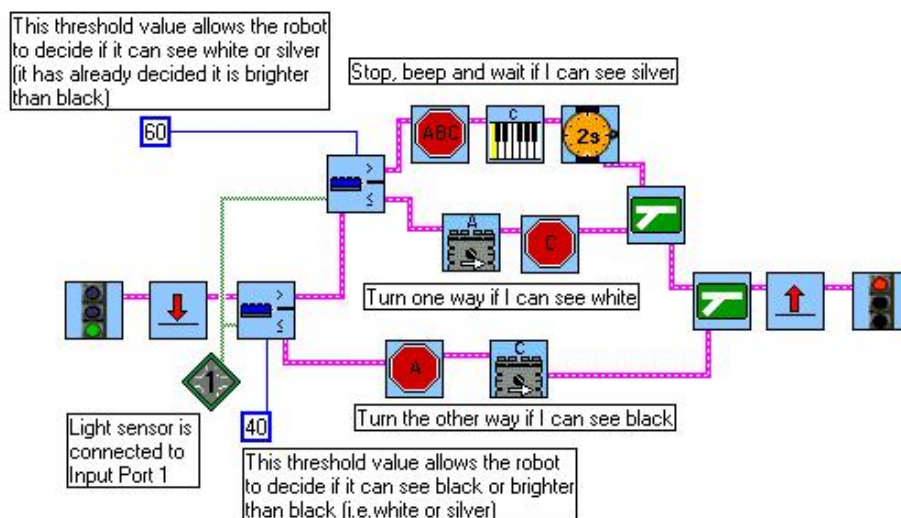
Phase 2: Program the robot to follow the edge of the line. Rather than using the linear program developed in the Pilot programming edge follower exercise, use a branch to decide whether the robot is over white or black:



Download the program to the brick, place the robot with the light sensor to the left of the black line, and press Run.

- Checklist:
- Motors connected correctly to Output ports A and C
 - Light sensor connected to Input port 1 (red LED should glow brightly)
 - Threshold value correctly set
 - Ensure the brick is switched on, in range of and facing the IR tower
 - Correct program slot being used to run the program
 - Light sensor threshold value set to the midpoint of the black and white readings

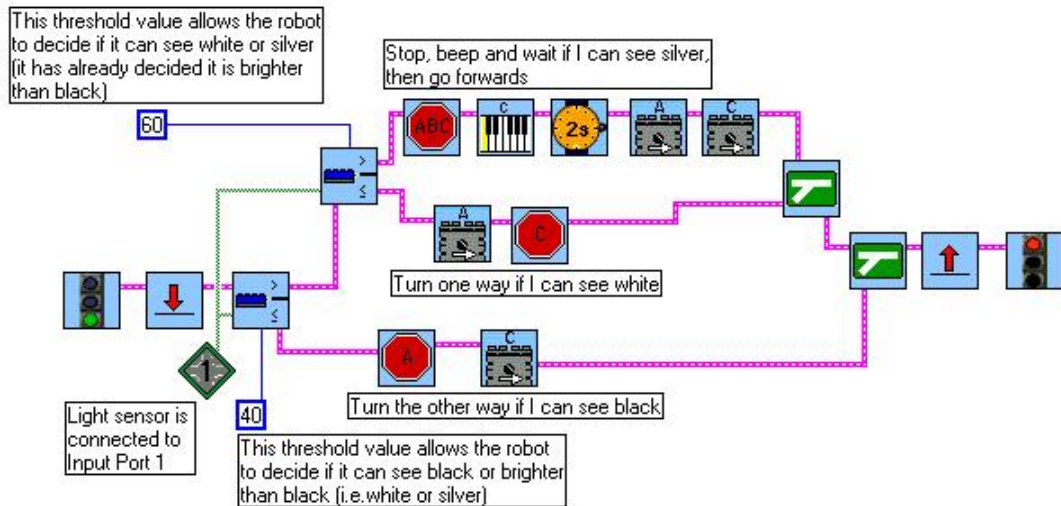
Phase 3: Now add another branch to decide if the bright reading is actually caused by the white floor or a silver body.



Download the program to the brick and try it out.

Did it work? You may find that having found a body, the robot never moved on again. There are various solutions to this. Can you think of any?

Phase 4: Here's one possible solution. After the 2 second wait, set the robot going forward:



Did it work this time? You may have found that after restarting the robot immediately stops and beeps again.

Phase 5: What you need to do now is put in a short delay before checking the light sensor again, but not so long that the robot passes over to the other side of the line. (What will happen if it does cross right over the line?)

