Robot to lead itself

Agenda

- Goal of project
- Components of robot
- Navigation
- Slam Algorithm

Goal of project

Robots are used in the auto, medical, and manufacturing industries, in all manner of exploration vehicles, and, of course, in many science fiction films.

Components of robot

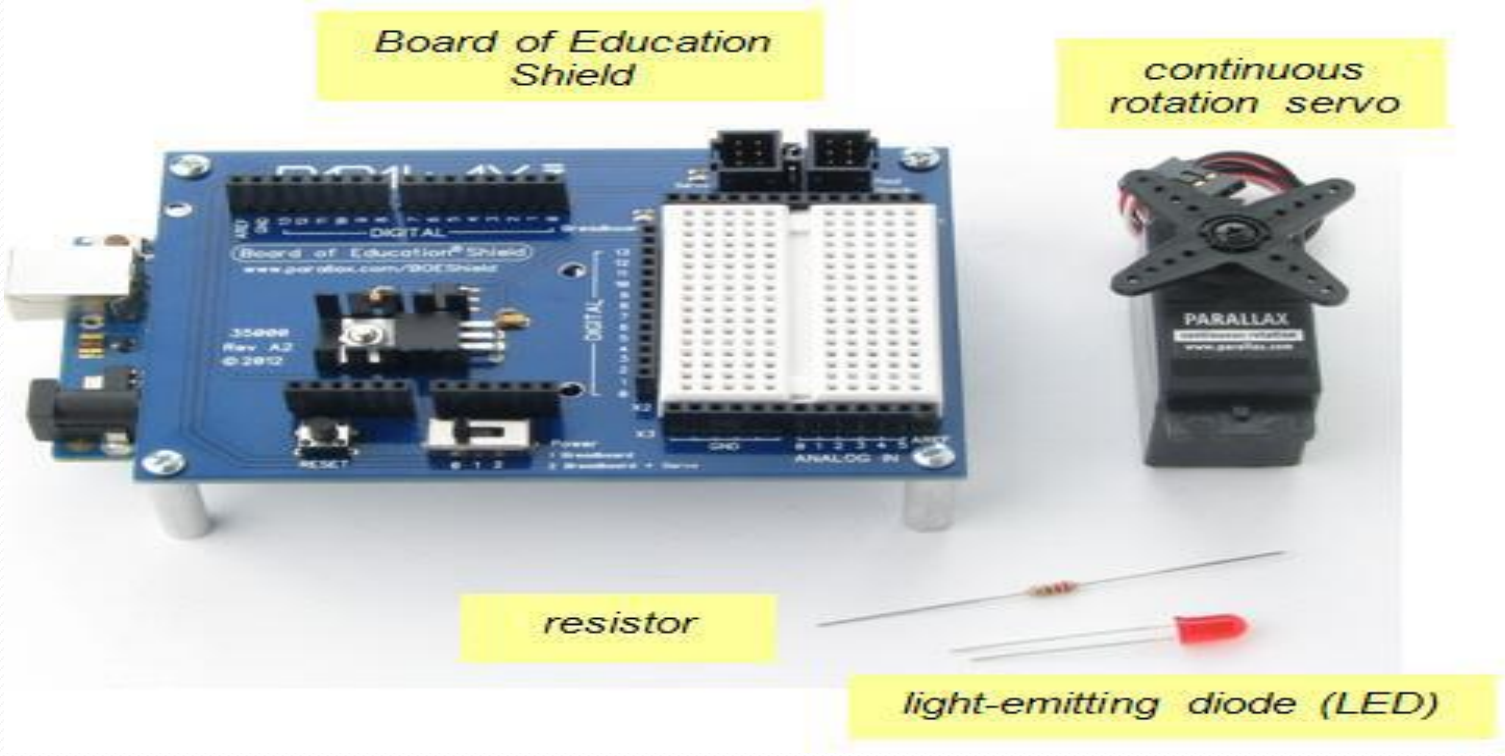
Components of robot

The Arduino brain…

..plugs into the BOE Shield…

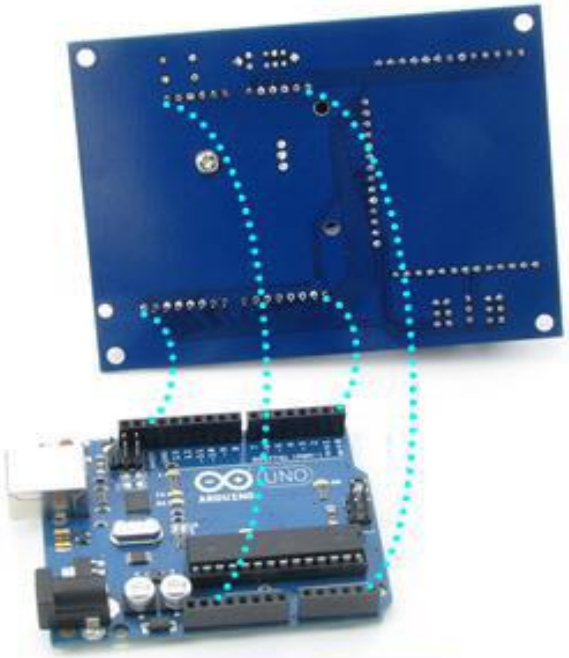
…which mounts on the robot chassis, to make a BOE Shield-Bot.

Components of robot

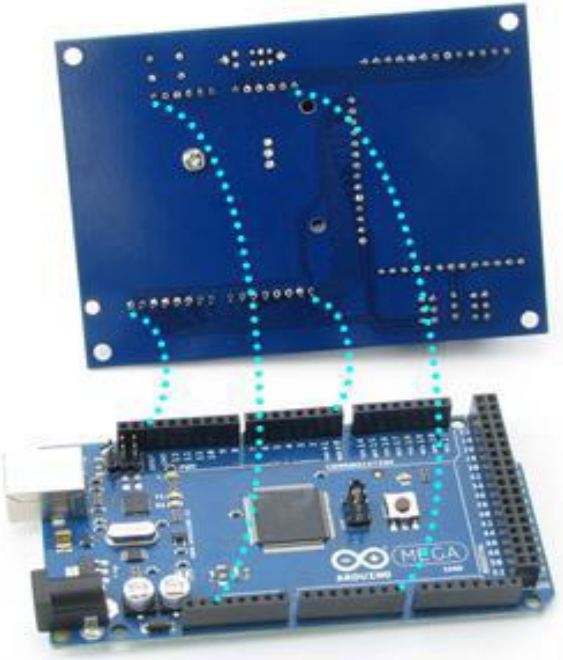


Components of robot

Components of robot

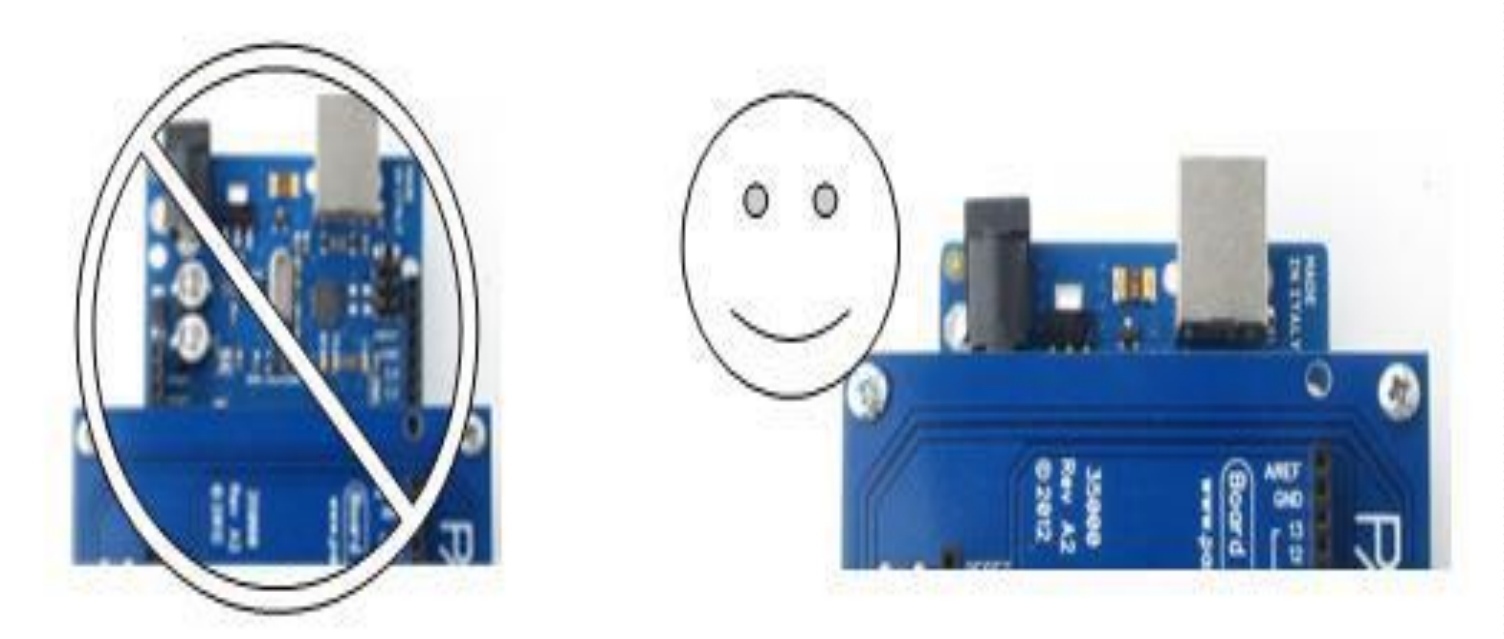


Uno R3



Mega R3

Components of robot



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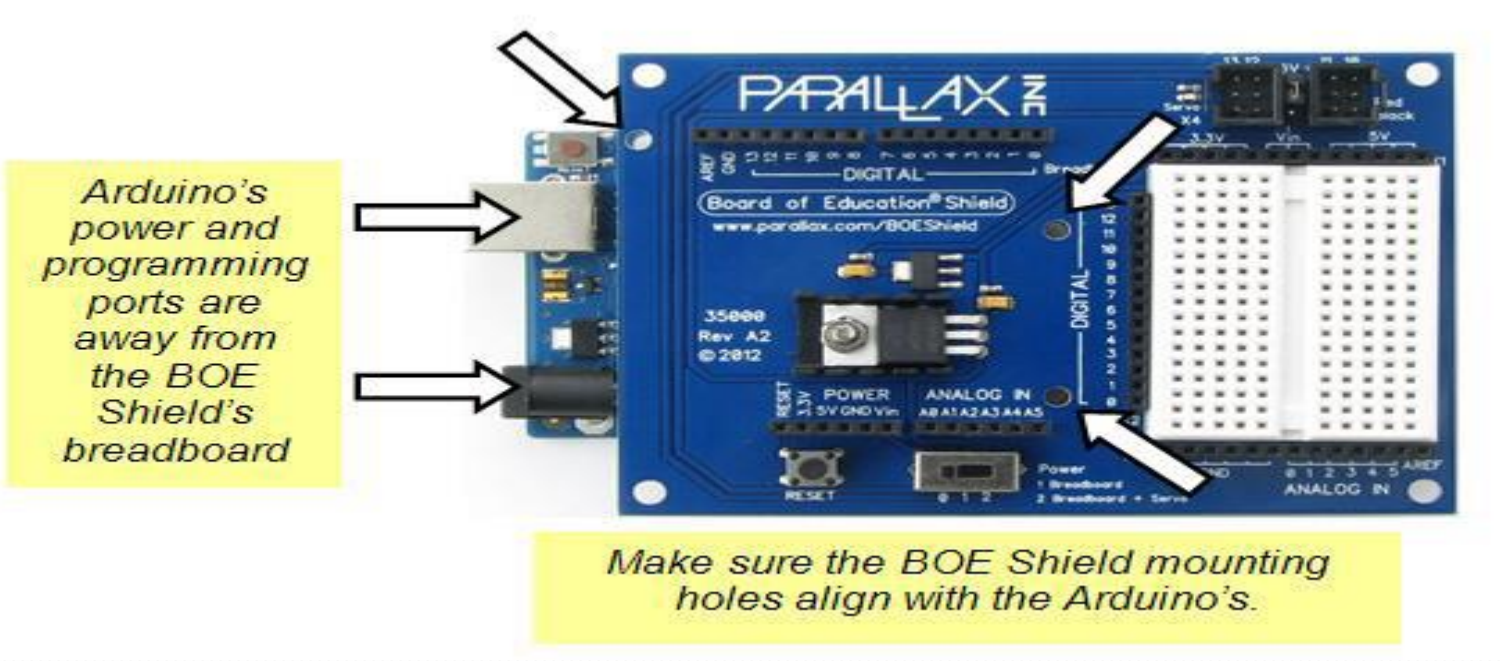

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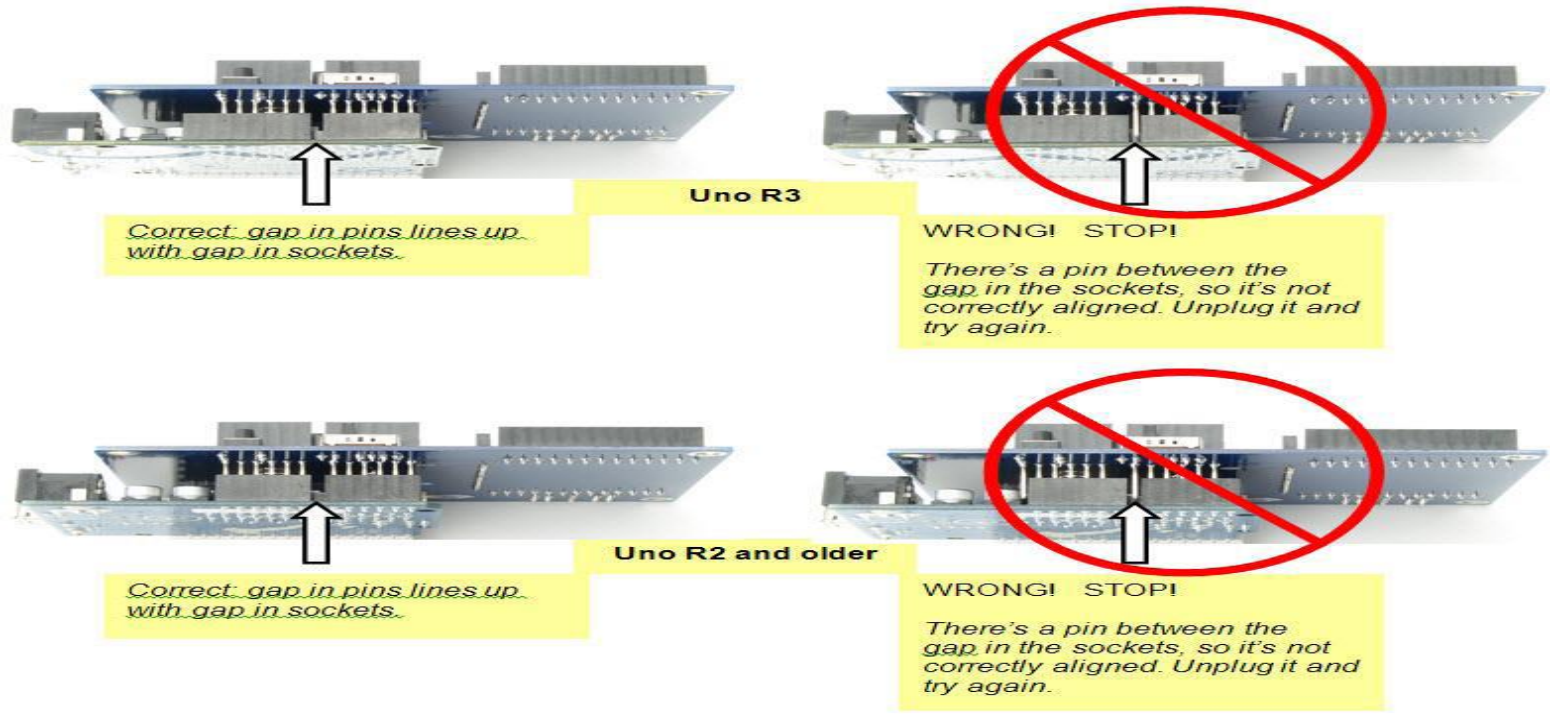

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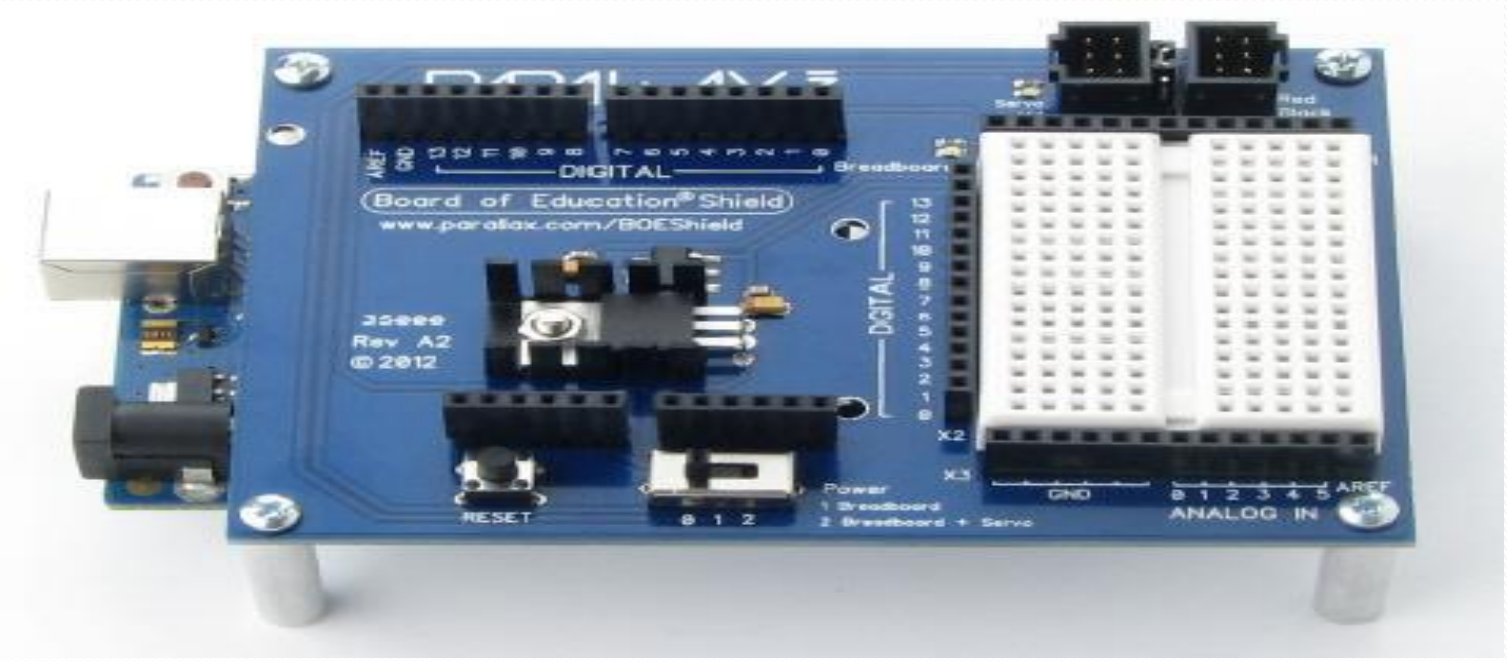

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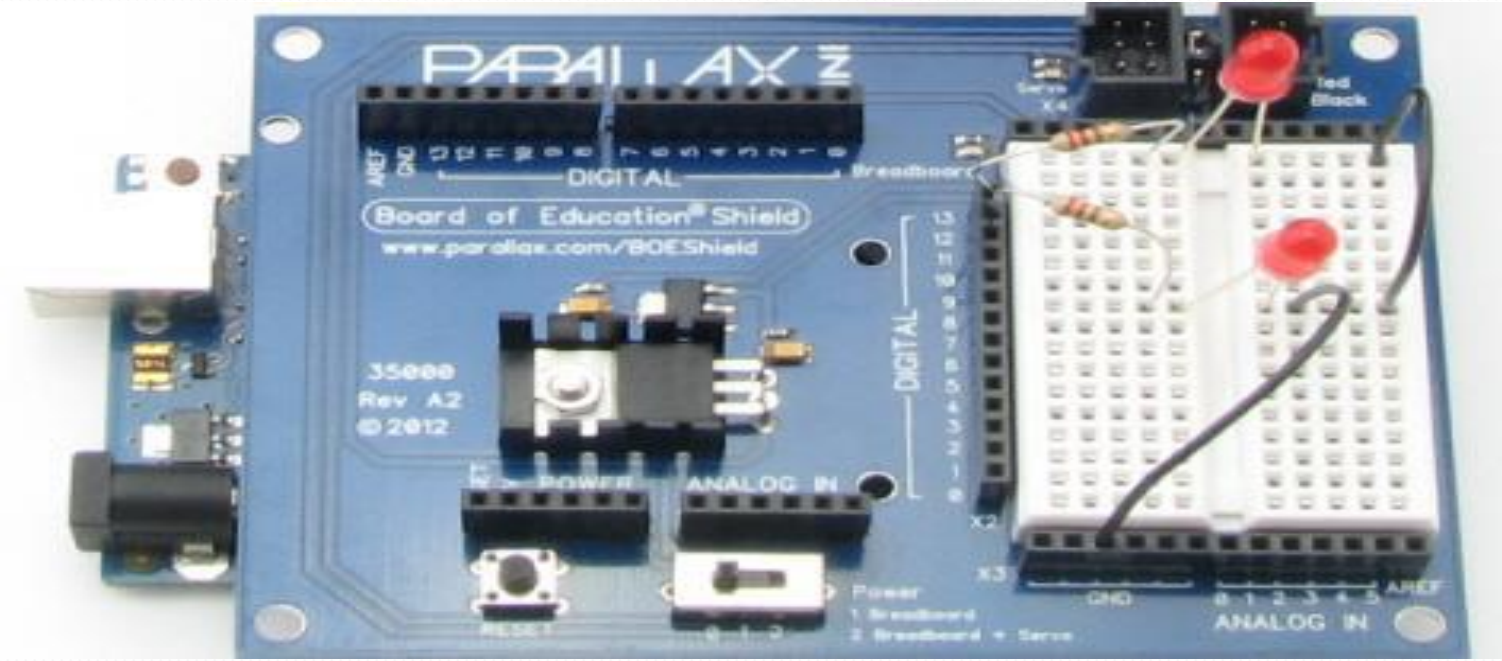

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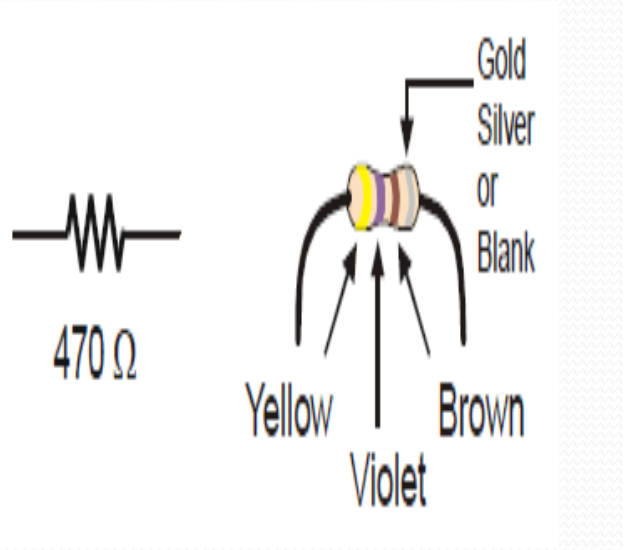

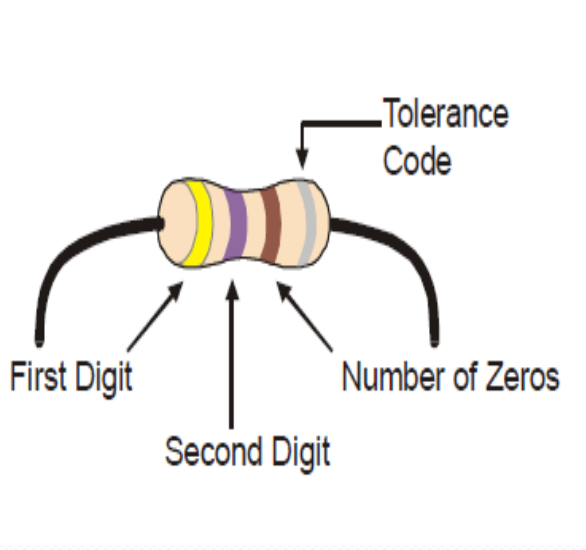

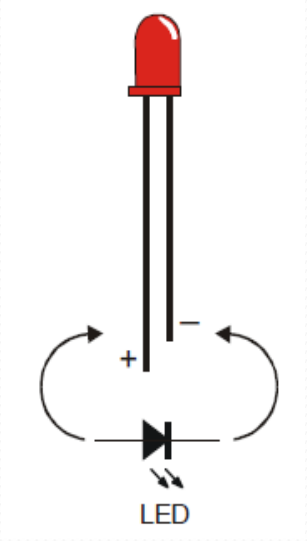

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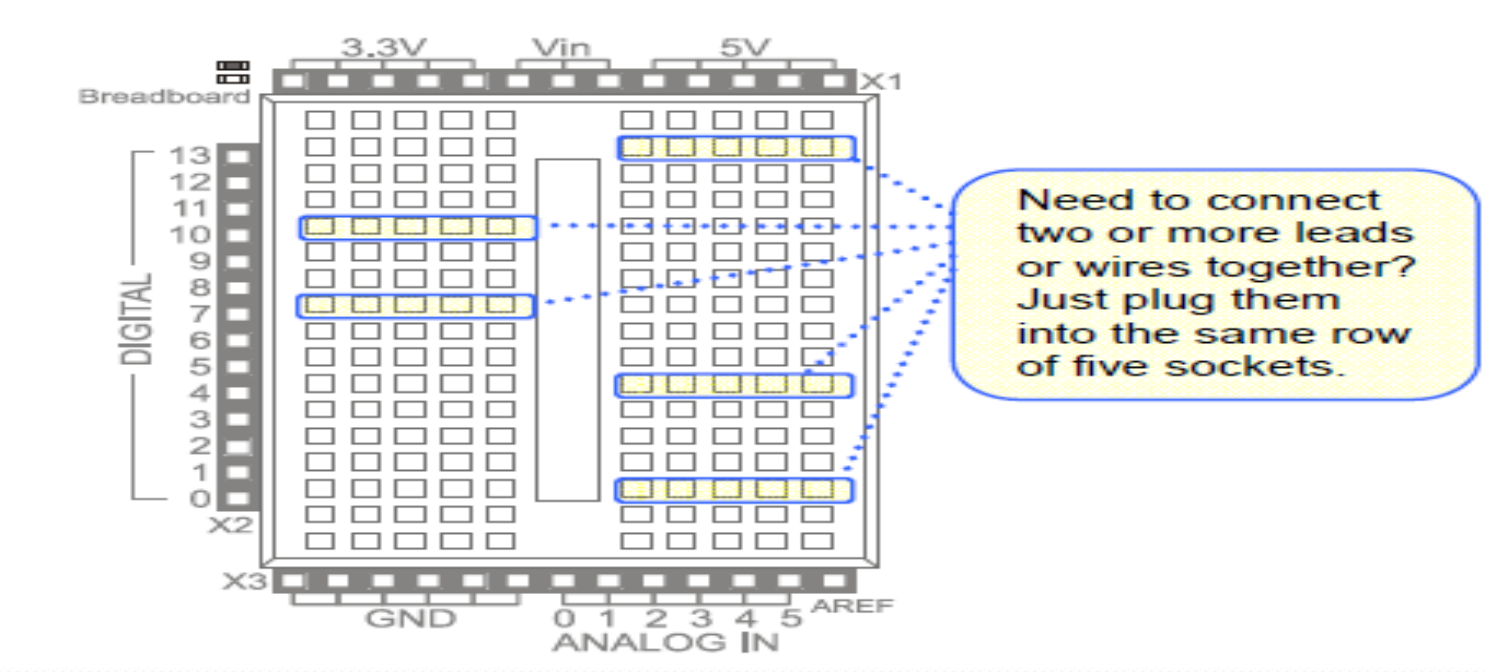

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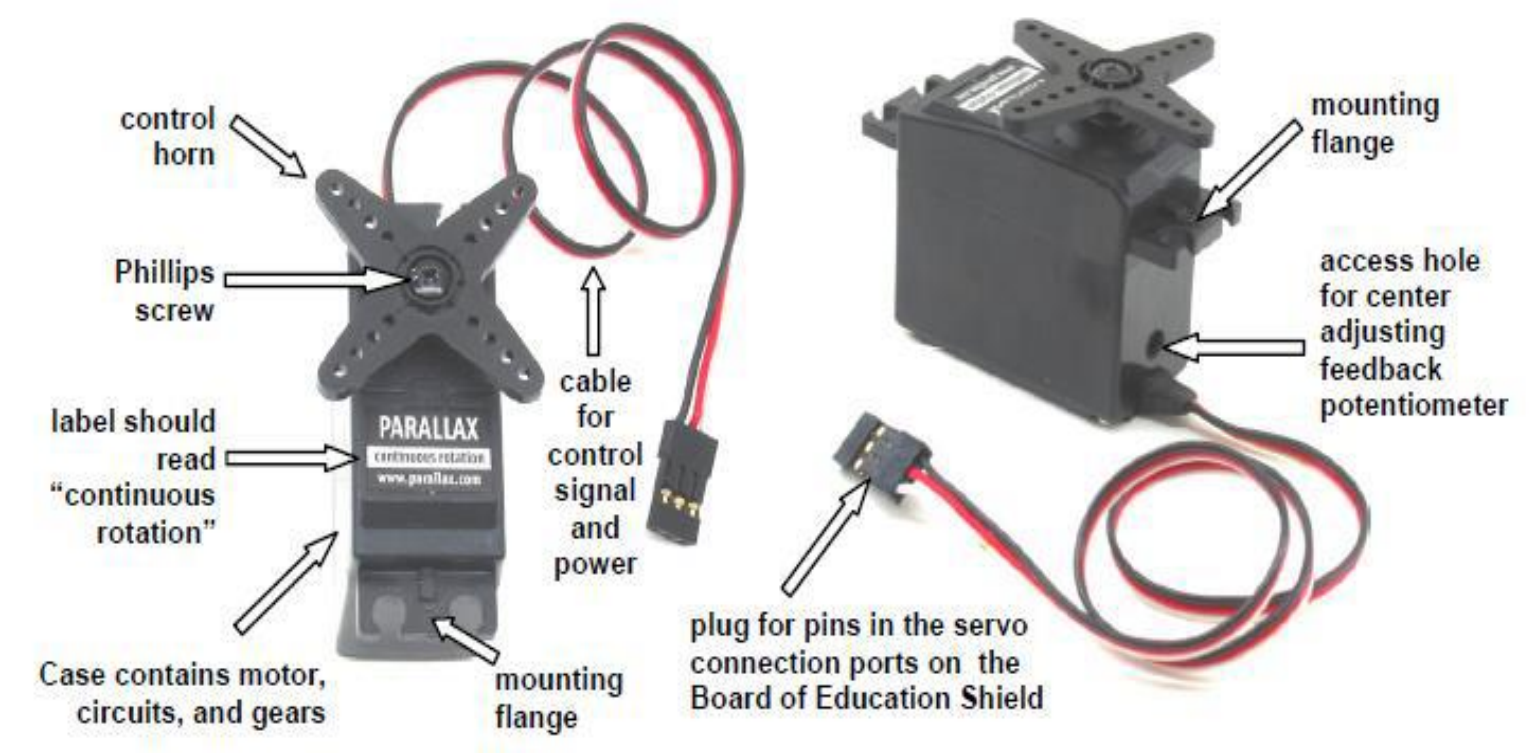

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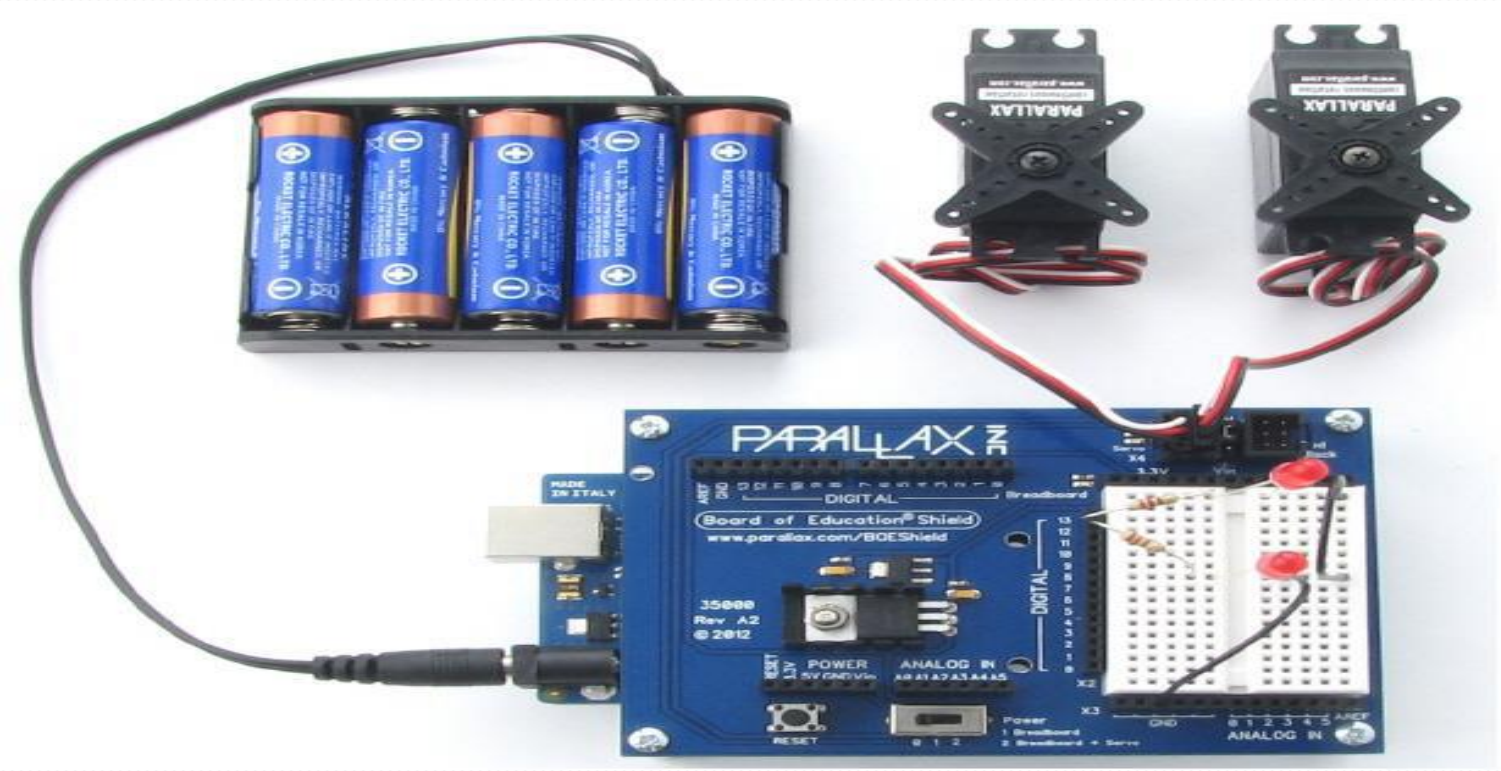

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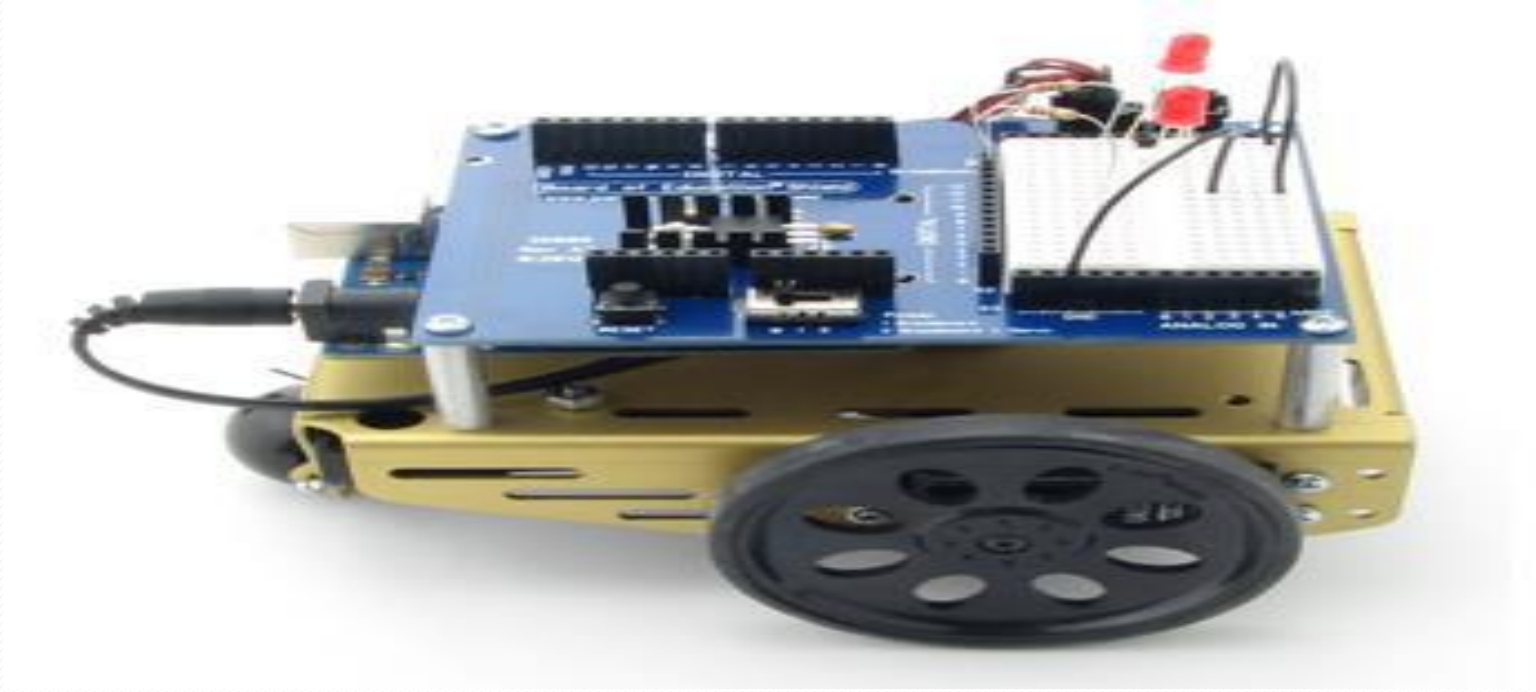
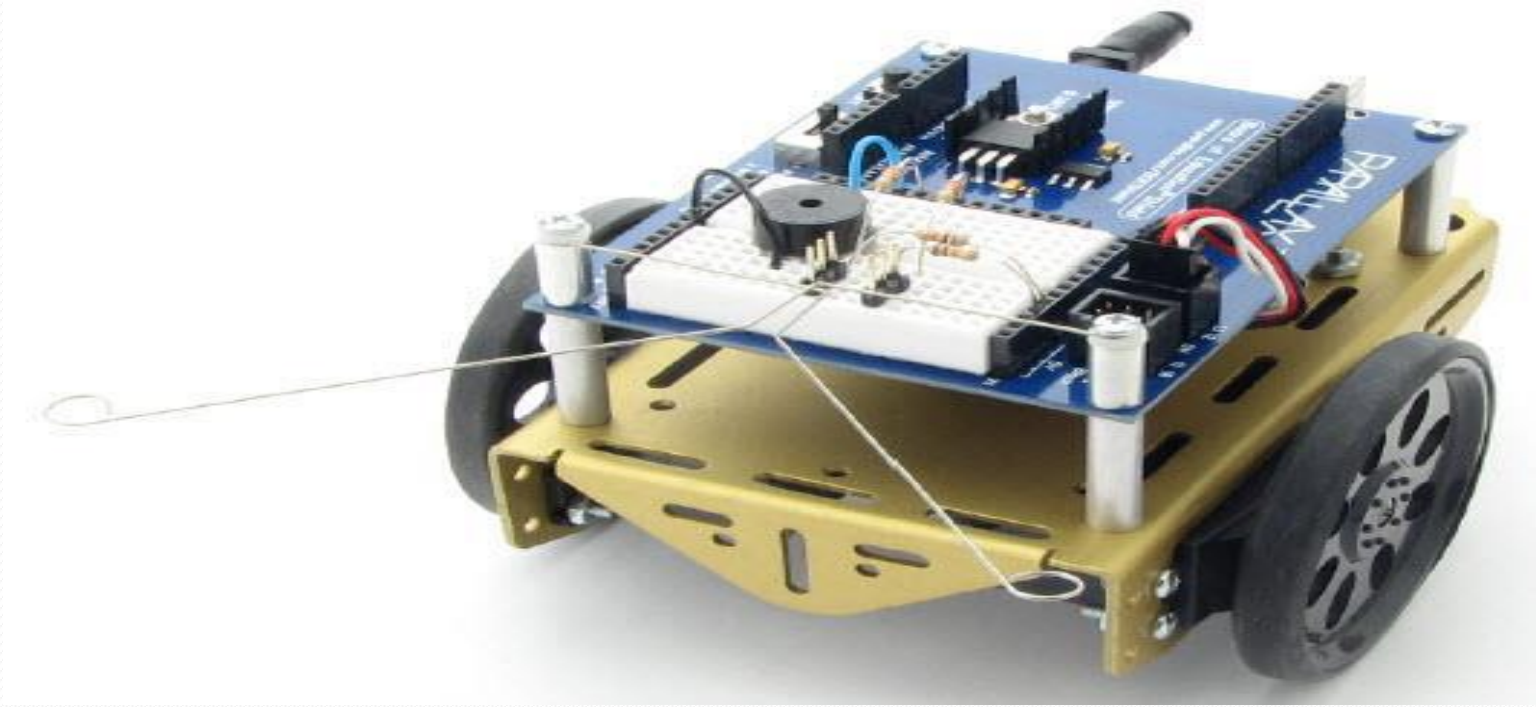


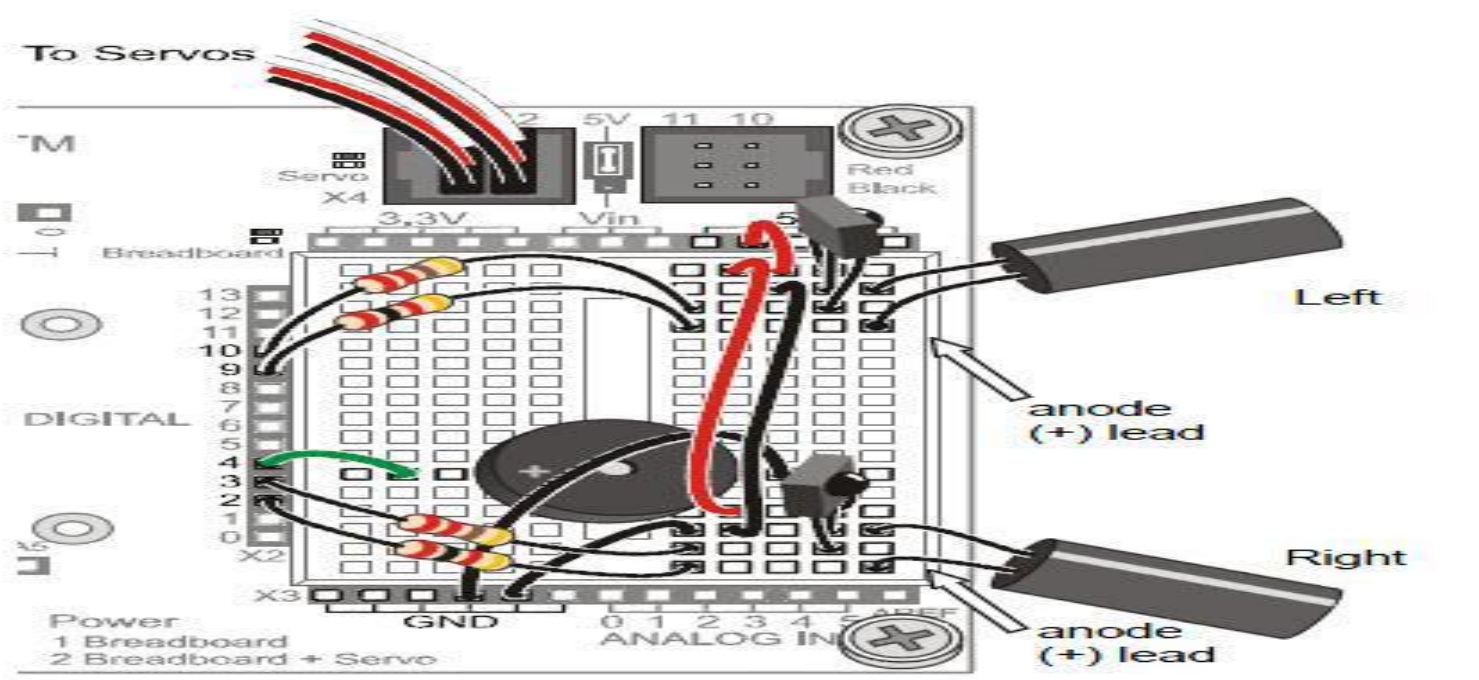
Navigation

- Tactile Navigation with Whiskers
- Navigation with Infrared Headlights
- Shield-Bot Roaming with Ping

Tactile Navigation with Whiskers



Navigation with Infrared Headlights



Shield-Bot Roaming with Ping

SLAM Algorithm

Simulation , Localization And Mapping

SLAM basically depends on :-

- Land Mark Extraction (RANSAC Algorithm)
- Data Association
- EKF (Extended Kalman Filter)

Land Mark Extraction (RANSAC Algorithm)

- Landmarks are features which can easily be re-observed and distinguished from the environment.
- RANSAC (Random Sampling Consensus) is a method which can be used to extract lines from a laser scan.

Land Mark Extraction (RANSAC Algorithm)

While

- there are still unassociated laser readings,
- and the number of readings is larger than the consensus,
- and we have done less than N trials.

do

- Select a random laser data reading.
- Randomly sample S data readings within D degrees of this laser data reading (for example, choose 5 sample readings that lie within 10 degrees of the randomly selected laser data reading).
- Using these S samples and the original reading calculate a least squares best fit line.
- Determine how many laser data readings lie within X centimeters of this best fit line.

Land Mark Extraction (RANSAC Algorithm)

If the number of laser data readings on the line is above some consensus C do the following:

- calculate new least squares best fit line based on all the laser readings determined to lie on the old best fit line.
- Add this best fit line to the lines we have extracted.
- Remove the number of readings lying on the line from the total set of unassociated readings.

Data Association

The problem of data association is that of matching observed landmarks from different (laser) scans with each other. We have also referred to this as re-observing landmarks.

EKF (Extended Kalman Filter)

The Extended Kalman Filter is used to estimate the state (position) of the robot from odometry data and landmark observations. The EKF is usually described in terms of state estimation alone (the robot is given a perfect map).

EKF (Extended Kalman Filter)

considered as three steps:

1. Update the current state estimate using the odometry data

2. Update the estimated state from re-observing landmarks.

3. Add new landmarks to the current state.

THANK YOU