Depth Detection Based Obstacle Avoidance

CS 684 Application Project

Group : 19

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Basic Idea

Given an Arena with objects placed in a random manner

- The Robot scans the area to create a Depth Map of the scene.
- Determine the position of the objects.
- Takes precise action to navigate through the obstacles.

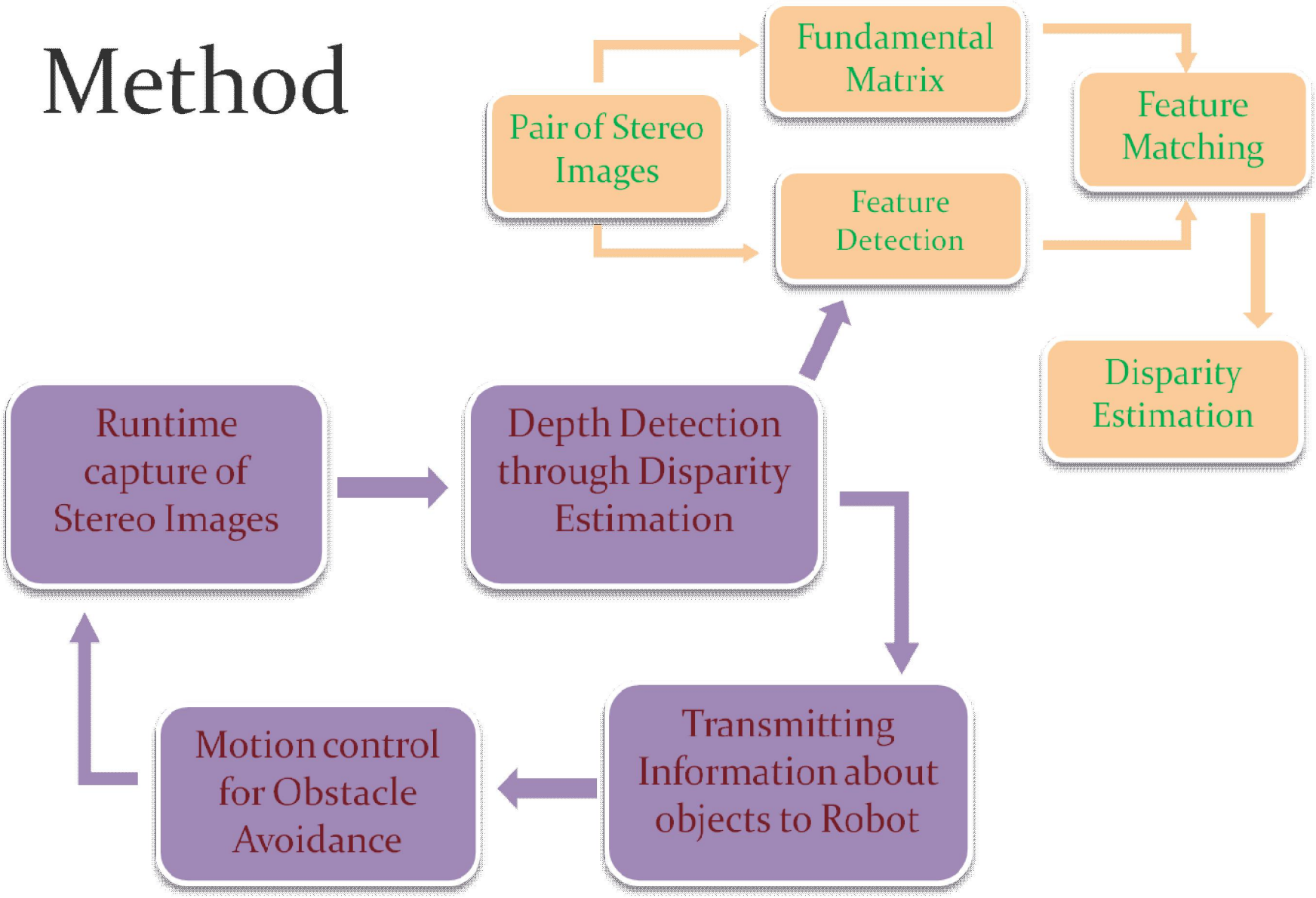
The implementation has three main components :

(i) A stereo vision algorithm for depth detection,

(ii) Construction of a Position model of the area,

(iii) Wireless Motion control for obstacle avoidance.

Method

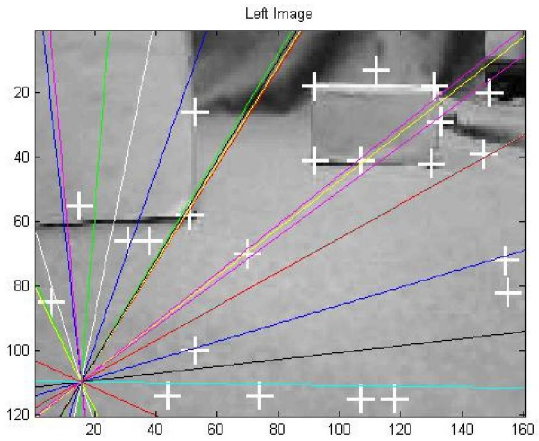

Runtime capture of Stereo Images
Depth Detection through Disparity Estimation
Pair of Stereo Images
Fundamental Matrix
Feature Detection
Feature Matching
Disparity Estimation
Transmitting Information about objects to Robot
Motion control for Obstacle Avoidance

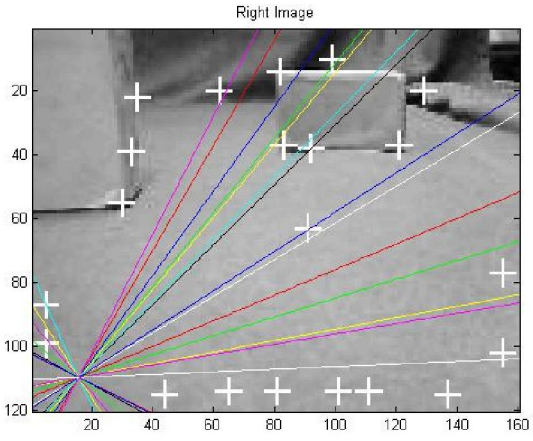
Method – Depth Detection

– Left Image

Right image

Depth Map





Implementation and Testing

- Code in C for controlling FB5 through XBee.
  - To move in particular direction.
  - To move in predefined steps.
- Coding in Matlab to capture stereo images using USB cameras and transmit data through XBee to FB5.
- Coding in Matlab for Depth detection on captured stereo pair images:
  - Testing and calibration with predefined shapes.
  - Different positions.
- Depth to Position mapping.
- Integration and runtime testing.

Problems faced

- Wireless cameras had to be replaced by USB cameras.
- Calibration of motor for precise 90 deg turn.
- Interference was caused due to neighboring XBee.
- Lighting conditions were not suitable .
- Discrete movement of FB5 rather than smooth due to delay in acknowledgement in Matlab.

Innovation

- A new approach was developed making object detection independent of its properties.
- Also facilitates Position mapping of objects and find their properties.

Future Work

- Further improvement in the Depth detection code to give more accurate results.
- Making image acquisition system wireless as well as system on-board facilitating the Robot to traverse distant location.


Thank You