

## CS684 Documentation



### CS684 – 2010 Project

#### Project: Automated Learning Robot

The objective of this document is to help someone else run the code that is delivered as part of this project.

**Project Title:** Automated Learning Robot

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## **Project Objective**

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The goal of this project is to make a Firebird V robot imitate the task performed by another robot. The first robot (teacher) performs a task which will be captured by an overhead camera. The camera is connected to a computer which performs image processing using Matlab and generates an encoded task. This task is then transferred to the second robot (learner) wirelessly through Zigbee serial communication. The learner receives the task, decodes it and performs it. Thus the task has been learnt.

## **Hardware Platform**

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1. Firebird V ATMEGA2560 (2)
2. Zigbee modules (3: one each on the bots and computer)
3. I-Ball Face-2-Face 8.0 webcam (effective 1.3 MP)

## **Software**

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1. AVR Studio 4
2. Matlab 7
3. Hyper Terminal
4. USB FSART driver (Zigbee driver)

## Code Description

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### Code Files

Filename	Purpose	Executes on
<b>teacher_bot.c</b>	To run the teacher robot	Robot
<b>learner_bot.c</b>	To run the learner robot	Robot
<b>movement.h</b>	Firebird V movement, speed and interrupt control functions	Robot
<b>lcd.h</b>	LCD display functions	Robot
<b>bot_detect.m</b>	Main function to start image processing and task detection	PC
<b>get_center.m</b>	Function to get the center of the coloured disk	PC
<b>calculate_path.m</b>	Function to calculate encoded path	PC
<b>check_linear.m</b>	Function to check if linear motion is starting from a specified point	PC
<b>check_turn.m</b>	Function to check if rotation is starting from a specified point	PC
<b>transfer_string.m</b>	Function to transfer a string through Zigbee	PC

### Deliverables

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Filename	Contains
<b>robot.zip</b>	Documented source code of programs to be burnt on Robot
<b>matlab.zip</b>	Documented Matlab files to be run on PC
<b>docs.zip</b>	HTML docs for the code files, generated using Doxygen
<b>files.zip</b>	Contains project related files (SRS, Final Report, Presentation)

## Execution Instructions

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### Preparing the Teacher Robot

1. Create a project in AVR Studio 4.1 containing the files *teacher\_bot.c* and *movement.h*
2. Configure project properties as follows:
  - a. Device: Atmega2560
  - b. Frequency: 11059200 Hz
  - c. Optimization: -O0
3. Compile the source code
4. Connect the Firebird V robot
5. Burn the hex file generated after compilation

### Preparing the Learner Robot

1. Create a project in AVR Studio 4.1 containing the files *learner\_bot.c*, *movement.h* and *lcd.h*
2. Configure project properties as follows:
  - a. Device: Atmega2560
  - b. Frequency: 11059200 Hz
  - c. Optimization: -O0
3. Compile the source code
4. Connect the Firebird V robot
5. Burn the hex file generated after compilation

### Controlling the Teacher Robot

1. Connect Zigbee module to the computer
2. Open Hyper Terminal and connect to the COM port of Zigbee

3. Set the Baud Rate as 9600

4. Use the following keystrokes to control the robot:

- '1' First pre-programmed task
- '2' Second pre-programmed task
- '3' Third pre-programmed task
- 'w' Forward
- 's' Reverse
- 'a' Left turn
- 'd' Right turn
- 'x' Stop

(Refer to documentation for more details about pre-programmed tasks)

## Image Processing using Matlab

1. Connect the webcam and Zigbee module
2. Extract all the Matlab files to some directory
3. Open Matlab and change to the above directory
4. Change the COM port details in *transfer\_string.m*
5. Change the arguments of *videoinput()* in *bot\_detect.m*
6. Run the function *bot\_detect()* to start image processing

## Coding Guidelines

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1. We have ensured that our code is readable, reusable and well commented
2. We used Doxygen to generate HTML documentation for our code
3. We have followed the file structure and other project submission guidelines of ERTS lab