Multi-Bot Controller

CS684 Project: Team 4
Thyagarajan Radhakrishnan (13305R004)
Gaurav Vijayvargia (133050031)
Vaibhav Dave (13V050002)
Jyoti Shankar (133050080)

Department of Computer Science and Engineering,
Indian Institute of Technology, Bombay

November 2013

Problem Statement

- Development of a central controller for allocation of minimallly shared shortest path in a multi-robot scenario

Requirement Specification (Initial)

- Schedulability test: To check the feasibility of a given task set using Clairvoyant with commute algorithm

Requirement Specification (Initial)

- Schedulability test: To check the feasibility of a given task set using Clairvoyant with commute algorithm
- Wireless communication between controller and robots during execution of schedule

Requirement Specification (Initial)

- Schedulability test: To check the feasibility of a given task set using Clairvoyant with commute algorithm
- Wireless communication between controller and robots during execution of schedule
- GUI on the controller for specifying tasks

Final System

Deliverables include:

Final System

Deliverables include:

- A graph based solution to generate the shortest path with minimal path sharing

Final System

Deliverables include:

- A graph based solution to generate the shortest path with minimal path sharing
- A GUI for specifying the source and destination node for a particular robot

Final System

Deliverables include:

- A graph based solution to generate the shortest path with minimal path sharing
- A GUI for specifying the source and destination node for a particular robot
- Wireless communication for packet exchange between central controller and robots

Final System

Deliverables include:

- A graph based solution to generate the shortest path with minimal path sharing
- A GUI for specifying the source and destination node for a particular robot
- Wireless communication for packet exchange between central controller and robots
- A well-defined packet format for sending commands to robots
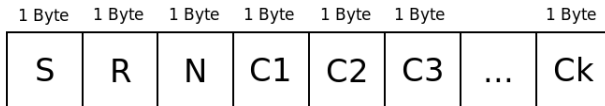
Final System
Packet Communication Protocol

- Packet Format:

Final System
Packet Communication Protocol

- Packet Format:

1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	1 Byte		1 Byte
S	R	N	C1	C2	C3	...	Ck

S : Start Byte = 0xFF
R : Robot ID (uniquely identifies the robot/packet destination)
N : No. of commands to be executed by the robot = k
C1 ... Ck : 'k' commands to be executed by the robot = {F, L, R, U}
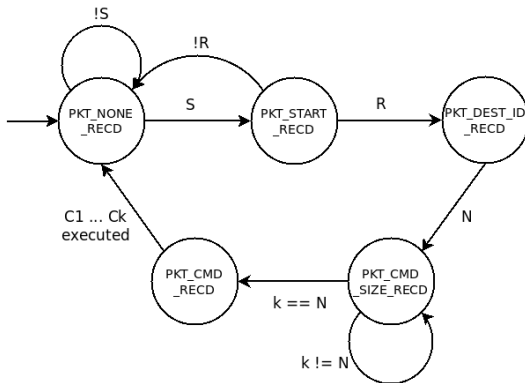where F - forward, L - turn left, R - turn right, U - U-turn

Final System
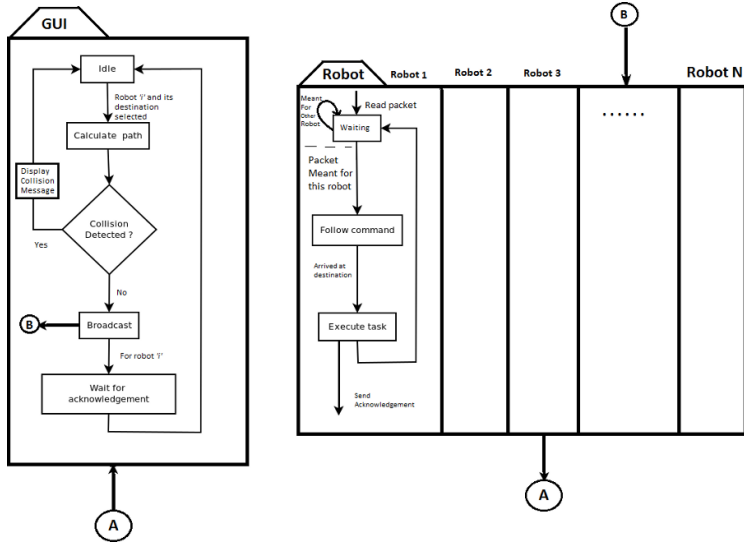Packet Communication Protocol

- Finite State Machine:

Final System
Packet Communication Protocol
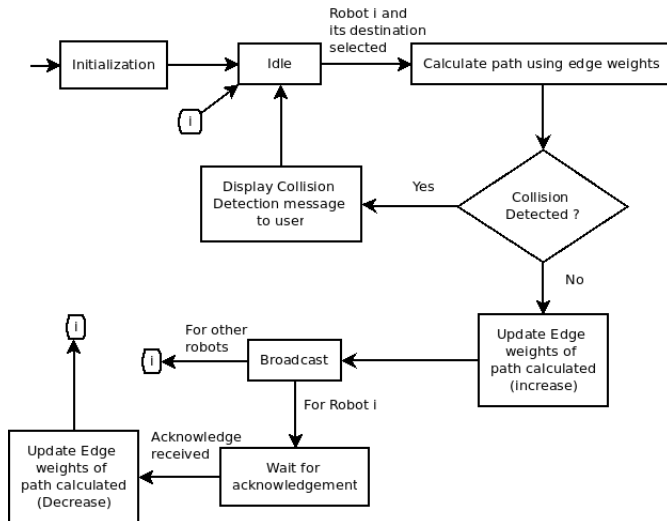
- Finite State Machine:

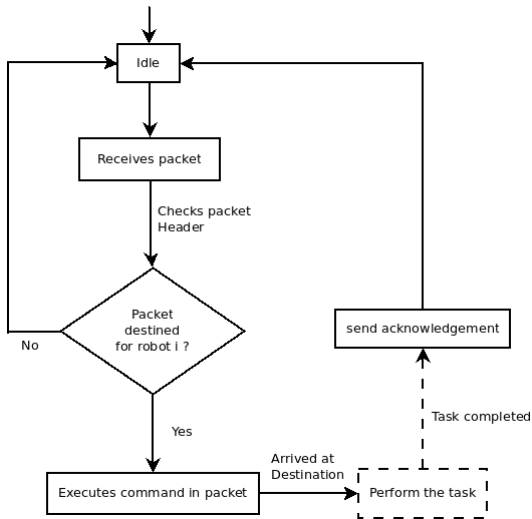# Final System
State Chart Diagram

Final System
Control Flow Diagram : GUI

Final System
Control Flow Diagram : Robot

Issues Encountered

- Understanding code for CWC algorithm
  - We developed an algorithm which was arena specific

Issues Encountered

- Understanding code for CWC algorithm
  - We developed an algorithm which was arena specific
- Black line following
  - Varying motor speed for different robots
  - All white sensing for robot due to thin black line

Issues Encountered

- Understanding code for CWC algorithm
  - We developed an algorithm which was arena specific
- Black line following
  - Varying motor speed for different robots
  - All white sensing for robot due to thin black line
- Generalizing algorithm and data structures

Issues Encountered

- Understanding code for CWC algorithm
  - We developed an algorithm which was arena specific
- Black line following
  - Varying motor speed for different robots
  - All white sensing for robot due to thin black line
- Generalizing algorithm and data structures
- Packet loss in wireless communication

Insight Gained

- Modular approach for solving a big problem

Insight Gained

- Modular approach for solving a big problem
- Making the solution as general as possible

Insight Gained

- Modular approach for solving a big problem
- Making the solution as general as possible
- Making the solution understandable for other developers by following conventional coding standards

Insight Gained

- Modular approach for solving a big problem
- Making the solution as general as possible
- Making the solution understandable for other developers by following conventional coding standards
- No problem is as easy as it seems

Insight Gained

- Modular approach for solving a big problem
- Making the solution as general as possible
- Making the solution understandable for other developers by following conventional coding standards
- No problem is as easy as it seems
- Team management

Future Work

- Extending the arena specific portion of the solution for larger greenhouse

Future Work

- Extending the arena specific portion of the solution for larger greenhouse
- Segment wise acknowledgment during path traversal

Future Work

- Extending the arena specific portion of the solution for larger greenhouse
- Segment wise acknowledgment during path traversal
- Robust packet communication protocol by having provision for re-transmission in case of packet loss

Future Work

- Extending the arena specific portion of the solution for larger greenhouse
- Segment wise acknowledgment during path traversal
- Robust packet communication protocol by having provision for re-transmission in case of packet loss
- Enhancing GUI to make it more user friendly (adding features like specifying robot location)