COLLISION DETECTION AND AVOIDANCE

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AGENDA

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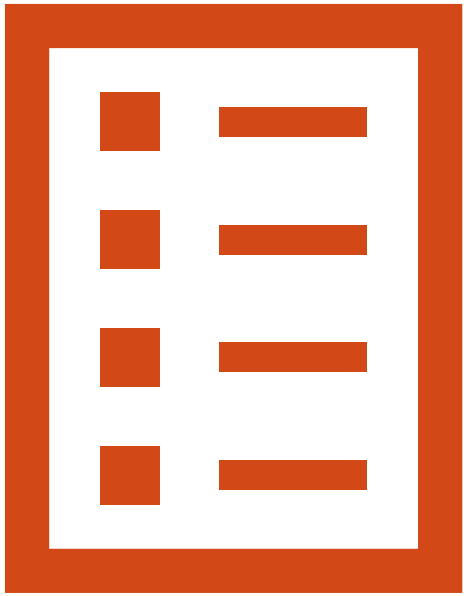
- Problem Statement
- Motivation
- Implementation
- Result
- Conclusion
- Future work
- References



INTRODUCTION

- Multirobot systems are prevailing compared to single robot counterparts due to benefits like wide coverage, diverse functionality and strong flexibility.
- Multirobot systems are used in surveillance tasks, security service etc.
- Considering the motion of the robots, it can either move in a flexible direction or in a fixed direction.
- We consider a fixed direction multirobot system for this project.
- Collision avoidance place a very important role in these multirobot systems as collision of robots would result in failure of the system.

PROBLEM STATEMENT

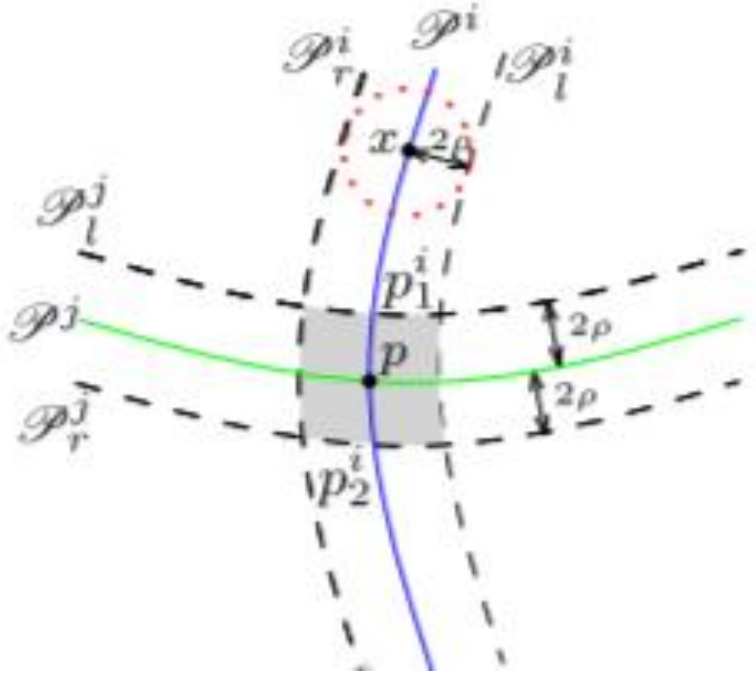
- Robots are moving in a fixed path and the path is such that robots may tend to collide with each other.
- The aim of our project is to prevent the collision of these robots by making them communicate with each other.
- The robots move in an arbitrary curve such that its difficult to analyze and design motion control for the system.

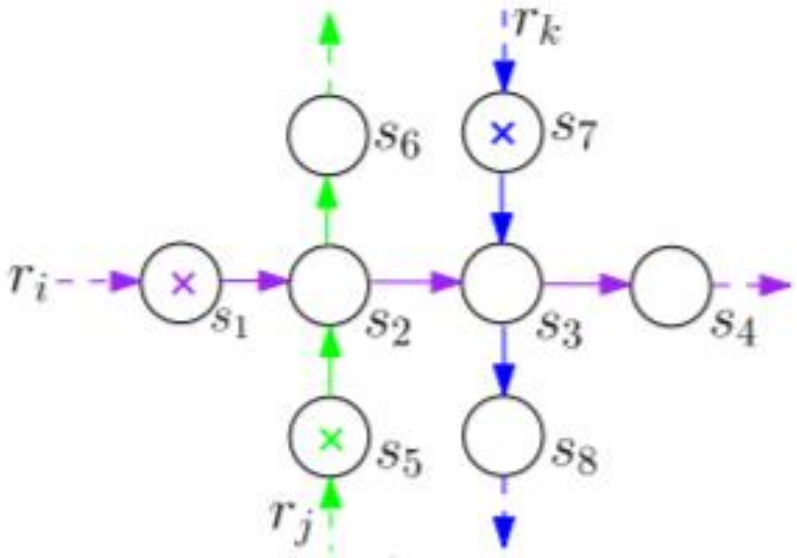
MOTIVATION

- Multirobot systems are used in surveillance tasks, reconnaissance missions, security service and other significant tasks.
- Errors in programming as well as unexpected events in the robot workspace may lead to collisions which may cause critical problems.
- Hence to prevent this common problem of collision, collision avoidance is necessary in multirobot systems.
- With growing applications of this kind of systems motion control has been a major issue.

IMPLEMENTATION

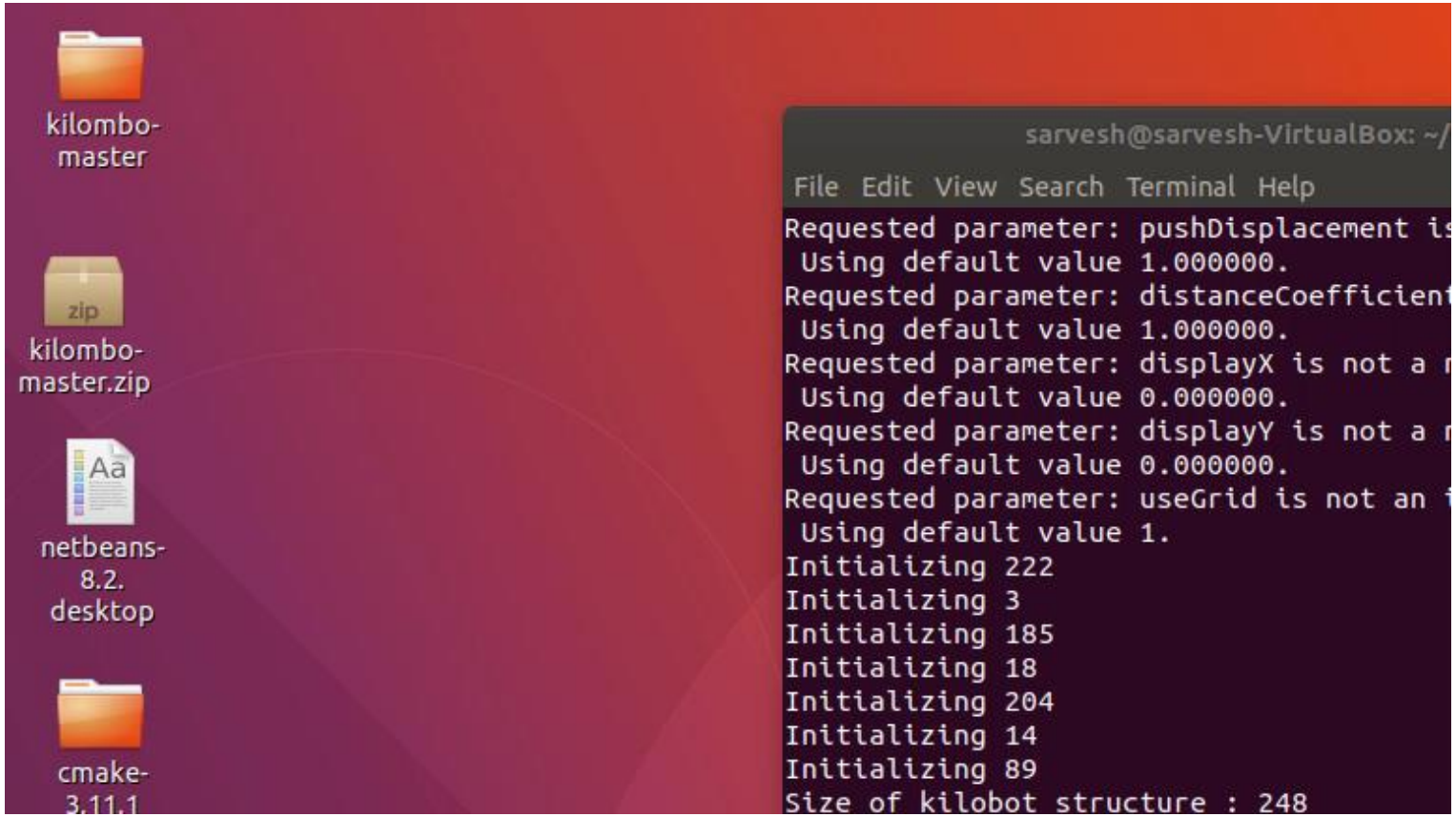
- In the simulation model that we used, there are five robots initially moving vertically and two robots are moving horizontally. Each robot has a configured path (exact distance) and cover specific region.
- The algorithm is performed by repeatedly stopping and resuming robots whose next move can cause collisions. Moreover, each robot should check its next two consecutive states to determine whether it can move forward.
- Each robot should check before resuming motion whether there is possibility of movement in its direction.

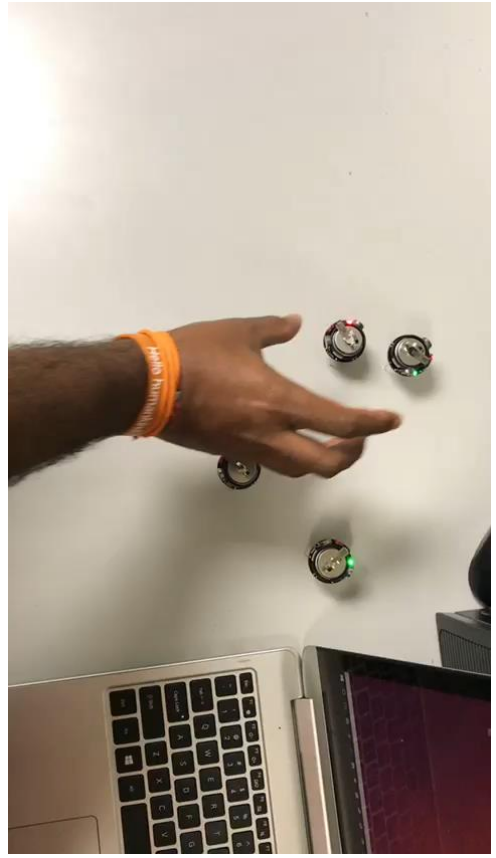




IMPLEMENTATION

RESULT


kilombo-master
zip
kilombo-master.zip
Aa
netbeans-8.2.desktop
cmake-3.11.1
sarvesh@sarvesh-VirtualBox: ~/
File Edit View Search Terminal Help
Requested parameter: pushDisplacement is
Using default value 1.000000.
Requested parameter: distanceCoefficient
Using default value 1.000000.
Requested parameter: displayX is not a
Using default value 0.000000.
Requested parameter: displayY is not a
Using default value 0.000000.
Requested parameter: useGrid is not an
Using default value 1.
Initializing 222
Initializing 3
Initializing 185
Initializing 18
Initializing 204
Initializing 14
Initializing 89
Size of kilobot structure : 248



CONCLUSION

- We investigate the policy of collision and deadlock avoidance in multirobot systems, where each robot has a predetermined and intersecting path.
- A distributed algorithm is proposed to avoid collision between robots and make sure that no robots get into dead state.
- The simulation results of a system with five robots further verify the effectiveness of the algorithm.

FUTURE WORK

- This algorithm assumes the path of each robot is predetermined and only consider the collisions among robots. However, it is also important to generate proper paths for robots to avoid external obstacles but challenging.
- In our project we have considered only the fixed path movement of the robots. Our future idea is to implement an efficient algorithm for robots which moves in a flexible directions like the ones mentioned below.
- Also in our current project, the robots are halted and resumed based on the IDs. Our future idea on this is that we could write an efficient algorithm to detect the robot which has the higher preference to resume it motion by halting the robots which has the lowest preference.
- This idea of collision avoidance can be implemented in many different systems
  - Robots at Home,
  - Robots at Super markets, etc

REFERENCES

- Yuan Zhou, Hesuan Hu, Yang Liu, Zuohua Ding, "**Collision and Deadlock Avoidance in Multirobot Systems: A Distributed Approach**", *IEEE Transactions on Systems, Man, And Cybernetics: Systems, Vol. 47, No. 7*, July 2017.