"Rescuing An Object By Reassembling Of Swarm Robotics"

Prof. S. I. Nipanikar
Faculty, E&TC Pune university/PVPIT college Pune.

Akshay H. Bharambe
Student of E&TC Engg Pune university/PVPIT Pune

Manish N. Dorkhande
Student of E&TC Engg Pune university/PVPIT Pune

Arati V. Gujarathi
Student of E&TC Engg Pune university/ PVPIT Pune

Abstract

In many places, the need arises of finding different kinds of objects. This need can be fulfilled by using the concept of Swarm Robotics and ZigBee technology.

In this a numbers of robots are given the task of finding or doing a particular task. Here in this project we are trying to demonstrate how 4 robots try to find a specific ball by giving the robot the ball's characteristics features like shape, size and colour. Based on this information the robots start to search in random directions in a defined area. When any one of them finds a ball, they broadcast the message of "object found" to other robots via ZigBee communication, asking them to stop the on-going search. This combined search is called Swarm Robotics.

1. Introduction

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In many places, the need arises of finding different kinds of objects. This need can be fulfilled by using the concept of Swarm Robotics and zigbee technology.

In this a numbers of robots are given the task of finding or doing a particular task. Here in this project robots are given two tasks firstly we are trying to demonstrate how 4 robots try to find a specific ball by giving the robot the ball's characteristics features like shape, size and colour. Camera is used to give the co-ordinates of the objects to the master and master sends the bots to the specified location .These bots takes position around the object in such a manner called as re-assembling of bots. After re-assembling these robots coordinately communicate between themselves and take the object to the specified position. This application is used for rescuing anybody from any location to the desired location like if any building has caught fire then sometimes humans cannot enter in the building in such conditions bots are send inside the building to rescue the human bodies and valuable objects without putting any life in danger. Hence swarm robotics can be used for rescuing operation. And also in the huge workshops of the companies we can this project as they can sort out the different object and can assemble them in proper manner .In this robots can keep the record also about the things which is being used from the workshops.

It can also used in shipping companies ,where the huge no. of goods are stored and transported every day. so for sort out the goods, for storage and also for keeping records we can use swarm robotics.

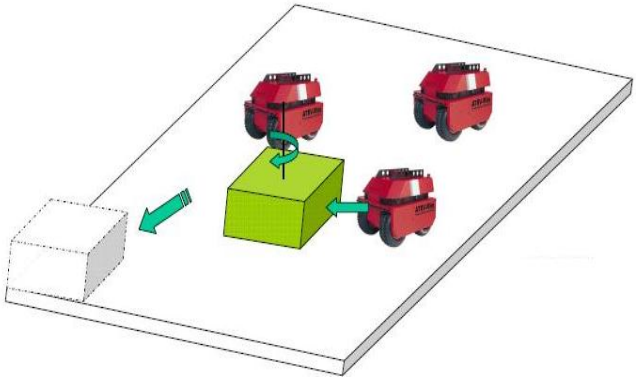


Figure 1. General Layout

1.2 Problem Defination

We use the robot for completing the task which are defined by us. But some times single robot cannot perform the task individually or single robot requires more time to complete the task. e.g. if we want to survey of any large area then we require more time to survey with single robot. or if we want to rescue the body from disaster then it cannot possible to rescue te body from single robot

Therefore we are using the swarm robotics to perform the task in more fast and easy.

As the robots are performing task by co-ordinating themselves and environments. We can perform the task in less time.

We use the SWARM ROBOTICS due to their advantages like

- Resolving complexity.
- Increasing performance.
- Simplicity in design.
- Reliable.

2. Literature Survey

We have refered the paper named "THE COOPERATION OF SWARM BOTS" By Francesco Mondada, Luca Maria Gambardella, Dario Floreano, Stafno Molni Jean-luice Deneuberg and Marco Dorigo. And Swarm Robotics is developed from the ant colony optimization .This algorithm was developed by Marco Dorigo in 1992 and was called as "Optimization, Learning and Natural". In this concept Ants forage for food and drop pheromones in their path, ants follow the pheromones to food and overtime, a short path is found, there after the swarm intelligence was developed.

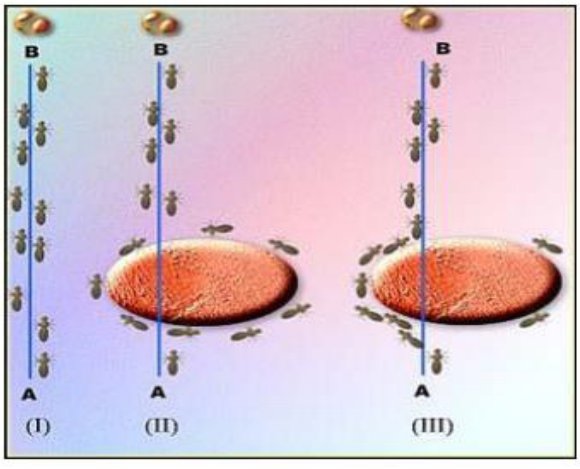


Figure 2. Shortest Path

Figure 3. Ant colony algorithm

Several advanced robotics applications, such as rescue and planetary or underwater exploration, must cope with very unstructured and partially unknown environments. Robots operating in such environments should display a high degree of mobility, versatility, and robustness to very different and time-varying operating conditions in order to successfully perform tasks such as displacement, exploration, or object transportation.

We also refered the paper "Swarm Intelligence And Swarm Application Framework" by don miner. He is in university of Maryland. He described what is the swarm and the different types of algorithm like ant colony, bird floking and also explained the different types of the applications based on the algorithm which is used.

Figure 4.Birds flocking Algorithm

Swarm behaviour, or swarming, is a collective behaviour exhibited by animals of similar size which aggregate together, perhaps milling about the same spot or perhaps moving en masse or migrating in some direction. As a term, swarming is applied particularly to insects, but can also be applied to any other animal that exhibits swarm behaviour. The term flocking is usually used to refer specifically to swarm behaviour in birds, herding to refer to swarm behaviour in quadrupeds, shoaling or schooling to refer to swarm behaviour in fish. Phytoplankton also gather in huge swarms called blooms, although these organisms are algae and are not self propelled the way animals are. By extension, the term swarm is applied also to inanimate entities which exhibit parallel behaviours, as in a robot swarm, an earthquake swarm, or a swarm of stars.

3. Block Dagram

- Base Station:

  The block diagram of Base station is shown below

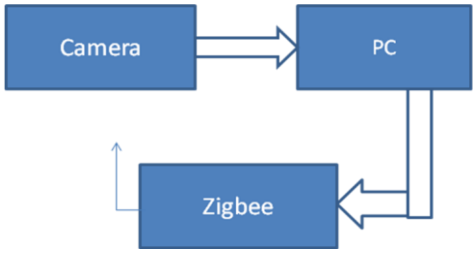


Figure 5.Block Diagram of base station

The exact location (coordinates) of the objects is send at the Base Station to the PC and it broadcast the same to the S-bots with the help of ZigBee module

1) ZigBee: We have used ZigBee module in master to communicate with the S-bots.
2) Camera: Here camera is used as a satellite, which is used to give the location of the object to the pc which can further send it to S-bots.
3) PC: PC is used as a display to see the location of the object and give the same to S-bots.

- Robot:

  The Block diagram of robot is shown below, we are using such 4 robots.

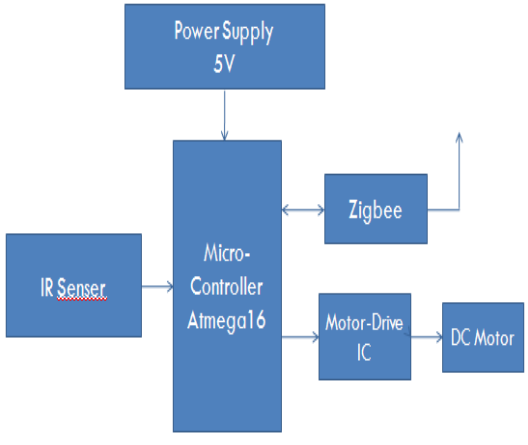


Figure 6. Block diagram of robot

1) AVR microcontroller: It is a multipurpose, programmable device that accepts digital data as input, and control and gives the output according to instructions.
2) IR sensors: An IR sensors is used to sense any kind of obstructions to avoid the collision and at the same time to avoid the collision between themselves.
3) ZigBee: We have used ZigBee module in S-bots to communicate within themselves.
4) Motor driver IC: Motor driver IC is used to boost the current to the level required by the motors to rotate in a desired speed.
5) Motors: Motors are used to rotate the wheels.
6) Power supply: It is used to provide adequate supply to each module.

4. Flowchart

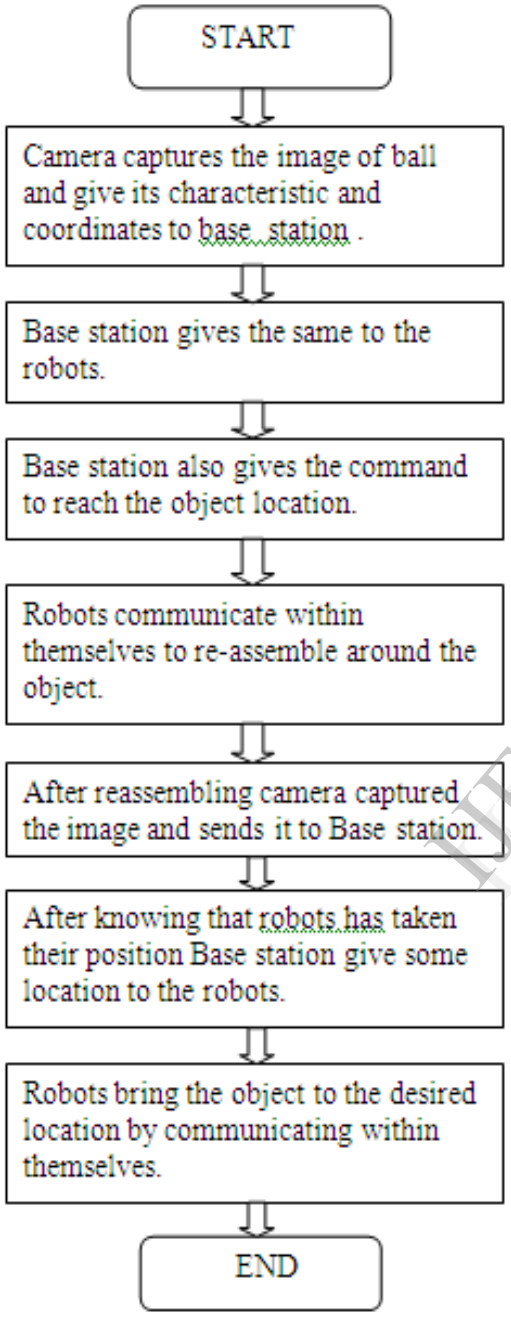


Figure 6 Flowchart

5. Hardware And Software Discription

5.1 Hardware Discription

a) AVR CPU (Atmega 16)
b) IR sensors (Infrared Proximity Sensor)
c) ZigBee (S1)
d) Motor driver IC (L2293D)
e) Camera
f) MAX 232
g) Motors (DC motors)

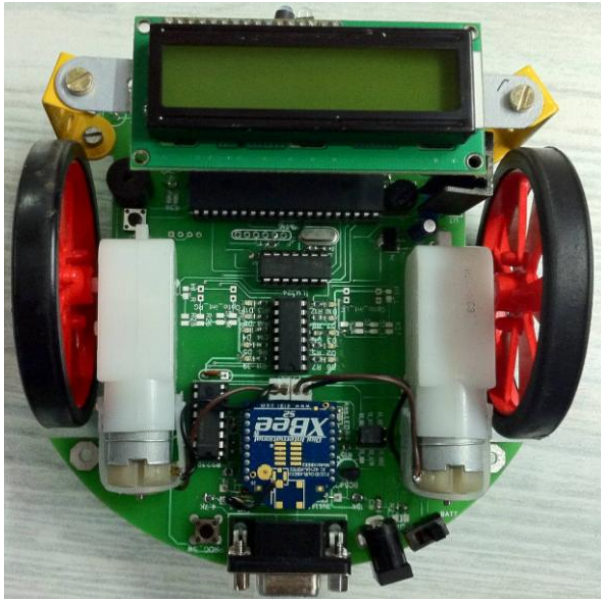


Figure 7. Robot

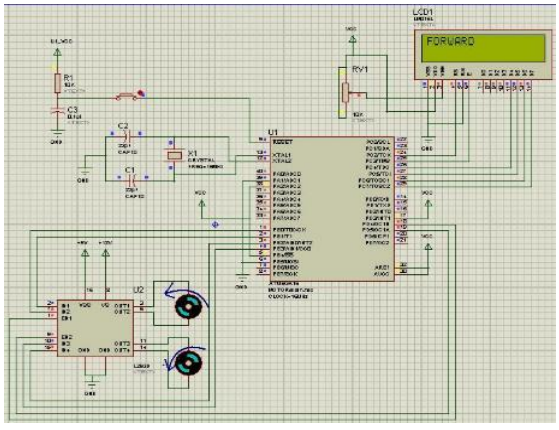
5.2 Software Discription

a) WinAVR
b) Proteus 7
c) ORCAD Software
d) RoboRealm

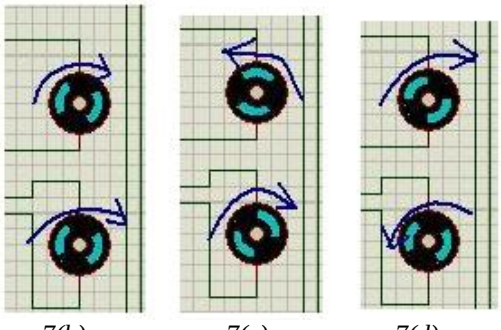
6. Simulation Result

i. Lcd and Motor Simulation

In simulation shown below is of motor moving forword and same is displayed on LCD. This simulation is done in proteus Software. Such as backword, righ abd left movment is also done.



7(a)



7(b) *7(c)* *7(d)*

Figure 7 (a) Forward, (b) Backward, (c)Right, (d) Left Movement of Motor

ii. Serial communication (USART) simulation

Here 'A' is transmitted to controller and the result had been seen in Vertual Terminal.

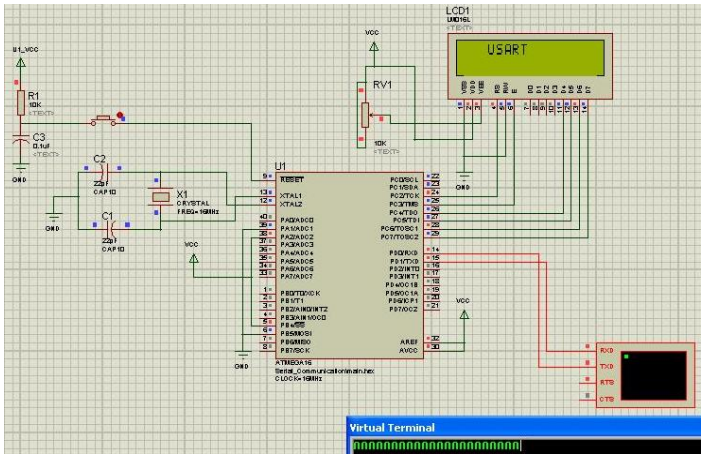


Figure 8. Simulation of USART

7. Conclusion

Thus we will demonstrate how 4 robots try to find a specific ball/object and bring (rescue) it to a desired location by re-assembling and communicating within themselves.

The characteristic of ball like its shape, size and color will be given to the robots via camera to identify the ball.

"They Are Many, but they Act as One!"

Swarm robotics is in its infancy, these days. Robots are just now being made capable of communicating with each other in real-time, meaning that a band of small robots can get together and really make a difference. No, they aren't capable of volunteering at soup kitchens just yet, but these small robotscan already do some pretty neat things.

8. Future Scope

- In future this project's use can be extended like the robots can be make an amphibious robots which can be used in water to find any object.
- Data sorting in the shipment of large container can be done by increasing the number of robots.

9. References

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