eYSIP2017

Distributed robotics - multi swarm robots

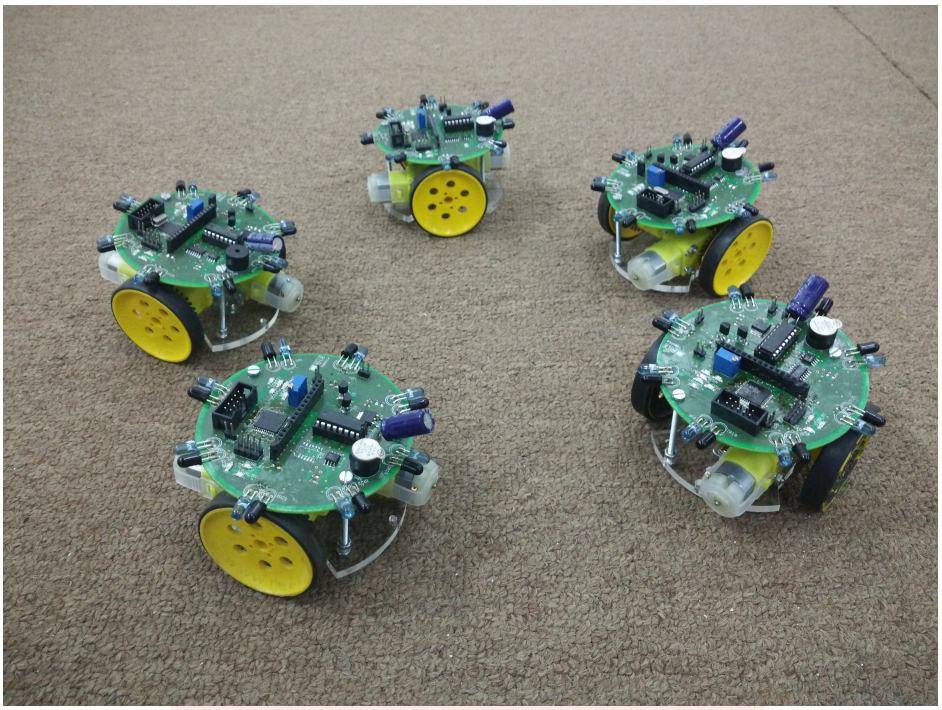

Figure 1: A picture of the swarm robots!

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Contents

Distributed robotics - multi swarm robots

1.1 Abstract

Swarm robotics is a field in robotics which implements coordination of multi robot systems which consist of large number of robots having simpler robots. There is a collective behavior that emerges from interactions between robots and interactions of robots with the environment. This behavior is emerged from field of biological studies of fishes, birds, ants, insects, etc. Application of swarm robotics varies from military, aviation to collective behavior of self driving cars. The objective of the project was to build miniaturized swarm bots and develop an algorithm for generic shape formation.

Following points are completed:

- Study the concepts of swarm robotics and get familiar with different robots available
- Study the kinematics of differential drive configuration
- Selecting appropriate sensors to be added
- Designing the PCB
- Assembling all the components
- Making of Mini bots

- Testing of Mini bots
- Implementing of circle formation of asynchronous fat robots with limited visibility in V-REP simulator
- Developed and implemented generic shape formation algorithm for a system of distributed robots in V-REP simulator
- Implemented follow the leader swarm behavior on Mini bots
- Implemented rendezvous swarm behavior on firebird V robots

Hardware parts

- List of hardware: COMPONENT LIST,
- Detail of each hardware: Atmega16 Datasheet, Chip component, Lamington road, Mumbai,
- Detail of each hardware: CD40106 Datasheet, Chip component, Lamington road, Mumbai,
- Detail of each hardware: L293D Datasheet, GALA Electronics, Lamington road, Mumbai,
- Detail of each hardware: LM158 Datasheet, Chip component, Lamington road, Mumbai,
- Connection diagram

sdhljkfhs jsdhfkjsld jshldfhsdf

Softwares used

- List of softwares used are V-rep, Fusion 360, AvrDude, Avrgcc, Texstudio, Git
- Details of software: V-rep: 3.4.0, download link,
- Installation steps download link,
- Details of software: Fusion 360: 3.4.0, download link,
- Installation steps download link,
- Details of software: AvrDude, download link,
- Details of software: Avrgcc, download link,
- Details of software: texstudio, download link,
- Installation steps download link,
- Details of software: git, download link,
- Installation steps download link,

Assembly of hardware

Circuit diagram and Steps of assembly of hardware with pictures for each step

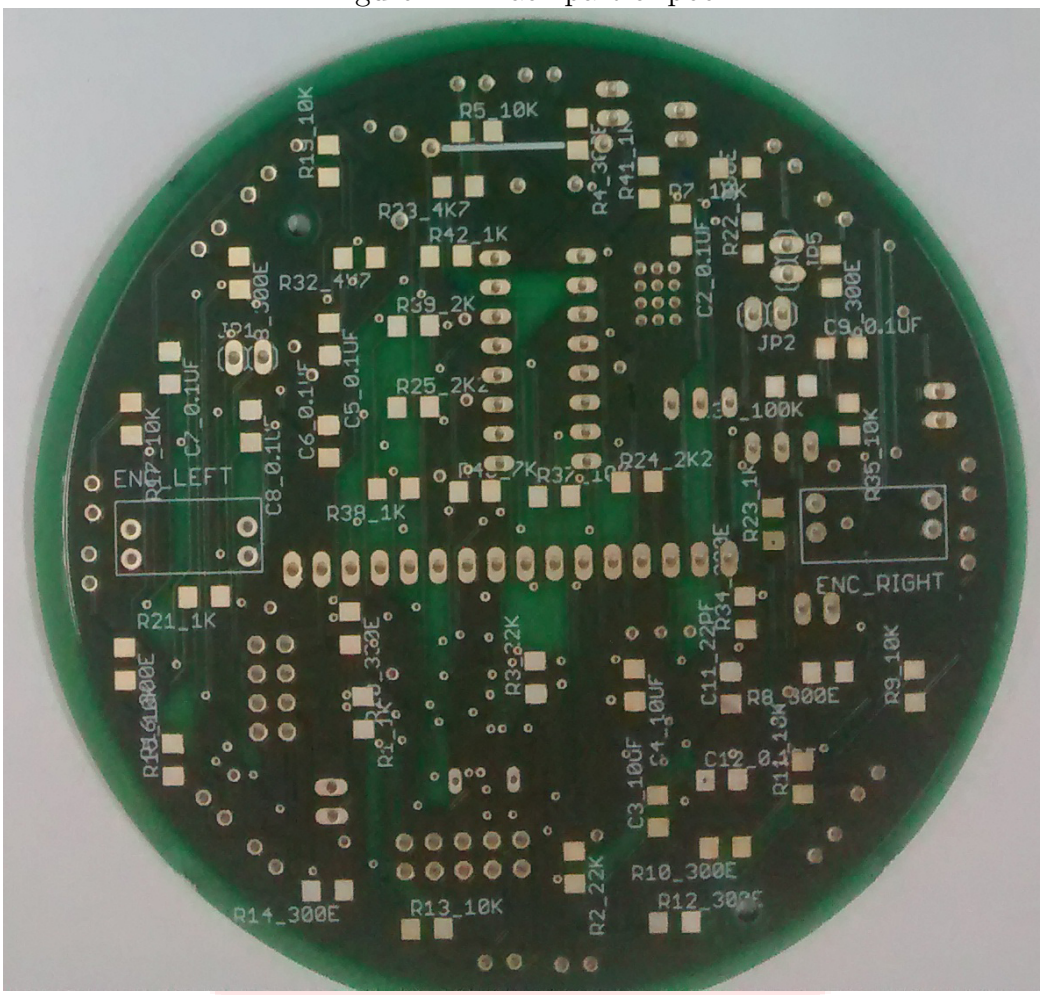
4.1 Circuit Diagram

Circuit schematic, simplified circuit diagram , block diagram of system

Step 1

Designing schematics and routing layout of PCB and getting them printed.

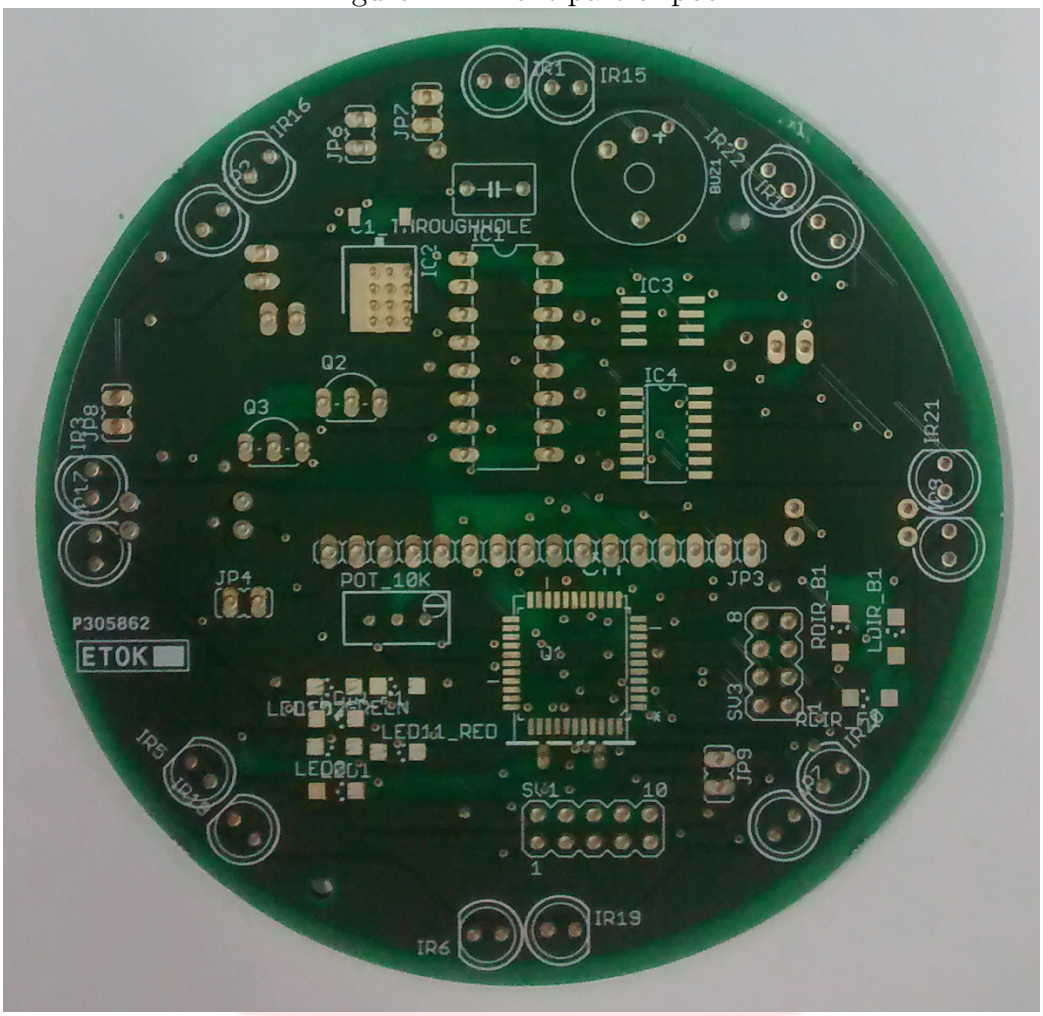
Figure 4.1: Back part of pcb



Step 2

Designing chassis and getting them laser cut. Fixing motors with L-clamps

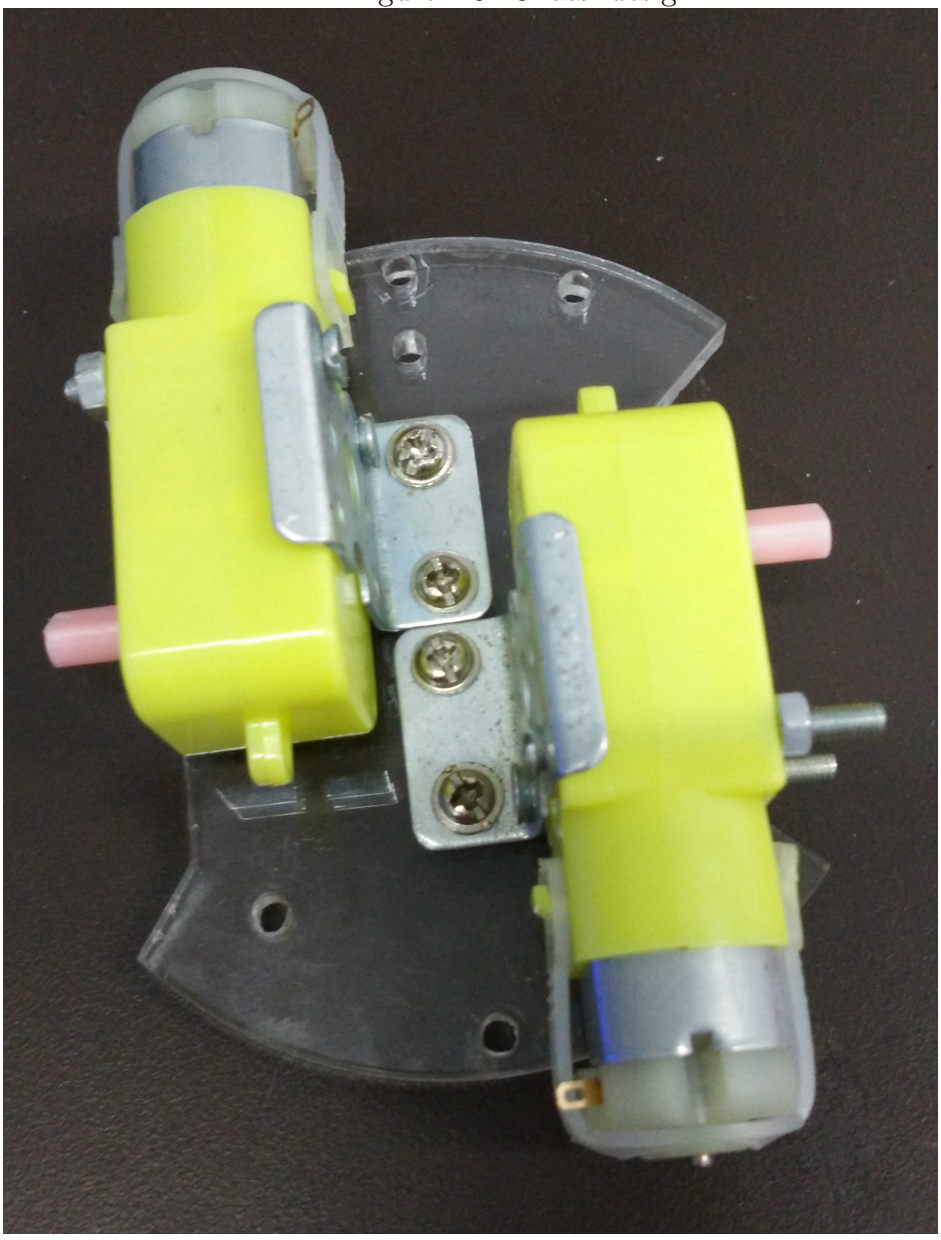
Figure 4.2: Front part of pcb



Step 3

Soldering PCBs and attaching PCB on top of chassi.

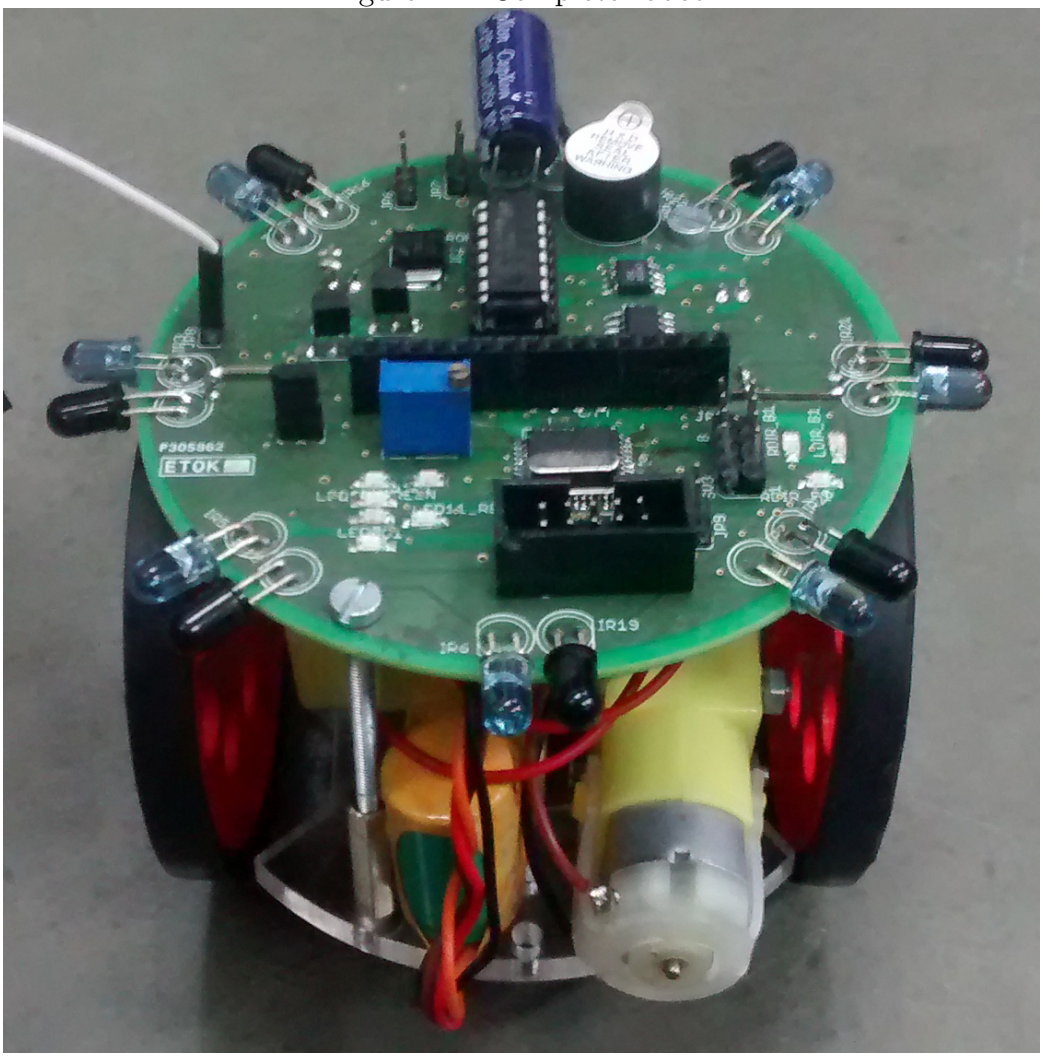
Figure 4.3: Chassi design



4.2 Software and Code

Github link for the repository of code

Figure 4.4: Complete robot.



4.3 Use and Demo

Final Setup Image

User Instruction for demonstration

Youtube Link of demonstration video

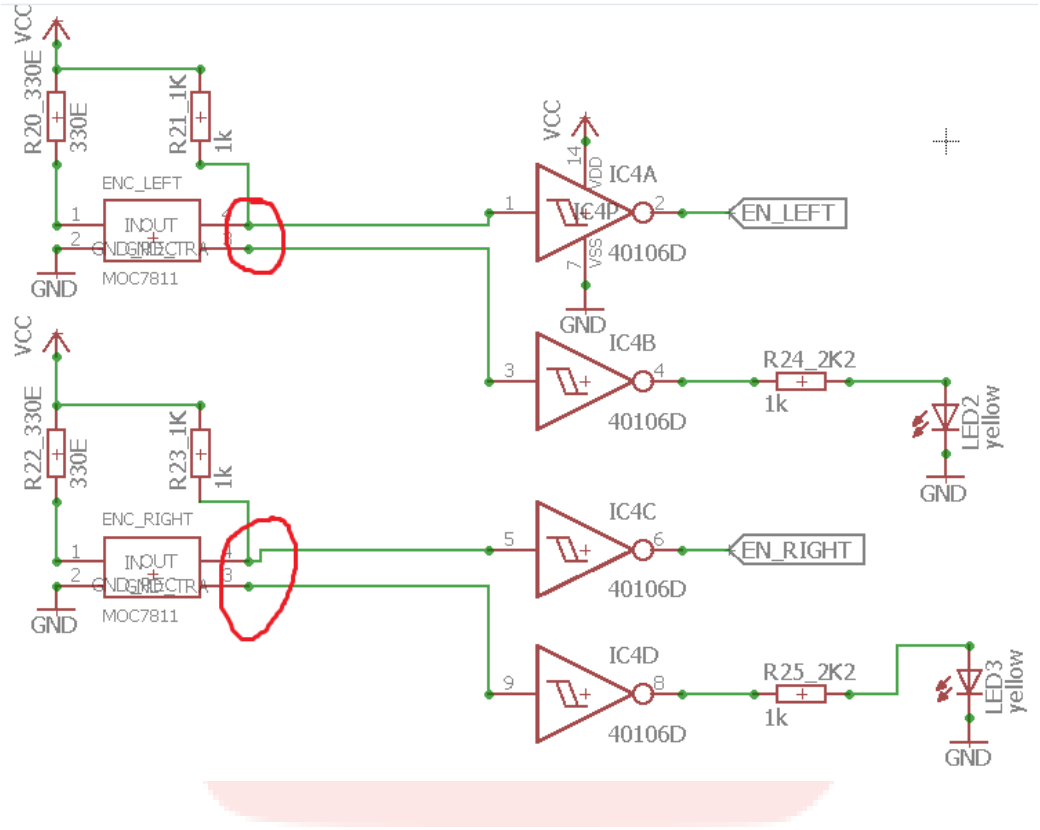
4.4 Future Work

Design an outer covering.

Implementing gathering and circle formation algorithms on Mini bots.

Solve collision of homogeneous dynamic swarm robots.

4.5 Bug report and Challenges



Bugs: Pin 3 of both encoders was supposed to be shorted to ground and connection to buffer connected to led was supposed to be shorted to pin 4.
Fix: The bug is fixed by shorting pin 3 to ground externally.

Challenges faced:
Placing components and routing air wires of PCB.

Reducing overall size of PCB.

Understanding different algorithms for circle formation and gathering algorithms for swarm robots to determine a common point for resolving global coordinate system

Soldering SMD components accurately.

Bibliography

[1] Ayan Dutta, Sruti Gan Chaudhuri, Suparno Datta and Krishnendu Mukhopadhyaya, *Circle formation by asynchronous fat robots with limited visiblity*

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[4] Swapnil Ghike and Krishnendu Mukhopadhyaya, *A distributed algorithm for pattern formation by autonomous robots, with no agreement on coordinate compass*

[5] Avik Chatterjee, Sruti Gan Chaudhuri, Krishnendu Mukhopadhyaya, *Gathering asynchronous swarm robots under non uniform limited visibilities*

[6] Krishnendu Mukhopadhyaya, *Distributed swarm robotics for swarm robots*