



ENGN8170: Group Project - Line Follower Robot

Group Name: The Great Guys

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Abstract: This poster presents the design and creation of a robot that autonomously navigate through a specific line, called Line Follower Robot. The project process encompasses designing circuit for robot movement based on the sensors, writing computer codes to program the robot, making prototype to test the feasibility, and troubleshooting of the robot's performance. This poster shows the work accomplished by the group as of the moment.

Introduction

Customer requirement

- Follow black line against white background
- Drive autonomously
- Simple and affordable elements and devices



Objective

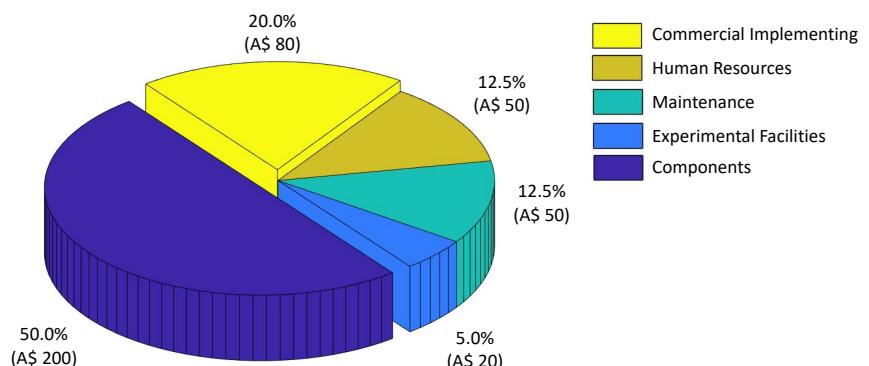
To develop a robot that can detect and follow black lines with IR sensors

Application

Robot can deliver materials, products, people in the same route continuously in different types of line with a function (e.g. Autonomous guided vehicle (AGV), Surveillance system, Fault detection, Medical support, Material transportation) [1].



Cost Analysis

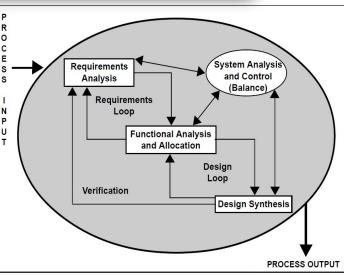


Total estimated cost of the project is A\$400. Big chunk of the budget (50%) is for the procurement of the components. Commercial implementation accounts for 20% of the total budget. To save costs related to human resources, experiments and maintenance of the robot were conducted.

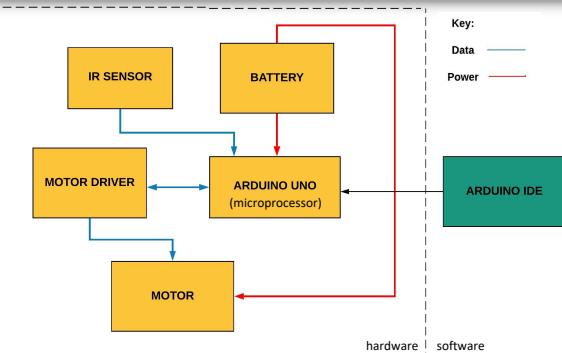
Design

Overview

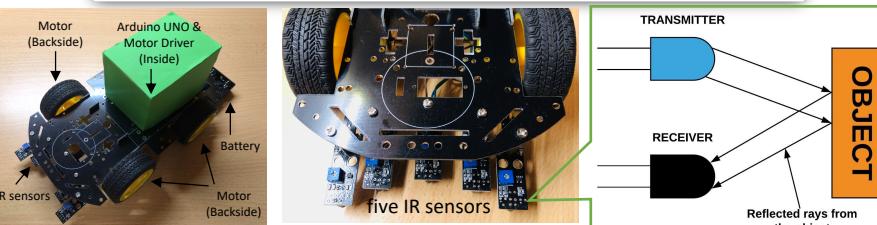
Systems Engineering [2] is the integration of technology and management in order to develop and achieve complex systems. It is a continuous feedback process that focuses on stakeholder needs at each phase. The designs are born out of these requirements and the end product is a customer driven solution.



1. Requirement Analysis & Functional Architecture



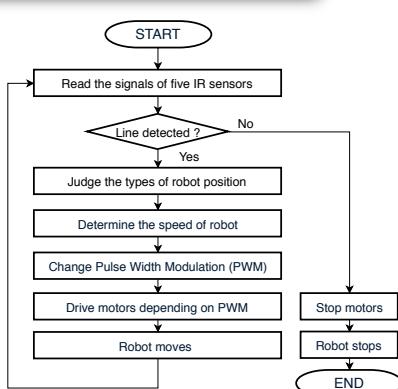
2. Physical Architecture



3. Design Synthesis

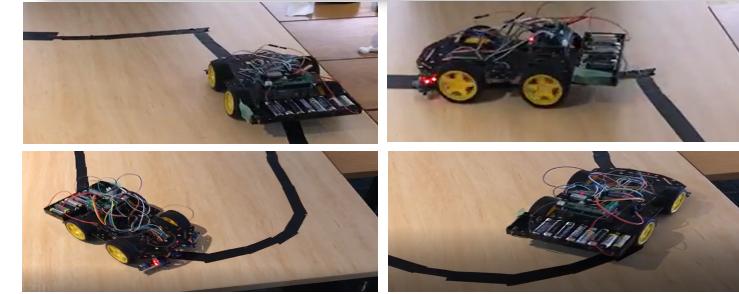
IR sensor					Output	
Left	Left-Middle	Middle	Right-Middle	Right	Motion	Error [arb.unit]
N	N	Y	N	N	↑	0
N	Y	Y	Y	N	↑	0
N	N	N/Y	Y	N	→	1
N	N	N/Y	N/Y	Y	→	2
N	Y	N/Y	N	N	←	-1
Y	N/Y	N/Y	N	N	←	-2
N	N	N	N	N	Stop	NA
N/Y	Y	Y	Y	N/Y	Special situation	NA

Y: IR sensor detects black
N: IR sensor detects white



Performance & Verification

Result



Capable to follow black line of straight line, gentle curve and perpendicular route.

Discussion

- Moving smoothly with PID control
- Detecting more colors
- Turning acute angle (less than 90 degree)

Future work

- The line follower robot can be used in logistics industry to reduce manpower costs
- Different sensors can be mounted on the line follower robot to complete different tasks
- In the airports, not only it can guide people, or people with disability /disabilities to their departure gates , but also it can carry the luggage for them

Conclusion

- The stakeholder needs, requirements, functional baseline and verification have been done.
- The basic functions of the robot have been implemented very well. However, limitation includes colour detection.
- To make robot more flexible, other functions can be added in the future.

References

- [1] M. Pakdaman and M. M. Sanaatiyan, "Design and implementation of line follower robot," in 2009, . DOI: 10.1109/ICCEE.2009.43.
[2] B. S. Blanchard and W. J. Fabrycky, *Systems Engineering and Analysis*, Pearson Education, Ed., 2011.