

Development of an autonomous mapping vehicle

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In recent years, technology related to autonomous vehicles has advanced rapidly. Numerous companies are working on self-driving vehicles that are capable of sensing their environment and navigating without human input. While significant progress has been made, numerous technological as well as social, legal and ethical challenges remain. However, the development of autonomous systems is not only restricted to vehicles. Again, in recent years, home robotic devices have also emerged that perform basic household tasks and research is gathering pace in autonomous robotic systems to be employed in the healthcare sector.

Within this project, you will gain experience of the full engineering cycle from developing ideas and designing solutions to solve a specific engineering problem through to the implementation and demonstration of a chosen solution. You will gain experience across a breadth of areas including basic mechanical and electronic construction, motor control, the selection and use of sensors, design of control algorithms and their implementation in software.

The project will initially involve the construction of a robotic vehicle from an off-the-shelf kit. Once construction is complete, appropriate hardware interfaces and software algorithms will be developed to control the servo motor drivers, which will enable the vehicle to move. The control will be implemented using a single board micro-controller such as an Arduino and functions will be developed for the full range of movements required by the vehicle.

Sensors will be incorporated to allow the vehicle to navigate, sense its environment and log its position / trajectory, with the ultimate goal of the vehicle being able to autonomously map the layout of simple spaces. Within the project, it will be necessary to review the availability of sensors and make appropriate engineering choices. Consideration of more advanced mapping techniques which employ a Raspberry Pi, camera module and image processing functions will also be investigated.

Project Aim

The aim of this project is to develop an autonomous mapping vehicle.

Project Objectives

1. Review the state-of-the-art on autonomous systems including home robotics, self-driving vehicles and any other relevant emerging applications.
2. Construct a robotic vehicle platform that can perform basic movements as directed by the user implementing key commands on an Arduino microprocessor.
3. Incorporate sensors onto the vehicle platform and interface them with the Arduino in order that the vehicle can 'sense' its environment and log its position as it moves.
4. Implement appropriate control algorithms so that the vehicle can autonomously map out the extent and major features of simple spaces.
5. Implement a vision system that allows the vehicle to capture images as it autonomously maps out a space (*advanced*).

Key Resources

- Seeed Studio website (www.seeedstudio.com) for all details of the platforms upon which the project will be based – the Wiki pages will be particularly useful
- Arduino website (www.arduino.cc) for all details of Arduino usage and programming – the Learning and Community sections will be particularly useful