Chapter 6

Experiments on Design of Obstacle Avoiding Robots Based on Sensors, Bluetooth, and IoT

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ABSTRACT

The mobile robotics industry is related to creating mobile robots that can move around in physical environments. Different types of mobile robot designs for obstacle avoidance have been experimented in the past based on different sensors, trajectory algorithms, etc. The chapter presents implementation details of different obstacle avoiding robots (OARs) using sensors, Bluetooth module, and IoT modules. The sensor-based obstacle-avoiding robots are designed using ultrasonic sensors and Arduino micro-controllers. Bluetooth-based obstacle-avoiding robots have been designed using Arduino mega and Bluetooth module and an Android application. IoT-based obstacle-avoiding robots can be designed in three different ways, using ethernet shield, node MCU, or Raspberry Pi. The IoT-based obstacle-avoiding robot using Raspberry Pi is the most popular mobile robot model that uses maximum on-chip modules in comparison to other designs, and also, the design can be extended by using cameras to use images for sensing the objects in order to avoid collisions.

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In this chapter, three different techniques for the design of an obstacle avoiding robot has been discussed.

INTRODUCTION

Robotics is considered to be an interdisciplinary branch of science and engineering dealing with the design and use of robots to replicate human actions. Nowadays robots are finding use in many situations e.g. automation of manufacturing process, space programs, environments that are dangerous to humans etc. Robots are increasingly being put to use in various industrial environments like automotive, aerospace, healthcare, quality control, and inspection, warehousing to perform repetitive tasks that require consistent precision and accuracy or heavy payload capacity e.g. material handling, order fulfillment, lifting trucks, automatic guided vehicles, packaging, quality control etc.

One of the recent advancements in robotics is the design of mobile robots. Automated guided vehicles follow predetermined paths while autonomous mobile robots can move from point A to B using alternative routes in case of congestion or obstacles. The autonomous mobile robots can be used in security, on-shelf inventory, production inspection, automated facility cleaning among other tasks.

LITERATURE SURVEY

Many attempts have been made in the past for the design of autonomous mobile robots. All these differ basically in the choice of sensors used, mapping of the path to be followed, the operations used to set the operational parameters and the hardware platform utilized.

The designs of the obstacle avoiding robots (OARs) discussed in the chapter are shown in Figure 1.

Tabassum et al. (2017) presented the design of an obstacle avoiding robot using Arduino microcontroller and three ultrasonic sensors for obstacle detection.

Chen et al. (2009) designed two models of a wheeled mobile robot for obstacle avoidance. The two models were named: Model 1: short-distance obstacle avoidance model and Model 2: target-driven obstacle avoidance model. The first model makes use of the ultrasonic sensors for avoiding the obstacles while the target-driven model makes use of fuzzy logic along with the sensor signals for speed control.

Yang et al. (2010) presented an intelligent mobile robot design for avoiding obstacles using multiple ultrasonic sensors and fuzzy control rules. All the programming has been performed in the VC environment using C and Colbert language.

Xiong et al. (2011) analyzed the movement of the designed robot under complex unknown environments. The robot’s obstacle avoiding algorithm is based on MIMO fuzzy rules on the basis of the shape analysis of the obstacle.

Boujelben et al. (2013) proposed an approach that is based on a hierarchical Fuzzy controller for designing an obstacle avoiding robot which can be placed in an unknown environment containing mobile obstacles.

Yamada et al. (2013) proposed a robot design that follows a designated path by avoiding mobile obstacles. In order to scan the region for obstacles, two laser sensors (one at the front and one at back) have been used.

Bhagat et al. (2016) designed an obstacle avoiding robot using ultrasonic sensors and ATMEGA-8 microcontroller.