Chapter 13

Design and Implementation of a Wireless Robot for Image Processing

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ABSTRACT

Robotics has developed into a solid discipline of study that incorporates the background, knowledge, and creativity of mechanical, electronics, electrical, computer, industrial, and manufacturing engineering. The versatility of a robot can be translated into increased productivity, improved product quality, and decreased production costs in numerous ways. The robot can be wired or wireless, and can have a controller device. Radio frequency control system is one of the most efficient controls for a robot. Other than control, image processing is one of the important parts of robotics. Moreover, it also requires hardware for interfacing with the system for radio frequency control. It is one of the key technologies which can be used in defense, safety, intelligent transport system, and efficient management traffic. In recent years, there has been an increased scope for image processing in robotics. The main goal of this work is to show a system that solves the practical problem of identification of real scenes. All the simulations have used MAT LAB software.

INTRODUCTION

Robotics is an interdisciplinary subject which drawing ideas and tools from mathematics, physics, engineering and computing. The field of robotics has its origin in science fiction. The word “robot” is based on the Czech word for slave, and was introduced into our culture in the early 1921 in a play by Czech playwright, novelist; and essayist Karel Capek about mechanical men that rebel against their human masters. Capek dreamt of a situation where bioprocess could create human-like machines,
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devoid of emotions and souls, who were strong, obeyed their masters, and could be produced quickly and cheaply. Czech word robota means “forced laborer” or “slave laborer”. The word “robotics” was coined by the renowned science fiction writer, Issac Asimov, in 1942 science fiction story, “Runabout”. A robot is a reprogrammable multifunctional manipulator designed to move material, parts, tools, or specialized devices through variable programmed motions for the performance of a variety of tasks. The versatility of a robot can be translated into increased productivity, improved product quality and decreased production costs in several ways. In the recent history we see a close relationship between the state of industry, the revolution in numeric and computer control of machinery, space exploration of imagination of creative people. A robot consists of various elements such as Manipulator, Sensory Devices, Controller and Power Conversion Unit. Actually, the robotic technology deals with the design, manufacture, operation and application of robots. The robotic technology uses computer system control, sensory feedback, actuator action and manipulation to execute the whole operation. The robotic technology deals with automatic technology that can be instructed by an operator to perform critical task in hazardous environment. Also, the robotic system created a new cluster of robotics and flexible robotics (Habib et al., 2007; “How to Make”, 2014). The mechanical system technique was introduced through the manufacturing era as there are various practical applications in industry such as automated machines, mobile-control robotic system and long distance remote-control. Now a day’s Image processing is one of the emerging fields of robotics. Advances in vision technology for robotics are expected to broaden the capabilities of robotic vision systems to allow for vision-based guidance of the robot arm, complex inspection for close dimensional tolerances and improved recognition and part location capabilities. The typical vision system consists of the camera and digitizing hardware, a digital computer and hardware & software necessary to interface them. This interface hardware and software is often referred to as a preprocessor. In the introduced work background subtraction technique is used and image processing is done by MATLAB software and robotic car is controlled by radio frequency. The software is used for real-time computer vision. A 14-16 mega pixel camera is placed over the robotic car to process image using MATLAB and battery-operated robot car is controlled by RF. To use the system wirelessly, all the applications of image processing are wrapped in robots. The robots can take their self-decision in any industry or else, whether man or machine works properly or not, sending information to supervisor by using digital camera placed at the top of the robotic car for image processing (Viola et al., 2004). The system has many applications in pattern recognition and machine vision for a complex security system to common areas and for parking admission to urban traffic control.

Image sensing functions involve the input of vision data by means of a vision camera focused on the scene of interest. The image consists of relative light intensities corresponding to the various portions of the scene. These light intensities are continuous analog values which must be sampled and converted into digital form. Special lighting techniques are needed to obtain an image of sufficient contrast. Various lighting techniques are there for good illumination of the scene. The image viewed by the camera is typically digitized by analog to digital converter (ADC) and stored in computer memory. The digital image is called a frame of vision data & is frequently captured by a hardware device called frame grabber and these devices are capable of digitizing images at the rate of 30 frames/second. ADC is either a part of a digital video camera or the front end of frame grabber. The choice is dependent on the type of hardware of the system. The digitized image matrix for each frame is stored and then subjected to image processing and analysis functions for data reduction and interpretation of the image. These steps are required in order to permit the real time application of vision analysis required in robotic application. Typically, an image frame will be thresholded to produce a binary image and then various feature
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