it take to pay for the robots from the savings in fewer employees? Assume that the skilled workers make $20 per hour, including benefits.
2. Develop an expert systems to predict the weather for the next few days. Use a word processing program to list and describe the IF-THEN rules you would use.
3. Use a graphics program, such as PowerPoint, to develop a brochure for a small restaurant. Contrast your brochure to one that could have been developed using a specialized multimedia application used to develop brochures. Write a report using a word-processing application on the advantages of a multimedia application compared to a graphics program.

TEAM ACTIVITIES

1. Do research with your team to identify KMSs in three different businesses or nonprofit organizations. Describe the types of tacit and explicit knowledge that would be needed by each organization or business.
2. Have your team develop an expert system to predict how many years it will take a typical student to graduate from your college or university, given the major the student selects, the number of courses taken each semester, the number of parties or social activities the student attends each month, and other factors. Each factor should be placed in one or more IF-THEN rules.
3. Have your team members explore the use of a special-purpose system in an industry of your choice. Describe the advantages and disadvantages of this special-purpose system.

WEB EXERCISES

1. Use the Internet to find information about the use of augmented reality. Describe what you found.
2. This chapter discussed several examples of expert systems. Search the Internet for two examples of the use of expert systems. Which one has the greatest potential to increase profits for a medium-sized firm? Explain your choice.
3. Use the Internet to find information about two of the special-purpose applications discussed in the chapter. Write a report about what you found.

CAREER EXERCISES

1. Describe how a COP can be used to help advance your career.
2. Describe how you could use multimedia in a career of your choice. Include applications in text and graphics, audio, video, and animation. Using a word processor, briefly describe how you would design each multimedia application to help your career.

CASE STUDIES

Case One

Google and BMW Train Cars to Drive Themselves

Artificial intelligence is defined in this chapter as computers having "the ability to mimic or duplicate the functions of the human brain." Driving a car in traffic is such an activity. By that definition vehicles that have begun to show the ability to drive in traffic have started to show intelligence.

Intelligent vehicle behavior, a step beyond the systems discussed in the Specialized Systems section of this chapter, is expected to become commonplace over the next few years. Alan Taub, General Motors vice president for research and development, predicts that self-driving will be a standard feature by 2020.

In October 2010, Google disclosed its Autonomous Car program. The firm's cars are easily spotted in and around San Francisco: the base Toyota Prius has a funnel-shaped device on the roof to hold a 64-beam laser rangefinder. Additional inputs to the control computer come from high-resolution maps of the area, two radar units on each bumper, a forward-facing camera to detect traffic lights, and GPS, inertial measurement unit, and wheel rotation counter to track vehicle motion.

Google's cars always travel with a licensed driver in the driver's seat. In the first 160,000 miles of operation, the driver had to take over twice: once when the car in front stopped and began to back into a parking space and once when a bicycle rider entered an intersection despite a red light. It would be fairly easy to program the cars' computers to check for cars starting to park but more difficult, though not impossible, to program them to handle cyclists running red lights. Situations in which a person has to take control should become rarer as time goes on.

The only accident involving a Google car in over 200,000 miles, by the way, came when one of the cars was rear ended while stopped at a traffic light. How many humans drive that far with only one minor fender bender?

Google is not the only company studying autonomous driving technology. Vehicle manufacturers are investigating it, too. BMW is probably the furthest along: in January 2012, it demonstrated a self-driving car on Germany's no-speed-limits autobahns. The company's car looks like any other BMW since its radars, cameras, laser scanners, and distance sensors are all inside the body. Nico Kaempchen, project manager of Highly Automated Driving at BMW Group Research and Technology, says "the system works on all freeways that we have mapped out beforehand."

Programming autonomous cars means studying driver behavior to a detailed level. How do drivers alternate at an intersection with four stop signs? If other drivers don't yield to the driverless car, how should it inch into the intersection to show that it wants its turn? How large must an animal be before a car takes evasive action to avoid it?

Society must also resolve legal issues about this technology. How can police officers pull over driverless cars? Do they even have the right to? How can driverless cars recognize police officers directing traffic and ignore traffic lights over those officers' heads?

Despite such concerns, driverless vehicles were legalized in Nevada in 2011. Similar legislation is pending in Florida and Hawaii and may soon be introduced in California.

Like it or not, though, we will soon give our cars more control than our ancestors ever gave their most intelligent horses. "It won't truly be an autonomous vehicle," said Brad Templeton, a software designer and a consultant for the Google project, "until you instruct it to drive to work and it heads to the beach instead."

Discussion Questions

1. Suppose you saw a Google autonomous car driving along in front of you and going about 5 mph (or 10 km/hr) slower than you believe it is safe to go. There are two travel lanes in your direction. Would you pass the autonomous car? Do you think that is any riskier than passing a car controlled by a human driver?
2. As noted in the case, Google's autonomous cars are easily recognized but BMW's are not. Do you think this matters? If it does, which do you prefer and why?

Critical Thinking Questions

1. Would you buy an autonomous car in the first year such cars are on the market? (Assume you were going to buy a new car anyhow, that the car itself appeals to you, and that its price is reasonable.) If not, when do you think you would?
2. You are a lawyer. An autonomous car injures your client. What do you recommend your client do? If you recommend suing, who do you sue? What are some arguments you might use? What might the defendants argue?

SOURCES: Guizzo, E., "How Google's Self-Driving Car Works," *IEEE Spectrum, spectrum.ieee.org/automaton/robotics/artificial-intelligence/how-google-self-driving-car-works,* October 18, 2011; Hachman, M., "Google's Self-Driving Car Challenge: 1 Million Miles, by Itself," *PC Magazine, www.pcmag.com/article2/0,2817,2395049,00.asp,* October 20, 2011; Kelly, T., BMW Self-Driving Car: Carmaker Shows off Hands-Free Car on Autobahn," *Huffington Post, www.huffingtonpost.com/2012/01/26/bmw-self-driving-car_n_1234362.html,* January 26, 2012; Trei, M., "BMW Challenges Google's Self-Driving Car," *NBC Bay Area News, www.nbcbayarea.com/blogs/press-here/BMW-Challenges-Googles-Self-Driving-Car-137892303.html,* January 23, 2012; Vanderbilt, T., "Five Reasons the Robo-Car Haters Are Wrong," *Wired, www.wired.com/autopia/2012/02/robo-car-haters-are-wrong,* February 9, 2012; Vanderbilt, T., "Let the Robot Drive: The Autonomous Car of the Future Is Here," *Wired, www.wired.com/magazine/2012/01/ff_autonomouscars,* January 20, 2012.

Case Two

Knowledge Management Improves Customer Support at Canon

Millions of U.S. consumers own Canon digital cameras, copiers, printers, binoculars, fax machines, camcorders, and calculators. Canon Information Technology Services (CITS) in Chesapeake, Virginia, fields support requests at a current rate of 200,000 calls, 50,000 e-mails, and 1,000 letters per month: a total of about three million contacts per year. CITS employs about 550 people to handle these contacts.

Canon's problem is that, until recently, they had no central knowledge repository. Product information was scattered over a CITS intranet, the Canon USA internet, hard-copy manuals, and an internally developed knowledge system. CITS could not ensure that all of the content was correct and did not conflict with the manuals or another system. Customers could use only the knowledge system, and it was not searchable. Support agents needed to check multiple sources of information on any product. This process was cumbersome, annoyed the agents, and wasted valuable time.

To address this problem, Canon installed Consona's Knowledge-Driven Support (KDS). KDS integrates knowledge management with case management software, a type of Customer Relationship Management software that you studied in Chapter 9.

As an example of integration, KDS supports *in-process authoring*. A representative who has just written a customer a long, complex explanation of how to solve a problem can enter that explanation directly into the knowledge base without having to recreate it or even copy and paste it. Agents don't have to take time after a call to create new knowledge when they could be improving their performance