ROBOTIC VEHICLE MOVEMENT WITH WEBCAM OPERATED BY CELL PHONE

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Abstract

The project is designed to develop a robotic vehicle that is controlled by a cell phone. DTMF commands from a phone are sent to another cell phone which is mounted on the robot. These commands are fed to a microcontroller of 8051 family to operate the vehicle movement through motor interface.

The main scope of project is to send commands from one cell phone to be received by another cell phone mounted on the robot to receive the DTMF (Dual Tone Multi Frequency) mode commands which are then decoded by a DTMF decoder.

The corresponding codes are then fed to a microcontroller, programmed to recognize those codes to operate 2nos DC motors through motor driver IC for any direction movement as per the sent commands from sender's mobile. The motors are controlled using motor driver IC which is interfaced to the microcontroller. It uses microcontroller from 8051 family and a battery for power source

INTRODUCTION

1.1 Introduction

This section outlines some of the ideas, considerations and possible choices at the beginning of the project. There were three basic ideas on which the specification could be built upon.

1.1.1 Single Intelligent Robot

The first idea was a single intelligent robot that would probably integrate a laptop on the chassis, which would allow for image processing, making decisions and communications. This would likely use most, if not all of the budget and the available time. However, if the necessary time and budget were available, relatively simple duplication could result in two or three of these robots. These could interact with each other; the complexity of this interaction depends directly on the time available.

1.1.2 Multiple Simple Robots

- The second idea was to make multiple simple robots, each being much less complex than the first idea. They could have some relatively simple rules on how to interact with each other so they could look intelligent. For example simple rules can be applied to each bird in a simulation and when combined into a flock of these birds they will move like a real flock of birds moving and changing direction.

1.1.3 Single Intelligent Robot with Multiple Simple Robots

- The final idea involved combining the two previous ideas to have a single complex robot (perhaps simpler than the first idea) with many smaller simple robots. Various ways they could interact were discussed
- Mother duck, ducklings and nest – the simple robots could run away when fully charged and the intelligent robot has to gather them up again. The mother could either 'scoop them up' or emit an audible sound which makes the duckling follow.
- Sheepdog and sheep – the intelligent robot has to herd the simple robots, which would act like the sheep.

1.2 History

This section contains some relevant background reading that may be of interest to the reader before reading the rest of the report. It starts off with an introduction to robots and to artificial intelligence.

Then a brief case study of an intelligent agent is presented. This case study mentions some sensors and therefore, following this, is a section on sensors, their associated weaknesses and some examples of the problems faced when fusing multiple-sensor data. Then a change of topic occurs into the field of image processing, which is heavily used in this project. Specifically, erosion and dilation are explored. The image processing library used in this project is then discussed. Finally, some of the topics required for filtering noisy estimates are considered. These include: defining the covariance matrix, introducing the Kalman filter, listing some of the filtering libraries available and outlining simultaneous localisation and mapping.

1.2.1 Introduction to Robots

The term robot was first introduced by the Czech playwright Karel Capek in the 1921 play Rosum's Universal Robots. It comes from the word Robota, which is Czech for 'forced workers' in the feudal system. The play featured machines created to simulate human beings in an attempt to prove that God does not exist. In 2005 the world market for robots was $6 billion a year for industrial robots, according to the International Federation of Robotics (IFR) and the United Nations Economic Commission for Europe (UNEC). This market is expected to grow substantially; it is predicted that 7 million service robots for personal use (that clean, protect or entertain) will be sold between 2005 and 2008 and 50,000 service robots for professional use will be installed over the same period. Jan Karlsson, the author of the UNEC report, cites falling robot prices, an increase in labour costs and improving technology as major driving forces for massive industry investment in robots. There are currently around 21,000 service robots in use worldwide performing tasks such as assisting surgeons, milking cows and handling toxic waste. The report predicts that by the end of 2010 robots will also assist elderly and handicapped people, fight fires, inspect pipes and hazardous sites. Robots have the potential for use within the service industries and also as potential carers in our rapidly ageing society.Intelligent robots are capable of recognising sounds and images through sensors and analysing this information to determine their actions. Conventional industrial robots (e.g. used in the automotive industry) require work patterns to be input before they can be operated. Large increases in computer power and advances in sensors, control software and mechanics are allowing robots to gain many more abilities, including walking, talking and manipulation. However Artificial Intelligence (AI) is behind these developments.8 AI is growing far more sophisticated, drawing on new information on how the human brain works and massive increases in computing power. Business and industry already rely on thousands of AI applications, for example to spot bank fraud and in the development of new drug therapies. There are significant problems however, which are hindering the development of robots. For example, different sensors must be used to obtain different kinds of information. There is no one sensor that works flawlessly in all applications. Data fusion techniques are required to utilise the positive side of each sensor, and ignore its negative side. There are still a large number of problems in not only the sensor technology, but also the sensor fusion algorithms.To conclude, there are numerous known problems facing the area of robotics; however, in the near future it is an area in which massive development will occur.

1.2.2 Introduction to Artificial Intelligence

Artificial Intelligence (AI) is what happens when a machine does something that could be considered intelligent if a human were to so the same, such as drive a car, play sports or pilot a plane. The term 'artificial intelligence' is synonymous to the term 'machine intelligence'; a machine is by definition something artificial. AI is wired into much of modern society, for example, AI programs are used to spot bank fraud, evaluate mortgage applications and to vacuum floors. The term 'agent' is used for anything that can be viewed as perceiving its environment through sensors and acting upon that environment through effectors. In AI there are three main types of intelligent agents: firstly the reflex agent, secondly the goal-based agent and finally the utility-based agent. A reflex agent is the simplest type; it perceives its current environment and its actions only depend upon 'condition-action' rules. For example: 'if car in front is breaking then initiate breaking'. A goal based agent is more complicated. It has some perception about the effect its actions will have upon the environment and whether those actions will help towards achieving its long term goal. A utility agent is similar to a goal based agent, but is more complex again, because it has some measure of how successful it is being. There are large differences in the environments that intelligent agents operate. Environments are classified as follows:

- Accessible - If an agent's sensors provide access to the complete state of the environment, then the environment is accessible to that agent. An accessible environment means that the robot does not need to maintain an internal model to keep track of the world.

- Deterministic - If the next state of the environment is completely determined by the current state plus the actions selected by the agent, then the environment is deterministic.

- Episodic - In an episodic environment, the agent's experience is divided into 'episodes'. Each episode consists of the agent perceiving and then acting. Subsequent episodes do not depend upon previous episodes. Episodic environments are simple because the agent does not need to think ahead.

- Static - If the environment cannot change while an agent is deciding on an action, then the environment is static.

- Discrete - If there are a limited number of distinct, clearly defined actions then the environment is discrete. It is important to understand the environment because different environment types require different agent programs to deal with them effectively. The robot built by the special engineering project had the following environment: inaccessible, nondeterministic, non-episodic, dynamic (i.e. not static) and continuous (i.e. not discrete). It was designed to be a goal-based agent.

1.3 SUMMARY

A robot is an intelligent, re-programmable and multifunctional manipulator designed to work in inaccessible environment to do variety of tasks which are laborious, threatened and risky. The robots with flexible structure are needed so that they can adapt themselves according to the pipeline parameters.

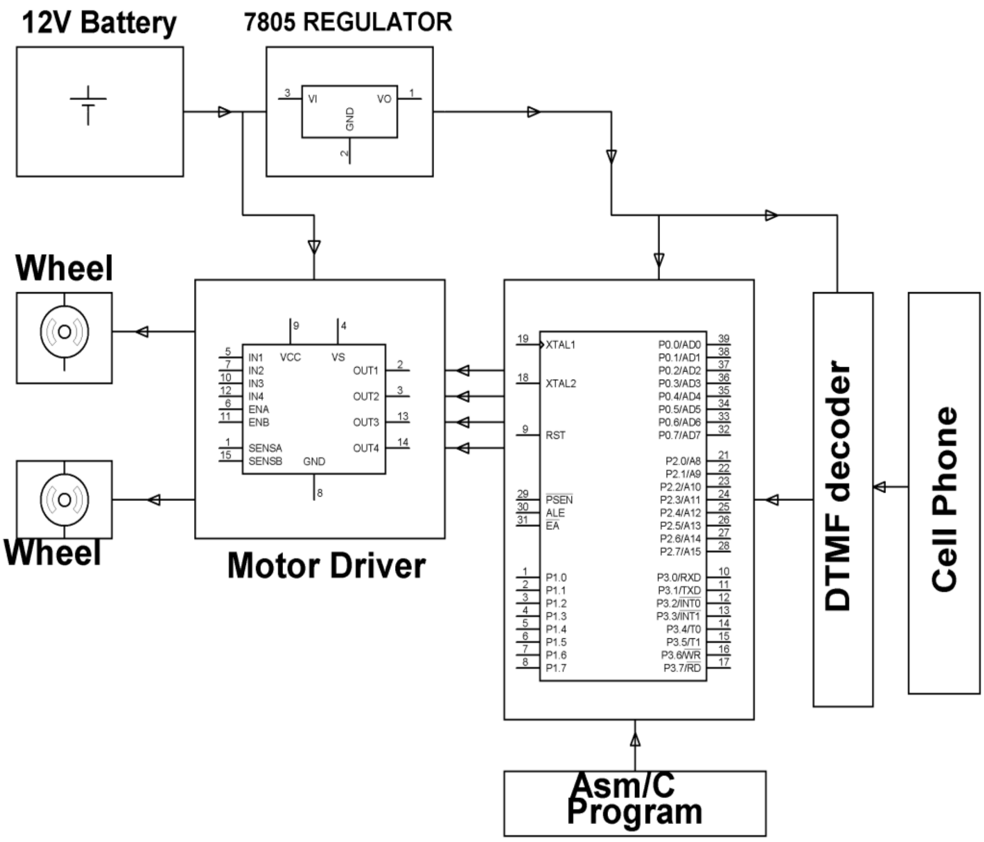

Fig. 5.12 BLOCK DIAGRAM

CONCLUSION

Mobile robotic systems have great potential for providing assistance in general surveillance tasks. From visual surveillance and long-term deployment in security operations, to victim identification and threat assessment at search and rescue sites. robotic systems may prove to be invaluable assets. Structural health monitoring has already seen practical implementation of robotic systems. While many robotic technologies are still in development, the commercial production of various remote-control inspection units for structural health monitoring is evidence of the effectiveness of these systems. Robotics use may not be widespread, yet the commercialization of various pipe-crawlers, tank-inspectors, etc. suggests that widespread practical implementation of robotic systems may occur in the near future. While many of the current technologies employed may have limitations (e.g., remote control, tethered systems), there is the potential for deployment of practical autonomous systems as well.

REFERENCES

[i] Schneider electric telemetry and remote scada solutions march 2012
Jim Ralston & Scott Monton Prosoft Technology February 2008
Rao Kalapatapu Isa 2004 Paper
James Fietsam, Eric Rochelkyle Dixon Doug Schumann.Arms, Steven. “Robotic Systems for Network Interrogation of Smart Civil Structures”.NSF Small Business Innovation Research Program Proposal. Burlington, VT:Microstrain, Inc. 1999.

[ii] Becker, Jens, Laurence J. Jacobs, and Jianmin Qu. “Characterization of Cement-Based Materials Using Diffuse Ultrasound”. Journal of Engineering Mechanics December 2003: 1478-1484.

[iii] Dolan, John, et al. Distributed Tactical Surveillance with ATVs. Proc. *SPIE* Conference on Unmanned Ground Vehicle Technology (Aerosense 1999). Vol. 3693. Bellingham, WA: *SPIE* 1999.

[iv] Envirosight, Inc. 111 Canfield Ave., Randolph, NJ 07869. Esser, Brian, et al. Wireless Inductive Robotic Inspection of Structures. Proc. *IASTED* 2000 International Conference. 14-16 August 2000. Honolulu: 2000.

BOOKS

[i] Axel Daniels & Wayne Salter, What is SCADA, CERN-CNL-2000-003 Vol. XXXV, issue no.3

[ii] Jhon B. Weber, Applying Visual Basic for Human Machine Interface Applications.

[iii] Tony Stafford, Taking Back – A SCADA case study, Camrosa Water District, California. July 2002.

[iv] Automating Manufacturing Systems with PLCs (Version 4.7, April 14, 2005) by Hugh Jack