An Autonomous Assistant Service Robot for an Office Environment

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Recently, Autonomous humanoid robotics technology is being expected to provide various services in human living environments. But the commercial availability of these types of robots is still not considerable, due to many unsolved problems in this research area. Self-localization and navigation of mobile robots are most challenging problems. So researchers have introduced many advanced navigation systems.

This paper presents a system of pre defined map base indoor navigation robot for known environment. The robot operates on a floor tile grid and uses sensor base technique for path planning. There is an array of reflective IR sensors for tracing line and counting the grid edges. The robot considers starting position as an absolute reference point. While navigating, processing unit updates the x, y coordinates and verify with defined map, thus it can obtain accurate path to the destination. Robots' linear motion control was done by comparing speeds of the main wheels using Pulse Width Modulation (PWM) technique. A closed loop Proportional Integral (PI) control system was used to synchronize speed of dual wheels. Omni directional wheel was used to reduce slip. The destination selection and robot navigation were controlled by a control panel with a graphical display. The robot delivers documents while keeping them inside a password secured cabin. Speaking ability enhance user friendliness of robot. Further the Current Date, Time, Temperature and Location were displaying to more favorable in the office environment. The control unit consists of a set of PIC Microcontrollers which were programmed in C Language by using I^2C and RS232 communication protocols. The algorithm of this robot was designed to demonstrate inside an office building. Its' maximum linear velocity is 0.26 $ms^{-1}$by navigating on a 5mm grid line .The minimum position error is within one tile. In this method the navigation errors wouldn't be cumulative.

Key words: Robot localization and navigation, Autonomous service robot, grid based navigation, closed loop feedback system