Chapter 4
Driverless Metro Train with Automatic Crowd Control System

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ABSTRACT

This chapter discusses about a prototype of Driverless Train Operation (DTO) mode. In DTO, driving is controlled and monitored automatically, without human assistance. A train attendant can intervene in emergencies. The automatic driving system takes care of the departure, the movement between two stations, and the automatic and precision stopping of the train and opening of the doors. If required, the door is automatically opened again. When passenger volume is high, additional trains are automatically sent into operation straight from the depot at the push of a button. The driverless metro train in our work is basically an embedded system based framework, which is designed to provide solutions for smooth a human machine interface while controlling high speed metro train using automated actuation and regulation mechanisms. In this work, the modeling of the metro train is done in a more precise way using an AVR microcontroller.

INTRODUCTION

In metro systems, automation refers to the process by which responsibility for operation management of the trains is transferred from the driver to the train control system (Punetha, Kumar, & Mehta, 2013). The various grades of automation range from driver-assisting functions for control of the brakes and automatic speed control of a train through automatic and precise stopping of a train in stations, opening and closing a train's doors to possible remote control and fully automatic metro operation without drivers. The Automated operation in a train generally consists of two components, the automatic train

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control and the automatic train protection systems. Automatic train control reduces the involvement of human in the operation of trains. The automatic train protection system reduces the cause of the alarm in the train. It ensures the safe driving of trains at all times. Automatic Train Control (ATC) systems work within an overall signaling system with interlocking, automatic train supervision, track vacancy detection and communication functions, route setting and train regulation. The ATO and ATC systems work together to maintain a train within a defined tolerance of its time table. The combined system will marginally adjust operating parameters such as the ratio of power to coast when moving and station dwell time, in order to bring the train back to the timetable slot defined for it. There is no driver, and no staff assigned to accompany the train. Automatic Train Protection (ATP) is the system and all equipment responsible for basic safety. It avoids collisions, red signal overrunning and exceeding speed limits by applying brakes automatically. A train protection system continuously monitors its speed, however, (Siemens, 2013) controlling the heavy crowd during the rush in a metro station is indeed a difficult task for a train attendant than a programmed machine. Folks in a station can ignore a person but not a machine.

This paper discusses about a prototype of Driverless Train Operation (DTO) mode. In DTO, driving is controlled and monitored automatically, without human assistance. A train attendant can intervene in emergencies. The automatic driving system takes care of the departure, the movement between two stations, and the automatic and precision stopping of the train and opening of the doors. If required, the door is automatically opened again. When passenger volume is high, additional trains are automatically sent into operation straight from the depot at the push of a button. The Underground Railway for Kolkata solved the problems to some extent. Later on the metros in Delhi, Mumbai and Bangalore came into operation. Such big metropolitan cities suffer daily from over passenger as the number of passengers using a city metro has been increasing steadily per day (Davies, 2000).

The driverless metro train in our work is basically an embedded system based, which is designed to bring out solutions to such types of burning problem and to face new challenges in an innovative and proactive manner. In this work, the modeling of the metro train is done in a more precise way using an AVR microcontroller. We implemented a line follower robot which we considered as a prototype for the metro train. The railway track is shown in black and white lines. The white line signifies the railway line over which the train moves whereas the black ones depict the railway stations. As the train is obstructed by black lines in between it, it halts and after that a buzzer blows and the door of the train opens automatically. As the passengers get inside the train the sensor attached to the door detects the number of passengers entering or leaving the train and displays the exact number of vacancy or seat capacity available in it along with an announcement inside the train. In our model, the information for the passengers is made available using a simple graphical interface and an announcement system designed on Visual Basics (VB). Finally, at the limit of the passengers, the buzzer blows again and the door closes automatically. The train moves out of the station and continue moving till it reach the next station. Following the same procedure the train moves in the same manner across different stations. Programming is done well to operate different parts of the system.

RELATED WORK

In order to establish a safe, reliable railway system, it is important to achieve an integrated system that comprehensively controls individual subsystems throughout the entire process, including design, manufacturing, procurement, installation, testing and commissioning.