ABSTRACT

A kind of ship berthing auxiliary system based on STM32F10X SCM (single-chip microcomputer) is introduced in this paper. When the ship is about to enter port, the distance between ship and port will be monitored by SKD-1200 (a kind of infrared distance measuring device), the velocity, acceleration and angular velocity of bow and poop will be measured by MPU6050 (consist of accelerometers and gyroscopes). All the data will be calculated by a given algorithm in SCM, the predicted track obtained will assist the captain to command berthing. At the same time, I2C criterion is adopted in the serial communication. Whenever the SCM receives a set of data, the software will interrupt a time, Corresponding image data formed in the SCM. Data will be transferred to the cab by the WSN-02 or GSM module and the image will appear in the screen. This process repeated each time to complete the berthing process dynamic monitoring.

KEY WORDS: berthing; STM32F10X; I2C; MPU6050; WSN-02; dynamic monitoring

INTRODUCTION

With the development of the shipping industry, the frequency which ships entering and leaving the port increases. Collisions caused by berthing have occurred. Vessels’ movement can’t be separated by force and inertia, which will produce motion and deflection. The complex environment of the port and nowadays ship is developing in large-scale, high-speed direction, which will increase the difficulty of berthing operation(Van Luong Tran, Namkyun Im,2012). In the berthing process, most captains and pilots steered by sailing experience. They estimated the distance between ship and port, the velocity, acceleration and angular velocity of bow and poop and predict how the movement trends will change, which will affect their steering. This process’s completion is under the cooperation of the captain, pilot and seaman. Most of the operation depends on experience, prone to large deviations, which is one of the major causes of accidents.

In order to increase the safety and efficacy of berthing, a lot of energy was invested to research and develop berthing aid system at home and abroad. The current mainstream berthing equipment is shore facilities, which are mostly used to measure but lacked of accuracy and applicability. Infrared range, radar range, GPS, etc. have been used so far. The infrared ray has the certain limitation of the weather visibility requirement; Radar also has a high demand for weather, if the echo is disturbed, the accuracy will be insufficient; GPS has large errors under low speed of berthing. Another berthing based on ship is the safest and the most stable way today—tug assist berthing, but it is not universal in inland and small port(ZHOU Zhang-ting, 2015).

A kind of ship-based berthing aid system is introduced in this paper, which uses wireless communication and embedded technology. Real-time data is collected in the SCM and processed in PC. Combined with the AIS information, dynamic image, predicted track and the monitoring distance between ship and shore will be given, which can aim driver to complete berthing safely.

WIRELESS DATA ACQUISITION

This chapter mainly introduces the hardware system of berthing and embedded technology. STM32F103C8T6 single-chip