

A Review on Automatic Robotic System for On-the-Road Painting

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Abstract— The main purpose of an automatic robotic system on-the-road is to navigate the road and painting of the road as per the requirement. The process of the development of an automatic robotic system is shown in this paper. The automatic robotic system has two main functions i.e. the autonomous mobile road navigation system and automatic road mark painting. The objective of this paper is on the painting system which is merged with the mobile platform and accomplish within the same computing environment. This paper will achieve its task by using automatic navigation components and an airless spray system for the painting. The process of painting will be done continuously and the robot will navigate it. The result of such a system is it will minimize the human error and time needed to complete a painting. It reduces the blocking of the road during painting and also diminishes the possibility of faded marks. As it does not include human intrusion the error will reach up to zero approximately.

Keywords: Automatic Mobile Robot, Airless Spray System, Cold Painting, Thermoplastic Road Marks

I. INTRODUCTION

The painting on the motorways is done to provide guidance and a path to pilgrims. When the road is constructed then is needed a mark to provide the direction to pedestrians and vehicle. The process marking required lots of employees, machinery and it also takes times. So to overcome we are introducing a new solution which automatically prints on the road with the help of automatic machines and controlling device. [1]

The automatic road marking machine is categorized into two parts that are an automatic navigation system and road painting. In the navigation system, we use two ultrasonic sensors which will measure the road width continuously. The second part of our system is painting in which air spray is used.

II. LITERATURE REVIEW

1) Autonomous Mobile Robotic System for On-the-Road Painting

– Mohammed A.H. ALI On Jan 2014

An autonomous mobile robotic system in the form of a crude working prototype has been designed and developed to perform an on-the-road painting task. The task of the road painting that were mostly done manually with more than one machine involved was accomplished in this system using a small mobile robot prototype that was equipped with components of a painting system mounted on its platform. Many benefits from such system can be derived such as avoiding the vehicle blocking of roads during painting and repainting of the faded marks; minimizing the time needed to perform the painting and getting suitable accurate through using the autonomous system. The experimental results show the effectiveness of the proposed algorithms for performing the road marks painting.

2) Heat-Based Automated On-The-Road Painting Machine – Mas Omar Mas Rosemal Hakim and Musa Mailah

A practical road lane painting mechanism attached to an electrical driven vehicle had been designed and developed. The prototype was tested based on mechatronic approach in which the elements of mechanical, electrical/electronic and computer control were completely integrated into the system. The painting machine was capable to produce different crude pattern lines in the middle of the road (single or double lines) which can be continuous or interval patterns based on the written algorithms inside microcontroller and is remotely controlled by the operator using a built smartphone app. The prototype performance was tested with white liquid paint with different diluted mixture to acquire the most suitable mixture for further testing. It is known that the best mixture was when the paint was mixed with 30% water compared to 10%, 50% and 60%. A number of modifications were made, particularly in the physical design and fabrication of the mechanical parts to enhance the performance. The heat assisted paint system prevents the paint from clogging and improves the paint flow in the system. Further works need to be done to improve the quality of the lines produced.

3) Mechatronic Design And Development Of A Semi-Automated On-The-Road Painting Machine

– Muhammad Khalid Mohd Jali, Musa Mailah and Shehab Ghadim Jurnal Mekanikal Dec 2016,

A working prototype of the semi-automatic on-the-road painting machine has been designed, developed and tested based on a mechatronics approach in which the mechanical parts, electrical/electronic components and computer control program were completely integrated. The prime mover, which is the electric bicycle, is operated by a human operator while the mobile platform with the paint accessories mounted on it, serves to provide the automatic operation of the painting process through the use of Arduino microcontroller system that interconnects the input and output devices and communicated digitally via the developed written computer program. It can also be said that three novel features were successfully incorporated into the prototype, i.e., the safety lamp for visibility and safety during operation, video camera and LCD screen for real-time monitoring of the painting task and most important of all, the semi-automatic operation of the machine is made possible via the use of the Arduino microcontroller system.

4) Road Divider Painting Machine.

– Vijay Raut, Dhanraj Raut, Pratapsinh Shelke, Niranjan Pandhe, B. R. PATIL

The robot eliminates the hazards caused due to the painting chemicals to the human painters such as eye and respiratory system problems and also the nature of painting procedure that requires repeated work and hand rising makes it boring, time and effort consuming. The robot is cost effective, reduces work force for human workers, and reduces time consumption.

III. AUTONOMOUS NAVIGATION SYSTEM

The word navigates indicate that it is a process or activity of ascertaining one's position and following a route. In this system, we use two ultrasonic sensors connected with a microcontroller which continuously navigate and calculate the center of the road at the time of turning it again navigate and calculate the center continuously.

IV. EMBEDDED SYSTEM INTERFACE

The interface between the painting system and navigation system is shown in Fig.1 The spray gun stays always open and the spray of the paint will be controlled signals coming from the main controller to trigger the valve and pump motor.[1] The interface consist of ultrasonic sensor, Atmega 328P microcontroller, LCD 16x2, relay, HC12, Preset POT, L298 motor driver. All the sections are connected to atmega 328p .it is a microcontroller which is used for multi-operation and used to control all the sections of the circuit.

Ultrasonic sensor is used to measure the distance (width) of the road. Two ultrasonic sensor is connected to the Atmega 328p microcontroller.

L298 motor driver is an interface I which used to make communication between motor & microcontroller.Hc12 transceiver is a wireless transceiver which performs the function of transmission and reception. Relay is used for the switching purpose and in this circuit it is used to operate paint sprayer. In this circuit diagram we use two preset potentiometers which is used to adjust the distance as per the requirement.

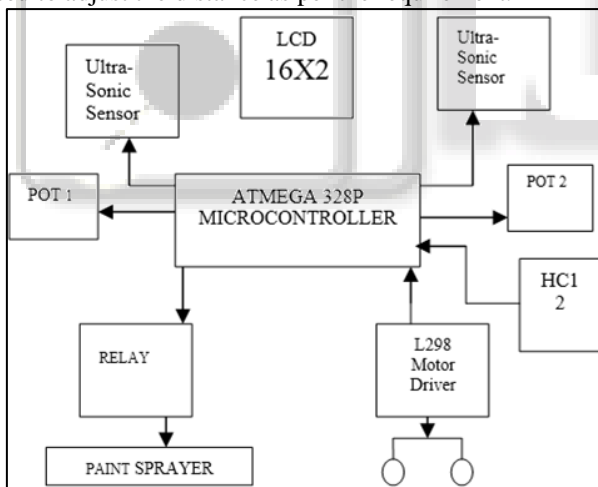


Fig. 1: Block Dig. Of Automatic Road Marking Machine

V. ROAD MARK PAINTING MATERIALS

Two main kinds of painting material can be found for the road marks painting task: thermoplastic paint and cold paint. We are using cold paint and it is described as follows.

A. Cold Paint

Cold road marking paint is a traditionally and commonly used in on-the-road painting task. It has low drying speed, short lifetime of usage, but with a low cost, which is widely used in city roads and common roads consisted of asphalt pavement and cement pavement. There are three colors to choose: white, yellow and blue.

The cold paint road marking is very common with a long history. Different from thermoplastic it is performed only by one unit road marking machine. In accordance with marking modes, the cold paint road marking machinery is divided into high-pressure airless type and low-pressure air spray type.

B. Road Marks Painting System

This system is attached to the mobile robot platform to produce autonomous robotic system for road marks painting. In this system, the autonomous navigation system will be used to detect the exact position of the road that will be painted like in the middle, at right or left. Based on the types of the road lane marks, the painting system shall include controlling the time period for spraying the paint on the roads. The timing control of the spray is done using the main controller, considering the same program with the navigation system (sharing the common part of the program).

C. Spray Painting Reference

A spray painting system module consists of a spray painting gun, a pressured container with a compressed air system and flexible tubing system. There, the atomizing air breaks the paint into small particles and coated on the surface which is to be painted. This type of system has a transfer efficiency ranging between 20% and 50%. A conventional spray gun uses air to atomize paint. Paint flows through a long tube which is pressurized from 8 to 30 psi. Figure 9 shows a spray gun with compressor.[2]



Fig. 2: Paint Spraying Gun with Compressor [2]

VI. CONCLUSION

In this paper, we have discovered an autonomous mobile robotic system to perform an on-the-road painting task. Normally the task of road painting which was done by the humans with more than one machine involved was accomplished in this system using a small mobile robot prototype that was equipped with components of a painting system mounted on its platform. This system can prove advantageous so that it would help in avoiding the vehicle blocking of roads during painting and repainting of faded marks. Also the important factor is time needed to perform painting and getting suitable accurate through using the autonomous system. Future important in the project may include the improved design and implementation of the spray gun accessories that takes into account the road mark template to have better accuracy, paint distribution and sharpness of the paint marks.

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- [5] Vijay Raut, Dhanraj Raut, Pratapsinh Shelke, Niranjan Pandhe, B. R. Patil ROAD DIVIDER PAINTING MACHINE

