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# Road Marker Robot

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Abstract-The development of an autonomous mobile robotic system for on-the-road marks painting is presented in this paper. The whole system involves two main parts, namely, the autonomous mobile robot navigation system and automated road mark painting system. The focus is on the painting system which is incorporated into the mobile robot platform and executed within the same computing environment. The main purpose of the proposed system is to accomplish its tasks using the autonomous navigation component for road detection and airless spray system for the painting. The painting of the marks on the road is performed while the autonomous system of mobile robot is continuously navigating the road. The benefit of such system is to minimise blocking of the roads during painting and repainting of the faded marks; also the time needed to perform the painting is smaller compared to the manual two-machines system. In addition, the autonomous system is accurate enough since the process is performed autonomously with minimal human intervention. The experimental results of the painting show the capability of the proposed algorithms in performing the road marks painting.

Introduction- Road mark paintings are used on the paved roadways to provide guidance and information to the drivers and pedestrians. A number of the markings on the roads can be classified into five categories i.e., longitudinal, lateral, mergingdiverging, symbols & letters and special situations. The painting of road marks in the existing systems involves two main tasks, which are accomplished separately during the road marking painting. Most of the road marking machine has a hydraulic guide rod to ensure the painting line is accurate and straight.The given below approaches have been used by us to test the proposed model:

I. To develop a model which would paint the rumble strips.
II. Sharing the information on the IOT panel about the detailings of rumble strips.
III. Controlling the types of rumble strips which needs to be painted.

We studied the use of rumble strips on a national highway as a measure against head-on collisions. The rumble strips were installed on a test track before installation on a road in service. Studies were conducted on the necessary construction machinery, the construction methods, and the effects of installation on a road in service. In addition, we studied the use of rumble strips as a measure against run-off-the-road accidents. The strips were found to be more costly, and difficult to install and maintain than traditional measures against head-on collisions. They were found to be safer for motorcycles than are center poles and chatter bars, and effective in reducing head-on collisions.

Related Projects –several researchers have worked to draw the rumble strips on the roads and highways. Shane M. Farritor and Steve Goddard, University of Nebraska-Lincoln have published a paper on “Intelligent Highway Safety Markers”, To help reduce work zone accidents, they have developed a system of Robotic Safety Barrels that work in teams to provide traffic control. The RSBs automatically position themselves to divert traffic and protect traffic workers. They’re the first elements of a team of Robotic Safety Markers that will include signs, cones, and possibly barricades and arrestors.Mohammed A.H. Ali, M. Mailah And Tang Howe Hing from Department of Applied Mechanics and Design, UniversitiTeknologi Malaysia, have published a paper on “Autonomous Mobile Robotic System for On-the-Road Painting”. Firstly, they have used a pre-markerto draw a field sketch in advance to avoid faulty marking. The road surface was pre-marked by a line using auxiliary equipment pre-marker, which determines the exact position of the road that will be painted such as in the middle, at right or left, etc. In the second stage, the user will move the thermoplastic or cold paint machine over the premarked lines that have been prepared in the first step and spray/throwing the paint to the road. Most of the road marking machine had a hydraulic guide rod to ensure the painting line was accurate and straight.

Technical components of the proposed system-

IR Sensor - Sensors are basically electronic devices which are used to sense the changes that occur in their surroundings. The change may be in color, temperature, moisture, sound, heat etc. They sense the change and work accordingly. In IR sensor the there is emitter and detector. Emitter emits the IR rays and detector detects it.The IR sensor basically consists of three components:

1. IR LED (emitter)
2. Photodiode (detector)
3. Op-Amps

Motor driver L293d - A motor driver translates the input to higher voltage while maintaining the promised current output, thereby acting as a current amplifier. This current is used to drive the motors, which usually require a larger current for their operation compared to the other peripherals. The motor driver uses L293D to drive 3 DC motors. It is a quadruple H-bridge and can provide bidirectional drive currents of up to 600 mA.

A tachometer (revolution-counter, tach, rev-counter, RPM gauge) – It is an instrument measuring the rotation speed of a shaft or disk, as in a motor or other machine.[1] The device usually displays the revolutions per minute (RPM) on a calibrated analogue dial, but digital displays are increasingly common. Tachometers or revolution counters on cars, aircraft, and other vehicles show the rate of rotation of the engine's crankshaft, and typically have markings indicating a safe range of rotation speeds. This can assist the driver in selecting appropriate throttle and gear settings for the driving conditions.

Audrino Uno - The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.[1] The board has 14 Digital pins, 6 Analog pins, and programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable.[4] It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts.

Audrino Nano- The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328P (Arduino Nano 3.x). It has more or less the same functionality of the Arduino Duemilanove, but in a different package. It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one.

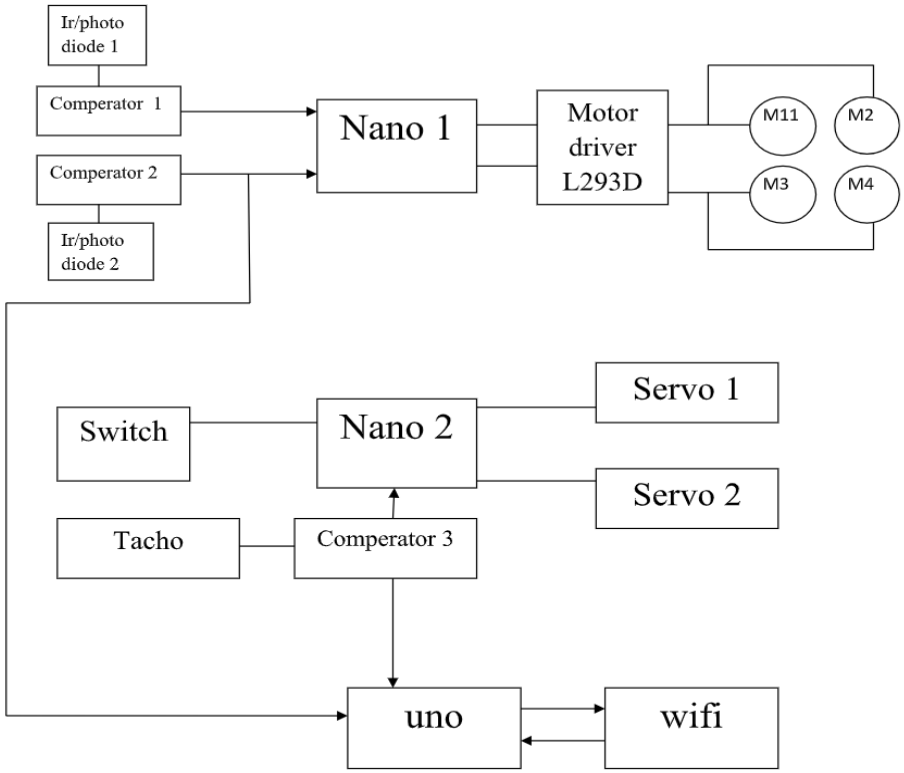
Wi-Fi module ESP8266- The ESP8266 Wi-Fi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much Wi-Fi-ability as a Wi-Fi Shield offers (and that's just out of the box)! The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community.This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external

circuitry, including the front-end module, is designed to occupy minimal PCB area. The ESP8266 supports APSD for VoIP applications and Bluetooth co-existence interfaces, it contains a self-calibrated RF allowing it to work under all operating conditions, and requires no external RF parts.

Proposed Model- Work under this project shall consist of installing rumble strips onasphalt highway shoulders where shown on the plans or where directed by the Engineer, and in conformance with these specifications Road markings can be done by automatic bot which sense the boundaries of the pavement of the roads.AT Mega 1284 is used to drive motors as per the direction based on the signal sense by the various sensors.The width of the rumble strip can be set manually, depending upon the standards of NHAI.The bot can able to print different types of rumble strips on road as per the requirements.Microcontroller are used to maintain wireless communication protocols and on the receiverside, it also takes care of obstacles and manual user inputs.Motor Driver provide the highcurrent required to drive the motors.Obstacle Sensors provide the alignment of the robot. The robot has been mounted with four ultrasonic sensors to avoid collision and damage .The three sensors monitor the forward, left and right directions. Painting robots are used byvehicle manufacturers to do detailing work on their cars in a consistent and systematic way.Some of these robots are designed with a robotic arm that moves vertically andhorizontally, to apply paint on all parts of the car. A patent granted in 1985 to the MazdaMotor Corporation also includes a door handler (a small mechanical hand) that can openand close doors on a vehicle and paint the interior.

Block diagram of the proposed model is given below

Fig 1. BLOCK DIAGRAM



Companies like FANUC continue to mass-produce industrial painting robots that are thensold to manufacturers for use. According to FANUC's website, these robots are useful inlimiting safety hazard such as the toxicity of paint, reducing wasted materials throughconsistent application, and increasing productivity. Early paint robotswere hydraulic versions - which are still in use today but are of inferior quality and safety -to the latest electronic offerings. The newest robots are accurate and deliver results withuniform film builds and exact thicknesses.Originally industrial paint robots were large and expensive, but robot prices have comedown to the point that general industry can now afford the same level of automation usedby the large automotive manufacturers.The selection of modern paint robot varies muchmore in size and payload to allow many configurations for painting items of allsizes.Painting robots generally have five or six axis motion, three for the base motions andup to three for applicator orientation. These robots can be used in any explosion hazardClass 1 Division 1 environment.There are multiple ideas people have come up with to increase the presence of paintingrobots in various industries. One such idea comes from technology professors; an interiorwall painting robot. The design aims to make the robots “roller-based” so that it can movefreely along walls and apply paint to them. The hope is to get people out of the toxicity ofinterior painting and decrease the amount of time it takes to finish walls. According to thedesigners, the robot can be made inexpensively as to make it more commercially available. The different views of the proposed model are given below:

Fig. 2- Top view

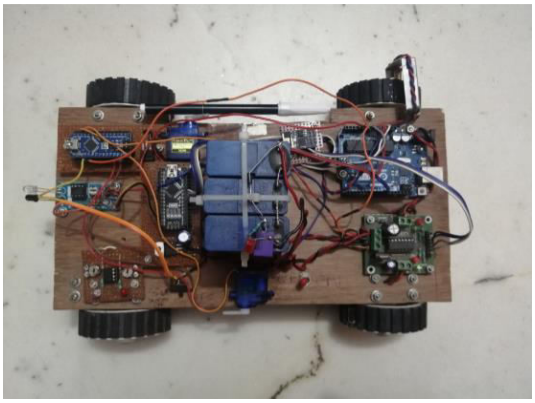
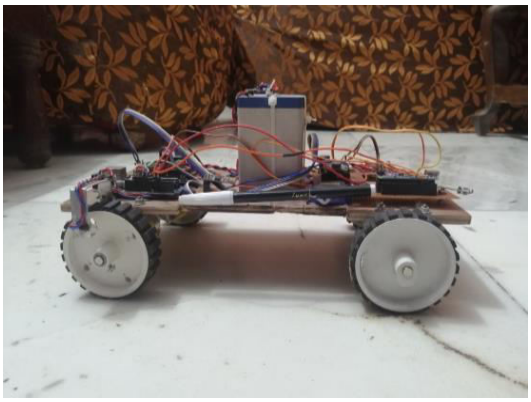


Fig. 3- Side view



Conclusion- The recent development in the field of robotic vehicle will result in the development of moreadvanced technology.This advancement of technology helps us to understand more about scienceand also helps us to improve our life. Once this technology will be common, cost will decreaseand they start their pursuit towards even better technologies. In traditional methods the Contractor had to pre-mark the location of the edge of the cut, and thebeginning and ending points of the sections, prior to the installation of the rumble strips, then theEngineer reviews and approves the locations. Also Rumble strips should not be installed onbridge decks, in acceleration and deceleration lanes, at drainage structures, at loop detector sawcut locations, or in other areas identified by the Engineer. So all this work depends on human andalso time taken which needs modification in this area. .This article provides an overview on what aspects should be concentrated on, while constructinga

road rumble strips and gives an idea on design and different working stages of marking theroad. Researchers are being done on the development of the robotic vehicles and the buddingstudents who are interested in this stream; this provides an added advantage to gain betterknowledge, which would open opportunities in building up much advanced version of thisvehicle. As we all know, to make an advanced version it is very important to anyone, onunderstanding the various current advancements in it and having a grip on these basic aspects.

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