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Automated Vehicular System Using Driverless Car

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Abstract— The traffic accident is occurring due to the driver error. Most of the accident is occur due to the cell phone, in car entertainment system and more traffic. In existing, car is used for public transportation but increased traffic and accident. In proposed, the driverless car also used for public transportation. The driverless car equipped with micro-computer system. It contains the map. The map and GPS system is used for public transportation. This Driverless vehicular system is improve safety and decrease traffic. It also decreases the pollution because of reduce the traffic.

Keywords: *GPS, Microcomputer, Map, vehicle.*

I. Introduction

Generally when we are the driver error is the most common cause of traffic accidents. Due to the cell phones, car entertainment system, traffic and complicated road systems are bigger problem for accident. The Line shadow car, for example, has been used in automatic production line for years. The 2005 DARPA Grand provocation and the 2007 DARPA urban provocation are two excellent driverless cars of the recent affair.

The former was definitely unpopulated west adventure, where the road tests for driverless licence in metropolis. Motivated by these models, we started this research. Although the level of technology and the scale of budget between the DARPA provocation and our model is considerable for both receive the GPS signal from the satellites and model is certainly a cost effective trial for the beginner.

The following can be seen, Speed of the car, the car status, When the last data was received. The project proposed here aims to design a system that will run the car autonomously without any human operates and also to provide alert messages during a crisis situation. In this paper, the propose approach for effectively designing user friendly driverless car control system. The application of driverless car control system is especially target at preventing accidents. The care accident is occurs due to the car to car collisions, over speeding problem, unmanned road crossing incidents etc.

The LPC11C14 are ARM cortex-M0 based microcontrollers for embedded applications. The embedded applications are high integration, low cost and low power consumption. The car unit has an on board GPS module. The car control system will send its present GPS location information repeatedly to the car server. By using SONAR, we can detect the obstacles and can reduce the severity of accidents. Metal detector sensor detects device by sensing the variations in the magnetic field around obstacles. Digital MEMS magnetometer is used for detect the magnetic field.

The mp3 audio files are stored in an external Micro SD memory card and an MP3 Decoder chip is used to play it in speaker for route the driverless car. The FAT-32 file system is used access the memory card file for microcontroller.

The robot unit is built with a four wheel driving mechanism using DC Motors driven. Motor Driver circuit is a DC motor driven. A trailer is also included to make it look like car. A high energy battery is used to provide the power. The power is given to all the units including the robot wheel motors. For this project we used three protocols such as I^2C (Inter Integrated Circuit), SPI (Serial Peripheral Interface), and UART (Universal Asynchronous Receiver Transmitter).

II. Architecture

As an alternative, we selected a suitable robotic vehicle. Basically, any kind of robotic vehicle which can move forward/backward and left/right powered electrically is candidate. Ultimately, we bought a child-suitable car having a maximal speed up to 2m/s on a flat playground and a maximal turning angle of the front wheel throughout 55^o.

The abilities of moving agilely and positioning precisely are two main objectives of a guide the driverless car system. Most of the efforts have been focused on electronic and electrical issues.

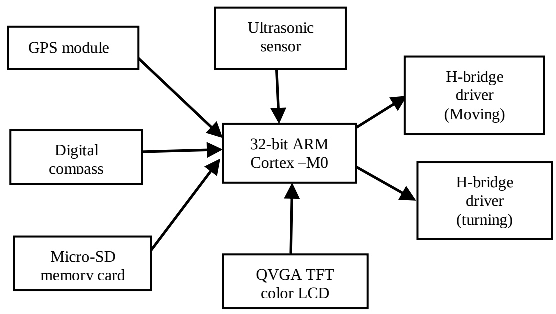


Fig.1.block diagram of a guidance system

III. Subsystem

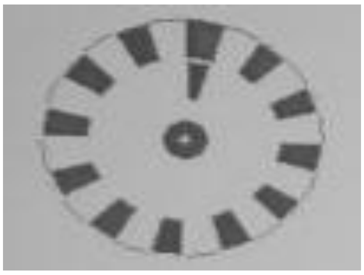
A. Driving the dc motor

Since the robotic vehicle already has two small dc motors respectively for moving and turning, we only need to change the drivers of the motors. The H-bridge seems to be the most popular approach for driving a dc motor. With actual PWM signals added to the inputs of the H-bridge driver, it is easy to implement speed- and direction- control on a dc motor. We choose L293D as the driver IC used thermal shutdown, short current protection, and four modes of operation (forward/reverse/short brake and stop).

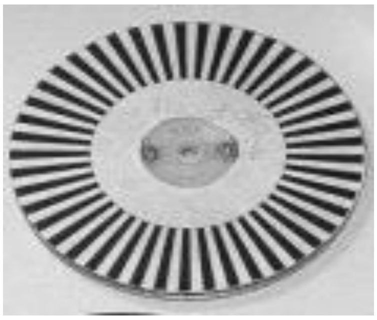
B. Sensing the movements of car

There is no sensor on the toy car to detect the speed of car, so we modify the duty cycle of PWM signal to execute the speed control. Basically, this advance worked well when the car dispatch a flat surface. But, hardly, the car stuck at some undetectable obstacles (such as small stones). Under this cause, same equipped with ultra-sonic sensor, the system can do nothing but stuck there (the MCU does not know anything about that). Fortunately, a reflective photo interrupter can overcome the awkward situation. By an appropriate arrangement adjacent the rear wheel, the reflective photo interrupter will output “on” whenever it is right over the reflective sticker, under other condition it outputs “off”.

Normally, when the car kept moving, the MCU will receive the constant on/off signal from the photo interrupter. On the contrary, once the on/off signal stopped, meaning that the car was fast, the MCU will improve the duty cycle of PWM signal to raise the output power of the motor. Usually, this is useful approach for escaping the direction. Fig. 2 shows the concept of homemade optical rotary sensor. Absolutely, the frequency of on/off signal is approximately proportional to the speed of the car. So, the MCU can make a rough measurement of speed with this signal.



(a)



(b)

Fig.2. Homemade optical rotary encoder. (a) The reflective sticker on the wheel. (b) The reflective photo interrupter nearby the wheel

Using the same type of photo interrupter and problem, with appropriate order near the front wheel (see Fig. 3), the car can make a null adjustment of forward direction before go strait.

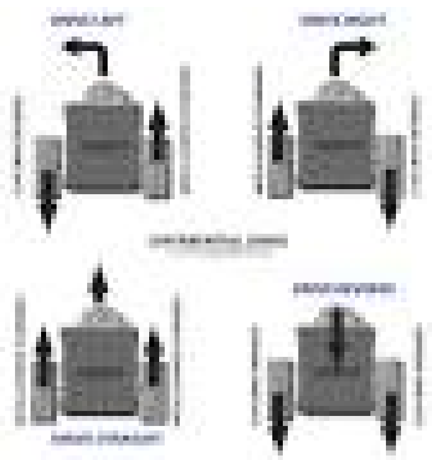


Fig.3 wheel adjustment

C. Guiding the car

The GPS receiver definitely plays the most important role in the guidance system. The GARMIN 15-H module is used in receives (updates) the GPS signal from the satellites. The information of the GPS signal will be removed by the module, and re-transmitted to the MCU through the serial port (RS232) once every second. Theoretically, the MCU can derive the area (and direction) between driverless car and end point through a series of computation value based on the GPS data. According to the result of computation value, the MCU could make a target for "where to go". In practice, however, there would be problematic to guide the car with the GPS data alone. Just imagine the following scenario: you are driving with eyes closed, and the passenger reports you "the target is in the South-East direction, 100 meters away from here". How can you make the correct result for turning left or right if you do not know the direction in front? Prosperously a small semiconductor sensor can tell you the exact direction in front of the car. The LSM303DLH Compass device was used in the case and could find the Earth's magnetic field and thereby output the angle from North. Fig.4 shows the concept of operation of the Compass device, in which the x axis of the Compass device indicates the long axis of the car body.

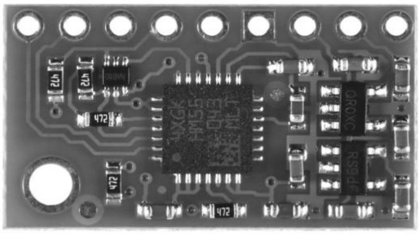


Fig. 4.the operation of LSM303DLH

Obviously, it will be much easier to guide when the system combined GPS receiver with Compass device; the concept of the guidance is shown in Fig. 4 Consider the driverless car is at the origin, the angle ϕ (derived from GPS data) from North is 50°, and the angle Θ (derived from Compass data) from North is 320°(clockwise). Instantly, there is no doubt that the driverless car should make a 90° right turn for the designation. Absolutely, it is problem for the driverless car to go straight exactly all the time. Therefore, after the right turn, the management system still need to modify the steering wheel (changing the turning angle of front wheel) frequently before the car appeared at the destination. This is consistent with the actual driving experience.

Notice that the Compass device is delicate to any kind of magnetic field. Not only the Earth's magnetic field, but also the stable magnet inside the dc motor will affect the sensor. Since there are two dc motors respectively the near front and rear wheels. Testing experiences illustrate a minimum distance of 30 cm between the Compass Module must be kept the motor(s) is need; or, the sensor will lose the accuracy.

D. Obstacle avoidance

It is a single transducer ultrasonic rangefinder. It features of both I2C and a Serial interfaces. A standard TTL level UART format at 9600 baud, start, stop and no parity bits, and may be connected directly to serial ports on any microcontroller used for serial interfaces. It may be connected together on a single bus, either I2C or Serial. New commands in the SRF02 include the ability to send an ultrasonic burst on its own without receiving the cycle, and the ability to perform receiving the cycle without the previous burst. This has been as desired feature on our sonar's and the SRF02 is the first to see its implementation. Because, it uses a single transducer for both transmission and reception. Dual transducer rangers are higher than minimum ranges. It used to minimum measurement range is around 15cm (6 inches). Like all our rangefinders, the SRF02 can measure in µs, cm or inches. The driverless car can avoid the detectable obstacle during the process of guidance.

Fig.5. Different cases of obstacle

E. QVGA TFT Color LCD

ILI9325 is a 262,144-color one-chip SOC driver for a-TFT liquid crystal display with resolution of 240RGBx320dots, contain a 720-channel source driver, a 320-channel gate driver, 172,800 bytes RAM for graphic data of 240RGBx320 dots, and power supply circuit. ILI9325 has four kinds of system interfaces which are i80-system MPU interface (8-/9-/16-/18-bit bus width), VSYNC interface (system interface + VSYNC, internal clock, DB[17:0]), serial data transfer interface (SPI) and RGB 6-/16-/18-bit interface (DOTCLK, VSYNC, HSYNC, ENABLE, DB[17:0]).

In RGB interface and VSYNC interface mode, the merging technique use of high-speed RAM write function and widow address function enables to display a moving picture at an area described by a user and still pictures in other areas on the screen simultaneously, which makes it desirable to transfer display the refresh data only to minimize data transfers and power consumption. ILI9325 can work with 1.65V I/O interface voltage, and an incorporated voltage follower circuit to generate voltage levels for driving an LCD. The ILI9325 also guided the operation to display in 8 colors and a sleep mode, allowing for precise power control by software and these appearance make the ILI9325 an ideal LCD driver for medium or small size portable products such as digital cellular phones, smart phone, PDA and PMP where long battery life is a major concern.

F. Touch Screen Controller

The ADS7843 is a 12-bit sampling ADC with a synchronous serial interface and driving touch screens is low on resistance switches. Typical power dissipation is 750µW at a 125 kHz throughput rate and a +2.7V supply. The reference voltage (VREF) can be separated between 1V and +VCC, providing a corresponding input voltage range of 0V to VREF. The device is consisting of a shutdown mode which reduces typical power dissipation to under 0.5µW. The ADS7843 is described down to 2.7V operation. Low power, high speed, and onboard switches make the ADS7843 ideal for battery-operated systems such as personal digital associated with resistive touch screens and other portable equipment. The ADS7843 is available in an SSOP-16 package and is specified over the –40°C to +85°C temperature range.

G. Micro-SD Memory card

The mp3 audio files are stored in an external 2-GB Micro-SD memory card and MP3 Decoder chip is used to play it in speaker. The microcontroller is able to activate the files in memory card via a FAT-32 system library. The position info is constantly checked with the pre-recorded route map in the memory card and the vehicle path is adjusted accordingly.

IV. WORKING AND RESULT ANALYSIS

The vehicle is equipped with a micro-computer system that contains a map of the area in which the vehicle works. Passengers go to a stop and push a button to call the elevator. When the vehicle enters, passengers get in and touch their end point on screen. Using the on-board computer and map the vehicle takes the passengers where they want to go. The autopilot consists of a GPS guidance system controlled by 32-bit ARM cortex-M0 MCU, in which operations such as GPS guiding, obstacle avoidance and motion control are integrated.

Fig.6 working method

A. Photo & Specifications

It is a 2-layor PCB with a size of 11cm x 5cm. The circuit comprises MCU, two H-bridge dc motor drivers, EIA-232 driver for GPS receiver, 12V-5V DC regulator IC, two add-on sockets for Compass device and wireless transceiver. The PCB is powered by the DC 12V battery of the robotic vehicle.

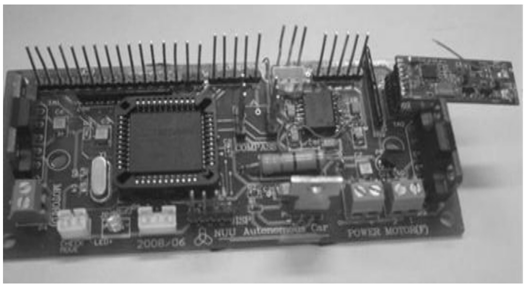


Fig.7 the PCB of the guidance system

The front view of the robotic vehicle. The arrows indicate the ultra-sonic sensors fixed on the “bumper” beneath the headlights.

Fig.8 Front view of the robotic vehicle and ultrasonic sensors

The SRF05 ultra-sonic device. It start amount of distance with a trigger pulse (duration > 10us) generated by the MCU. The echo signal is proportional to the gap of the obstacle in front. The SRF05 can be triggered every 50ms, or 20 times each second. In this case, the MCU triggers the module at a rate of 10Hz. It also needs a DC 5V power.

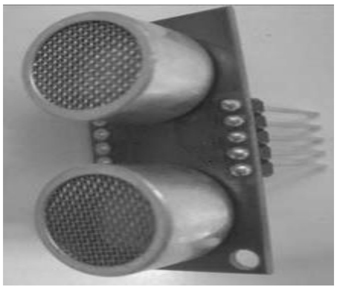


Fig .9 SRF05 (ultrasonic sensor)

The GPS receiver and attached antenna. The size of receiver module is around 4.5cm x 3.5cm. It is supported by EIA 232 interface to convey with the MCU, and it can be powered by DC 8~40V (12V in this case).

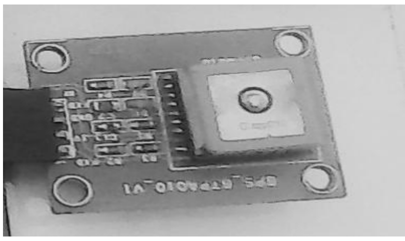


Fig .10 The GPS receiver

The Micro-SD Memory card(2GB). The position info is continuously check with the pre-recorded map in the memory card.

Fig.11 Micro-SD Memory card

CONCLUSIONS

This project is used GPS data to monitor cars and offer real time information about location of car to users. All cars including the major cars will be monitored by a navigation system which will be satellite based. At present the information of the running cars are monitored with the help of manual monitoring which is not accurate but with the help of this project the movement and direction of the cars can be recorded, which will also include the exact location and speed in real time basis. Passengers may also be available to see real time locations, as server has integrated the GPS application with Google maps. INSAT-3C satellite will aid in location of moving cars. The GPS system can give an accuracy of about 10 meters, with a lag of about 2 minutes.

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