Design of Smart Vehicle Control System based on LPC2148,Arduino and RTOS

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Abstract -*This paper utilizes LPC2148 of ARM 7 as the core controller in the smart vehicle to accomplish an ongoing operation framework (OS) RTOS. This controller acts as the control framework to work the whole vehicle. The constant RTOS upgrades the execution of control and disentangles the configuration and administration of programming. What's more, this framework utilizes voice-driven standard, enhancing the human communication in the middle of machines and administrators. The use of high-exactness of ultrasonic sensors on snag evasion robot gives a surety to security. Furthermore, the utilization of LCD as the machine interface encourages the troubleshooting and control of robot.*

Key Words: Embedded; LPC2148; FreeRTOS; Smart Vehicle; Arduino Uno.

1.INTRODUCTION

ARM microcontroller is rich in assets, which has great adaptability . Its primary leeway is elite, ease and control utilization. It is a 32-bit processor which is incorporated 16-bit Thumb direction set which permits the substitution of the processor by the 51series, for example, the utilization of both 32-bit processor speed. ARM-based installed framework has great execution and compactness, along these lines; it has been generally utilized as a part of different commercial enterprises. The ARM microchip is additionally utilized as a part of the control framework for shrewd vehicle. It is a superior decision because of the money saving advantage investigation. Porting on ARM RTOS working framework, it further improves the frameworks' constant control execution and security. Furthermore, it facilitates the outline of the useful

modules and in addition the expansion of its applications

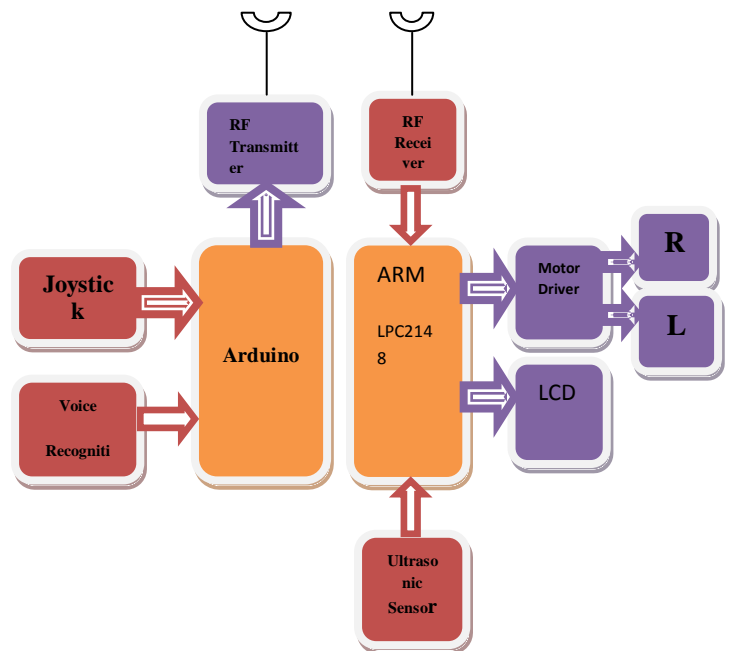## 1.1 HARDWARE DESIGN OF THE CONTROL SYSTEM IN SMART VEHICLE

Fig -1: Block Diagram of System.

1.1. Control module

The control arrangement of miniaturized scale controller uses LPC2148. It is in charge of LCD show, RF receiver ,motor Driver,ultrasonic signs if there should be an occurrence of weakened procurement and DC engine PWM speed control signals, ultrasonic signs begin to send, to accomplish the practical modules worldwide coordination and control. Arduino on RF Transmitter side is incharge of Joystick,Voice recognition module

1.2.LCD module

The control framework utilizes 16*2 Character LCD. Built- in 5 x 8 dots with cursor

• Controller (KS 0066 or Equivalent)

• + 5V control supply (Also accessible for + 3V)

• 1/16 duty cycle

• B/L to be driven by pin 1, pin 2 or pin 15, pin 16 or A.K (LED)

• N.V. discretionary for + 3V control supply.

Features include basic geometry rendering, window manager, icons, menus, drop- down menu, English text display, the color conversion. Friendly interface can make the hardware and software debugging more concise, easier to control.

1.3. Voice recognition and playback module

Voice Recognition Module is a compact and easy-control speaking recognition board. This product is a speaker-dependent voice recognition module. It supports up to 80 voice commands in all. Max 7 voice commands could work at the same time. Any sound could be trained as command. Users need to train the module first before let it recognizing any voice command. This board has 2 controlling ways: Serial Port (full function), General Input Pins (part of function). General Output Pins on the board could generate several kinds of waves while corresponding voice command was recognized.
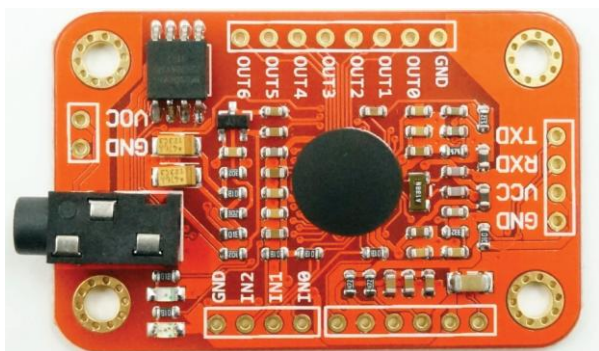

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Fig -2 Voice recognition Module V3

1.4. Ultrasonic obstacle avoidance module

Ultrasonic ranging module HC - SR04 gives 2cm - 400cm non-contact estimation work, the running precision can reach to 3mm. The modules incorporates ultrasonic transmitters, beneficiary and control circuit. The fundamental rule of work is Using IO trigger for no less than 10us abnormal state signal. The Module naturally sends eight 40 kHz and recognize whether there is a heartbeat signal back. IF the sign back, through abnormal state, time of high yield IO length of time is the time from sending ultrasonic to returning. Test separation = (abnormal state time×velocity of sound (340M/S)/2 .

Fig -3 Ultrasonic Obstacle Avoidance Sensor.

1.5. Joystick control module

It is fundamentally comprised by the multi-hub controller, joystick, hand brake switch, shift catch, handle, and wires. It's driving the auto moves, for example, forward, backward, turn left, transform right and stop into a relating electrical sign through the ARM I/O port info. ARM gets a control order, calling the proper capacity. The PWM controls the sign, so as to accomplish the auto's engine drive control.

1.6. DC motor driver module

The L293D are quadruple high-momentum half-H drivers. The L293 is intended to give bidirectional drive streams of up to 1 A at voltages from 4.5 V to 36 V. The L293D is intended to give bidirectional drive streams of up to 600-mA at voltages from 4.5 V to 36 V. Both gadgets are intended to drive inductive loads, for example, transfers, solenoids, dc and bipolar going engines, and in addition other high-current/high-voltage loads in positive-supply applications. It utilizes ARM chip PWM beat width modulator to drive DC engine, by changing the obligation cycle of the PWM sign to the DC engine speed controller. Through the H-span circuit to the engine switching control, the particular DC engine

power drive circuit is appeared in Figure 3.DC engine drive circuit so that the DC engine will work with the ARM inserted framework control supply to confine the work to enhance the ARM control framework unwavering quality and steadiness
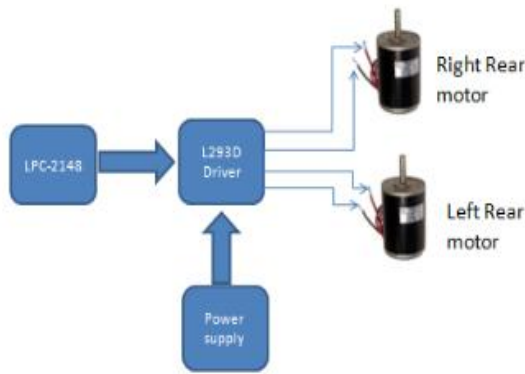

Fig -4 Motor Driver Circuit.

1.7. RF Transmitter and Receiver module.

The 434MHz Transmitter is an ASK Hybrid transmitter module. It uses saw resonator for frequency stability. The receiver is an ASK super heterodyne receiver with PLL synthesizer and crystal oscillator, with an effective low cost, small size, and simple-to-use for designing.

The ST-RX02-ASK is an ASK Hybrid receiver module. A effective low cost solution for using at 315/433.92 MHZ. The circuit shape of ST-RX02-ASK is L/C.

Receiver Frequency: 315 / 433.92 MHZ.

Typical sensitivity: -105dBm.

Supply Current: 3.5mA.

IF Frequency: 1MHz.

2. SOFTWARE DESIGN OF THE CONTROL SYSTEM

RTOS is a finished, convenient, can be cured and Spreaded cut preemptive constant multitasking kernel. Features include: source code, portability, can cured, can be cut, openness hardship, multi-tasking nature, can oversee up to 64 undertakings, works and benefits, call deterministic execution time, every assignment has its own particular stack, giving an assortment of framework administrations, interfere with administration, support up to 255 layers of intrude on settling. RTOS is transplanted

to the comparing microchip. The client application is running on the different assignments on RTOS .According to the framework outline prerequisites; the application incorporates a sum of seven errands.

(1) Initialization tasks (void task0 (void * pdata)): the taskpriority is 0, the highest priority.
(2) Scanning task (void tk_Scan (void * pdata)): the task priority of 16, its priority is higher than the system idle task only.
(3) LCM display tasks (void tk_LCM (void * pdata)): the task priority is set to 4, a high level, mainly to complete the system status information and display of debug information.
(4) The left motor speed control task (void tk_Mot_L (void * pdata)): Task Priority 5, activated by the scanning task.
(5) The right motor speed control task (void tk_Mot_R (void * pdata)): Task Priority 6, activated by the scanning task.
(6) PWM control task (void tk_PWM (void * pdata)): the task priority of 7, the main function of the PWM output waveform is set to adjust in order to achieve so the motor speed control.
(7) Voice playback tasks (void tk_Sound (void * pdata)): the task priority of 8, activated by the scanning task

3. CONCLUSIONS

The smart vehicle control framework utilizes voice control and LCD show, making the auto easier to understand man-machine communication. The vehicle control framework additionally includes a high precision ultrasonic obstacle avoidance module to enhance the security of the smart auto driving. Including an intense LPC2148ARM RTOS installed microcontroller and real-time working framework for keen auto control framework equipment and programming secluded outline, the whole framework is helpful for the further updating and upgrades to improve the effectiveness of the framework plan. This framework can be utilized as the bearer of the versatile robot, after development of the innovation and can be connected to get control frameworks, private watch, site

examination, smart toys, and different ranges, market prospects, has extraordinary financial advantages

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