Smart Vehicle Control System based on ARM 7 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: RTOS, Smart Vehicle Control System

I. INTRODUCTION

ARM microcontroller is rich in assets, which has great adaptability [1]. 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 [2]. ARM-based installed framework has great execution and compactness, along these lines; it has been generally utilized as a part of different commercial enterprises [3, 4]. 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

II. HARDWARE DESIGN OF THE CONTROL SYSTEM IN SMART VEHICLE

A. Control Module

The control arrangement of miniaturized scale controller uses LPC2148. It is in charge of voice command signal, voice playback of encoded signs, LCD show, joystick control flag, the remote control signals, 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.

B. 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 [5].

Fig. 1: 16*2 Characters LCD

C. Voice Recognition and Playback Module

It is the heart of the entire system. HM2007 is a voice recognition chip with on-chip analog front end, voice analysis, recognition process and system control functions. The input voice command is analyzed, processed, recognized and then obtained at one of its output port which is then decoded , amplified and given to motors of robot car. Speech recognition and identification training phase is divided into phases: training phase of the task is to establish the basic unit of recognition acoustic model. Identification stage is to analyze the use of speech analysis speech feature parameters, according to certain criteria and measure compared with the system model, the recognition results obtained by the judge. The voice recognition module in the system is limited mainly to the five voice commands (forward, stop, backward, turn left, turn right order) to identify the judge, and the command signal is encoded by the I/O port to send to the main chip, the master chip signal processing for the command, call the appropriate subroutine to make the appropriate action to respond. Voice playback chip integrates voice signal amplification, filtering, sampling, A/D conversion module.

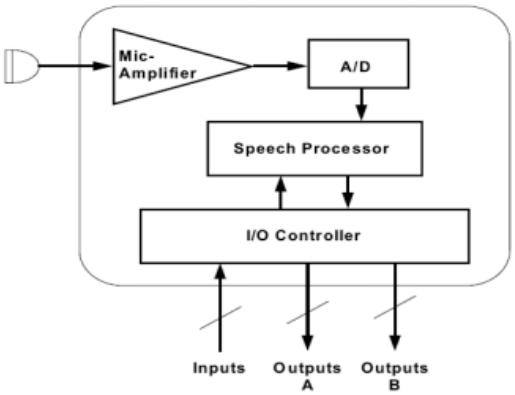

Fig. 2: Voice Playback Chip

D. 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. Since a Ultrasonic Ranging Module HC - SR04 as appeared in figure 2 have a substantial, poor course, the separation from the objective can just get data yet can't give exact data on the objective range.

Fig. 2: Ultrasonic Ranging Module HC - SR04

E. 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. [6].

F. 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.

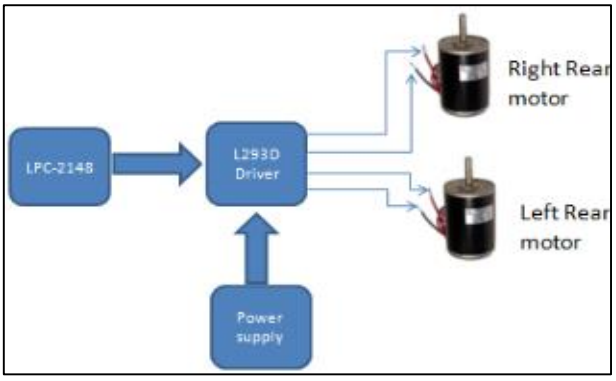

Fig. 3: Driver Module of the Motor.

III. SOFTWARE DESIGN OF THE CONTROL SYSTEM

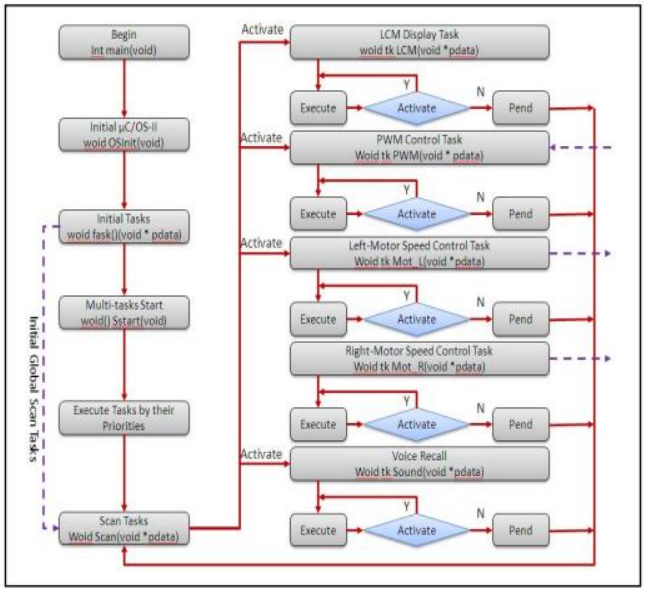

Fig. 4: The Software Flow Chart of the Smart Vehicle Control System

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. The framework program structure outline is appeared in Figure 4

*A. Initialization tasks (void task0 (void * pdata)):*

The task priority is 0, the highest priority.

*B. Scanning task (void tk_Scan (void * pdata)):*

The task priority of 16, its priority is higher than the system idle task only.

*C. 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.

*D. The left motor speed control task (void tk_Mot_L (void * pdata)):*

Task Priority 5, activated by the scanning task.

*E. The right motor speed control task (void tk_Mot_R (void * pdata)):*

Task Priority 6, activated by the scanning task.

*F. 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.

*G. Voice playback tasks (void tk_Sound (void * pdata)):*

The task priority of 8, activated by the scanning task.

IV. RESULT

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 tso get to control frameworks, private watch, site examination, smart toys, and different ranges, market prospects, has extraordinary financial advantages. Physicall Setup of Project is shown in Fig 5.

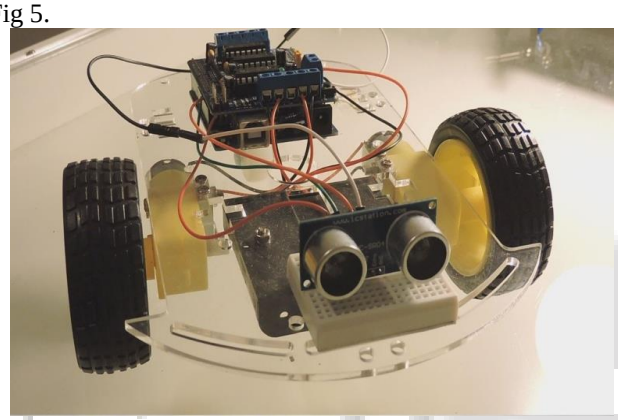

Fig. 5: Setup of Robot.

REFERENCES

[1] S. Chen, B. Mulgrew, and P. M. Grant, ―A clustering technique for digital communications channel equalization using radial basis function networks,‖ IEEE Trans. on Neural Networks, vol. 4, pp. 570-578, July 1993.
[2] J. U. Duncombe, ―Infrared navigation—Part I: An assessment of feasibility,‖ IEEE Trans. Electron Devices, vol. ED-11, pp. 34-39, Jan.1959.
[3] C. Y. Lin, M. Wu, J. A. Bloom, I. J. Cox, and M. Miller, ―Rotation, scale, and translation resilient public watermarking for images,‖ IEEE Trans. Image Process., vol. 10, no. 5, pp. 767-782, May 2001.
[4] A. Cichocki and R. Unbehaven, Neural Networks for Optimization and Signal Processing, 1st ed. Chichester, U.K.: Wiley, 1993, ch. 2, pp. 45-47.
[5] W.-K. Chen, Linear Networks and Systems, Belmont, CA: Wadsworth, 1993, pp. 123-135.
[6] H. Poor, An Introduction to Signal Detection and Estimation; New York: Springer-Verlag, 1985, ch. 4.

