

Implementation of RTOS on Embedded Linux using Ultrasonic Sensors for Wi-Fi Robot

S.Preethi

**M.Tech, Embedded Systems (ES),
Aurora Technological and Research Institute, Telangana, India.**

Abstract:

A robot is a virtual or mechanical artificial agent. In practice it is usually an electro-mechanical machine, which is guided by computer or electronic programming and is thus able to do tasks. Robots are outfitted with wide reaches and slim arms, steady repeatability and precise tooling-all, of which allows them to be extremely accurate. This high precision capability makes them a good match for pick and place application. Controlling robots wirelessly is very helpful for a wide range of applications ranging from industrial to medical fields. The aim of this project is to develop a robot which should be controlled by an authorized person at any time and from any place using the web technology. Here, the ultrasonic sensor module functions to receive input data, which is a result of detection of obstacle. Based on ultrasonic sensor data, the controller automatically predicts the path for robot to move. In this system, we are using four ultrasonic sensors for four directions of the robot. The status of movement of the robot can be monitored from the remote PC/smart phone through Wi-Fi.

Keywords:

Robot, Ultrasonic sensor, Metal detector, Dc motor.

I. INTRODUCTION:

Earlier we use human power for defusing the bomb and changing the cadmium rods in atomic power plant, which is very dangerous for human life and leads to the human hazard because developed suit for preventing the radiation of radioactive substances are not powerful and not prevent more than an hour. This leads to the less work efficiency and increases the risks. For avoiding this types of problem in the nuclear power plant, the additional features of this project is that the robot is controlled by web server . If the technician is not present in the power plant then no need to worry he can access the robot from his home or anywhere in the world which saves the travel expenses and time.

We use our robot to detect the bomb. Our robot consists of DC geared motor which helps in smooth moving of robot and provides proper control on the robot movement. This project is developed for the helping of humans and reducing the risks of their lives. For working of this project internet connection is needed and a server pc must be run on the host side to which client can access for anywhere in the world. He should only enter the IP address of the host and pass through the authentication process and then he can control the robot.

II. HARDWARE IMPLEMENTATION:

The hardware implementation of the proposed robot system consists of ARM controller, DC motor, Ultrasonic sensor, Metal detector and remote PC for monitoring the data as shown in the figure 1.

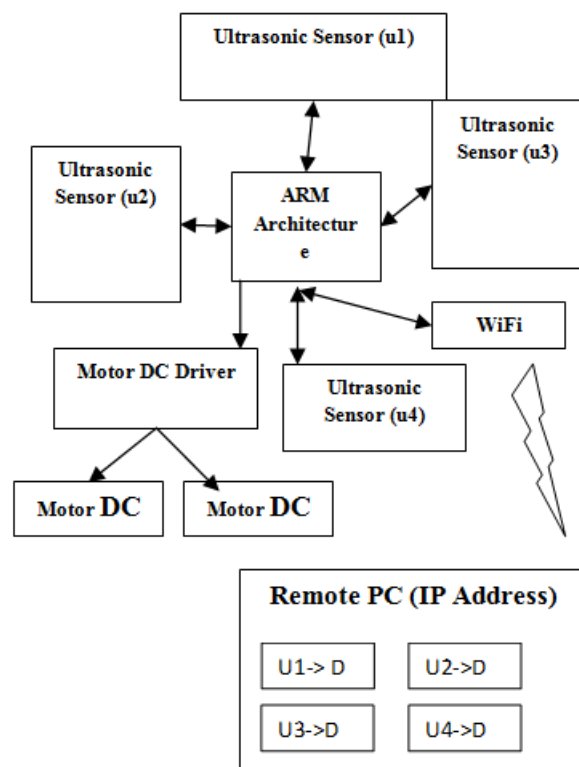


Fig1: Block Diagram

A. IMPLEMENTATION OF SENSOR SYSTEMS:

The proposed system uses various sensors to detect the obstacles. The sensors are placed in the robot moving in all the directions to convert the physical quantities like radiations from the body, temperature etc which are the basis for detecting the objects into the signals that are easily read or interpreted by remote observer or rescue team. Different types of sensors used in the proposed system are:

a. Ultrasonic Sensor:

Ultrasonic distance sensors consist of 3 major parts: A transmitter, a receiver and a timer. To measure a distance the timer triggers the transmitter which emits a series of pulses, and then the timer waits until the receiver detects the reflection of the pulses and stops the timer. The time measured is then divided by 2 and multiplied with the speed of sound. The result is the distance between the sensor and the object in front of it. The transmitter sends out a stream of pulses on a carrier frequency. The maximum frequency humans can hear is about 20 KHz. A frequency higher than that is picked to avoid annoying humans with the constant beep -- 40 KHz is a common value.



Figure2: Ultrasonic Sensor .

The receiver triggers when it receives a signal with that particular frequency. This is not necessary the signal the transmitter sent. If more than one ultrasonic sensor with the same carrier frequency are used, they can detect each other's signals.

b. Metal Detector:

Metal detectors are useful for finding metal inclusions hidden within objects. If the sensor comes near a piece of metal this is indicated by a changing tone.

B. ARM Controller: Mini2440 Development Board:

The MINI2440 is an efficient ARM9 development board with a reasonable price, it characterizes simple method and high performance-price ratio. Based on the Samsung S3C2440 microprocessor, it embodies professional stable CPU core power source chip and reset chip to ensure the stability of the system operation. The PCB on the MINI2440 board is designed to be 4- layers board, adopting the ENIG technology and professional equal-length wiring to ensure the completeness of the signals of the key signal wire; and manufactured and released under stringent quality control plans.

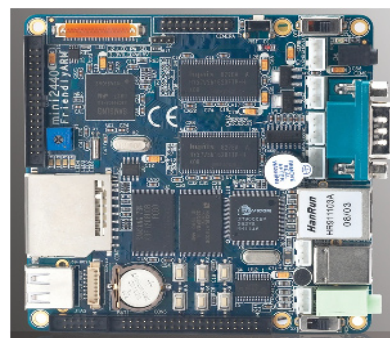


Fig3. Mini2440 Development board

C. L293D Motor Driver:

L293D a dual HBridge motor driver (as shown in figure 4), so with one IC we can interface two DC motors which can be controlled in both clockwise and counter clockwise direction and if you have motor with fix direction of motion. You can make use of all the four I/Os to connect up to four DC motors. L293D has output current of 600mA and peak output current of 1.2A per channel. Moreover for protection of circuit from back EMF output diodes are included.

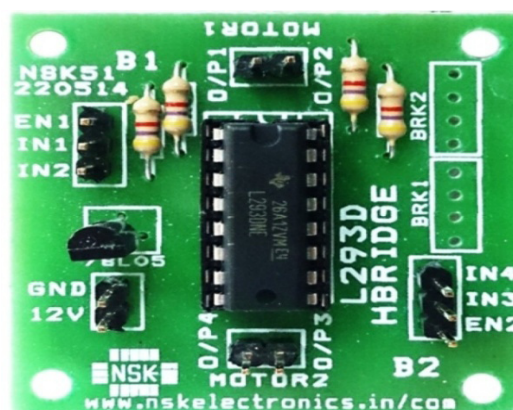


Fig4: L293D H-Bridge motor driver

III. SOFTWARE SPECIFICATIONS AND FRAMEWORK:

Software Specifications:

1. Real Time Operating System.
2. Qt for Embedded Linux.

1. Real-Time Operating System:

RTOS is an operating system which is used to perform a task within a particular time interval i.e. within the specific allocated time. Compared with OS and RTOS supports the multitasking operations and time scheduling tasks. Real-time OS is the level of its consistency concerning the amount of time it takes to accept and complete an application's task. If we are implementing any task without RTOS, it is less accurate since in normal operations systems we perform a task one by one. So we are implementing our project using real time operating system. The multitasking is a process to perform more than one application or task at concurrently, it means it is possible to perform many operations at the same time. So in this project we are implementing RTOS concepts. The main advantage of RTOS is multitasking and time scheduling and rescheduling etc. In RTOS due to the internal minimum time delay of the time scheduling process it will give the output within the specified time.

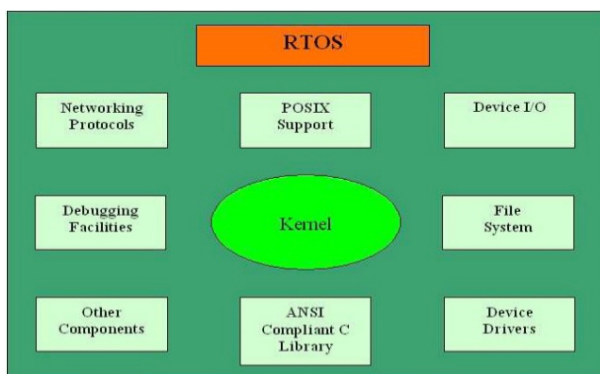


Fig5: RTOS Architecture

2. Qt for Embedded Linux:

Qt for Embedded Linux is a C++ framework for GUI and application development for embedded devices. It runs on a variety of processors, usually with Embedded Linux. Qt for Embedded Linux provides the standard Qt API for embedded devices with a lightweight window system.

IV. RESULTS:



Fig6: Prototype of Robot.

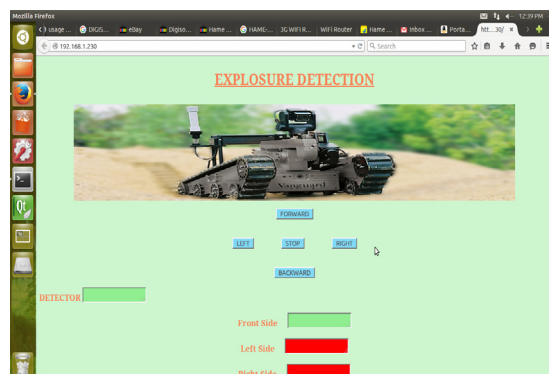


Fig7: Remote monitoring in webpage.

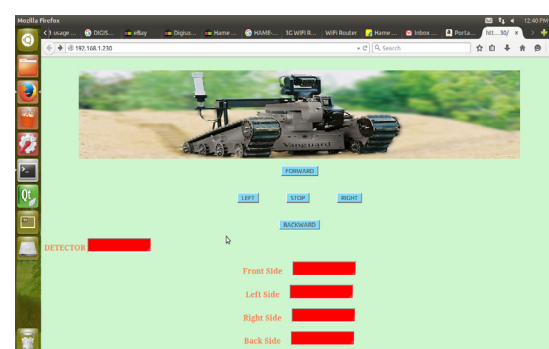


Fig8: Indication of obstacle in webpage.

V. CONCLUSION:

As we all know, these days India is sick off massive terror attacks, bomb explosions at plush resorts. To avoid such disasters technological power must exceed human power. The robot can be used in war field, mines, power station, military operations, industries, research and educational institutions and so on. And also be used wherever people cannot go or where things doing too dangerous for humans to do safely.

An obstacle present in the field is detected through the Ultrasonic sensor similarly the Metal detector sensor detects the presence of bomb. The above two sensed parameters were sent to the server and monitored in the webpage.

VI. REFERENCES:

- [1]. Abinav Kumar Singh et al, "RF Controlled Terrorist Fighting Robot". IJCSC, Vol 1, No. 1, Jan – Jun 2010, pages 109 – 112.
- [2]. Adafruit Industries, "PIR Motion Sensor tutorial". Reference, <http://www.instructables.com/id/PIR-Motion-Sensor-Tutorial/>.
- [3]. Krishna Nanda Gupta et al, "Motor Driver L293D, IC L293 and its avr interface v1.0".
- [4]. NSK Electronics, "L293D Motor Drive". Reference, "http://www.nskelectronics.in/index.php?route=product/product&product_id=144".
- [5]. Praveen, "Infrared Transmitter and Receiver module". Reference, "https://commons.wikimedia.org/wiki/File:Infrared_Transceiver_Circuit.jpg".
- [6]. R. Sharma et al, "DTMF Based Remote Control system" IEEE International Conference ICIT 2006, pp. 2380-2383, December 2006.
- [7]. Rajeev et al, "An Embedded Autonomous Robotic System for Alive Human Body Detection and Rescue Operation". International Journal of Scientific and Research Publications, Volume 4, Issue 5, May 2014. ISSN 2250-3153.
- [8]. Ruffaida Shamroukh, Fahed Awad "Detection of surviving humans in destructed environments using a simulated autonomous robot" IEEE Transaction, March 24-26, 2009.
- [9]. Steve Furber, "ARM System-on-chip Architecture-2nd edition".
- [10]. Wikipedia, uploaded by Mysid, https://en.wikipedia.org/wiki/Dual-tone_multi-frequency_signaling.

Authors Profile:

1. Mr. N. Pradeep Kumar Goud has completed M.Tech (ES). He is currently working as Assistant Professor at Aurora's Technological and Research Institute, Telangana, India.

2. S. Preethi, M.Tech Embedded Systems, Aurora's Technological and Research Institute, Telangana India.