

Design and Development of ARM Based Remote Control Car Unit for Search Missions

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Abstract

This project work is focused on the remote control car which is widely used in search missions such as in the occurrence of natural disasters and calamities. This system is developed using ARM 7 (LPC2148) microcontroller to detect the obstacles and the live bodies that are caught beneath the natural disaster without any harm to human beings.

This car module is made up of a commercially available remote car chassis and controlling of the motor is performed using motor control unit (L293D). An exclusively developed Android application is adopted for controlling the car with Bluetooth as the platform. Also the UV sensor is integrated in the system to sense the obstacles and the objects. The Wi-Fi camera is erected for monitoring of real-time situations.

1. Introduction

In this modern world due to the unevenness causing in the climatic conditions the occurrence of the natural and disasters like the earth quakes, flood, tsunami, hurricanes etc., is becoming a huge problem which causes a great damage to the humanity in terms of property and the living beings. In such situations use of heavy cranes and heavy machinery for the rescue may result harming the living beings and property beneath the collapsed buildings.

Hence we have to use light weight alternatives like dogs or some robot cars for the rescue operations. Dogs can be able to identify the existence of the bodies, however it's difficult to know about their situation whether they are alive or dead and only remote cars can be able to send the information regarding the situation. So a continuous search is necessary to build a finest robot which gives us an exact picture of the situation and having the capability of controlling from far distances. It also finds its application in the search missions of police and military such as bomb detection, tracing enemies, etc.

Now-a-days as the mobile usage has become a part of human's life such as an essential commodity, and the availability of mobile is huge so the project designed with the basis of the mobile platform will fetch a better scope for the usage of the car. Most of the cell phones, approximately 75% are using Android as an operation system. Hence car module is designed using the Android application having more advantages.

This project work presents a design of an ARM based remote controlled car unit for search missions that is controlled using an Android mobile phone. Further an application is designed for controlling the car having Bluetooth as the communication medium. It also senses the distance, obstacles and the objects present in front of the car using a UV sensor. The module is monitored using a Wi-Fi camera, and the block diagram for the system is shown in Fig.1

The paper is divided as follows: section II presents a

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summary of the application of the project, design of the remote car has been discussed in the section III. Section IV explains the implementation and the experimentation of the car, and section V is all about the conclusion and the future scope.

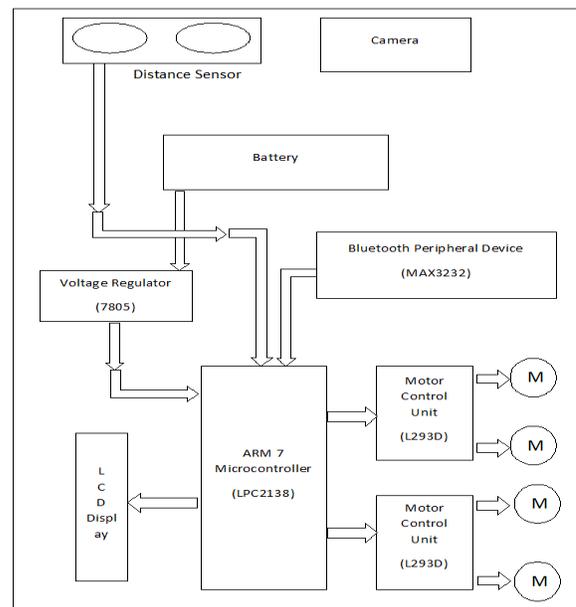


Fig. 1. Block Diagram ARM Based Remote Control Car

2. Application Summary

This kind of projects are widely in usage, but the main aim of this project is to build the research remote car at a low cost, in the previous models they used two microprocessors for the designing of the car, but here the designing of the car had been done using only one ARM microcontroller (LPC2148) integrating both Bluetooth and UV sensor on it, with which the complexity of the circuit is reduced and also the cost of the project got reduced eventually. Apart from that, this project uses the motor control unit (L293D) for the motion control unlike the

earlier in which a separate module had been used for motion control.

This car can also be used in several search missions like bomb detection, in which the human involvement is a risk job, and it also finds its application in police and military search missions.

3. Design of System

In this section the design of the RC car unit using ARM processor and the android custom-made application had been discussed,

A. Design of RC Car

Car is made from the chassis which is commercially available in the market, used four DC motor of 12V, 60 rpm for the motion of the car. Space is provided on the top of the car such that the hardware can be mounted on the surface of it.

In the hardware part of the car includes ARM microcontroller (LPC2148), Motion control unit (L293D), a Bluetooth module, voltage regulator, UV sensor, Wi-Fi Camera, and a battery. All these components are mounted on the top of the car chassis, the view of the car can be seen in Fig.2.

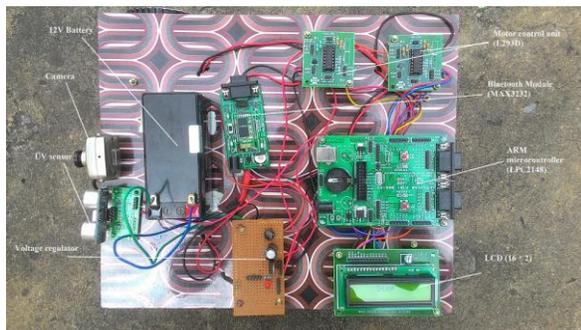


Fig. 2. Top view of the car mentioned with components

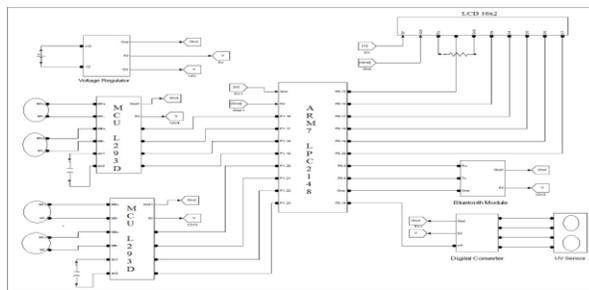


Fig. 3. Schematic of interfacing the ARM controller with Other Components

ARM 7 (LPC2148) consists of 40 pins in which 20 pins are used 2 pins for the supply, 8 pins for interfacing two (L293D), 6 pins for the display, 3 pins for Bluetooth, and 1 pin to interfacing UV sensor. So it said to be the heart of the system. Schematic of interfacing the LPC2148 with the other units are shown in fig.3. Program for working of the car is designed using Kiel software which is loaded to the ARM processor using the COM.0 port.

Motor control unit (L293D) is a chip which is used for controlling the motion of the car, this IC can control two DC motors of 12V, 0.8A rating, this receives the controlling signals from the ARM processor for motor controls. It needs

DC power supply 12V, and 5V. 12V for the motors and 5V for the internal working

A Bluetooth module is mounted on the top of the board which is used for the interfacing of car and smart phone. This requires 5V for its working and it communicates with the smart phone through 2.4 GHz ISM band. It is connected to the ARM controller physically. Initially phone and the Bluetooth module has to be interfaced and then the modules receives the commands sent by the master (transmitter) and this commands is sent to the ARM controller for the functioning of the car.

An ultrasonic distance sensor is mounted on the front part of chassis board, which is used for sensing the obstacles presented in front of the car up to 3meter distance. 5V DC power supply is required for its working. This is connected to the ARM controller. It detects the obstacle that obstructs and sends the information to the ARM controller to stop the car.

A camera (FVGA, 640 * 480) is mounted on the front portion of the car, which provides the front view of the car. it 9V Dc supply separately. Its sends the video of the front portion of the car and sends to the monitoring device. For this purpose we used a TV tuner setup, which helps interfacing the camera with the laptop.

And a voltage regulator is also mounted on the chassis board, as the system requires 12V for the motors and 5V for working of IC's, a battery of 12V is taken and using this voltage regulator 5V has been produced.

B. Custom-made Android Application Design

An application has been designed using the commands that had been loaded in the ARM microcontroller, for the controlling of the car using Bluetooth as medium. This custom-made application has to be installed in the Android smartphone, and then it has to be interfaced to the car using Bluetooth as the medium. This application is provided with the user friendly graphical interface for sending commands to the car. When the user gives the commands, this commands will be sent by Bluetooth transmitter, and then this received by the Bluetooth module on the car, which sends to ARM controller for controlling of the motion.

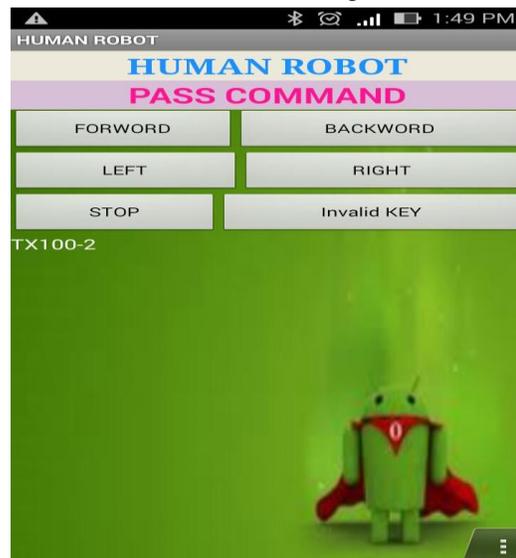


Fig. 4. Snapshot of the Custom-made Android Application

The flowchart to interface smartphone with RC car unit for controlling the motion of the motors can be seen in the fig.5 and the snapshot of the android application is shown in the fig.4

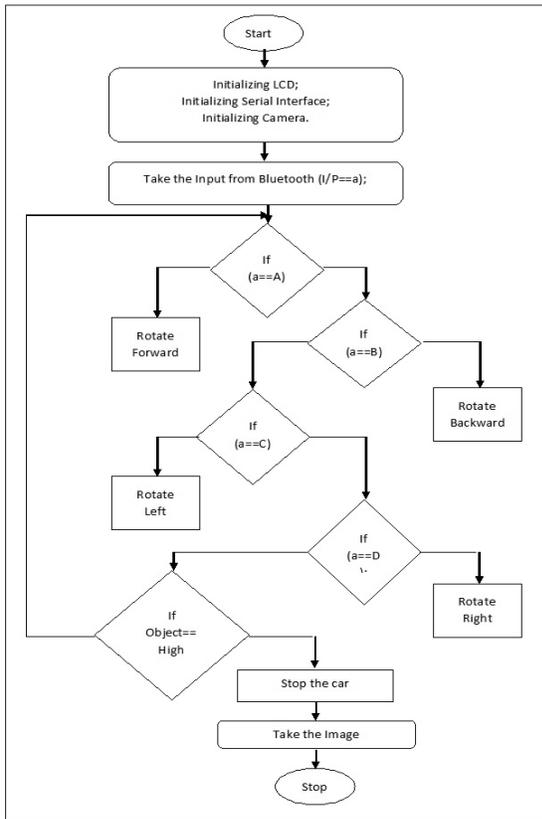


Fig: 5. Flowchart for the interfacing of smart phone with the RC car unit

4. Characterization and Experimentation of System

The Remote Control car unit had been designed which weighs 1.1Kg, and measures 25*12*10 cm3. It runs at maximum speed of 60m/s, and it can carry up to 750gms of extra load if it's necessary. The system is powered by using two batteries 12V and 9V, 12V battery is the main source for the system, 9V is only to power camera. The current consumption from the battery when the car is fully loaded is measured to be 0.8A. The details of the current consumption for the ARM controller has been tabulated and is shown in table.1.

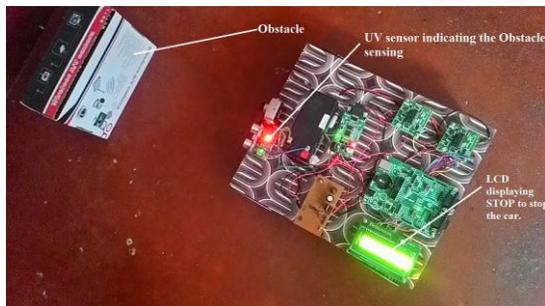


Fig: 6. Working of the Car When an Obstacle is Obstructed

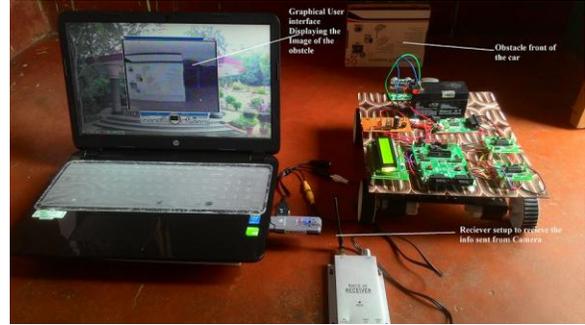


Fig: 7. Snapshot of GUI displaying the info from camera.

Table: 1. Current consumption details of the System

Part (s)	Current (A)
ARM controller	0.05
Motor Control Unit	0.05
Bluetooth module	0.05
Camera	0.1
DC motors	0.5
UV sensor	0.05

The maximum range of Bluetooth communication is 30m, and that of camera is 50m in open space. The system is designed to stop the car when an obstacle is detected 1 meter apart.

5. Conclusion And Future Scope

The Remote Control car unit has been designed and fabricated which can be controlled using an Android device. This system is meant for research missions like occurrence of natural disasters and calamities. The car unit is tiny enough to pass through small passages to search for the survivors whom got struck beneath the rubbles. It costs 7500INR for building of this car which includes the components costs and manufacturing costs. The controlling car is designed using Android device is because of knowing the abundant availability of Android devices like smart phone or tablet. Hence we conclude that the ARM based Remote Control car unit is an economical tool used for the research missions like the occurrence of natural disasters.

In the future we are planning to build using a single Motor control instead of two by replacing the DC motors with the efficient servomotors which consumes less current, to increase the controlling capability to greater distance, and to reduce the size of the car using the compact devices using the advanced ARM controller.

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