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Study of Arduino Controlled Robotic System

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ABSTRACT: The robotics and automation industry are widely used because of its simplicity and ability to change according to our needs. The project is designed to develop a robotic vehicle using Arduino for remote operation for monitoring purpose. The robot can transmit real time information with the help of Arduino board connected to computer or any smart device.

KEYWORDS: Arduino, RF Robot, Robotic Control, Wireless.

I. INTRODUCTION

In the advent growth of new technologies, computer capacity provided realistic opportunity for new robot controls in all aspects in our daily life. This technical improvement requires high performance robots created faster, more accurate and more intelligent robots. In this paper we present a simple Arduino-board based robot that can be driven remotely using an RF remote control. This robot can be built very quickly in a small budget. The RF remote control provides the advantage of a good controlling range (up to 100 metres with proper antennae) besides being omnidirectional.

II. AN ARDUINO CONTROLLED ROBOT

Arduino is a computer hardware and software company. In the world of digital devices and interactive objects that can sense and control the physical world, project and user community designs and manufactures Arduino board controlled robots for many applications. Arduino boards may be purchased preassembled, or as kits, at the same time. The project is based on a family of designs manufactured primarily by Smart Projects in Italy, and also by several other vendors, using various 8-bit or 32-bit Atmel processors. These systems provide sets of digital and analog pins that can be interfaced to various expansion boards (so-called shields) and other circuits. The boards feature serial communications interfaces, including on some models, for loading programs from personal computers. For programming the microcontrollers, the Arduino platform provides an (IDE) based on the project, which includes support for programming languages. The first Arduino was introduced in 2005. The project leaders sought to provide an inexpensive and easy way for novices and professionals to create devices that interact with their environment using and Common examples for beginner hobbyists include simple and motion detectors. As estimated in mid-2011 that over 300,000 official Arduinos had been commercially produced, and in 2013 that 700,000 official boards were in users' hands.

III. ARDUINO PROGRAMMING LANGUAGE

Arduino is an open source electronics prototyping platform that is used by expert to novice programmers. These novice programmers can be anyone from a child to artists. The aim of Arduino is to provide flexible, easy-to-use hardware and software. Arduino users program using the Arduino IDE which is the same as coding in C/C++. The current programming process is purely text based. Each program written is called a sketch. Before being deployed onto the Arduino board the sketch is compiled and converted into a C program.

IV. PROPOSED CIRCUIT DESCRIPTION

The block diagram of the robot is shown in Fig. 1. It has two major sections: (a) transmitter and (b) receiver and motor driver. The transmitter circuit (Fig. 2) is built around encoder IC HT12E (IC1), 433MHz RF transmitter module (TX1) and a few discrete components. The receiver and motor driver circuit (Fig. 3) is built around Arduino UNO board (BOARD1), decoder IC HT12D (IC2), 433MHz RF receiver module (RX1), motor driver IC L293D (IC3), regulator IC 7805 (IC4) and a few discrete components.

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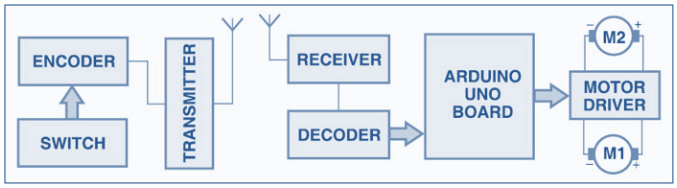

Fig. 1: Block diagram of Arduino-based RF controlled robot

V. ARDUINO BOARD

Arduino Board is an ATmega328 microcontroller. It consists of 14 digital input/output pins, six analogue inputs, ICSP header, microcontroller and operated with 16MHz crystal oscillator. It also consists of a power jack & reset button. The board is very user friendly. To get started the board has to be connected to the computer with USB port. The microcontroller is programmed by Arduino programming language.

Microcontroller	ATmega32u4
Operating Voltage	5V
Input Voltage	5V through flat cable
Digital I/O Pins	5
PWM Channels	6
Analog Input Channels	4 (of the Digital I/O pins)
Analog Input Channels (multiplexed)	8
DC Current per I/O Pin	40 mA
Flash Memory	32 KB (ATmega32u4) of which 4 KB used by boot loader
SRAM	2.5 KB (ATmega32u4)
EEPROM (internal)	1 KB (ATmega32u4)
EEPROM (external)	512 Kbit (I2C)
Clock Speed	16 MHz
Keypad	5 keys
Knob	potentiometer attached to analog pin
Full color LCD	over SPI communication
SD card reader	for FAT16 formatted cards
Speaker	8 Ohm
Digital Compass	provides deviation from the geographical north in degrees
I2C soldering ports	3
Prototyping areas	4
Radius	185 mm
Heigth	85 mm

Table 1: Components in Arduino Board

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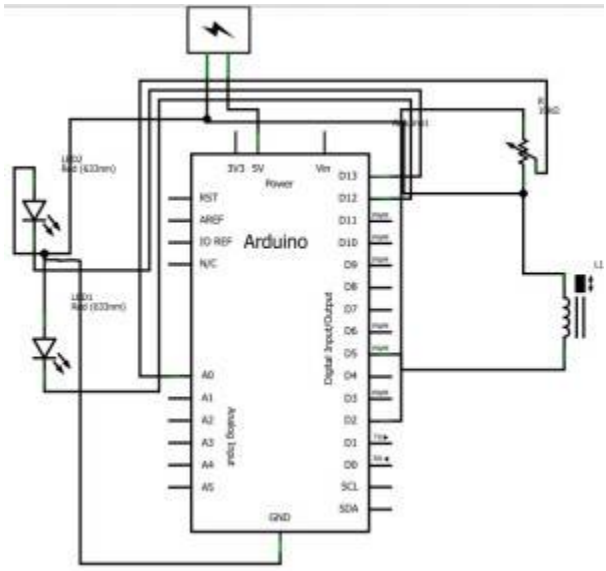

Fig 2: Arduino Uno with Digital Input/output

VI. REMOTE CONTROL

To control the robot from remote an encoder decoder pair (HT12E and HT12D) with a transmitter-receiver pair is used. Here we propose 433MHz transmitter-receiver pair with the encoder-receiver pair. The encoder-decoder are ICs of CMOS with working voltage range of 2.4V to 12V.The encoder has 12 lines (8-address lines & 4-address/data lines) is serially transmitted when transmit enable pin is taken low. The output data serially appears on OUT pin.

The transmitted data consists of differing lengths of pulses for '1' and '0' which is of positive going. The '0' pulse width is of twice that of '1' pulse width. The address part of the data received on A0 through A7 pins four times in succession is done, only then valid transmission pin is taken high. The internal oscillation frequency of decoder HT12D is 50 times more than the encoder HT12E. The data on address pins AD8-AD11 of HT12E appears on pins D8-D11 (data lines) of HT12D, the device acts as receiver of 4-bit data with 8-bit addressing.

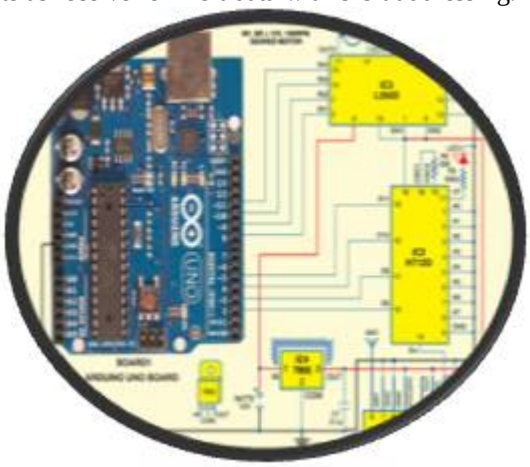

Fig. 3: Receiver and Motor driver Circuit

Transmitter: Resistor R1 is connected between oscillator pins 15 and 16 to set the transmitter frequency. Switches S1, S2, S3 and S4 are interfaced with AD8 - AD11 of encoder HT12E for forward, reverse , left and right motions, respectively.

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The TE pin is ground in HT12E so that the encoder is permanently enabled for transmission. When any switch is pressed, the respective data is transmitted serially from DOUT pin through the RF ASK transmitter module.

VII. APPLICATIONS AND FUTURE WORK

The RF Arduino board plays a very key role in many applications such as Virtual Wire Library, making a wireless thermometer, Pick N Place Robot with soft catching gripper ,Fire Fighting Robotic vehicle, Automatic wireless health monitoring in hospitals, Unique office communication system using RF. A Bluetooth module is interfaced to the Arduino Uno board at the receiver end while on the transmitter end, a Graphical User Interface application on the cell phone sends ON/OFF commands to the receiver where loads are connected. By touching the identified location on the Graphical User Interface, lamps are used as loads in this project can be turned ON/OFF remotely by using this technology. The loads are operated by using Arduino Uno board through thyristor using triacs and OPTO-Isolators. this system overcomes this problem by controlling the intensity on street by gradually reducing intensity by controlling the voltage applied to these lamps. This system uses Arduino board to produce PWM pulse and it is programmed in such a way that it decreases the voltage applied to these lamps gradually till late nights and completely shutdowns at morning.

Thus, Arduino development board can sense the environment by receiving input from different sensors and affects its surroundings by controlling motors, lights and other actuators. The microcontroller on the board is programmed using the Arduino programming language. Arduino is used very well in home automation where Houses are becoming smarter and well developed by using such kind of advanced technologies. Modern houses are gradually increasing the way of design by shifting to centralized control system with remote controlled switches instead of conventional switches.

VIII. RESULT

The Arduino board used in our study has the microcontroller ATmega328 microcontroller with 14 digital input/output pins, six analogue inputs, ICSP header, microcontroller and operated with 16MHz crystal oscillator along with Flash memory, EEPROM along with transmitter and receiver pair (HT12E and HT12D) is used for building various projects in wireless communication in robotic systems used to pick and drop objects, capture real time picture in night vision, transmit and receive the RF signals which are used in military, automation of homes and workspot, etc.

IX. CONCLUSION AND FUTURE WORK

In this project we have seen the main circuits involved in the RF Arduino board and its operation to control remote robot. This system can further be improved by adding additional microcontrollers and by adding another Arduino board with added features to perform multiple functions together at the same time. The system can add accelerometer, sensors, image sensing in wireless communication, various automation like home automation, industrial automation when required, used in advancement of military. Arduino UNO board can be programmed to operate in the end users requirements creating smart world in the near future.

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