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Industrial Automation Through RF Base Multi Channel Wireless Remote Controller

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Abstract

In our day to day life science plays very important role. The various devices make our life comfortable. But still we feel that there should be atomization provided in our Home or Industry. To switch ON various Home appliances, there should be any device or remote control that can control it. So that by using this we can control different devices present in our Home.

Also in many industries for e.g. small-scale industries or in offices controlling of various devices or machines is very difficult. In industries each motor or machine is switch on or off manually. So that it increases number of labors and also time is waste. In order to avoid this, we can use this technique. Also in Industries there are many types of machinery. For Industrial atomization we can use this. The RF based multiple channels remote control provides 9999 channels. By connecting devices to these channels we can control them. Also it can be used for controlling speed of fan or speed of AC or DC motors. We can rotate these motors in forward or in reverse direction. It is convenient to use RF based multiple channel remote control for switching or controlling Home appliances and Industrial devices.

Keywords: RF Transceiver, KEIL3, Dimmer.

INTRODUCTION

In today's competitive market, Industries are facing the growing demands for improving process efficiencies, comply with environmental regulations, and meet corporate financial objectives. Given the increasing age of many industrial systems and the dynamic industrial manufacturing market, intelligent and low-cost industrial automation systems are required to improve the productivity and efficiency of such systems. Traditionally, industrial automation systems are realized through wired communications. However, the wired automation systems require expensive communication cables to be installed and regularly maintained, and thus, they are not widely implemented in industrial plants because of their high cost. Therefore, there is an urgent need for cost-effective wireless automation systems that enable significant savings by optimizing the management of industrial systems [8].

The aim of the system is to provide a cost effective solution that will provide controlling of home or industrial appliances remotely and will also enable security against intrusion in the absence of owner. In this technique there is no limitation of controlling of devices not to switching but also to vary the speed of fan or controlling speed of AC or DC motors in industries. In this project implementation, only one remote can control up to 9999 devices and three Dimmers, it may be AC or DC Motors of 230 V. These dimmers speed can be separately vary and controls two dc motors in bidirectional speed that is in forward or revere directions also.

This provides high speed and more flexibility. It has multiple ports so connection and control of multiple devices is possible. Its practical implementation is very easy and RF module range is very high so it can control long range easily. This system can be used for industrial based automation systems, also used in small scale industries or used in offices or for Home appliances. This can also be used in Security, Data Networking, Relay controlled devices and Robotics manufacturing systems.

I. Main Controlling Units

- Main Microcontroller Module
- Dimmer Controller Module
- Liquid Crystal Display Module
- 12V DC Motor Module
- Triac Switching Module

All controlling modules used to control different devices are shown.

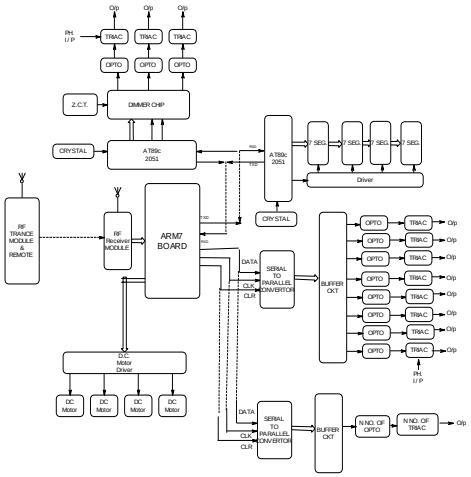

Fig No. 1: Block Diagram of ARM7 Board

A. Main Microcontroller Module

The main board contains ARM7, the main board controller consists of 64 Pins and the crystal frequency is 12MHz for specific baud rate i.e. 9600 Bps. The ARM7 board is not directly connected to RF receiver module due to voltage difference of receiver i.e. it works on 5V and ARM7 board or its Port works on only 3.3V so we used opto-coupler and transistor based circuit for voltage level shifting.

Dimmer board controller is connected to Tx & Rx pin for serial data communication. In this controller, there is no need of port initialization for I/P Or O/p. It receives the data from RF modules in Four BIT and controlling other microcontrollers in specific serial BAUD rate and switching the triac devices that is in only ON/OFF state.

For the purpose of ventilation or gate controlling or automation of industrial devices the D.C. motor is used. The motor driver Circuit is connected to the ARM7 board of controller and controlling command is given from main controller, first it selects which motor to run & then controls it in both directions i.e. forward or reverse directions.

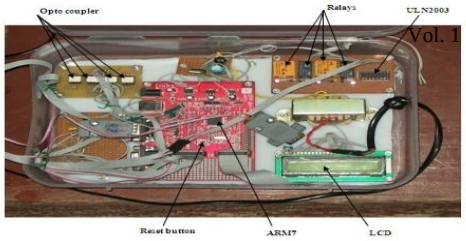

Fig No. 2: ARM7 Board

B. Dimmer Controller Module

The dimmer controller board controls FANs or an AC/DC motor.

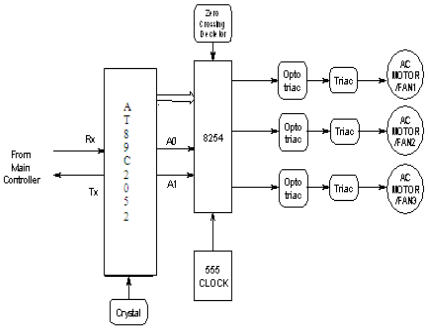

Fig No.3: Dimmer Board Connection

This board consists of AT89C2052 controller and 8254 for controlling TRIAC and 555 astable circuit is used for generating frequency for 8254 chip. These chips have three outputs for Triac triggering. Each channel and mode selection is on pin A0 and A1, and pin data bus and read / write pin are connected to AT89C2052 microcontroller and all gate pins are connected to zero crossing circuit. The o/p is connected to the opto triac i.e. moc 3021 for isolated circuit. Serial port is connected to the main board controller for data communication.

The 8254 is a counter/timer device designed to solve the common timing control problems in microcomputer system design. It provides three independent 16-bit counters, each capable of handling clock inputs up to 10MHz. All modes are software programmable [13]. But in this project, it is used for Triac triggering, clock is given from 555 astable circuit and gate pulses are given from zero crossing detector, when sine waves or other simple waveforms crosses zero then it generates a single pulse i.e. whenever sine wave crosses zero then gate pins of 8254 chip starts to fire Triac according to counter value which is given by controller. All gate pins are connected to ZCT. Serial port is connected to the main board controller for data communication.

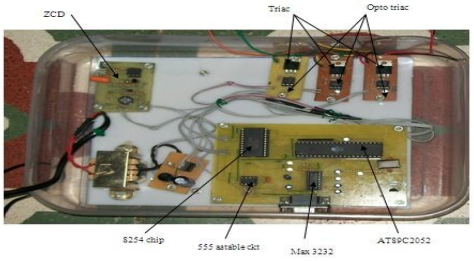

Fig No.4: Dimmer Board

C. Liquid Crystal Display Module

There are various different controlling sections so it can be displayed on Liquid Crystal Display (LCD) Display. Whenever we select mode, it show entering mode and controlling value. LCDs can add a lot to your application in terms of providing a useful interface for the user, debugging an application or just giving it a "professional" look. The most common type of LCD controller is the Hitatchi 44780 which provides a relatively simple interface between a processor and an LCD.

Fig No. 5: LCD Display

D. DC Motor Module

In DC Motor Module, ULN2003A is used for driving 12V DC relay. The ULN2003 is a high voltage, high current Darlington arrays each containing seven open collector Darlington pairs with common emitters. Each channel rated at 500mA and can withstand peak currents of 600mA. Suppression diodes are included for inductive load driving and the inputs are pinned opposite the outputs to simplify board layout [14].

In this chip there are seven channels but we used only four channels for four relays for controlling two DC motors. For first motor, first relay is for ON/OFF motor and combination of first and second relay is used for forward or reverse directions. Similarly, for second motor, third relay is for ON/OFF motor and combination of third and fourth relay is used for forward or reverse directions.

E. Triac Switching Module

The triac switching module is used to switching ON/OFF the devices.

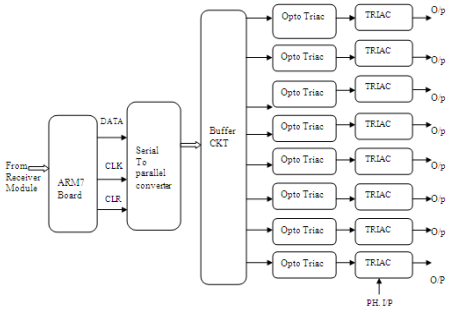

Fig No. 5: Block Diagram of Triac Board

This module presents a new reliable, flexible and inexpensive remote lighting control system. The hardware and software design are presented. The experimental results have shown that this wireless technology is suitable for wireless control in home lighting and proved that the new wireless network has a more vast range of prospects in home automation and industrial control [3]. When we select this mode, data from ARM7 board is send to serial to parallel converter and it triggers the Triac to switch the output devices i.e. makes it ON/OFF. For isolation purpose opto triac is used between serial to parallel converter and Triacs. In this way, we are going to connect up to 9999 devices.

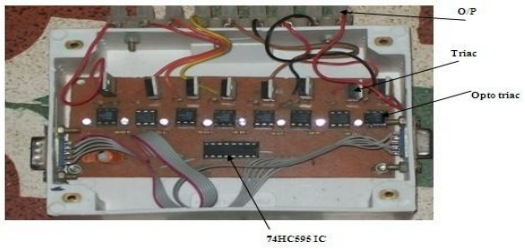

Fig No. 6: Triac Switching Board

II. RF Remote Control

Radio frequency has traditionally been used to remotely control barriers, automatic gates & doors, industrial access control systems and motorized gates & doors by utilizing hand held transmitters and remote receivers.

A. RF Transmitter Module

- Transmitter Range: 500m
- Supply Power: DC 12V Battery
- Operating Current: 15-40mA
- Frequency: 433MHz

B. RF Receiver Module

- Operating Voltage: 5 V DC
- Operating Current: 5 mA
- Receiving Sensitivity: -103 dbm
- OperatingFrequency:315 MHz/433MHz selectable
- Transfer Rate: 4.8K
- Modulation: ASK
- Output: TTL

III. Keil3 Compiler

In this development of C code is used to run on the LPC2129. While there are a large number of commercial compiler tools and the open source GCC compiler, but Keil Microcontroller development kit (MDK-ARM) is used in the programming. The MDK-ARM is a comprehensive development environment for ARM-based microcontrollers. It includes an IDE called uVision, the ARM Real View compiler, a real time operating system, software simulator with peripheral simulation and a JTAG hardware debugger. An add-on run time library (RTL-ARM) provides a set of middleware components including a TCP/IP stack, embedded file system, USB and CAN drivers. The MDK-ARM is being supported by third party software products. HiTOP works with many different compilers. In the case of the ARM architecture, the Keil Real View and GNU compilers are very popular. The Hitex and Keil ARM tools can be used for any other ARM7-based microcontroller [2].

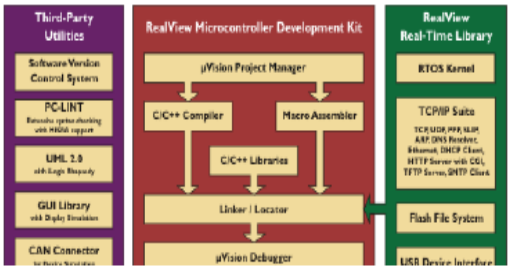

Fig No. 7: The Keil MDK-ARM Tool Kit

IV. CONCLUSION

Industrial automation with high degree of quality may be achieved using this project. Multiple devices may be connected and controlled with the help of single remote. Considering the dynamic market this project can provide a way to design intelligent and low-cost industrial automation systems to improve the productivity and efficiency of the systems. Traditionally, industrial automation systems are realized through wired communications. However, the wired automation systems require expensive communication cables to be installed and regularly maintained, and thus, they are not widely implemented in industrial plants because of their high cost.

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