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Research Article

Design of an Embedded Control Scheme for Control of Remote Appliances

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I N F O

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A B S T R A C T

In today's world remote control over the electronic appliances is of the utmost importance. The conventional techniques are either wired or work on a line of sight communication and hence put a limit on the range over they can be operated. In today's era communication system is bringing the world closer and telecommunication is one of the inevitable parts and serves the best medium to control the appliances. The objective of the work presented here is to control the appliances/ devices from any corner of the world, which can be effectively, achieved through telephonic control since the telephonic network covers the entire globe. This work employs the same technique for controlling various devices through the telephone line.[1]

The basic heart of this research work is the DTMF tone. All the data required to control the appliances is based on the detection of the DTMF tone. The output of the DTMF decoder comes out to be in a digital form and hence is directly compatible with the microcontroller and hence highlights a new path to the user authentication process and automatic termination of call on system or line malfunction. All the above-mentioned requirements can be fulfilled through an electronic circuit that consists of ring detector, hook switch, DTMF tone decoder, noise canceller, latch and a microcontroller.

Keywords: Remote Control, Communications, Micro-controller, ADC

Introduction to the Work

Science and technology are progressing in leaps and bounds today. The growth of industries is opening new avenues for development and innovations. With the advent of automation, industries are looking for cost reduction and restructuring of the development cycle and servicing. In considerations with such changes, the demand for accuracy, data retention capability, data transfer speed is ever increasing. The key to success of any company is its information flow, be it between departments to department i.e. human-to-human or machine to human, the costliest possession to any company is information. Companies are finding various methods and installing new systems, even adopting or completely changing the existing system to be in the race to success. With many new ways and technologies developing every hour to cater this new

age transition, the need for systems with high efficiency, retention and simplicity is spiraling in growth.[2]

To achieve this the electronics and computer science field are dedicate sources, not only are new standards being developed, but also new branches of engineering are being found in this process, control systems, industrial automation, embedded systems, remote access/ sensing, data monitoring and acquisition are few of the examples. Our research, targets to simulate, design and implement such a device. This device, the data acquisition and remote equipment control is designed to enable the user to control the device from distance. Even if there are a number of devices at different places, the presence of data acquisition and remote equipment control system at each place makes it possible to control over them. The physical variables at these locations can be studied and the devices accordingly controlled, which will efficiently acquire the data and control such remotely, placed equipment. The implemented system will be capable of reading eight 8-bit analog channels and 8 digital channels.[3]

The parameters of the equipment like voltage, current, temperature, etc, that are converted into corresponding voltage values, are read through these eight 8-bit analog channels, while the status i.e., ON or OFF will be read through the 8 digital channels. A provision to control the status of a device (control device) is also provided. The job of data acquisition and control is performed by the micro-controller 89C52, which forms the kernel of the design.[4-7]

To support the job of the kernel, other components like the ADC, Multiplexers, 8255 PPI, EPROM, RAM, Latches, Display, Keyboard, are interfaced. The communication between the remote site and the central control point is done through telephone line via modem. At central control room, data is displayed on the PC using VB graphics.[8]

Objectives of the Work

The objectives of the research work are summarized as follows:

- To design an 89C52 micro-controller based system interface to control and read parameters of equipment. The system has a RS232 port.
- To design a 10-bit ADC circuit with 8 channel multiplex facility.
- To assemble/ solder circuit boards for 6 digit 7-segment display, 89C52 board, an ADC interface board.
- To assemble interface wires/cables for hooking up the circuits to target system
- To design the software in assembly language to achieve the objectives.
- To design the PC end software in VB6.0 to communicate to remote 89C52 via PSTN (Public Switched Telephone Network) at different locations.
- A-D plug in boards are used at the remote end and using multiplexers to multiplex the data lines and the number of control variables/ parameters are increased tremendously.
- At the remote end, dedicated controllers are interfaced with the original system, which increases the functionality of the present system from monitoring to actual control system.
- The implemented design is interfaced with compatible boards to increase the use in accordance with requirement and standards adopted by the industry.
- To make the entire process full automatic.[9,10]

Process Design

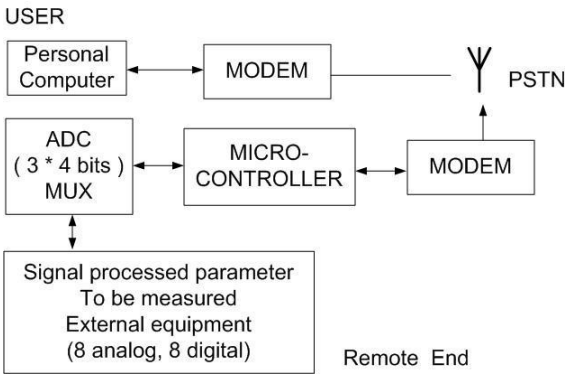

Figure 1.Basic Block Diagram

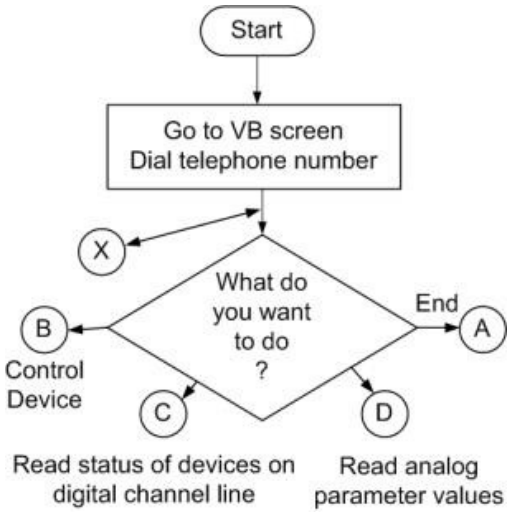

Figure 2.Flow chart to read status of devices

The process begins as follows. Initially a link is established between the remote site and the central control station by dialing appropriate number. After the link is established, the command for reading the analog and digital channels is given subsequently. Then, the values of the channels are displayed on the PC screen, at the central control station. If needed, a change in the state of a device can be made. After the monitoring process is over, the link is disconnected. The basic block diagram of the process is shown in Figure 1.[11]

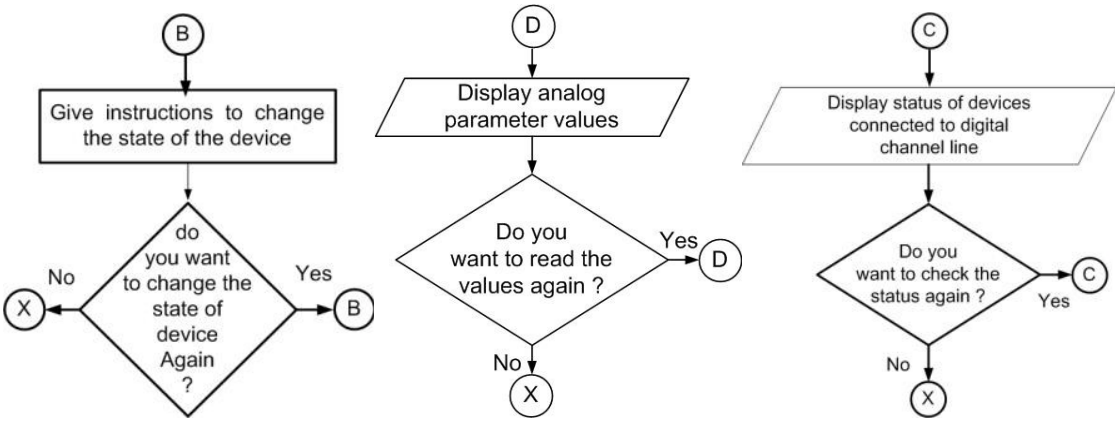

Figure 3.Flow chart to change the state of the device,
Figure 4.Algorithm to display parametric values,
Figure 5.Algorithm to check the status of the device

The project targets set can be achieved by implementing the block diagram. The overall view of the block diagram is as follows. We get processed 8 analog and 8 digital channels from the equipment. These 8 analog channels are given to the ADC and analog multiplexer. These are then connected to one of the ports of 8255. The digital channels are connected to the other port of 8255. Microcontroller generates the address and control signal for acquiring data from the equipment or the memory chips. The monitor program will be stored in the EPROM, whereas the data from the equipment will be stored in the RAM.

There is a 7-segment display, with 4 fields for address and fields for data. The touch keypad, keyboard is used to send commands or address or data to the microcontroller, which will be displayed on the display during debugging or diagnosis. The components of the system block diagram are shown in the Figure 6.[12]

Design of Communication System

The remote control is actually the transmitter, receiver and the interface cards all put together. Transmitter transmits the pulses

coded according to the button that is pressed. At the other end, the receiver IC decodes the information and any one of it pin goes to logic high depending on the button number that is pressed. The remote control is used to teach the robot how to do a particular task. Once taught, it can playback all the stored instructions. Keeping in view the enormous energy saving afforded by LCD over LED, especially for battery powered applications, a oriole display module which is dot matrix LCD that is capable of displaying alphanumeric, kana (Japanese) characters and symbols is used. The ODM is interfaced to the controller card through the 8255-2. The ADC cards provide the 8-bit equivalent of all the positions of left wheel, right wheel, arm base, shoulder, elbow, roll and gripper movements at its o/p depending upon ADC channel selected.

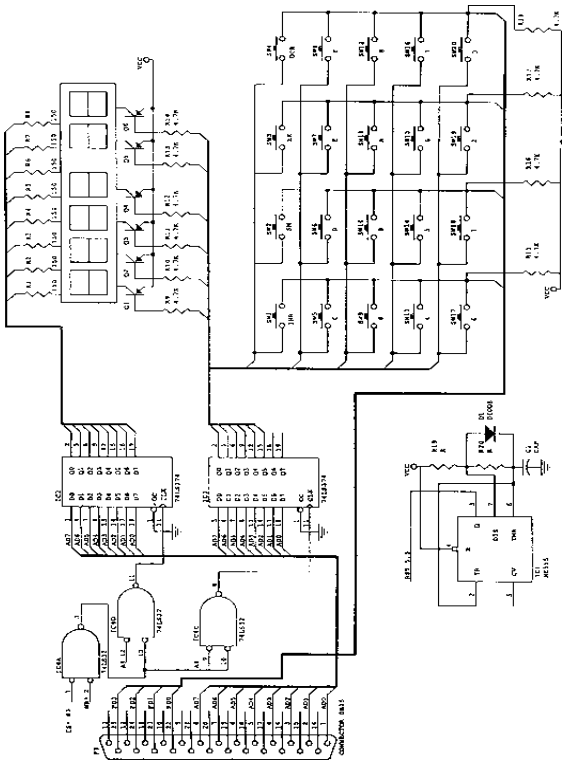

Figure 6.Display and keyboard design

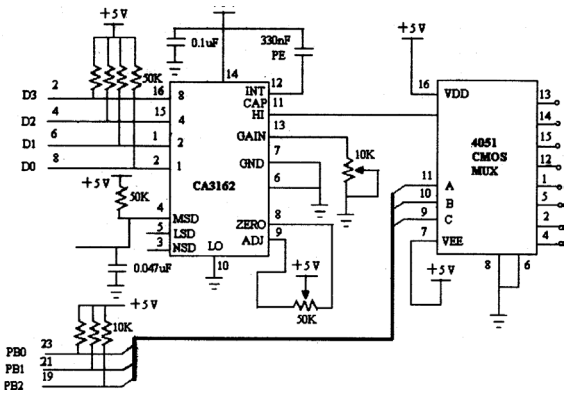

Figure 7.Analog to Digital Conversion board design

In commercial establishment, its activities may not be concentrated at a particular place, but widespread. These widespread units need to be periodically monitored, to ensure their proper functioning. Provision of manpower for each of these units is not profitable and dispensable. So to economize, a central control station is set up for monitoring these remotely located units. To regulate the functioning of these unmanned units, the data from these units is needed to be acquired at regular intervals as they have chances of failure. For the data acquisition and controlling to be successfully implemented, a device needs to be placed, at the remote site, which will act as a bridge between the main control station and the remote site.

Conclusion

On varying the potentiometer, which simulates the analog quantities we find a corresponding change m the readings on the computer after giving the command for data acquisition. The digital values were simulated m the program and displayed on the VB screen. LED used, which simulates any ongoing process at the remote end had been controlled by initiating appropriate command from the user end. In case of any alerting increase in any of the measured data was also indicated at the user end.

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