GUI Based Device Controller Using MATLAB

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Abstract: The application of the device control in real life is very common nowadays. There are many applications that have been developed by using device control in electronic field such as home automation, industrial automation, etc. The objective of this project is to develop the Graphical User Interface of device control through MATLAB, interface the MATLAB GUI that consist of transmitter and receiver program with hardware via serial communication and control the various devices. By using MATLAB GUIDE, the process of laying out and programming GUIs and interface with microcontroller via serial communication port to control the devices will be easier because it is already provides a set of tools. As a result, the devices at remote location can be controlled by PC having MATLAB GUI and interface the MATLAB GUI with microcontroller via serial communication port.

Index Terms— MATLAB, GUI, Microcontroller AT89S8253.

1 INTRODUCTION

Automation is today's fact, where more things are being completed every day automatically, usually the basic tasks of turning on or off certain devices and beyond, either remotely or in close proximity. The control of the devices when completely taken over by the machines, the process of monitoring and reporting becomes more important. Depending on the location of its usage, automation differs in its name as industrial automation, home automation etc. With the development of low cost electronic components home automation migrated from being an industrial application to home automation. The home automation, our point of concern deals with the control of home appliances from a central location. Market researches claim that most of the homes will be equipped with home automation systems in the very near future. The whole process of supervising, controlling and monitoring electrical devices and equipments from electric power stations and the distribution grids is based on automation, protection,

data acquisition and equipment control. A popular application in this field, which is in highly demand, involves controlling the power equipment in the building, such as the motor, heater, lamp and air conditioner. The problem of power management is the remote control adjustment, which is a result from consumers' carelessness. Microcontrollers are suitable in low-cost control applications. There are many tradeoffs that are addressed during the control system design, of which control allocation is an integral part, dictate the need for a reliable, computer-based design tool. The proposed system architecture, considering both the hardware and software elements involved is essential in this new era. There are various applications with built in controllers and ready for internet access which may be too expensive and complicated to build whereas this is a dedicated application which is cost effective. The next section will briefly introduce the units in the automation system.

In this project the user specified embedded program is entered into the computer and downloaded from the computer to the microcontroller using serial connection between them. Further the computer acts as a host for an interactive GUI for the user so as to control the various devices connected to the microcontroller.

The device controller consists of two sections of software and hardware. As software MATLAB is used because it already consists of Graphical User Interface (GUI) tool. First of all, the data is sent to the USB port of the computer. The Universal Asynchronous Receiver and Transmitter (UART) module converts this standard into the TTL standard of the microcontroller. UART transmits bytes of data as individual bits in a sequential pattern. At the hardware side, another UART re-assembles the bits into complete bytes. Each UART consists of a shift register, for the conversion of serial and parallel forms. The microcontroller reads the data from the computer therefore turning on the devices accordingly. ULN2803 IC is used to activate the relays to turn on/off the home appliances. A pair of Darlington transistor is required by every relay to operate in order to provide the high current. Using relay, the

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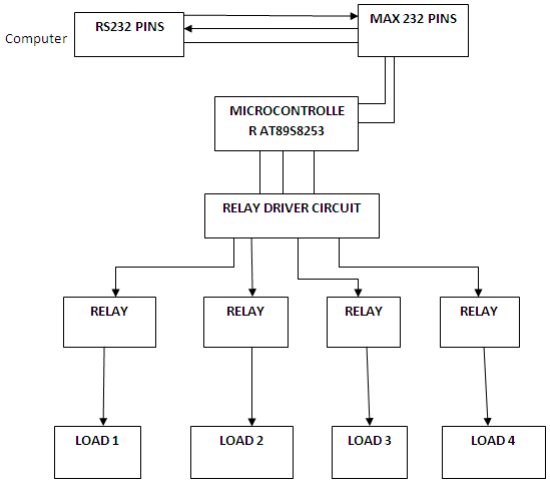
isolation form ac to dc is carried out and also the switching is done easily.

The device controller generally can be referred as an example of master slave communication where all devices act as slave being controlled by the single PC acting as master. Here the computer is the main controlling unit that governs the operation of RS232 convertor with the AT89C52 microcontroller circuit system that is referred to as a slave unit.

To interface the USB port of the computer with the system developed, the USB-to-RS232 convertor is used. The USB port as a serial port protocol is initialized by the driver of USB-to-RS232 convertor. By transforming the RS232 levels back to 0 and 5 Volts with the use of common level connector that is MAX232 the CMOS level is converted into Transistor Transistor Logic (TTL). The receiver transmitter pin of MAX 232 is connected to receiver transmitter pin of microcontroller. The MAX232 is used with five 1 uF capacitors to adjust the voltage level difference between the PC based logic and controller based logic.

Separate interface devices are used to convert the logic level signals of the UART to and from the external signaling levels. External signals may be of many different forms. The UART usually does not directly generate or receive the external signals used between different items of equipment. Transmitting and receiving UARTs must be set for the same bit speed, character length, parity, and stop bits for proper operation. The receiving UART may detect some mismatched. This converter is responsible for transmitting ASCII (American Standard Code for Information Interchange) data from GUI to microcontroller. USB to RS232 TTL Module contains a CP2102 single-chip USB to UART Bridge which converts data traffic between USB and UART formats. The chip includes a complete USB 2.0 full-speed function controller; bridge control logic and a UART interface with transmit/receive buffers and modem handshake signals.



Hardware:

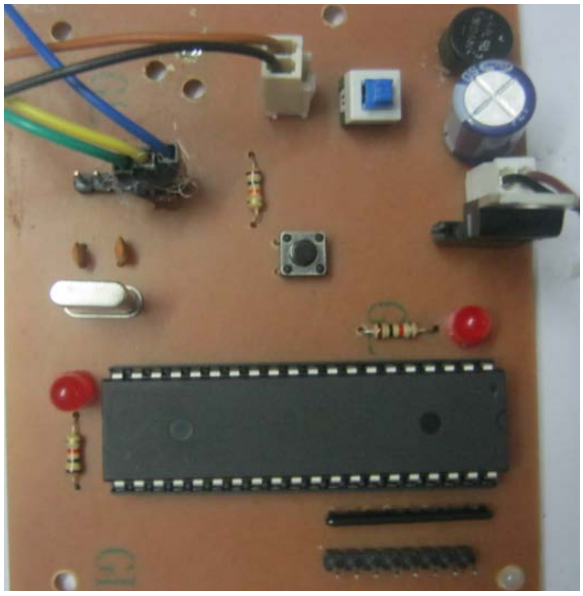
I.Module 1 (Microcontroller AT89S8253)

The Mat lab code generated is sent from the PC to the USB port. The serial data sent through it is USB based. The conversion of this into the TTL standard of the microcontroller is done through the UART module. The different components are designed and fixed on the chip as per the requirement and their specifications. Bridge rectifier transforms the AC input to DC output.

The DC output from the rectifier is eventually passed to the electrolytic capacitor which is used to store electricity or electric energy. Electrolytic capacitors use a molecular thin oxide film as dielectric which result in large capacitance values. Electrolytic capacitors are polarized and they must be connected the correct way round only, with at least one of their leads marked +ve or -ve. Then the supply is being passed through the 7805 IC that is the voltage regulator IC. A voltage regulator is designed for automatic maintenance of a constant voltage level. Here, it is used to maintain the constant 5V supply. It ensures internal current limiting, thermal shut down and safe operating area protection, making it essentially ineffaceable. If adequate heat sinking is provided, they can deliver over 1A output current.

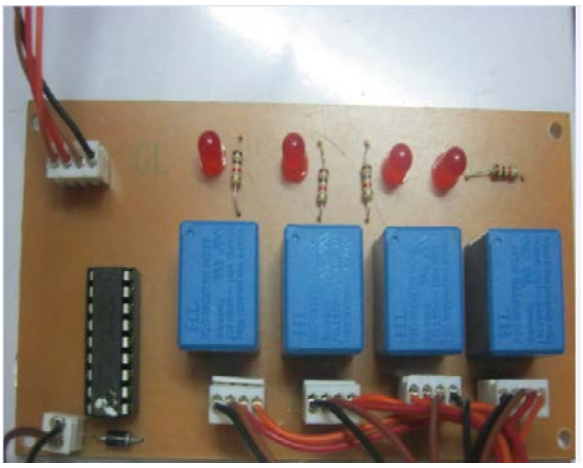
Here, microprocessor used, operates using quartz crystal oscillator as it is frequency determining device to generate clock waveform with its fundamental frequency that can extend to hundred of megahertz. Crystal oscillators are preferably used as they provide the highest accuracy and frequency stabilization. When supply is given to the microcontroller, it is activated n performs its operation accordingly. Here we are using Atmel AT89S8253 microcontroller which is a comparatively powerful microcontroller providing a highly flexible and cost effective solution to many embedded control applications.

The microcontroller reads the data from the computer and thereby activates the relay driver.



II. Module 2 (Relay Driver circuitry):

A relay uses a small current to flip a switch to enable a larger circuit. A relay will usually have either three or four ports on it, a positive post for the small current, a positive post for the larger current, and either two negative posts or one common negative post. If there are four posts, the positive and negative for each respective circuit will be directly across one another. You may use it for simple ON/OFF switching electronic as well as electrical devices-home lights, DC motors, solenoids and others. It basically provides the isolation form ac to dc and also the switching is done easily. Here loads are demonstrated by the help of LEDs and bulbs for the purpose of simplicity. Here we are using IC ULN 2803 and it is used because, A ULN2803 is an Integrated Circuit (IC) chip with a High Voltage/High Current Darlington Transistor Array. It allows you to interface TTL signals with higher voltage/current loads on. The ULN2803 is designed to be compatible with standard TTL families. The major advantage of using this IC is that it can fulfill the need for high voltage and high current also. This is enabled through a low voltage and low current source to give high voltage and high current output.



CONCLUSION

The GUI based device control using Mat lab has been presented in this paper. Here an elaborate and immaculate discussion of all our associated work pertaining to the study, that includes GUI toolbox of Mat lab, programming and designing of microcontroller for controlling the various loads has been presented.

The various loads used in our project demonstrate the functions that are being performed and hence the communication between the PC and the various devices associated. Here the PC is sending message to the controller simply by serial communication that desirably controls the load connected to it.

GUI provides the process for transmission of ASCII character data selected by the user to transcend the information. The converter that is used here provides the communication between the RS232 port of the PC and USB port of the microcontroller.

All the load devices are connected via computer network preferably to allow control by a PC, and it allows remote access through the internet. With the integration of information technologies and the home environment, various systems and appliances are able to communicate in an efficient manner which results in convenience, energy efficiency, and safety benefits.

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