GUI-MATLAB Based Home/Industrial Automation Using MCU89S52

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Abstract: *Within the ambit of wireless technology, appearance of remote control based devices and appliances have become the order of the day. It reduces human affords and increase the efficiency. Every sector needs automation, ranging from home to industries. Automation Systems perform by allowing a number of devices to communicate with a central controller which in turn communicates all information to the user or the owner of the system as per the instructions and the structure of the system. The application of such automation systems could be in areas such as heating, lighting, defense, energy management, audio and video systems, health monitoring, and entertainment. Keeping all these facts in mind, this paper propose a system which based on GUI controlling through a PC(personal computer) or LAPTOP. This paper propose automation of appliances like fan,bulb, motor, fire sensor.To automate these appliances, we can use the different wireless communication media like infrared, Bluetooth, Radio frequency, RFID, GSM, DTMF and GUI-MATLAB and implemented with the help of microcontroller-89c51 to compare the robustness and efficiency of output. To automate the industrial appliances we have to programe the CPU-89S52 in Embedded C. Being an emerging area of research, a review of the most recent literature and implementation has been carried out and presented in Section 2. The methodological framework and the system design are presented in Section 3. Concluding remarks are given in section 4.*

Keywords: Automation, Embedded System, Microcontroller 89S52, Infrared Sensor, dual tone multiple frequency (DTMF), Bluetooth, radio frequency, GSM Module, MATLAB, GUI(Graphic User Interface).

1. Introduction

Microcontrollers are used in the industrial world to control many types of equipment, ranging from consumer to specialized devices. Furthermore, there is a growing need for offline support of a computers main processor. The demand will grow as more equipment uses more intelligence. One of the most popular is Motorola 68HC11. The 68HC11 microcontroller is relatively easy to work with, yet they have most of the features essential for a complete control system. Thus student of control automation can use them to work with control systems at the component level. The interested person can also use them as tools to understand and experiment with computer and data communications systems. As time passed our engineers have developed a better microcontroller to perform the specific task. For example: ATMEL8051 family, ATMEL8052 family, ATmega AVR family, TI-MSP430, ARM family and many more. These all controllers are present in the market for development of such types of specific task. As per the application we need to choose one of them. The criteria of choosing the microcontroller are by their features, cost, power consumption, area, available memory inside the chip etc. So as per our objective in this paper we have selected a controller 89S52 from ATMEL8052 family. It has 8KB of on chip ROM and 256 bytes of RAM, 32 I/O Pins and easy to program.

Industrial automation meant for a system which monitor the input points (sensors and signals generated by the GSM, Bluetooth, RF Transmitter, RFID, DTMF) and respond as per their described behavior after crossing a threshold limit set by the user. So far many scientists have done lots of research in the field of automation. For example: there is automation using IR sensor, In addition some of them have improved their communication medium to robust and efficient their system. Moreover, due to the advancement in computer era, it facilitates the development of electronic devices such as digital cameras, digital images have been widely used in many area. Therefore, security is also an important issue.

2. Review of Industrial Automation

The industrial Automation can be done in different means of communication -:

(A) *Industrial Automation using IR Sensors:* This scheme uses two pair of IR sensors. IR has property that it can't penetrate the obstacle or object. In this project we exploit this property of IR. One pair of IR module is mounted at the entrance in such a way that the output of IR will be logic 1 at MCU unit if a person enters, which is indicated by an indicator LED. So, this module is used to detect the coming person and a liquid crystal display (LCD) unit is also used to display the total number of person inside the premises. MCU unit is program in such manner that, if total count of person inside the defined area is greater than zero then a 12volt, 7amp relay is used to turn on the light and exhaust fan.

Another pair of IR is used at the exit gate, when this sensor unit will be active the person count will be decreased by one and if total count is zero, the relay section will be activated to turn off all the appliances.
Major drawback of this project is it is not efficient system because of low sensing range of infrared which is approx 10 to 20 centimeter.

(B) Industrial Automation Using RF (Radio Frequency) based in this method of industrial automation we use radio frequency. To implement it we need RF transmitter and receiver pair along with encoder (HT12E) and decoder (HT12D) IC. To give the input to RF transmitter we need input medium, thus we can use active high switch, which is first encoded with the help of HT12E and then encoded signal is being transmitted with the help of RF transmitter module. The signal transmitted is being received by RF receiver wirelessly and then decoded in by decoder HT12D. To automate the appliances MCU unit is programmed and compared from the received input and control the relay section to turn on and off the home and industrial appliances.

The developed system is efficient and robust and provide better range as compared to IR but not fully automatic. Its performance is good.

(C) Industrial Automation using dual tone multiple frequency (DTMF) Signal generated from keypad of mobile is basically termed as DTMF. In mobile keypad row and column frequencies are different. On pressing of any key a multiplied frequency of row and column is generated and is known as DTMF.In this scheme we use DTMF signal as an input signal to automate the industrial appliances. As DTMF signal has analogous nature therefore we need to decode this signal and convert it into digital signal. For this purpose we are using MT8870 IC. To transfer the signal generated by the mobile to the DTMF Decoder IC we use headphone through an earpiece. Output of MT8870 is denoted as [Q3 Q2 Q1 Q0]. To convert the output CMOS logic to TTL logic we have used 74LS04 not gate IC. Output of 74LS04 is transferred to MCU unit and then MCU 89S52 is programmed in such a way that it control the relay section to turn on and off the appliances as per the received signal from the mobile. Performance of this system is very good and efficient but little bit tedious in sense of circuit

complexity. This system is costlier than other because to automate the system user need to connect the call, on the other hand this system does not have any range limitation.

(D) Industrial Automation using Android Application through Bluetooth: this plan has limited area access that is approx 20 meter. In this scheme generally we use Bluetooth as a communication media. MCU unit is connected through an android application via Bluetooth. As per the made application for android mobile it will transmit an ASCII character and is being received by Bluetooth module, which is connected to UART of MCU 89S52. Now as per the programming of MCU89S52 it will compare the received character and as per the comparison result the control signal will be transferred to relay section to perform the automation like turning on and off the appliances. Performance of this system is overall good, but the main problem of this project is limited access. It has also maintained good robustness in cheaper cost.

(E) Industrial Automation through SMS:
In this system GSM is used to transmit and receive the message over phone. Generally attention command (AT) is used to read, write and delete the message form inbox. Some basic commands are:

1. AT+CMGF=1; this command is used to take the GSM in SMS mode.
2. AT+CMGD=1; this command is used to delete the first message from the inbox.
3. AT+CMGR=1; this command is used to read the first message from inbox.
4. AT+CMGS="9509285752 "<enter>,<your message>; this command is used to is use to send the message on the given mobile number.

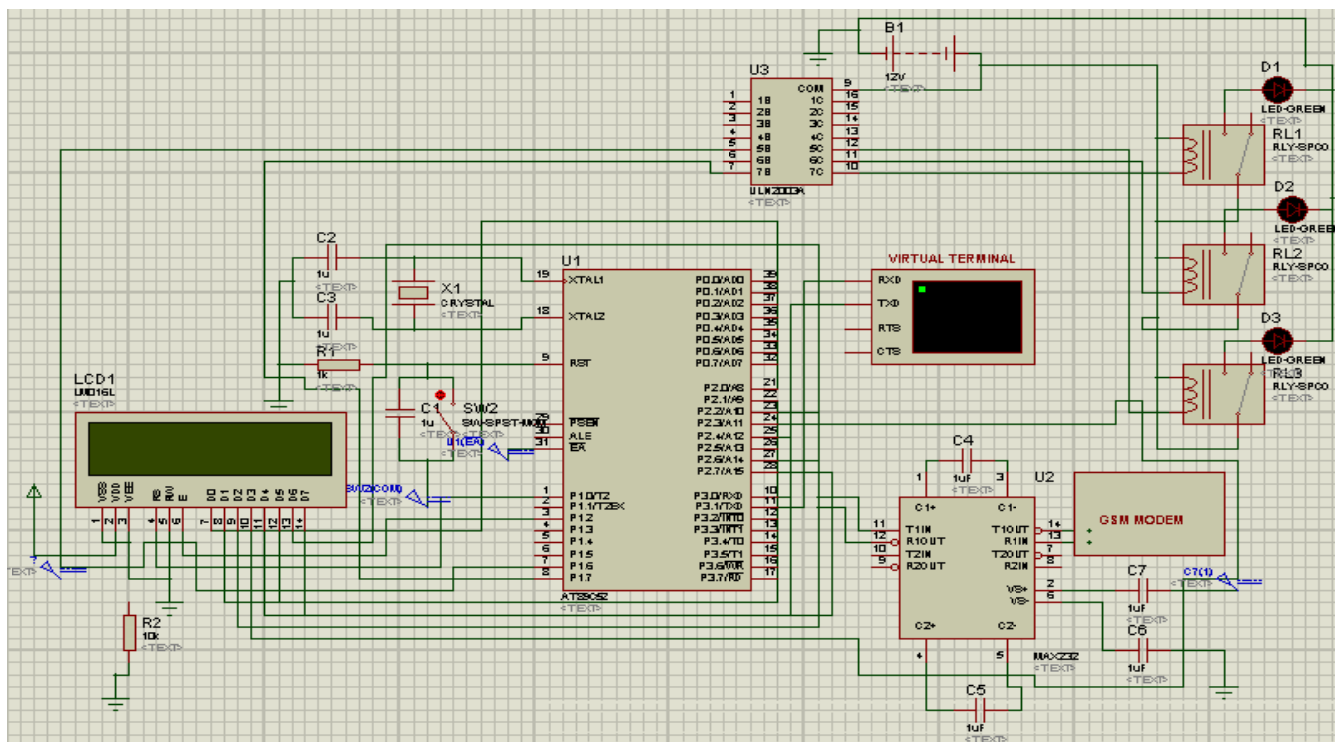The complete system is depicted as displayed in fig-1:

Figure 1: GSM Based Industrial Automation System.

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An external GSM modem is used to connect with MCU unit to receive the SMS. On receiving the message in proper format and text, MCU89S52 will transfer the control signal to relay section to turn on and off the appliances.

2.1 The objective of the exploration outlined in this paper is:

1. Perform the industrial automation using GUI made application in MATLAB.
2. Perform the industrial automation using Infrared Sensor, DTMF, Bluetooth, RF transmitter and receiver, and GSM.
3. Compare the performance of all the systems.

3. Proposed Work

For the objective proposed in this paper, to achieve this, a smart industrial automation system is used. The proposed offering scheme uses graphic user interface (GUI) based application designed in MATLAB-14. Purpose of this designed application is to transfer the control signal to the MCU unit, so that MCU unit can compare the received data and transfer the control signal to relay section to turn on and off the device. To perform this task Instrument Control Toolbox of MATLAB is used to interface GUI environment and MCU 89S52 in serial mode with specified baud rate (Bits per signal) through communication port of PC or LAPTOP. On pressing of ON button in GUI it will transmit an ASCII Code of 'Q' and on pressing of OFF button it will transmit an ASCII Code of 'q' and the same is repeated for all four devices. Block representation of proposed work is depicted in figure2:
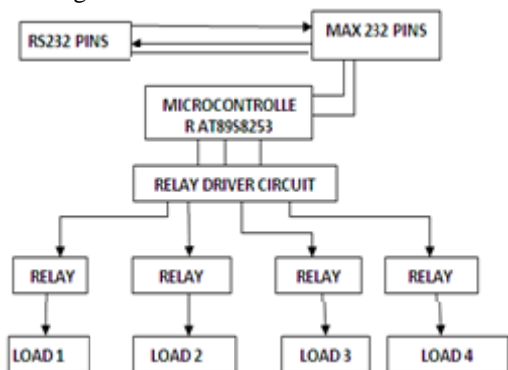

Figure 2: Block Diagram of proposed work

This device consists of two sections:

1. ***Transmitter side:*** At transmitter side GUI based designed application as shown in figure-3 is used to transmit some predefined ASCII code (like here it is Q, R, W, E q, r, w, e) to the MCU 89S51. To connect the MATLAB and MCU unit, a MATLAB code is designed for Instrument control toolbox. Through MATLAB coding first of all, we transfer a byte through USB of LAPTOP. UART (Universal Asynchronous Receiver and Transmitter) unit is used convert RS232 logic into TTL logic supported by microcontroller.

In this project the user specified embedded program developed in Embedded C is entered into the computer and downloaded from the computer to the microcontroller using serial communication through RS232 protocol between them. Further the computer acts as a Master for an interactive GUI for the user so as to control the various devices connected to the microcontroller. Circuit diagram of transmitter side is shown in figure-4.
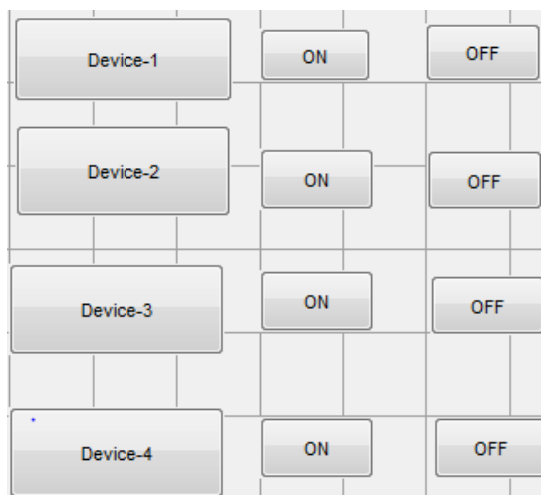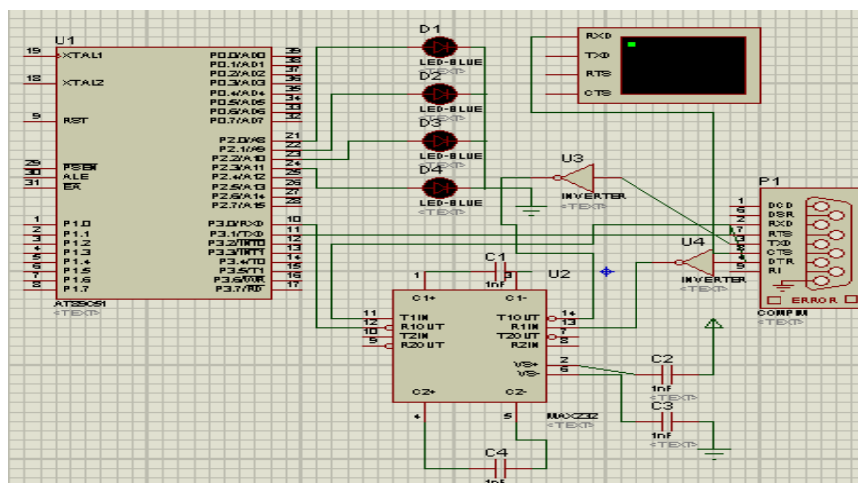

Figure 3: Application designed in GUI (MATLAB)

Figure 4: Transmitter Side of proposed System

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2. *Receiver side:* At receiver side data received at input of MCU unit is being compared the data as per the loaded code in the microcontroller and take decision to turn on and off the device connected to the relay section. A ULN2003 IC is used to activate the relays. In order to provide high current a Darlington pair of transistor is required, therefore we are using ULN2003, which consist of seven pair of Darlington transistor and controlled seven relays at a time. Block diagram of receiver side is presented in figure-5. One relay is used to control one device, in this project we have used four relay, which is connected to bulb, fan, exhaust fan, and motor, for water pumping in case of active fire alert sensor. Benefits of proposed work are it is more efficient and reliable. It is secure, reliable, power efficient and cheap as well.
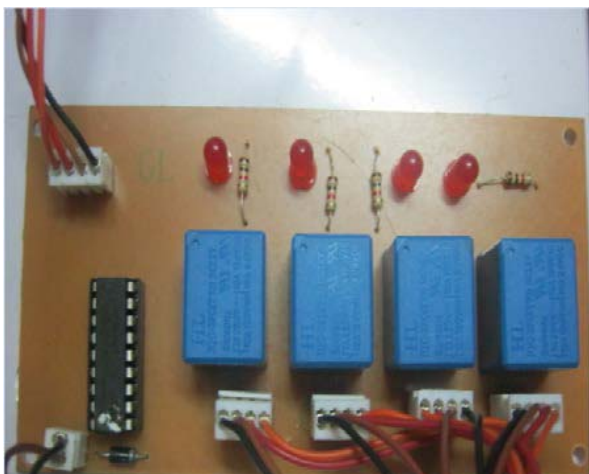

Figure 5: Receiver Side of Proposed System

4. Conclusion

The GUI based Industrial computerization utilizing MATLAB has been implemented within this paper. Here a profoundly organized and impeccable discourse of all our related work relating to the study, that incorporates GUI tool of MATLAB, programming and outlining of MCU89S52 for controlling the different burdens has been exhibited.

The numerous loads used in our project demonstrate the functions that are being performed and hence the communication between the LAPTOP/PC and the various devices associated. Here the LAPTOP/PC is transmitting message (An ASCII Code) to the MCU89S52 simply by serial communication that desirably controls the load connected to it. As per the specification of relay used we can control any of the devices operates up to 7Amp.

GUI gives the methodology to transmission of ASCII character information chose by the client to transcend the data. The converter that is utilized here gives the correspondence between the RS232 port of the LAPTOP/PC and USB port of the microcontroller.

All the load devices are associated by means of machine system ideally to permit control by a PC, and it permits remote get to through the web. With the incorporation of data innovations and the nature's domain, different frameworks and apparatuses can convey in a proficient way which brings about comfort, vitality effectiveness, and security profits.

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