

HOME AUTOMATION SYSTEM USING ARDUINO AND MATLAB

Than Than Min¹, Saw Kay Thwe Moe², Hnin Thae Mon³

¹ Than Than Min, Department of Electronic Engineering, Kyaukse, Myanmar

² Saw Kay Thwe Moe, Department of Electronic Engineering, Kyaukse, Myanmar

³ Hnin Thae Mon, Department of Electronic Engineering, Kyaukse, Myanmar

ABSTRACT

In this paper are using MATLAB with Arduino to control the Home appliances, through a Graphical User Interface in Computer. In computer side, this system used GUI in MATLAB to create some buttons for controlling home appliances. For communication between Arduino and MATLAB, first need to install the MATLAB and Simulink Support for Arduino or Arduino IO Package software. After installing files, create a GUI for Home Automation Project. Basically in GUI, in this system create push buttons for controlling the home appliances from computer. Buttons can be created by going into Graphical User Interface in New menu in MATLAB. Now after creating the buttons, when click on Run button in that GUI window The purpose of this paper is to develop the Graphical User Interface (GUI) of home automation through Matlab GUIDE, interface the Matlab GUI with hardware via communication port and control the DC motor and bulb through Matlab GUI. By using Matlab GUIDE, it provides a set of tools which simplify the process of laying out and programming GUIs and interface with Arduino UNO via serial communication port to control the DC motor and bulb. The main plan is to mechanically management and electronic home appliances. Many industrial and analysis versions of home automation system are introduced and designed. In this system, demonstrates interfacing between Matlab and Arduino board for household equipment monitoring and control. Arduino board is interfaced with Matlab using serial communication to control home appliances. Proper commanding is done from Matlab GUI, household equipments can be turned ON or OFF which are interfaced to Arduino through relay board, direction and speed control which are interfaced to Arduino through H bridge driver.

Keyword : - Arduino, MATLAB, GUI, DC motor

1. Introduction

Home automation is very promising field that is growing at faster rate. Home automation is a technology involving centralized and autonomous control of housing, buildings and industry, including safety features against various sudden unanticipated scenarios. Home automation basically incorporates an electronic control of household activities like control of electrical appliances, lighting, heating and air condition and security system. The rapid growth and application of control system has not been confined to industrial use but are implemented in personal and private spaces of people all around the world. In the present day, security systems play an important role in the protection of lives and investment. This is achieved by the incorporation of various subsystems into the security system with a single control unit such as surveillance, intruder control, access control, fire detection, etc. A smart home is one that is equipped with lighting, heating and electronic devices that can be controlled remotely by smartphone or via Bluetooth or Internet[4].

Home automation gives an individual the ability to remotely or automatically control things around the home. A home appliance is a device or instrument designed to perform a specific function, especially an electrical device, such as fan, for household use. Automation is today's fact, where things are being controlled automatically, usually the basic tasks of turning ON/OFF certain devices and beyond, either remotely or in close proximity. In this smart home automation system, the motors are controlled using Matlab GUI and Arduino UNO microcontroller. This instrument is the best for the power electronics lab for education purpose. The driver components are assembled and programmed through Arduino algorithm developed. The desired motors are connected; external power supply is required to power the relay cards and also the driver. The main unit of this drive is Arduino Board

UNO. It controls the panel of different motors using Matlab GUI (Graphical User Interface). A panel is designed in Matlab which serially communicates with Arduino microcontroller.

2. HARDWARE IMPLEMENTATION

2.1 Operation of Home Automation System using Matlab and Arduino

GUI (Graphical User Interfaces) is used as it provides control of software applications, eliminating the need to learn a language or type commands in order to run the application. Matlab applications are self-contained Matlab programs with GUI front ends that automate a task or calculation. It typically consists of controls such as menus, toolbars, buttons, and sliders. This paper can create our own custom applications, including their corresponding GUI. According to application, panels are created. GUI is designed in Matlab to control all motors, fan and bulb. First panel is for connecting and disconnecting COM port associated with Arduino, all the other panels are associated with respective motors controlling speed, direction, fan speed control and light control.

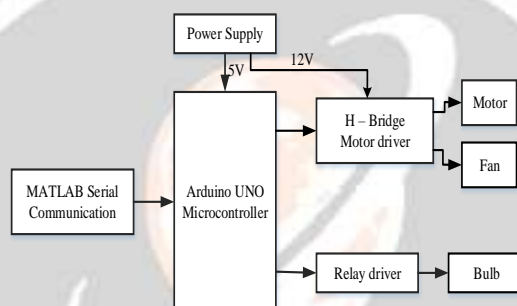


Fig -1 Overall Block Diagram

Different types of motors are interfaced with Arduino using PWM and digital pins which is then controlled by Matlab GUI. Interfacing is done along with different control driver ICs and relays. All this together forms a relay module and driver module. A power supply is also separately provided. The direction of DC motor is controlled by L298N IC whose ENABLE 2 pin is connected to PWM pin 6, input 3 is connect digital pin 7 and input 4 is connect digital pin 8 of Arduino, it controls speed and the direction of DC motor and ENABLE 1 pin is connected to PWM pin 10, input 1 is connect digital pin 3 and input 2 is connect digital pin 5 of Arduino, it controls speed of fan. ON/OFF of AC load is done using digital pin 13 so AC bulb is controlled by relay.

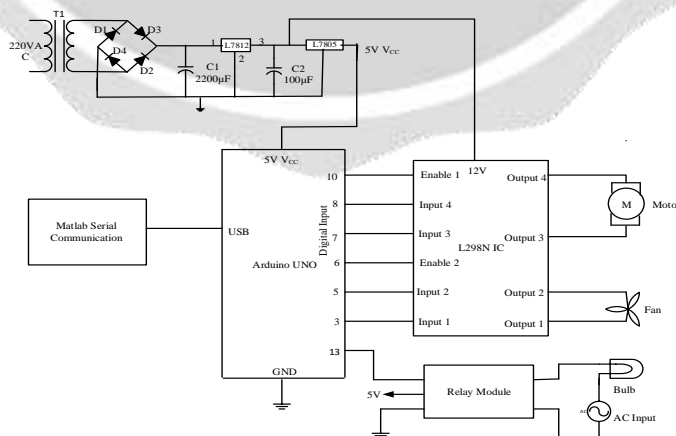


Fig- 2 Overall Circuit Diagram of System

3. SOFTWARE IMPLEMENTATION

3.1 Flow Chart of Motor Control

In this motor control system, the input is obtained from Matlab GUI. Microcontroller will receive input data from the Matlab GUI and will process it into output on the motor. The input of this Matlab GUI panel is the door open and door closed, then to set program on the desired command and output DC motor rotate limits. If the Matlab GUI panel is pressed door open button, then the door will open. If the Matlab GUI panel is pressed counter door close button, then the door will close. If the Matlab GUI panel is pressed stop button presses, then the motor will stop.

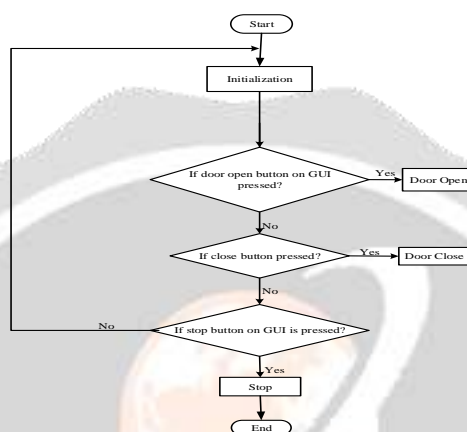


Fig- 3 Flow Chart of Motor Control

3.2 Flow Chart of Fan Speed Control

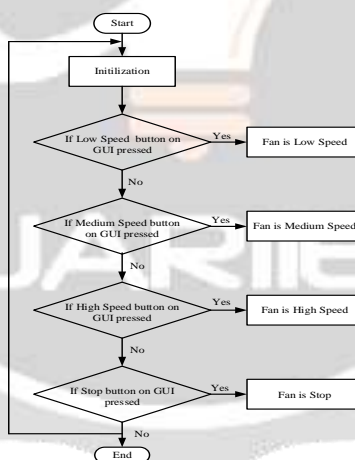


Fig- 4 Flow Chart of Fan Speed Control

In this fan speed control system, the input is obtained from Matlab GUI. Microcontroller will receive input data from the Matlab GUI and will process it into output on the fan. The input of this Matlab GUI panel is the low speed, medium speed and high speed, then to set program on the desired command and output fan speed rotate limits. If the Matlab GUI panel is pressed low speed button, then the fan will slowly rotate. If the Matlab GUI panel is pressed medium speed button, then the fan will medium rotate. If the Matlab GUI panel is pressed high speed button, then the fan will quickly rotate.

3.3 Flow Chart of Light Control

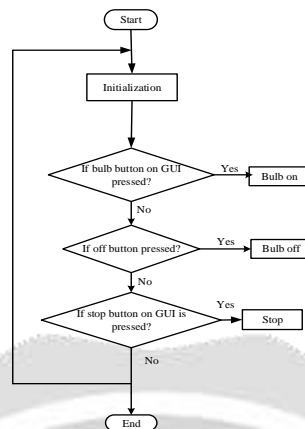


Fig- 5 Flow Chart of Light Control

In this light control system, the input is obtained from Matlab GUI. Microcontroller will receive input data from the Matlab GUI and will process it into output on the bulb. The input of this Matlab GUI panel is the ON and OFF, then to set program on the desired command and output AC light. If the Matlab GUI panel is pressed ON button, then the light is turned ON. If the Matlab GUI panel is pressed OFF button, then the light is turned OFF.

3.4 Open the Arduino IDE

Step I: From the Arduino IDE, go to File > Open, locate the file adioe.pde, (in the ArduinoIO/pde/adioe folder) and open it.

Step II: Connect the Arduino, make sure that the right board and serial port are selected in the IDE, (Tools/Board and Tool/Serial Port) then select File -> Upload to I/O Board and wait for the "Done Uploading" message



Fig- 6 Upload to I/O Board

3.5 Package installation in Matlab

When installing the Arduino IO package on your operating system it is important that users have the right to access the serial port and modify the pathdef.m files.

Step I: Run Matlab as administrator (just one time for the purpose of installing the package) by right-clicking on the Matlab icon and selecting "Run as Administrator". This will allow the updated path to be saved.

Step II: Then from Matlab, launch the "install_arduino" command, this will simply add the relevant ArduinoIO folders to the Matlab path and save the path.

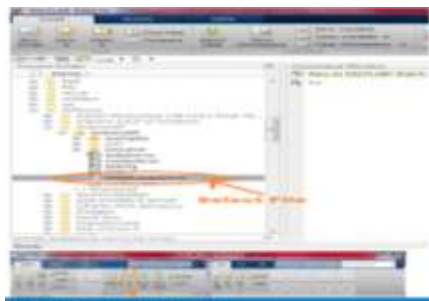


Fig-7 Install.arduino.com

4 TEST AND RESULT

The security panel designed by MATLAB GUI is given above which consists of several pushbutton, radio button and check box. Figure 8 shows Graphical User Interface designed in MATLAB to home automation system.



Fig-8 Create GUI Design

Table 1 Description of GUI Element

Sr No	Element	Description
1	Pushbutton1	Door Open
2	Pushbutton2	Door Close
3	Pushbutton3	Motor Stop
4	Radio button1	Fan Low speed
5	Radio button2	Fan Medium speed
6	Radio button3	Fan High speed
7	Radio button4	Fan Stop
8	Check Box1	Bulb ON
9	Check Box1	Bulb OFF

Figure 9 shows system status when pushbutton 1 pressed door is close, pushbutton 1 is designed MATLAB GUI. Figure 10 shows system status when pushbutton 2 pressed doors is open, pushbutton 2 is designed MATLAB

GUI. Figure 11 shows system status when radio button 1 and check box 1 pressed fan is low speed and bulb ON, radio button 1 and check box 1 are designed MATLAB GUI. Figure 12 shows system status when radio button 2 and check box 1 pressed fan is medium speed and bulb ON, radio button 2 and check box 1 are designed MATLAB GUI. Figure 13 shows system status when radio button 3 and check box 1 pressed fan is medium speed and bulb ON, radio button 3 and check box 1 are designed MATLAB GUI. Figure 14 shows system status when check box 1 pressed bulb ON, check box 1 is designed MATLAB GUI. Figure 15 shows system status when check box 2 pressed bulb OFF, check box 2 is designed MATLAB GUI.



Fig-9 System Result with Door Close



Fig-10 System Result with Door Open



Fig-11 System Result with Two Device ON (Fan is High Speed and Bulb ON)



Fig-12 System Result with Two Device ON (Fan is Medium Speed and Bulb ON)

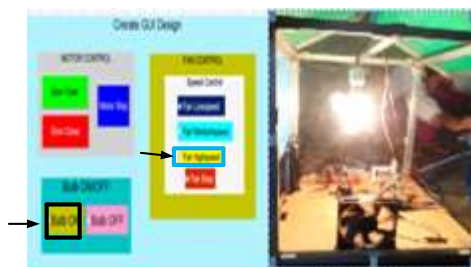


Fig-13 System Result with Two Device ON (Fan is Low Speed and Bulb ON)



Fig-14 System Result with One Device ON (Bulb ON)



Fig-15 System Result with One Device ON (Bulb OFF)

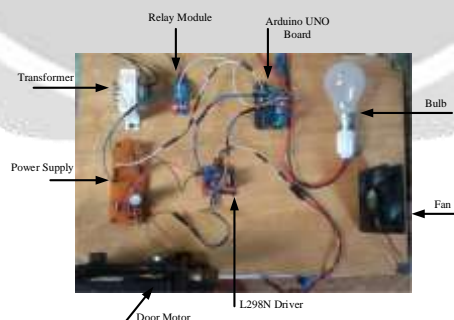


Fig-16 Practical View of the hardware

5. Conclusion

In this thesis presented a system which is developed with Matlab Arduino interface to control simple home appliances. The GUI designed in Matlab allow user to turn ON and OFF interfaced devices and shows current status of these devices check box, speed control interface devices and show of these device radio button and door open,

close interface devices and show of these device push button. Radio button in one panel which are low speed, medium speed and high speed Thus system presented in this thesis is useful to understand basic hardware interfacing and controlling with Matlab Arduino interface.

The purpose of this thesis was to create an interactive GUI to control the home automation system. Also a visual aid is more appealing and our aim was to make it interactive. the GUI can be extended to other purposes also and not only learning about the dc motor. It can be used for learning dc motors, relay, H bridge driver and other. The use of a GUI through Matlab is quite extensive as it can be coupled with other toolboxes in Matlab quite effectively

6. ACKNOWLEDGMENT

The author would like to thank to their parents and their colleagues. The author has to express out appreciation to their candidate for hard working during the course of this research.

7. REFERENCES

- [1] Anonymous: *DC Motor Basics*, June, 2018, <https://www.groschopp.com/dc-motor-basics/>
- [2] Adriansyah, A.; Dani, A.W., "Design of Small Smart Home system based on Arduino", *Electrical Power, Electronics, Communications, Controls and Informatics Seminar (EECCIS)*, 2014, Malang, pp.121 – 125, 27-28 Aug. 2014
- [3] Anonymous: *All about IC 7805 Voltage Regulator*, October, 2017, <https://electronicsforu.com/resources/learn-electronics/7805-ic-voltage-regulator>.
- [4] Neaz Md. Morshed, G.M. Muid-Ur-Rahman-"Microcontroller Based Home Automation System Using Bluetooth, GSM, WiFi and DTMF"- Department of ECE, North South University, Dhaka, Bangladesh. Proceedings of 2015 3rd International Conference on Advances in Electrical Engineering
- [5] Selasa: *Keypad 4x4 Matrix di Arduino Uno*, June, 2016, <http://at-moproduction.blogspot.com/keypad-4x4-matrix-di-arduino-uno.html>.