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Home Automation with MATLAB and ARDUINO Interface

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ABSTRACT: Home automation trade has drawn goodish attention of researchers for quite a decade. The main plan is to mechanically management and monitor electrical and electronic home appliances. Consistent with the marketing research firm ABI regarding 4 million home automation systems were subscribed globally in 2013.An equivalent firm additionally calculable that regarding 90 million homes would use home automation system by top of 2017,Many industrial and analysis versions of home automation system are introduced and designed. Good home system has captured many technologies. Main aim of this paper is to propose a system which demonstrates interfacing between MATLAB and Arduino board for household equipment monitoring and control. In proposed system, Arduino board is interfaced with MATLAB using serial communication to control home appliances. Image acquisition device is interfaced to MATLAB that will continuously show the status of household equipments on Graphical User Interface [GUI] designed in MATLAB. Proper commanding is done from MATLAB GUI, household equipments can be turned ON or OFF which are interfaced to Arduino through relay board.

KEYWORDS: Arduino, MATLAB, Automation, Condition monitoring, Computerized Monitoring, Appliances control

I. INTRODUCTION

The Home automation market is very promising field that is growing at faster rate [8] [9] [10]. Lot of discussion has been carried out about home automation systems. It shows that, home automation is a technology involving centralized & autonomous control of housing, buildings and industry, including safety features against various sudden unanticipated scenarios [9]. Home automation basically incorporates an electronic control of household activities like control of electrical appliances, lightning, central heating & air conditioning and security system. The rapid growth and application of control systems has not been confined to industrial use but also implemented in personal and private spaces of people all around the world. The idea of autonomous home has been one of the most desirable technologies in life of human beings and considerable improvements have been made in this field. [14].The system presented in this paper shows continuous monitoring and control of home appliances with Arduino Matlab interface. Realizing the hardware potential, software suppliers Like Mathworks and National Instruments have included the Arduino package on the software accessories of MATLAB and LAB View [13].

II. LITERATURE SURVEY

In 21st century, various system implementations are present for home automation with wired as well as wireless communication as key element. A comparative analysis on most common and recent techniques that have been implemented in field of home automation systems along with advantages and disadvantages of each [3] [9]. A novel architecture for a home automation system is presented and implemented in [11] using Zigbee technology which lowers the expense of system and the instructiveness of respective systems. Generally advanced aged people have more needs than middle aged people. Thus efforts are made to improve home automation system by using Z-wave technology to transfer data in home network to have control over devices [1]. A system architecture presented in [4] provides control over networked devices which can be controlled securely via

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internet. An intelligent automation system using Google cloud messaging server and android operating system uses a local device to transfer a signal to home appliances, a webserver to store customer and mobile smart device running android application as the emerging technology in home automation [2]. As Speech processing with MATLAB and android application plays very vital role to support home automation system, a system presented in [6] [7] uses speech processing and speech recognition to control electrical appliances. System architecture developed in [5] consists of ATMega16 as brain of system along with different supporting hardware's like remote controller, touch screen, temperature and humidity sensor, speed regulator. As per commands forwarded by user through touch screen all home appliances can be controlled manually .the system also works with complete automotive mode by detecting presence of human beings according to given commands. Now a day's many systems are implemented which uses simple image processing algorithm designed in MATLAB and hardware control support through MATLAB-Arduino interface [8].

III. SYSTEM IMPLEMENTATION

System presented in this paper mainly contains Arduino board as brain of system which gives signalling to relay board to turn ON/OFF required device which is 230v 60W bulb, and 12 V dc motor. Necessary commanding signals are given through MATLAB to Arduino board via serial communication. Status of prototypes architecture is monitored continuously using Web cam which uses image acquisition toolbox of MATLAB. System diagram of presented system is as shown in figure 1.

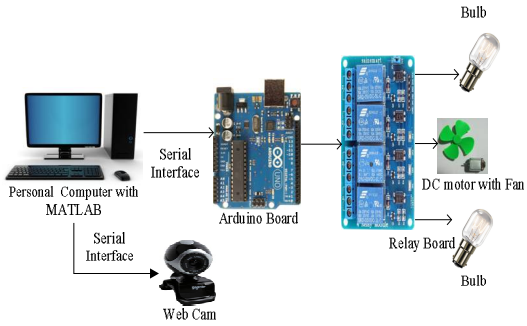

Figure 1. System diagram of presented system

3.1 Software Implementation:

For System proposed in this paper, Arduino board is configured as server to have proper interfacing with MATLAB. Required program implementation is done in MATLAB with Graphical User Interface which gives feasibility to User. The detailed work flow for software implementation is as shown in figure 2.

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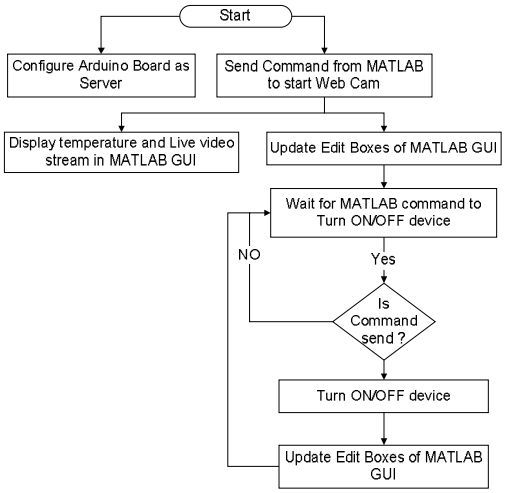

Figure 2: Work flow of proposed system

3.2 Hardware Implementation:

3.2.1 Arduino Board:

Figure 3: Arduino Uno Board

The Uno is a microcontroller board as shown in figure 3 based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

3.2.2 Web Camera:

Figure 4: Web Camera

The web camera used in proposed system is as shown in figure 4 which featured with a 2.0 megapixel sensor that provides smooth videos, sharp pictures, clear sound and rich colors. It has an effective resolution of 300 kilopixels, interpolated resolution of 16 megapixels and a maximum video resolution of 640 x 480. The stand for easy mounting on monitors or any flat panel object. The cable can be extended up to 4 feet so you can place the camera in the best possible location that will suit your needs.

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3.2.3 Relay Board :

Figure 5: Relay Board

A 5V 4-Channel Relay interface board used in proposed system, This board is able to control various appliances, and other equipments with large current. It can be controlled directly by various Microcontrollers like Arduino , 8051, AVR, PIC, DSP, ARM, ARM, MSP430, TTL logic.

3.2.4 Bulb :

Figure 6: Electric Bulb

The electric bulb of 230v 15w used in proposed system is as shown in figure 6.

3.2.5 DC Motor:

Figure 7: DC motor with Fan

The motor interfaced to Arduino in proposed system is as shown in figure 7 which often used on small models and are ideal for educational applications or for experimental use.Motor is a stout DC motor useful in many hobbyist projects such as radio controlled vehicles, robotics, model-building, home automation, and etcThe 2 mm shaft can be used to attach with fan supplied connection is via 2 tags on the back of the motor. The two flat sides enable easy mounting onto a panel or PCB**.**

IV. RESULTS

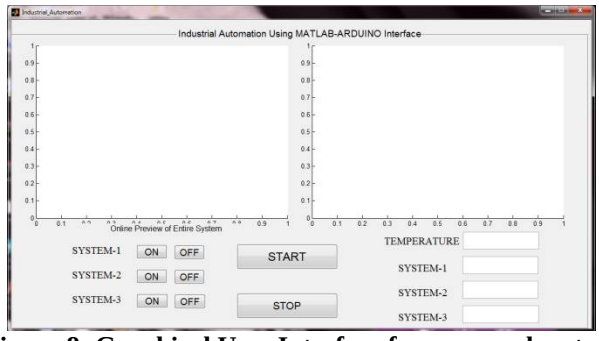

Figure 8: Graphical User Interface for proposed system

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Figure 8 shows Graphical User Interface designed in MATLAB to support proposed system. Table 1 shows the description of elements present in designed GUI.

Table 1: Description of GUI elements

Sr No.	Element	Name	Description
1	Axis- 1	Video Preview	Shows live monitoring of system
2	Axis- 2	Temperature Graph	Shows graph of sensed temperature
3	Pushbuttons -1	START	To start system
4	Pushbuttons -2	STOP	Stops system
5	Pushbuttons 3,5,7	ON	To Turn ON required device
	Pushbuttons 4,6,78	OFF	To Turn OFF required device
6	Edit Box-1	-	Displays Temperature
7	Edit Box 2,3,4	-	Displays status of device [ON/OFF]

Figure 9: Complete System Set up

Figure 9 shows complete system setup as per block diagram. It consist of Laptop, home appliances such as 230v 50Hz bulb(2 in Nos.) and 12 v dc motor representing as fan as shown in figure 10

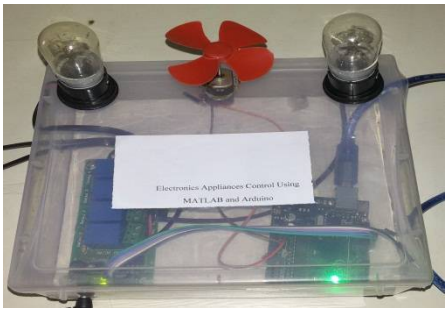

Figure 10: Electronics Device Setup

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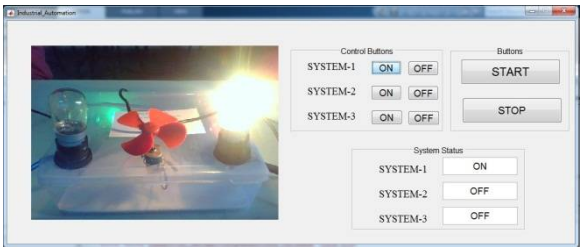

Figure 11: System Result with one Device ON

Figure 11 shows system status when pushbutton 1 is turned ON. Corresponding to this bulb 1 is turned ON and same will be reflected in edit box of designed GUI.

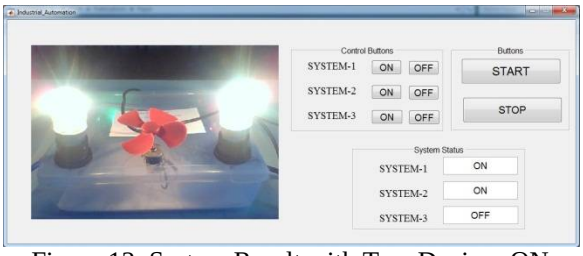

Figure 12: System Result with Two Devices ON

Figure 12 shows system status when along with pushbutton 1, pushbutton 2 is turned ON. Corresponding to this bulb 1 and bulb 2 are turned ON and same will be reflected in edit box of designed GUI.

Figure 13: System Result with All Devices ON

Figure 13 shows system status with all appliances are turned ON and same will be reflected in edit box of designed GUI.

IV. CONCLUSION

In this paper, we presented a system which is developed with MATLAB-Arduino interface to control simple home appliances. Webcam is interface and access through MATLAB to have continuous monitoring of whole system setup. The GUI designed in MATLAB allow user to turn ON and OFF interfaced devices and shows current status of these devices in edit box. Thus system presented in this paper is useful to understand basic hardware interfacing and controlling with MATLAB-Arduino interface.

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