ONE TOUCH DEVICE CONTROL MODULE WITH AUTHENTICATION FOR ELDER PEOPLE

[1]SANKAR KUMAR S, [2]SUBHASHINI G, [3]SARANYA S

Department of Electronics and Communication Engineering
Velammal College of Engineering and Technology, Madurai-625009, Tamil Nadu
E-mail: sankaraa@vcet.ac.in, gsubhashini17@gmail.com,sriisaranya@gmail.com

Abstract: There are several human disabilities in nature due to ageing such as movement, poor vision etc. lead to reduction or loss of the degrees of elder people freedom and decrease the quality of their life. Main objective of this proposed work is to design and develop a touch screen based system for elder people exclusively which allows the user comfortably to monitor and control the electric loads, which are at long range just by touching the screen on the handheld portable device without moving here and there and thereby increase their life quality through their active contribution towards the family with which they bound. Even though there are various type remote controllers, they enhance the complexity to the elder people in searching the correct control button among several small buttons due to poor vision. To overcome this complexity, this paper introduces a touch screen based control system. Moreover, to avoid the system usage by an unauthorized person, authentication feature is introduced, which makes this system a highly secured one. The developed system can create safe, intelligent, portable, user friendly, low cost and of course low power consumption.

Keywords: Elder people, Touch Screen, Intelligent, Authentication

I. INTRODUCTION

With the advent of science and technology, people especially the elder people need to use modern high technology to improve their quality of life and expand freedom of life. Since most of them lives home bound and don't tend to venture out in the neighborhoods, their world gets smaller. Besides, their health concerns such as limited mobility, arthritis, vision and/or hearing problems, which may hinder their everyday tasks and so the current younger society thought that they are useless and frail. This intelligent system is developed based on such thought on elder people, to make them an active member in their family by active contribution towards their family with which they bound and live longer, healthy and happy. So many electrical devices in the homes require as many remote controllers to control them individually. Through this portable hand-held system handling, electrical energy saving can be achieved during the absence of family members, by comfortably controlling the electrical home appliances, which are at long range, in single touch without moving here and there. This user friendly system comprises Touch screen module, Microcontroller and Radio Frequency (RF). The microcontroller and RF wireless modules together create ease of operation in single touch and do not influence the health concerns of the geriatric. Moreover, since this system is based on touch screen, anybody even a child can touch it and hence gets operated which leads somehow towards hazardous moments. So, in order to avoid such situations and also the system usage by an unauthorized person, authentication is provided to make this system a highly secured one. This intelligent, hand-held, user friendly, cost efficient, energy saving design is developed with touch screen sensor along with microcontroller and communication technologies for elder people assistant.

II. EXISTING COMMUNICATION METHODS

The existing device control systems were developed using various communication technologies such as Network management, Power line, Global System for Mobile Communication (GSM), Bluetooth etc., which are discussed and implemented with some limitations, which are given below towards the control of electrical devices and not focused on security and safety measures of the control device.

Network Management

The use of java technology incorporates built-in network security features. But it requires an intrusive and expensive wired installation. This system architecture generally incorporates a personal computer for the purpose of network management and provision of remote access. It increases the overall fiscal expense and adds complexity to the system. Also it has a lack of network interoperability in monitoring activities, which leads to three potential problems such as duplication of monitoring activities, possibility of interference between coexisting networks and offers limited flexibility in controlling the devices.

Power line

The use of Power line communication limits the positioning of devices within the home to areas in close proximity to power sockets. It can disturb and create problems over power line communications, if a noisy home appliance is connected to the power line. The power line could be unstable, if the house is near an electric closet.

GSM

It is an expensive way to control home appliances. Multiple users share the same bandwidth and it needs high data rate for transmission. The transmission can encounter interference which causes electronic interference. It can interfere with certain electronics, such as pace makers and hearing aids. Such interference is due to the fact that GSM uses a pulse-transmission technology.

Bluetooth

This architecture reduces the amount of physical wiring required and the intrusive installation. However, it does not completely ease the intrusiveness of the installation due to the incorporation of some wired communications. Moreover, the sharing of a single Bluetooth module between numerous devices has the disadvantage of incurring an access delay.

III. PROPOSED COMMUNCICATION METHOD

RF refers to the frequencies that fall within the electromagnetic spectrum associated with radio wave propagation. When applied to an antenna, RF current creates electromagnetic fields that propagate the applied signal through space. Any RF field has a wavelength that is inversely proportional to the frequency. This means that the frequency of an RF signal is inversely proportional to the wavelength of the field. RF Transmitter and Receiver work at 433 MHz, because remote control employs a frequency modulation (FM) radio frequency of 433 MHz transmission that has a strength range of 400 meters outdoors or 200 meters indoors [through a wall] to operate any electronic /electric relay driven gadget through a radio frequency decoder. 433 MHz frequency can be produced by a small (size of a postage stamp) simple 4 bit chip that has no complicated circuit and better than complex inconvenient ones for higher range. 433 MHz frequency modulation radio waves are best suited for short range applications and therefore useful for short range use 433MHz (433.92MHz in fact). The 433 MHz RF Transmitter allows users to easily send serial data or other information wirelessly.

IV. PROPOSED SYSTEM

Considering all the limitations of above mentioned communication technologies and the user's ease of operation, it is proposed to introduce a better one which would suit this proposed work, which is RF communication technology along with the Touch Screen module to control the electrical devices and also focused towards authentication to enhance the security as an added feature.

The functional block diagram of this hand-held Touch screen based device control module, which comprises Touch Screen, PIC Microcontroller, RF Transmitter and Receiver modules along with drivers with four loads to be controlled, is shown in Fig.1 (a) and (b) respectively.

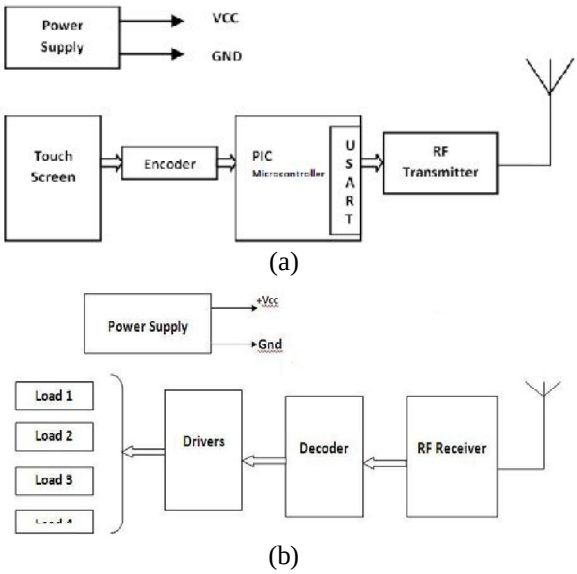


Fig.1 Functional Block diagram of proposed system (a) Transmitter Module and (b) Receiver Module

Touch Screen

A touch screen is a transparent screen that is sensitive to human touch, allowing a user to interact with the device by touching pictures or words on the screen and this technology is designed to help individuals who have difficulty manipulating keyboard / keypad. Since our proposed system is for elder people, who also have the difficulty of operating remote control keypads, we introduce this touch screen technology to make the user's interaction with the device towards control of the loads comfortable by single touch.

Though there are several types like Resistive, Capacitive and Surface acoustic wave, considering the physique and poor vision of elder people, a pressure sensitive 4-wire resistive touch screen with 75% clarity is recommended in the proposed system, in order to avoid incidental touches.

Resistive Touch Screen

A resistive touch screen is composed of many layers, as shown in Fig.2. The two most important layers are made of a flexible polymer which are coated with a resistive material and are separated with an air gap or microdots. The resistive material is applied in lines on each sheet and they are placed perpendicular to each other.

When a person touches their finger to a resistive touch screen, the two layers are pressed together, and the points of intersection on the two layers allow the processor to accurately measure the position of the touch.

When pressure is applied to the screen, a uniform voltage is applied to the first sheet, and the second sheet measures the voltage as distance along the first

sheet, which gives the X coordinate. Similarly, when the X coordinate has been ascertained, a voltage is applied to the second sheet, and the first sheet is used to measure the distance, which gives the Y coordinate. These measurements take place in only a few milliseconds, which means that a touch is registered as soon as contact is made.

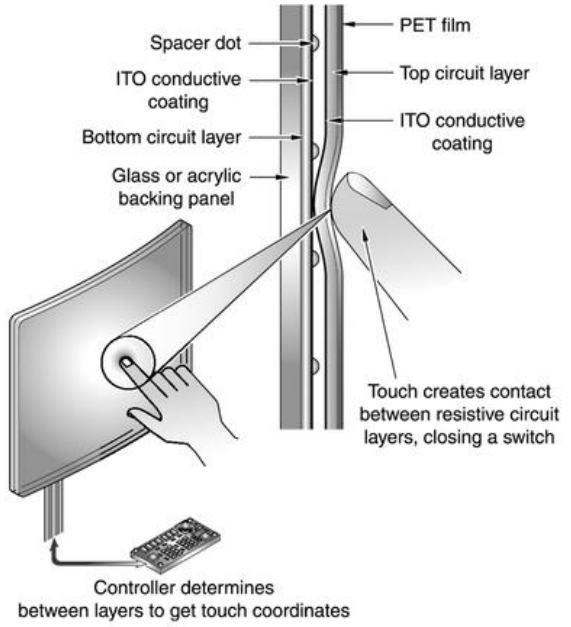


Fig.2 Resistive Touch Screen

Since these types of touch screens rely on a point of contact between the two resistive layers, any pointing device like a finger or stylus can be used on them. These screens are also quite inexpensive to manufacture as they don't require specialized components. Due to the design of these screens, registering multiple points of contact was not possible due to vectoring issues. However, new technology is now available that overcomes these vectoring issues and allows multiple points of contact to be measured.

Since the output of Resistive Touch Screen is analogous, it should be converted into digital form which would be compatible to any microprocessor/microcontroller. Microcontroller is device, which is specially designed for performing particular task, a computer-on-chip, usually comprises of I/O ports, RAM, ROM and CPU also. For a portable, simple, user friendly application design, microcontroller is widely preferred for various fields. Moreover, microcontrollers are built using Complementary Metal Oxide Semiconductor (CMOS) Technology resulting optimum performance with the least consumption of power. Because of single dedicated task design, the latency of the task is fast and more reliable.

PIC Microcontroller

In our proposed system, to convert the analogous output from 4-wire touch screen into digital, as a touch screen controller, to process the data from touch screen and control the devices accordingly, an appropriate microcontroller, which is PIC 16F877, an 8-bit Microcontroller, a high performance Reduced Instruction Set Computer (RISC) CPU with Low power, high speed CMOS FLASH, RAM and EEPROM technology, 10-bit in-built Analog-to-Digital Converter, 30 I/O lines, 3 timer/counter and PWM modules, is recommended. With the use of PIC16F877, it is possible to design both touch screen controller and load controller instead of using two different controllers, which lead to complexity as well as more power consumption.

Flowcode for PIC

Flowcode for PIC is a very high level language programming system for PIC microcontrollers based on flowcharts. Flowcode allows to design complex PIC based control systems by simply drawing a flowchart of the desired program in a matter of minutes even without any prior programming skills. Flowcode is built on a C compiler - C2C. The advantage of using Flowcode is, having the skill on C language and hardware description of the design, being unskilled in assembly language programming, can develop coding for the desired application.

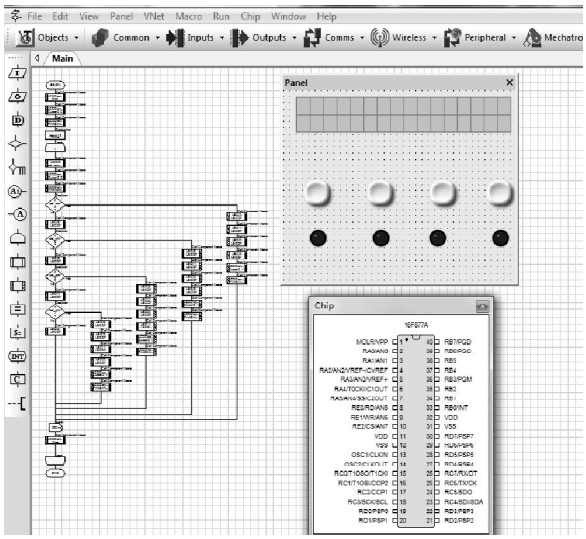


Fig. 3 Developed Flowcode for our proposed system

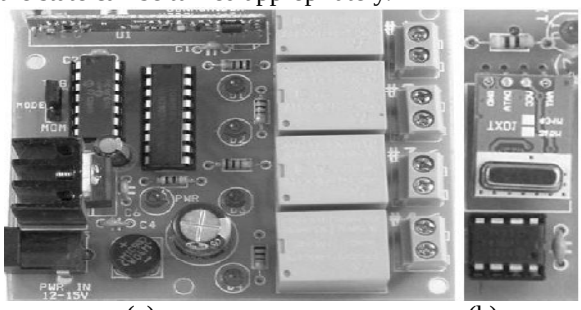
The PIC16F877A is utilized in the proposed system, which is made by Microchip as a main controller to control the entire system. The programming of PIC16F877 is developed using **Flowcode** (v4.2.3.58) for PIC, a PIC development environment with an intuitive graphical interface that allows developing programs for PIC microcontroller level block diagrams. This environment allows easy creation of programs by simply dragging and dropping icons on the required block diagram and the developed program has been burnt into PIC16F877 using PIC burner. The Flowcode developed for our proposed system is shown in Fig. 3.

RF Transmitter & Receiver

Based on the output of PIC microcontroller after encoding, RF transmitter shown in Fig. 4(a), which has onboard antenna for signal transmission,

transmits the encoded signal to remote control and at the receiver end the signal will be decoded to operate the relays appropriately.

RF Receiver module, shown in Fig. 4(b), is developed with relay to control the electric devices, because relay contact can control any equipment in momentary mode (On till key pressed) or Toggle Mode (Toggle on each key press). Each relay has indicator LED showing current status. At the receiver end the RF receiver module extracts the data signal from the carrier frequency. Decoder IC decodes this signal and sets the corresponding output high. This active HIGH output is used to operate a relays via ULN2003 which is a transistor array. Since, our proposed work is to change the mode of load (i.e) ON-to-OFF / OFF-to-ON, the receiver module should have the latching facility, for which a flip-flop based circuit is introduced, so that on receipt of RF signal the state can be turned appropriately.



(a) (b)

Fig. 4 RF Modules (a) Transmitter (b) Receiver

V. DEVELOPED ALGORITHM

Step 1: Get the user password and perform Authentication
Step 2: If authentication is failure, go to step 1
Step 3: Else unlock the system for controlling the loads
Step 4: Initialize the I/O ports
Step 5: Start timer and wait for input from module by the user
Step 6: If there is no input from the module before the timer expires, then go to standby mode
Step 7: Else, read the coordinates from the touch screen module
Step 8: Based on the coordinates, change the status (ON/OFF) of the respective load(s)
For example, 2 x 2 matrix touch screen module

- If the coordinate is from II quadrant, then change the status of load1
- Else if it is from I quadrant, then change the status of load 2
- Else if it is from III quadrant, then change the status of load 3
- Else if it is from IV quadrant, then change the status of load 4

Step 9: Go to step 6 to read the next coordinate
Step 10: Check for user's lock; if yes, lock the module and go to 1.
Step 11: Else wait for predefined time and after that lock the module automatically and go to step 1.

VI. RESULTS AND FUTURE WORK

As an initiative, the characteristics study of the touch screen is experimented as a whole for one touch and the corresponding digital output from controller observed and the performance is up to the requirement. Later, performance study took over 4 sections by splitting the touch screen into four portions column wise. Each portion is numbered as 1, 2, 3 and 4 based on the voltage range obtained, as shown in Fig.5.

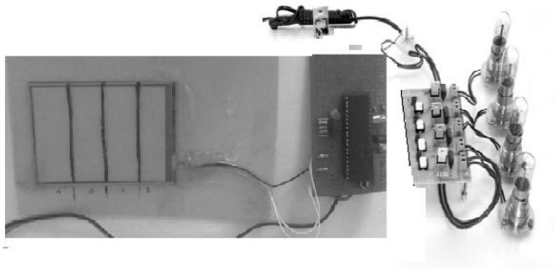


Fig.5 Proposed system – Developed so far

For the separated portions, studies were made on the consistency and the output result is also up to the requirement. Based on the study of 4 portions, the major part of our proposed system, the authentication, without any additional hardware, for which the coding has been developed with Flowcode for a 4-digit password, which is shown in Fig. 6 and the same is burnt into the PIC microcontroller and tested. It is observed that the authentication part is working satisfactorily.

Study on the Taylor made RF Transmitter and Receiver modules for about 100 m range is made and the results were recorded. In the receiver module, the additional Flip-Flop part circuitry is supposed to be added for latching, in order to change the state of the loads under control and finally after combining the Touch Screen Controller and the RF module, the complete module will be tested with appropriate Flowcode up to the relay switching, with which the load are connected.

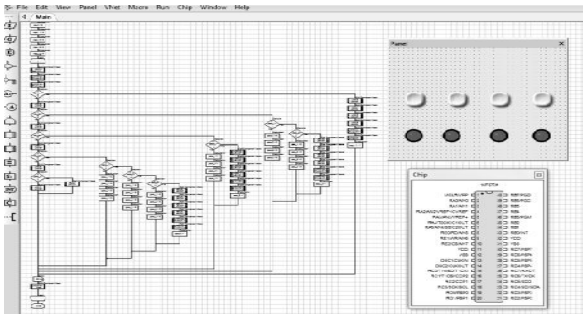


Fig.6 Flowcode for Authentication

In the enhanced version of our work, a module is to be proposed for a person who is bedridden, usually needs full-time care and attention and remain immobile unless they are helped by their family, friends or medical staff, which allows the user comfortably to enable/disable the loads for watching TV, listening to music, and to have communication with the medical staff, food court staff etc., which are at long range just by touching the screen on the handheld portable device without mobility.

CONCLUSION

A touch screen based prototype device control has been developed that allows users, the elder people, to control the surrounding artifacts of their home using single touch. The resistive touch screen solves the problems of multiple contacts and accidental activation of functions of the touch screen. As future work, to enhance the module security biometric authentication is proposed and expansion by means of subset matrix to control the functions of each selected device.

REFERENCES

[1] Khusvinder Gill “A Zigbee Based Home Automation System”, IEEE Transaction on Consumer electronics, May 2009

[2] Ali Ziya Alkar “An Internet based Home Automation System for Multi functional Devices” in 2005

[3] A.Alherish “Design and implementation of Home Automation System” in 2004

[4] K.Balasubramanian " Analysis of Remote Control Techniques Employed in Home Automation and Security Systems" in IEEE Transactions on Consumer Electonics,Aug 2009

[5] Dae-Man Han "Smart Home Energy Management Electronics,in IEEE Transactions on Consumer Electronics,Aug 2010

[6] Khusvinder Gill "A Zig Bee-Based Home Automation System,in IEEE Transaction on Consumer Electonics,May 2009

[7] A.Alheraish "Design and Implementation of Home Automation System",in IEEE Transaction on Consumer Electronics,Nov 2004

[8] Elena Mainardi “Design of portable touch screen interface for power line domestic systems “ in 4th IEEE conference on Automation Science and Engineering, USA ,Aug 2008

[9] Juan Pablo cotre “Developing a touch screen based domotic tool for users with motor disabilities” in 2012 Nineth International conference on IT

★★★