Resistive Touch Screen Based Home Automation System Design

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Abstract: Human and computer interaction has been developed into a wide and sophisticated field. Earlier automating electrical devices were completely mechanical. But with the invention of computer system, many computer researchers have tried to create computer based intelligent systems to accomplish many of their functionalities. Touch screen controlled home automation system is one of them. These fascinating efforts to create intelligent systems is to provide human being a more convenient & comfortable life. Moreover, it would accelerate the working speed of users.

This paper concentrates primarily on experimental experiences on home automation system with a low-cost [resistive] touchscreen technology. The proposed system provide an environment in which user can give commands by touching desired position on the touchscreen to automate the control of electrical devices. The interfacing circuit is designed using electronic components available in local market to keep the cost at low level.

Introduction:

The paper mainly aims in designing completely automated switch board with the help of touch screen sensor to control the house hold appliances to operate the devices effectively to provide a user friendly environment. It majorly aims in providing a reliable system for illiterates and old people who finds difficulty in operating few high end devices like washing machine, microwave oven etc.

Touch screen based devices can be easily reachable to the common man due to its simpler operation, and at the same time it challenges the designers of the device. These touch screen sensors can be used as a replacement of the existing switches in home which produces sparks and also may results in fire accidents in few situations.

Considering the advantages of touch screen sensors an advanced automation system was developed to control the appliances in the house. The device consists of a microcontroller, which is interfaced with the input and output modules, the controller acts as an intermediate medium between both of them. So the controller can be termed as a control unit. The input module is a touch screen sensor, which takes the input from the user and fed it to the microcontroller. The output module is the appliances to be controlled.

In my circuit, a touch panel is interfaced to the microcontroller which sends ON/OFF commands to the microcontroller where loads are connected. By touching the specified portion on the touch screen panel, the loads can be turned ON/OFF. The microcontroller used here is from PIC16F family. The loads are interfaced to the microcontroller using opto-isolators and triacs.

History of Home Automation:

The emergence of electrical home appliances began between 1915 and 1920; the decline in domestic servants meant that households needed cheap, mechanical replacements. Domestic electricity supply, however, was still in its infancy - meaning this luxury was afforded only the more affluent households.

In 1966 Jim Sutherland, an engineer working for Westinghouse Electric, developed a home automation system called “ECHO IV”; this was a private project and never commercialized. The first “wired homes” were built by American hobbyists during the 1960s, but were limited by the technology of the times. The term "smart
"house" was first coined by the American Association of House builders in 1984.

With the invention of the microcontroller, the cost of electronic control fell rapidly. Remote and intelligent control technologies were adopted by the building services industry and appliance manufacturers worldwide, as they offer the end user easily accessible and/or greater control of their products. While there is still much room for growth, according to ABI Research, 1.5 million home automation systems were installed in the US in 2012, and a sharp uptake could see shipments topping over 8 million in 2017.

About Home Automation Using Touch Screen

The main objective of this paper is to develop a home automation system with a touch screen based control panel.

As technology is advancing so houses are also getting smarter. Modern houses are gradually shifting from conventional switches to centralized control system, involving touch screen switches. Touch screen control panels are also designed for commercial, industrial and medical systems.

Home automation (also called domotics) is the residential extension of "building automation". It is automation of the home, housework or household activity. Home automation may include centralized control of lighting, HVAC (heating, ventilation and air conditioning), appliances, and other systems, to provide improved convenience, comfort, energy efficiency and security. Disabled can provide increased quality of life for persons who might otherwise require caregivers or institutional care.

Further it can be enhanced by using GSM modem interfaced to the control unit. Using GSM modem, the user can control home appliances by sending an SMS.

Need Of Automation

Earlier, we looked into the face of future when we talked about automated devices, which could do anything on instigation of a controller, but today it has become a reality.

An automated device can replace good amount of human working force, moreover humans are more prone to errors and in intensive conditions the probability of error increases whereas, an automated device can work with diligence, versatility and with almost zero error. Replacing human operators in tasks that involve hard physical or monotonous work.

Replacing humans in tasks done in dangerous environments (i.e. fire, space, volcanoes, nuclear facilities, underwater, etc) Performing tasks that are beyond human capabilities of size, weight, speed, endurance, etc

Economy Improvement

Automation may improve in economy of enterprises, society or most of humankind. For example, when an enterprise that has invested in automation technology recovers its investment, or when a state or country increases its income due to automation like Germany or Japan in the 20th Century.

This is why this paper looks into construction and implementation of a system involving hardware to control a variety of electrical and electronics system.

Touch Screen

Touch screen or touch activated technology has been around for a few decades now, but only recently prices have dropped and the technology is in great use.

As an input device touch screens offer a more natural interaction that humans are used to, which offers a great advantage for businesses selling to the general public over traditional keyboards and mouses.

This article will look at how to interface to a 4-wire resistive touch screen and find out the X and Y coordinates of the current point being touched. A minimal number of parts will be used to simplify the system hardware, and to focus more on the theory of how it works.

Determination of XY-Coordinates Touch Panel

A touch panel is a thin, self-adhesive transparent panel placed over the screen of a graphic LCD. It is very sensitive to pressure so that even a soft touch causes some changes on output signal.

There are a few types of touch panel. The simplest one is the resistive touch panel which will be discussed here.
Principle Of Operation

A resistive touch panel consists of two transparent rigid foils, forming a “sandwich” structure, that have resistive layers on their inner sides. The resistance of these layers usually does not exceed 1KΩ. The opposite sides of the foils have contacts available for use through a flat cable. The process of determining coordinates of the point in which the touch panel is pressed can be broken up into two steps. The first one is the determination of the X coordinate and the second one is the determination of the Y coordinate of the point. In order to determine the X coordinate, it is necessary to connect the left contact on the X surface to ground and the right contact to the power supply. This enables a voltage divider to be obtained by pressing the touch panel. The value of the divider is read on the bottom contact of the Y surface. Voltage can be in the range of 0V to the power supply and depends on the X coordinate. If the point is closer to the left contact of the X surface, the voltage will be closer to 0V. In order to determine the Y coordinate, it is necessary to connect the bottom contact on the Y surface to ground, and the upper contact to power supply. In this case, the voltage is read on the left contact of the X surface.

Connecting To Microcontroller

In order to connect a touch panel to the microcontroller(PIC16F877A) it is necessary to create a circuit for touch panel control. By means of this circuit, the microcontroller connects appropriate contacts of the touch panel to ground and the power supply (as described above) in order to determine the X coordinates.

Considering that the touch panel surface is slightly larger than the surface of the graphic LCD, in case you want greater accuracy when determining the coordinates, it is necessary to perform the software calibration of the touch panel.

PIC MICROCONTROLLERS

- Very lean instruction set – only 35 instructions
- All instructions are single-cycle instructions except branching which are two.
- Crystal frequency : DC – 20 MHz clock frequency
  DC – 200 ns instruction cycle

Analog Features:
- It has 8-channel 10- bit formatted [right or left aligned] Analog-to-Digital Converters (A/D)
- There are two analog comparators
- Programmable on-chip voltage reference (VREF)
- inputs and internal voltage reference
- Comparator outputs are externally accessible

Block Diagram

Key Words
Microcontroller Unit [MCU] : the micro computer systems are to be developed by the single semiconductor chip.

Touch Panel

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Circuit Diagram

In this circuit three LED’s are connected parallel through the voltage regulator IC 7805. Basically the led’s are 1watt led so that the current limiting is essential which is to be calculated by the ohms law;

\[ \text{VOLTAGE [V]} = \frac{\text{CURRENT [I]}}{\text{RESISTANCE [R]}} \]

This LED’s are connected to ground through the port bits of port B. That means, the LED anode is always high whenever the port bit of the controller is grounded then the LED will glow. This paper is coined with the ultimate
microcontroller PIC16f877A. It is very powerful compared to the other RISC processors. Basically it is 8 bit RISC architecture in nature. This controller having more advanced in-built peripherals like ADC, MEMORY, I2C, SPI, SSP and UART.

Here in this paper; Full wave bridge rectifier is used to convert the AC voltage to DC voltage +5V regulated supply is needed for the entire CPU operation for that purpose IC7805 is used to regulate the unregulated +12V supply.

Here in this paper; switch mode type reset circuit is used to reset the entire CPU operation. Because of that if any malfunction occurs the system will be restarted easily.

Circuit Operation

The main objective of this paper is to develop a home automation system with a touch screen based control panel. A touch panel is interfaced to the microcontroller which sends ON/OFF commands to the microcontroller where loads are connected. By touching the specified portion on the touch screen panel, the loads can be turned ON/OFF.

The 4-wire Resistive Touch Screen consists of a conductive bottom layer of either glass or film and a conductive top film layer, separated by extremely small, transparent spacer dots. A voltage is applied across the conductive surface. Any type of probe, including fingers, gloved fingers, credit cards, pens, etc., that can be used to apply pressure against the top film will activate the screen. When ample touch pressure is applied to the top layer, the film flexes inward and makes contact with the bottom layer resulting in a voltage drop. This change in voltage is detected by the controller. By alternating the voltage signal between the top and bottom layer, the X and Y coordinates of the user’s touch are computed. In a Film on Glass (FG) construction, the bottom layer is an ITO coated glass. In a Polyester Laminated (PL) or film-film-glass construction the bottom conductive layer is polyester. An additional layer of Optically Clear Adhesive (OCA) bonds the bottom polyester layer to a backer typically made of glass or poly material.

The paper was divided into three phases. The First phase is to measure the touch point voltage values through the ADC. The second phase of the idea is fix the voltage value to the particular load and the third phase is to control the appliances.

Future Advancement

Remote control to control the home automation system can be designed with touch screen technology to make it more user friendly in case of elderly or physically handicapped people where it gets difficult for them to go near to the appliance to operate them.

Conclusion

A home automation system integrates electrical devices in a house with each other. The techniques employed in home automation include those in building automation as well as the control of domastic activities, such as home entertainment systems, houseplant and yard watering, pet feeding, changing the ambiance “scenes” for different events (such as dinners or parties), and the use of domastic robots. Devices may be connected through a computer network to allow control by a personal computer, and may allow remote access from the computer.

At last this Research has reached new height and successful one even through it has few drawbacks when it has been implemented in existing old system. One of our main objectives was to reduce the cost as far as possible, and to avoid manual errors in various fields. Every effort was done to keep the hardware count to a minimum.

References