

Touch Screen based Speed Control of Single Phase Induction Motor

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Abstract— This paper gives a brief idea of touch screen technology and its interfacing with a controller to control the speed of single phase induction motor. Here touch screen technology and Programmable System on Chip (PSOC) microcontroller concept is utilized which is less space consumption and easy to design. The aim of this paper is to have remote sensing and speed control of an AC motor.

click, double click and drag. A software utility needs to be installed on the computer hard drive to further customize the different settings. Touch screens are great for the cause and effect and software applications that require direct select. Figure 1 show the microcontroller and CPLD based systems.

Index Terms— Touch Screen Technology, PSOC, CPLD

I. INTRODUCTION

The main aim of this paper is use the touch screen in the speed control system of AC motor and DC motors. In this paper the resistive touch screen, where the user has to physically touch the screen with slight impact on the screen, this variation in the resistance is read by the touch screen controller, this in turns sends the data to the micro controller using the signal conditioning circuit. The micro controller will read the data obtained from the touch screen controller and will decode the message and depending on the data decoded it will perform the specified task of driving the speed of the motor. The software developed in the CPLD will read the data from wireless network and will decode the same, after which it will drive the CPLD unit connected to the SCR control unit, which then drives the motor speed or if the bulb is connected it will drive the intensity of the bulb. The user on touching the screen at particular position the speed of the motor is controlled and like this at different position the different speed is controlled. In this paper the following new technologies are utilized

- PSOC microcontroller
- Touch screen technology
- Multiple function processor(CPLD)
- Wireless control

The motive of this paper is to design an accurate, precise control, less area in memory and easy way of controlling of single phase induction motor.

II. BLOCK DIAGRAM

2.1 Touch Screen

Touch screens are a clear sheet of plastic with tiny sensors that detect pressure from either a finger tip or a pointing device. When these sensors are pressed, they perform, they perform the functions found with the traditional mouse; single

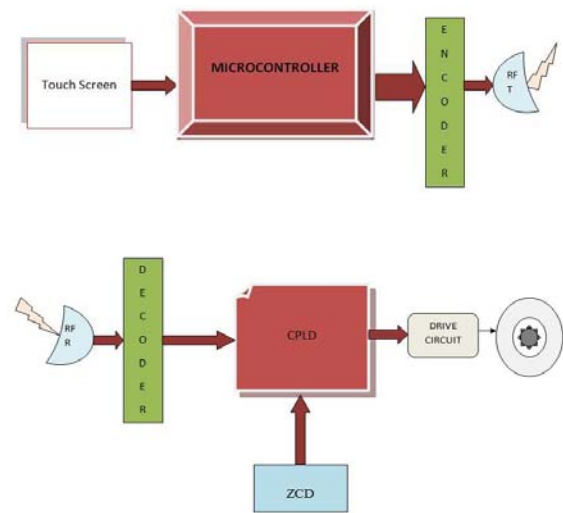


Fig.1. Microcontroller and CPLD

2.2 Four Wire Resistive Touch screens

Four-wire resistive touch technology consists of a glass or acrylic panel that is coated with electrically conductive and resistive layers. The thin layers are separated by invisible separator dots. When operating, an electrical current moves through the screen. When pressure is applied to the screen the layers are pressed together, causing a change in the electrical current and a touch event to be registered. 4-Wire resistive type touch screens are generally the most affordable [2].

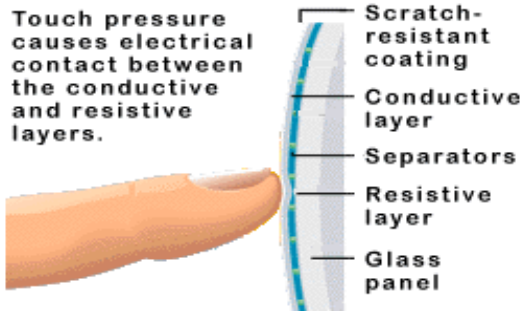


Fig.2. Touch Screen

screen we should interface it with PSOC micro controller. The parameters of Touch Screen are X axis measurement, Y axis measurement and Touch pressure. The circuit diagram of X axis measurement is shown in Figure 5[1].

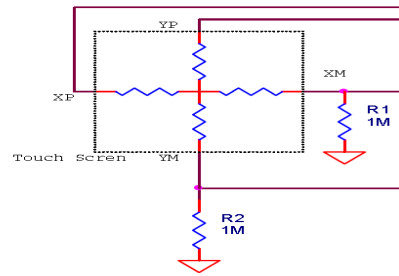


Fig.4. Touch screen pattern

2.3 Interface of 4 Wire Resistive Touch screen with PSOC

Although clarity is less than with other touch screen types, resistive screens are very durable and can be used in a variety of environments. This type of screen is recommended for individual, home, school, or office use, or less demanding point-of-sale systems, restaurant systems, etc.

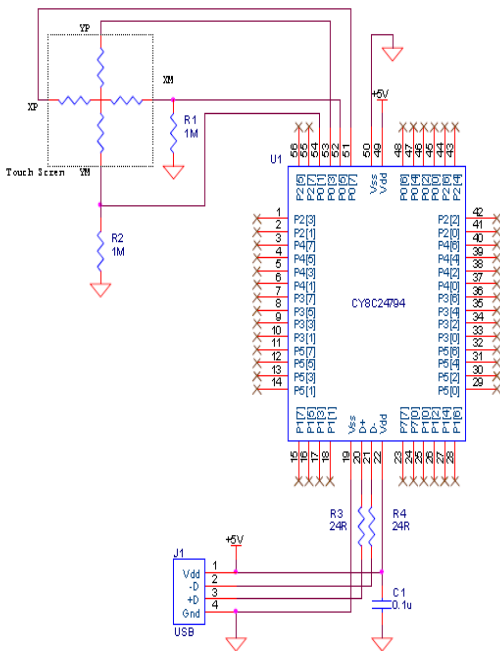


Fig.3. Interface of 4 Wire Resistive Touch screen with PSOC

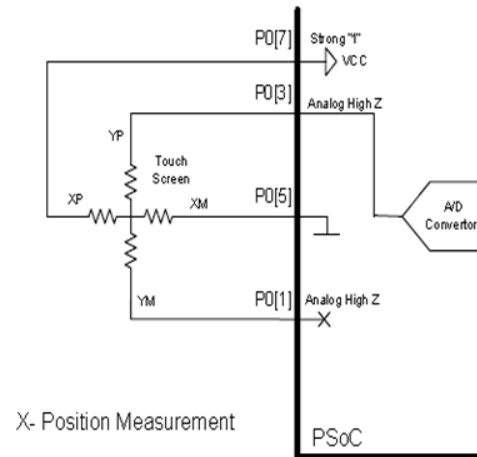


Fig.5. X- Axis measurement of touch screen

2.4 Measurement of Touch screen Parameters

Figure 2 shows the touch screen pattern. Now we should know how to use it. To measure the parameters of touch

Name	Description	
Drive Mode 1[7:0]	Bit 1 of the Drive mode, for each of 8-port pins, for a GPIO port.	
[2:0]	Pin Output High Pin Output Low Notes	
000b	Strong Resistive	
001b	Strong Strong	
010b	High-Z High-Z	Digital input enabled.
011b	Resistive Strong	
100b	Slow + strong High-Z	
101b	Slow + strong Slow + strong	
110b	High-Z High-Z	Reset state. Digital input disabled for zero power.
111b	High-Z Slow + strong	I2C Compatible mode.

Modes	7	6	5	4	3	2	1	0	CW
X POS	1	0	0	0	0	0	0	0	80
M0	1	0	0	0	0	0	1	0	82
M1	1	1	1	1	1	1	0	1	FD
M2	0	1	0	1	1	1	0	1	5D

Fig.6. Complete measurement of parameters

Above Figure shows a complete approach of Measurement of Touch Screen parameter i.e. X position. Similarly for Y

position and touch pressure is done. To know more details refer technical document by Cypress [3].

results of the various column and row positions are tabulated in Table 1.

2.5 Detailed Approach of Touch Screen interface with PSOC microcontroller

Necessity of PSOC

- Touch screen controller need MUX+PGA (programmable gain amplifier)+ADC
- In PSOC → MUX+ PGA + ADC are available & they are inbuilt.
- In built clock frequency, so no need external crystal.

All these are done with the help of “PSOC designer Software”. Make a LOOK UP table to know the axis of touch screen.

Three requirements of touch screen are

- 1) X position
- 2) Y position
- 3) Touch Pressure Z of both X & Y position

The flow chart is as follows

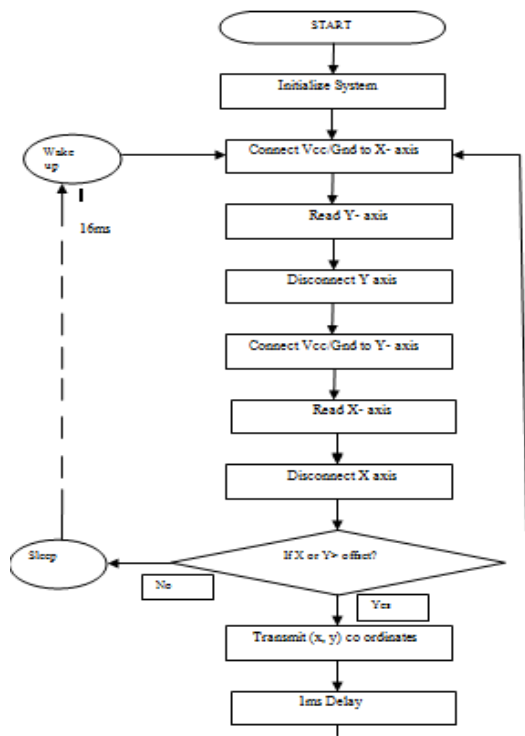


Fig.7. Flow chart to know the axis

To know the axis of Touch screen PSOC is interfaced with LCD. The circuit diagram is as shown in Figure 8 [5]. The

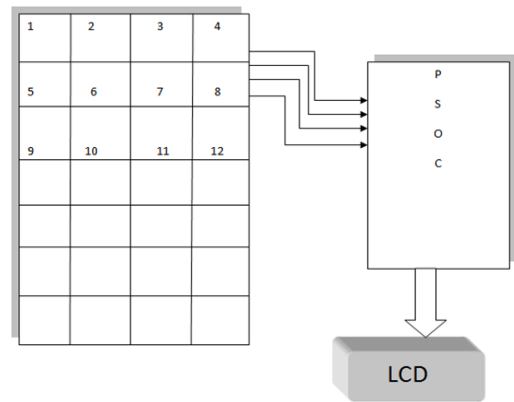


Fig.8. Touch screen and PSOC

TABLE 1

CODE FOR X AND Y POSITION

ROW	XMIN	XMAX	Y1MIN	Y1MAX	Y2MIN	Y2MAX	Y3MIN	Y3MAX
ROW1	0D04	0D025	032F	0330	06CC	06DB	09EE	09F0
ROW2	0A90	0AAB	0344	034D	08A2	08A6	09F8	0A00
ROW3	0869	0875	035D	0366	06E8	06EF	0A00	0A11
ROW4	066A	0675	0363	0378	06F1	06FE	0A1E	0A24
ROW5	0412	0419	036C	0375	067C	0703	0A1B	0A2F

2.6 Transmission of signal

The above results are coded in the PSOC microcontroller and even programming is done to send the signal from Encoder. HT12E encoder is used. Similarly to receive the signal an decoder is used, here HT12D is used. The advantage of this Encoder and Decoder is it will convert digital data into frequency. Radio Frequency Transmission is used which has 433.3MHz and around 2km of distance.

2.7 Testing

Once the coding is done with microcontroller then output of hardware is tested, i.e. by connecting LED as shown in Figure 9. If you touch the position 1 in touch screen then LED 1 is enabled. Similarly up to 16 bit we can check. In this paper only 6 different speeds is considered so 6 combinations is checked. Similarly once Encoder and RFT is connected to PSOC the receiving end is also tested as shown in Figure 10.

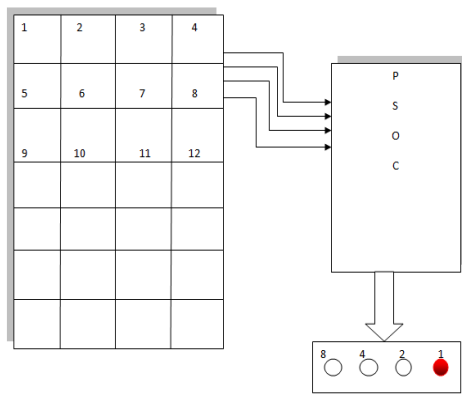


Fig.9. LED display

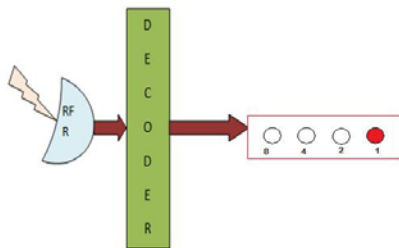


Fig.10. Receiving End

III. CONTROL OF AC MOTOR

In control part Complex Programmable Logic Device (CPLD), Driver circuit and gate pulses design is done. Once output of the decoder is satisfied, it will be interfaced with CPLD. For reset or as oscillator for CPLD, 555 timer is used [6]. The circuit diagram is as shown below Figure 11. As the size and complexity of digital system increases, more and more computer aided design tools are being introduced into the hardware design process. Programmable logic devices provide the benefits of high integration levels without the risks or expenses of IC development. CPLD'S can be designed and verified quickly while the same process requires several weeks with discrete IC's [10]. These devices being software configured and field programmable. Users can modify their designs very easily. Also there are no, Non-Recurring Engineering (NRE) costs and no delays for prototypes to be manufactured. This results in significant cost savings in design and production. VHDL language is used for programming CPLD [7, 8, and 9]. The design of 555 timers is as follows.

$$\begin{aligned} \text{Charging Time} &= 0.693 * R_1 R_2 * C \\ \text{Discharging Time} &= 0.693 * R_2 * C \\ \text{Period} &= 0.693 * (R_1 + 2R_2) \\ \text{Frequency} &= 1.44 / (R_1 + 2R_2) C \end{aligned}$$

$R_1 = 1 \text{ K}\Omega$, $R_2 = 10 \text{ K}\Omega$, $C = 0.001 \mu\text{F}$
Then Frequency = 68 kHz

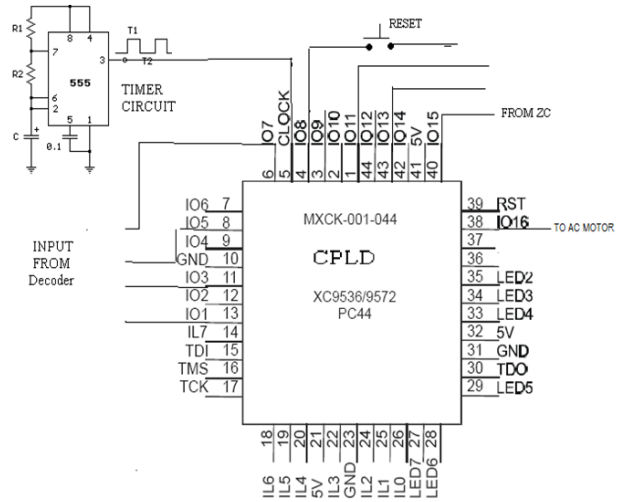


Fig. 11. CPLD and Timer Interface

IV. GATE PULSE

The gate pulses for the TRIAC circuit are designed by Zero Crossing Detector ZCD circuit. The ZCD circuit is connected to CPLD as shown in Fig 5. When decoder gets position one from touch screen and it send to CPLD, the pulses generated from ZCD will be read by controller and according to coding and number of counter set in the coding the speed will vary. The ZCD circuit is as shown in Figure 12 [4].

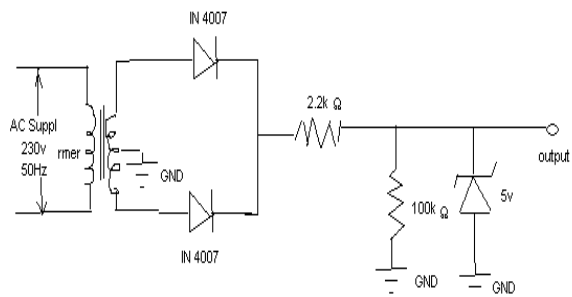


Fig.12. ZCD Circuit

In the above figure the first waveform shows input AC voltage of 220, and second wave shows output of full wave rectifier i.e., 220 volt DC and third wave indicate output of complete circuit of 5 volt DC.

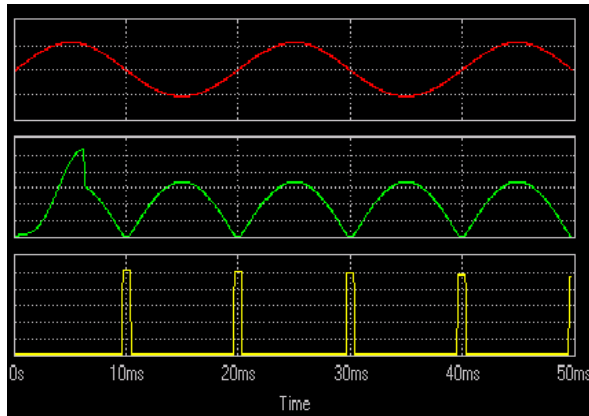


Fig.13. Output waveforms of ZCD

V. TRIAC CIRCUIT

The TRIAC is known as a component which is essential in controlling power from an AC source (mains). In most cases, the circuit has an inductive component: either because of the nature of the load itself: motors, transformers, ballast inductance; or because of the source impedance: utilization of the secondary of a transformer, length of the supply line, etc. On inductive loads, the operating conditions vary considerably, when closing the circuit, depending on the control mode (gate current, polarity and width) and synchronization of the firing. In order to build an optimal control circuit it is indispensable to analyze the various possibilities. The TRIAC circuit is as shown in Fig ure 7.

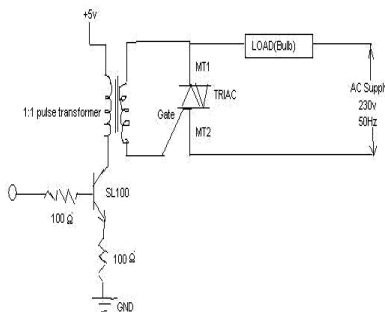


Fig.14. TRIAC circuit

The position of the touch screen for various speed of the motor is shown if Table 2. The main advantages of this system are user friendly, no dangers associated with switching, long life, more reliable, consumes less power, easy control of speed and compact in size. The main applications are power cutting

industries, cranes, electric trains and latest application as in washing machines.

TABLE 2
TOUCH SCREEN POSITION

TOUCH SCREEN POSITION	SPEED IN RPM	OUTPUT VOLTAGE IN VOLTS
1	190	73
2	245	117
3	350	199
4	600	207
5	774	211
6	STOP	STOP

VI. CONCLUSION

In this project we are using Touch Screen in order to control electrical equipments like AC/DC motor, electric bulbs. By making use of this technology, we can control the equipment in a safe and simpler manner. It is easy to operate and can be operated by any one. The danger of electric shock with conventional switches is also eliminated by using technology. The power consumed is relatively low compared to switches. With constant improvement in touch screen technology it would be more feasible to use touch screen than the conventional switches. Use of this type of control would make the systems more reliable and long life.

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