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Handheld Touch Screen Super Scope Device for Engineering Students

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Abstract:Practical Sessions are the backbone of qualification in engineering education. It leads to better understanding and allows mastering scientific concepts and theories. The lack of availability of practical sessions at many universities and institutions owing to the cost and the unavailability of skilled instructors, the most of the time caused decline in experimentation in engineering education over the last decades. Even though the revolution of remote laboratories and touchscreen based smartphone, most of engineering colleges in India continue the tradition of introducing the students to a decade old instruments. The objective is to design and develop a portable device called Super Scope which is ALL-IN-ONE electronics laboratory equipment that has multiple functionalities needed by a modern day engineering students for their practical experiments in electronics laboratory that would replace the existing superfluity of instruments. The device is completely operated from touch screen using touch buttons and menus.

Keywords: Oscilloscopes, Touch Screen, Multimeter, PIC16F877A

I.INTRODUCTION

In the world's current scenario, the high cost and administration burdens of physical equipment have caused a significant decline in experimentation within engineering education. This situation has induced the development and adoption ofremote laboratories as a replacement. Currently, remote laboratories based on a large variety of technologies have been developed at multiple universities and adopted in industrial electronics engineering education. The tendency in the development of distance laboratories is to integrate real distance and virtual distance laboratories in a unique remote laboratory and letting the users to develop their own controllers in aremote way. In such kind of laboratories, the complexity in the hardware and software design is drastically increased. The traditional, proximal, model of the laboratory class is coming under increasing pressure because of the changing anxieties of engineering developments. Scheduling increasingly large numbers of small groups of students, each of which requires an hour (or more) of continuous and adequately controlled access to an expensive piece of laboratory apparatus, is a difficult and expensive task. An increasingly prevalent olution to this dilemma is the use of alternative access modes – either simulation (or virtual) laboratories or distant access to factual laboratory hardware. Web-based remote laboratories have been presented by universities in undergraduate engineering courses since 1996, with the number and sophistication of these efforts growing each year. Test and measurement instruments such as oscilloscopes and multimeter are the traditional hardware tools, an electronics engineer would have on this bench. Students in engineering programme, when exposed to these devices, often come across a multitude of equipment's such as voltmeter, ammeter, oscilloscopes and even simple things like calculator. Even after the touch screen smart phone revolution, most of the engineering degrees in India continue the tradition of introducing the students to a decade old instruments. The extensive evolution of the global economy and worldwide competition in the industrial market has demanded a further restructuring and enhancement of engineering education. So,

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having recognized that the nature of the learning outcomes arising from lab experiences has a complex relationship withthe characteristics of the interaction modality, it is worth seeing the way in which the technologies that are used effect the nature of the interaction. So, in this paper, Handheld All-in-One Electronics Lab Device has been introduced to overcome from those technologies.

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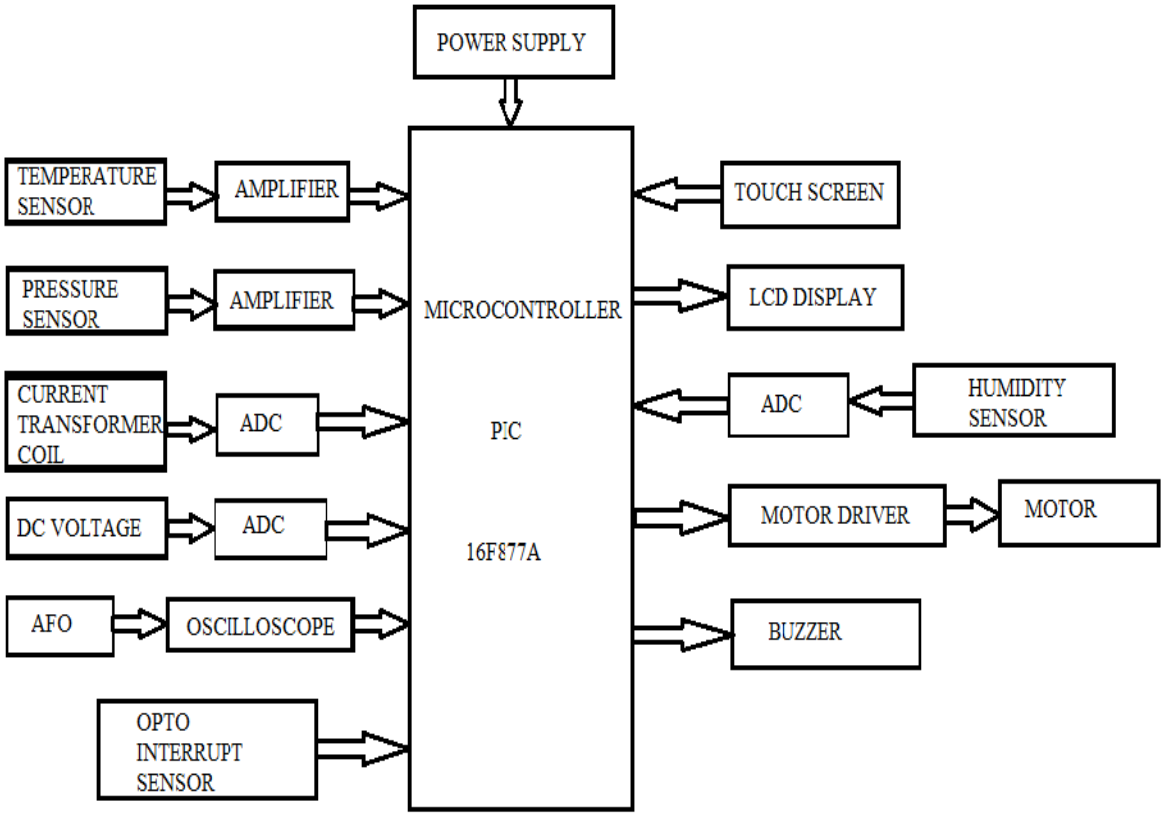
II.BLOCK DIAGRAM



III. BLOCK DIAGRAM DESCRIPTION

A.PIC 16F877A Microcontroller

PIC 16F877A is one of the most advanced microcontroller from Microchip. This controller is extensively used for investigational and modern applications because of its low price, extensive range of applications, high worth, and ease of obtainability. The PIC 16F877A features all the components which modern microcontrollers normally have.

B. Power Supply

Available power source is an Ac voltage arrives at 230V.Since our electronic circuits require only very minimal voltage and current we use step down power transformer. Step down transformer is designed in such a way that the input is 230V and output of 12V. Another thing is that electronic circuits operate in DC whereas available output of transformer is AC of 12V. So rectifier circuit is used to convert AC to DC. Rectifier circuit consists of four diodes formed in bridge fashion so as to convert incoming AC to DC.

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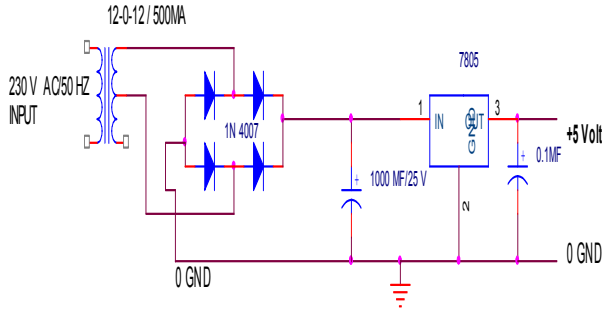

Fig No. 1 Circuit Diagram of Power Supply

C. Pressure Sensor

The SX Series of pressure sensors provides the lowest cost components for measuring pressures up to 150 psi. These sensors were speciallyintended for use with non-ionic media, such as air, dry gases, and the like. Appropriate pressure ranges are obtainable to measure differential, gauge, and absolute pressures from 0 to 1 psi (5X01) up to 0 to 150 psi (5X150). In this, the senor of type 5X150 is used to get a sensing range from 0 to 150 psi. The sensed pressure is amplified using an amplifier which then gives to *pin 6* of microcontroller.

D. Temperature Sensor

The LM 35 is an integrated circuit sensor can be used to measure temperature with an electrical output proportional to the temperature (in °C). The LM35 series are precision integrated-circuit temperature sensors have an output voltage proportional to the Celsius (Centigrade) temperature. The LM35 is rated to operate over a −55° to +150°C temperature range, while the LM35C is rated for a −40° to +110°C range (−10° with improved accuracy).The sensed temperature is amplified using an amplifier which then gives to *pin 2* of microcontroller.

E. Current Transformer Coil

The **Current Transformer**(C.T.), is a type of "instrument transformer" that is designed to produce an alternating current in its secondary winding which is proportional to the current being measured in its primary.*Current transformers*diminish high voltage currents to a much lower value and provide a convenient way of safely monitoring the actual electrical current flowing in an AC transmission line using a standard ammeter. The working principle of a current transformer is no different from that of an ordinary transformer. The current from the coil is given to the ADC circuit for conversion. The digitized output from ADC is then fed to *Pin 3* of PIC.

F. Analog to Digital Converter

The ADC0809 data acquisition component is a monolithic CMOS device for efficient conversion of incoming analog signals to digital one. The 8-bit A/D converter uses successive approximation as the conversion technique. The basic working mode of this ADC is Successive Approximation type. This can be easily interfaced to all microprocessors.

G.Opto Interrupt Sensor

The MCT2XXX series optoisolators consist of a gallium arsenide infrared emitting diode driving a silicon phototransistor in a 4-pin dual in-line package. The optocoupler circuit is as shown in the figure.The sensed temperature is amplified using an amplifier which then gives to *Pin 7* of microcontroller. The respective output of the sensor will measure the speed of the connected to the *Pin 23*which then senses the speed of the motor and the result will again fed back to the PIC of *Pin 25.*

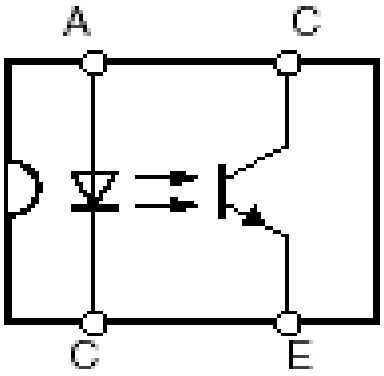

Fig No. 2 Opto Coupler

H. Humidity Sensor

An analog humidity sensor gauges the humidity of the air relatively using a capacitor-based system. The sensor is completed out of a film usually made of either glass or ceramics. The insulator which captivates the water is made out of a polymer which takes in and releases water based on the relative humidity of the given area. This changes charge level

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in the capacitor of the on board electrical circuit. The analog output of the device is given to ADC for conversion. The conversion is made to digitized form and then fed to the *Pin 5 of* microcontroller.

I. Digital Oscilloscope

Digital Signal Oscilloscope – used to monitor signals acquisitioned through the inbuilt 10-bit A to D converter. The signals will be shown in color waveforms in a nice 65K Color QVGA Touch screen TFT Graphical LCD Display. The oscilloscope gets input from the Function Generator and that gives the waveform according to the command/input given by the user.

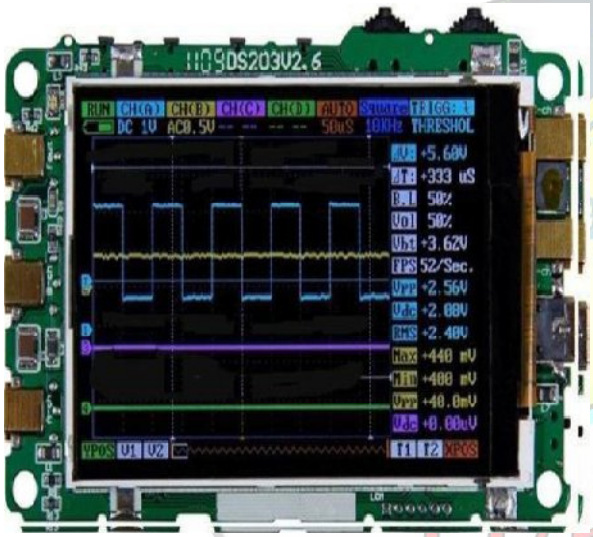

Fig No. 3 Waveform Display

K. Buzzer

An electronic device for signaling with sound is called as a buzzer or beeper. The major use of the buzzers is in automobiles, domesticapplications such as a microwave oven, or game shows. It commonly containsa number of switches or sensors connected to a control unit that determines if and which button was pushed or a preset time has failed, and usually irradiates a light on the correct button or control panel, and sounds a caution in the form of a constant or irregular buzzing or beeping sound. Initially, this method was centered on an electromechanical system which was identical to an electric bell without the metal gong (which makes the ringing noise). This will be connected to *Pin 18* of the microcontroller.

J. LCD Display

LCD stands for liquid crystal; this is an output device with a limited viewing angle. The choice of LCD as an output method was because of its cost of use and is better with alphabets when compared with a 7-segment LED display. This gets data from the microcontroller and shows the same thing. This makes the whole device user friendly by showing the balance left in the card. The output channels of the Microcontroller are given to the LCD display.

IV.SOFTWARE

A. Embedded C

Embedded C is a set of language extensions for the C Programming language by the C Standards committee to address commonality issues that exist between C extensions for different embedded systems. Traditionally, embedded C programming requires nonstandard extensions to the C language in order to support exotic features such as fixed-point arithmeticand basic I/O operations.

Embedded C uses most of the syntax and semantics of standard C. It is small and reasonably simpler to learn, understand, program and debug. In comparison with assembly, C code written is more reliable and easy, more portable between different systems. C compilers are available for almost all embedded devices in use today. C has the advantage of processor-independence i.e. it is independent of

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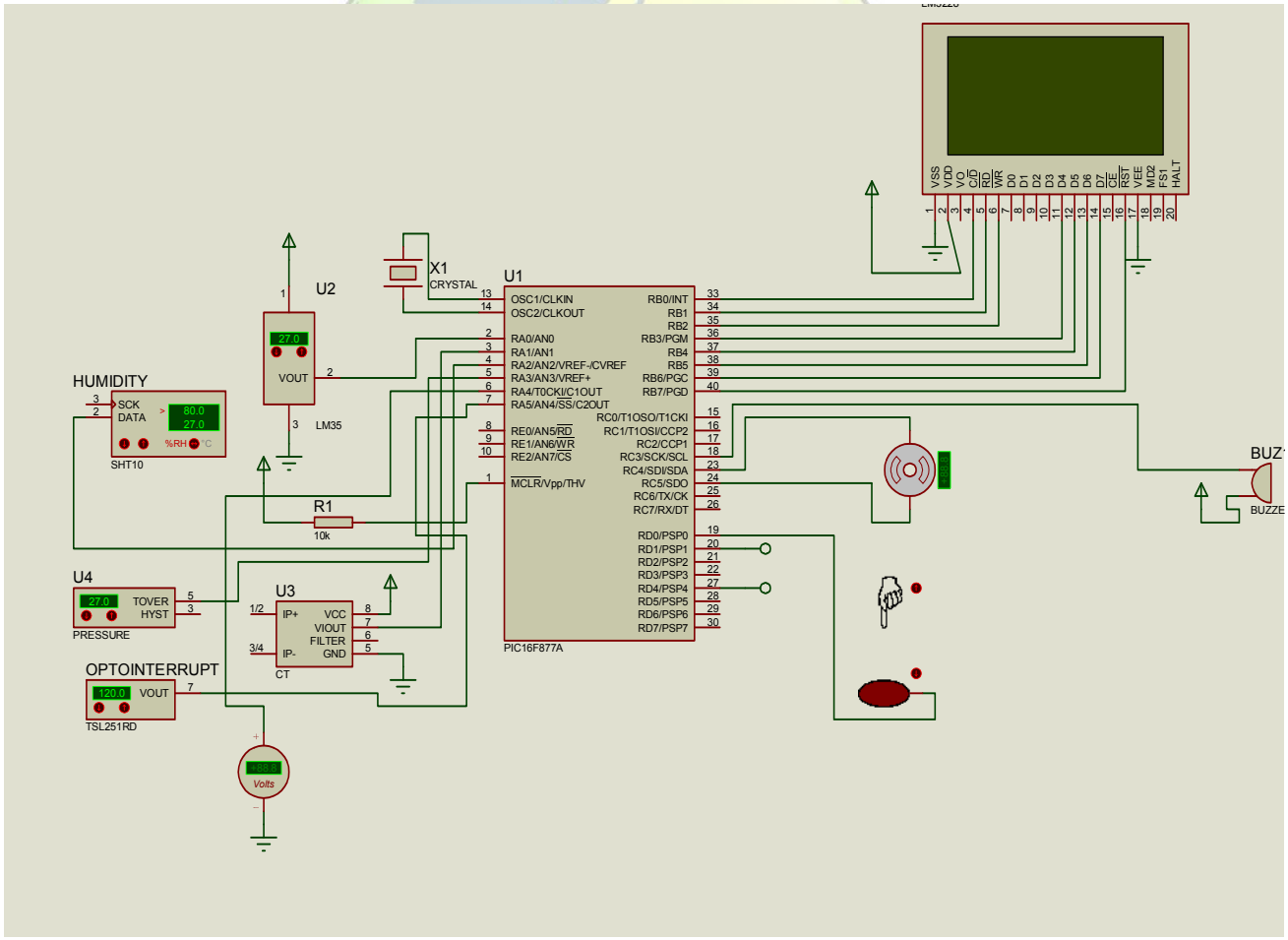
the kind of controllers or processors used, and is not specific to any particular microprocessor/microcontroller or any system.

Arudino Compiler

Arduino is an open-source computer hardware and software company, project and user community whichproposals and manufactures kits for building digital devices and interactive objects that can sense and control the corporal world. The scheme is centered on a family of microcontroller board designs manufactured primarily by Smart Projects in Italy, and also by several other vendors, using various 8-bit AtmelAVR microcontrollers or 32-bit Atmel ARMprocessors. These systems provide sets of digital and analogI/O pins that can be interfaced to various extension boards and other circuits. The panels feature serial communications interfaces that includesUSB on some copies, for heaping programs from personal computers. For encoding the microcontrollers, the Arduino platform affords an Integrated Development Environment (IDE) based on the Processing project, which includes support for C and C++ programming languages.

Fig No. 4 Buzzer

V.CIRCUIT DIAGRAM



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VI.CONCLUSION

This paper gives an improved version of the proximal workbench that is used in the present engineering studies. For these benefits to be recognized, attention must be given to the difficultinteraction between desired educational consequences, pedagogical (theoretical) design, and the nature of the technology supporting the laboratory. In this paper the main aim is to design and develop a portable device called Super-Scope which is ALL-IN-ONE electronics lab equipment with multiple functionalities needed by a modern day engineering student for their practical experiments in electronics that would replace the decade old instruments. As such, many improvements can be made upon this initial design. That being said, it is felt that this system represents a functioning miniature scale model which could be replicated to a much larger scale.

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BIOGRAPHY

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