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Digital IC Tester using Arduino

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Abstract: Digital IC tester is a microcontroller based circuitry that tests weather the IC is in good working condition or bad condition. In industries, testing of the product is a major and expensive and time consuming process. Before making the whole system work, testing is mandatorily performed to avoid errors and undesired results. Similarly, in educational institutions, while performing practical it is necessary to check the ICs whether it is good or bad before performing experiments. Many a small faults at IC level makes system perform inaccurately and produce wrong outputs. The proposed system gives a cheap, small, portable and easy to handle IC tester that tests the ICs belonging to basic gate circuitary such as mux, demux, encoder, basic gates.

Keyword: *Digital IC Tester, Arduino Mega 2560, Mux, Demux, 74 Series IC, Keypad.*

I. INTRODUCTION

The IC tester simply determines which are workable gates and which are faulty. The main purpose of the project is to develop a digital IC tester that is very less expensive and handy than that of what are available in markets. The aim is to check the ICs in very due course of time and display results of ICs being good or faulty immediately. The necessary input signal conditions are applied to the inputs of the gate through microcontroller and output of each gate is monitored and compared with the truth table, and depending on that comparison IC is tested whether it is good or faulty.

The basic function of digital IC tester is to test the logic functioning of the ICs as described in the truth table/function table. The truth tables are stored in database while coding of the microcontroller. The test displays the good ICs and faulty ICs on LCD. The test is being accomplished with the ICs belonging to the basic logic gate IC series. There are many IC tester available in market, varieties of choices are present for users. But we have developed a tester that is very cheap, portable, easy to handle as well as reconfigurable.

The paper is organized as follows. Section II defines the problem statement, section III elaborates the system designed, section IV shows hardware connection, section V shows the results, section VI concludes the whole work done and Section VII gives a future scope for the system developed.

II. PROBLEM STATEMENT

In general it is the most important requirement of testing the ICs before using them for IC based work. Faulty ICs gives us results that are inappropriate to work and unexpected. These wrong outputs results leads in wrong evaluation and analysis. Time and resources are very important in this developing era. And one cannot afford wasting so much of time and resources in finding silly faults caused by faulty ICs. Thus there is a need to develop a low cost and easy maintainable, user friendly digital IC tester.

III. PROPOSED SYSTEM

The following figure shows a flow diagram of the proposed system.

- On starting the system, the system is automatically reset and an initializing message is displayed on LCD like “Please enter IC in zif socket”.
- The ZIF socket is used to place the IC that is to be tested. IC is placed in the socket and that IC number is entered through the keypad and is also displayed on 16*2 LCD display.

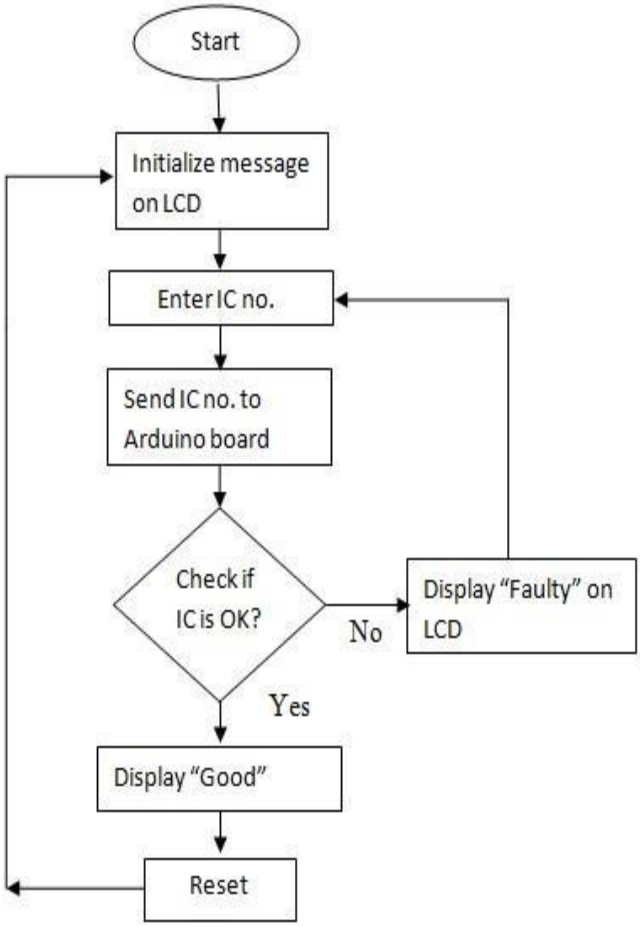

Fig. 1 Flowchart Of Operation

- If by mistake IC number entered is wrong we have to reset the circuit by pressing button.
- As IC number is entered, it is send to the Arduino board where it checks weather is good or bad based on database. If IC is good then a message “IC is good” is displayed. And if IC is faulty, a message is displayed “IC is faulty”.

III. SYSTEM DESIGN

Figure 2, shows the block diagram of project. The arrow associated with it shows the data flow. The first block is ZIF socket. There are several possible choices for the method that will be used to connect ICs to the microcontroller via socket. The preferred amd mostly used method is a ZIF (Zero Insertion Force) socket. They are available in different sizes and formats but one should be chosen that accepts ICs of up to 30 pins and different package widths (a “universal” type). The

pin diagrams of logic gates used to make necessary connections between Arduino mega 2560 and ZIF socket. The ZIF socket used is a 30 pin ZIF socket. We can test upto 30 pin ICs. Digital Pins 23 to 54 are used here to interface ZIF and arduino mega 2560.

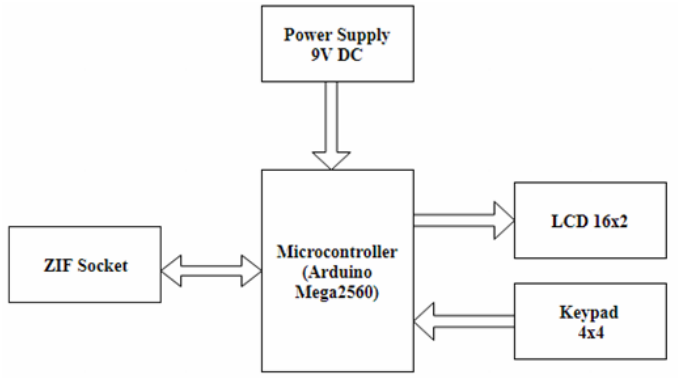

Fig. 2 Block Diagram

To display results and inputs give we have used a LCD display. It is a 16X2 LCD display, having 2 rows with 16 character.

To provide IC number to the microcontroller we need a keypad. We have used a 4x4 keypad. It contain of 4 rows and 4 columns. The keypad is contain 16-buttons, somewhat similar to what you might find on a telephone. A 16-button keypad has 4 columns and 4 row. Pressing a button will short one of the four rows outputs to one of the four column inputs. From this input, the Arduino can determine which button was pressed out of 16 buttons. For example, when key 1 is pressed, column 1 and row 1 are shorted together. The Arduino will find out the button is pressed, present in first row.

Arduino IDE

Arduino is an open platform, based on easy-to-use hardware and software over the years. Arduino acts as a brain of thousands of projects, from smallest project to complex instruments.

After downloading the software, we have to write our code in code window. After writing code select the board type, baud rate etc. Compile the code and upload it on the board. After uploading completed successfully, now we read to use our microcontroller.

Proteus VSM

Proteus Virtual System Modeling (VSM) is a software that combines mixed mode circuit simulation, animated components and microprocessor models to facilitate co-simulation of complete microcontroller based designs. When the coding of microcontroller done writing in Arduino IDE, HEX file of the source code which is compiled by the IDE is load into the Proteus VSM circuit for simulation. Through the simulation, we can straight debug the error in the source code and correct the error immediately.

IV. HARDWARE CONNECTION

Below figure shows overall circuit connection for logic IC functional tester. 9V battery is the power source for this logic IC tester. On board voltage regulators were used to reduce voltage level become 5V to be use for ATmega2560 and other peripherals. Main power switch used to control the power of the circuit either is turn on or turn off. ATmega2560 microcontroller acts as the brain of the circuit. It controlled LCD, keypad, ZIF socket and send and receives command. Reset button is needed for reset the microcontrollers when either microcontroller is malfunction and wrong IC number entered by user. ZIF socket is used for users place their model ICs that wish to test in the circuit. ATmega2560 microcontroller passes prewritten test condition for testing IC. There are multiple ways to test IC. We can test IC using their truth tables or functional tables.

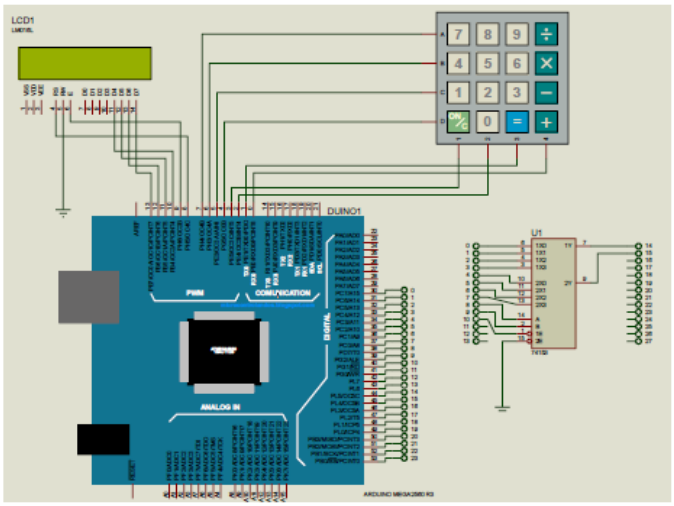

Fig 3: Circuit Connection

Lets take an example of an IC 7408 i.e. AND gate. It has two input and one output. We know that when both input are high then only the output is high. We externally give input to two pin and read output from the output pin with the help of microcontroller. If the desired output is obtained then LCD shows pass test otherwise IC is faulty.

V. RESULT

After we developed the codes for the microcontroller and the graphic user interface (Proteus), the Digital IC Tester project works up and well functions. Following figures are the results of the developed system that displays corresponding results on LCD as well as on serial monitor of Arduino IDE. We can see all the display messages like Welcome, asking for IC number and the message of IC being faulty or good.

Figure 4: Initialize message on LCD

Figure 4 above shows that on turning on the system, the first message displayed on LCD screen.

Figure 5: Entered IC number for testing

Figure 5 shows that after a short delay, the system asks the user to enter the IC number that is inserted into the ZIF socket.

Figure 6: Checking in database for IC testing

Figure 6 shows that, since of dual 4 input multiplexer 73LS153 IC is inserted into the ZIF socket, its corresponding number as defined in code i.e. 74153 was entered through keypad. As soon as system receives the IC number, it immediately performs the tests with the IC being mounted with its corresponding truth table that is stored in database which is again created using arduino coding.

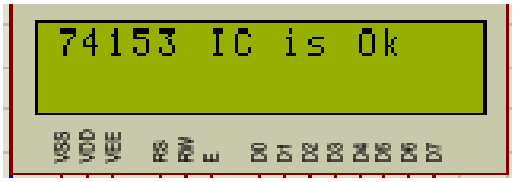

Figure 7: IC is good

Figure 8: IC is faulty

Figure 7 and 8 shows that the IC is good/faulty after comparing the tests carried on IC and the actual truth table.

CONCLUSION

The Digital IC tester tests the ICs being placed in ZIF socket and gives results of ICs being good or faulty. The model is user friendly and is easy to use and maintain. It reduces time to test IC as we are testing it automatically compared to manually testing where various connections and application of inputs is done. The code is reconfigurable. If any further changes are required to make according to the need of user, it can be done very easily. The market price of IC testers is very high whereas this model hardly cost for INR 1500. It saves lots of time and resources and thus is economically efficient.

Future Scope

This project has large potential to be improved by number of ways.

This system can be further developed for many other market ICs other than 74 series IC (such has Op-Amp, regulators, comparators etc) used here as it is reconfigurable. The developed IC tester is useful for educational purpose, but further advance development can make it efficient for industrial use.

The IC tester project can also be enhanced to be able to identify unmarked devices with the help of auto-identification mode so that a more powerful and functional IC tester can be provided for users.

The wrong/no insertion of the IC can be detected by programming in microcontroller. For example, if an IC is not inserted incorrectly, buzzer will be buzz to inform users with indication on LCD that “IC is inserted incorrectly” or “No IC is inserted”.

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