ARUD TESTER

Major project

Report
Submitted in the partial fulfillment of the requirements
For the award of the degree of
Bachelor of Technology in
Electronics And Communication Engineering

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DELARATION

The Project Report entitled “ARUD TESTOR”is a record of bonafide work of **K. Kamal Sai, BH. Aditya Reddy, N. Eswar, K.YN Sagar** baring 180040252,180040254,180040256,180040257submitted in partial fulfillment for the award of B. Tech in Electronics And Communication Engineering to the K L University. The results embodied in this report have not been copied from any other departments/University/Institute.

CERTIFICATE

This is to certify that the Project Report “ARUD TESTOR WITH DISPLAY ” is being submitted by **K. Kamal Sai, BH. Aditya Reddy, N. Eswar, K.YN Sagar** submitted in partial fulfillment for the award of B. Tech in Electronics And Communication Engineering to the K L University is a record of bonafide work carried out under our guidance and supervision.

Signature of the Supervisor

Name: Ms. Sri Nidhi

Designation: Asst. professor

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ABSTRACT

IC’s, the main component of each and every electronic circuit can be used for wide variety of purposes and functions. But sometime due to faulty ICs the circuit doesn’t work. Indeed, it is lot tedious work to debug the circuit and confirm whether the circuiting is creating problem or the IC itself is dead. So, to come up with these sorts of problems IC tester confirm whether the IC under consideration is working properly or not.

The digital IC tester is implemented by using the Atmega2560 microcontroller board. The processing of the inputs and outputs is done by the microcontroller. The display part on the microcontroller board is modeled using LCD. After the successful testing of the IC, the result is displayed on the LCD.

The basic function of the digital IC tester is to test a digital IC for correct logical functioning as described in the truth table and/or function table. It can test digital ICs having a maximum of 20 pins. Since it is programmable, any number of ICs can be tested within the constraint of the memory available. This model applies the necessary signals to the inputs of the IC, monitoring the outputs at each stage and comparing them with the outputs in the truth table. Any discrepancy in the functioning of the IC results in a fail indication, displays the faulty and good gates on the LCD. The testing procedure is accomplished with the help of keys present on the main board.

INTRODUCTION

In any manufacturing industry there are continuous efforts in cost reductions, upgrade quality and improve overall efficiencies. In electronic industry, with dramatic increase in circuit complexity and the need for the higher levels of reliability, a major contributor cost in any product can be in the testing. However, we should recognize in the real world that no product is perfect, so that testing and in particular automatic testing will be an essential part of production in the foreseeable future.

In industries, research centers and college, etc. some common IC's are frequently used; many time’s people face problems due to some fault in these integrated circuits. So, it is very essential to test them before actually using them in any of the applications. Microcontroller based digital IC tester is best solution for these problems. It has the capability of testing some of the available digital IC of 20 pins. The main advantage over the industry standard for the project is its low cost and eases of updating to any new IC design only through software updating.

This project represents a prototype IC tester that is highly capable, highly reliable as well as cost-effective. Here, we develop a program with different functions for checking different ICs. We systematically analyse and test the prototype for several ICs, accessing each individual pin with all possible inputs. We also investigate truth tables associated with different ICs over a display channel.

The input is given to the corresponding pins of the IC to be tested using program stored in micro-controller acting as slave. The output is taken from the relevant pin. It is compared with the look-up table of that IC being stored in the memory. Depending on the result of comparison, the output is displayed in the LCD display.

Steps to complete the project.

• I did the basic circuit on breadboard and Tried with few basic ICs on it.

• I developed the circuit which can put on PCB and can be used for all the ICs.

• To make the project user friendly, I worked to make the keypad and LCD interface.

FEATURES OF IC TESTER

1: User friendly set up and operates.

2: Nokia 5110character LCD display.

3: Built in 10 numerical keys and directional keypad.

4: Identifies over 40 digital ICs (up to 20 pins).

5: Various LED'S and LCD display to present the test results FAIL or PASS.

TECHNICAL SPECIFICATIONS:

FAMILY **:** TTL(Transistor-transistor Logic), CMOS(Complementary Metal Oxide Semiconductor)

RANGE **:** Logic Gates can tested.

TEST SOCKETS **:** A single 20 pin ZIF sockets for IC Testing.

PACKAGE **:** DIP14, 16 and 20 pins.

DISPLAY **:** Nokia 5110 LCD Display.

INDICATOR LEDs: 1 bright LED of 3 mm each.

KEY PAD **:** 5X3 MATRIX TYPE**.**

ELECTRICAL **:** 230 V (+/- 10 %), 1 phase, 50 Hz (+/- 2 %)

ARDUINO MEGA 2560

The MEGA 2560 is designed for more complex projects. With 54 digital I/O pins, 16 analog inputs and a larger space for your sketch it is the recommended board for 3D printers and robotics projects. This gives your projects plenty of room and opportunities.

Programming

The Mega 2560 board can be programmed with the Arduino Software (IDE). For details, see there inference and tutorials.

The ATmega2560 on the Mega 2560 comes preprogrammed with a bootloader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol (reference, C header files).

You can also bypass the bootloader and program the microcontroller through the ICSP (In-Circuit Serial Programming) header using Arduino ISP or similar; see these instructions for details.

The ATmega16U2 (or 8U2 in the rev1 and rev2 boards) firmware source code is available in the Arduino repository. The ATmega16U2/8U2 is loaded with a DFU bootloader, which can be activated by:

- On Rev1 boards: connecting the solder jumper on the back of the board (near the map of Italy) and then resetting the 8U2.
- On Rev2 or later boards: there is a resistor that pulling the 8U2/16U2 HWB line to ground, making it easier to put into DFU mode. You can then use Atmel's FLIP software (Windows) or the DFU programmer (Mac OS X and Linux) to load a new firmware. Or you can use the ISP header with an external programmer (overwriting the DFU bootloader). See this user-contributed tutorial for more information.

Warnings

The Mega 2560 has a resettable polyfuse that protects your computer's USB ports from shorts and overcurrent. Although most computers provide their own internal protection, the fuse provides an extra layer of protection. If more than 500 mA is applied to the USB port, the fuse will automatically break the connection until the short or overload is removed.

Power

The Mega 2560 can be powered via the USB connection or with an external power supply. The power source is selected automatically.

External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the GND and Vin pin headers of the POWER connector.

The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may become unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

The power pins are as follows:

Vin. The input voltage to the board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.

- 5V. This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 12V), the USB connector (5V), or the VIN pin of the board (7-12V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage your board. We don't advise it.
- 3V3. A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
- GND. Ground pins.
- IOREF. This pin on the board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source or enable voltage translators on the outputs for working with the 5V or 3.3V.

Memory

The ATmega2560 has 256 KB of flash memory for storing code (of which 8 KB is used for the bootloader), 8 KB of SRAM and 4 KB of EEPROM (which can be read and written with the EEPROM library).

Input and Output

See the mapping between Arduino pins and Atmega2560 ports:

Each of the 54 digital pins on the Mega can be used as an input or output, using pinMode(),digitalWrite(), and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive 20 mA as recommended operating condition and has an internal pull-up resistor (disconnected by default) of 20-50 k ohm. A maximum of 40mA is the value that must not be exceeded to avoid permanent damage to the microcontroller.

In addition, some pins have specialized functions:

- Serial: 0 (RX) and 1 (TX); Serial 1: 19 (RX) and 18 (TX); Serial 2: 17 (RX) and 16 (TX); Serial 3: 15 (RX) and 14 (TX). Used to receive (RX) and transmit (TX) TTL serial data. Pins 0 and 1 are also connected to the corresponding pins of the ATmega16U2 USB-to-TTL Serial chip.
- External Interrupts: 2 (interrupt 0), 3 (interrupt 1), 18 (interrupt 5), 19 (interrupt 4), 20 (interrupt 3), and 21 (interrupt 2). These pins can be configured to trigger an interrupt on a low level, a rising or falling edge, or a change in level. See the attachInterrupt() function for details.
- PWM: 2 to 13 and 44 to 46. Provide 8-bit PWM output with the analogWrite() function.
- SPI: 50 (MISO), 51 (MOSI), 52 (SCK), 53 (SS). These pins support SPI communication using theSPI library. The SPI pins are also broken out on the ICSP header, which is physically compatible with the Arduino /Genuino Uno and the old Duemilanove and Diecimila Arduino boards.
- LED: 13. There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.
- TWI: 20 (SDA) and 21 (SCL). Support TWI communication using the Wire library. Note that these pins are not in the same location as the TWI pins on the old Duemilanove or Diecimila Arduino boards.

See also the mapping Arduino Mega 2560 PIN diagram.

The Mega 2560 has 16 analog inputs, each of which provide 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and analogReference() function.
There are a couple of other pins on the board:

- AREF. Reference voltage for the analog inputs. Used with analogReference().
- Reset. Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

Communication

The Mega 2560 board has a number of facilities for communicating with a computer, another board, or other microcontrollers. The ATmega2560 provides four hardware UARTs for TTL (5V) serial communication. An ATmega16U2 (AT mega 8U2 on the revision 1 and revision 2 boards) on the board channels one of these over USB and provides a virtual com port to software on the computer (Windows machines will need a .inf file, but OSX and Linux machines will recognize the board as a COM port automatically. The Arduino Software (IDE) includes a serial monitor which allows simple textual data to be sent to and from the board. The RX and TX LEDs on the board will flash when data is being transmitted via the ATmega8U2/ATmega16U2 chip and USB connection to the computer (but not for serial communication on pins 0 and 1).

A SoftwareSerial library allows for serial communication on any of the Mega 2560's digital pins.

The Mega 2560 also supports TWI and SPI communication. The Arduino Software (IDE) includes a Wire library to simplify use of the TWI bus; see the documentation for details. For SPI communication, use the SPI library.

Physical Characteristics and Shield Compatibility

The maximum length and width of the Mega 2560 PCB are 4 and 2.1 inches respectively, with the USB connector and power jack extending beyond the former dimension. Three screw holes allow the board to be attached to a surface or case. Note that the distance between digital pins 7 and 8 is 160 mil (0.16"), not an even multiple of the 100 mil spacing of the other pins.

The Mega 2560 is designed to be compatible with most shields designed for the Uno and the older Diecimila or Duemilanove Arduino boards. Digital pins 0 to 13 (and the adjacent AREF and GND pins), analog inputs 0 to 5, the power header, and ICSP header are all in equivalent locations. Furthermore, the main UART (serial port) is located on the same pins (0 and 1), as are external interrupts 0 and 1 (pins 2 and 3 respectively). SPI is available through the ICSP header on both the Mega 2560 and Duemilanove / Diecimila boards. Please note that I2C is not located on the same pins on the Mega 2560 board (20 and 21) as the Duemilanove / Diecimila boards (analog inputs 4 and 5).

Automatic (Software) Reset

Rather then requiring a physical press of the reset button before an upload, the Mega 2560 is designed in a way that allows it to be reset by software running on a connected computer. One of the hardware flow control lines (DTR) of the ATmega8U2 is connected to the reset line of the ATmega2560 via a 100 nanofarad capacitor. When this line is asserted (taken low), the reset line drops long enough to reset the chip. The Arduino Software (IDE) uses this capability to allow you to upload code by simply pressing the upload button in the Arduino environment. This means that the bootloader can have a shorter timeout, as the lowering of DTR can be well-coordinated with the start of the upload.

This setup has other implications. When the Mega 2560 board is connected to either a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB). For the following half-second or so, the bootloader is running on the ATMega2560. While it is programmed to ignore malformed data (i.e.

anything besides an upload of new code), it will intercept the first few bytes of data sent to the board after a connection is opened. If a sketch running on the board receives one-time configuration or other data when it first starts, make sure that the software with which it communicates waits a second after opening the connection and before sending this data.

The Mega 2560 board contains a trace that can be cut to disable the auto-reset. The pads on either side of the trace can be soldered together to re-enable it. It's labeled "RESET-EN". You may also be able to disable the auto-reset by connecting a 110 ohm resistor from 5V to the reset line; see this forum thread for details.

1n4148 diode: The 1N4148 is a standard silicon switching signal diode. It is one of the most popular and long-lived switching diodes because of its dependable specifications and low cost. Its name follows the jedec nomenclature. The 1N4148 is useful in switching applications up to about 100 MHz with a reverse recovery time of no more than 4ns

As the most common mass-produced switching diode, the 1N4148 replaced the older 1N914. They differed mainly in their leakage current specification, however, today most manufacturers list common specifications. For example, Vishay lists the same leakage current for both parts:

- 25 nA at -20 V, 25°C
- 5 µA at -75 V, 25°C
- 50 µA at -20 V, 150°C

Today manufacturers produce the 1N4148 and sell it as either part number. It was second sounded by many manufacturers; texas instrument listed their version of the device in an October 1966 data sheet. These device types have an enduring popularity in low-current applications.

The JEDEC registered part numbers 1N4148 and 1N914 are diodes in an axial package. Diodes with similar properties are available in surface mount packages.

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- 1N4148 in DO-65 glass axial package.

Surface mount packages

- LL4148 in Minimelf package.
- 1N4148W in sod-123 package.
- 1N4148WS in sod-323 package.
- 1N4148WT in sod-543package. Note: Some surface-mount packages are marked with "T4" text.

Specifications

V_{RRM} = 100 V (maximum repetitive reverse voltage)

- I_O = 200 mA (average rectified forward current)
- I_F = 300 mA (DC forward current)
- I_f = 400 mA (recurring peak forward current)
- I_{FSM} = 1 A at 1 s pulse width; 4 A at 1 µs pulse width (non-repetitive peak forward surge current)

Electrical and thermal characteristics[7]

- V_F = 1 V at 10 mA (maximum forward voltage)
- V_R = 75 V at 5 µA; 100 V at 100 µA (minimum breakdown voltage and reverse leakage current)
- t_{rr} = 4 ns (maximum reverse-recovery time)
- P_D = 500 mW (maximum power dissipation)

MECHANICAL DATA Case:

DO-35 (DO-204AH)

Weight: approx. 125 mg Cathode

band color: black Packaging codes

options: TR/10K per 13" reel (52 mm tape), 50K/box TAP/10K per ammopack (52 mm tape), 50K/box

FEATURES:

- Fast switching speed
- High reliability
- High conductance
- For general purpose switching applications
- AEC-Q101 qualified

Resistors:

A **resistor** is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, **resistors** are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses.

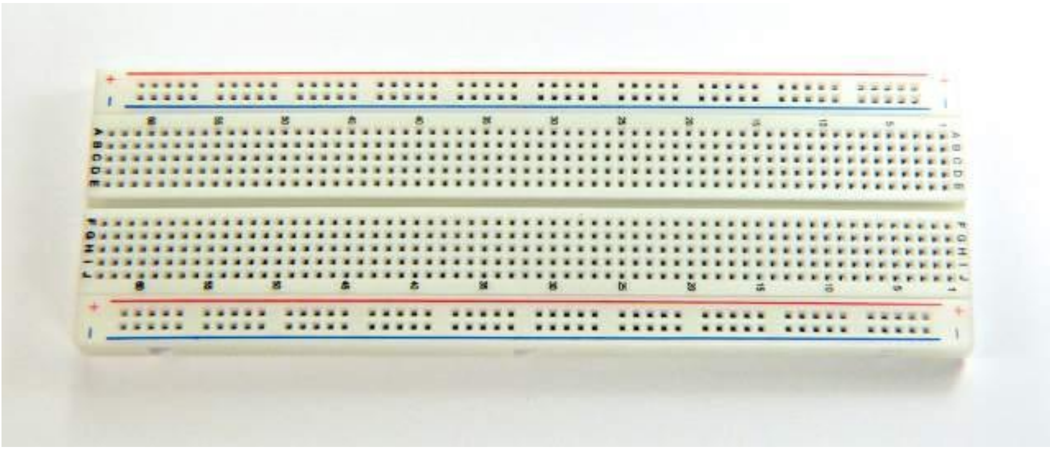
- **Tactile switch:**

These small sized switches are placed on PCBs and are used to close an electrical circuit when the button is pressed by a person.

When the button is pressed, the switches turn ON and when the button is released, the switches turn OFF.

A tactile switch is a switch whose operation is perceptible by touch.

Bread board:



A breadboard is a construction base for prototyping of electronics. Originally the word referred to a literal bread board, a polished piece of wood used for slicing bread. In the 1970s the solderless breadboard became available and nowadays the term "breadboard" is commonly used to refer to these.

- **ZIF socket:**

Zero insertion force is a type of IC socket or electrical connector that requires very little force for insertion.

Nokia5110 display:

This LCD is easy to control and helps improve the project's user interface (UI), as compared to when using the usual LED matrices or 16×2 character LCDs. The small display (diagonal 4.2cm approx) has 84×48 individual pixels, which allows this LCD to be used for graphics, text or bitmaps. These displays are inexpensive, easy to use, require only a few digital I/O pins and are fairly low power as well.

Pins

To interface with and power the LCD, there are 8-pin headers below it. You will find the labels of these pins on the front side. These pins are:
1. RST – Reset – Input pin – Active low
2. CE – Chip Select – Input pin – Active low
3. DC – Mode (data/instruction) selection – Input pin- Select between Command mode (low) and Data mode (high).
4. DIN – Serial Data In line – Input pin
5. CLK – Serial Clock Line – Input pin
6. VCC – Power input (3.3v or 5v) – Input pin – Preferably 3.3V
7. BL – Back Light LED control – Input pin- 3.3V
8. GND – Ground

Use 3.3v as Vcc to avoid damaging the display. 5 digital output pins are needed when manually controlling the chip select and reset lines while using the display. Another pin can be used to control the back light.

The display uses the PCD8544 controller chip from Philips. This chip is designed to run only between 3 and 5V, have 3v communication levels, and need about 10mA current. Logic levels must be 3V to prevent damage. No extra level shifter is needed.
The back light can draw up to a total of 80-100mA.

ARCHITECTURE OF PROJECT:

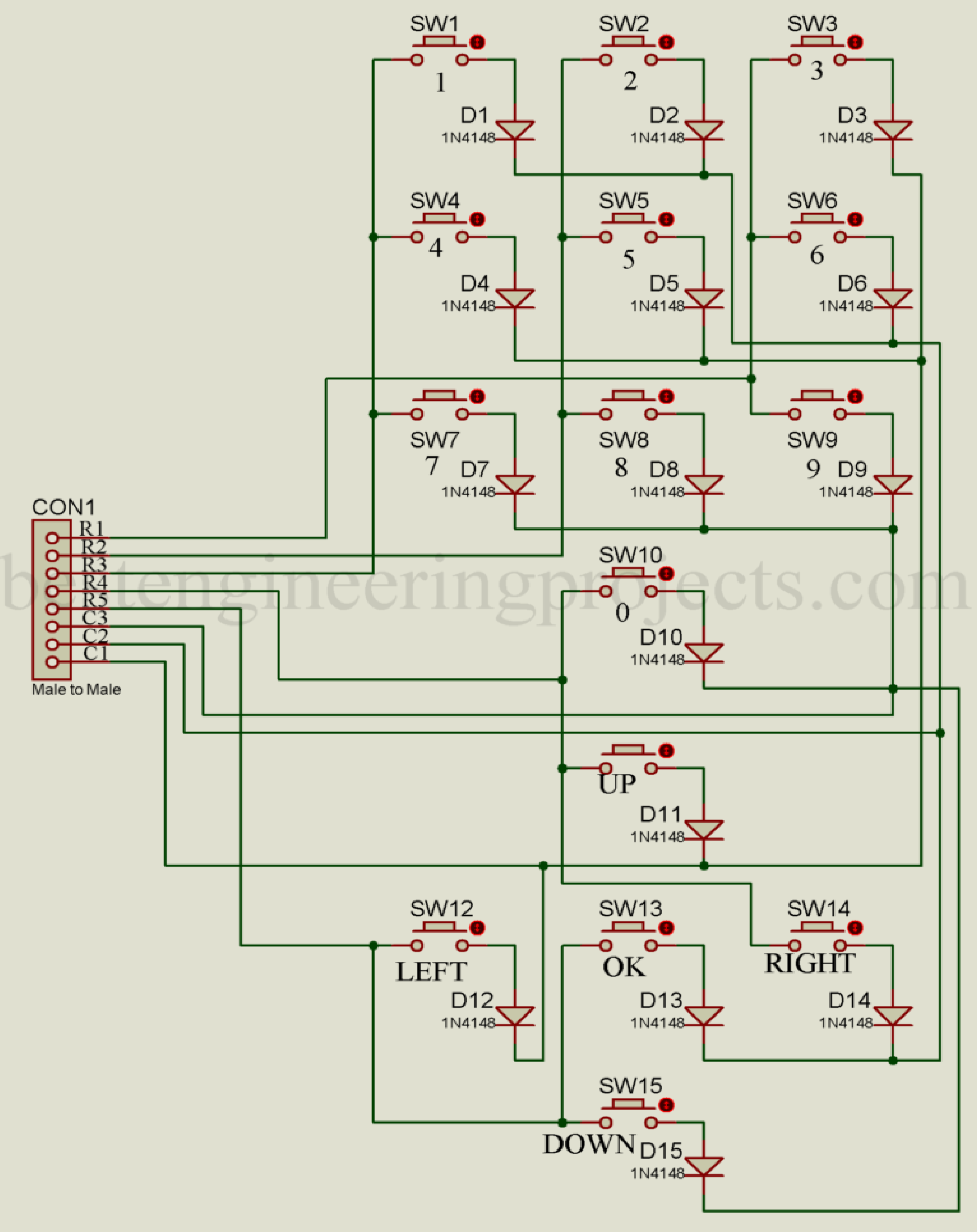
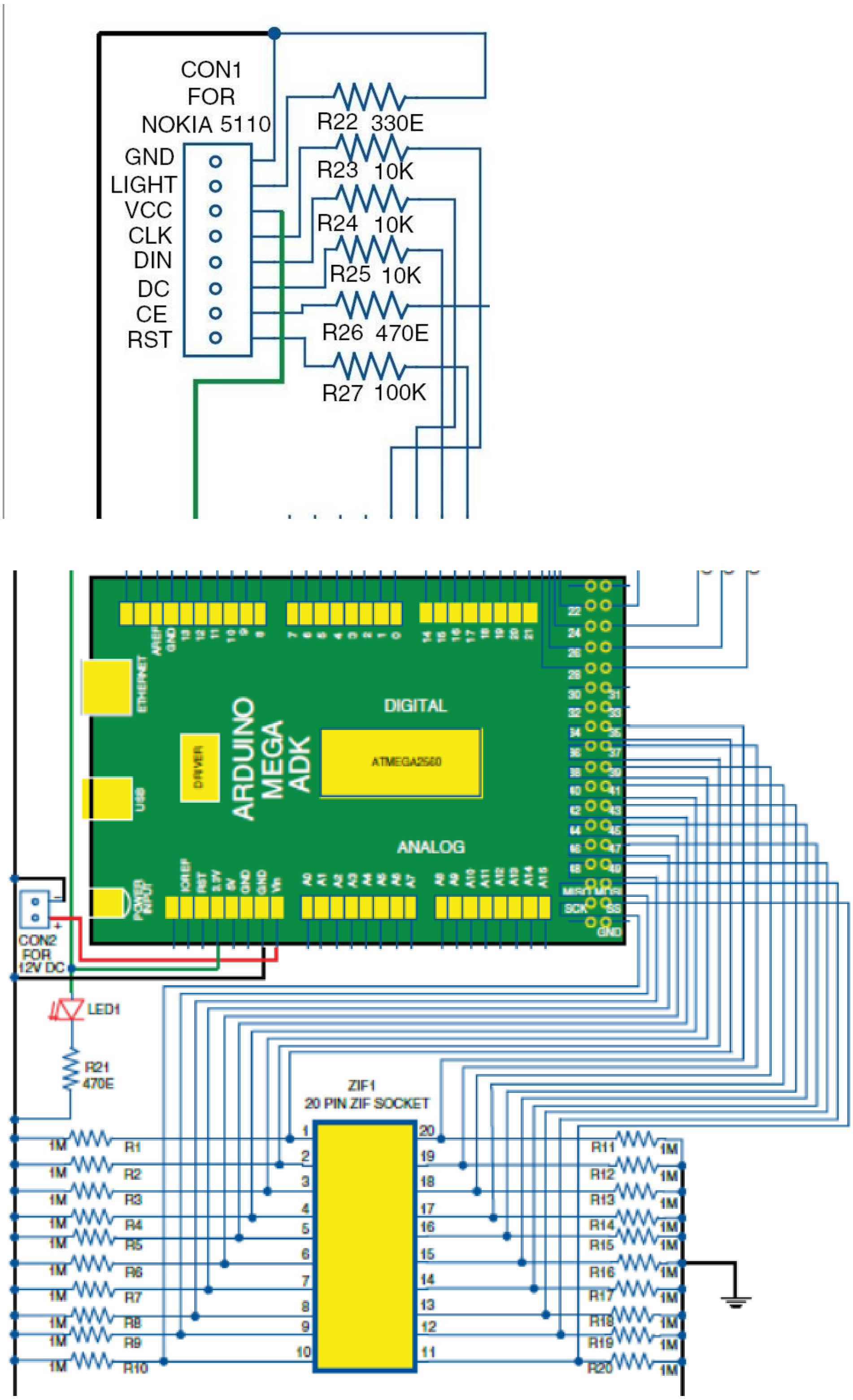


Figure 4: Circuit Diagram of DIY 5x3 Matrix Keypad for Arduino


CON1
FOR
NOKIA 5110
GND
LIGHT
VCC
CLK
DIN
DC
CE
RST
R22 330E
R23 10K
R24 10K
R25 10K
R26 470E
R27 100K
ARDUINO
MEGA
ADK
DIGITAL
ANALOG
ATMEGA2560
ETHERNET
USB
DRIVER
POWER INPUT
CON2
FOR
12V DC
LED1
R21
470E
ZIF1
20 PIN ZIF SOCKET
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
1M

ALGORITHM OF CODE FOR DIGITAL IC TESTER

I. Begin.
II. Reset the circuit.
III. Initialize the LCD.
IV. Display the message “Enter IC number”.
V. Wait for some time.
VI. Press the IC number on the keypad.
VII. Display the IC number.
VIII. Check the working of IC depending upon the truth tables.
IX. Depending upon the output, give the control signals to the microcontroller to display respective messages on LCD.
X. Stop.

WORKING:

ATmega2560 in Arduino Mega is equipped with a bootloader which enables new codes to be uploaded into the MCU without using an external hardware programmer. The LCD screen used in this prototype has 48×84 pixels. It uses a low-power CMOS LCD controller (PCD8544) with a moderate power requirement of 3.3V. This can be adjusted to MCU power requirements with suitable resistors. For controlling the LCD, a simple library named lcd with some basic functions has been designed. The purpose of using keypad matrix principle is to reduce the required number of input/output (I/O) pins for controlling the keys. While taking an input, only one column is read at a time. The column to be read is connected to logical 0V.

Now, while checking the state of rows, it is possible to detect which key is pressed from that particular column. After reading one column, the MCU immediately goes for the next one by connecting the new column to logical 0V. It is very important that only that particular column (under checking) is connected to logical 0V. Otherwise, it will not be possible to detect proper input. In this manner, all columns are read one by one to obtain one complete cycle of the matrix scan.

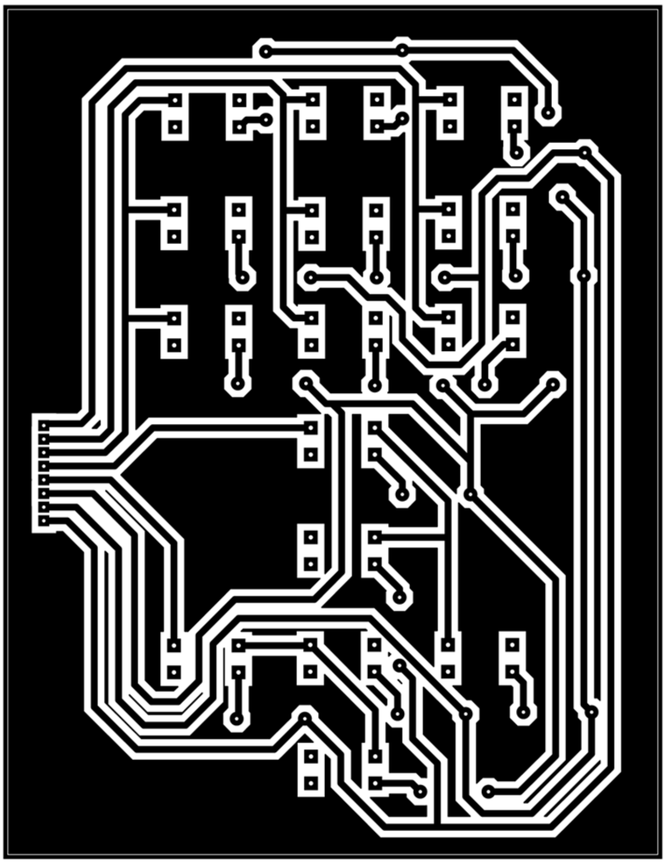
With a clock speed of 16MHz, ATmega2560 is capable of scanning the whole matrix thousands of times per second. Note that diodes are added along all switches in order to eliminate unexpected results due to simultaneous multiple pressing of keys. For controlling the keypad, another library named keypad enables the user to feed different inputs to the MCU.

In the circuit, each I/O pin (associated with ZIF socket) is connected to 1-mega-ohm pull-down resistor. These resistors (R1 to R20) prevent the floating condition of input pins when these are not connected to any state (high/low). For the code designed for this IC tester to work perfectly, it is recommended that all connections to Arduino pins are made exactly as in the circuit diagram. If anything in the circuit diagram is changed, one must modify the code for the same.

This prototype is used to test the following ICs successfully: 4000, 4001, 4002, 4011, 4012, 4023, 4025, 4029, 4030, 4049, 4050, 4068, 4069, 4070, 4071, 4072, 4073, 4075, 4077, 4081, 4082, 4093, 5408, 5409, 5411, 5421, 5479, 7266, 7400, 7401, 7402, 7403, 7404, 7405, 7408, 7409, 7410, 7411, 7412, 7414, 7420, 7421, 7427, 7430, 7432, 7473, 7474, 7476, 7478, 7479, 7486, 74132 and 74393. ICs 4011, 4023, 4029, 4030, 4069, 4093, 7402, 7404, 7414, 7476 and 74393.

CONSTRUCTION AND TESTING:

One can use this PCB as Arduino shield with Arduino Mega ADK board using 12V power supply at CON2. Otherwise, Arduino Mega ADK board can be interfaced with the PCB using cable connectors and power supply from 12V/1-amp adaptor. As shown in block diagram, the MCU is interfaced through an LCD, a keypad and an IC ZIF socket.



5*3 Matrix Keyboard

As different ICs come with their own specifications, checking process for each may vary. Here, we take an example of a common NAND gate IC 4011, whose truth table is shown in Table IV.

Auto-search method. In this process, the number of pins of the IC to be checked is entered first. The device then starts manifesting all possible input signals to the IC and takes back its response for each possible input. If a response matches the output of a particular IC in its database, then it declares that IC as good.

Manual-checking method. In this method, the IC number is entered first. On continuation, basic detail of that IC is displayed. At the start of the checking process, an option for truth table is provided for the user or viewing the truth tables, this option must be selected. At the next stage, the MCU initialises the signal processing task.

In case of this specific NAND gate IC 4011, the MCU provides 5V supply to pin 14 and 0V to pin 7. As this IC has four NAND gates, each of these is checked one by one. The MCU provides the necessary combination of inputs to each gate as per

the truth table (Table IV) and takes back outputs from the IC (4011) as its input.

Then, by comparing these observed results with expected results as per IC specifications, the MCU yields its conclusion on that gate. Finally, the number of good and bad gates is displayed, in addition to the overall condition of the IC.

TABLE IV

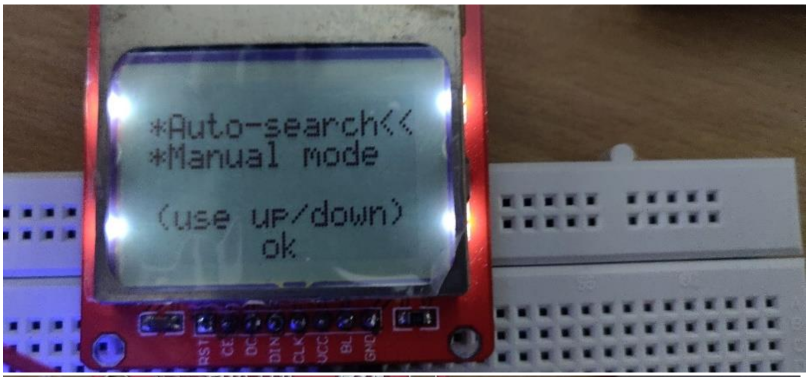
TRUTH TABLE FOR NAND GATE

ut A Input	B	Output
0	0	1
0	1	1
1	0	1
1	1	0

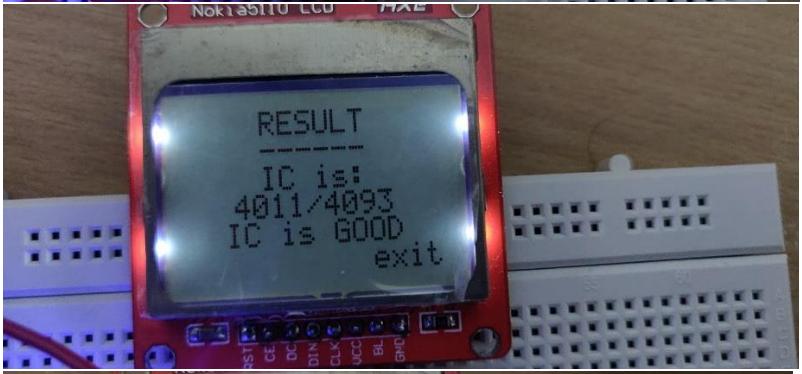
CODE:

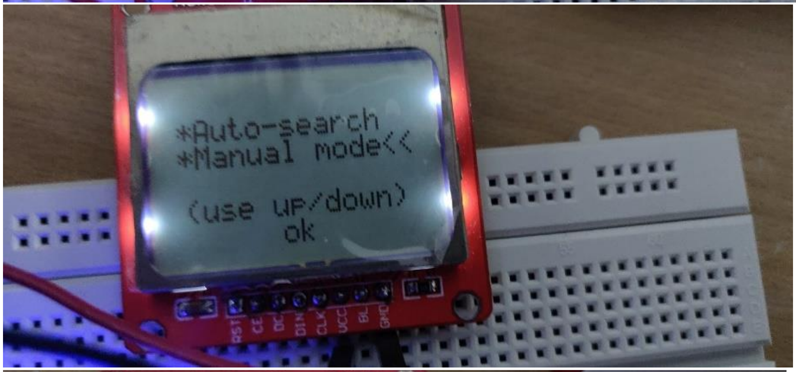
https://drive.google.com/open?id=1dD8RhNqZhjiuyoaSpqPL7lXeV2xDXGtMT_bgWzZQ538

OUTPUT:


*Auto-search<<
*Manual mode
(use up/down)
ok
RST CE DC DIN CLK VCC BL GND


Nokia5110 LCD
HXE
Auto-search
No. of pins:
14
ext ok clr
RST CE DC DIN CLK VCC BL GND


Nokia5110 LCD
HXE
RESULT
IC is:
4011/4093
IC is GOOD
exit
RST CE DC DIN CLK VCC BL GND


*Auto-search
*Manual mode<<
(use up/down)
ok
RST CE DC DIN CLK VCC BL GND


Nokia5110 LCD
HXE
Enter IC no.
7476
ext ok clr
RST CE DC DIN CLK VCC BL GND

ADVANTAGES:

1)Easy to user for checking the ICs

2)Due to fault IC the real time projects and experiments fail. This project will be useful to prevent.
3)As we can see that the IC testers cost more. Thorough this project any user can purchase it for low cost.

PROBLEMS FACED:

1) Circuiting on breadboard was not firm enough. It was unreliable so wehave remade our circuit on PCB.

2)While coming to coding part it is a bit easy algorithm but the memory size is not efficient.

FUTURE EXTENSION:

The project can be extended as following:

1) It can be extended for more than 28 pin IC's by changing some hardware and some data of that IC.

2) It can be extended to Analog IC's.

3) As more libraries defined this can test most of the ICs.