

Interim project report on

DEVELOPMENT OF NOVEL DIGITAL IC TESTER AND IDENTIFIER

*Submitted to Indian School of Mines in partial
fulfillment of the requirement for
the award of degree of*

Bachelor of Technology

in

Electronics and Communication Engineering

by

Vipul Gupta (2013JE0147)

Yash Patidar (2013JE692)



Department of Electronics Engineering

Under the guidance of

Dr. Mukul Kumar Das (Associate Professor)

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Abstract

The Digital IC Tester and Identifier is basically used to test Integrated Circuits (ICs). We can easily test any digital IC (74xx series) using this kind of an IC tester. Unlike other IC testers, this is more reliable and easier since we don't need to rig up different kind of circuits for different kind of ICs, each time we need to test them. The novelty of this device is it also identifies the IC before testing and tests each gate individually and displays the result. It also comes with an Android support application, communicating with the device using Bluetooth interface, which downloads the Circuit diagram as well the truth table (datasheet). This device is suitable for application in Digital Circuit lab or basic electronics lab in any educational institute or for electronics hobbyist looking for economical IC tester.

Acknowledgement

I would like to express my deep gratitude to Associate Professor Dr. Mukul Kumar Das, Department of Electronics Engineering, ISM Dhanbad for granting me with an opportunity to work on the project “Digital IC Tester and Identifier” for 6th Semester under his guidance. I would be always indebted to my project guide Assistant Professor Jaisingh Thangaraj, Department of Electronics Engineering, ISM Dhanbad whose proper guidance helped me to proceed with this project in the right direction. This progress would not be possible without his proper mentorship. Lastly, I would like to thank my family and friends for their help and support in this project.

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1.Introduction

An Integrated Circuit tester (IC tester) is used to test Integrated Circuits (ICs). We can easily test any digital IC using this kind of an IC tester. For testing an IC, we need to use different hardware circuits for different ICs; like we need a particular kind of tester for testing a logic gate and another for testing flip flops or shift registers which involves more complication and time involved will also be more. So here's an IC tester to overcome this problem. Unlike other IC testers, this is more reliable and easier since we don't need to rig up different kind of circuits for different kind of ICs, each time we need to test them.

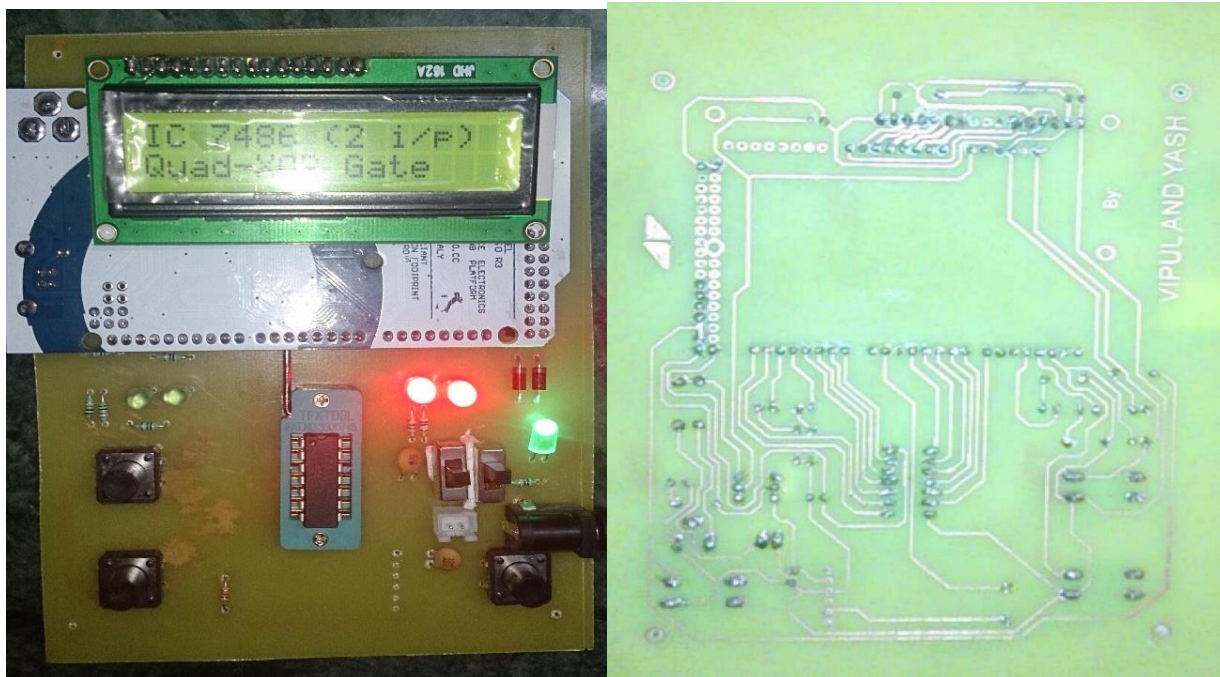
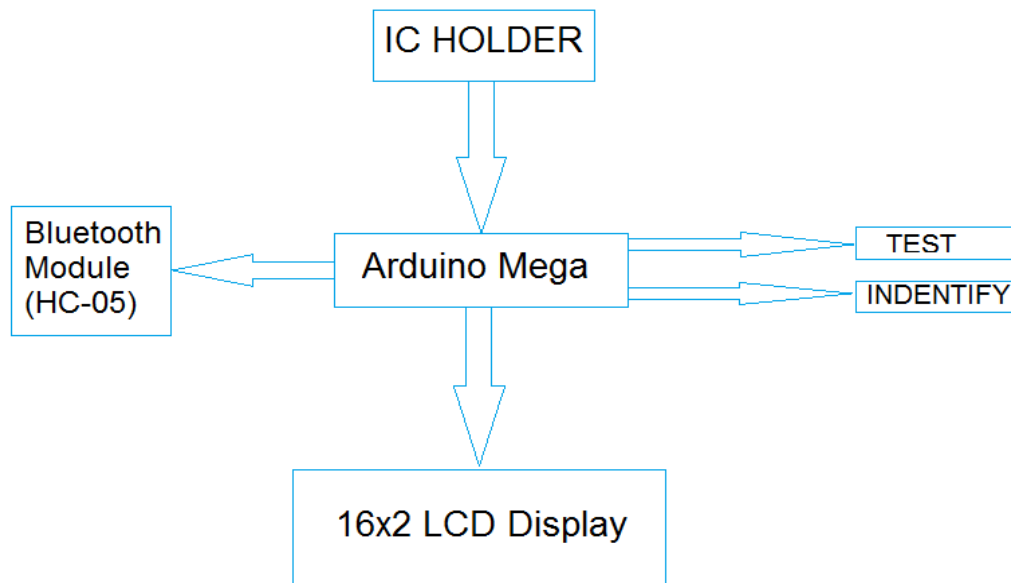
Unlike the IC testers available in the market today which are usually expensive, this IC tester is affordable and user-friendly and also **identifies the particular IC** before testing. This IC tester is constructed using Arduino Mega (Atmega 1286) microcontroller along with a bluetooth module and a display unit. It can test digital ICs having 14 pins (7400 series). Since it is programmable, any number of ICs can be tested within the constraint of the memory available. This IC tester can be used to test a wide variety of ICs which includes simple logic gates and also sequential and combinational ICs like flip-flops, counters, shift registers etc. It is portable and easy to use.

The block diagram of the programmable digital IC tester is as shown in the next page. It consists of Arduino Mega (Atmega 1286), 14-pin ZIF IC socket, display unit, Test and Identify buttons, Bluetooth Module (HC-05).

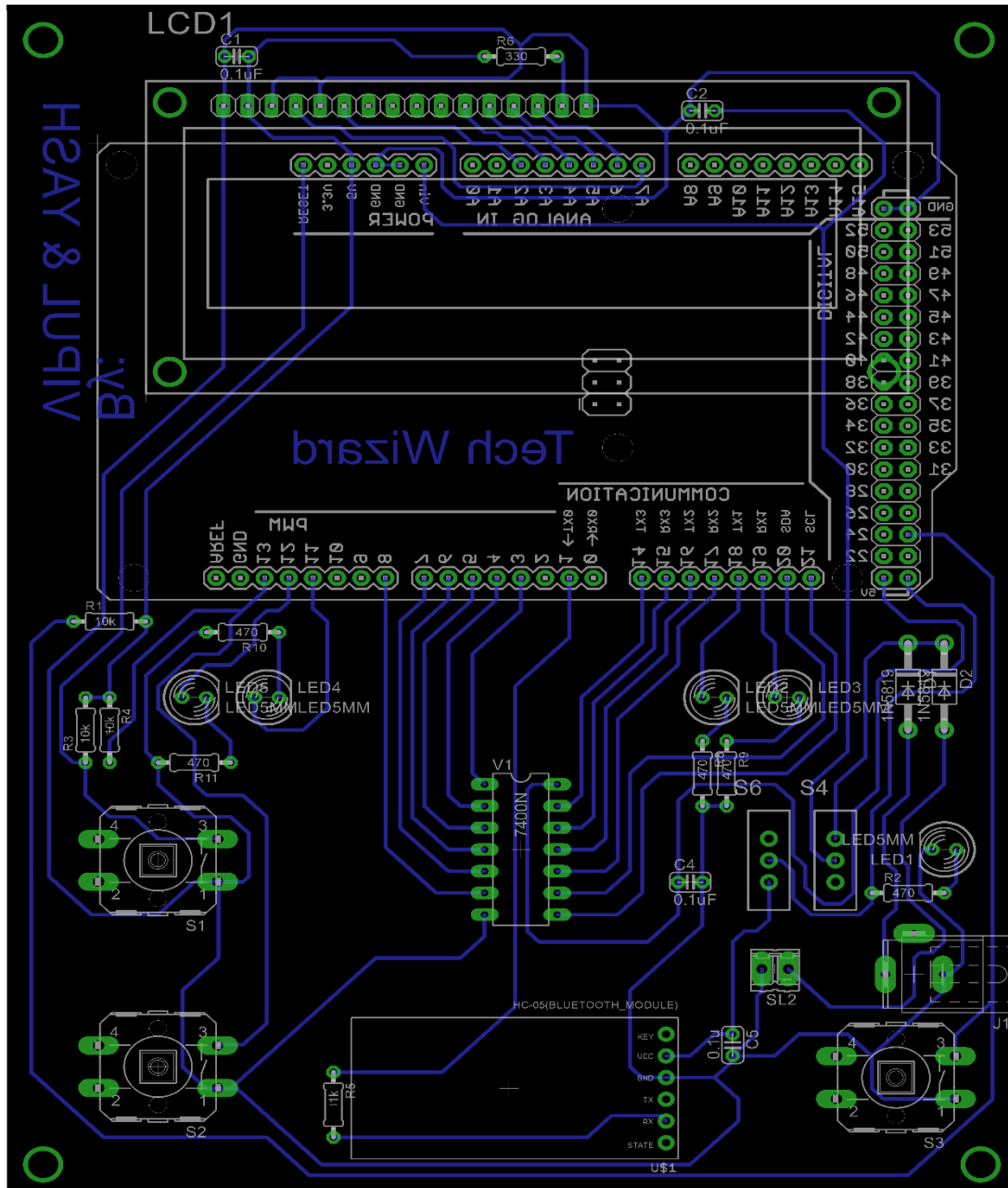
To test a particular digital IC, one needs to insert the IC into the ZIF IC socket and press the "IDENTIFY" button. The IC number and name gets displayed on the LCD display unit.

Then to test individual gates, one needs to press the "TEST" button. If all the gates of the IC are fine then the green LED's will glow and if any of the gates is damaged then the red LED's will glow. Individual status of each gate can be seen on LCD display.

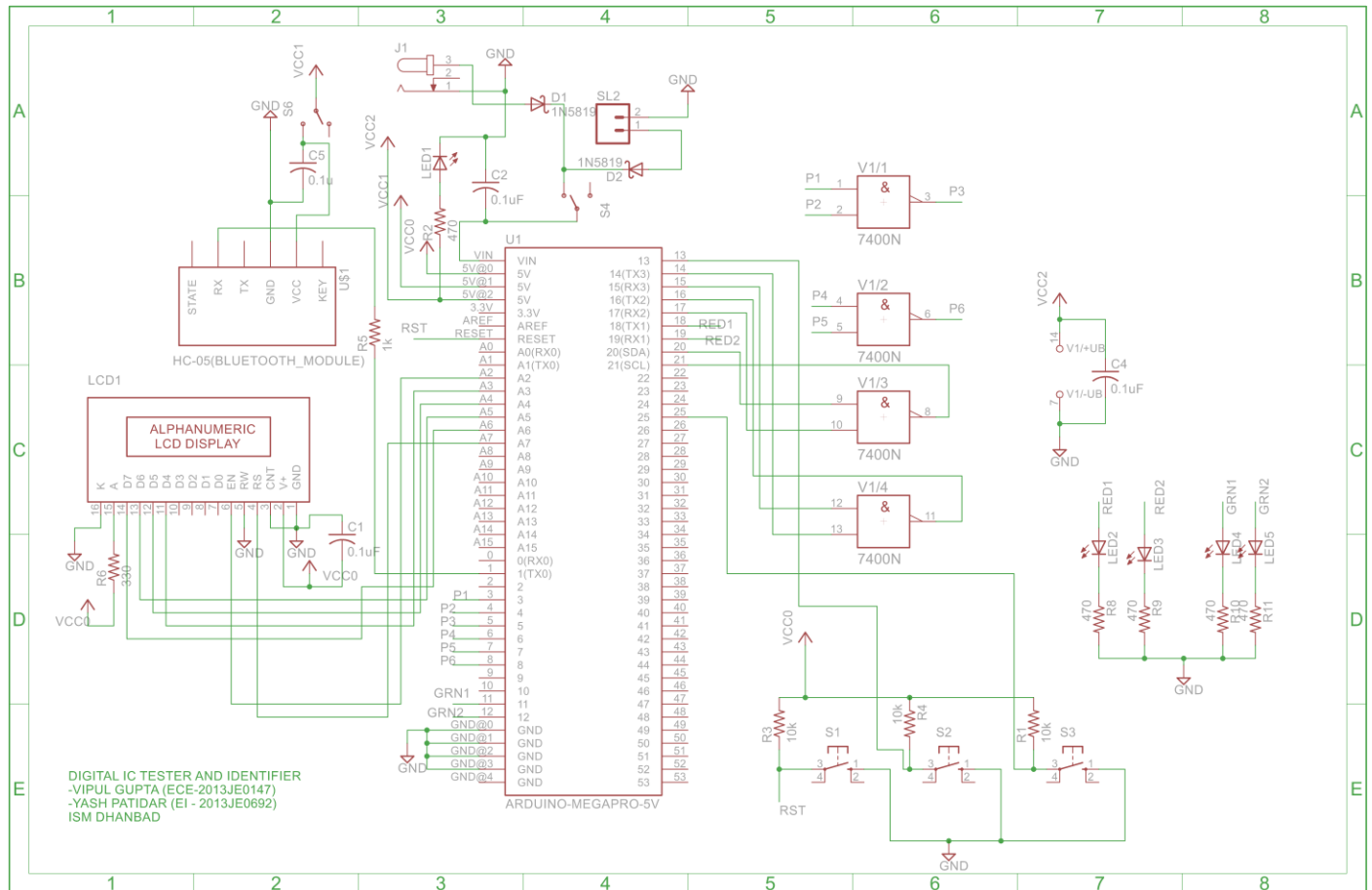
2. Block Diagram :-



3.PCB Layout



4.Circuit Diagram

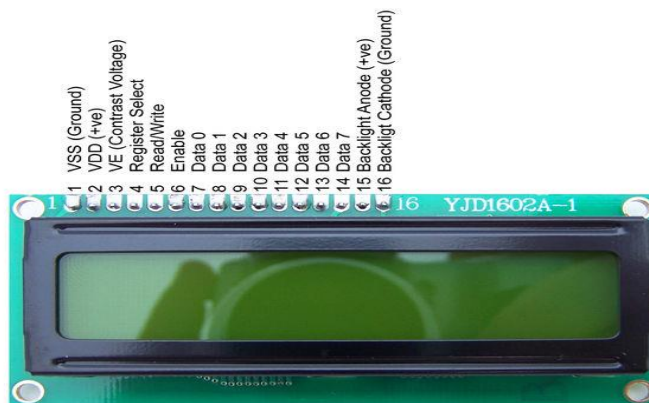


5. Hardware Design and functionality:

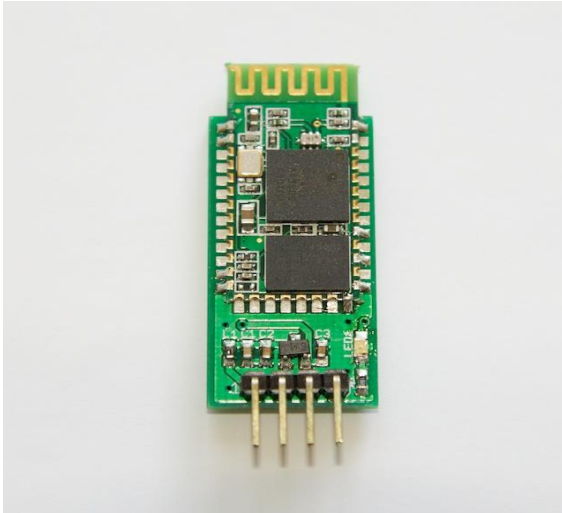
1. **Display Unit:** To display the result and for interaction with the user an HD44780 Liquid Crystal Display is used. This is a 2 line LCD with 16 input pins.

Pin Specifications of HD44780 LCD:

- Pin 1, 2, 3: Used for controlling brightness and contrast of the LCD .
- Pin 4: Register Select (RS) RS = 0; Select command register RS = 1; Select data register.
- Pin 5: Read/ Write (R/W) R/W = 0; Write R/W = 1 ; Read
- Pin 6: Enable (E): A high to low pulse is needed at this pin for the LCD to read its inputs
- Pin 7 to Pin 14: Data lines
- Pin 15: Vcc i.e. 5V, used for glowing the backlight.
- Pin 16: Ground i.e. 0V.

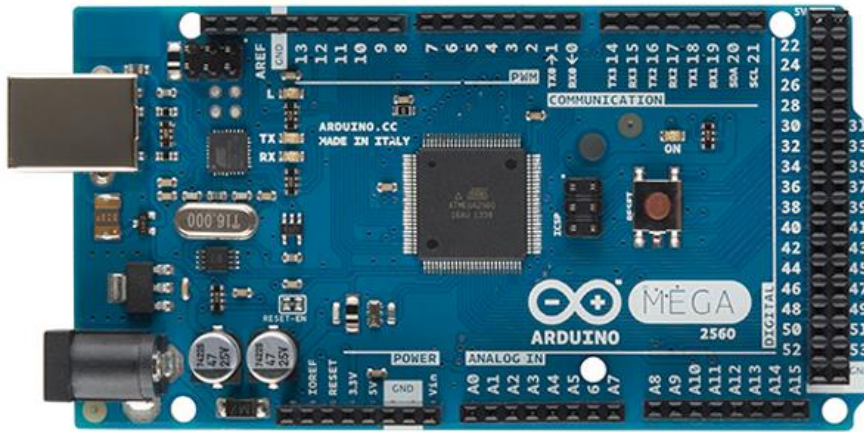


2. **Bluetooth Module (HC-05) :** To display the result on android application Bluetooth module is used.



- 3. Microcontroller :** The Arduino Mega is a microcontroller board based on the ATmega1280. It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	54 (of which 15 provide PWM output)
Analog Input Pins	16
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	128 KB of which 4 KB used by bootloader
SRAM	8 KB
EEPROM	4 KB
Clock Speed	16 MHz



The ATmega1280 has 128 KB of flash memory for storing code (of which 4 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).

4. **Functionality**

The device tests and identifies the particular IC by applying the truth table in digital format using the digital pins of the microcontroller, i.e., High for 5V and Low for 0V. Two Power-On switches have been provided along with an indicating LED, one for power source and other for Bluetooth module. Three push buttons are provided, 1- Reset Switch, 2- Identify switch and 3- Test switch. For plugging the IC, 14 pin ZIF socket is placed in the middle of the board. We place the IC in the socket before powering the device.

After switching on the device, press the “Identify” button to identify the IC, e.g., IC 7400 (2 i/p) Quad Nand Gate, and then we press the “Test” button to test the individual gate, e.g., 1: OK 2: OK 3: OK 4:OK.

The truth table and the circuit diagram can be downloaded using the Android application.

6. Usability

This is very useful device for testing the digital logic IC's as there are multiple gates in each IC and those are to be tested one at a time, and in some case we can have to test up to six gates, while in another case we may have IC which takes up to 3 input. It is very painful and time consuming, so it saves time and human effort for testing the IC. And it gives the result instantaneously.

It can be used in Digital Circuit Lab and Basic Electronics lab in any engineering institution.

ICs THAT CAN BE TESTED PRESENTLY

- 7400- Quad 2-Input NAND Gate
- 7402- Quad 2-Input NOR Gate
- 7404- Hex 2-Input NOT Gate
- 7408 Quad 2-Input AND Gates
- 7410 Triple 3-Input NAND Gates
- 7411 Triple 3-Input AND Gates
- 7420 Double 4-Input NAND Gates
- 7421 Double 4-Input AND Gates
- 7427 Triple 3-Input NOR Gates
- 7432 Quad 2-Input OR Gates

7.Future Developments

This Integrated Circuit Tester is only programmed for the ICs of 7400 series. However, this device can be easily extended for a large no. of ICs as long as memory permits. No rewiring is required. Only editing the source code accordingly will be needed. The function and truth table in the source code need to be added for any IC to be functional.