Journal of Fundamental and Applied Sciences

ISSN 1112-9867

Available online at http://www.jfas.info

Research Article

Special Issue

E-TESTER: THE DEVELOPMENT OF AN ELECTRONIC BOARD THAT CHECK COMMONLY USED ARDUINO-BASED ELECTRONIC COMPONENTS AND MODULES

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Published online: 01 February 2018

ABSTRACT

The introduction of Arduino controller has sparked interest among hobbyist, school students and engineering students to learn embedded programming. One of the problem face by the new learners of Arduino is to check, whether the Arduino electronic components used is fit for use. This project attempts to introduce an all-in-one component checker that able to identify whether the electronic component is functional or faulty by inserting the component to the given jig. This first version of E-TESTER can test 12 commonly used electronic components and modules. The result section shows the simulation and the hardware implementation on different scenarios.

Keywords: Arduino controllers; embedded programming.

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doi: http://dx.doi.org/10.4314/jfas.v10i2s.37

1. INTRODUCTION

E-TESTER is inspired based on personal experience faced by the authors. Being an electrical engineer student, the authors had experienced problem to determine the cause of a newly bought Ultrasonic sensor does not give a valid reading. The authors had been checking whether the source code written is inaccurate or there is a mistake in circuit connection, only later to find out that the newly bought component is faulty. This cause a lot of time wasted and can be avoid if there is a component check to fitness of the electronic component. Another potential use of E-TESTER is at the laboratories or workshop, where many different type of electronic components can be tested in a short time without required to build the circuit connection and written any codes.

Electronic component testing is not something new. The most commonly used equipment to test an electronic component is a multimeter. A multimeter as shown in Fig. 1 can be used to determine the values of resistor, value of capacitor, value of forward drop of a diode, continuity test and value of current gain in transistors [1]. Based on this value, the user can conclude whether the electronic component fit for use. Unfortunately, the main disadvantage of using a multimeter is that it requires the user some knowledge on electronics for the user to conclude whether the fitness of the electronic component. Karni Tech Solution had designed a semiconductor component checker that able to check the parameters of transistors [2]. At the Minimax Electronic website, the company sells an electronic component tester called MME-ECT 20 which automatically test most of IC after the user enter the integrated circuit (IC) number [3]. Atlas ESR 70 produced by Peak Electronic Design able to check diodes, resistors, inductors, and transformer [4]. There is also a Do-It-Yourself (DIY) component tester proposed by Baweja Akshay who uploaded the details of the DIY component tester contruction and codes at the Instructables website [5]. The author claimed that the component tester able to test: resitsors, capacitors, inductors, Bipolar Junction Transistor (BJT), Field Effect Transistor (FET), thyristors, and diode. Daniu [6] produced a color-display multi-functional transistor tester that able to perform similar tasks as stated in [5]. Meterk [7] also produced a multi-functional transistor tester that able to test most of the components stated in [5]. An Indonesia-based company, Duwi Arsana produced an electronic component

tester called Komponen Tester [8]. Notice that most of these component tester tests basic components but none of them attempt to test a much more complex component or module such as joystick module. This project attempt to fill the gap by proposing a component tester that able to test commonly used Arduino-based electronic components and modules such as joystick.

2. METHODOLOGY

The proposed electronic board of the electronic component checker, E-TESTER is a prototype that attempt to show the possibility of having an electronic board/jig that able to test most commonly used electronic components. For this first version of E-TESTER, the authors had limit the scope of the project to 12 commonly used components which are uni-colour Light Emited Diode (LED), bi-colour LED, tri-colour LED, buzzer, resistors, 16 X 2 Liquid Crystal Display (LCD), Light Dependent Resistor (LDR) sensor, LM35 sensor, joystick, seven segment display, ultrasonic sensor and water sensor. Fig. 1 shows the schematic diagram of E-TESTER drawn using Proteus 8. Note that there are several components not shown in the schematic diagram: water sensor, joystick, RGB and bicolor LED because the components are not available in the Proteus 8's library.

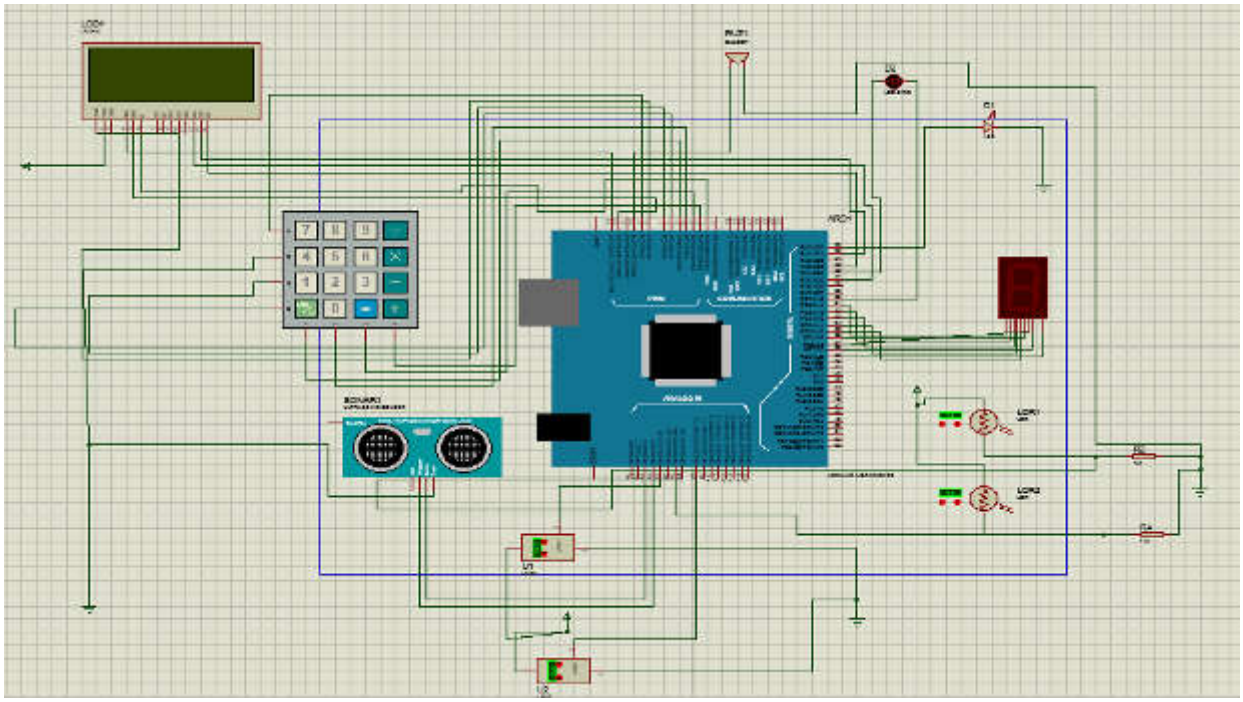


Fig.1. Schematic diagram of E-TESTER

Fig. 2 shows the hardware implementation of the E-TESTER. From the figure, it can be clearly seen location of each component need to be slot for testing. The 20 X 4 LCD is use to display any request from E-TESTER, while the keypad is use as input for accepting user selection.

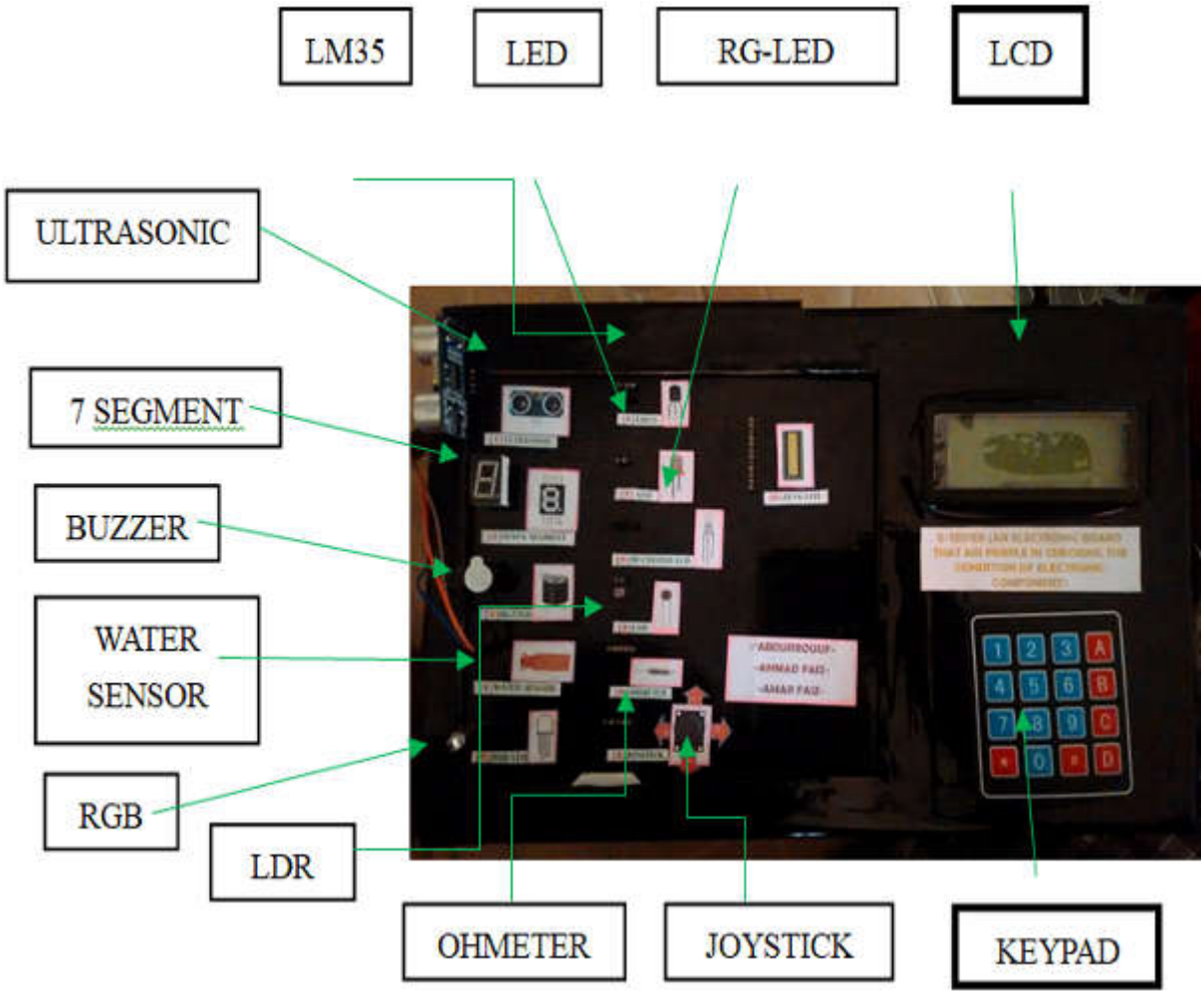


Fig.2. Top view of E-TESTER prototype

Fig. 3 shows the general flowchart of E-TESTER. Once E-TESTER is turn on, the board will display a welcome message while performing initialization process in the background. Once done, it will display a request for user to select what components to be test. Once the user had key in the option using the membrane keypad, E-TESTER will ask the user to connect the component that need to be check at the corresponding pins. Then, the user need to press a button to inform the E-TESTER that the component had been inserted. Next, E-TESTER will request the user to follow specific set of instructions. These instructions are based on the component that needs to be test. Once all the instructions had been followed, E-TESTER will conclude whether the component is fit or faulty.

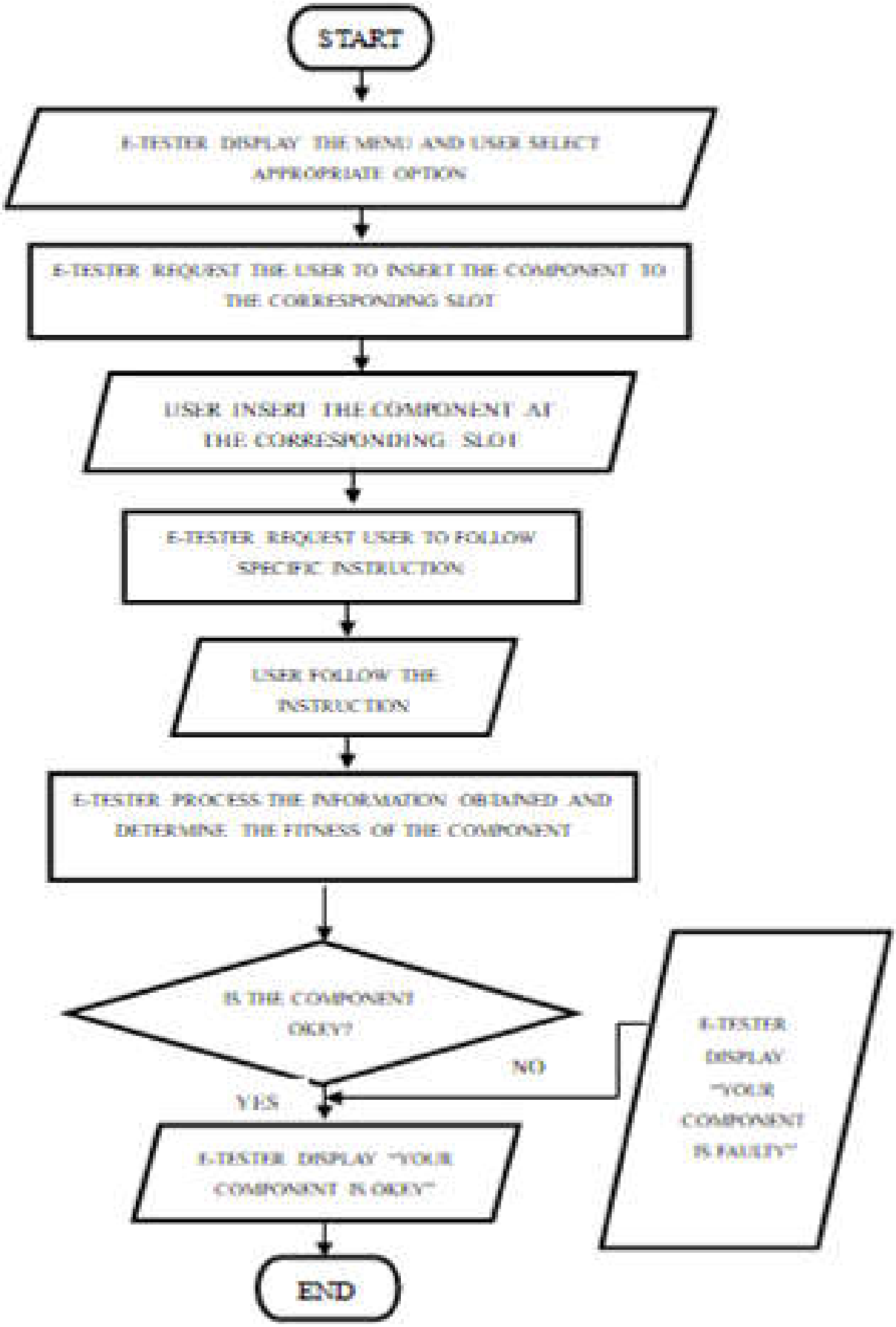
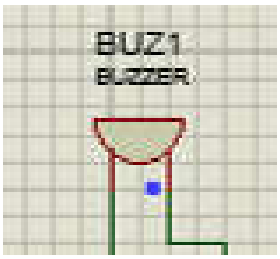
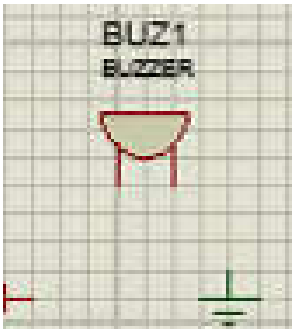


Fig.3. General flowchart of E-TESTER's operation

3. RESULTS AND DISCUSSION

This result section is divided to three subsections which are the simulation result, the hardware result and a brief survey. Table 1 shows the result of the simulation result. Simulation is limited to LED, buzzer and seven segments due to limitation of Proteus 8 library. Table 2 shows the hardware result which consist all 12 components. For bi-colour LED and tri-colour LED, E-TESTER able to check for both types: common-anode and common-cathode. Based on the software simulation and hardware implementation, the outcomes of each scenario are as expected.

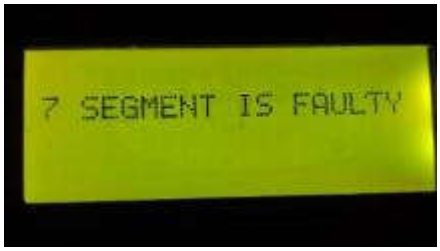
Table 1. Software simulation of E-TESTER

No.	Software Simulation		Explanation
	Instruction	**Result**	
		Buzzer	
1		 (a)	This simulation shows that the user need to insert the buzzer to the board. To show that the buzzer in good condition, there is red indicator that shows the flow of current. If there is blue indicator, the buzzer is faulty or wrong connection of polarity. Therefore, the LCD will display the result of the buzzer. “Buzzer is ok” if there is a connection and current flow. If not (b), the LCD will display
	 (a)	 (b)	
	 (b)		

			"buzzer faulty"

Table 2. Hardware implementation

No.	Condition	Expected Result	Hardware Result
		Ultrasonic Sensor	
1	Scenario: User want to test a functional ultrasonic sensor. User need to select their component	The LCD will give instruction to user.	
2	User press 1 to choose ultrasonic sensor.	The LCD will display to user to move the object for 5 cm and 10 cm.	
3	User move the object for 5 cm and 10 cm.	Ultrasonic sensor will read the value of the distance.	
4	User gets the result of their component.	The LCD will display the result after move the object for 5cm and 10cm.	
		Seven Segment Display	

1	Scenario: User want to test a faulty and okay seven segment display. User press 2 to choose 7 segment display.	The LCD will display to ask user to insert the 7 segment.	
2	User check the pattern display on 7 segment	The LCD will display to ask user that there is "8." pattern displayed? If there is "8." display on the seven segment, the seven segment is ok. If user cannot see the display of "8.", the seven segment is faulty	  (a) Faulty 7 segement display  (b) Functional 7 segment display
3	User gets the result of their component.	The LCD will display the result which is "7 segment is faulty" if user do not see the "8." On their seven segment. The LCD will display	 (a) Feedback for faulty 7segment display

(b) Feedback for faulty 7 segment display

4. CONCLUSION

This paper presented the development of the "all-in-one" electronic board checker that able to check 12 commonly used Arduino [9-11] components. Details of the hardware and software implementation had been explained. Result of the prototype had been tested had been presented. The next course of action of this project is to obtain preliminary feedback from potential users in order to improve the prototype further.

5. ACKNOWLEDGEMENTS

The authors would like to thanks Ministry of Higher Education (MOHE) and Research Management Institute of Universiti Teknologi MARA (UiTM) for providing financial support under ARAS fund grant 600-IRMI/DANA 5/3/ARAS (0120/2016).

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How to cite this article:
Anuar A, Hussin AF, Majid MA, Abidin AFZ, Yusoff ZM, Hassan KK, Ali NM, Harun MH, Rizman ZI. E-tester: the development of an electronic board that check commonly used arduino-based electronic components and modules. J. Fundam. Appl. Sci., 2018, *10(2S), 514-523.*