

Smart Finder Using IoT System

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Abstract

Practical learning in Electronics requires handling and managing many electronic components, tools, and equipment. A study has been done to improve the time-consuming process to locate these parts in an electronic workshop. As a result, **Smart Finder** was designed to replace the manual search method. This product utilizes the Internet of Things (IoT) as a link between a smartphone and NodeMCU microcontroller. Connectivity between the phone and microcontroller enables users to locate electronic parts from anywhere within the communication coverage. Smart Finder Application on the smartphone is built with MIT App Inventor. After the required login process , users need to select the component/part on the menu in the application. Once the component/part is selected, LED which acts as indicator on the selected component/part storage turns on. These few steps would simplify and expediate the searching process. Based on the result of the questionnaires, more than 95% of respondents agreed that Smart Finder helps in saving time in preparing parts for practical classes. Further improvements on the project would be adding better security measures, application for IOS users, and more useful interfaces or features to improve workshop management in Electronic Program.

Keywords: Smart Finder, IoT, application, NodeMCU, LED

INTRODUCTION

Teaching and Learning processes in Vocational Colleges are mostly based on practical works related to real fields. Practical trainings or modules in Electronic Program syllabus involves working with a lot of electronic components, tools and equipments [1]. All these parts need to be stored properly and accordingly for good inventory control and workshop operation. Labels on the storage bins or compartments are used to identify the electronic parts. Therefore, to find a particular component or tools, students need to read the indexes and the labels on the storage bins or compartments.

Based on a survey conducted internally, it was found that preparing for practical classes is tedious and time-consuming . The manual search reduces the effectiveness of the Teaching and Learning process [2]. Locating electronic parts that has been done manually need to be replaced with a better and easier process. Hence, Smart Finder is developed to improve the storage system in an electronic workshop. It is a simple electronic kit which is built with Node MicroController Unit, NodeMcu [3]. A microcontroller allows users to save processing time thus expediate the searching process.

In this era of development, there are several technologies that have changed the world such as the Internet of Things (IoT) and Global Positioning System (GPS) . IoT is a technology based on IR 4.0 and is widely used nowadays. Therefore, to make this product more accessible, IoT offers connectivity and GPS provides accurate location [4] in Smart Finder. The utilization of IoT and positioning system provide a better and efficient searching process. LEDs is then used as indicators to pin point the location of components or parts.

The use of applications on smartphones makes Smart Finder more user-friendly. A mobile application, most commonly referred to as an app, is an application software designed to run on a mobile

device, such as a smartphone or tablet computer. Since Android is the most popular operating system in the world [5], MIT App Inventor is used to create a suitable app for Smart Finder [6]. MIT App Inventor is an online platform designed to create applications by using a visual blocks language .

Basically, the new searching method will begin with the selection of components or tools provided on the application in an Android based smartphone. The link provided by IoT between the smartphone and NodeMCU will then control the LEDs on the storage compartments to complete the findings.

METHOD

Waterfall model was used as a guideline in the development process of Smart Finder. This model has a sequential design approach and is easy to understand. It goes through phases of concept initiation, design analysis, development & testing of product and product maintenance. The basic concept behind the Waterfall model is that each stage of production must be completed before moving on to the next stage. [7]. Even though it is a conventional design, it is the most suitable for Smart Finder due to the product hardware and software development involved. Figure 1 shows the Waterfall design model (1).

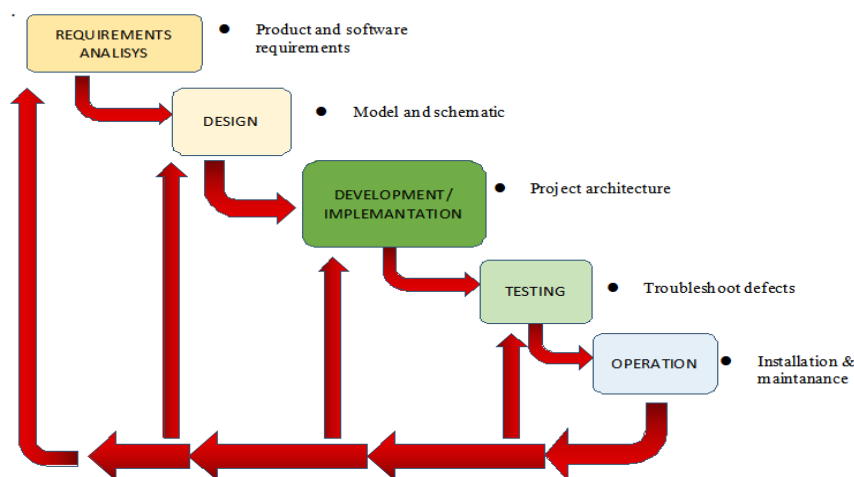


Figure 1. Waterfall Design Model

Requirements and design

Figure 2 shows the conceptual phase or the block diagram of Smart Finder (2). A registered user with Service Set Identifier (SSID) and Password uses the Smart Finder application to select a particular component or tool. The NodeMCU, very inexpensive System-on-a-Chip (SoC) called the ESP8266 controller is equipped with a Wi-fi module. It accesses the internet via the IoT. IoT is a network system that can control electronic or electrical equipment wirelessly. The LED, placed on the storage bin lights up to indicate the location of the selected component or tool[6].

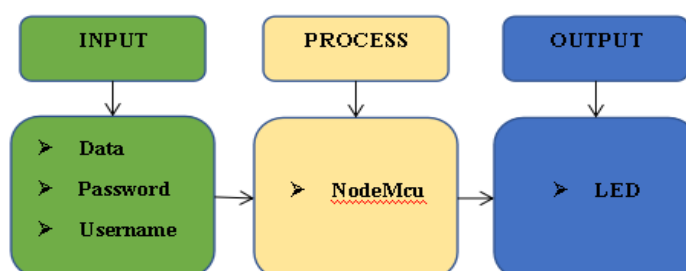


Figure 2 . Block diagram of the project

Development

The Username and Password data is stored on Firebase for the Log-In and Sign-Up processes while the user data is stored in Google Sheets[7][8]. The NodeMCU is controlled by a smartphone through an application created on the MIT App Inventor[9]. This application serves to access and control the LEDs. Even though the project needs both progression on the software/ programming and the hardware, much effort was used in obtaining the correct program or codes to operate the microcontroller and developing the Smart Finder application. Figure 3 shows part of the software used to build the Android application using MIT App Inventor (3).

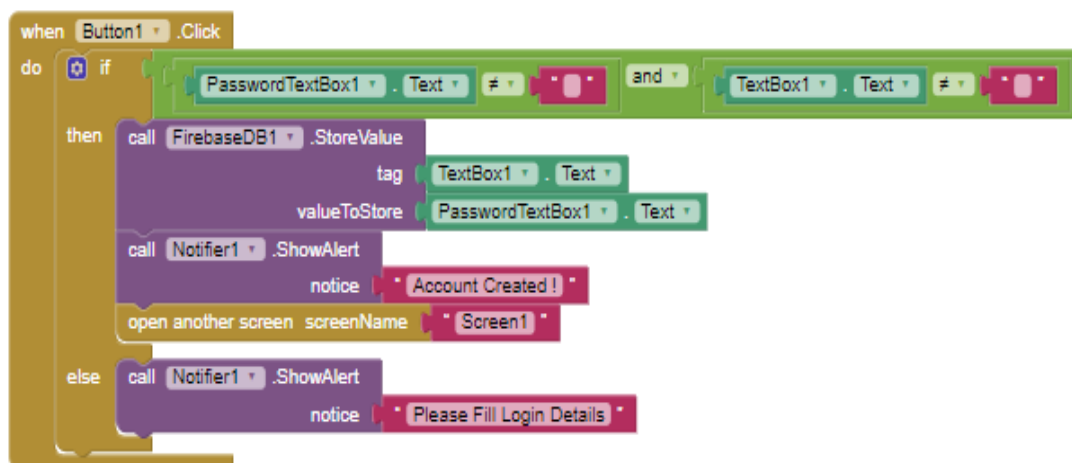


Figure 3 . Android Application

Figure 4 shows a sample of component bin to store electronic components (4). The LEDs are hardwired to each compartment and will lit up to identify the location of the searched components. The NodeMCU are placed under the component bin.



Figure 4 . Location of LEDs on a sample component storage bin

Project Testing and Operation.

Figure 5 shows the flow chart for steps taken after the designing and development stages until the completion of Smart Finder using the Waterfall model (5)[2] .

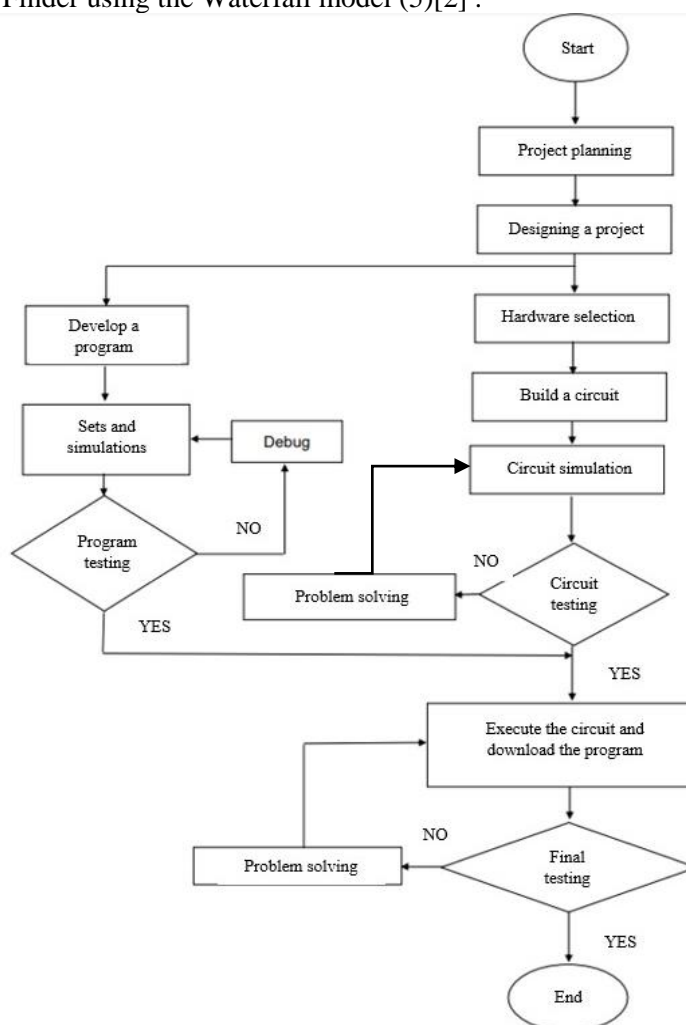


Figure 5. Project flow chart

DISCUSSION AND RESULTS

There are a couple of factors that contribute as advantages of using Smart Finder. The product is mostly useful because of IoT. Wireless communication that supports Android smartphones are capable of offering connectivity at our convenience. With this technology, the users are able to carry out components or tools searching by using a smartphone[10].

Smart Finder Application will request the user to type in the username and password. Among the data stored in Google Sheets is the user Login time and date. The user then, select the component and values to be searched on the menu provided. These data will serve as security measures and as an inventory-tracking record in a workshop. Figure 6 shows some of the results of using MIT App Inventor to create the application on the smartphone.

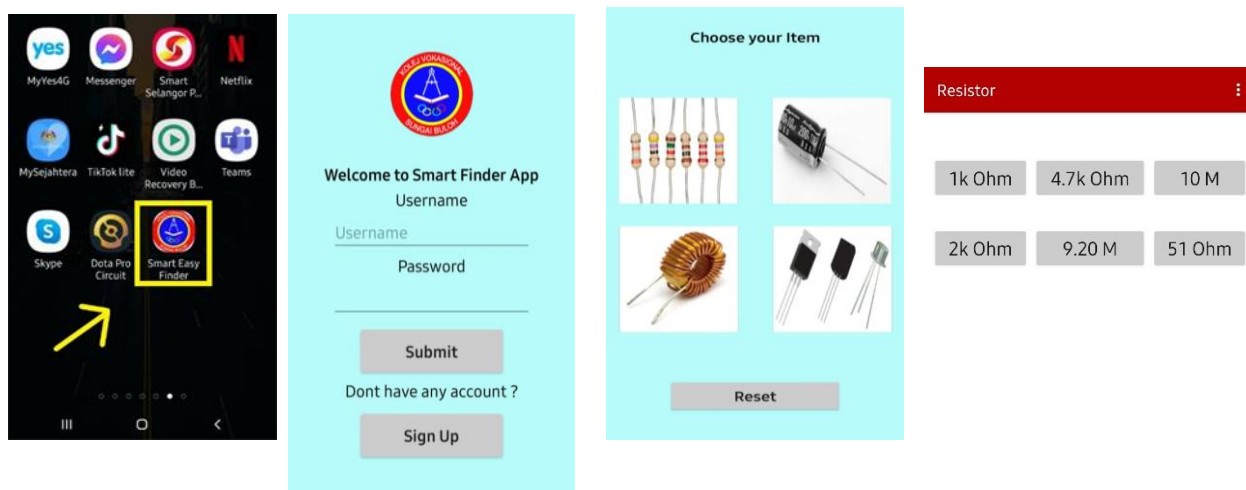


Figure 6 - Android Smart Finder App

Smart Finder is very effective because the search medium uses microcontroller NodeMCU as opposed to manual system. [11] . NodeMCU module is actually managed by the password to control the LEDs through IoT. In this system, the microcontroller works through serial data transmission to facilitate wireless communication (6). The advantages of using NodeMCU ESP8266 platform are low cost, low energy consumption, small in size and built with a Wi-Fi module to support networking[12]

Smart Finder has proven to simplify work and save workshop management time .Based on a quick survey conducted on 196 respondents using Google Form , 99.5% of respondents agree that Smart Finder facilitates and expedites the process of finding components and tools. And 99 % of respondents agree that the product will also reduce workshop management time. Figure 7 and 8 show the Pie Charts of both responses of the survey (7) (8).

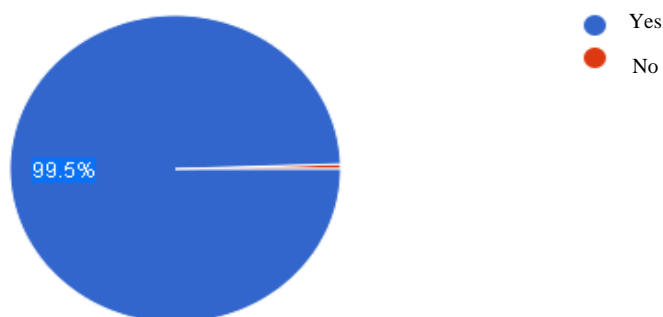


Figure 7. Pie Chart – Does Smart Finder facilitate and expedite components / tools search ?

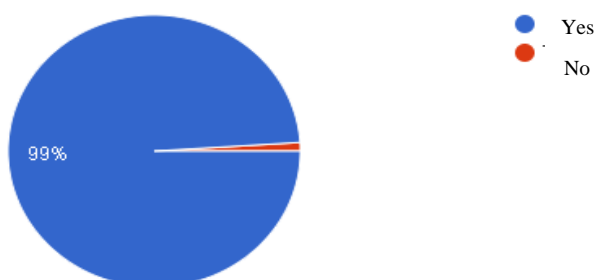


Figure 8. Pie Chart – Does Smart Finder save workshop management time ?

CONCLUSION

The Smart Finder is designed for the convenience of the users. It saves time because the system only needs Android smartphones to operate. Users do not need computers or terminals to access the system. It solves the component and tools searching problems and therefore helps eliminating issues in managing the workshop. In addition, Smart Finder is user friendly, easy to use and suitable with current lifestyle.

There are several suggestions to improve the potential of the product.

i. Security

From a security standpoint, smartphones with fingerprint scanners can be used for the Login process using Kodular because the MIT app inventor does not have such features.

ii. LED timer

In terms of functionality, a timer can be used to turn off the led on the component bin automatically.

iii. Smart Finder application on IOS system.

The Smart Finder App can only be used by Android based smartphones. Another application built through Thunkable, which is available in the App Store, can be used to cater for the IOS users.

Smart Finder system is based on the latest technology. This technology is able to create an environment that enables students or lecturers to enhance their Teaching and Learning process. It will also helps workshop owners or managers oversee their tools, components and equipment more efficiently compared to using manual methods.

REFERENCES

- [1] R. Othman, "MOE - Info Program", *Moe.gov.my*, 2021. [Online]. Available: <https://www.moe.gov.my/en/tvet/vocational-college/info-program>. [Accessed: 29- Aug- 2021]
- [2] M. Bin Abdul Nasir, *Membangunkan Smart Finder Menggunakan Sistem IoT Dan Modul NODEMCU 8266*, Selangor, Malaysia, 2020, pp. 2-3.
- [3] P.Bruegger, - *GPS Tracker*, 1st ed. University of Fribourg, Switzerland, 2006, pp. 4-5
- [4] K. Ghosh, M. Bhowmick and D. Joddar, *Globally controlled multiple relays using NODE MCU*, 1st ed. Kolkata: Maulana Abul Kalam Azad University of Technology, 2018, pp. 1-76.
- [5] M. Rifat and M. Fahad, "Android controlled home automation system based on different power optimization modes", <https://www.semanticscholar.org/>, 2018. [Online]. Available: <https://www.semanticscholar.org/paper/Android-controlled-home-automation-system-based-on-Rifat-Fahad/0650c1ebe76d7600c6a521f88f4fcfa1fc722ddb#paper-header>. [Accessed: 28- Aug- 2021].
- [6] NodeMCU ESP8266, <https://components101.com/>, 2020. [Online]. Available: <https://components101.com/development-boards/nodemcu-esp8266-pinout-features-and-datasheet>. [Accessed: 28- Aug- 2021].
- [7] The Coding Bus, *How to create login and signup in MIT App Inventor using Firebase*. 2020.
- [8] A. Karn, *How to create Login Page in MIT App Inventor using Firebase*. 2018.
- [9] The Coding Bus, *MIT App Inventor Button Tutorials | Tutorials #2*. 2019.
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[10] B. Bisect, "NodeMCU - Wikipedia", En.wikipedia.org, 2021. [Online]. Available: <https://en.wikipedia.org/wiki/NodeMCU>. [Accessed: 28- Aug- 2021].

[11] DIY Planetleak, App Inventor 2 ESP8266 GPIO Control with Nodemcu LUA. 2015.

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