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The Making of an Item-Locating-Ringing Sticker using a Radio Frequency Module

Dr. Julie Ann B. Real[1], Mark Raphael D. Dela Cruz[2], Ralph Benedict J. Capili[3], Sofia Isabel A. Flores[4], Ember Eliyah M. Rueda[5], Riona Samantha V. Salandanan[6]
[1, 2, 3, 4, 5, 6]Research Development, Accreditation and Publication Office, PSD, Doha, Qatar

Abstract: The objective of this study is to make an Item-locating Ringing Sticker using a Radio Frequency Module. This study contains the making of an Item-locating Ringing Sticker that aims to assist the people who frequently misplace items and also aims to aid them in spending less time when finding the lost objects. The searching device consists of a receiver and transmitter modules or Radio Frequency Modules, which are used for serial communication. The process includes assembling, connecting the 3.7v battery and push-button to the RF Wireless Tx Module for the transmitter, and connecting the 3.7v battery and buzzer to the Rx Module 433 MHz for the receiver. When a user is utilizing the device, the transmitter would emit serial codes to the receiver wirelessly with the help of an antenna, thus allowing the activation of the transmitter and the sound emission of the receiver to be in sync. Following the creation of the device, its functionality would be tested in terms of audibility, range of connection, and transmission delay. volume, range of connection, and the transmission delay time. The receiver of the Item-locating Ringing Sticker can produce an average sound volume of 93.67 decibels, allowing the user to hear the sound's direction, which would be guiding them in finding the misplaced object. The range of connection between the transmitter and receiver devices is between 0 meters and 8 meters. This shows that the minimum distance of connection is 0 meters, and the devices only have a maximum radius of 8 meters for the retention of connection. The Item-locating Ringing Sticker has an average scale of 0.015 seconds in transmission delay per meter, which means that the delay time scales with distance.
Keywords: Radio Frequency Module, Item-locating, Ringing Sticker, Misplaced Items, Serial Communication

I. INTRODUCTION

An Item-locating Ringing Sticker is a device that indicates an item that the owner has misplaced by sending out a sound through another electronic device such as mobile phones or keychains. The device helps the owner locate an item that they have misplaced by emitting a familiar sound, which he or she could detect from a specific point in the room. To utilize the device, it needs a medium to be able to transmit a reminder to the user, such as ringing stickers. Ringing stickers are devices that contain an alarm system that makes the notification. These stickers are convenient to use due to their straightforward features.

Receiver and transmitter modules are the main materials that were used to conduct this study. These modules work together by receiving serial data and transmitting them wirelessly through an antenna. These materials are cost-efficient and are easy to integrate as well. RF modules are most often used in consumer products such as remotes, alarms, and sensor applications which is why the researchers chose this as their main component in producing an item-location ringing sticker. Moreover, its wireless system is more convenient to use and it does not require a line of sight.

The researchers utilized wireless radio frequency modules due to their effectiveness and convenience. The first product would be the Item-locating Ringing Sticker remote which transmits the data. The gadget processed by the transmitter module is used to notify or locate a missing item. The second product is a Ringing Sticker. The invention would be stuck to a certain belonging that a person would most likely misplace like wallets, cellphones, and house keys.

II. METHODS

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A. Research Design

This study utilized the quantitative experimental design of research, meaning it is more on physical experimentation rather than written descriptions. Tanner (2018) stated that experimental research is the type of research that aims to determine "cause and effect" relationships of defined variables under controlled conditions, create products with certain materials, create comparisons between two specific products, test feasibility and/or effectiveness of products, and more.

The relationship between the independent and dependent variable was tested through the hypothesis. In this study, Radio Frequency Module is the independent variable and the Item-locating Ringing Sticker is the dependent variable. Quantitative method was used in order to organize the experiment properly and to ensure that the right type of data is available to answer the research questions as clearly and efficiently as possible. It is necessary to use this method because it provides a high level of control over the variables that demonstrates an outcome and has an advantage in finding accurate results.

B. Research Locale

The research study was conducted in one of the researcher's house in Barwa City, Mesaimeer (Zone 56) Qatar

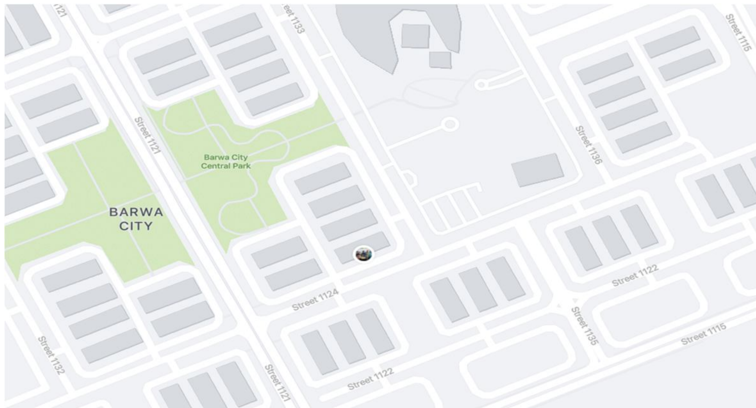


Figure 2. The Location Map of The Researchers' Residences, Doha, Qatar

III.DATA ANALYSIS

This chapter brings about the results and interpretation of data that were collected from the assembling and testing the product.

1) The Loudness of the Audio Volume of the Item-locating Ringing Sticker in terms of Decibels.

The researchers

TABLE I
The Audio Volume of the Item-locating Ringing Sticker

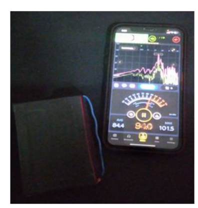
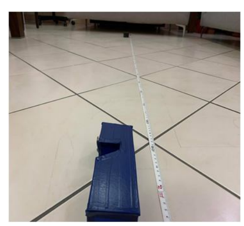
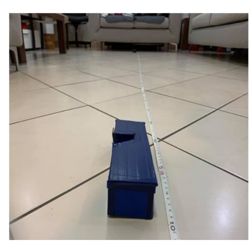
Trials	Audio Volume (dB)	Images
First Trial of Measurement	93.7dB	
Second Trial of Measurement	92.9dB	
Third Trial of Measurement	94.4dB	
Average Audio Volume	93.67dB	

Table 1 shows the different trials to check the loudness of the product through the unit decibels. In the first trial of measurement, the audio volume was 93.7 decibels, while in the second trial of measuring the audio volume of the product, it was 92.9 decibels. In the third trial of measurement, the audio volume was 94.4 decibels. More than one trial was done to see if there are significant changes in the audio volume of the Item-locating ringing sticker and to be able to determine its average audio volume regardless of distance and location.

There was minimal increase in the amount of decibels every trial, having less than 1 decibel gap. Delving deeper into the result, it can be stated that this minimal change in audio volume is normal to happen. This is similar to the study of the Federal Communications Commission (2020) which explained that the change in amount of decibels occurs because of the interference that happens when unwanted radio frequency signals disrupt the use of a device. Furthermore, the result establishes the fact that the item-locating ringing sticker is audible and safe to human ears, having an average audio volume of 93.67 decibels. This is because as stated by Miyara (2018), the human ear can perceive sounds ranging from 0dB to 120dB, sounds within this range are safe for the human ear whereas sounds exceeding this range can cause hearing impairment.

2) The Maximum Range of Connection Between the Item-locating Ringing Sticker and its Remote Control

TABLE II
The Range of Connection of the Item-locating Ringing Sticker

Trials	Distance (m)	Pictures
First Trial of Measurement	0m	
Second Trial of Measurement	1m	
Third Trial of Measurement	2m	
Fourth Trial of Measurement	3m	

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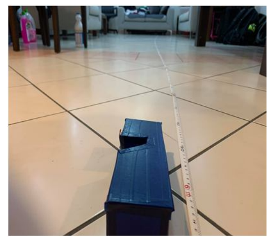
Fifth Trial of Measurement	4m	
Sixth Trial of Measurement	5m	
Seventh Trial of Measurement	6m	
Eighth Trial of Measurement	7m	
Last Trial of Measurement	8m	

Table 2 shows the range of connection between the Item-locating Ringing Sticker (receiver) and its remote control (transmitter) was tested by placing the receiver directly beside the transmitter then gradually adding an additional 1 meter until it reaches 8 meters. The results show that the minimum distance of the range of connection is 0 meters. It is evident that the maximum range of connection is 8 meters. This is the ideal radius in which the Item-locating Ringing Sticker can still be activated because it can ensure the audibility and connection within different rooms in a household. According to Baker (2019), the minimum target for airborne noise of blocking in buildings is 45dB. Moreover, with the maximum 8 meters of connectivity, it is ensured that the sound produced by the Item-locating Ringing Sticker would reach the different rooms in a household.

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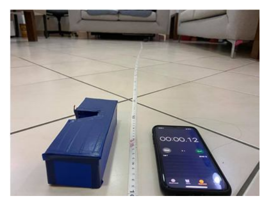
3) The Time of Transmission Delay by Unit Seconds for the Item-locating Ringing Sticker to react after Being Activated

Table III
The Transmission Delay of the Item-locating Ringing Sticker

Trials	Distance (m)	Transmission Delay (s)	Pictures
First Trial of Measurement	0m	0.09s	
Second Trial of Measurement	1m	0.10s	
Third Trial of Measurement	2m	0.11s	
Fourth Trial of Measurement	3m	0.12s	
Fifth Trial of Measurement	4m	0.14s	
Sixth Trial of Measurement	5m	0.15s	

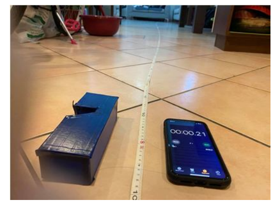
Seventh Trial of Measurement	6m	0.16s	
Eighth Trial of Measurement	7m	0.19s	
NInth Trial of Measurement	8m	0.21s	
Average Transmission Delay per Meter	0.015s		

Table 3 contains the data recorded when testing for the time of transmission delay between the transmitter and the receiver. In the first trial of measurement, there was a set 0-meter distance between the two devices, and the time between the response of the transmitter and receiver is 0.09 seconds. For the second trial of measurement, there has been an increase of 1 meter in the distance, making the current distance between the devices 1 meter. The recorded time of transmission delay for 1 meter is 0.10 seconds. For the third trial of measurement, the distance was set to 2 meters and has recorded a transmission delay time of 0.11 seconds. For the fourth trial of measurement, 3 meters is the set distance, and it recorded a transmission delay time of 0.12 seconds. In the fifth trial of measurement, the distance was set to 4 meters and it recorded a transmission delay time of 0.14 seconds. For the sixth trial of measurement, the distance was 5 meters and the transmission delay time is 0.15 seconds. In the seventh trial of measurement, the set distance was 6 meters and its transmission delay time is 0.16 seconds. For the eighth trial of measurement, the distance was set to 7 meters and the transmission delay time is 0.19 seconds. For the ninth and final trial of measurement, the distance was 8 meters and the transmission delay time was 0.21 seconds.

Between the 1st and 2nd, 2nd and 3rd, 3rd and 4th, 4th and 5th, 5th, and 6th, 6th and 7th, 7th and 8th, and 8th and 9th trials, the differences in transmission delay time are meters are 0.01, 0.01, 0.01, 0.02, 0.01, 0.01, 0.03, and 0.02 seconds respectively. When finding the average transmission delay, the given differences and their sum would be divided into eight, hence the average transmission delay would be 0.015 seconds, meaning that the scale between the distance and transmission delay time would be 1 meter to 0.015 seconds. This particular information of the device is required because according to researchers Kaufmann et al. (2012), the knowledge of time delays undergone by signals are critically needed for the accuracy of ranging measurements. Therefore, knowing the transmission delay time is necessary for testing telecommunication devices and technologies.

IV. DISCUSSION

The summary, conclusions, and recommendations that were all based on the collected and interpreted data are discussed in this chapter. The results were based according to the questions presented in the previous part of this paper. This chapter describes the results of the Item-locating Ringing Sticker using a Radio Frequency Module.

A. Summary

Item-locating Ringing Stickers are devices used to locate misplaced items within a certain range of connections. These devices can help students, the elderly, and employed individuals. The Item-locating Ringing Sticker is beneficial especially to those who struggle with forgetfulness and to those who have the habit of misplacing their belongings. The Radio Frequency Module was the main material used to make this output wherein the system works through the help of electromagnetic radiation, specifically radio waves. This experimental research intended to create a product that was the Item-locating Ringing Sticker out of a Radio Frequency Module. This study specifically aimed to determine the audibility of the Item-locating Ringing Sticker in terms of decibels, the maximum range of connection by meter between the Item-locating Ringing Sticker and its remote control, and the transmission delay between the transmitter and receiver. There are only two major steps in the making of the Item-locating Ringing Sticker. The first step was to connect the 3.7v battery and push-button to the RF Wireless Tx Module (Transmitter). And the last step was to connect the 3.7v battery and buzzer to the Rx Module 433 MHz (Receiver).

B. Summary of Findings

The following is the summary of results for each Statement of the Problem of this study. These are the prominent findings of the Item-Locating Ringing Sticker:

1) *The Audio Volume of the Item-locating Ringing Sticker:* The audio volume of the Item-locating Ringing Sticker was tested by the researchers by positioning the sound level meter directly next to the Item-Locating Ringing Sticker to measure its original audio volume regardless of distance and location. With this, the average audio volume of the item-locating ringing sticker was 93.67 decibels.
2) *The Range of Connection of the Item-locating Ringing Sticker:* The range of connection of the Item-locating Ringing Sticker was tested by activating the Item-locating Ringing Sticker at an increasing distance. The Item-locating Ringing Sticker can be activated with a minimum of 0 meters of distance from its remote up until the maximum distance of 8 meters.
3) *The Transmission Delay of the Item-locating Ringing Sticker:* The transmission delay time of the Item-locating Ringing sticker was tested by measuring the time of delay between the activation of the transmitter and the sound emission of the receiver. The Item-locating Ringing Sticker's transmission delay increases in an average of 0.015 seconds for every meter increased in distance.

V. CONCLUSION

The findings based on the statistical analysis of data lead to the following conclusions:

A. The Item-locating Sticker was able to successfully produce an audible sound that is safe to the human ears with an average of 93.67 decibels.

B. The Item-locating Sticker proved its effectiveness of having an 8-meter maximum range of connection with the use of radio frequency.

C. The Item-locating Sticker's transmission delay varies with the distance between the transmitter and receiver, therefore having an additional average transmission delay time of 0.015 seconds per meter increased in distance

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BIOGRAPHICAL SKETCH

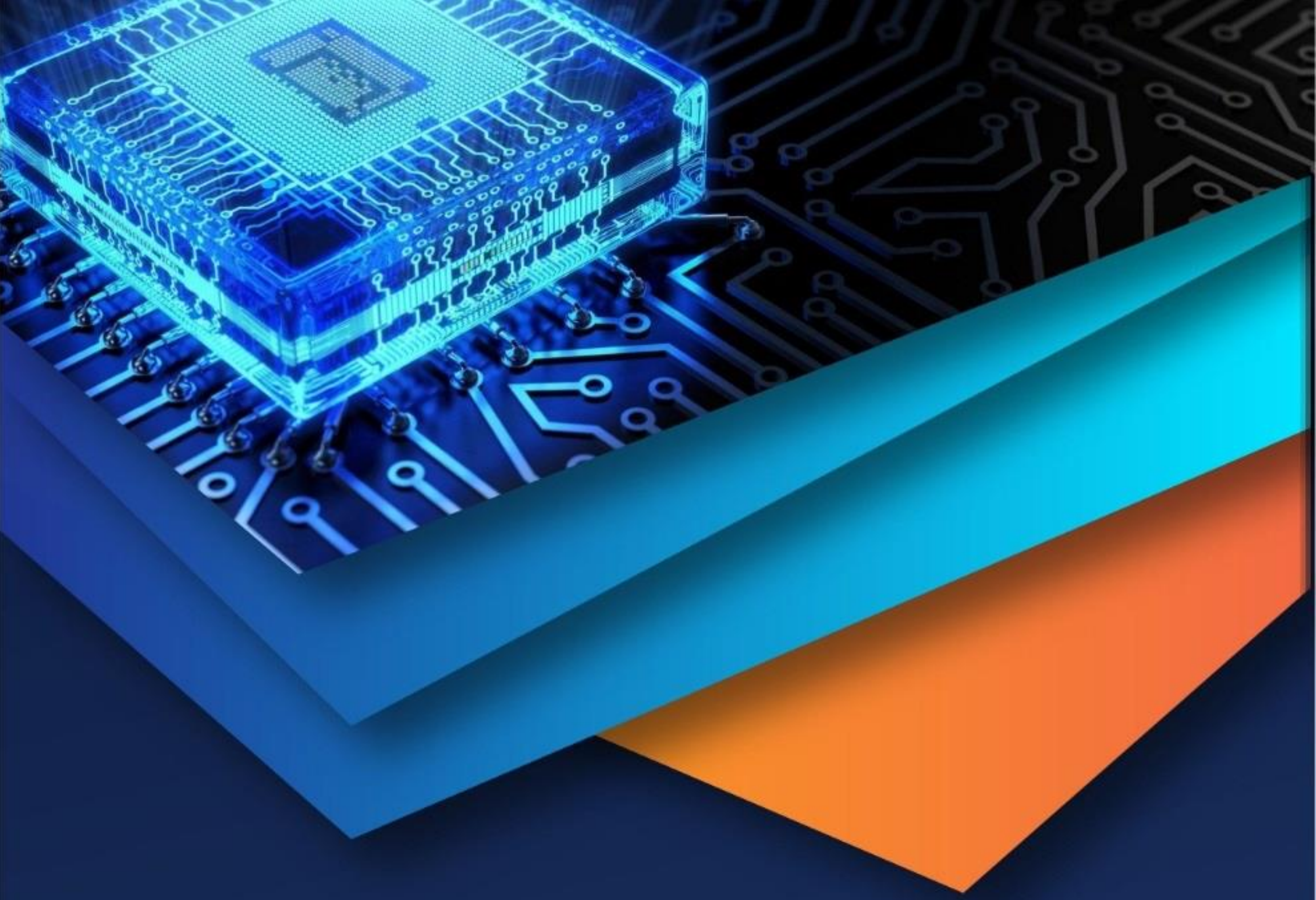
Mark Raphael D. Dela Cruz was born on the tenth of October 2004 in Manila, Philippines. He has been a part of the pilot section since 7th Grade. He joined the art club in his first year of Junior High School wherein he sold his painting in Pinta 2018 with the title of “Sent from Above”. He was a bronze awardee for 2 consecutive years. He was the best in drafting in the 2nd Quarter of Grade 9. He believes in the saying that "You miss 100% of the shots you don't take." - Wayne Gretzky.

Ralph Benedict J. Capili was born on the fourteenth of June 2005 in Paranaque City in the Philippines. He has been part of the pilot section for 9 years since his primary days. He, along with his former co-researchers, won the best tri fold display, S.Y. 2016-2017. He has been part of the group placed as Champions, in Science Banner S.Y. 2019-2020. Moreover, he achieved 1st runner-up in both Math Race on S.Y. 2018-2019 and Science Race on S.Y. 2019-2020. He believes in the quote “What is essential is invisible in the eye” by Antoine de Saint-Exupéry.

Sofia Isabel A. Flores was born on the first of August 2005 in Cavite City in the Philippines. She has been a part of the pilot section for 8 consecutive years. She, along with her fellow researchers, won as champion in the Science Investigatory Project, S.Y. 2014-2015, best tri-fold display, S.Y. 2016-2017, and 1st runner-up in Research Congress S.Y. 2018-2019. She also manifests her fondness for music by playing the piano, ukulele, and guitar during her spare time. She is inclined with the quote "The way to get started is to quit talking and begin doing."

Ember Eliyah M. Rueda was born on the 14th of November 2004 in Baguio City. For 9 years, she has been a consistent high honor student both in her latter school, National Science School, and in Philippine School Doha. For 2 consecutive years, she has been an active delegate representative of various countries in the Model United Nations held in Georgetown University, Qatar. She was a finalist in the Amazing Race Math Olympics 2018-2019. She is also the class president of her batch. Her passion for protean music prompted her to study various instruments such as the guitar, flute, ukulele, and piano. She is in accord with the quote "Be somebody who makes everybody feel like a somebody."

Riona Samantha V. Salandanan was born on the 3rd of May in the year 2005 in Calamba City, Laguna, Philippines. Since her Grade 2 years, she has been part of the pilot section.. She has been part of the group placed as Champions, in Science Banner S.Y. 2019-2020 and Science Music Video S.Y. 2019-2020 back in Science Fair 2020. She showed passion for both logical and creative activities by joining the Math Club and Glee Club. She graduated as the 7th Honorable Mention in the 24th Commencement Exercises for the Intermediate Department in school years 2016-2017. She strongly relates and affirms the quote "Nothing is so fatiguing as the eternal hanging on of an uncompleted task" by William James.



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