A Survey On low energy bluetooth based key locator and Device Detector Components

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ABSTRACT

This wireless low energy bluetooth 5.0 based Device Detector is a handy gadget that is meant to assist you in locating any items that you may have misplaced or lost. People who are prone to misplacing their items will find that it is quite easy to use and advantageous to their situation. It comes with one receiver that you may connect to your stuff in order to keep track of things like keys, remotes, backpacks, sunglass/spectacle cases, and other items that are often misplaced. The Device Detector acts as a server and to perform an operation it has a client side product dedicated application with the help of an application client that can buzz and blink the device detector, it can be attached with your stuff. The device is battery operated. The purpose of this survey is to take an overview of currently market available products and under the bluetooth Smart operated tags.

Key words : Battery life, Cost, ESP32, Features ,Low Energy Bluetooth 5.0, Range, Tags.

1. INTRODUCTION

Tags are used for tracking the stuff of regular life. It has a dedicated mobile application to perform the operation and detect the stuff. Most of the Device detector or tags work on low energy bluetooth. Thay are compact in size, less power consumption, user friendly and effective in use. But the cost is high. We can make the device detector cheaper by making them with ESP32 chips and Low Energy Bluetooth 5.0. Bluetooth paves the way for the practical use of wireless control in everyday life. ESP32 microcontroller has become increasingly powerful in recent years; it is now capable of effortlessly controlling an inbuilt Bluetooth module, and an ESP-32 micro-controller comes equipped with flash memory that only has to be programmed once. Bluetooth low bandwidth energy (LE), commonly referred to as Bluetooth Smart or Version 4.0+ of the Bluetooth protocol, is the power-efficient and application-friendly version of Bluetooth that was developed specifically for the Internet of Things (IoT).Bluetooth is a relatively new communication protocol that was developed to enable wireless networking between computer devices that are equipped with Bluetooth. Bluetooth enables devices to connect with one another using short-range radio links, freeing them from the limits of wires, cables, and requirements that they have a line of sight to each other. Robustness, minimal complexity, low power consumption, and cheap cost are among the desired attributes that Bluetooth has.

2. BACKGROUND

One of the most important considerations when developing a new product is the choice of components. In this paper, we will discuss the use of Bluetooth 5.0 and the ESP32 chip in a product. We will explore the features and capabilities of each, with a focus on the advantages they can bring to the product being developed. Additionally, we will examine the challenges of integrating the two into a single product and discuss the potential benefits that such a product could offer to its users. The aim is to provide an understanding of the components and their potential application in the product, as well as to identify possible issues that could arise during development.

2.1 Challenges of device detector Use- Using Device detectors comes with its own set of challenges. Battery life is one of the most common issues, as most Device detectors require regular battery replacements. Additionally, the compatibility of Device detectors with different devices can be an issue, as some Device detectors may not be compatible with certain devices. Furthermore, multiple transmitters may be required for each item in order to ensure a wide range of coverage.

2.2 Bluetooth 5.0 Bluetooth Low Energy (BLE) 5.0 is the best protocol for Device detectors due to its low energy requirements, low cost, and wide range of compatibility.low energy bluetooth 5.0[1] is an upgrade of the previous low energy bluetooth 4.2 protocol, offering improved range, faster

data transfer speeds, longer battery life, and better security features. The improved data transfer speeds and range make it ideal for tracking items that may be far away or have limited access to power sources. Additionally,low energy bluetooth 5.0 is a low-cost protocol and is compatible with a wide range of devices, making it an ideal choice for many key-locator manufacturers.

2.3 ESP32-The ESP32[2] is one of the best microcontrollers for creating a Device detector with the Bluetooth Low Energy 5.0 protocol. This is because the ESP32 offers several important features that make it an ideal choice for such a project. ESP32 is a low-cost, low-power solution that has a wide range of peripherals, including integrated Wi-Fi and Bluetooth. This makes it highly suitable for creating a Device detector device that requires wireless communication. ESP32 is a very powerful chip with an ARM Cortex-M4 processor core, which makes it capable of running complex tasks with ease. This makes it an ideal choice for running the Bluetooth Low Energy 5.0 protocol, which requires higher processing power than earlier versions of the protocol. Third, the ESP32 also provides highly accurate timing and a wide range of sensors, which makes it perfect for accurately tracking the position of the key. This makes it ideal for creating a Device detector with the latest version of the Bluetooth Low Energy protocol.

3. METHODOLOGY

In this survey, we evaluated eleven key finders based on their launch date, features, pros, cons, and warranty. The key finders evaluated in this survey were: Letstrack TAG mini, Vaya smart, Tag8 dolphin, Quadrate key finder, Cospex smart key finder, Boutique smart key finder, Panasonic seekit edge, Tile Mate (2020), Wosports key finder, and Apple air tags.

3.1 Existing Device Detectors-

3.1.1 Letstrack TAG mini- Letstrack TAG mini[3] is a device detector device that helps users locate their lost keys, wallets, and other small items. It comes equipped with a range of features such as Separation Alert, Global Applicability, Find Your Phone, and Selfie button. The device is powered by a 75mAh battery that can last for 6-8 months. However, the battery is non-replaceable, which could be a potential drawback.

3.1.2 Vaya smart- Vaya smart[4] is a key finder device that helps users locate their lost items such as keys, wallets, and bags. It has a loud 90 decibel alarm that can be triggered by using the accompanying smartphone app. The device is also splash proof and has a removable battery with a life of up to 12 months. Some of the potential research areas for this product could include user satisfaction with the loudness and effectiveness of the alarm, durability and longevity of the device, and the ease of replacing the battery. Additionally, researchers could investigate how well the device works in different environments or with different types of items (e.g. keys vs. wallets). Overall, Vaya smart is a useful device that can help users locate their lost items in a short time.

3.1.3 Tag8 dolphin- The Tag8 Dolphin[5] is a Bluetooth-enabled key finder that can help you locate your lost items such as keys, wallets, and bags. It has a unique QR code feature that allows you to quickly and easily find your lost items with the help of the Tag8 community. The device also has an anti-lost alarm system and ultra-long battery life of 30 months. One of the main pros of the Tag8 Dolphin is its loud 98dB alarm sound, making it easier to locate your lost items. However, it is important to note that this product is primarily designed for luggage, and may not be suitable for other types of items.

3.1.4 Quadrate key finder- The Quadrate[6] key finder is a Bluetooth-enabled key tracking device that allows users to locate their keys using a smartphone app. It features a camera button function and Bluetooth 4.0 technology for increased connectivity. The device has a removable battery and can last for up to 30 days. However, it does not have a sound or light alert, which may be a drawback for some users. From a research perspective, the Quadrate key finder offers an opportunity to study the effectiveness of a removable battery in key tracking devices and the impact of sound and light alerts on user satisfaction.

3.1.5 Cospex smart key finder- The Cospex Smart[7] Key Finder is a small, lightweight device that helps users keep track of their keys, wallets, and other small items. It features an alarm function that can be triggered remotely, allowing the user to quickly locate a misplaced item. The device is powered by a CR2025 battery, which has a capacity of 190mAh and is rated to last for 12 months. One of the pros of this device is its ultra-low power consumption which makes it last long, however, it comes with a downside of not having a LED light and being relatively high in cost. Overall, the Cospex Smart Key Finder is a useful tool for anyone who frequently misplaces their keys or other small items, and it comes with a 1-year warranty.

3.1.6 Boutique smart key finder- The Boutique smart[8] key finder is a device that helps in keeping track of your keys, wallets, bags, and other personal belongings. It is equipped with features like easy and quick location, ultra-long battery life, and a lifetime warranty. The sound of the alarm is between 80-95 dB and it comes with a replaceable CR2032 battery. However, it does not have a buzzer or light-up feature. Additionally, there is no warranty provided with this product. From a research perspective, it would be interesting to investigate if adding a buzzer or light-up feature would improve the usability of the device. Additionally, it would be worth exploring if a warranty could be offered without significantly increasing the cost of the product.

3.1.7 Panasonic seekit edge- The Panasonic Seekit Edge[9] is a key finder device that aims to help users locate their lost items. It features a separation indicator and voice alert, as well as a "Last Seen Location" feature, which allows users to see the last location where the device was connected to their smartphone. The device is also water resistant. However, one of the cons of the device is that the battery is non-replaceable. From a research perspective, this product could be improved by incorporating a more durable and replaceable battery, as well as additional features such as GPS tracking. Additionally, further research could be conducted on user satisfaction and effectiveness of the "Last Seen Location" feature.

3.1.8 Tile Mate (2020)- The Tile Mate (2020)[10] is a key finder device that uses Bluetooth technology to help users locate their misplaced items. One of its main features is the GPS tracking capability, which allows users to see the last known location of their lost item on a map. Additionally, the device has a range of up to 250 ft/76 m, making it possible to locate items even when they are out of sight. The device is also water-resistant and can work with both Android and Apple devices. Other features include a loud buzz, a community-finding feature, and voice-assisted finding with Alexa. Some potential areas for improvement could include increasing the range and adding more advanced features such as real-time tracking and biometric locking.

3.1.9 Wosports key finder- The Wosports[11] key finder is a Bluetooth-enabled device that can be attached to keys, wallets, and other items to help locate them when they are lost. It has a dedicated remote control, a loud beeping sound, long-lasting batteries, and a red flashing LED light to help users locate their lost items. It has a powerful sound and long-distance range, however, it is relatively high in cost and has high battery consumption. From a research perspective, improvements could be made in terms of reducing the cost and battery consumption of the device, while also potentially adding additional features such as GPS tracking.

3.1.10 Apple air tag- The Apple Air Tag[12] is a highly advanced and feature-rich key finder device. It is designed to be compact and easy to use, with a range of features that make it an ideal choice for people who are always on the go. Some of the key features of this product include a loud buzzer, a large community of users, and a range of up to 120 meters. Additionally, the Air Tag is water-resistant, making it a great choice for outdoor use. One of the main advantages of this product is that it can connect with NFC-capable smartphones, which allows for easy location tracking and remote control. However, one of the main disadvantages of this product is its high cost, which may be a barrier for some users. Overall, the Apple Air Tag is an excellent choice for anyone who needs a reliable and high-performing key finder device.

3.1.11 Tile mate pro- The Tile Mate Pro[13] is a key finder device that uses Bluetooth technology to help users locate their misplaced items. It features a loud buzz, a community feature, and a range of up to 120 meters. Its main benefits include a long Bluetooth range, a replaceable battery, and compatibility with various voice assistants. However, it also has a higher cost compared to other key finder devices. From a research perspective, the Tile Mate Pro could be studied in terms of its effectiveness in locating lost items, user satisfaction, and potential improvements in cost or design.

3.2 Battery details of existing market products-

This section provides the battery type, battery capacity, battery life, replaceable or non replaceable, chargeable or non chargeable shown in table 1.

Table 1: Battery details of existing market products

Battery details of existing market products					
Name	Battery Type	Battery Capacity(mAh)	Battery life(months)	Replaceable battery	Chargeable
Letstrack TAG mini[3]	CR2032	75	6-8	no	non-rechargeable
Vaya smart[4]	CR2032	NA	12	yes	non-rechargeable
Tag8 dolphin[5]	CR2032	220	12	yes	non-rechargeable
Quadrate	CR24	500	12	yes	non-

key finder[6]	50				rechargeable
Cospex smart key finder[7]	CR2025	190	12	no	non-rechargeable
Boutique smart key finder[8]	CR2477	450	12	yes	chargeable
Panasonic seekit edge[9]	CR2032	220	18	both	non-rechargeable
Tile Mate (2020)[10]	CR1632	70	12	both	non-rechargeable
Wosports key finder[11]	CR2032	220	9	yes	non-rechargeable
Apple air tags[12]	CR2032	220	12	yes	non-rechargeable
Tile mate pro[13]	CR2032	220	12	yes	non-rechargeable

3.3 Range, technology and no. of keys can connect to the existing market products-

This section provides the Range, technology and no. of clients can connect to the device shown in table 2.

Table 2: Technology, range, no. of keys can connect to the client

Technology, Range, No. of Keys can connect to the client			
Name	Technology	Range(feet)	No. of keys can connect
Letstrack TAG mini[3]	Bluetooth : 4.0	250	10
Vaya smart[4]	Bluetooth	100	4
Tag8 dolphin[5]	Bluetooth	60	200
Quadrate key finder[6]	Bluetooth 4.0	82	1
Cospex smart key finder[7]	Bluetooth	32	8
Boutique smart key finder[8]	Wifi	50-115	4
Panasonic seekit edge[9]	Bluetooth 5.0	100	1
Tile Mate (2020)[10]	Bluetooth 4.0	150	4
Wosports key finder[11]	RFID	100	6
Apple air tags[12]	Bluetooth 5.0	100	10
Tile mate pro[13]	Bluetooth 5.0,	250	200

3.4 Cost, company name, launch date and warranty of existing market products-

This section provides the Cost, company name, launch date and warranty shown in table 3.

Table 3: Cost, company name, launch date and warranty of existing market products

Cost, Company name, Launch date and Warranty				
Name	Company name	Launch date (mm/dd/ yyyy)	Cost in indian rupees	Warranty
Letstrack TAG mini[3]	Letstrack Limited	10/23/2020	1698	6 Months
Vaya smart[4]	Shamaru Trading Company.	9/26/2019	2990	1 year
Tag8 dolphin [5]	3Y Ventures LLP	6/24/2020	1499	6 Months
Quadrate key finder[6]	teknistore.com	7/19/2019	828	30 days
Cospex smart key finder[7]	Cospex.com	4/7/2021	439	1 year
Boutique smart key finder[8]	Boutique	10/16/2020	1582	no warranty
Panasonic seekit edge[9]	panasonic	11/30/2018	397	1 year
Tile Mate (2020) [10]	Tile Inc.	8/21/2019	4599	3 year
Wosports key finder [11]	Wosports		5978	1 year
Apple air tags[12]	Apple Inc.	4/30/2021	3990	1 year
Tile mate pro[13]	Tile Inc.	1/1/2020	9475	Up to 1-year

3.5 Features, pros and cons of existing market products-

This section provides the details of Features, pros and cons of existing market products are shown in table 4.

Table 4: Features, Pros and cons of existing products

Features, Pros and Cons of existing products			
Name	**Features**	**pros**	**cons**
Letstrack TAG mini[3]	Separation Alert,Global Applicability, Find Your Phone,selfie button	Lost & Found Community, 75mAH battery	non replaceable battery
Vaya smart[4]	90 db loud alert Splash proof	60 db sound alert,removable battery	No warranty
Tag8 dolphin [5]	Location Tracking, Anti-Lost Alarm System, Ultra Long Battery Life- 30 months, Alarm sound is 98dB	Unique QR Code,Community Search	Suitable for luggage only
Quadrate key finder[6]	Cam Button Function,Bluetooth 4.0	removable battery	no sound alert,no light
Cospex smart key finder[7]	Alarm,3-6 months	Ultra low power	no LED,high cost
Boutique smart key finder[8]	easy,quickly to locate,ultra-long battery life, lifetime warranty	sound is 80-95 dB,replaceable CR2032 battery	no buzz, no light up
Panasonic seekit edge[9]	separation indicator, voice alert	Last Seen Location,Water Resistant	Non replaceable battery
Tile Mate (2020) [10]	GPS Tracking, Bluetooth	Up to 250 ft / 76 m Bluetooth range,Up to 3-year non-replaceable battery,Water-	no light up,no buzz
		resistant,Voice-assisted finding with Alexa	
Wosports key finder [11]	Dedicated remote, Loud Beeping Sound,	Long Lasting Batteries,Red flashes led light,6 key finders receivers,Powerful sound & long distance range	High cost, high battery consumption
Apple air tags[12]	buzz,compact, best till the date,splash	big community,it can connect with NFC capable smartphones	high cost
Tile mate pro[13]	Loud buzz,community,120m range	Up to 400 ft / 120 m -- Our longest Bluetooth range, Up to 1-year replaceable battery, Water-resistant, Works with Android™ and Apple® devices, Voice-assisted finding with Alexa, Google and Siri,Attach and go	high cost

4. PROPOSED DEVICE DETECTOR

In the above discussion, we have surveyed various products and found their pros and cons. Although there are lots of advantages of the existing products, there are some gaps because of which there is a scope of new device detector. The high cost, more power consumption, less range of the product were some of the issues and to overcome these issues we have proposed a new product based on low energy bluetooth technology.A low energy bluetooth 5.0 based device detector with esp32 microcontroller will meet the requirement of Cost, range, and power consumption.

5. CONCLUSION AND FUTURE WORK

5.1 Conclusion : This comparative analysis has provided an in-depth look at the current market available products in terms of their features, prices, battery specifications,range and battery life. The Cost of the existing market products is high and not having normal features like leds. Most of the products have 220 mAh CR2032 batteries. Approx battery life of every product 12 months. In this survey low energy bluetooth 5.0 based products having low power consumption in comparison with other protocols like wifi and rfid.

5.2 Future work : In this survey we studied most of the top rated device detectors that are available in the current market. The cost of the product is high and some features of these products make their cost very high. Now there are options available to make this product more cost efficient.we will use the ESP32 microcontroller and low energy bluetooth 5.0 and make the prototype with a dedicated android mobile application. to build a remotely wirelessly controlled embedded system. It is a rechargeable device. In the future, this technology can be expanded to other fields. Since it is a small embedded system, it can be easily used on other IoT (Internet of Things) for remote controlling. Any collected data can be sent through Bluetooth technology, Bluetooth technology is very advanced nowadays and really power saving.

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