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Design of Tracking System for Kids

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Abstract: Recently many cases of missing children have been reported. Parents are always worried about the possibility of their children being abducted. Therefore, the purpose of this paper is to develop a wearable tool that can be used to track a missing child within a certain distance based on the Internet of Things (IoT) to overcome the problem. This technology can be very useful in the field of security. The project focuses on the development of a wearable GPS-based system and a Blynk app for tracking children. This will help parents find their child easily. In addition, the system will allow users to track children remotely over a mobile network. This will also allow the user to get the coordinates of the latitude and longitude and the whereabouts of the child. The system consists of two main components: a NEO6M GPS receiver and a NodeMCU module. The latter has a built-in GPS receiver that allows tracking of children.

Keywords: IoT, Tracking System, GPS

1. Introduction

This journal discusses the development of a tracker system that utilizes the Internet of Things, the NodeMCU (ESP8266) microcontroller, and Blynk as the data receiving and transmission medium. The Internet of Things is a networked system that provides a unique identity and the capability to transmit data without human or computer intervention. The Internet of Things (IoT) is a network of interconnected computer devices, mechanical and digital equipment. Additionally, it refers to the communication of devices with one another through the Internet. Data from the Internet of Things is disseminated through modules or microcontrollers and may be processed and analyzed using a variety of IoT platforms, including Blynk, Thinger.io, and Thingspeak [1].

The child tracker technology is intended to successfully track down missing children by precisely transmitting latitude and longitude information. This project will operate under a notion of sending and receiving. A command or instruction previously specified in the microcontroller's code is received. This command or instruction will be used to validate phone-to-Blynk application connection. What then transmits? The information was stored in longitude and latitude, then processed, and transmitted to the phone. GPS collected this data. Then, it will be processed by a CPU inside the gadget. Only then, it will

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be sent to a targeted device via the GSM system. The system will need the communication device to meet certain criteria.

1.1 Problem statement

The weekend is an ideal time for a family to reconnect. The mall is a popular destination for families to spend time together. Always keep in mind that places such as shopping malls are very risky when it comes to missing kid situations. According to police statistics, a total of 15 children were reported missing in 2014, 1782 in 2015, and 140 in January of this year [2]. Johor had the greatest number of reported missing children (681), followed by Selangor (538) and Kedah (474) over the same time [3]. Due to the aforementioned issue, we are so motivated to resolve it and offer a better solution for everyone since we think that everyone should be able to buy a device capable of tracking missing children. As a result, the concept of designing a tracking system for children was born. When asked, this gadget will send the latitude and longitude of the tracker worn by children to the guardian's phone. This is a proactive measure in light of the current statistics on child loss in Malaysia, which are becoming more severe by the day.

1.2 Literature Review

Previous studies and research may be helpful in developing this new project. The author [1] suggests the usage of the Blynk architecture to aid with vehicle tracking and monitoring systems. This may be done using Ultrasonic, gas, IR, temperature sensor, or GPS. In the suggested approach, Blynk was utilized for monitoring while apps were used for monitoring. The next research, the author states a low-cost campus bus tracker is suggested by utilizing Wi-Fi proximity approach and GPS information, where three communication techniques are explored. The bus position is shown on the website, and bus driver's location data is provided via Android applications [4]. ESP8266 module-based paper that is used to communicate and transmit data to the user. The author [5] proposed a framework for developing Android app-based vehicle monitoring for GPS and GSM. This approach focuses on vehicle position tracking. The paper's findings build on user-device communication via GSM and move data through GSM, whereas the suggested system utilizes ESP8266 to do the same.

2. Methodology

Our proposed system as shown in Figure 1 is divided into three modules:

i. GPS module to read location of missing kid and will be transmit to ESP 8266
ii. ESP 8266 Wi-Fi module act as to receive and transmit data for GPS and Blynk
iii. Blynk apps will display coordinates to user

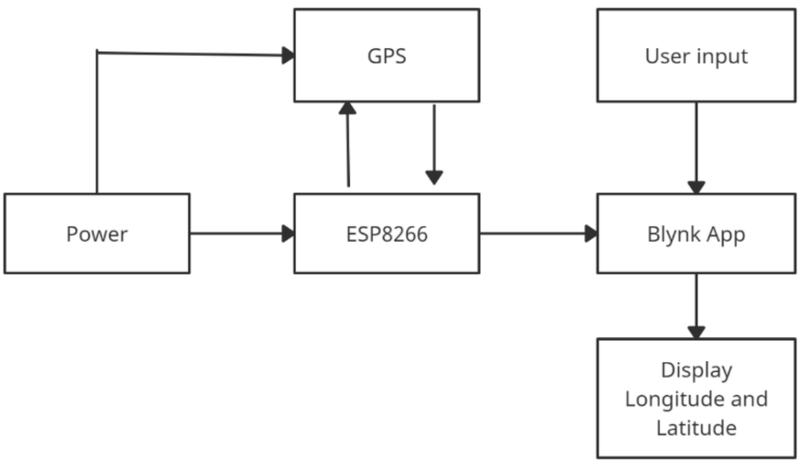

Figure 1: Block diagram of the project

2.1 Methods

Figure 2 shows the flow chart of the project. The process begins when the ESP8266 and Blynk application are ready in the "ON" mode. These two machines can also ensure that they are connected to WiFi. If not, it should be returned to the phase mentioned above. Second, the ESP8266 must wait for the user to request a location. If the request is invalid, something needs to be demanded from Blynk. If correct, GPS can detect the series and create the coordinates, i.e. longitude and latitude. The data will then be stored in the NodeMCU module (ESP8266) and displayed in Blynk. In the end, the customer will collect the data to be able to locate the missing child.

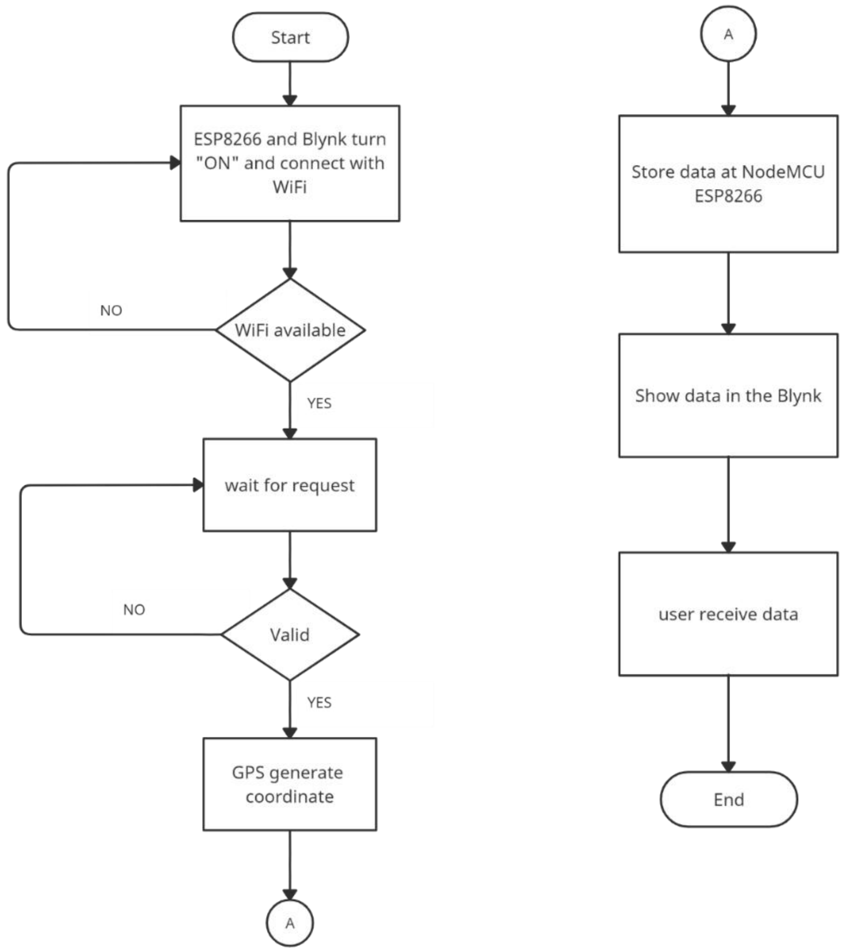

Figure 2: Flowchart of the project

2.2 Materials

For this project, only 3 materials are used that is:

- NodeMCU ESP 8266 – functions as a data storage device in the Blynk Cloud, as well as a data transmit and receive device between the GPS module and the user of the Blynk application.
- GPS Module Ublox Neo-6M – to generate the coordinate of latitude and longitude.
- Lithium battery (power supply).

Table 1 lists quantity for each component used in this project.

Table 1: List of components

Component	Unit
NodeMcu ESP8266	1
GPS Module Ublox Neo-6M	1
Lithium Battery	1

2.3 Getting GPS location of the device

The GPS module is linked to the ESP8266 module to obtain the child's GPS position. If the GPS module receives a 5V supply, it will deliver a string containing the longitude and latitude of the place where the GPS module is physically located. If the GPS module is kept by the child, it will transmit the longitude and latitude of the device through its serial port, which is connected to the ESP8266 module. For internet connectivity, we used the ESP 8266 Wi-Fi module in our system. After reading the string from the GPS module, it is saved and sent to the Blynk cloud through the Wi-Fi module. This Wi-Fi module is powered by 3.3V. To enable the Wi-Fi module, connect Enable pin EN to 3.3V. Reset pin RST is linked to 3.3V to enable power-on reset for the Wi-Fi module.

The Wi-Fi module interfaces with the Blynk IoT platform. As shown in Figure 3, the Blynk IoT platform enables internet-based connectivity between your devices and a smart phone. The Blynk libraries allow communication with the server and handle all incoming and outgoing instructions. They are utilized on all major hardware platforms. To connect your gear to the Blynk app, a device authentication token must be generated. When you download the Blynk app for Android, we get an authentication token through your registered email address. The Blynk Library is a plug-in that runs alongside your hardware application. It is responsible for all connection and data exchange between your hardware, Blynk Cloud, and your app project. The Blynk app includes a widget box for showing data sent from a Wi-Fi module to an Android phone through the Blynk cloud. As we are transmitting the school bus's latitude and longitude coordinates, we utilized the Blynk app's map widget to show the school bus's current position on a mobile device used by parents or school administration.

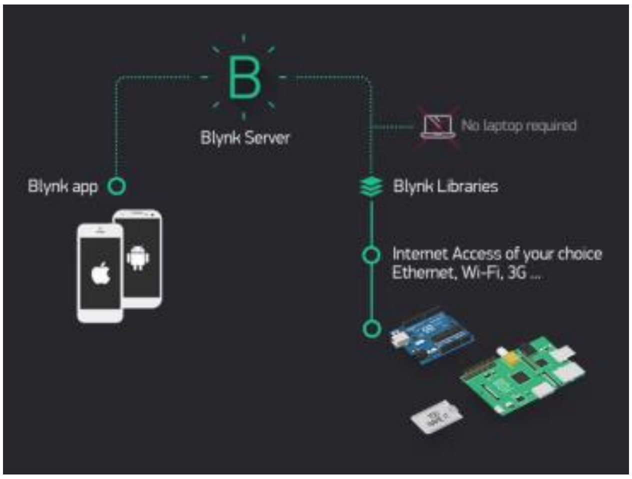

Figure 3: Data flow to Blynk App

3. Results and Discussion

Several experiments were done to examine performance of the tracker system device. This test's primary objective is to confirm that all components and modules utilized in this experiment are suitable for usage. Additionally, this test is done to identify the best environment for the tracker device mechanism. As previously indicated, a smartphone controls the GPS and ESP8266 modules via the Blynk Application.

3.1 Getting GPS location of the device

GPS tests are done in an open field or anywhere that has no thick wall to obstruct the line of sight between the GPS antenna module and the GPS satellite. Figure 4 shows the output of serial monitor after the implement the Wi-Fi module and GPS combined to perform simulation. Simulation effects as shown in Figure 5, where the module is connected to the internet and to the Blynk server, and where the latitude and longitude of the Arduino IDE are displayed similarly to they are in the Blynk application.

```
LAT:  3.205106
LONG: 101.541664

LAT:  3.205107
LONG: 101.541672

LAT:  3.205107
LONG: 101.541672

LAT:  3.205106
LONG: 101.541664

LAT:  3.205106
LONG: 101.541664
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Figure 4: Coordinate that generate by GPS

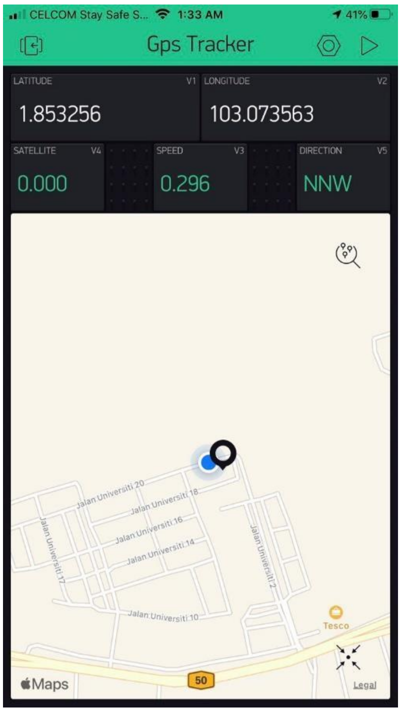

Figure 5: Latitude and longitude data inside Blynk application

3.2 Result accuracy of coordinate

To assess the position accuracy of the device, an experiment was conducted comparing latitude and longitude between the Blynk application and Google Maps. Compared to Blynk, Google Maps is utilized since research and development have long been done and well-established. Based on the Table

2, it was observed that there is a minor discrepancy in latitude and longitude positions provided by the Blynk application and Google Maps in all destination locations. Despite this, almost all the sites, eight out of ten, are within a 20-meter radius. Only two sites, B and J, exhibit a significant difference in distance between the Blynk Application and Google Maps, which is 170.8m and 85.6m. Additionally, a graph is provided that displays the coordinates produced by the Blynk Application and Google Maps as shown in Figure 6.

Table 2: Coordinate comparison between Blynk and Google Maps in the Sungai Buloh district

LOCATION	BLYNK		GOOGLE MAPS		Different Point, m
	Lattitude	*Longitude*	*Lattitude*	*Longitude*	
A	3.193761	101.535294	3.193610	101.535354	18.1m
B	3.193375	101.546715	3.193341	101.548253	170.8m
C	3.192813	101.554451	3.192765	101.554411	6.9m
D	3.194952	101.567268	3.194945	101.567259	1.3m
E	3.199130	101.578041	3.199046	101.578062	9.6m
F	3.204072	101.587814	3.204064	101.587894	8.9m
G	3.208140	101.614899	3.208185	101.614876	5.6m
H	3.196192	101.592094	3.196257	101.592111	7.5m
I	3.221381	101.562675	3.221392	101.562711	4.2m
J	3.205135	101.541748	3.205260	101.540987	85.6m

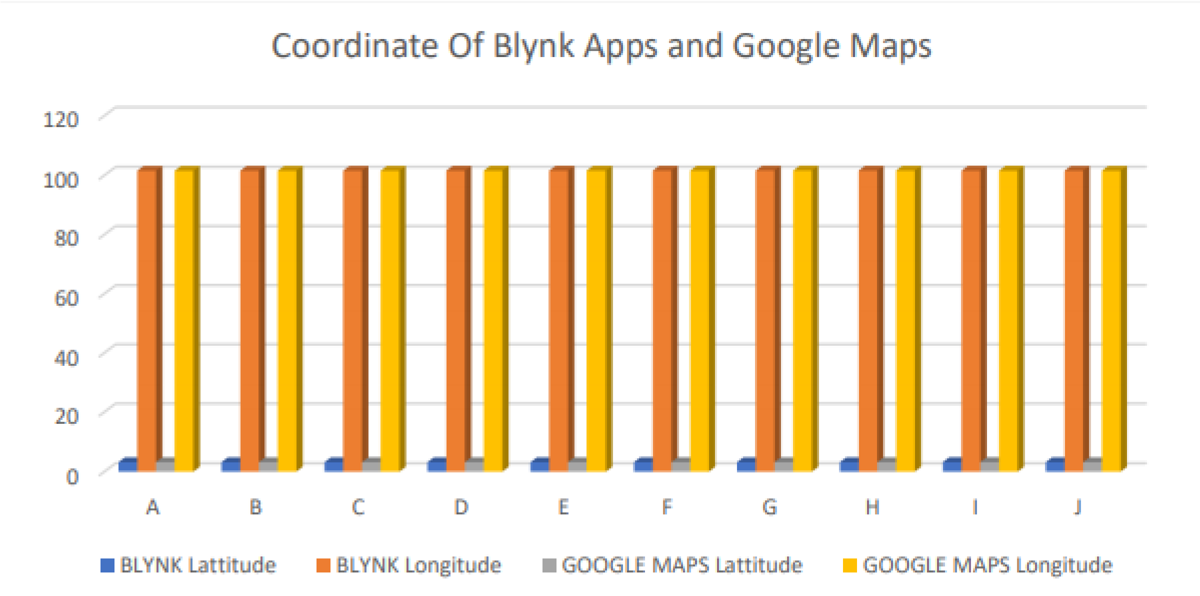

Figure 6: Graph of coordinate between Blynk and Google Maps

3.2 Result of device working distance

The following experiment was conducted to evaluate how effectively Blynk could identify a device as it traveled from the user's phone. This trial continues in the Sungai Buloh district. This time, the distance is set to 10km and movement of the device is reported every 1km. Based on the Table 3, it demonstrates that Blynk from users may detect the device at every kilometer in the neighboring district or district of Sungai Buloh. Figure 7 shows the distances and widget maps at kilometers 2 until 10 as further proof for this experiment. Two dots emerge from the map's widget, namely blue dot and black dot. The blue dot is the user's Blynk application, whereas the device's black dot.

Table 3: Distance range tabulation between Blynk and device

DISTANCE (km)	COORDINATE		LOCATION
	Latitude	Longitude	
1	3.198153	101.536415	Jln. Kubu Gajah
2	3.191679	101.533096	Persiaran Delima
3	3.185251	101.533096	Subang Suria
4	3.177197	101.53614	Mutiara Subang
5	3.173911	101.532051	Bdr. Pinggiran Subang
6	3.172413	101.540115	Subang Bestari
7	3.174696	101.545662	Persiaran Fajar
8	3.177507	101.544853	Persiaran Pelangi
9	3.169935	101.550705	Persiaran Cakerawala
10	3.162201	101.552299	Subang 2

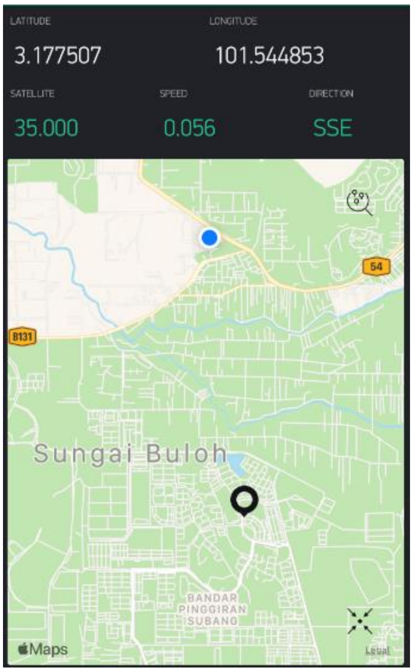

Figure 7: Map at kilometer 2 – 10

4. Conclusion

At the conclusion of this research, an effective tracking system for children was created. This system was comprised of both hardware and software elements. The ESP8266 successfully connected to Wi-Fi and used the GPS module to produce a latitude longitude position. There are no technical difficulties in uploading the data to the Blynk cloud. Additionally, a mobile application for the software system has been created successfully. When both the gadget and the user's phone are switched on and connected to Wi-Fi, this application may determine the child's position. Additionally, the mobile application is completely functioning, and all tasks may be performed regularly. Finally, this project was successfully finished on time and under budget. The system works flawlessly.

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