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Child Tracking System using Blynk and GPS Technology

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Abstract: Child missing or kidnapping is a significant issue affecting many families globally. A child tracking system is a technological solution providing access to real-time information on the whereabouts of children through SMS notifications and Blynk. In this project, the child's location is tracked using a GPS module and then sent to a NodeMCU ESP8266 microcontroller. The microcontroller processes the data, and the location data is then analyzed and displayed in real-time on the Blynk app. This project also features an SMS notification system that sends an alert message to the parent's phone to track the coordinates of the child in Google Maps. The ESP8266 establishes a connection and provides GPS data to the Blynk application when it is inside the 45-meter Wi-Fi range. But the ESP8266 switches to GSM mode if the child goes outside of this range and loses Wi-Fi connectivity. In GSM mode, it continuously monitors the location of the child by sending coordinates through SMS to the parent's phone every minute. The project achieved all its objectives and provided an easy approach for parents to keep track of their children's whereabouts and react quickly in a state of emergency.

Keywords: Tracking System, GPS, Coordinates

1. Introduction

Nowadays, the rate of child abduction cases in Malaysia is increasing every year. The greatest concerns of great parents are their children, particularly their safety. However, parents are increasingly seen as complacent and negligent in providing strict monitoring of their children's safety at school or in public places. Parents are busy with the use of cell phones or gadgets and leave the child alone because their eyes are busy with the device and not watching the child [1]. Recently, a female artist who is also an actress and host, Lufya, claimed to be facing an anxious moment when she was hit on the head and body with a stick to kidnap her daughter, Laana Haura, 5, at a playground in Kota Damansara [2].

The problem of missing and kidnapped children is something of which we should be aware. This project is proposed to assist children is a child tracking system with GPS, SMS notification, and the Blynk application. This project uses dual-path communication via both a cellular and Wi-Fi connection.

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The goal of this project is to locate children and track them in the area specified for using the Global Positioning System (GPS). GPS is chosen due to its increased coverage and improved accuracy and reliability [3]. The SIM900A GSM module is essential for communicating between the child tracking device and the parent's mobile phone, thus ensuring quick reactions during emergencies or when the child deviates from established safe zones. The advantage of using GSM communication is that the user may communicate wirelessly as long as both the users are in a cellular service area [4].

2. Materials and Methods

2.1 Materials

The key components of this system include a NodeMCU ESp8266 as a microcontroller, a GPS module for tracking position, a Blynk app to track coordinates, and a GSM module to transfer coordinates to the phone. The location of missing children will be determined first by the Blynk app when Wi-Fi is connected, and then by SMS sent to smartphones via the GSM module when Wi-Fi is disconnected.

a) NodeMCU ESP8266 features significant on-board computing capabilities and ample storage, allowing it to be integrated with sensors via its GPIOs (General Purpose input/output) [5].

b) U-blox NEO-6M GPS module is a high-performance full GPS receiver with a robust satellite search capacity. It can monitor the status of the module using the power and signal indicators.

c) SIM900A GSM GPRS module is a cellular digital system used in mobile devices. It is an international mobile standard that is commonly used for long-distance communication.

d) Blynk application is a mobile applications that supports hardware platforms such as Arduino, Raspberry Pi [6] and could control several boards linked to a using a smartphone [7].

2.2 Methods

This project includes a GPS module, a microcontroller (NodeMCU ESP8266), a GSM module, and a mobile phone for the user. The system is programmed in the Arduino IDE, which allows the microcontroller to communicate with the GSM and GPS, accept data from the GPS, and send it via GSM [8]. Figure 1 shows the block diagram for this project.

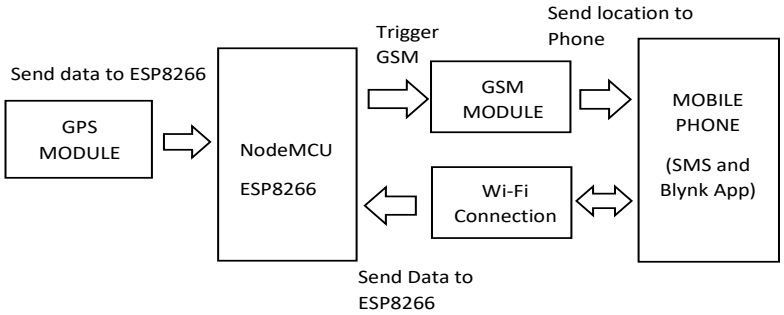

Figure 1: Block diagram of child tracking system

2.3 Circuit Diagram

Based on the flow chart in Figure 2, when the GPS and GSM are on, GPS will track the location of the device. Then, when the location is detected and Wi-Fi is already connected, the Blynk app will be running. In Blynk app, it will detect the location through map and give the data of latitude and longitude. When Wi-Fi is disconnected, the Blynk app will not run and keep reconnecting, it will send message

via GSM containing GPS location which is the coordinates of the child. The coordinates will be sent to the user mobile phone.

The circuit diagram for this project is shown in Figure 3. The NodeMCU ESP8266, GPS module and GSM module are the main components used.

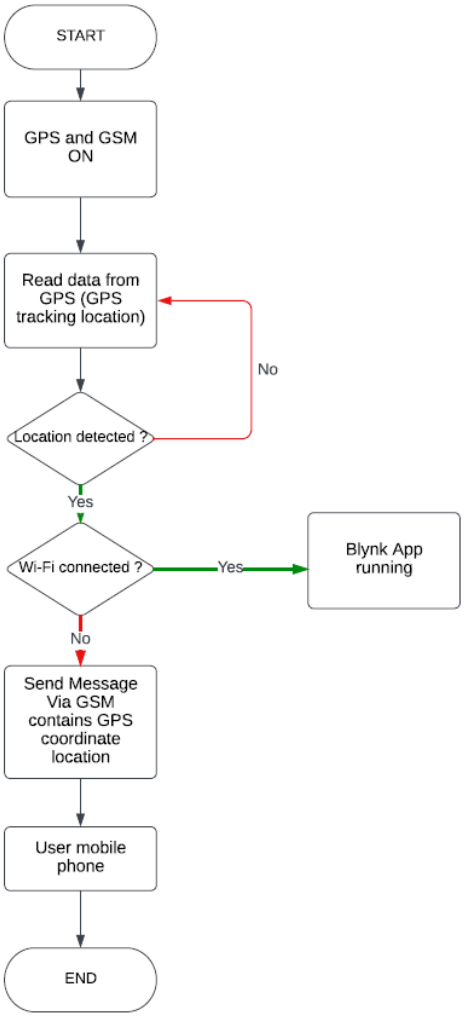

Figure 2: Flow chart of system operation

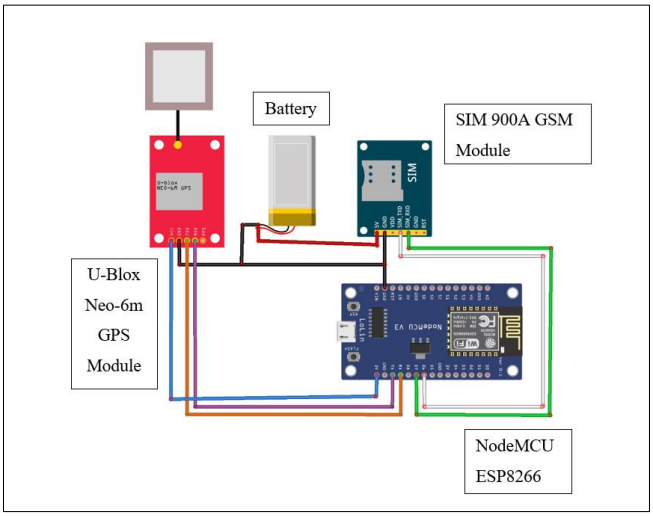

Figure 3: Circuit diagram

3. Results and Discussion

When the Wi-Fi connection is connected to the system, the Blynk application will start operating and display the coordinate and position of the children on the Blynk apps. Results from the Blynk application were taken from three different locations, which are Tasik UTHM (Table 1), Tasik Y Batu Pahat (Table 2) and Dataran Penggaram Batu Pahat (Table 3). This area is a recreational place for a family and this area is also visited by many people. There is a possibility that the children will leave the area without us realizing it. To ensure the safety of children in recreational areas like Tasik UTHM, Tasik Y Batu Pahat, and Dataran Penggaram Batu Pahat, it's important to take some precautions. These 3 places have specified reasons to choose because in Tasik Y have many trees compared to Tasik UTHM because it is affecting the signal of GPS. In Dataran Penggaram a very large area to get the result of this system. Data display on the Blynk app as in Figure 4. Tasik UTHM Parit Raja, Tasik Y Batu Pahat, and Dataran Penggaram Batu Pahat are the three places represented in the data. These are recreational sites that are routinely visited by many people, especially families. From result of 3 locations using Blynk app, Wi-Fi will disconnect in range 45 meters and above this is because, Wi-Fi transmissions at 2.4GHz typically have a range of roughly 150 feet or 45 meters.

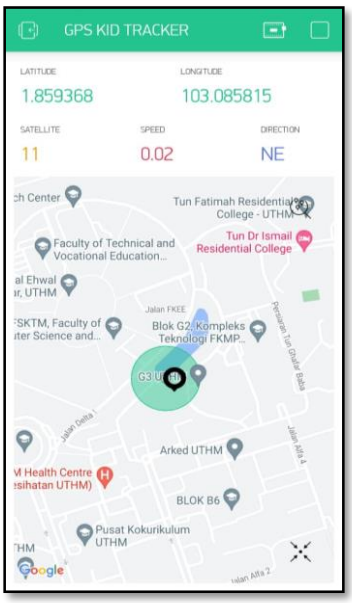

Figure 4: Data display on the Blynk app

Table 1: Location at Tasik UTHM

Meters	Latitude	Longitude	Satellite	Speed (m/s)	Wi-Fi Connection
5 meters	1.859368	103.085815	11	0.02	Yes
10 meters	1.859410	103.085854	11	0.02	Yes
15 meters	1.859451	103.085907	0	0.06	Yes
20 meters	1.859483	103.085968	10	0.04	Yes
25 meters	1.859532	103.086006	11	0.07	Yes
30 meters	1.859558	103.086044	12	3.26	Yes
35 meters	1.859563	103.086052	12	2.04	Yes
45 meters	0	0	0	0	Disconnected

Table 2: Location at Tasik Y Batu Pahat

Meters	Latitude	Longitude	Satellite	Speed (m/s)	Wi-Fi Connection
5 meters	1.843035	102.937500	5	0.44	Yes
10 meters	1.843085	102.937523	0	0.19	Yes
15 meters	1.843139	102.937515	9	0.57	Yes
20 meters	1.843172	102.937569	9	0.96	Yes
25 meters	1.843261	102.937599	9	0.89	Yes
30 meters	1.843327	102.937614	9	2.67	Yes
35 meters	1.843403	102.937660	9	1.39	Yes
45 meters	0	0	0	0	Disconnected

Table 3: Location at Dataran Penggaram Batu Pahat

Meters	Latitude	Longitude	Satellite	Speed (m/s)	Wi-Fi Connection
5 meters	1.846766	102.934837	3	0.02	Yes
10 meters	1.846688	102.934845	3	0	Yes
15 meters	1.846637	102.934807	3	0.31	Yes
20 meters	1.846589	102.934814	3	0.17	Yes
25 meters	1.846525	102.934799	3	2.22	Yes
30 meters	1.864455	102.934776	3	0.11	Yes
35 meters	1.846373	102.934753	3	1.72	Yes
45 meters	0	0	0	0	Disconnected

Referring to Table 1, Wi-Fi is available up to 35 to 40 meters at Tasik UTHM Parit Raja. The number of satellites present in that area is from 0 to 12, while the speed ranges from 0.02 m/s to 3.26 m/s. There is no Wi-Fi connection available beyond 45 meters. Wi-Fi connection is also available in Table 2, which represents Tasik Y Batu Pahat, up to 35 to 40 meters. The number of satellites present in that area is from 0 to 9, and the speed ranges from 0.19 m/s to 2.67 m/s. Similarly, there is no Wi-Fi connectivity beyond 45 meters. Table 3 shows data for Dataran Penggaram Batu Pahat, where Wi-Fi is available up to 35 until 40 meters away. The number of satellites present in that area is 3 and the speeds range from 0 m/s to 2.22 m/s. As with the other places, there is no Wi-Fi connection beyond 45 meters.

Since the speed value in the 3 tables reflects the speed of the tracked object (child or device) as it moves across various distances, it is continually changing. It is critical to keep in mind that speed is a dynamic quantity that can change quickly as the monitored object moves and reacts to its surroundings. This results in varied numbers at different places as the speed value in the Table 1 – 3 reflect the tracked object's movement in real-time over the designated distances. Wi-Fi connectivity is offered up to 35 to 40 meters in these recreational locations. It is crucial to remember that the Wi-Fi connection is lost after this distance, and the satellite signal and speed data are not provided. As a result, if visit these sites with children, make sure they are properly supervised within the Wi-Fi coverage zone to avoid them accidentally leaving the region

When the Wi-Fi connection is lost or disconnected, the system will begin again. The Wi-Fi connection will cause the GPS module to retrieve the device's current coordinates and position. After determining the data location, the data will be transmitted via GSM module. Users will receive SMS messages that contain coordinates with is longitude and latitude continuously every one minute as shown in Figure 5.

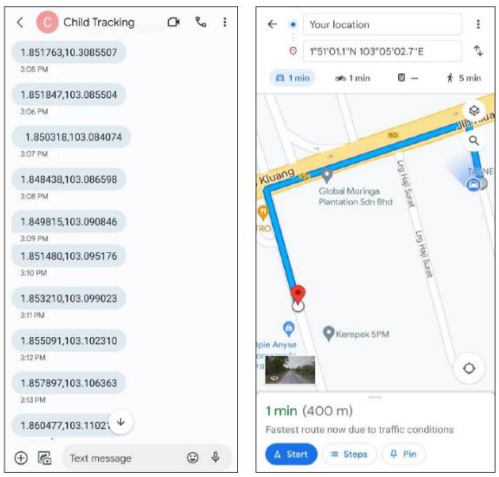

Figure 5: The data coordinates location receives by SMS and location at Google maps

Four area has been chosen to test the performance of the GPS system. Figures 6 – 9 show the results of the GPS module at four separate locations. The area is from Parit Jelutong to Parit Raja, from Parit Raja to Pura Kencana, from Pura Kencana to Tasik Y Batu Pahat and Parit Raja to village area in Parit Raja. Without any interruption, the systems continually send the data position from the beginning point to the destination in Figures 6-8. In Figure 9, the GPS system is unable to receive some signals while the device is in the village area where there is no signal, so the user only receives a few coordinates from the GPS until the GPS module start blinking again and the user receive other coordinates from the device.

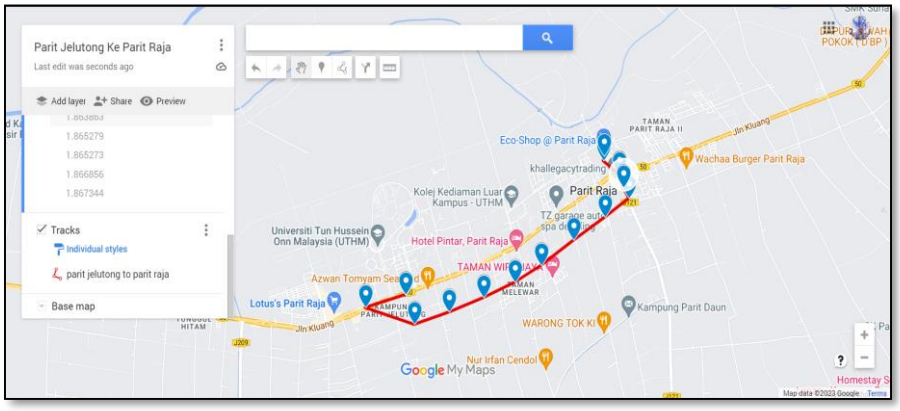

Figure 6: Data location receives from Parit Jelutong to Parit Raja

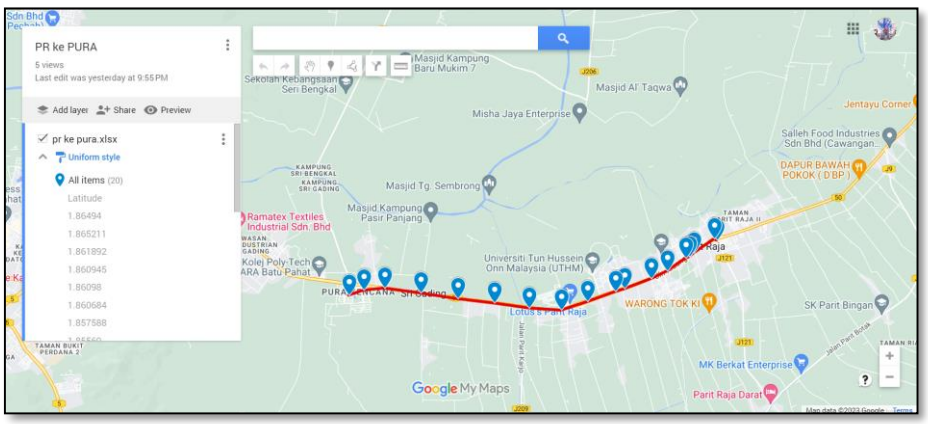

Figure 7: Data location receives from Parit Raja to Pura Kencana

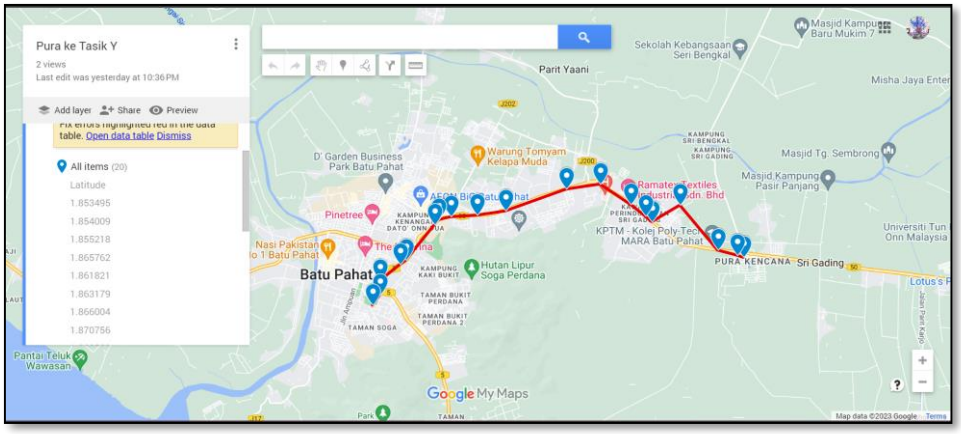

Figure 8: Data location receives from Pura Kencana to Tasik Y Batu Pahat

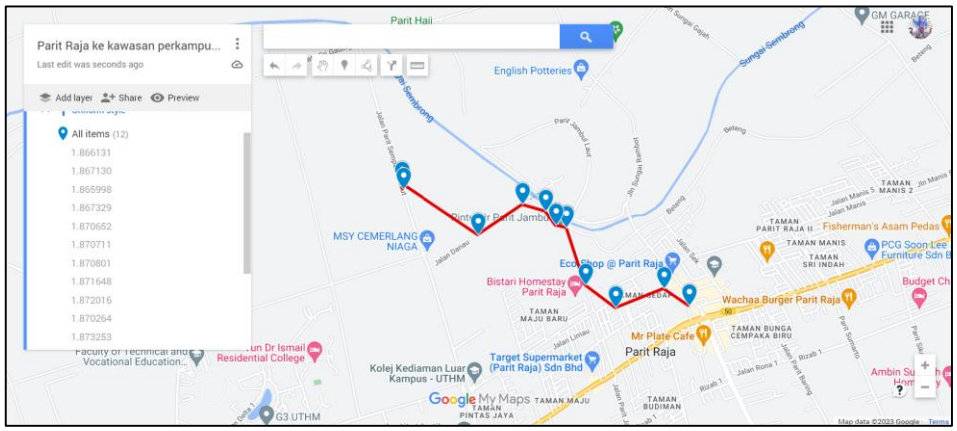

Figure 9: Data location receives from Parit Raja to village area at Parit Raja

4. Conclusion

Finally, the integration of a kid tracking system with a GPS module, GSM module, and ESP8266, as well as the option to switch between Wi-Fi and GSM connections, provides a full solution for assuring the safety and security of children. Using Wi-Fi connectivity, the system can send real-time location updates to a Blynk app, allowing parents to effortlessly monitor their child's whereabouts. When Wi-Fi access is unavailable, the system quickly switches to GSM mode and delivers coordinated location data via SMS, allowing parents to track their child's location using Google Maps. This dual-mode functionality improves the child tracking system's dependability and efficacy independent of Wi-Fi network availability. With this system in place, parents can receive fast notifications if their child deviates from a predefined safe zone, allowing them to respond quickly and take appropriate action. Furthermore, in emergency scenarios or when a child is in distress, the system enables for fast action, potentially decreasing the dangers connected with abduction or accidents. The project ended with the accomplishment of all the mentioned objectives.

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