Detecting and Identifying Kidnapping Incidents in Nigeria using a Smartwatch and Its Application

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ABSTRACT

This research work introduces a software system designed to address the pressing issue of kidnapping in Nigeria, aiming to create a safer and more peaceful country. The system utilizes the geo-location API of commonly used handheld digital devices, primarily smartwatches equipped with the necessary functionalities. The software system sends real-time crime location updates via SMS to a predefined phone number when activated. The system periodically transmits updates to ensure comprehensive coverage, particularly when the victim's location changes. This innovative solution aims to enhance security and aid in crime prevention efforts in Nigeria. The significance of this research is to introduce a system that is made up of two primary architectures (software and hardware). To assist in curbing the kidnapping issues in Nigeria. This study will no doubt be useful to our country. When the victim triggers or starts the software, the response team will receive an SMS alert containing the location and information of a victim on the hotline provided for them. Aside from that, periodic updates are being transmitted to the response team.

1.0 Introduction

Kidnapping for ransom is a growing global issue; in a year at least 25,000 reported cases worldwide (Campbell, 2020). Many cases go unreported, indicating an even higher incidence (Ezemenaka, 2018). This tactic has been used by political terrorists and those involved in resource struggles since the mid-1990s (Agnes & Henry, 2018). In Africa, countries like Nigeria have seen a significant rise in kidnapping, making it a major security challenge (Meek, 2020).

Smartwatch technology using short messaging has become necessary to mitigate the rampant cases of kidnapping around the world. Report shows that there were at least 25,000 kidnapping for ransom cases across the world (Campbell, 2020). However, most cases go unreported which predicts a more significant rise in number (Ezemenaka, 2018). These have become an international concern over the last two decades. Since the mid-1990s, kidnapping has dramatically increased as a preferred tactic of political terrorists and resource struggle (Agnes & Henry, 2018). Usually, ransoms are collected to finance their activities which constitute treat to peace, security, and development in these regions (Erezi, 2020).

Considering Africa as a continent for instance, kidnapping rate has taken an alarming dimension in the last two decades, most especially in countries like Egypt, Cameroun, Ethiopia, Mali, Somali, Chad, Niger Republic, and Nigeria (Meek, 2020). Since the mid 2000s, kidnapping has pushed the peripheries of West African countries (e.g., Nigeria) into the international news (Agnes & Henry, 2018; Meek, 2020). As a result, Nigeria was globally declared as one of the red flag countries to avoid due to high number of frequent kidnapping incidences (Abdulkabir, 2017). These have become one of Nigerians biggest challenges (Ezemenaka, 2018).

In another concern, the rise of Boko Haram insurgency in 2011 who believed that western education should be abolished for the purpose of the establishment of Islamic State of Nigeria, posed a significant threat (Olurounbi, 2021). On the other hand, there has been a lot of incidence of kidnapping in the North-western region of Nigeria such as in Maiduguri, Zamfara, Niger, and Kaduna (Osasona, 2021).

To address these concerns, several researchers proposed approaches. Amongst these researches, Akinbowale 2021, proposed Geo-fencing as a virtual perimeter in a geographical area that uses location-based services as a boundary for an area. The location monitoring system is an LBS (Location Based Services) system which utilizes the GPS found on a smartphone. The proposed scheme presents a model that allows family members to directly monitor the whereabouts of loved ones using the incorporation of Geofencing technology, Kalman filter, GPS, and SMS (Short Messages Services) (Babatunde et al., 2021). In another development, Taha's, 2023, proposed a software application utilizing a smartphone device equipped with a GPS or GSM module.

The primary purpose of this application is to enable users to track the location of children in real-time and send the SMS to the receiver. The GPS module allows the device to receive signals from satellites, enabling accurate location tracking. Additionally, the GSM module is responsible for transmitting the

location data through the GSM network, ensuring that users can access the information remotely. By setting the GPS to a high power mode, the application can activate the GPS module and initiate signal reception from the satellites, further enhancing the accuracy and reliability of the location tracking process (Taha et al., 2023).

In 2021, Al-anezi proposed a cutting-edge smartphone application designed to enhance child safety and security within the family. The application is intended for installation on all family members' smartphones and offers GPS-based location tracking without the need for an internet connection. By leveraging the device's GPS services, the application can accurately pinpoint the child's specific location and provide real-time updates whenever the child changes places. One of the application's key features is its reliance on GSM technology to share location information. This ensures that even in the absence of an internet connection, the application can send SMS messages containing a link to a Google map, enabling family members to access and view the child's position (Mafaz, 2020).

Although most of these researchers have contributed significantly in proffering solution that will mitigate insecurity, however, there is need to further propose an ideal solution to properly deal with the concern of kidnapping in Nigeria.

Problem Statement

Kidnapping have become a major problem in our country Nigeria, where individuals are kidnapped for ransom. As a major organized crime, kidnapping has posed a threat to national security (Inyang & Abraham, 2013). Besides, kidnappers often exploit their victims by collecting victims' mobile phones denying them access to avoid being track by the security agencies. To address these concerns, several researchers like Mafaz (2023), Sirikonda and Amu (2023), Taha (2022), Chima (2021), Al-Anezi (2021), Akimbowale (2020) have proposed various approaches to serve as a potential solution. However, their proposed solutions have several limitations such as reliance on smartphone technology using short messaging and network glitches. For such existing approaches to be ideal in combating kidnapping cases, redundancy and robustness in the network (GPS) must be considered to ensure its reliability and effectiveness in real-life scenarios. Therefore, this research proposes a multi-faceted approach using smartwatch Technology that combined preventive measures, reliable technology to combat kidnapping in Nigeria.

Aim and Objectives

The aim of this research work is to develop a software application system that can be used to send SMS location details of a victim to the pre-define/registered numbers or security personnel to track the last geo-locations of a kidnapped victim, which could effectively assist the security personnel or relative in curbing the current kidnapping issues in Nigeria.

The specific objectives of the study are:

1.   To develop a model that minimizes average end-to-end delay in victim rescue;

2.   To evaluate the proposed model in order to determine its efficiency in minimizing victim casualties.

2.0 Reviews of Related Work

Systems have been discovered to use this research project's technology and algorithms, with the majority being tracking and alarm systems (Chima, 2020; Taha, 2023; Mafaz, 2020; Akimbowale, 2021; Al-anezi, 2021; Sirikonda & Amu, 2022; Tamakloe, 2022; Gondaliya, 2021; Ganiyu, 2023; Manaswini. 2020; Adejumobi, 2021; Vaijnath, 2021; White, 2022; Amu, 2022).

Intelligent Security Systems: Devices equipped with microcontrollers that send emergency alerts via SMS to authorities and designated contacts when activated by a button or voice command (Taha et al., 2023).

Mobile Applications for Kidnapping Situations: Applications installed on family members' smartphones that use GPS and GSM to track and share a child's location without needing internet access (Al-Anezi et al., 2020).

Geo-fencing and Location Monitoring: Systems that use GPS and location-based services to create virtual perimeters (geo-fences) for monitoring loved ones, sending alerts when these boundaries are crossed (Babatunde et al., 2021).

TMESK System: A system with multiple units that monitors children's safety in specific zones using GPS data, sending alerts to parents and authorities if a child leaves the safe zone (Sirikonda, 2020).

Hardware-Software Integrated Tracking: Devices combining hardware (e.g., microcontrollers, accelerometers) and software for real-time location tracking and emergency response (Harrington & Saloner, 2022).

Bluetooth-based Indoor Localization: A low-cost infrastructure using Bluetooth sensors for indoor mobile device tracking and navigation, displaying the device's location on a map (Sukreep et al., 2020).

Stalking Behavior Identification: A study analyzing stalking behavior patterns from victims' perspectives, particularly in different stalker-victim relationships (Eleanor et al., 2022).

Safety Devices with Multi-features: Devices integrating fingerprint scanners, GPS, GSM, and self-defense mechanisms like shock wave generators for comprehensive personal protection (Satpute et al., 2022).

Persistent Women Tracking Systems: Integrated systems combining various technologies to improve women's safety and reduce crimes against them (Karunya & Kalaiselvi, 2019).

Human Safety Devices: Devices that activate through voice commands or panic buttons, sending location alerts to authorities and triggering nearby alarms for public awareness (Sharma, 2020).

Smart Bags for Child Safety: Backpacks with built-in GPS and GSM modules for real-time tracking, sending location updates when the child leaves a predefined area (Adejumobi & Basiru, 2021).

Smart Bands: Wearable devices that trigger emergency alerts, track location continuously, and alert nearby people using buzzers and vibrating sensors (Manaswini et al., 2020).

Vehicle Tracking Systems: Devices that use GPS and GSM modules to send location updates of vehicles via SMS, including Google map links for easy tracking (Ganiyu, 2023).

These technologies aim to provide real-time monitoring, improve response times in emergencies, and enhance overall safety through advanced tracking and communication systems.

Finding from the Existing Literature

While the mentioned existing approaches contribute to enhancing safety and security, they also have certain limitations that need to be considered:

✓ **Privacy Concerns:** These systems involve collecting and transmitting personal and sensitive data, such as location information. This raises privacy concerns, especially when it comes to children. Users might be worried about their data being misused or accessed by unauthorized parties.

✓ **False Alarms:** In real-time tracking systems, false alarms can occur due to technical glitches or misinterpretation of data. Frequent false alarms could lead to decreased trust in the system and might divert attention and resources from genuine emergencies.

✓ **Dependence on Technology:** These solutions heavily rely on technology, specifically GPS and internet connectivity. In cases of network outages or device malfunctions, the effectiveness of these systems could be compromised, leaving users vulnerable.

✓ **Technical Limitations:** The accuracy of GPS-based systems can vary, especially in urban areas with tall buildings and obstructions. Additionally, indoor tracking may not be as reliable, making it challenging to monitor children or individuals in enclosed spaces.

✓ **Limited Battery Life:** Many wearable devices have limited battery life. In emergency situations, a dead battery could render the device useless, preventing users from seeking help when needed.

✓ **User Accessibility:** The effectiveness of these systems relies on users being able to operate and understand the technology. This could be a limitation for young children or elderly individuals who might struggle with using the devices properly.

✓ **Cost:** Some of these solutions involve purchasing specialized devices or subscribing to services, which might be cost-prohibitive for certain individuals or families.

✓ **Reliability of GSM Networks:** SMS-based systems that rely on GSM networks might face challenges in areas with poor network coverage, limiting their effectiveness in remote or rural locations.

✓ **False Sense of Security:** While these systems provide a sense of security, they might also lead users to believe that they are entirely safe, potentially leading to risky behaviors or neglecting other safety measures.

✓ **Response Time:** Even with real-time tracking, the effectiveness of the response by authorities or caregivers depends on their ability to react promptly. Delays in response could undermine the purpose of these systems.

✓ **System Vulnerabilities:** As with any technology, these systems could be vulnerable to hacking or other cyber threats, potentially leading to unauthorized access to sensitive information or misuse of the system.

With these findings from the existing literature's the use of smart watch technology and applications will improve safety and security due its fitness, portable wearable device and in most cases its consider unrecognized by the kidnappers, particularly in cases of kidnapping, victim safety, and locating missing persons. The integration of GPS, GSM, and other technologies will enables real-time location tracking and communication, making these solutions valuable tools for enhancing personal safety and providing aid during emergencies.

3.0 Research Method

The motivation behind the study is to address the alarming increase in the incidence of kidnapping in Nigeria and the challenges faced by successive governments in effectively curbing this unlawful act. The researcher aims to provide a solution that utilizes modern technology, specifically smartwatch technology, to enhance safety and security in society, particularly in cases of kidnapping, victim safety, and locating missing persons.

Research design is divided into five phases, phase one problem formulation, phase two study of similar solution, phase three is design, four is implementation and testing and phase five is evaluation. Phases one and two of the research are related to observation, phase three design techniques, phase four implements the design, in the end phase five produces result for analysis.
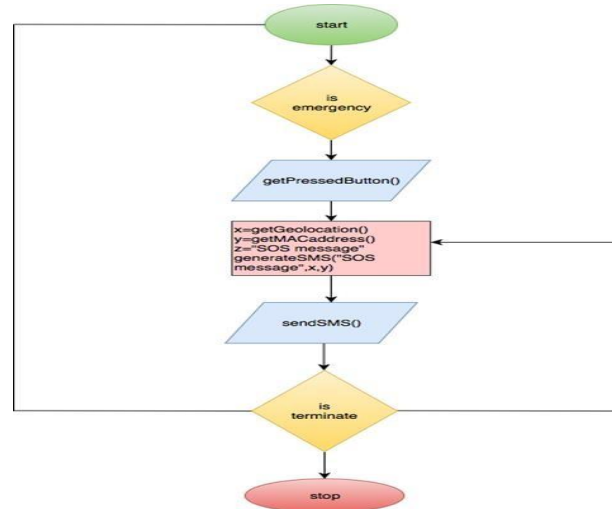

Figure 3.1: Software Framework

Details of the Research Framework

The application works as normal Android OS software, and its named 'Blower'. When the user launches the application, the main activity file is returned which is the entry point to the application. When the report button is clicked, the Geo-location and the SMS API are triggered. An SMS is generated with details of the current coordinates and MAC address of the device and sent to a predefined number. This message is composed and sent continuously after every 8 seconds, unless it is stopped by the user. Factors that could stop the application are peculiar to other applications out: out of battery, stopped manually by user, or other exceptions. The Figure 3.2 shows the architecture of the system.
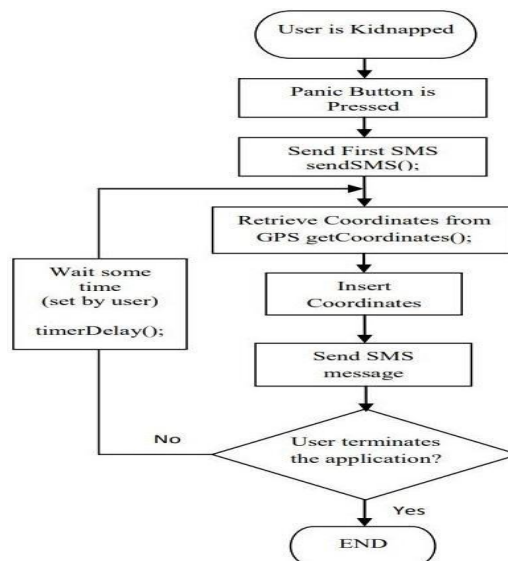

Figure 3.2: Flowchart of Software

Datasets Description

A survey questionnaire, to establish and refine our research on how to identify the location of kidnapped victims to ensure the effectiveness and reliability of our survey questionnaire; we will follow established best practices. First, we will subject the questionnaire to content validation, seeking input from an expert in the field who possesses expertise in security matters. This expert validation process will help ensure that the questionnaire is grounded in relevant knowledge and concepts.

Following content validation, we will conduct face validation with the intended respondents, specifically individuals from Kebbi State who are relevant to our study. This step is crucial in gauging the questionnaire's clarity, relevance, and appropriateness for our target population.

Subsequently, we will prepare the survey questionnaire for study. A total of 40 survey questionnaires will be distributed for the following attributes, 10 for the farmers, 10 for the travelers, 10 for the security personnel's, and 10 for the individuals, this will allowing us to assess the reliability and validity of the questionnaire. For more detailed information on the operational framework of this stage, please refer to Table 3.1, which provides an overview of the key steps and processes involved in questionnaire development.

Table 3.1: Framework

Activities	Objectives	Deliverable s
Identify target respondents	To select proper respondents	Identified population
Design sampling plan	To design sampling	Sample size
Develop the survey instrument	To develop a questionnaire instrument based on the research	Developed questionnaire
Face validity and content validity of questionnaire instrument	To establish face validity from target respondents and content validity of the questionnaire from expert	Validated questionnaire
Reliability	To improve the reliability and validity of the questionnaire	Reliable and valid questionnaire

Unit of Analysis

The unit of analysis is the level of aggregation of the data collected during the subsequent data analysis stage (Yang et al., 2020). This study is proposed to focus on how to identify the kidnapped victim's location based on security personnel only.

Identify Target Respondent

The focus group for this research study comprises individual, security personnel, farmers, Drivers, and Travelers who are stationed in Kebbi State and their neighboring edge, encompassing all of its local government areas. It's crucial to note that the selected respondents possess practical experience and a deep understanding of kidnapping incidents due to their prior involvement and exposure to such situations. Consequently, their insights and perspectives will be particularly valuable in addressing the research objectives effectively.

Sampling Technique

Lim et al. (2021), in his study, states that to research a group of people, it's rarely possible to collect data from every person in that group; instead, select a sample. The sample is the group of individuals who will participate in the research. To draw valid conclusions from the results, there is a need to carefully decide how to select a sample that is representative of the group as a whole.

The questionnaires were prepared for this study. The research instrument named as Part 1 Consist of Demographic Information of Respondent, while Part 2 consist of Sections "Questionnaire A" to collect data regarding opinions of individuals (Security personnel's), which consists of open-ended questions. "Questionnaire B" are about the respondents' opinions on the usage and experience in the smartwatch to collect data regarding the opinions concerning the Kidnapping and missing persons here in Nigeria, etc. "Questionnaire C" the impact of rescue mission using smartwatch for Tracking (Regarding the usage and experience with smartwatch) from the kidnappers to find out is there any ideas/methods for locating or identifying a victim. Finally questions were asked while conducting the interview with Security personnel's. It included questions on areas like how long does it take for them to locate or identify the victim, Response Time and Assistance, awareness of the Smartwatch-Based Alert System, and Suggestions for Improvement.

System Requirements

The minimum software requirement for the effective development and implementation of this system are as follows:

1. Microsoft Window 8/7/Vista/2003 (32 or 64 bits)

2. 400 hard disk space

3. 4GB RAM (4 GB)

4. At least 1 GB for Android SDK, Emulator System, images and catches 5-Java Development Kit (JDK 7)

5. Java programming

6. Android studio version 4.2.1

7. Google Maps

8. GPS technology also will be use.

In addition, the JAVA programming language and the android studio application are used to develop the apps that are implemented with the android smartwatch and android smartphone. The minimum hardware requirement for the effective development and implementation   of this system are as follow:

1.   Android Smartwatch device

2.   Android Smartphone device

Performance Evaluation Metrics

Performance evaluation metrics are used to measure and assess the effectiveness, efficiency, and quality of a system, model, or process. In the context of proposed research on the smartwatch-Based Alert System for curbing kidnapping, would likely want to evaluate the performance of the system in terms of its ability to accurately and efficiently alert security personnel or relatives about a victim's location. Here are some relevant performance evaluation metrics that could consider:

i.   Accuracy

Location Accuracy: Measure how accurately the system can determine the victim's location and whether it matches the actual location. Victim Identification: Assess how well the system can correctly identify when a person is in distress and needs assistance. Here's a general equation for assessing the accuracy of a smartwatch system measurements:

Accuracy (%) = [(Measured Value - True Value) / True Value] x 100.

To find the mean of the UTM coordinates (which is in meters), and use that to calculate the "delta X" and "delta Y" positions by subtracting the mean X and mean Y to create two new columns in the spreadsheet.

Calculate the standard deviation of the delta X and Y columns.

$latex \sigma=\sqrt{\frac{1}{N}\sum_{i=1}^N(x_i-\mu)^2}$

Use the standard deviation to calculate the CEP (50%) radius using the following formula:

$latex CEP=0.59(\sigma_x+\sigma_y)$

where $latex \sigma_x$ is the standard deviation of the easting value, and $latex \sigma_y$ is the standard deviation of the nothing. In this case, the radius is 6.06 meters.

Then calculate the 2DRMS (95%) radius using the formula:

$latex 2DRMS=2\sqrt{\sigma_x^2+\sigma_y^2}$

That radius is 14.86 meters.

Finally, plot the delta X and delta Y columns, and the CEP and 2DRMS rings to help you visualize the accuracy. The results of my experiment are presented in an embedded Figure 3.5 below:
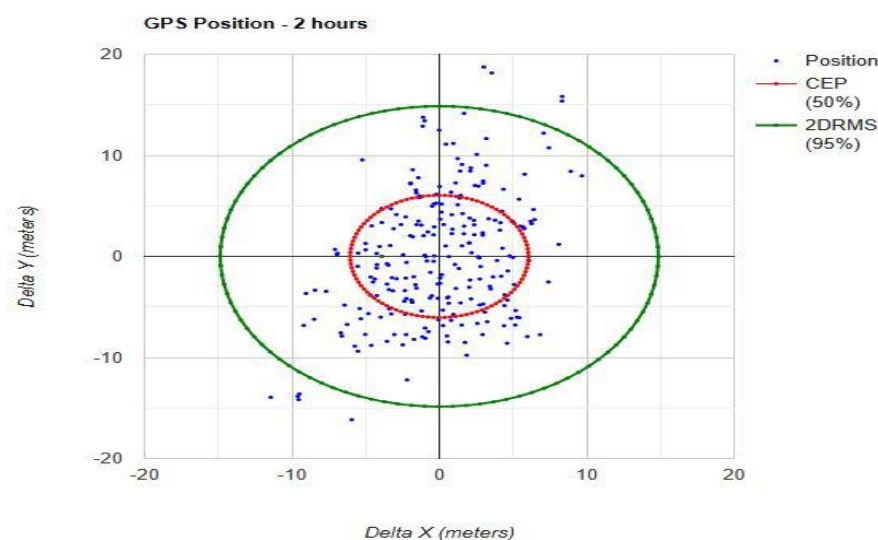
Figure 3.5: GPS Accuracy positioning

ii.   Response Time

Alert Trigger to Notification Time: Evaluate how quickly the system detects the alert trigger (button click) and sends out the notification to the designated recipients. Recipient Response Time: Measure the time it takes for the security personnel or relatives to respond to the notification.

Response time is typically measured as the time it takes for the system to process a request or user input and provide a corresponding output or feedback. The following way to represent response time is with the equation:

Response Time (RT) = Processing Time (PT) + Queuing Time (QT) + Transmission Time (TT) + Wait Time (WT)

Where:

Processing Time (PT): The time taken by the system or processor to execute the necessary operations to fulfill the request.

Queuing Time (QT): The time spent waiting in a queue if multiple requests are in line for processing.

Transmission Time (TT): The time taken for data to be transmitted between components or devices (e.g., sensors, communication modules).

Wait Time (WT): Any additional waiting time before the request is initiated (e.g., user interface lag or latency).

It's important to note that these components vary depending on the specific context and the type of operation being measured. Response time can be critical for user experience, especially in interactive applications or when real-time data is involved, such as fitness tracking or notifications.

In practice, response time is often measured experimentally using benchmark tests or performance monitoring tools to capture the actual time it takes for the smartwatch system to respond to a tasks or inputs.

iii.   Reliability

System Uptime: Determine the percentage of time the system is operational and ready to respond to alerts.

False Alerts: Assess how often the system triggers alerts when there is no actual emergency. Reliability in the context of a smartwatch typically refers to the probability that the smartwatch system will function correctly and consistently over a specified period of time. It is often measured using the concept of Mean Time between Failures (MTBF) or Failure Rate (λ).

The reliability of a smartwatch (R) can be expressed as:

$R(t) = e^{\wedge}(-\lambda t)$

Where:

R (t) represents the reliability of the smartwatch at time t.

λ (lambda) is the failure rate, which is a measure of how frequently the smartwatch fails or stops working.

e is the base of the natural logarithm (approximately equal to 2.71828).

In this equation, as time (t) increases, the reliability (R (t)) decreases if the failure rate (λ) is constant. This equation allows you to calculate the probability that the smartwatch will still be functioning properly at a given point in time based on its failure rate.

iv.   Scalability

Number of Simultaneous Alerts: Test the system's ability to handle multiple alerts occurring at the same time. Response Time with Increased Load: Measure how the system's response time is affected as the number of alerts increases. For a simplified representation of scalability, the following equations have been used:

Scalability = (Performance at Current Load) / (Performance at Increased Load)

In this equation:

"Performance at Current Load" represents the smartwatch's system performance when operating under the current workload or demand.

"Performance at Increased Load" represents the smartwatch's performance when subjected to a higher workload or increased demand.

Scalability values greater than 1 indicate that the smartwatch system can handle increased loads while maintaining or even improving performance. Values less than 1 suggest that the performance degrades as the load increases, indicating poor scalability.

Keep in mind that evaluating scalability for a smartwatch system would require specific performance metrics (e.g., response time, processing speed, battery life) and testing under different usage scenarios. It also involves considering both hardware and software aspects of the device. The scalability of a smartwatch can vary depending on its design, hardware capabilities, and the efficiency of its software.

Implementation of the Proposal Approach

Implementing the approach for the "Blower" smartwatch-based alert system involves translating the system specification and research findings into actual software and hardware components. The communication between the smartwatch and a server involves a server responsible for transferring the coordinate

message from the victim's device to the registered number. Communication between the smartwatch is mainly done through the server, which is the application server and the Google Cloud Messaging server. Both servers must ensure real-time communication between the smartwatches over a stable network connection. There are two users needed to demonstrate the workflow of the research: the victim, which is the sender, and the relatives or security personnel, which is the receiver.

Evaluation of the Proposed Approach

In order to determine the effectiveness of the proposed approach, a survey questionnaire was used in its evaluation. The 150 number of target respondents were used in the evaluation of the proposed system. Previous researchers like Mafaz et al. (2020), Akinbowale et al. (2021), Pratiskha et. al. (2022) reviewed that tracking systems and adopting new technology, such as wearable devices, were reviewed. A structured questionnaire is adapted from existing instruments to suit the developed research (Poli et al., 2011).

Demographic Analysis

This section discusses the background information of the respondents that were relevant to the study (security personnel). Their analysis was done in frequencies and percentages which were presented in the following Tables:

Table 4.1: Description of respondents by gender categories

(Source: Result of Analysis 2024)

Participants		Frequency	Percent	Valid Percent
	Male	121	80.7	80.7
Valid	Female	26	17.3	17.3
	Total	147	98.0	98.0
Missing	System	3	2.0	
Total		**150**	**100.0**	

Findings in Table 4.1, show that 121 (80.7%) of the respondents were male and 26(17.3%) were Female. This implied that the study proportionately considered each among those which were selected to participate in the study.

Table 4.2: Summary of the Key Findings

	Questions	Finding Description
1	Gender Categories	The majority of respondents were male (80.7%), and a smaller percentage were female (17.3%).
2	Age Groups	Most respondents were in the age group of 36 to 45 years (49.3%), followed by 20 to 35 years (44.7%). Only a small percentage was in the age group of 46 to 55 years (4.0%).
3	Educational Qualification Categories	The majority of respondents held a Bachelor's degree (B.Sc.) (38.0%), followed by SSCE (Secondary School Certificate Examination) holders (28.0%). A smaller percentage had a Diploma (26.7%) or a Master's degree (M.Sc.) (5.3%).
4	Educational Qualification Categories	The majority of respondents held a Bachelor's degree (B.Sc.) (38.0%), followed by SSCE (Secondary School Certificate Examination) holders (28.0%). A smaller percentage had a Diploma (26.7%) or a Master's degree (M.Sc.) (5.3%).
5	Duration of Occupation	The majority of respondents had more than 10 years of experience in their occupation (52.7%). Smaller percentages had 5-10 years of experience (37.3%) or 1-5 years of experience (8.0%).

6	Willingness to Use Smartwatch Tracking App Frequently	A significant percentage of respondents agreed to use the smartwatch tracking app frequently, with 30.0% strongly agreeing and 40.0% agreeing.
7	User-Friendliness of the App Interface and Controls	A majority of respondents found the smartwatch app's interface and controls to be user-friendly, with 18.0% strongly agreeing and 53.7% agreeing.
8	Perceived Complexity of the Smartwatch App	Most respondents strongly disagreed that the smartwatch app was complicated to them (58.7%), indicating that they did not find it complicated.
9	Need for Technical Support	A significant majority of respondents strongly disagreed with the need for technical support to use the smartwatch (32.0%), suggesting they did not require technical assistance.
10	Impact on Responding to Emergencies	A large percentage of respondents agreed that the smartwatch app could improve their ability to respond to emergencies (34.0% strongly agreeing and 45.3% agreeing).
11	Improvement in Rescue Work	Most respondents agreed that using the system by the victim would improve their rescue work, making their work more effective (27.3% strongly agreeing and 52.7% agreeing).
12	Helpfulness of System Responses	A majority of respondents found the system's responses to be helpful in their rescue activities (54.0% strongly agreeing and 32.7% agreeing).
13	Impact on Success of Rescue Missions	The majority of respondents believed that the system's responses significantly impacted the success of their rescue missions (52.0% strongly agreeing and 34.7% agreeing).
14	Benefits of the Smartwatch Tracking App Features	Most respondents agreed that the features of the smartwatch tracking app benefited their rescue operations (54.7% strongly agreeing and 35.3% agreeing).
15	Satisfaction with the App in the Context of Work	A significant majority of respondents were satisfied with the smartwatch tracking app in the context of their work as security professionals (34.7% strongly agreeing and 42.0% agreeing).
16	Impact on Skills and Motivation	Most respondents believed that using the system's responses would make them skilled and motivated (28.0% strongly agreeing and 48.7% agreeing).
17	Ease of Becoming an Expert	A majority of respondents agreed that it would be easy to become an expert in rescue missions using the smartwatch system's app (21.3% strongly agreeing and 48.7% agreeing).
18	Usefulness for Tracking Victims	Most respondents agreed that using the system was a good idea for easy tracking of victims (24.7% strongly agreeing and 58.7% agreeing).

4.3: Comparison result of the evaluation approach

S	**Comparison Results of The Evaluation Approach**	**Description**
1	Distance Range and connectivity	This study uses satellite GPS to establish a connection with the smartwatch, allowing for coverage over a long distance range. In contrast, Swami et al. (2022) rely on Bluetooth/Wi-Fi connections between a smartphone and a smartwatch, which can have limited range. This is a significant advantage, especially in scenarios where the user may be far from their smartphone.
2	Reliability and Consistency	Satellite-based connections tend to be more reliable and consistent, as they are not as susceptible to signal interference or range limitations. In comparison, Bluetooth/Wi-Fi connections may be disrupted or lost in areas with obstacles or signal interference.
3	Security	This study approach of triggering an SMS message to a registered number without the consent of potential assailants offers a security advantage over voice command or buzzing systems proposed by Sharma et al. (2020). Terrorists or malicious

		individuals can easily interfere with or stop sound-based alerts, but they have limited control over the discreet transmission of an SMS message.
4	Simplicity and Ease of Use	The direct button press to send an SMS message for help is a straightforward and user-friendly approach. It eliminates the need for complex voice commands or reliance on noise-based alerts. Users in distress can quickly and easily request assistance, enhancing the system's usability.
5	Independence from PC Connection	While Taha et al. (2023) use a PC connection for their GPS/GSM module, this study connects the smartwatch app directly to a satellite network. This eliminates the need for a PC and simplifies the user experience, making it more convenient and accessible.
6	Comparison of Location Accuracy	This study should also consider evaluating the accuracy of location tracking in this study compared to the other works. Satellite GPS may provide more precise location data compared to GSM-based tracking, especially in areas with good satellite coverage.

Comparison of the Results Obtained with that Benchmark Approach

The result of this study is similar to that of Swami et al. (2022), whose major goal was to add a function or application to smartwatches that notify the missing user of the smartwatch, i.e., if someone is missing, another person will be notified that they are missing them. Bluetooth, or Wi-Fi, is used to send someone a notification that someone is looking for them using their smartwatch's IP address. The smartwatch will check our smartphone's contact information before a contact's name from the contact list can be chosen. The disparity between the two research is that Swami et al. (2022) use a Bluetooth/Wi-Fi connection between a smartphone and a smartwatch, whereas this research communicates with the satellite GPS to fetch the geo-location of the smartwatch, i.e., to say the connection is between the satellite GPS and smartwatch. It shows that when a long distance range is covered, there will be a restriction (range) of detection in the work of Swami et al. (2022), while in this study, the connection of smartwatch and satellite covers a long distance range.

Recommendation

Hopefully, this system software called 'Blower' will help minimize kidnapping issues in Nigeria when adequately deployed and utilized. This device will probably be beneficial for people. The setback is that some smartwatches could be expensive; others on the market are relatively cheap. The solution tries to cover many edge cases with compatibility, so endpoints are exposed for other app developers to build extensions around the central application. It is also believed that this endeavour will make a difference in the lives of many, with individuals walking and travelling fearlessly.

Feature Work

Future work for the "Blower" smartwatch-based alert system can involve several areas of development and enhancement to further improve its functionality and impact. Here are some potential areas for future work:

Enhanced user interfaces to develop more intuitive and user-friendly interfaces for smartwatch and smartphone applications to simplify alerting, especially during high-stress situations.

Artificial Intelligence (AI) Integration to integrate AI capabilities to enhance the system's ability to detect distress signals and assess the severity of emergencies, providing more context to respondents, voice and Gesture Commands to implement voice and gesture recognition features allowing, users to trigger alerts and communicate with the system hands-free.

Multi-Language Support to add support for multiple languages to ensure that the system can be used effectively by individuals from diverse linguistic backgrounds. Emergency Services Feedback Loop to establish a feedback loop between emergency services and the system to receive updates on response times and outcomes, enabling continuous improvement. Cross-Platform Compatibility to ensure compatibility with a broader range of smartphone platforms (iOS, etc.) to expand the user base.

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The availability of Data

Available upon request

Author Contributions:

All authors contributed to the research as follows: "Conceptualization — Ibrahim Alhaji Bello, Methodology— Shahidu Ibrahim.; Formal analysis— Ibrahim A. Bello & Shahidu Ibrahim; Resources— Ibrahim Alhaji Bello ,Writing— Abubakar Bashir, Original draft preparation— Shahidu Ibrahim & Abubakar Bashir.

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