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CTrack: Location Tracking Android Application

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Abstract: CTrack is a mobile application that ensures security for children. The main objective of this application is to develop a location monitoring system for children. These days, parents are deeply concerned about sending out their children for education and other purposes due to the rising incidents of children going missing. The primary objective of this application is to guarantee the safety and welfare of children by enabling parents to monitor their locations consistently. It also aims to implement stringent measures to prevent unintentional removal or deactivation of the app by the children. This proposed application can provide peace of mind by assisting parents keep track of their children's activities. The main features of this application are GPS-based location monitoring, geo-fencing, and strong security measures to prevent unauthorized access and deletion. Most Significantly, the system incorporates innovative security mechanisms that require a security key which is only available to the parents, for any uninstallation or disabling attempts by the child. This feature is designed to strengthen the application against child misuse, thereby ensuring continuous monitoring capabilities for the parents. This proposed application not only addresses parental concerns regarding child safety but also prioritizes the child's privacy and device integrity**.**

IndexTerms **- Android Studio, Android OS, Global positioning system, Firebase database.**

1.INTRODUCTION

In response to the alarming prevalence of outdoor vulnerabilities faced by children, particularly concerning incidents of abduction and extortion, the CTrack application emerges as a robust safeguard leveraging contemporary technological advancements. By harnessing sophisticated tracking mechanisms, CTrack stands as a pivotal tool in ensuring the safety of children. Through real-time location monitoring and seamless transmission of precise coordinates to parents, the application serves as a proactive defense against potential threats. Its utilization of cutting-edge technology not only empowers parents with actionable insights but also establishes a formidable deterrent against malicious actors. In effect, CTrack represents a paradigm shift in safeguarding children, offering unparalleled security in an increasingly uncertain environment. This paper delves into the technical intricacies and societal implications of the CTrack application, shedding light on its efficacy in addressing the pressing need for child safety in today's world. Parents are increasingly concerned about the safety of their children, especially given the rise in incidents, particularly affecting girls. The proposed system aims to address the challenges parents face in managing the presence of their children, particularly in situations where children attend school, participate in extracurricular activities, or are transported involved outside the home environment. Additionally, with many children living far from home for education or work, parents are deeply invested in monitoring their movements, ensuring they attend college and visit secure places. In this application, both parents and children must register. Only after registration can parents access their children's location.

The application utilizes the Firebase system to securely store user details such as email and password. Parents have to send a request to access the location of their children. Once they send the request the child has to accept it. Then the location details are shared with the parent. If a child tries to disable the access they can't. This application stands out for its tamper-proof design, ensuring that children cannot uninstall it without parental permission. Any attempt by children to remove the application triggers an instant notification to their parents, thereby maintaining the integrity of the tracking and monitoring features. This application offers a variety of location change detection methods, helping users to know exactly where their children are, thus increasing safety. This helps in Effectively location-aware application systems in sensing and Use of location information.

In an era marked by heightened child safety awareness, protecting children from risks has become a top priority for parents. With the increase in abduction, extortion, and other dangers facing children, the demand for innovative solutions for real-time monitoring and proactive defense mechanisms has never been higher. In response to these concerns, the CTrack application emerges as a beacon of hope, utilizing advanced tracking technologies to ensure the safety of children in various environments.

As parents navigate the challenges of keeping track of their children, especially with activities like school attendance, extracurricular activities, or travel, the need for a reliable and tamper-proof monitoring system is crucial. The CTrack application not only provides

parents with insights into their children's locations but also acts as a strong deterrent against threats, offering reassurance in an uncertain world.

This paper explores the technical details and societal impact of the CTrack application, focusing on its effectiveness in addressing the need for child safety measures in modern society. By examining the secure storage mechanisms of user data through the Firebase system and the features that prevent unauthorized uninstallation, this study highlights the transformative effect of advanced location-aware technologies in safeguarding children and empowering parents with better monitoring capabilities.

2.NEED OF THE STUDY.

The SALT system enhances location tracking by implementing various features. Firstly, it ensures secure data transmission by sending location data to Firebase every 10 seconds, even if the SIM card is changed or GPS is disabled. This continuous data transfer guarantees that the information remains safe and accessible at all times. Additionally, SALT allows for tracking without requiring user consent, which can be crucial in emergencies where immediate location monitoring is necessary. By storing data in Firebase, the system enhances security measures, reducing the vulnerability to potential attacks. Moreover, SALT enables real-time tracking, providing users with the ability to monitor the device's location whenever needed. Lastly, the system utilizes smart positioning techniques by combining GPS with other sensors to achieve accurate tracking while conserving energy. Overall, the SALT system offers a reliable and secure solution for effectively tracking Android devices [1].

The Location-Based Parental Control-Child Tracking App provides essential features to assist parents in ensuring the safety of their children. Through the app, parents can effectively monitor and manage their child's phone activities using SMS commands. This includes the ability to view their child's messages and control specific functions on the child's phone. Additionally, the app offers a valuable feature where parents can retrieve important details about the child's SIM card, such as the SIM number and location, which are then automatically sent to the parent's phone for reference. Furthermore, parents can remotely control the child's phone by triggering calls to the parent's number or making the phone ring continuously through SMS commands. The app also enables real-time location tracking of the child, allowing parents to monitor their child's whereabouts on a map with a timeline feature. To ensure security and prevent unauthorized access, the app only accepts commands from authorized parent numbers, enhancing the overall safety measures in place. These integrated features collectively empower parents with the necessary tools to effectively monitor, control, and track their child's safety through the app [2].

The Android Application for School Bus Tracking and Student Monitoring System incorporates various key components and functionalities to enhance student safety during school commutes. Utilizing wireless technologies like GPS and GPRS/GSM, the system enables real-time tracking of school buses and monitoring of student attendance with precision and efficiency. Through an intuitive mobile application interface, parents, faculty, drivers, and administrators can easily access features such as attendance monitoring, vehicle tracking, and communication, fostering seamless interaction with the system. Interacting with a cloud server, the system ensures centralized data management, storing user details, bus information, routes, and attendance records for streamlined communication among users. Integration with Firebase facilitates real-time data storage and retrieval, particularly for GPS location data, enhancing data management and communication efficiency. Parents receive timely notifications regarding important events related to their child's bus journey, promoting heightened safety awareness and parental involvement. Emphasizing data security and privacy, the system securely stores information on the cloud server and implements robust authentication mechanisms, bolstering overall reliability and trustworthiness. Furthermore, the system offers potential for future enhancements like a Fingerprint Scanner, RFID Tags, Estimated Time of Arrival (ETA), and a chat box for parent-faculty interaction, promising improved functionality and user experience. Collectively, these technical aspects work in tandem to ensure the system's efficient operation and effectiveness in safeguarding students during their school commutes [3].

In the realm of mobile applications designed to enhance individual security, the development of real-time location monitoring apps with integrated emergency alert features has garnered significant attention. These apps play a crucial role in ensuring user safety by enabling the transmission of precise location data and distress signals to authorized contacts or emergency services during critical situations. Leveraging technologies such as GPS, Wi-Fi, and cellular networks, these apps provide continuous and accurate tracking of user locations in real time, thereby bolstering safety and security measures. Additionally, the incorporation of geofencing technology allows users to define virtual boundaries and receive alerts upon entering or exiting specified zones, further enhancing the safety protocols offered by these applications. User experience is a key focus, with user-friendly interfaces facilitating quick access to emergency functionalities, including alarm triggering and real-time location updates displayed on interactive maps for added context. Moreover, privacy controls are paramount in these apps, offering users granular control over the sharing of their location data to instill trust and differentiate the app in terms of privacy features. By seamlessly integrating these features, real-time location monitoring apps with emergency alert capabilities provide a holistic solution for empowering users to proactively address safety concerns and respond effectively to emergencies, thereby contributing to a more secure digital environment [4].

3.METHODOLOGY

3.1 System Workflow

Our proposed system differs from existing systems by integrating specific features from them while adding unique functionalities. Both parents and children must individually register for the application, with the registered details stored in Firebase. Firebase is also used for authentication. After the parent's registration, they must send a request to their children to access their location. Once the children accept the request, their location details are shared with the corresponding requested device. When the request is accepted, a key is generated on the parent side to control the disabling process of the children's application. If children want to stop

sharing their location details, they must enter the key generated on their parent side; otherwise, they cannot stop the tracking by their parents. After key generation, the location details and alerts are received in the parent-side application.

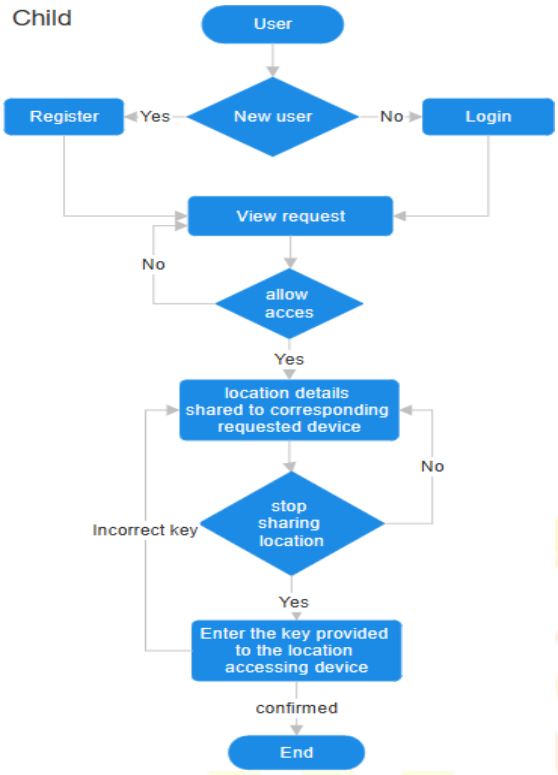

Fig. 1. Workflow of the system on child side

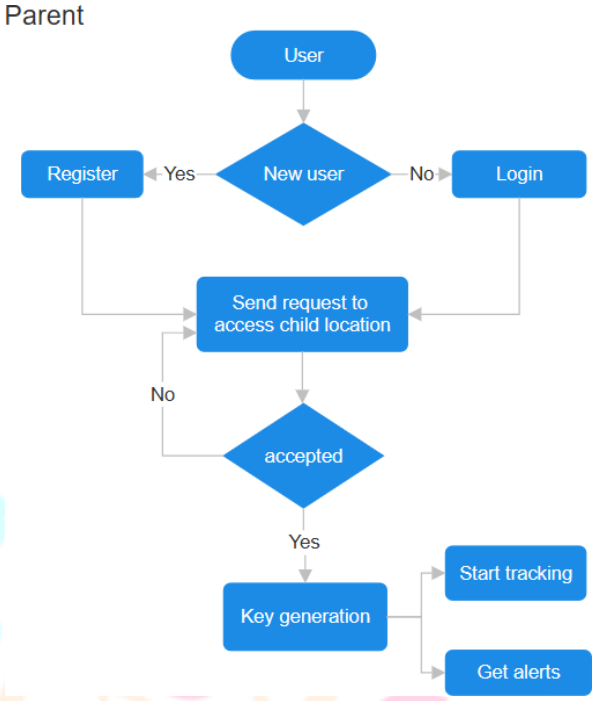

Fig. 2. Workflow of the system on parent side

3.2 Development Environment

The application is developed using Android Studio, with Java used for validation and XML for the UI. In Android Studio, Firebase connection is enabled under the tools section. When initiating a project in the Firebase console, you're prompted to input your SHA-1 key, an essential step in the setup process. This key serves multiple vital functions within the Firebase ecosystem. It plays a pivotal role in authentication, enabling Firebase to establish a secure connection with your Android application. Upon adding your app to the Firebase project, the SHA-1 key facilitates the generation of a bespoke configuration file (typically named google-services.json). This file encapsulates critical credentials and configurations required for seamless interaction between your app and Firebase services. Moreover, the SHA-1 key serves as a security measure, ensuring that only applications signed with the corresponding certificate can gain access to your Firebase project. This authentication mechanism is fundamental in safeguarding your Firebase resources against unauthorized access and misuse. Additionally, the SHA-1 key acts as a unique identifier, allowing Firebase to distinguish between different iterations of your app and deliver tailored services accordingly. The inclusion of the SHA-1 key during project setup is integral to establishing a secure and seamless integration between your Android app and Firebase services.

3.3 Modules and Permissions

Different modules are created, such as the main activity which works after the login module, signup, and login modules. In the manifest file, location permissions are specified. All the modules are Java class files, and XML layouts are used for the framework.

3.4 Google Maps Integration

Integrating Google Maps into the CTrack application for location tracking involves a systematic approach:

1. Google Maps API Key Setup: Creating a Google Cloud Platform (GCP) project, enabling the Google Maps SDK for Android, generating an API key, and restricting its usage to the app's package name.

2. Dependency Inclusion: Incorporating the necessary Google Play Services dependencies, including the Maps SDK, into the app's build.gradle file.

3. UI Design: Determining the placement of the map within the app's UI and creating an appropriate layout XML file.

4. Initialization: Initializing Google Maps in the designated activity or fragment, involving the initialization of the GoogleMap object and implementing the OnMapReadyCallback interface to handle the map's readiness.

5. Permissions and Location Retrieval: Requesting location permissions and retrieving the user's location using the Fused Location Provider API.

6. Displaying Location: Displaying the user's location on the map by adding markers or moving the camera to the user's coordinates.

7. Continuous Location Tracking: Setting up location updates for continuous tracking, especially for applications requiring real-time tracking like CTrack.

3.5 Geofencing Implementation

3.5.1 Geofence Definition

Specific locations where alerts will be triggered upon the child's entry or exit are determined. Common locations such as homes, schools, or parks are considered. Geofences are defined around these locations by specifying their center coordinates (latitude and longitude) and radius.

3.5.2 Geofencing Implementation in Child's App

The Geofencing API provided by Google Play services is utilized within the child's application. Geofences are programmatically set up by creating instances of Geofence objects with pertinent parameters such as a unique geofence ID and transition types (e.g., enter, exit). These geofences are then registered with the Geofencing Client, specifying the desired transition types.

3.5.3 Handling Geofence Events

Handling geofence events is crucial. When the child's device crosses the boundary of a defined geofence, a geofence transition event is triggered. Processing this event involves determining key details such as the geofence ID and the type of transition (entry or exit). Subsequently, actions are initiated based on these events, such as sending alerts or notifications to the parent's device.

3.5.4 Tampering Attempt Mitigation

Robust security measures are implemented to safeguard against tampering attempts by the child. Techniques such as code obfuscation, tamper detection mechanisms, and secure communication protocols are employed to fortify the child's app against unauthorized modifications or location spoofing. Continuous monitoring of the app and device environment enables the detection of any suspicious activity, allowing for appropriate action to be taken, such as disabling location tracking or notifying the parent.

3.5.5 Communication with Parent's App

Establishing seamless communication between the child's and parent's apps facilitates the transmission of geofence events and alerts. Relevant information, including geofence IDs, transition types, and timestamps, is relayed from the child's device to the parent's device in real-time or through periodic updates. Alerts or notifications are then displayed on the parent's device upon the occurrence of geofence events, providing timely updates on the child's location changes.

4. RESULTS AND DISCUSSION

4.1 Result

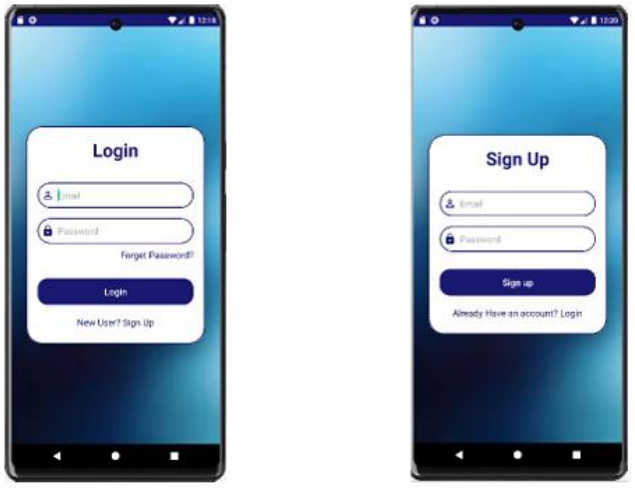

Fig. 3. Login and Signup Modules

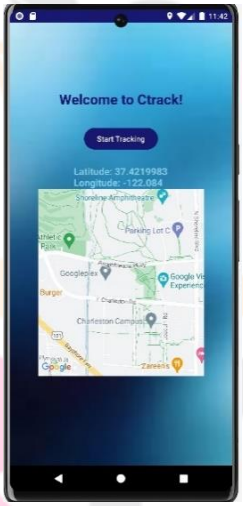

Fig. 4. Location tracking Module

5.CONCLUSION

In conclusion, the proposed Android application ensures safety, and the location information is precisely provided by this application. This application is positioned as a comprehensive and efficient tool for enhancing personal safety and security due to its precise location monitoring, quick emergency alert generation, user-friendly interface, low battery consumption, and robust privacy features. By comparing our system with others, we emphasize its strengths and contributions to the growing field of safety-oriented mobile apps. This application facilitates the user's movement in outdoor areas, guaranteeing smooth operation and offering detailed location information. It provides a directional map to navigate the various regions seamlessly, all within a single integrated system. In the future, new features will be added to ensure more security and reliability of the location data.

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