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Transforming Women Safety with Information Technology: A Mobile Real-Time Intelligence Framework

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Abstract: - Despite significant technological advancements, women's safety remains a pressing issue in modern society. Women face threats to their safety in various environments, including while traveling alone, on secluded roads, and in the workplace. Education plays a crucial role in empowering women and raising awareness about safety measures. Despite government and NGO efforts, violence against women continues to rise, with instances of harassment, abuse, eve-teasing, kidnapping, domestic violence, and rape persisting. While women have made strides in various fields, including sports, business, politics, and entertainment, safety concerns remain a significant challenge, especially for those working in the IT and corporate sectors, including night shifts. Sexual harassment in the workplace, including by supervisors or seniors, is a growing concern. Existing safety systems often overlook crucial features such as audio or video recordings, which could aid in identifying perpetrators and ensuring justice for women. To address these limitations, a Real-Time Intelligent System for Women's Safety is proposed, leveraging technologies such as machine learning, artificial intelligence, and data science. This system aims to provide sophisticated yet user-friendly safety features, including live location sharing with authorities and contacts, predicting safe routes, recording evidence, and offering legal rights guidance for women in distress.

Keywords: Women Safety; Mobile App; Women Safety Systems; Real Time Intelligent System; Domestic Violence; Women Empowerment; Women Harassment; Machine Learning;

I. INTRODUCTION

There is no country or city in the world where women can live and move freely without violence. In all aspects women are unsafe. The crime against them increases at a higher rate. There are many instances of harassment, kidnapping, abuse and rape. Women are working equally as of men. They are leading in every field such as sports, business, politics, education, movies, dance etc. But still they are never safe (Mahmud et. al., 2017). Non-working women feel insecure to step out of their house due to the increase in crime rates like harassment, abuse, violence, stalking, eve-teasing etc. With the boom in the IT and corporate sector, many women are working and even during nightshifts. The employed women feel themselves more in danger because they face harassment during travelling and at workplace also. Sexual harassment is increasing rapidly. Women are continuously harassed by men those are working as their senior.

Even the technology has advanced a lot in these modern times, women safety is still a huge issue (Mahmud et. al., 2017). Women are not safe anywhere. They face extreme troubles when they are alone, travelling on lonely roads (Alone et. al., 2017). Education is essential for everyone and especially for women for their better growth. It provides awareness and capacity to distinguish between good and bad. It is a powerful weapon to end poverty. Women are still facing safety issues everywhere. In some cases mothers feel handicap to protect their daughters from several harassments. For women safety people tried lots of ways & techniques but still a sophisticated

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system needs to be developed. The new system should be intelligent enough to sense the dangerous locations in advance and it must help women to protect in worst situations.

It is everyone's duty to provide safe and secure environment to women. The students must be taught about physical education and how to protect themselves in untimed situation (Pankan and Radhakrishnan, 2016). The economy of the country rises if their women are secure and educated. It can uplift the society and will prove betterment for the nation. In every minute woman is being harassed, molested, assaulted and violated at various places. Number of the women victim increases daily. About 35% of women have experienced some kind of physical & sexual violence in their life. There are many women safety applications that have been developed for their safety, improvement in lifestyle and to decrease the violence against them (Rose, 2013). But no application works for past violence or incident already happened with them. They have no evidence or justification according to the law for proving themselves right.

The research is always helpful no matter how many applications are already working on it but every time women faced newer harassment ways by the society. To come out from the dangerous situations a system requires new ways and technique help. It's not easy to judge any person's mind how they harass the women and in what ways. So it can only be predicted by our past experience. The criminals used to crime and harass women in new ways so that they can never be caught. There cannot be a cop with women all the time. In order to catch the criminals, women safety applications needs to be developed that can learn from the past experience of women to secure their future. New features and techniques need to be incorporated in order to develop intelligent applications that may predict fully safe route and provide women safety. Expert system should be included so that women can be made aware of the laws and rights.

The system should help women to check out the safe route before leaving their home. If they face any trouble they can record the evidence by through audio video recording in their mobiles. These evidences and live location can be sent to the predefined numbers, police, doctor and lawyers. In case they lost their life by the harasser or criminal, the proof will already reach at right place. This will be helpful in finding the criminal and justice will be provided to their family. Mobile based app for women safety should be developed as everyone is using mobile these days. It needs to be highly sophisticated with all features and easy to use. Moreover it should be build using latest technology like machine learning, data science, artificial intelligence etc. Expert system should be there to know about women rights. It should be intelligent to send live and current location, record evidences and to predict the safe route.

II. LITERATURE REVIEW

This section reviews the current research papers and articles to present the existing knowledge and findings both theoretically and methodologically on the particular topic. The following papers discuss issues regarding women safety, security, awareness and women safety systems, applications and models:

The authors expressed that violence against women is an outcome of gender relations that assume men are superior to women (Uzun and Uzunboylu, 2015). Violence incorporates physical aggression, such as blows, blackmail, attempted hanging, sexual abuse, humiliation, burns, economic or emotional threats and control over speech and conduct. Generally, violence takes place in a man-woman relationship within the family, state and society. Some preventive measures are requested with psychological help to stop violence against women.

Nowadays security for everyone and especially for women and children is a major issue in the World. The authors (Ansari et. al, 2017) enlighten on the latest annoyance of Kopardi that wobbled the nation. The people woke us for women safety and try to find various techniques to defend them. The paper proposed a new technology with one touch system using GSM & GPS for women safety. With this women can defend themselves while facing any problems or challenges. The system uses hardware such as raspberry pi, GSM, GPS and force sensor. Whenever women sense danger the button needs to be pressed. The GPS will find the location and sends an emergency message using GSM to police control room and to the saved contacts. The system is reliable and environment friendly but not cost effective. Moreover a new device will be carried by women or children all the time.

The author (Shimpi, 2017) accessed the current status of women and their security. The author proposed mobile based application with use of ARM7 interface to send the location of the affected. A message will be send using a LCD display to the saved contact that help is needed. The author also focused that GPS with only provide

longitude and latitude values. The Emergency key is also provided in the system. In danger situation, women will press the emergency key makes a loud sound. The system does not take care of any evidence and latest technologies like machine learning, artificial intelligence etc.

The authors (Verma et al., 2017) stated that with the increase in women's education and workforce, their outdoor activities have also been increased. For such activities, the majority of the women utilize buses, so necessary safety measures need to be implemented. The author tries to explore various service gaps and intended to analyse them linked to safety factors and requirements of women.

The authors (Amoatemaa et. al., 2017) explored the safety in campus, where it is required and at which period of time. So, a survey was conducted with security questions. Typically students express their feelings about safety that they need mostly after dark and at some places where they are alone. Major factors were contributed by students about their requirements for safety reasons e.g. CCTV cameras, police patrols, emergency contact.

In this paper, WalkSafe application based on location is discussed (Vaghela and Shih, 2018). It notifies the users' emergencies around them. The key features of this location-based application are – interface, urgent situation notification from the records of past incidents, and type of emergency. The survey was conducted and the application was favoured by the users due to their safety reasons. The author suggested that an enormous amount of work needs to be done for safety purposes using wearable technology.

Women are unsafe in all aspects in the world and the crime against them is increasing rapidly. In this paper, authors (Kumbhar et. al, 2018) reviewed many papers, discussed gaps and propose a quick responding mechanism that can help women in troubled situations. A woman needs to press the button in untimed situation and the location in terms of latitude and longitude is sent via SMS to few pre-defined numbers. In the proposed system, authors make use of controller - ATMEGA328P that is interfaced with other equipments. 'C' language is used to develop a program. Only latitude and longitude is sent via SMS. Actual location, evidence, doctor, police control and ambulance are highly ignored. It is a portable device which may be difficult to carry and is not cost effective.

It is the most important duty of every person to provide safe environment to women. The country does not rise where the women are not safe and are being harassed. Since the ancient time, women are given most respected place in the society but every day and every minute some women of all walks of life (women, girls and babies) are getting harassed, molested, assaulted and violated at various places all over the world. About 35% of women have faced physical or sexual violence in their life. The authors (Pragna et. al, 2018) reviewed numerous applications and devices that were present in order to decrease violence against women. They also added a small measure of improvement in their paper that can increase the performance of these devices and may provide better women safety.

The authors (Bobhate et. al., 2018) expressed that the crime rate is increasing rapidly and it becomes a major factor for girls' security. A mobile based application with fingerprint authentication was proposed. The proposed system helps to provide safety and security for hostel girls'. In a danger situation, the emergency key has to be pressed. The system becomes activated and the emergency message will be sent to the hostel warden as well as to the parents along with the location.

The authors (Likhitha and Hemalatha, 2019) and (Latha et. al, 2020) expressed their views regarding women safety and security. Women safety and independence is a major concern in the modern times. They are harassed, molested, violated, assaulted and even raped. There are many laws and regulations but with no success. The researchers proposed a system which makes use of Arduino, LED, GPS, GSM etc. The victim can flash LED light to the attacker which can make him blind for approx 5 seconds. SOS button is provided that can send the location of the victim. It is a wearable device and maybe not easy to carry and may not be affordable by every women. No recording system (voice and camera) is there for capturing evidence.

The authors (Sathyasri et. al, 2019) proposed a "Smart Band" device in order to provide women safety. The design and implementation of this band has been discussed in the paper. The device system consists of trigger, microcontroller (ATmega2560), GSM module (SIM900), GPS module (Neo-6M), IoT module (ESP-12E), Neuro Stimulator, Buzzer and Vibrating Sensor for making a device. After activating the device GPS tracks the current location and GSM send the message. Neuro simulator detects the attacker and produces electric shock, buzzer is

used for alarm and IoT is used to keep track of location. The device is portable but not possible to buy and keep it all time for everyone. Shock produced can affect the victim also. Battery is also used that needs to be charged.

Women feel less secure and face lots of problems when they go outside. They are harassed all the time either from front or from the back. To overcome these problems authors (Ramya and Vimal, 2020) developed a smart portable device to keep track of victim's location. The device records the pulse all the time. When heartbeat increases the device will send a misery message to the contacts already fed. The device can also be helpful in measuring haemoglobin and stress level. It is a wearable device and maybe not easy to carry and may not be affordable by every women.

The authors stated that in reality violence against women in India is much more that it appears to us (Chakraborty et al., 2021). The paper was based on data published by National Crime Record Bureau from 2001-02 to 2014-15. The authors applied panel progression technique in identifying the factors that can control crime against women. Factors like economic growth, parental guidance and education can decrease the crime.

Crime against women is a major issue all over the world. Attempts have been made to prevent it but every year huge data is produced of different kinds of crime in different parts of the world (Prasad et al., 2021). Analyzing these datasets can identify major crime patterns and their time of occurrences. The authors used Huber regression to analyse the dataset and time series algorithm to visualize it.

As the crime against women is increasing daily, women safety issue must be the topmost priority of any Government. Nowadays people are using smart phone effectively. An app was developed that can send the message to the registered contact (Bhagwat et al., 2021). An application also keeps the user location when clicked. Crime pattern and important hidden relations can be analyzed from crime data.

The paper is based on the big data technology (Li, 2021). It established the application platform based on visualization for improving the intelligence level of University's safety management. The system was tested and the results show that the response time of the system is very good. It recognizes the digitalization and mobility of campus security management to progress campus security and offers a data basis for the decision-making of smart campus.

III. PROBLEM STATEMENT

Even the technology has advanced a lot in these modern times, women safety is still a giant issue. Women are not safe anywhere. They face extreme troubles when they are alone, travelling on lonely roads & abounded. Education is essential for everyone and especially for women for their better growth. It provides awareness and capacity to distinguish between good and bad. It is a powerful weapon to end poverty. Government and NGOs has made many rules and regulations for women safety but violence is increasing day by day. There are many women safety system, applications and devices but all are facing some limitations. A Real Time Intelligent System for Women Safety needs to be developed to overcome these limitations and to address the following areas for providing more safety and security [29][30].

- Even though a lot of women safety systems, devices and applications are there, still a more refined system, application or device needs to be developed in order to make women feel safe and secure while they are alone or in trouble [31][32].
- No device or application has the potential of recording voice or image for evidences.
- They do not have the feature to contact hospitals, ambulance or fire brigades in case of emergency [33][34].
- Wearable systems like watches, bands, jackets etc. are expensive. Some of them are heavy and use voltage and buzzers to produce shocks that can harm the victim itself.
- The developed system sends location to only police or saved contacts but the system needs to be intelligent in sending real time location and evidence to police, hospitals, ambulance, fire brigades or even lawyers [35][36].
- A system in hand having intelligent modes and SOS facility may help women out from troubling situations.
- None of the systems are using latest technologies like machine learning, data science etc. They also lack use of expert system that can guide women for their laws and rights.
- The developed system are not able to discover and show the safe path when women needs to go alone outside.

IV. PROPOSED SYSTEM

To overcome the above problems, the following Real Time Intelligent Systems (RTIS) for women safety has been proposed. The features incorporated in the proposed system are shown in the Figure-1 below.

Figure-1 Real Time Intelligent System (RTIS) for Women Safety

Following are the features of the proposed system: -

1. **User –** The user (women) can sign-up with valid mail ID and can save her data (head to toe), personal details like a photograph, address (parental, in-laws or special address), phone number and valid identity proof (PAN, Aadhar, Voter ID, Passport, etc.).
2. **Expert System** – Women can get awareness about their rights and acts that are provided by the Government for their welfare. Machine Learning can be used to expertise the system which provides information about women's acts and rights.
3. **Evidence -** The victims are mostly short of evidences in case of emergency. To provide a solution, a signup option will be provided to the women to store their personal, professional and other important information that is directly stored in the police and medicinal databases. The user can store video recording, image capturing, secret text message as evidence. In case of a critical situation, this evidence message can be sent to the police and to stored phone numbers.
4. **Police, Doctor, Ambulance, Fire Brigade, Friends & Family** – These sections will provide assistance to victim women on a single button in any kind of emergency. The user can select any of the assistance and RTIS will send live location / text message / call to the specified number. The combination of all these modules can also be availed by the user in worst situations.

V. RESULTS

The prototype for the Real-Time Intelligent System for Women's Safety is crafted using Android Studio, a powerful integrated development environment (IDE) specifically designed for Android application development. Leveraging the robust features and tools offered by Android Studio, the prototype aims to deliver a seamless and user-friendly experience for women users. By harnessing the flexibility and functionality provided by the Android platform, the prototype ensures compatibility with a wide range of Android devices, empowering women to access safety features conveniently from their smartphones. Through meticulous development and testing within Android

Studio, the prototype endeavors to realize its vision of enhancing women's safety in real-time, offering a practical solution that integrates seamlessly into their daily lives. Table 1 defines the system requirements and minimum specification required.

Table 1. System Parameters

System Requirements	Minimum Specifications
Operating System	Windows 7/8/10, macOS 10.12+
CPU	Intel Core i5 or equivalent
RAM	8GB or higher
Disk Space	4GB available space
Development Software	Android Studio 4.0+
Java Development Kit	JDK 8 or later
Android SDK	Latest version installed
Emulator	Recommended: Google Pixel Device
Graphics	Minimum 1280x800 screen resolution
Internet Connection	Required for SDK and updates
Additional Tools	Git for version control, Adobe XD for UI/UX design, Gradle build system.

The following Figure-2 depicts the home screen. Then click on last profile button. It will show the screen as in Figure-3. Enter the profile data as displayed in Figure-4.

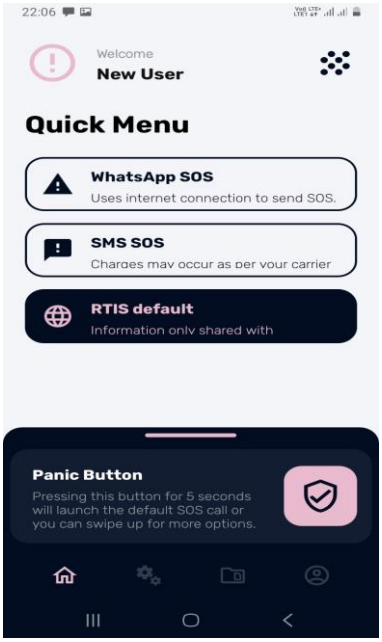

Figure-2 Home Screen

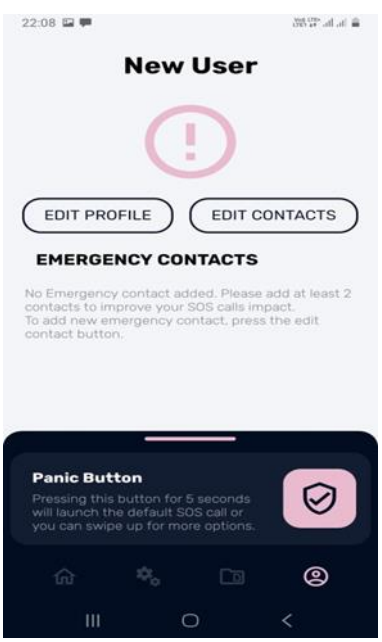

Figure-3 Profile Window

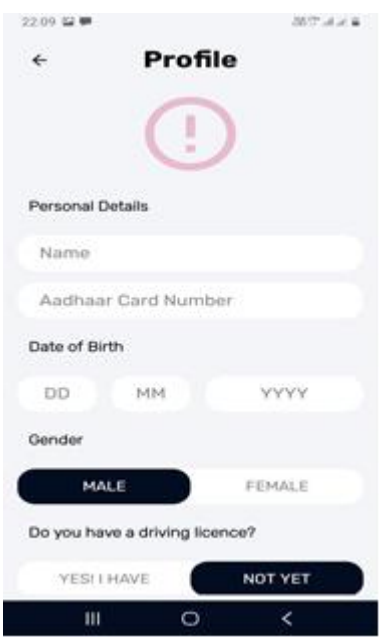

Figure-4 Enter the Profile

After entering the profile data as in Figure-5, the data will be saved as user name appears on the top as shown in Figure-6. Then click on save contacts and enter maximum upto three contacts as shown in Figure-7 for emergency where SMS or WhatsApp can be send during distress situations.

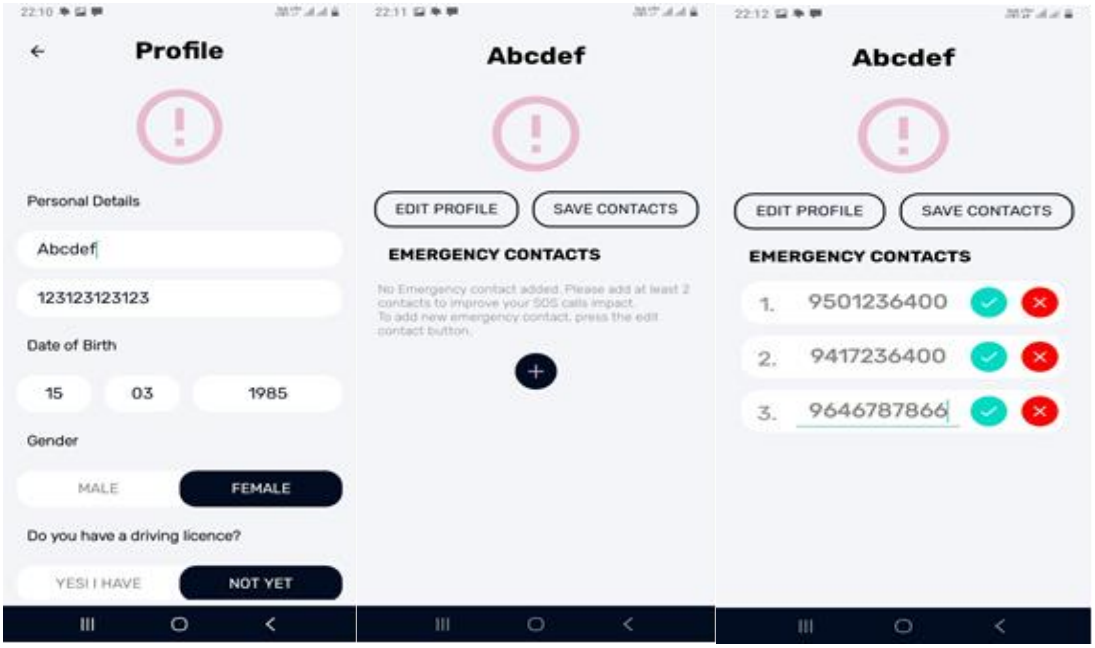

Figure-5 Profile Data **Figure-6** Profile Name Window **Figure-7** Emergency List

Figure-8 shows the home screen with user name. Hold the panic button for 5 seconds to generate SOS. Figure-9 shows the generated SOS. After the SOS is generated SMS / WhatsApp message to the registered emergency contacts as shown in Figure-10.

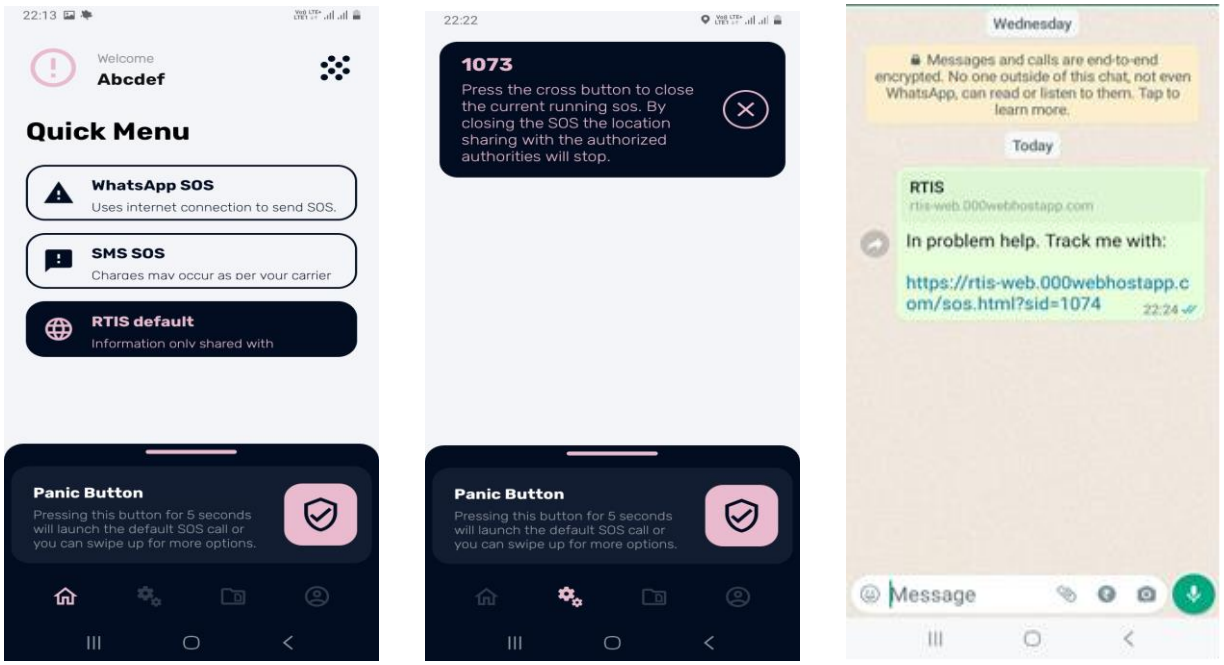

Figure-8 Home Screen **Figure-9** SOS Window **Figure-10** WhatsApp Message

When the SOS is generated, the locations can be tracked by the emergency contact list users and to police, ambulance, doctor, fire brigade etc. to whom the web end link is provided as in Figure-11. Here user starts from red color and ends his journey at maroon color. If the user feels that she is out of danger, then the cross button on SOS window can be clicked.

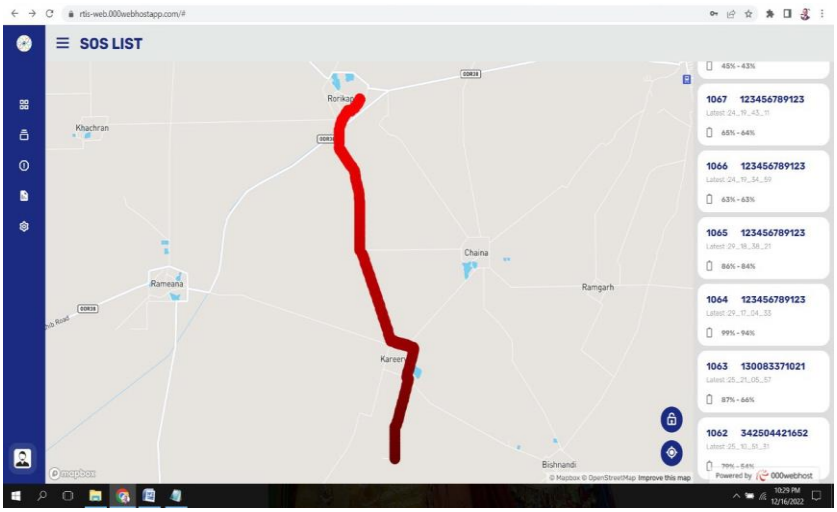

Figure-11 Track of SOS

The whole data of this application has been stored in Firebase which is a realtime database. The user registered in firebase is shown in Figure-12. Each user when registered will be assigned a unique ID("UID") as shown in Figure-13.

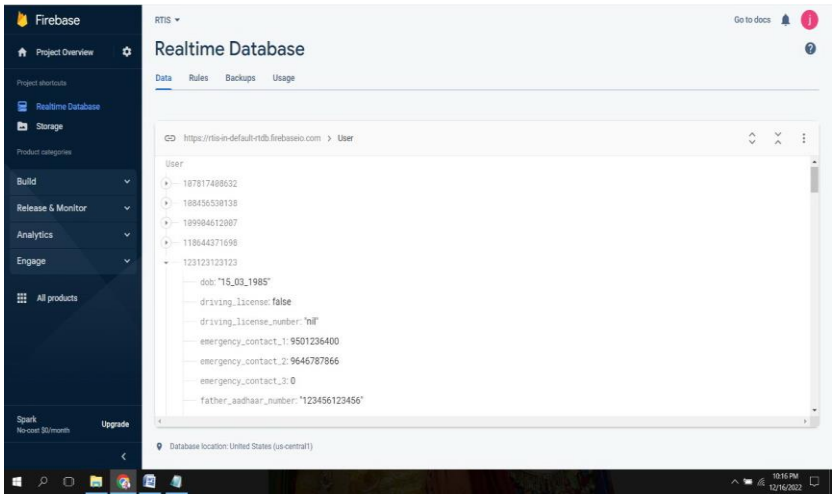

Figure-12 Firebase Database with Registered User Entry

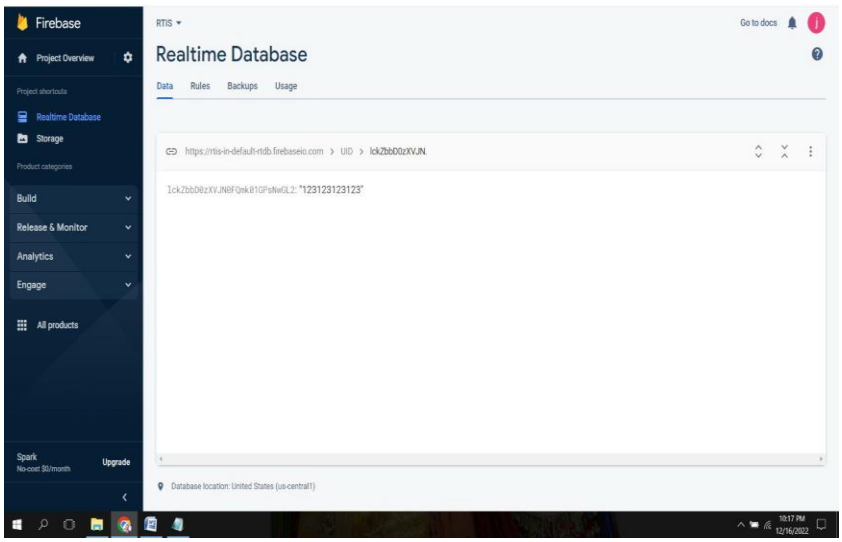

Figure-13 UID for every user

When the SOS is generated the camera captures the pics both from front and back camera. The following Figure-14 shows four images stored in SOS number 1067. The image name starting with ‘b’ is from back camera and image name starting with ‘f’ is from front camera. The criminals are not aware of these and these images will act as evidences for the user.

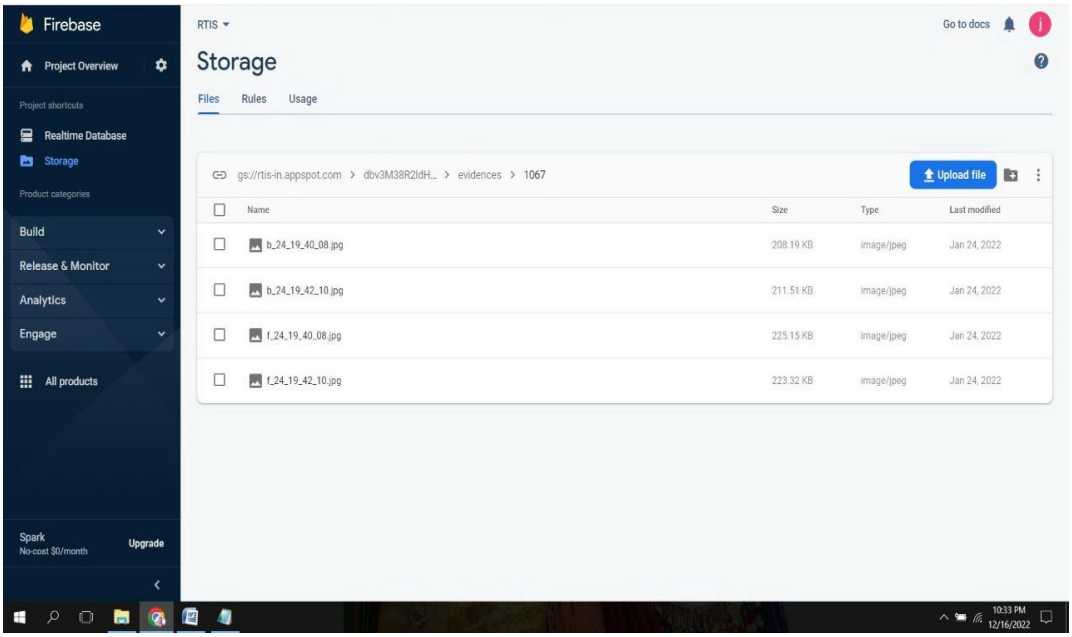

Figure-14 Evidence images captured from both front and back camera

VI. CONCLUSION AND FUTURE SCOPE

The research emphasizes the crucial nexus between women's safety, education, and awareness. Despite existing applications, women encounter new forms of harassment, necessitating ongoing advancements in safety technology. To address these challenges, intelligent safety solutions must integrate new features and techniques. Such systems should empower women to preemptively assess safe routes and record evidence through audio-video recordings on their mobile devices. Transmitting this data to predefined contacts, including authorities and legal professionals, ensures swift response and justice in emergencies. Existing systems often lack such provisions, highlighting the need for innovative solutions. The proposed Real-Time Intelligent System for Women's Safety aims to bridge these gaps, offering sophisticated features and user-friendly interfaces. In emergencies, the system will dispatch live location alerts, predict safe routes, record evidence, and provide guidance on women's rights. Integrating modern technologies like Machine Learning and Data Science enhances the system's efficacy. Ultimately, the proposed Women's Safety system seeks to create a secure environment where women feel protected and empowered.

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