A Smart IoT Device for Child's Safety Real Time Monitoring System

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Abstract: The IoT technology is used to monitor the child's safety in the real time. The overall system is controlled by the Raspberry pi 3 module and it is connected to all the IoT devices. The child's body temperature and pulse rate values are extracted through sensors. Whenever child experiences any abnormal feelings or unusual activities like fear, anxiety, etc. the temperature and pulse rate values reach above threshold and when child speaks with a specific keyword (i.e. "Help Me" or "Save Me") then the voice recognition system gets activated. The child's input voice will be converted into text format. When these text formats gets matched with the keywords then immediately pi camera captures the image of an attacker and sends an E-mail alert and at the same time even SMS alert is sent to the parents/guardians. The parents can also watch the live video streaming of the attacker in the YouTube channel from their remote location. This safety system also sends SMS alert message through Twilio in the local language (i.e. Kannada and Hindi) to the registered phone numbers (i.e. surrounding/neighbors of the victim), so that any local citizen can read and understand the message to save the child.

Index Terms: IoT applications, Raspberry pi, Temperature Sensor, Pulse Rate Sensor, Bluetooth Module, pi camera Twilio application.

1. Introduction

The Internet of Things (IoT) seems to be an essential part of the daily lifestyle. Internet of Things has an impact on human life, both consciously and unconsciously [1]. With a help of digital technology, any device is regulated and makes people life easier. The improvement of sensor technology, the availability of internet-connected devices, and data processing [2] algorithms enable connected devices to respond intelligently in emergency circumstances without the need for user intercession [3]. The IoT devices are used in a variety of areas, including agriculture, healthcare, industrial, security, and telecommunications applications [4]. IoT improves technology via improvements in software, hardware, and advanced tools [5]. It also makes use of new technologies in the domains of monitoring, connectivity, and robotic [6]. Because of its advanced capabilities in the social, economic, and political effect of users, IoT brings about worldwide changes. In worldwide, the IoT business [7] is estimated to exceed USD 1,386.06 billion by 2026, rising over USD 761.4 billion in 2020 [8], at even a CAGR (Compound Annual Growth Rate) of 10.53 percent (2021-2026) [9].

Internet of Things (IoT) has an impact on human life, both consciously and unconsciously. With a help of digital technology, any device is regulated and makes people life easier. Women's and children's protection is a serious worry in a country like INDIA, where women and children are succeeding in every sector. India is a peaceful country that is one of the safest places to visit in the world. Many girls or children even now feel unsafely to move freely in the streets in our nation due numerous cases of violence against the women and child. In today's world, safety is the most important force for everybody in the modern century. The government has provided public safety through rules and regulations to citizens for their safety and security. Even through our country is economically improving, However, there are so several abuses occurring against children and women. In general, [10] 70% metropolitan cities such as

Delhi, Mumbai, Bengaluru, Hyderabad, Kolkata, Pune, and Chennai have a higher percentage of working women than other cities

A smart system has been created to keep children or women safe and secure in society. When children or women are in a dangerous or emergency situation, a special protection system has been developed for them. The use of mobile phones from small children to the old aged persons it significantly increased across the world. As a result, the government and people have created a number of mobile applications and smart devices to assist children and women who are in danger. Even while developing a variety of technologies and apps, the rate of sexual offenses or kidnapping hasn't reduced. Children or Women safety technologies may include a variety of apps that are popular in today's world and that are using in the real-life whenever emergency scenarios such as Raksha , My Security My Responsibility (MSMR) women safety, Find My Friends or Family or Kids – Location Tracker, Suraksha .

In this proposed work, we have explored about the child's safety design technology. By using the different technology, we can save the child from the strangers, harassments or kidnapping. IoT [11] will play the main role to design a child safety monitoring system with the help of sensors and safety devices. In general, [12] children have the right to convey their concern to their parents regarding crimes they face in everyday life.

The innocent children [13] have no idea about what bad is happening to them. It is also difficult for parents to determine whether or not their children are sexually harassed. Hence, [15] a smart real-time monitoring system is necessary for every child out there to keep them safe. It is clear that [16] there is a significant necessity for children's security in the country. As a response, [17] it is now feasible to use contemporary technology [18] to resolve child safety problems in society in an intelligent manner. For such outcome, [19] the point of this study is to utilize a present technological innovation, namely the Internet of Things, to reduce the child's harassment

Its follows that's how this paper is organized 2, the literature survey on the child safety wearable devices and the objectives of the proposed system which is related to child safety motoring system were discussed. In the section 3, we explain about the methodology on the proposed system and how to use the technology to save the child from the strangers. In the section 4, we have discussed about the block diagram of the system with the hardware connection and the results with the snapshots of the work carried out. In the section 5, we have verified the system to check how it works in real time monitoring system. Then, in the final section, presents the conclusion to our study and outcome of the research work.

2. Literature Survey

Prashanth, Dantu Sai et al [20], here author have built an android application that combines all of the specific functionality, such as real-time location monitoring, and implements the vast majority of the latest software's technology, including such GPS monitoring and SOS (Save Our Souls). This system involves the initial authentication as well as emergency contact numbers, and also the device is required to upgrade the emergency contacts on a regular basis in an application at the point when a child moves from one location to another location then Pub Nub's channel is used and it has settled with a specific location whenever child exceed from specific location then alert message is sent to the parents and emergency contact numbers.

Bhanupriya and Sundarajan [21], here author explains about a system that is combined with several devices, including a wireless "Activity Tracker Wrist Band" has been pre-programmed including all required details, including user reactions such as frustration, anxiety, nervousness, and fear. When the victim is presented with these conditions, the device efficiently controls the location of children within the designated area by using various sensors to generate urgent signals that are transmitted to the mobile phone.

Kalpana seelam et al [22], the authors present a women's or child's secure and stable electronic system that includes a sensors and microcontroller with device utilizes pulse sensor, variable sensor, MEMS technology, temperature sensor, and touch sensor. Making use of a variable resistor and a microelectronics accelerometer, the system detects body parameters such as heart rate, temperature changes, and victim acceleration, as well as the injured individual's voice using a sound sensor.

M. Z. A. A. Aziz et al [23], here author discusses that the device is designed to avoid sound or speech, as well as any movement, created by children left in a car. The system's main aim is to expand a full infrastructure that uses the global framework for mobile communication to interact with people. This device is used to detect the strongest possible sound made by a person. Moreover, it is capable of sensing motion in a vehicle caused by a person. The voice sensor will not be able to hear noise coming from outside the car. Any noise made from outside would be inaudible if the car door is securely closed.

Bhoopal, Keerthana, Vallidevi Krishnamurthy at al [24,25], authors discuss about the SMS and E-mail based technique to help the guardians to track the children in the real-time. Various devices are connected to a child's which specific tool via internet channels concerned about the children as well as parents in real time or for women protection may also be used to protect by this device. The guardians will have remote access to monitor their children via SMS and E-mail alert. The system includes Raspberry pi module as a controller along with GPS, E-mail and SMS gateway. Python 2.7 Idle compiler is used for device compilation. A server is built so that all the data is collected and stored in data server and information can be seen by parents. A Raspberry pi camera is used to capture the image of opposite

person in the system. For a wider scope, the app will be released in the future on other adaptable devices such as iOS and Windows.

Prasad, Sanjana et al [26], here author explains about a smart monitoring device which is used to record/capture video/images of the attacker and it will be sent via probable device to a smart phone. It is beneficial because it provides both ends with reliability and confidentiality. It is authenticated and encrypted on the receiver hand, so that the individual involved has access to the information. In the event of an emergency, such as an older person being ill, military zones, smart houses, offices, factories, and so on, necessary steps will be done in a limited period of time. The computer will recode the video of the people in that location and their positions so that precise information can be collected on the receiver side.

The main purpose of the system is to efficiently help child defend themselves in situations where they feel unsafe. The proposed system will monitor child's safety and health condition like body temperature and pulse rate. If the child experiences any abnormal feelings or unusual activities like fear, anxiety, nervousness, any other illness, the system will notify the parents/guardians. When the child talks, the voice recognition system checks for the keywords like "Help Me", "Save Me", "Danger Condition" in the child's text phrase, if the keywords match the text phrase, then an alert message with the picture of the attacker will be sent via E-mail of the parents/guardians. The parents can watch the live video streaming of their child in the YouTube and also the picture of an attacker from their remote location. This project will send an alert message in the local language, so that any local citizen can understand and save the child.

3. Methodology

In the literature, figure 1 shows over view of the child safety monitoring system have been designed through the various alerting techniques (i.e., messages alert, live location tracking, voice module, shock generator, etc) to the parents/guardians. As far as the researcher's knowledge, in the literature no authors have worked on alerting techniques like sending SMS in the local language or live video streaming on the YouTube channel. This research work not only waits for the parents/guardian's arrivals to rescue the child, but it also alerts any good citizen of this country (i.e., located near child's location) to save the child.

The methodology can include several steps such as conducting a needs assessment, researching available sensor technologies, evaluating their suitability for child safety monitoring, and designing a prototype device. By following this methodology, the research objective of designing a wearable device with sensors can be achieved. The systematic approach ensures that the device is purpose-built for child safety, taking into account factors like comfort, durability, and accuracy involve researching GPS and GSM technologies, evaluating their strengths and limitations, and selecting the most appropriate technology for real-time location tracking. It can also include developing algorithms and protocols for reliable and accurate location updates. By following this methodology, the research objective of developing a real-time location tracking system can be achieved. The systematic approach ensures that the system is effective in tracking a child's location and provides timely updates to the parents or guardians.

The research objective of implementing a two-way communication feature can be achieved. The systematic approach ensures that the communication feature is reliable, secure, and user-friendly, enabling effective communication between the child and their parents or guardians. the research objective of evaluating the effectiveness and usability of the monitoring system can be achieved. The systematic approach ensures that the system's performance and user experience are assessed, leading to refinements and enhancements based on user feedback.

By following the proposed methodology, the research objectives of designing a wearable device, developing a real-time location tracking system, implementing two-way communication, ensuring data security and privacy, and evaluating the system's effectiveness and usability can be facilitated. The methodology provides a structured and organized approach, guiding the research process and ensuring that each objective is addressed comprehensively.

The overall system will be controlled by the Raspberry pi 3 module and it is connected to all the IoT devices. According to the medical science, it is proved that a healthy child's body temperature should be less than 38℃ and pulse rate must be less than 70BPM. LM35 and PLSNSR1 are sensor devices, which are used for measuring the temperature and pulse rate respectively. Whenever child experiences any abnormal feelings or unusual activities like fear, anxiety, nervousness, or any other illness, the temperature value and pulse rate values reach above threshold value (i.e., >38℃ and >70BPM) then alert message is sent to the parents/guardians via Twilio application. In the process, the Bluetooth voice module (i.e., HC-05 Module) gets activated with serial port UART (Universal Asynchronous Receiver/Transmitter) commutation protocol. When the child is in panic condition if he/she speaks with a specific keyword (i.e., "Help Me" and "Save Me"), this will be recognized by GTTS (Google Text-to Speech) by using python library. Using the Bluetooth Module HC-05, the child's input voice will be converted into text format by using URT-8 (Unicode Transformation Format 8-bit) this input voice will be given via microphone that is through voice bot application. When these text format (i.e., text phases) gets matched with the keywords then immediately pi camera gets activated. This camera captures and sends the image of an attacker to the parents/guardians via E-mail alert using SMTP (Simple Mail Transfer protocol) and also SMS alert is sent using Twilio application.

In this proposed system, we are adding child's neighbours/surrounding person's phone number, so that any person who resides near the child's location will receive an SMS alert so that the child will be saved, even before the parents arrive. One more feature that we have added in this proposed system, is to send an alert message (i.e., through SMS) to

the neighbour person's phone number in local language like Kannada and Hindi using Twilio application, so that any local citizen can read the SMS and save the child. At the same time parents/guardians can watch a live video of the attacker by turning on YouTube channel. The live video streaming is generated with stream key raspivid I2C (Inter-Integrated Circuit) protocol and Uniform Resource Locator (URL) link is connected to raspberry pi camera module. The child's health data (i.e., temperature and pulse rate) through sensors will be updated every minute in the Telegram application, so that the parents/guardian can monitor child's health and its safeness.

Figure 1: Flow Chart of Proposed System
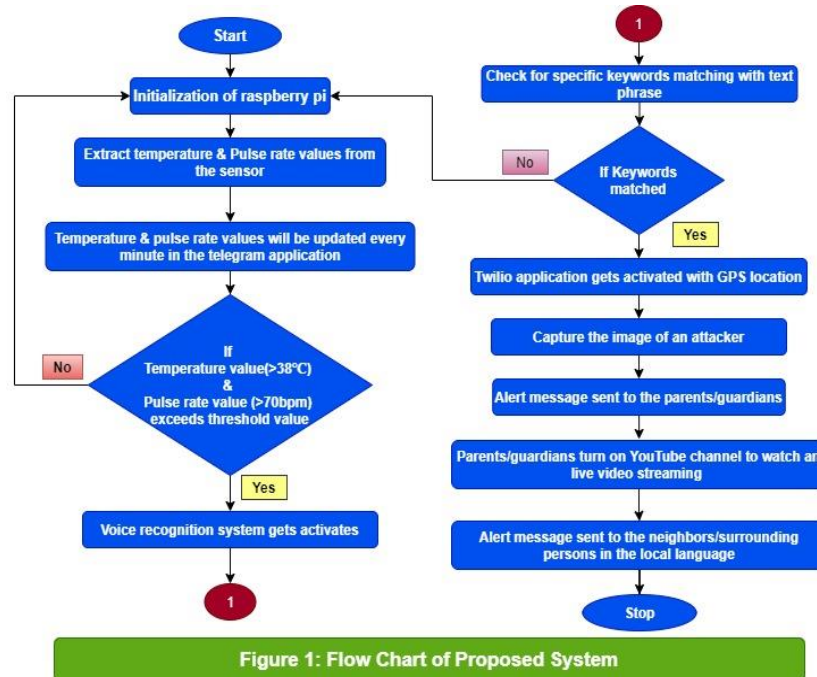
Fig. 1. Flow Chart of Proposed System.

The proposed system, a smart IoT device for child's safety real-time monitoring, offers several advancements and features that can greatly benefit parents or guardians in ensuring their child's safety. Here's a rational evaluation of the proposed system and suggestions for its advancing features along with the best applicable scenario:

1. Real-time Monitoring: The system provides real-time monitoring of the child's location, vital signs, and other relevant data. This feature allows parents or guardians to have constant visibility into their child's well-being and whereabouts, ensuring their safety. The system can send immediate alerts in case of emergencies or if the child moves outside defined safe zones.
    Advancing Feature: Integration with Artificial Intelligence (AI) algorithms to analyze data patterns and detect potential risks or anomalies automatically. For example, the system could identify sudden changes in heart rate or unusual activity patterns that may indicate distress or potential danger to the child.
    Best Applicable Scenario: This advancing feature would be particularly useful in scenarios where parents or guardians cannot actively monitor the child's data at all times, such as during busy work hours or overnight. The AI algorithms can act as an additional layer of protection and provide timely alerts or suggestions based on the analyzed data.
2. Two-Way Communication: The system enables two-way communication between the child and parents or guardians. This feature allows for immediate interaction, ensuring that the child can reach out for help or communicate any concerns directly to their caregivers.
    Advancing Feature: Language Processing and Natural Language Understanding capabilities to enhance communication. The system could employ AI-driven language processing algorithms to understand and interpret the child's messages more accurately, even if they are in an informal or incomplete format.
    Best Applicable Scenario: This advancing feature would be beneficial in situations where the child may not be able to communicate their needs clearly or where they may feel uncomfortable or hesitant to articulate their concerns explicitly. The system's improved language processing capabilities can help overcome communication barriers and better understand the child's messages.
3. Data Analytics and Insights: The system stores and analyzes historical data, providing parents or guardians with insights into their child's health trends, activity patterns, and behavior. This feature can assist in identifying long-term patterns, assessing the child's overall well-being, and detecting any deviations from the norm.

4. Advancing Feature: Personalized Health and Safety Recommendations. By leveraging machine learning algorithms, the system could generate personalized recommendations for the child's health and safety based on the analysis of their historical data. These recommendations could include suggestions for physical activities, sleep routines, or precautions based on specific patterns or individual needs.

    Best Applicable Scenario: This advancing feature would be valuable for parents or guardians who wish to optimize their child's overall well-being and safety. By providing personalized recommendations, the system can support proactive measures and help parents or guardians make informed decisions regarding their child's health and safety.

4. Results and Discussion

To conduct this research work, we have used hardware and software setup. The hardware components and its functionalities are discussed below:

4.1. System Architecture

The system architecture of the proposed system has been designed with the help of block diagram as shown in the figure 2. The system consists of various hardware components such as Raspberry pi 3+ module, ADC, pi camera, two sensors (i.e., LM35 & PLSNSR1), Bluetooth module and software requirements such as Twilio app, voice bot app and telegram app. Raspberry pi 3+ module will control the overall system with the power supply of 5v connected to ADC for the conversation of analog signal to digital values for measuring the sensor values. The ADC converter consist of 8-pins to communicate with two sensors (i.e., LM35 & PLSNSR1) connected to raspberry pi with the pin number 25 for serial communication, input pin to 18 and output pin to 23 with the voltage reference and supply volts of 3.3v. LM35 & PLSNSR1 consist of 3-pins (i.e., VCC, GND to ADC and VOUT to raspberry pi) to measure body temperature and heart rate with the power supply of 5v. The Bluetooth module has 4 pins (i.e., VCC, GND, RX and TX) connected to ADC module (i.e., GND) and raspberry pi (i.e., GND pin to 2, RX pin to 3 & TX pin to 4). Voice bot application (i.e., Microphone) used has an input voice of child to recognize the specific keyword configured in the system and connected to Bluetooth module. Raspberry pi camera used to capture the image and live video of the attacker with camera serial interface configuration with raspberry pi module (i.e., CSI pin). To send alert message via is SIP protocol from Twilio application and email alert via SMTP protocol in the system. The sensor values get updated in telegram application through MTProto protocol by using python libraries.
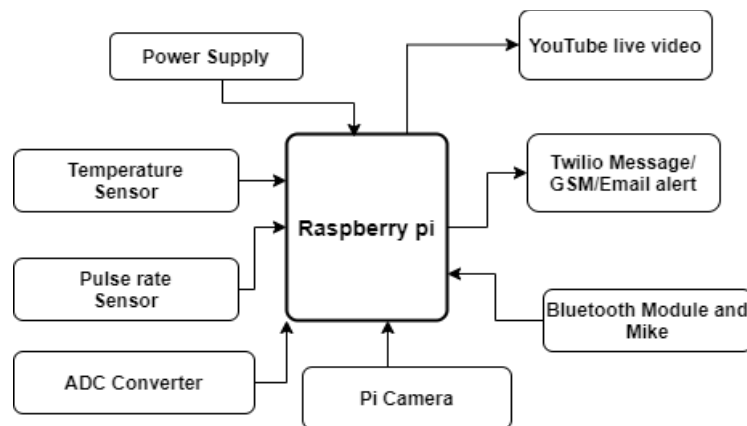

Fig. 2. Block Diagram of the Proposed System

To monitor the overall experiment of child safety real time monitoring system we have divided into five phases (i.e. Child health data, Child's voice recognition system., Alert messages sent to the parents/guardians, Live video steaming. And Alert message sent to the victim's neighbours)

4.2. Child health data

Whenever the child is in abnormal or normal state, based on that its health data (i.e., pulse rate and temperature rate) condition varies. Hence, in the first phase, we check for the child health condition by using the two sensors like temperature sensor and pulse rate sensor. The child's body temperature is detected by sensing LM35 sensor and pulse rate is detected by light sensor and infrared rays recognized by holding a hand on the PLSNR1 sensor.

The normal child body temperature and pulse heart rate value should be less than 38℃ and 70bpm respectively. If the temperature and pulse rate values reach above threshold value (i.e. >38℃ and >70bpm) then it is known as abnormal health state. The output value is verified from the sensors and the readings are noted down as shown in the figure 3 & 4.

Fig. 3. Normal Health State Value

Fig. 4. Abnormal Health Value

4.3. Child's Voice Recognition System

Once temperature and pulse rate values of the child reaches above threshold values, then in the second phase, voice recognition system gets activated. In this phase, Bluetooth module is connected to voice bot application which acts as a microphone to recognize the child's input voice in the form of text phrases like "help me" and "save me" as shown in the figure 5.
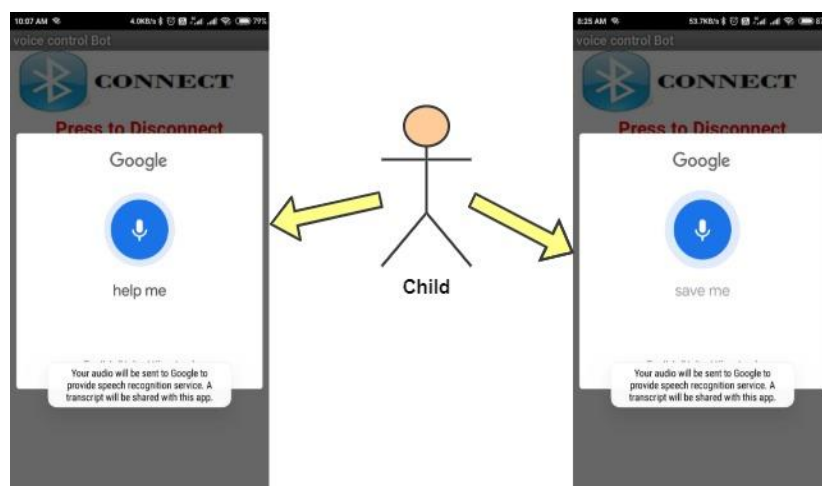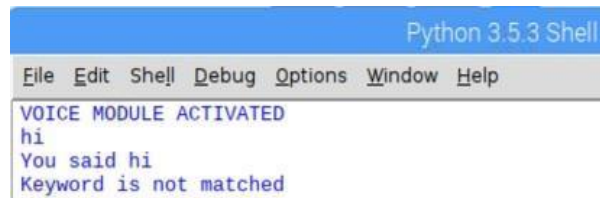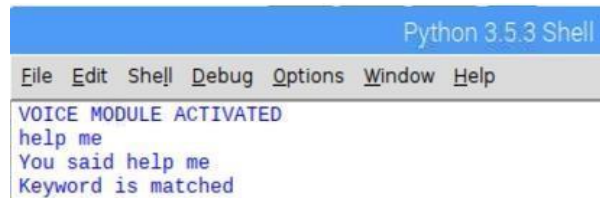

Fig. 5. Text Frames (i.e., "help me" and "save me") of the Child's Voice Recognition

If the child speaks with specific keywords (i.e., "help me" or "save me") then system checks for text phrases to get matched with those keywords as shown in the figure 6. Once the keyword gets matched, then immediately the voice recognition system captures the image of the attacker. The authors don't want to project some human beings as an attacker and put their snapshot as an output and prove the result. Hence, for the demo purpose we have assumed the image of the doll (i.e., as an attacker), which is as shown in the figure 7. When the child is in normal conversation with others then the keywords doesn't get matched. Hence, the system displays the output and no image gets captured.

Fig. 6. Keyword is Matched

Fig. 7. Keyword is Not Matched

4.4. Alert Messages sent to the Parents/Guardians

In this phase, we are sending alert messages to the parents/guardians during the four different cases (i.e. Child's abnormal health condition, Child's voice recognition system, Attackers image capture, Regular child's health data monitoring)

Case 1: Child's abnormal health condition:

When the child's body temperature and pulse rate value reach above threshold values then the child's real time monitoring system will notify to their parents/guardians through SMS alert message the parents/guardians will be known that child is in abnormal condition by the seeing the text message (i.e., "Child is in abnormal take care") along with the live location so that child can bee take care by the parents/guardians as soon as possible is shown in the figure 8.
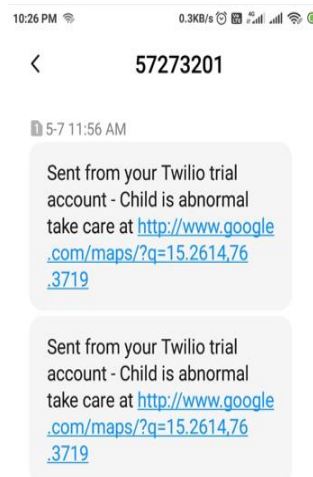

Fig. 8. SMS Alert Message during Abnormal Health Condition

Case 2: Child's Voice Recognition System:

Whenever child is in danger condition voice recognition system gets activated and it will check for specific keywords (i.e., "help me" and "save me"). If the keywords match with text phrases, then system will send an SMS alert message with live location sent to the parents/guardians as shown in the figure 9.
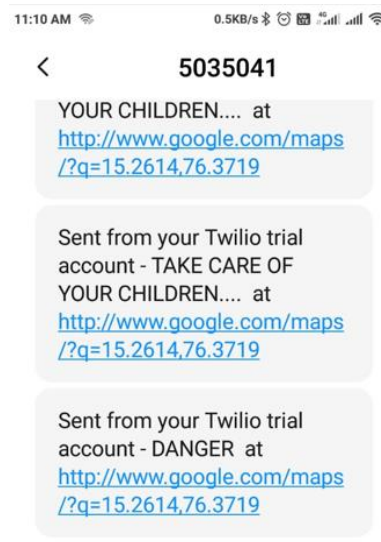
Fig. 9. Alert Message when Keywords Matches with Text Phrases

Whenever child is in danger condition like missing, sexual assault, harassment etc then the voice recognition system will send a text message as "Danger" to the parents/guardians through SMS alert message and the live location of the child. So that parents/guardians can take immediate action to save the child from the attacker.

Case 3: Attackers Image Capture:

Once the keyword gets matched, then immediately the voice recognition system captures the image of the attacker then captured image is sent to their parents/guardians via email alert as shown in the figure 10.
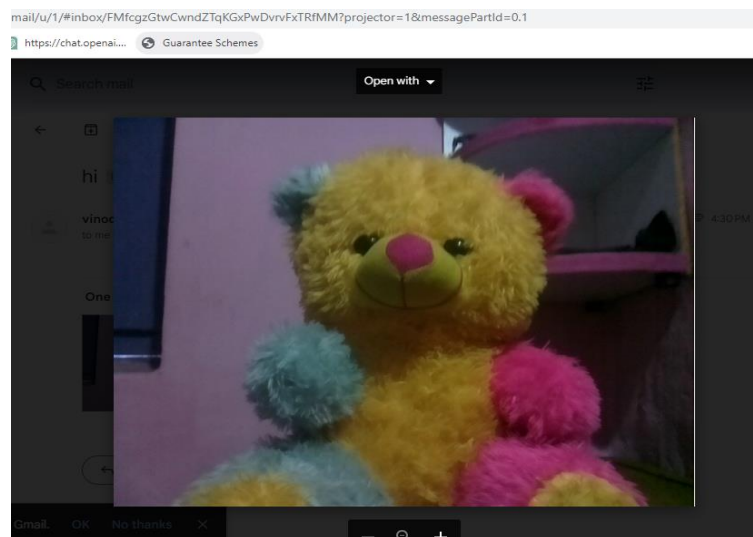

Fig. 10. Image of the Attacker Through Email Alert

Then the image of an attacker could be used by the police for any further investigation. The parents/guardians can also give the image of the attacker to the press report and also uploading his image in any social media like Facebook, WhatsApp, twitter etc. helps in the reduction of the future crimes from that particular attacker.

Case 4: Regular Child's Health Data Monitor:

In the process, the child's health data (i.e., Temperature value and Pulse rate value) will be updating to the parents/guardians every minute in the telegram application as shown in the figure 11.
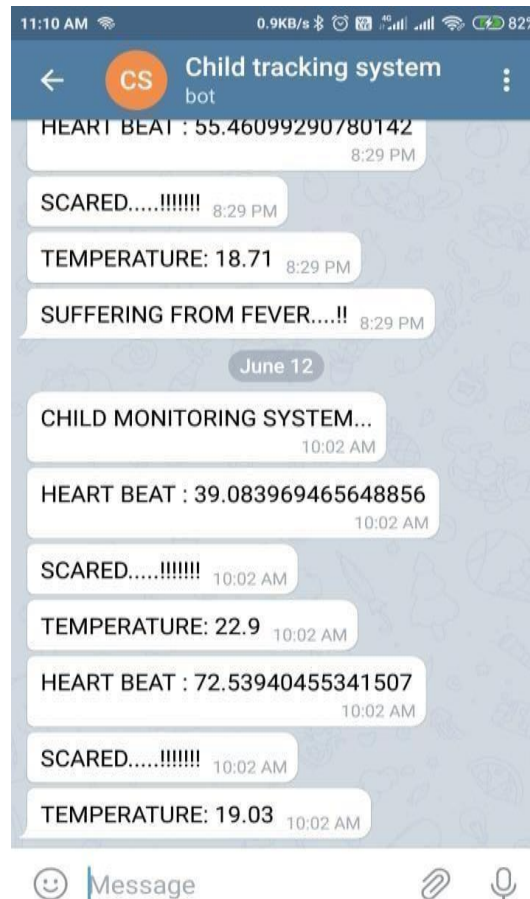
Fig. 11. Updating Sensor Values in Telegram

The regularly usage of social media application now a days it is very common in this world, so in the scene we are using telegram application to updated the child health data to monitor and to take care of the child. If the child's health data is regularly updating to the parents/guardians so that they can monitor their child's health condition like normal or abnormal health state.

4.5. Live Streaming

In the fourth phase we have worked with live video streaming in YouTube channel. To run the live streaming in YouTube channel, we are giving certain input command in the system to get into live streaming which is shown in the figure 12. Once parents/guardians come to know that the child is in danger condition through an SMS alert message and also email alert by seeing the image of the attacker then they can turn on their YouTube channel to watch the live video of the attacker as shown in the figure 13.

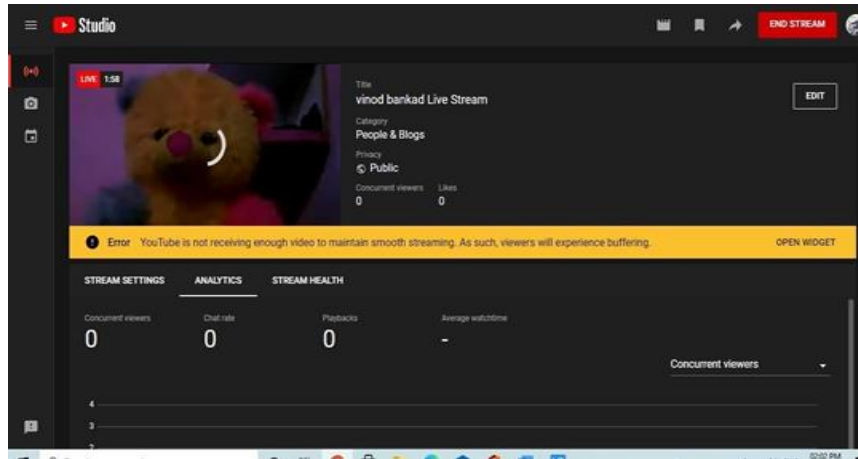Fig. 12. Input Command to Run Live Video Streaming

Fig. 13. Live Video Streaming

The live video streaming will be very helpful for the parents/guardians to watch a live location and also live video of an attacker and to identify the image of an attacker which is received to parents/guardians via email alert. The use of YouTube channel will help for the parents/guardians because the live video will be recorded and it will be saved in YouTube channel with specific date and time and also sent via email alert to the parents/guardians for further investigation by the police.

4.6. Alert Message in Local Language

The final phase of our experiment is to send in the local language (i.e. Kannada and Hindi) an SMS alert message to the surrounding/neighbours of the victim. We have added surrounding/neighbours phone numbers in the system, so that they will get an SMS alert message in local language like Kannada and Hindi which is shown in the figure 14.

Fig. 14. SMS Alert Message in Local Language Kannada / Hindi

The person whoever resides the child local can save the child as soon as possible before parents/guardians arrives the victim location. So, whoever registered to the system like surrounding/neighbours persons phone number in the system then they will get an alert message in the local language like Kannada, Hindi, Telugu etc, so every citizen of their respective state can read and understand the alert message.

5. System Verification

After analyzing the overall system work, now we will verify the system according to the outcome of this experiment. As shown in the Table 1, the system is verified with 12 different trails to know the accuracy of the system (i.e., how many times system got succeeded or failed) during the execution of the project. The system is verified with the time and outcome of the experiment such as Child health data, Child's voice recognition system, Alert messages sent to the parents/guardians, live video steaming and Alert message in local language.

Table 1. Overall System Verification

Trail no	Date & Time	Sensor values	Child health date	Child's voice recognition system	Alert message sent to parents/guardians	Live video streaming	Alert message in local language
1	24/8/2021 12:20 PM	Temperature – 28.5℃ Pulse rate – 55.9bpm	Normal health condition	System not recognised input voice	Alert message is not sent	Live video not streaming	Alert message is not sent
2	24/8/2021 12:22 PM	Temperature – 26.7℃ Pulse rate – 53.2bpm	Normal health condition	System not recognised input voice	Alert message is not sent	Live video not streaming	Alert message is not sent
3	24/8/2021 12:28 PM	Temperature – 38.4℃ Pulse rate – 67.7bpm	Normal health condition	System not recognised input voice	Alert message is not sent	Live video not streaming	Alert message is not sent
4	24/8/2021 12:32 PM	Temperature – 38.9℃ Pulse rate – 72.4bpm	Abnormal health condition	System not recognised input voice	Alert message is not sent	Live video not streaming	Alert message is not sent
5	24/8/2021 12:40 PM	Temperature – 39.3℃ Pulse rate – 66.2bpm	Normal health condition	System not recognised input voice	Alert message is not sent	Live video not streaming	Alert message is not sent
6	24/8/2021 12:48 PM	Temperature – 35.6℃ Pulse rate – 69.3bpm	Normal health condition	System not recognised input voice	Alert message is not sent	Live video not streaming	Alert message is not sent
7	24/8/2021 12:55 PM	Temperature – 39.2℃ Pulse rate – 59.8bpm	Normal health condition	System not recognised input voice	Alert message is not sent	Live video not streaming	Alert message is not sent
8	24/8/2021 1:02 PM	Temperature – 27.4℃ Pulse rate – 78.2bpm	Normal health condition	System not recognised input voice	Alert message is not sent	Live video not streaming	Alert message is not sent
9	24/8/2021 1:11 PM	Temperature – 39.4℃ Pulse rate – 73.4bpm	Abnormal health condition	System not recognised input voice	Alert message sent	Live video not streaming	Alert message sent
10	24/8/2021 1:18 PM	Temperature – 41.2℃ Pulse rate – 82.4bpm	Abnormal health condition	System recognised input voice	Alert message sent	Live video streaming	Alert message sent
11	24/8/2021 1:24 PM	Temperature – 40.2℃ Pulse rate – 74.4bpm	Abnormal health condition	System recognised input voice	Alert message sent	Live video streaming	Alert message sent
12	24/8/2021 1:32 PM	Temperature – 43.5℃ Pulse rate – 85.4bpm	Abnormal health condition	System recognised input voice	Alert message sent	Live video streaming	Alert message sent

From the Table 1, in the trail numbers 1,2,3,5,6,7,8 we can see that the sensor values (i.e., Temperature and Pulse rate) were changing according to the body temperature and the pulse rate values which is the normal health condition values, hence there were no further actions in the other phases of this research work (i.e., voice recognition system, alert message, live video streaming, alert message in local language). From the trail numbers 10,11,12 we have seen that sensor values were increased above threshold values so child is in abnormal health condition then voice recognition system got activated and alert message is sent to parents/guardians at the same time live video streaming and the alert message in the local language is sent to surrounding/neighbour's persons. In the trail numbers 4 and 9, we have seen that abnormal health condition but there were some errors like input voice was not recognized due to some connection error or maybe Bluetooth is disconnected in the system, live video was not streamed due to the Internet connection issue and alert message got delayed due to the network issues. After verifying the system for 12 different trails we came to know the number of success and failure attempts and also calculated the success and failure rate.

Calculate the success and failure rate with the system accuracy

The accuracy is calculated by using the success and failure rate of the experiment. To calculate for success and failure rate of the system, three essential parameters are needed and these parameters are X (i.e., Number of success

attempts), Y (i.e., Number of failure attempts) and N is total number of trails. To calculate the success rate and failure rate is shown below:

P=X/N*100, where in P is the success rate
Q = Y/N*100, where in Q is the failure rate.

From the Table 1, we can check that the X is total number of success attempts, Y is total number failure attempts and N is the total number of trails. The calculation part of success and failure rate as shown in the Table 2:

Table 2. Calculation of success and failure rate of the system

Success rate	Failure rate
$P = \frac{X}{N} * 100$	$Q = \frac{Y}{N} * 100$
Where P = Success rate	Where Q = Failure rate
X = 10 success attempts (according to the Table 1)	Y = 2 failure attempts (according to the Table 1)
N = Total number of trails is 12	N = Total number of trails is 12
$P = \frac{10}{12} * 100 = 0.833*100$	$Q = \frac{2}{12} * 100 = 0.1667*100$
P = 83.33% (1)	Q = 16.67 % (2)

From the above calculation, we got 83.33% as success rate and 16.67% as failure rate. From this experiment, we can observe that the success rate is more than failure.

Let's calculate the system accuracy by adding the success and failure rate from the above calculation and dividing by the total number trails.

$$Accuracy = \frac{Succes\ rate + Failure\ rate}{Total\ Number\ of\ trails}$$

$$Accuracy = \frac{83.33 + 16.67}{12} = 84.717 \approx 85\%$$

We have got 85% of accuracy. Hence, our system can be used for the child safety in the real time monitoring system for parents/guardians.

In this section, it is explained the results of research and at the same time is given the comprehensive discussion. Results can be presented in figures, graphs, tables and others that make the reader understand easily.

6. Conclusions

The main aim of this research work is to provide an effective and convenient solution to the parents or guardians to keep track of their child's safety and to reduce the increased occurrence of crime against children harassment. The emergence of risks to children results in a growth in the number of safety technologies and applications. The outcome of this work is to monitor the child's safety and health during the abnormal condition. It is used for safety purpose of child whenever the child is missing, kidnapped or any harassment happens, an alert message is sent through email and live location of the child will be sent to their parents/guardians. The parents can watch the live video streaming of their child and also the picture of an attacker from their remote location. This live video streaming of child and the picture of an attacker can be used by the police for further investigation. This system will send an alert message in the local language, so that any local citizen can understand and save the child. This system will also be applicable for safety of women and elderly aged people in the society. By using this system, we assure that child's missing, kidnapping, harassment etc can be controlled.

This work significantly advances the field of child safety monitoring by introducing a comprehensive system that integrates various technologies to address the emerging risks faced by children. By combining features such as live video streaming, real-time location tracking, and immediate alert messages, this system provides parents or guardians with a powerful tool to protect their children from incidents like kidnapping, harassment, or going missing. The scientific justification for this work lies in the need for an effective and technologically advanced solution to mitigate these risks and ensure the safety of children. By capturing live video streaming of the child and capturing the picture of the attacker, this system provides valuable evidence that can be utilized by the police for further investigation and legal proceedings. The integration of local language alert messages facilitates the involvement of the local community in rescuing the child, thereby fostering a collaborative approach to child safety.

The proposed system has broad applicability beyond child safety and can be extended to enhance the safety of women and elderly individuals in society. By leveraging the same underlying framework, this system can be adapted to monitor and protect vulnerable individuals in various scenarios. Furthermore, future extensions of this work could explore additional features such as facial recognition technology for automated identification of potential threats,

integration with emergency response systems, or collaboration with local law enforcement agencies to ensure a swift and effective response.

In summary, this research work advances the field of child safety monitoring by providing an innovative system that combines multiple technologies to protect children from risks and crimes. The scientific justification lies in the urgent need for an effective solution to combat the increasing occurrence of crimes against children. The proposed system not only enhances immediate safety measures but also provides evidence for investigation purposes. Its potential applications extend to the safety of women and elderly individuals. By using this system, we can make significant strides in controlling and mitigating incidents such as child abduction, harassment, and missing cases, contributing to the overall safety and well-being of our society.

Future Scope

As the world's primaries go a list obscure children's safety, this model will help us achieve that goal while also gradually reaching out torural regions, where children maybe nefitata reasonable cost and leave their homes without fear. This system may be improved by adding a calling option and sending the position to the local police station. Images may be seen by clicking on them. The child safety system can be designed with the help of an android application. Parents/guardians should register child's in formation in the application and this information will be saved in the cloud database. By this way whoever using this application can see child status which is connected to the smart IoT devices carrying by a child. In the designed android application, we should have access to watch live video streaming from picamera and also image of the attacker by getting a notification to the mobile.

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