CHILDREN SAFETY SYSTEM

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ABSTRACT

The Child Safety System using Raspberry Pi-3 is an IoT-based real-time monitoring solution designed to enhance child protection in various environments. The system integrates multiple sensors such as heart-rate, DHT11 temperature and humidity, sound sensor, GPS module, webcam, and a panic button. The Raspberry Pi-3 acts as the central controller, collecting and analysing data to detect abnormal conditions related to health and environment. It enables continuous monitoring of the child's vital parameters, surrounding conditions, and real-time location. The webcam provides live video streaming for visual supervision, while the panic button allows the child to send instant alerts during emergencies. All sensor data, alerts, and location details are transmitted to a web server for remote access by parents or guardians. This system ensures quick response, continuous monitoring, and improved safety, providing a smart, efficient, and reliable solution for child protection using IoT technology.

KEYWORDS: ***Children Safety System, Raspberry Pi, Wireless Sensor Network (WSN), Monitoring, Emergency Alert.***

INTRODUCTION

Child safety has become a major concern in today's fast-growing and technology-driven society due to increasing urbanization and exposure to risks such as health emergencies, unsafe environments, and potential threats. Traditional safety methods are no longer sufficient to handle real-time situations, creating a need for smart and automated solutions. The advancement of Internet of Things (IoT) technology enables continuous monitoring and instant communication through connected devices. The proposed Child Safety System using Raspberry Pi-3 integrates multiple sensors to monitor a child's health, environment, and location in real time. It includes features such as heart rate monitoring, temperature and humidity sensing, sound detection, GPS tracking, live video streaming, and a panic button for emergency alerts. The Raspberry Pi-3 acts as the central unit, processing sensor data

and detecting abnormal conditions. All information is transmitted to a web server for remote access by parents or guardians. This system ensures quick response during emergencies and provides a reliable, efficient, and scalable solution for enhancing child safety.

RELATED WORK

Child safety systems have improved with the use of IoT technology and smart devices. Earlier systems mainly used GPS and GSM modules to track the child's location and send alerts to parents. These systems provided basic safety but did not support real-time monitoring or multiple safety features. Later, researchers added sensors like heart rate and temperature to monitor the child's health and environment. Some systems also used sound sensors and cameras to detect danger and provide visual information. Raspberry Pi is widely used as a central controller because it supports multiple sensors and real-time data processing. However, many existing systems still have limitations such as delayed alerts, limited accuracy, and lack of complete integration of all safety features. Hence, there is a need for a more efficient system that combines health monitoring, environment sensing, location tracking, and real-time communication for better child safety.

LITERATURE SURVEY

Numerous research works have focused on improving child safety using IoT-based systems and wearable technologies. Sharma and Gupta (2020) developed a system using wearable sensors to monitor health and movement, generating alerts during abnormal conditions. Brown and Adams (2020) proposed a Raspberry Pi-based framework for real-time monitoring with improved scalability and multi-sensor integration. George and Raj (2021) introduced a sound-based system to detect distress signals, while Babu and Kumar (2021) utilized Wireless Sensor Networks (WSN) for wide-area monitoring with low power consumption. Kumar and Prasad (2019) designed a system combining health and environmental sensors to detect unsafe conditions, and Mishra and Singh (2021) implemented DHT11-based environmental monitoring system using Raspberry Pi. Verma and Tripathi (2020) proposed a GPS-GSM tracking system for location-based alerts, while Singh and Rani (2019) developed a panic button-based emergency alert mechanism. Ahmed and Al Saadi (2020) introduced a camera-based surveillance system for visual monitoring, and Patel and Desai (2021) designed a wearable device for continuous location tracking. Despite these developments, many existing systems lack complete

integration of health, environmental, location, and visual monitoring features, highlighting the need for a more efficient and comprehensive child safety system.

EXISTING METHOD

The base paper presents a wearable child safety device using Raspberry Pi-3 with GSM-based SMS communication for monitoring. Parents can request the child's location via SMS, ensuring long-distance communication, though it is slower than real-time systems. The system mainly focuses on GPS-based location tracking along with basic health and environmental monitoring. A pulse sensor is used to track heart rate and detect abnormal conditions, while a sound sensor identifies distress through noise levels. Temperature monitoring is included but limited in scope. A Raspberry Pi camera captures images during suspicious situations and sends them via email for visual verification. All sensors are interfaced with the Raspberry Pi, and data is processed locally before sending alerts through SMS or email. However, the system relies on predefined thresholds, lacks real-time web monitoring, and does not support advanced environmental sensing or cloud integration. These limitations reduce its effectiveness in critical situations and highlight the need for a more advanced solution.

PROPOSED METHOD

The proposed Child Safety System using Raspberry Pi-3 is an IoT-based real-time monitoring solution designed to ensure child safety by continuously tracking health, environment, and location. The Raspberry Pi-3 acts as the central unit, collecting and processing data from multiple sensors. A heart rate sensor monitors the child's physiological condition and detects abnormalities, while a DHT11 sensor measures temperature and humidity to ensure a safe environment. A sound sensor identifies unusual noises indicating distress, improving emergency detection accuracy. The GPS module provides real-time location tracking, helping parents monitor movement and prevent unsafe situations. A web camera enables live visual monitoring for better decision-making during emergencies. A panic button allows the child to send instant alerts when in danger. All data is transmitted to a web server, enabling remote access through mobile or internet-based platforms. The system integrates multiple safety features into a single platform, offering a reliable, efficient, and scalable solution for comprehensive child protection.

ARCHITECTURE

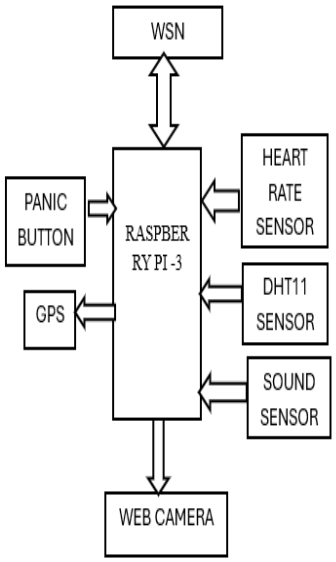

Fig 1: Block Diagram

METHODOLOGY DESCRIPTION

Raspberry Pi-3 collects data from all the modules connected to it and acts as the main controller of the system. The data from sensors is processed and transmitted to the web server through IoT communication. The heart rate sensor monitors the child's pulse continuously and compares it with reference values to detect abnormal conditions. The DHT11 sensor measures temperature and humidity to ensure a safe environment for the child. The sound sensor detects unusual or loud noises, and if the sound level exceeds the threshold, it indicates possible distress. The GPS module determines the real-time location of the child and sends location details for tracking. The web camera captures images or provides live video streaming to monitor the child's surroundings. The panic button allows the child to send an immediate alert during emergencies. All sensors operate with a 5V power supply and are interfaced with Raspberry Pi-3, which processes the data and ensures timely alerts to parents or guardians.

SOFTWARE AND HARDWARE REQUIREMENTS

Raspberry Pi 3:

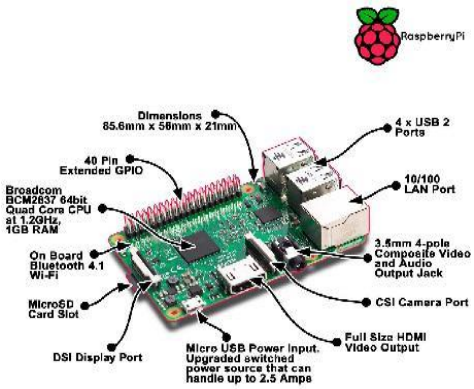

Fig 2.1: Raspberry Pi 3

The system has been designed using Raspberry Pi3, Pulse sensor, Sound sensor, GPS, GSM, Raspberry pi camera. Design of this device consists of Raspberry pi board to which camera, pulse sensor, sound sensor is connected and we are supplying 5V power. Capacitor sensor is used for taping, based on the input provided by the user authorized person gets the notification via SMS or email. By using this parent can track the children location and ensure safety in real time. The above diagram shows the Circuit connections of the device.

GPS: The GPS module is used to track the real-time location of the child. It continuously receives location coordinates such as latitude and longitude and sends them to the Raspberry Pi-3 for processing. The system then transmits this location data to the web server, allowing parents or guardians to monitor the child's movements remotely. This feature helps in quickly locating the child during emergencies and ensures better safety and tracking.

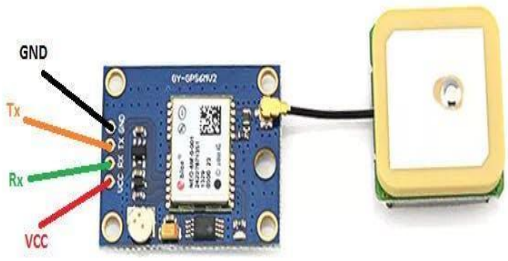

Fig 2.2: GPS Module

Panic Button: The panic button is an emergency feature that allows the child to send an instant alert when in danger. When pressed, it immediately sends a signal to the Raspberry Pi-3, which processes the request and transmits an alert to the web server or parents. This ensures quick communication during critical situations, even if automatic sensors fail to detect the problem, thereby improving the overall safety of the child.

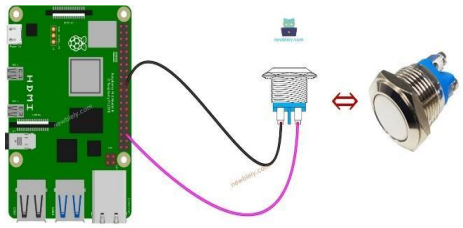

Fig 2.3: Panic Button

Heart Rate Sensor: The heart rate sensor is used to continuously monitor the child's pulse rate. It measures the heartbeat and sends the data to the Raspberry Pi-3 for analysis. The system compares the readings with predefined normal values to detect abnormalities such as stress or medical emergencies. If any unusual variation is observed, an alert is generated and sent to parents or guardians, ensuring timely action and better health monitoring.

Fig 2.4: Heart Rate Sensor

DHT11 Sensor: The DHT11 sensor is used to measure the temperature and humidity of the child's surroundings. It continuously collects environmental data and sends it to the Raspberry Pi-3 for processing. The system compares the values with safe limits to detect uncomfortable or unsafe conditions. If abnormal temperature or humidity levels

are detected, alerts are sent to parents or guardians, helping ensure a safe and healthy environment for the child.

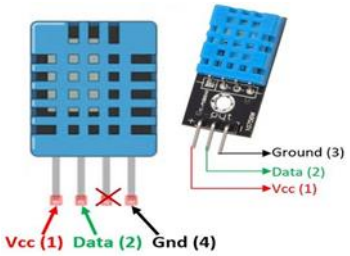

Fig 2.5: DHT11 Sensor

Sound Sensor: The sound sensor is used to detect noise levels in the child's surroundings. It continuously monitors sound intensity and sends the data to the Raspberry Pi-3 for analysis. The system compares the sound level with predefined threshold values to identify unusual or loud noises such as crying or shouting. If the sound exceeds the set limit, it indicates possible distress and triggers an alert to parents or guardians, helping in timely response to potential danger.

Fig 2.6: Sound Sensor

Web Camera:

Fig 2.7: Web Camera

The web camera is used to provide visual monitoring of the child's surroundings. It captures images or streams live video and sends the data to the Raspberry Pi-3 for processing. The system can transmit this visual data to the web server, allowing parents or guardians to view the child's condition remotely. This helps in better understanding of situations during emergencies and improves overall safety monitoring.

Wireless Sensor Network (WSN):

The Wireless Sensor Network (WSN) is used to enable communication between multiple sensors and the Raspberry Pi-3. It allows sensors to transmit data wirelessly, ensuring efficient and reliable data transfer within the system. WSN helps in collecting real-time information from different modules such as health, environment, and sound sensors. This improves system flexibility, reduces wiring complexity, and ensures continuous monitoring for better child safety.

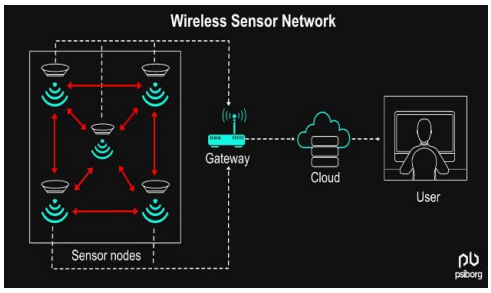

Figure 2.8: Wireless Sensor Network (WSN)

RESULTS AND DISCUSSIONS

This image shows a Raspberry Pi based child safety system prototype developed using different sensors and modules. It includes components such as GPS for live location tracking, a camera for monitoring, motion sensors for detecting movement, and a servo motor for control functions. The system is designed to monitor the child's location and surroundings in real time. It helps parents receive alerts and improves child safety through smart tracking and security features.

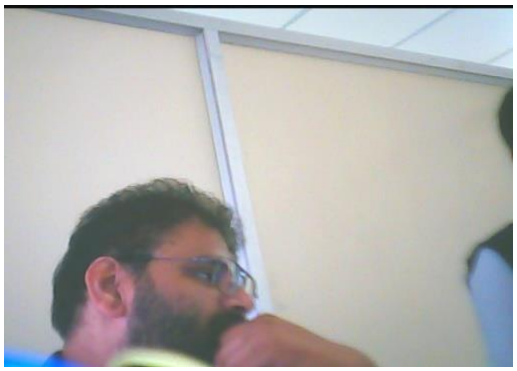

Fig 3.1: Children safety system circuit.

This image shows the alert notification system used in the child safety project. The system sends instant messages whenever sound is detected and also. updates the child's heart rate status. It provides live GPS location links through Google Maps for easy tracking. Parents can use these alerts to know the child's condition and exact location at any time. This improves safety and enables quick action during emergencies.

Fig 3.2: Alert Notification Output

This image shows the live camera monitoring feature of the child safety project. The camera captures real-time surroundings and nearby persons for safety observation. It helps parents or guardians monitor the child's environment remotely. The system can be used to identify suspicious activity or unexpected situations. This feature increases security and supports quick response during emergencies.

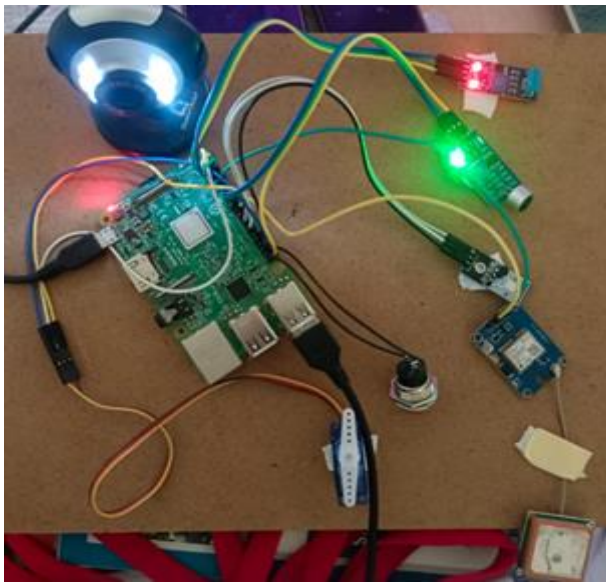

Figure 9.3: Live Camera Monitoring Output

This image shows the live GPS location tracking feature of the child safety project displayed on Google Maps. The blue marker indicates the current real-time position of the child. Parents can easily monitor the child's exact location through the mobile device. It helps in tracking movement and finding the child quickly if needed. This feature improves safety and ensures immediate response during emergencies.

Figure 9.4: Live GPS Tracking Output

CONCLUSION

The proposed Child Safety System using Raspberry Pi-3 provides a smart and efficient solution for ensuring child protection through real-time monitoring. By integrating multiple sensors such as heart rate, temperature, humidity, sound, GPS, and camera, the system continuously tracks the child's health, environment, and location. The panic button enhances emergency response by allowing instant alerts. All data is processed and transmitted to a web server, enabling parents to monitor the child remotely. The system overcomes limitations of existing methods by offering multi-sensor integration, real-time updates, and improved reliability. Thus, it ensures quick response during emergencies and provides a scalable, secure, and effective approach to child safety using IoT technology.

FUTURE ENHANCEMENT

The proposed system can be further improved by integrating cloud storage for secure data backup and long-term monitoring. Advanced sensors such as gas and air quality sensors can be added to enhance environmental safety. AI and machine learning techniques can be implemented for smart activity detection and predictive alerts. Mobile application support can improve user accessibility and real-time notifications. These enhancements will make the system more

intelligent, scalable, and efficient for future child safety applications**.**

REFERENCES

[1] A. Sharma and R. Gupta, "IoT-based real-time child monitoring system using wearable sensors," *IEEE Internet of Things Journal*, vol. 7, no. 5, pp. 4503–4511, 2020.

[2] D. Brown and K. Adams, "Low-cost IoT framework using Raspberry Pi for real-time monitoring applications," *IEEE Transactions on Instrumentation and Measurement*, vol. 69, no. 8, pp. 6008–6016, 2020.

[3] L. George and P. Raj, "IoT-based safety system using sound detection for emergency prediction," *IEEE Access*, vol. 9, pp. 88532–88540, 2021.

[4] S. Babu and M. R. Kumar, "WSN-enabled smart alert mechanism for child and elderly safety," *IEEE Communications Letters*, vol. 25, no. 6, pp. 1901–1904, 2021.

[5] S. Kumar and B. Prasad, "Real-time health monitoring using heart-rate and environmental sensors," in *IEEE Int. Conf. on Smart Technologies for IoT*, 2019, pp. 89–94.

[6] R. Mishra and K. Singh, "Environmental monitoring using DHT11 sensor and Raspberry Pi," in *IEEE Int. Conf. on Intelligent Computing and Control Systems*, 2021, pp. 333–338.

[7] P. Verma and A. Tripathi, "Design of GPS-GSM based tracking system with emergency alert for children," *IEEE Sensors Letters*, vol. 4, no. 3, pp. 1–4, 2020.

[8] A. K. Singh and S. Rani, "Emergency alert system using panic button and IoT," in *Proc. IEEE Int. Conf. on Electronics, Communication and Aerospace Technology*, 2019, pp. 125–130.

[9] T. Ahmed and H. Al-Saadi, "Raspberry Pi-based surveillance and image capturing system for safety applications," in *IEEE Global Conference on Internet of Things*, 2020, pp. 22–27.

[10] M. Patel and S. Desai, "Smart child safety wearable device using GPS and GSM," in *Proc. IEEE Int. Conf. on Computing, Communication and Security*, 2021, pp. 112–117.

[11] J. Lee and M. Park, "Wearable IoT device for child safety monitoring using multi-sensor integration," IEEE Sensors Journal, vol. 21, no. 4, pp. 5123–5131, 2021.

[12] K. N. Qureshi and A. H. Abdullah, "A survey on intelligent wearable devices for child safety using IoT," IEEE Access, vol. 8, pp. 140286–140304, 2020.

[13] S. R. Moosavi, T. Gia, and O. Postolache, "End-to-end IoT-based system for real-time health monitoring and alert generation," IEEE Internet of Things Journal, vol. 5, no. 6, pp. 4646–4655, 2018.

[14] V. Sharma and R. Tiwari, "Smart wearable system for tracking children using GPS and cloud computing," in Proc. IEEE Int. Conf. on Advanced Networks and Telecommunications Systems, 2019, pp. 1–5.

[15] M. A. Rahman and S. Hossain, "An IoT-based smart wearable safety device for women and children," in IEEE Int. Conf. on Robotics, Electrical and Signal Processing Techniques, 2019, pp. 1–6.

[16] Y. Liu and X. Wang, "Cloud-enabled IoT framework for real-time tracking and monitoring applications," IEEE Transactions on Cloud Computing, vol. 9, no. 2, pp. 705–717, 2021.

[17] H. Ghayvat, S. Mukhopadhyay, and X. Gui, "WSN-based smart monitoring system for child safety and activity tracking," IEEE Sensors Journal, vol. 18, no. 4, pp. 1780–1787, 2018.