



Building An Intelligent Security System for Preventing Child Abduction

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Abstract

The care of new born infants is the most important and sensitive part of the biomedical domain. A prototype is developed which gives a reliable and efficient infant monitoring system that can play a vital role in providing better infant care. The focus of this paper is to implement a smart health monitoring system that uses non-invasive sensors to read different health parameters. Implementation of affordable medical technology health monitoring sensor system is developed and demonstrated to measure blood saturation levels (SpO₂), heart rate, motion rate, and body temperature simultaneously. The embedded system is based on a Wi-Fi module to the mobile application for the parents to be aware of his condition for reassurance. The safety issue of the infant is also confirmed in this system. So its location can be required in the application using a GPS module so that the infant more saver to avoid widespread abductions and The theft of the infants is reduced.

Keywords: Child abduction; Bracelet; Biological signals measurements

1 introduction

The misbehaviours toward women and children are growing exponentially worse every day. They run the risk of being easily abducted. Crime against children is on the rise across the globe right now. The safety of children has grown to be a top priority due to the prevalence of human trafficking and the numerous occurrences of missing children that have been recorded in recent years. The age range of 4 to 8 year olds is naive and frequently targets kidnapping. Women in today's time, and child suffers from several physical harassment, whether out in public, attending school, working, or travelling. The three main issues in regard to child protection are kidnapping, missing children, and child harassment. It is time to set up a safety support system for kids visiting public places. Parents are constantly concerned for the safety of their kids, especially when they travel to remote locations or go to crowded public areas. Numerous programmes are being created to protect kids in every way. This article introduces the Parent-Hook product, which is intended for lost child tracking. The Parent-Hook is a safety band that may be attached to a child's wrist without having any sensors or other potentially dangerous chips. and child suffers from several physical harassment, whether out in public, attending school, working, or travelling. The medical market is improved as a result of recent technological advancements, which also helps to control the mortality risk of preterm infants. Children find it unsettling to leave their homes. There are many Android applications for smartphones, but many additional solutions have been developed for people who don't use smartphones or who can't keep their mobile device close at work [1, 2, 3, 4].

The Internet of Things (IoT) is the expansion of internet connectivity beyond conventional devices like desktop and laptop computers, smart phones, and tablets to a wide range of gadgets and everyday items that use embedded technology to communicate and interact with the outside world, all via the Internet. Everyday devices become smarter, everyday processing becomes intelligent, and everyday communication becomes educational thanks to the Internet of Things. Even though the Internet of Things is still developing, it has already made remarkable achievements as a global media solution for the linked world. The development of adjacent fields does not usually begin with a study of architecture specifically. The researchers are currently unable to fully understand the scope of Internet of Things-centric techniques due to a lack of general architectural understanding [5, 6, 7, 8].

Premature child are the most challenging aspect to concentrate on in the biomedical sector. Due to their gestational age or heart conditions, some premature children are at a higher risk than the usual chance of contracting diseases or passing away. Changes in several physiological aspects of the human body, such as heart rate, oxygen saturation, body temperature, blood pressure, etc., are frequently linked to diseases. The diagnosis of these conditions is doing a few tests in the hospital to compare physiological function measurements to normal levels and then determine whether or not the conditions are more or less prevalent. Many attempts have been made to send baby data remotely to the mother thanks to recent developments in wireless sensor networks. This paper makes a proposal for an intelligent control system for an infant incubator that will aid in the care and supervision of the child. In the following paper, hardware and software are built to provide child monitoring of medical vitals and location. This system's application is used in an intelligent bracelet to provide health care monitoring and tracking services together. The proposed system suggested in this research offers the most dependable care for children when compared to the ordinary systems [9, 10, 11, 12].

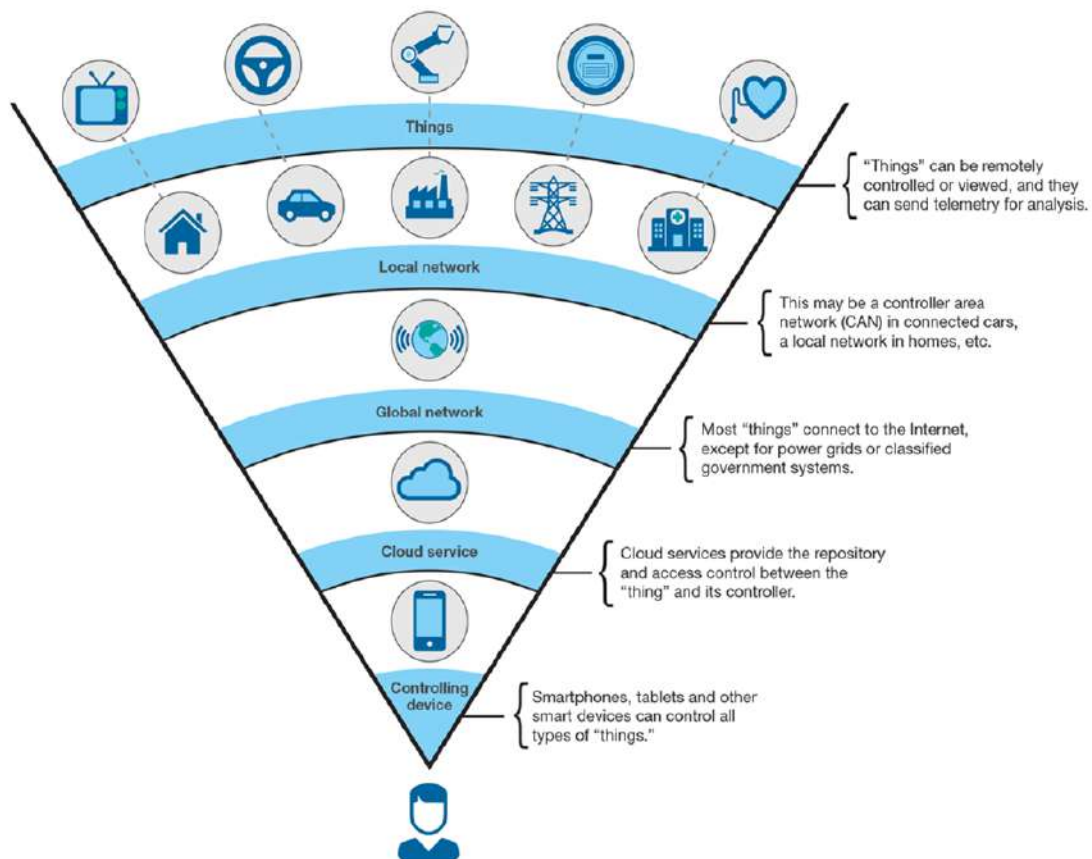


Figure 1: IoT architectures.

The goal of this project is to develop and put into use a closed-loop control system to control the temperature, humidity, and monitor the child's vital signs in order to prevent jaundice and maintain the right quantity of oxygen in the blood. The system's implementation is split into two components, which are then integrated. Mobile phones make up most of the device, along with an android application for the application part, a Wi-Fi module for the embedded components, a GPS module, and a wi-fi module for the embedded component.

The various sensors that are utilized to measure the biological signals outside of guarded areas are directly connected to the main control unit. Also included is the Wi-Fi Module (ESP8266), which is employed to wirelessly send the data that has been recorded or sensed to the Firebase platform. In this paper, a child bracelet is created using the SOLIDWORKS program, and its mechanical design is examined through in-depth simulations. In addition, a graphical user interface based on Internet of Things concepts is also created, utilizing a mobile application, to remotely control and monitor the child [13, 14, 15, 16].

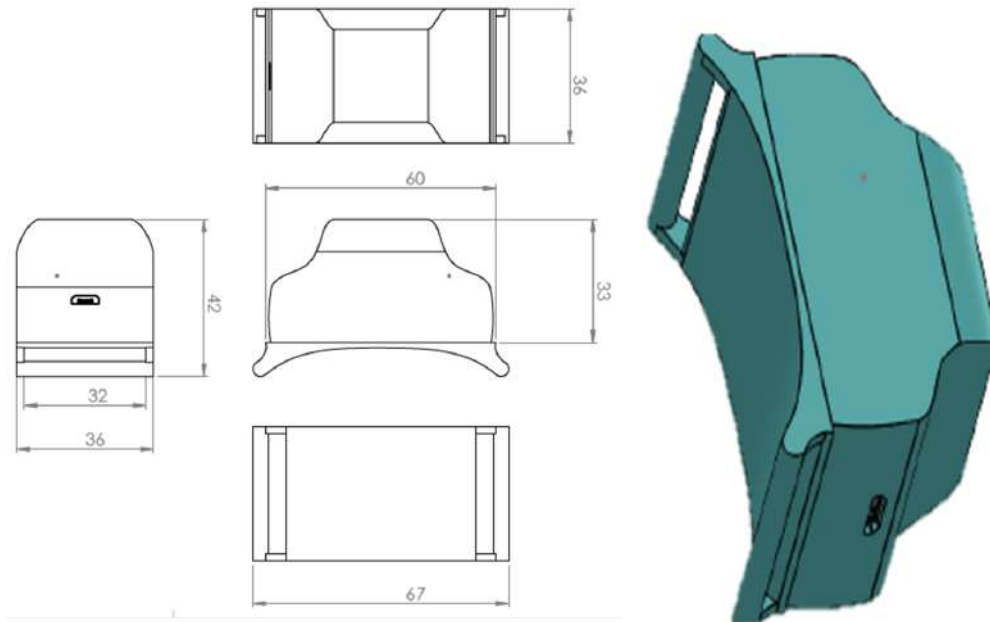


Figure 2: Design of the proposed system.

2 Hardware Implementation

A critical step was locating the proper hardware for the gadget. To compare the main blocks in various control units in terms of "cost, handling, and simplicity of use," a thorough study had been done. The controllers for monitoring the baby's vital signs, allowing the mother to keep an eye on him while he was in the nursery, and tracking his whereabouts in the event of an abduction were then selected. The IoT module, about which more will be introduced in the following subsections, was used to transmit the data to the Bi-Tracker application [17, 18].

2.1 The Node MCU (ESP8266 Wi-Fi)

We'll use the Node MCU to connect software and hardware (ESP8266 Wi-Fi). A low-cost System-on-a-Chip (SoC) called the ESP8266 serves as the foundation of the open-source Node MCU (Node Micro Controller Unit). It will be used to host the program or to transfer Wi-Fi networking tasks from one application processor to another as presented in Figure 3.

2.2 ECG Module AD8232

The AD8232 Single Lead Heart Rate Monitor functions as an op-amp to assist in obtaining a clear signal from the PR and QT Intervals effortlessly; Figure 4. It is a single chip designed to extract, amplify, and filter biopotential signals for biopotential measurement applications. The SDN pin, LO+ pin, LO- pin, OUTPUT pin, 3.3V pin, and GND pin were all present in the heart rate monitoring sensor like the AD8232 [19, 20, 21, 22].

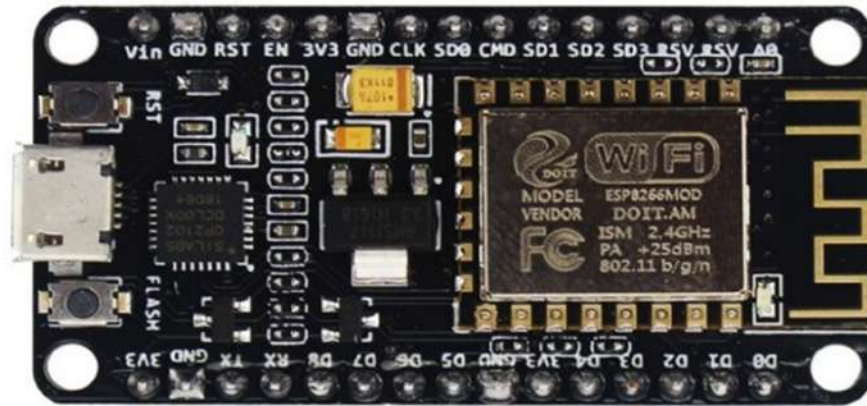


Figure 3: Node-MCU (ESP8266 Wi-Fi).

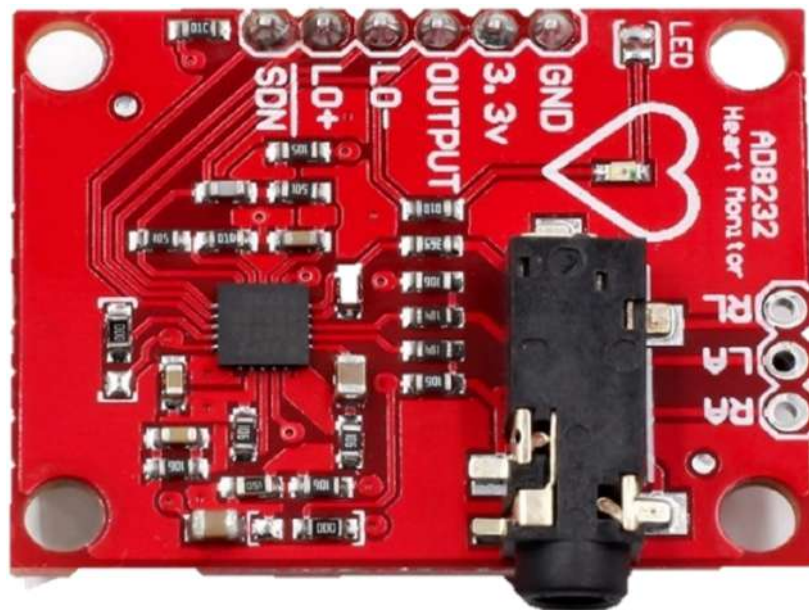


Figure 4: ECG Module AD8232.

2.3 Max30102 (Pulse Oximeter SpO2)

A heart rate monitor module and pulse oximetry were included into the MAX30102. It had internal LEDs, photodetectors, optical components, low-noise electronics, and circuitry that rejected ambient light as shown in Figure 5. To simplify the design-in process for portable and wearable devices, the MAX30102 offered a complete system solution [23, 24, 25, 26].

2.4 NEO-6m GPS

A range of standalone GPS receivers with high-performance (u-blox) 6 positioning engines is the NEO-6 module series. These adaptable and reasonably priced receivers provided a wide range of connectivity options in a small $16 \times 12.2 \times 2.4$ mm package; Figure 6.

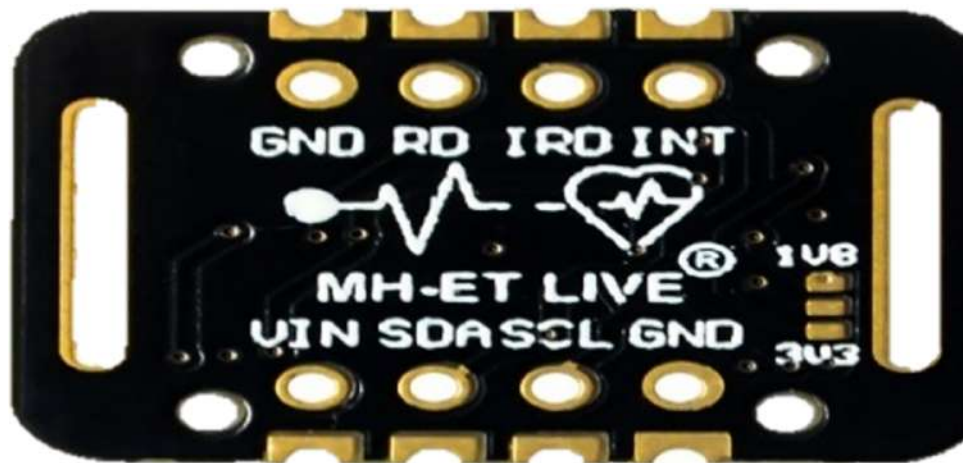


Figure 5: ECG Module AD8232.

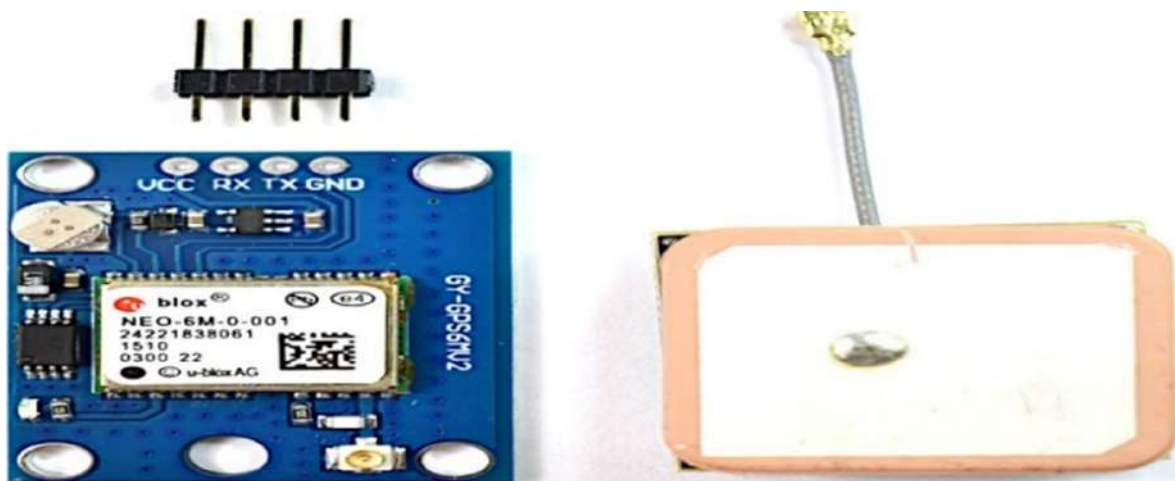


Figure 6: NEO-6m GPS.

3 Software implementation

The proposed mobile application presents a novel application that allows administrators and parents to monitor the child health anytime and anywhere via a communication protocol enabling a real-time exchange of data on the needed vital signs. The application also provides a streaming service and a map to show the child location. When the doctor clicks on the baby's name, the baby profile screen appears, which monitors the infant's vital signs and location while also offering streaming service. When choosing to view baby's location, the map screen will appear to see where the baby has been through a marker which indicates his location. When choosing to view baby's live camera, Camera live stream is started by opening a page on the browser displays a live location as shown in Figure 7.

4 Conclusions

Children today find it challenging and unsafe to venture outside unsupervised in the middle of the day. Children are terrified to go out alone due to the rise in kidnappings and harassment of young people. A method that will assist kids in all life-or-death situations and boost their confidence has been developed in order to assure kids' safety and security in the quickest way feasible. Numerous studies have been conducted in this field taking into account various technologies to assist children. A system with new features is created by drawing inspiration from these technologies, making it safer and more dependable for kids. In the area of health

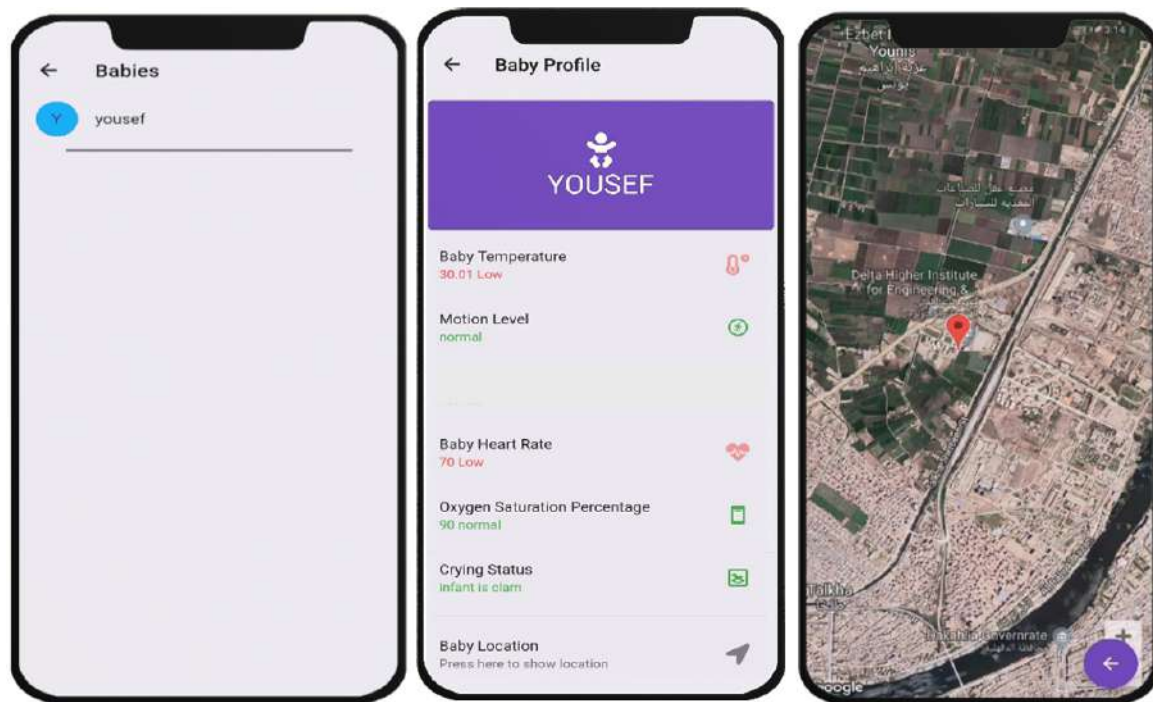


Figure 7: Child Screens.

care and early identification of health disorders, the health monitoring system is essential. The baby's health metrics are routinely monitored by this system, and it compares them to pre-set specifications. When real-time data deviates from pre-defined data, an alert signal is sent to the parents to take the appropriate action and to the mother through a smartphone application so she can feel secure. The doctor or caregiver can use this information to monitor the infant's health and take the necessary action in the event of an emergency. For added assurance, the mother is a constant indicator of both the child's location and health.

References

- [1] S. Arun Kumar and A. Kumaresan. Towards building intelligent systems to enhance the child safety and security. In *2017 International Conference on Intelligent Computing and Control (I2C2)*, pages 1–5, 2017.
- [2] El-Sayed M. El-Kenawy, Seyedali Mirjalili, Fawaz Alassery, Yu-Dong Zhang, Marwa Metwally Eid, Shady Y. El-Mashad, Bandar Abdullah Aloyaydi, Abdelhameed Ibrahim, and Abdelaziz A. Abdelhamid. Novel Meta-Heuristic Algorithm for Feature Selection, Unconstrained Functions and Engineering Problems. *IEEE Access*, 10:40536–40555, 2022.
- [3] Mikiko Sode Tanaka. Data gathering algorithm for children's observation system: For realizing real-time performance in information terminal bus stop. In *2018 15th IEEE Annual Consumer Communications Networking Conference (CCNC)*, pages 1–2, 2018.
- [4] Hala Hassan, Ali Ibrahim El-Desouky, Abdelhameed Ibrahim, El-Sayed M. El-Kenawy, and Reham Arnous. Enhanced QoS-Based Model for Trust Assessment in Cloud Computing Environment. *IEEE Access*, 8:43752–43763, 2020.
- [5] Sunil K Punjabi, Suvarna Chaure, Ujwala Ravale, and Deepti Reddy. Smart intelligent system for women and child security. In *2018 IEEE 9th Annual Information Technology, Electronics and Mobile Communication Conference (IEMCON)*, pages 451–454, 2018.
- [6] Abdelaziz A. Abdelhamid, El-Sayed M. El-Kenawy, Bandar Alotaibi, Ghada M. Amer, Mahmoud Y. Abdelkader, Abdelhameed Ibrahim, and Marwa Metwally Eid. Robust Speech Emotion Recognition Using CNN+LSTM Based on Stochastic Fractal Search Optimization Algorithm. *IEEE Access*, 10:49265–49284, 2022.

- [7] Zhiyuan Fang, Li Wei, Wei Chen, and Yangjun He. A rfid-based kindergarten intelligence security system. In *2012 IEEE Ninth International Conference on e-Business Engineering*, pages 321–326, 2012.
- [8] Marwa M. Eid, El-Sayed M. El-kenawy, and Abdelhameed Ibrahim. A binary Sine Cosine-Modified Whale Optimization Algorithm for Feature Selection. In *2021 National Computing Colleges Conference (NCCC)*, pages 1–6, Taif, Saudi Arabia, March 2021. IEEE.
- [9] Atsushi Ito, Tomoyuki Ohta, and Shinji Inoue. Security system for children on school route. In *2009 International Symposium on Autonomous Decentralized Systems*, pages 1–6, 2009.
- [10] Doaa Sami Khafaga, Amel Ali Alhussan, El-Sayed M. El-kenawy, Ali E. Takieldeem, Tarek M. Hassan, Ehab A. Hegazy, Elsayed Abdel Fattah Eid, Abdelhameed Ibrahim, and Abdelaziz A. Abdelhamid. Metaheuristics for Feature Selection and Classification in Diagnostic Breast-Cancer. *Computers, Materials & Continua*, 73(1):749–765, 2022.
- [11] Harshal Chaudhary, Dr. Ranjana Zinjore, and Dr. Varsha Pathak. Parent-hook: A child tracking system based on cloud url. In *2020 International Conference on Smart Innovations in Design, Environment, Management, Planning and Computing (ICSIDEMPC)*, pages 219–224, 2020.
- [12] El-Sayed M. El-Kenawy, Seyedali Mirjalili, Sherif S. M. Ghoneim, Marwa Metwally Eid, M. El-Said, Zeeshan Shafi Khan, and Abdelhameed Ibrahim. Advanced Ensemble Model for Solar Radiation Forecasting Using Sine Cosine Algorithm and Newton’s Laws. *IEEE Access*, 9:115750–115765, 2021.
- [13] R. Kamalraj, E.S. Madhan, K. Ghanya, and V. Bhargavi. Enhance safety and security system for children in school campus by using wearable sensors. In *2020 Fourth International Conference on Computing Methodologies and Communication (ICCMC)*, pages 986–990, 2020.
- [14] Doaa Sami Khafaga, Amel Ali Alhussan, El-Sayed M. El-kenawy, Abdelhameed Ibrahim, Said H. Abd Elkhaliq, Shady Y. El-Mashad, and Abdelaziz A. Abdelhamid. Improved Prediction of Metamaterial Antenna Bandwidth Using Adaptive Optimization of LSTM. *Computers, Materials & Continua*, 73(1):865–881, 2022.
- [15] Zeeshan Siddiqui and Nida Zeeshan. A survey on cybersecurity challenges and awareness for children of all ages. In *2020 International Conference on Computing, Electronics Communications Engineering (iCCECE)*, pages 131–136, 2020.
- [16] Abdullah Ali Salamai, El-Sayed M. El-kenawy, and Ibrahim Abdelhameed. Dynamic Voting Classifier for Risk Identification in Supply Chain 4.0. *Computers, Materials & Continua*, 69(3):3749–3766, 2021.
- [17] Vinoth Rengaraj and Kamal Bijlani. A study and implementation of smart id card with m-learning and child security. In *2016 2nd International Conference on Applied and Theoretical Computing and Communication Technology (iCATccT)*, pages 305–311, 2016.
- [18] Nagwan Abdel Samee, El-Sayed M. El-Kenawy, Ghada Atteia, Mona M. Jamjoom, Abdelhameed Ibrahim, Abdelaziz A. Abdelhamid, Noha E. El-Attar, Tarek Gaber, Adam Slowik, and Mahmoud Y. Shams. Metaheuristic Optimization Through Deep Learning Classification of COVID-19 in Chest X-Ray Images. *Computers, Materials & Continua*, 73(2):4193–4210, 2022.
- [19] Mohammad Zulfafiz Md Isa, Muhammad Mahadi Abdul Jamil, Tengku Nadzlin Tengku Ibrahim, Muhammad Shukri Ahmad, Nur Adilah Abd Rahman, and Mohamad Nazib Adon. Children security and tracking system using bluetooth and gps technology. In *2019 9th IEEE International Conference on Control System, Computing and Engineering (ICCSCE)*, pages 184–187, 2019.
- [20] Hussah Nasser AlEisa, El-Sayed M. El-kenawy, Amel Ali Alhussan, Mohamed Saber, Abdelaziz A. Abdelhamid, and Doaa Sami Khafaga. Transfer Learning for Chest X-rays Diagnosis Using Dipper Throated Algorithm. *Computers, Materials & Continua*, 73(2):2371–2387, 2022.
- [21] Cassandra Dsouza, Dhanashree Rane, Anjanette Raj, Supriya Murkar, and Namita Agarwal. Design of child security system. In *2018 3rd International Conference for Convergence in Technology (I2CT)*, pages 1–4, 2018.
- [22] Abdelhameed Ibrahim, Seyedali Mirjalili, M. El-Said, Sherif S. M. Ghoneim, Mosleh M. Al-Harhi, Tarek F. Ibrahim, and El-Sayed M. El-Kenawy. Wind Speed Ensemble Forecasting Based on Deep Learning Using Adaptive Dynamic Optimization Algorithm. *IEEE Access*, 9:125787–125804, 2021.

- [23] K. Solic, H. Ocevcic, I. Fosic, I. Horvat, M. Vukovic, and T. Ramljak. Towards overall information security and privacy (isp) taxonomy. In *2017 40th International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO)*, pages 1298–1301, 2017.
- [24] Doaa Sami Khafaga, Amel Ali Alhussan, El-Sayed M. El-Kenawy, Abdelhameed Ibrahim, Marwa Metwally Eid, and Abdelaziz A. Abdelhamid. Solving optimization problems of metamaterial and double t-shape antennas using advanced meta-heuristics algorithms. *IEEE Access*, 10:74449–74471, 2022.
- [25] Sparsh Sangal and Ruchika Bathla. Implementation of restrictions in smart home devices for safety of children. In *2019 4th International Conference on Information Systems and Computer Networks (ISCON)*, pages 139–143, 2019.
- [26] El-Sayed M. El-kenawy, Hattan F. Abutarboush, Ali Wagdy Mohamed, and Abdelhameed Ibrahim. Advance Artificial Intelligence Technique for Designing Double T-Shaped Monopole Antenna. *Computers, Materials & Continua*, 69(3):2983–2995, 2021.