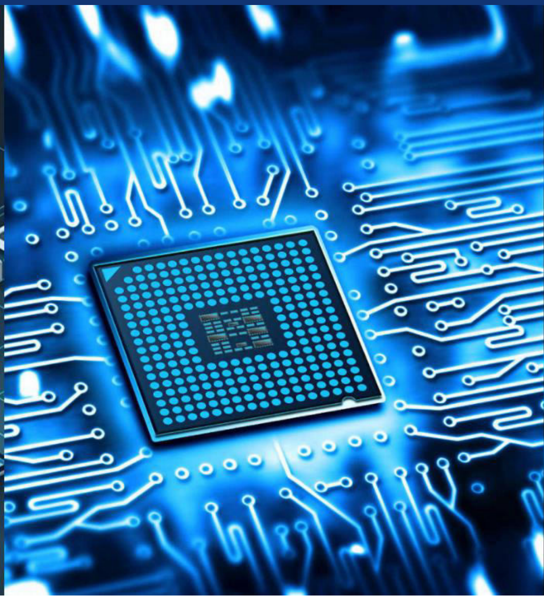
ISSN(O): 2320-9801
ISSN(P): 2320-9798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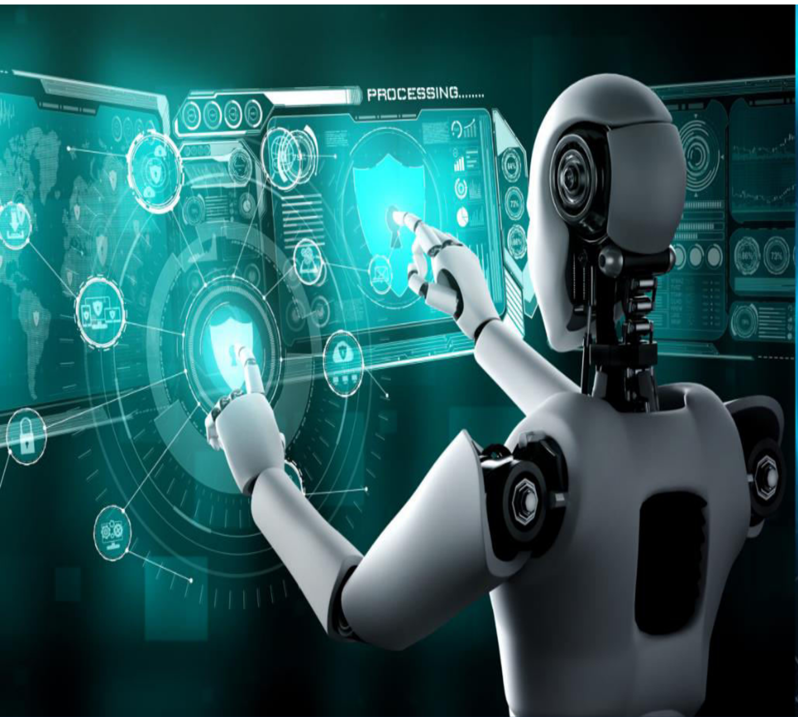

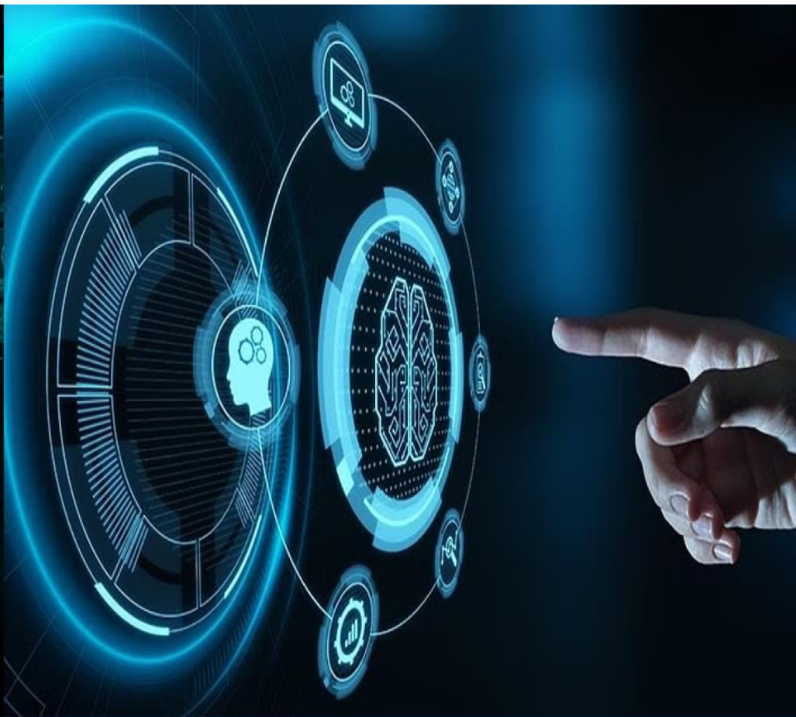

Impact Factor: 8.625 **Volume 13, Issue 1, January 2025**

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www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.625| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

Smart Parenting Care Robot using Raspberry PI Pico

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ABSTRACT: The Parental Caring Robot is a multifunctional robotic system designed to assist parents in ensuring the health, safety, and engagement of their children. Leveraging advancements in robotics, machine learning, and embedded systems, the robot offers a robust platform for real-time child monitoring and interactive support. At its core, the robot is powered by a Raspberry Pi Pico, which serves as the central processing unit for integrating various sensors, actuators, and intelligent systems. The system incorporates a heartbeat sensor and a temperature sensor to continuously monitor the child's vital health parameters. This data is displayed on an LCD screen for real-time updates, allowing parents to monitor the child's condition remotely. An emergency switch provides an additional layer of safety by triggering alerts in critical situations, ensuring timely responses to potential emergencies.

KEYWORDS: IOT, Machine learning, Temperature Sensor, Pulse rate sensor, DC Motors, Servo Motors.

I. INTRODUCTION

In today's fast-paced world, where parents often juggle professional responsibilities alongside care giving, ensuring the constant well-being of children can be a challenging task. The advent of robotics and artificial intelligence has opened new avenues to assist parents by providing innovative solutions for child care. The Parental Caring Robot is one such cutting-edge solution, designed to bridge the gap between parental presence and the child's day-to-day needs. This project focuses on creating a multifunctional robotic system that combines real-time health monitoring, emotional support, and intelligent interaction to cater to the diverse needs of children. The robot leverages the power of a Raspberry Pi Pico microcontroller for seamless integration of various components, including sensors, actuators, and intelligent systems.

The robot is equipped with a heartbeat sensor and a temperature sensor to monitor the child's vital signs continuously. This data is displayed on an LCD screen, enabling easy access to crucial health information. In emergencies, an emergency switch allows for immediate alert notifications, enhancing the safety features of the robot. Mobility is another essential aspect of the system, achieved through an H-Bridge motor driver and DC motors, allowing the robot to move autonomously or on command to reach the child when needed. A key highlight of the robot is its capability to address specific caregiving tasks through three dispensary units designed to deliver essential items such as medication, food, or first-aid supplies.

II. PROBLEM STATEMENT

In the modern world, balancing professional and personal responsibilities often leaves parents with limited time to provide constant attention and care for their children. This challenge becomes more pronounced when ensuring a child's health, safety, and emotional well-being, especially in the absence of immediate parental supervision. Children require continuous monitoring for their physical health, support for their emotional needs, and guidance to develop

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healthy habits. Traditional care giving methods, such as manual health checks or nanny care, have their limitations, including lack of real-time updates, absence of immediate responses during emergencies, and limited ability to provide emotional support or interactive engagement.

III. LITERATURE SURVEY

1.Wing-Yue Geoffrey Louie, Jessica Korneder , Virgil Zeigler-Hill (2022) Parental Attitudes, Trust, and Comfort with Using Robots for Providing Care to Children with Developmental Disabilities

Parents of children with developmental disabilities face significantly higher workloads than parents of neurotypical children due to their higher care giving demands. Consequently, parents of children with developmental disabilities often face emotional, physical, mental, and social health declines. Currently there has been significant research and development of robots for providing care to children with developmental disabilities to address a variety of care giving scenarios. However, it is presently unclear whether parents would be comfortable with robots interacting with their children in these different child-robot interaction scenarios. In this paper, we investigate parental comfort toward robots caring for children with developmental disabilities in a variety of interaction scenarios and the influence of parental negative attitudes toward robots as well as trust on their comfort toward robots in these scenarios. Overall, our findings suggest that US parental attitudes, trust, and comfort toward robots caring for children with developmental disabilities are neutral. Parents were most comfortable with a robot serving as a teaching assistant to children with a developmental disability and least comfortable as a bus driver. Furthermore, trust for robots had a medium positive association with comfort with child-robot interactions and negative attitudes toward robots had a medium negative association with comfort with child-robot interactions.

2. Xueyan Li (2021) A mobile robot navigation algorithm and mobile modeling to help people recover from gait.

In existing factories, robots are less necessary to consider people. However, when designing and using service robots, human factors should be taken into account. With the application of service robots in daily life, more functions are needed. In particular, medical service robots need functions, namely intelligent functions. Especially in order to help patients with encephalopathy (cerebral hemorrhage, cerebral infarction, low energy), gait assistance, mobile robot must take ergonomic factors into consideration. In order to develop medical security service robot, ergonomic design must be considered. Figure 2 shows the ergonomic design parameters of the robot. In this paper, the navigation algorithm of walking - assisted robot is analyzed from the perspective of ergonomics. Navigation algorithms for mobile robots can be divided into two modes. The traditional derivative method has some defects in the dynamic environment. Reaction is a method that works well under dynamic conditions. However, the number of behavior functions is limited.

3. Jaclyn Barnes, S. Maryam FakhrHosseini, Eric Vasey (2020) Child-Robot Theater: Engaging Elementary Students in Informal STEAM Education Using Robots.

One of the options to make science, technology, engineering, and mathematics (STEM) more accessible, especially for children, is to integrate STEM content into more attractive materials and familiar formats. In this line, by integrating STEM with arts and design, we have created an after school program, "Child-Robot Theater" for children in a rural elementary school. We administered two programs over two years and in total 37 children participated in the two-phase program, from which 23 children were included in the analysis of this study. We infused the contents of science, robotics, and computer science with acting, dancing, singing, and drawing inspired by the theater production. Through this longitudinal research, we have successfully demonstrated the informal outreach program with the robots in the wild and achieved improvements in making a robot theater program. After briefly introducing our pedagogical framework and procedure, we delineate potential impacts, lessons, and recommendations for future works. We believe that our efforts could stimulate diverse discussion and practice of using robots and theater for STEAM education across the science, art, and education communities.

4. L. Aryananda (2018) - Recognizing and remembering individuals: online and unsupervised face recognition for humanoid robot

Individual recognition is a widely reported phenomenon in the animal world, where it contributes to successful maternal interaction, parental care, group breeding, cooperation, mate choice, etc. This work addresses the question of how one may implement such social competence in a humanoid robot. We argue that the robot must be able to recognize people and learn about their various characteristics through embodied social interaction. Thus, we proposed an initial implementation of an online and unsupervised face recognition system for Kismet, our sociable robotic

© 2025 IJIRCCE | Volume 13, Issue 1, January 2025| DOI: 10.15680/IJIRCCE.2025.1301058

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.625| ESTD Year: 2013|

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platform. We show how specific features of this particular application drove our decision and implementation process, challenged by the difficulty of the face recognition problem, which has so far been explored in the supervised manner. Experimental results are reported to illustrate what was solved and the lessons learned from the current implementation.

IV. OBJECTIVES

1. To develop a robotic system for smart parenting, capable of child activity monitoring and health supervision.
2. To provide timely food delivery and ensure healthy eating habits using automated systems.
3. To alert parents in case of emergencies like child falls or health deterioration.
4. To detect excessive mobile usage and warn the child.
5. To assist children in homework and studies through AI-based voice assistance.
6. To create a system capable of notifying parents about critical conditions through mobile alerts.

V. DESCRIPTION OF THIS PROJECT

Present Technology

The Smart parenting care robot System employs advanced IoT and automation technologies to improve child monitoring and safety. Key technological components include:

1. IoT Devices and Sensors: Raspberry Pi Pico microcontroller interfacing with sensors like, temperature sensor, pulse rate sensor, and real-time data collection.
2. Automation: Servo motors controlling robot for food delivery and DC motors for movement.
3. Deep Learning: OpenCV-based emotion and fall detection using a laptop camera to identify child issues.
4. Communication: Telegram notifications for real- time alerts about child emotions and emergency situations
5. Data Integration: Real-time monitoring and analysis of sensor data for decision-making and operational efficiency.

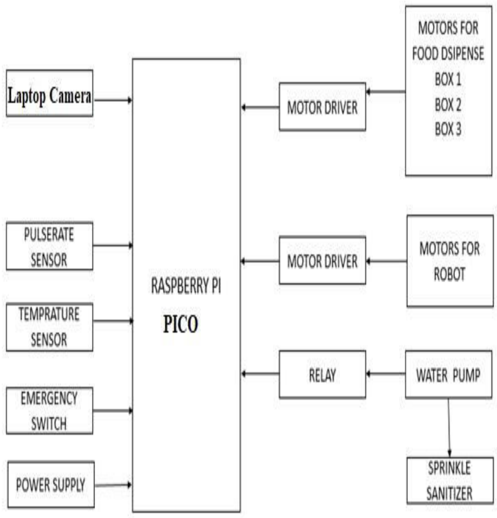
FUTURE SCOPE

The project encompasses:

- Hardware Design and Integration
- Sensor-based Health Monitoring System
- AI-Powered Interaction Module
- Emergency Response Mechanism
- Remote Monitoring and Control Interface

VI. METHODOLOGY

Block Diagram



The Parental Caring Robot operates as an intelligent system designed to monitor, interact with, and assist children. The system integrates various hardware components and intelligent features, managed by a Raspberry Pi Pico, to provide a seamless care giving experience. The working of the robot can be broken down into the following components and functionalities:

1. Health Monitoring
The robot uses a heartbeat sensor and a temperature sensor to monitor the child's vital health parameters continuously. The data collected by these sensors is displayed on an LCD screen, enabling parents or caregivers to view real-time updates. In case of abnormal readings, such as elevated temperature or irregular heartbeat, the system can trigger alerts, notifying parents immediately.

2. Emergency Response
The robot includes an emergency switch that the child can press to send an immediate alert in case of danger or discomfort. This feature ensures a rapid response to emergencies, enhancing the safety and reliability of the system.

3. Mobility and Navigation
The robot is equipped with DC motors controlled by an H-Bridge motor driver, enabling smooth and efficient movement. It can move autonomously based on predefined paths or be remotely controlled by parents to reach the child when needed. The mobility feature allows the robot to deliver essential supplies or respond to emergencies in real time.

4. Dispensary Units
The robot is designed with three dispensary units to store and dispense essential items, such as medication, food, or first-aid supplies. Based on the child's needs or commands from parents, the robot can deliver these items efficiently, reducing the need for constant parental intervention.

5. Emotional Engagement and Interaction
The robot features a Gemini chat bot to interact with the child. Using natural language processing, the cha tbot can analyze the child's emotions and respond accordingly, offering emotional support and answering questions

© 2025 IJIRCCE | Volume 13, Issue 1, January 2025| DOI: 10.15680/IJIRCCE.2025.1301058

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6. Cellphone Usage Monitoring
The robot includes a machine-learning-enabled camera that detects cellphone usage by the child. If excessive usage is detected, the system can notify parents and provide gentle reminders to the child to minimize screen time, promoting healthier habits.

7.Integrated Monitoring and Notifications
The robot integrates all its functionalities into a central system powered by the Raspberry Pi Pico. Parents can monitor the robot's data and receive alerts via notifications on their devices, ensuring they remain informed about their child's health, safety, and activities at all times.

Functional Requirements

1. Health Monitoring
- Monitor the child's heartbeat using a heartbeat sensor.
- Track the child's body temperature using a temperature sensor.
- Display real-time health data on the LCD screen.
- Trigger alerts when abnormal health metrics are detected.

2. Emergency Response
- Include an emergency switch for the child to signal an urgent situation.
- Notify parents or caregivers instantly in case of emergency.

3. Robot Movement
- Enable movement using H-Bridge motor driver and DC motors.
- Support autonomous navigation within predefined paths.
- Allow manual control via parent commands for custom navigation.

4. Dispensary Units
- Include three dispensary units to deliver medication, food, or first-aid supplies.
- Allow parent-controlled or child-triggered dispensing operations.

5. Emotional Interaction and Support
- Use the Gemini chatbot to engage with the child.
- Analyze the child's emotions through interactions and provide supportive responses.
- Answer questions to foster an engaging and interactive environment.

6. Cellphone Monitoring
- Detect cellphone usage using a machine-learning-enabled camera.
- Notify parents about excessive screen time and remind the child to limit usage.

7. Alerts and Notifications
- Send notifications to parents in case of:
- Abnormal health readings.
- Emergency switch activation.
- Prolonged cellphone usage.

8. Interface and Display
- Provide a real-time display of health and system status on the LCD screen.

9. Power Management
- Notify users of low battery status and ensure efficient power usage.

Non-Functional Requirements

1. Performance
- The system shall monitor and process health data within 1 second intervals.
- Notifications to parents must be sent within 5 seconds of any critical event.

2. Reliability
- The robot shall operate continuously for a minimum of 6 hours on a single charge.
- Ensure that sensors provide accurate readings with 95% accuracy.

3.Usability
- The system shall have an intuitive interface for parents to control robot operations.

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- The child's interaction with the Gemini chatbot shall be natural and engaging.

4.Security
- Protect sensitive health and interaction data using encryption.
- Ensure the system can only be accessed by authorized users (parents or caregivers).

5.Scalability
- The system shall allow integration of additional sensors or modules (e.g., oxygen level monitoring).

6.Maintainability
- The robot's hardware and software shall be modular for easy updates and repairs.
- Documentation shall be provided for troubleshooting and component replacement.

7.Efficiency
- The system shall optimize battery usage to extend operational time.
- Sensors and components shall operate at minimal power consumption without compromising performance.

Hardware and Software Requirements
Hardware:
- Raspberry Pi Pico
- Camera
- LCD display
- H-bridge
- Heartbeat Sensor
- Temperature Sensor
- Emergency Switch
- DC Motor
- Power Supply

Software:
- Python with YOLO algorithm
- Open cv
- Arduino IDE
- Embedded C
- Telegram API

VII. EXPECTED RESULT

1. Create real-time health parameter tracking mechanism.
2. implement AI-driven emotional support interface.
3. Design autonomous navigation and interaction capabilities.
4. Establish multi-functional dispensary and emergency response system.
5. To develop a robotic system for smart parenting, capable of child activity monitoring and health supervision.
6. To provide timely food delivery and ensure healthy eating habits using automated systems.
7. To alert parents in case of emergencies like child falls or health deterioration.
8. To detect excessive mobile usage and warn the child.

VIII. CONCLUSION

The smart parenting care robot is a powerful tool that bridges the gap between technology and care giving, making it easier for parents to monitor and interact with their children even when physically apart. By offering activity monitoring, health tracking, educational assistance, and emergency alerts, the system provides peace of mind to parents while fostering a safer and more engaging environment for children. As future developments and integration progress, the robot could evolve to become an indispensable part of smart parenting.

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The Parental Caring Robot represents a paradigm shift in childcare technology. By integrating advanced robotics, AI, and intelligent monitoring systems, we've created a comprehensive solution that addresses modern parental challenges. This innovative platform demonstrates the transformative potential of technology in creating safer, more supportive environments for children.

ACKNOWLEDGMENT

The satisfaction that accompanies the successful completion of this major project would be complete only with the mention of the people who made it possible, whose support rewarded our effort with success. We are grateful to **Dr. Ambedkar Institute of Technology** for its ideals and its inspirations for having provided us with the facilities that have made this major project a success.

We are grateful to our Principal **Dr. Thippeswamy**, Dr. Ambedkar Institute of Technology, who gave a continuous support and provided us comfortable environment to work in.

We would like to express our sincere thanks to **Dr. Jambunath Baligar**, Professor and Head, Department of Electronics and Communication Engineering, Dr. Ambedkar Institute of Technology for his support.

We pay out profound gratefulness and express our deepest gratitude to our mini project guide **Mrs Vidyashree N,** Assistant professor, Department of Electronics and Communication Engineering for the suggestions and guidance. We are thankful to our major project coordinators **Dr. Meenakshi L Rathod,** Assistant Professor, Dept. of Electronics and communication, for their advice, supervision and guidance throughout the course of the project.

It is our pleasure to acknowledge the cooperation extended by teaching staff and non-teaching staff members of Dept. of Electronics and Communication Engineering, Dr. Ambedkar Institute of Technology for the encouragement during project work. Finally, it gives immense pleasure to acknowledge the cooperation extended by family members, friends for the encouragement during this Project Work.

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