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AI driven multimodal interactive humanoid for childcare with compendious analysis with machine learning

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Abstract - The AI driven multimodal interactive humanoid for childcare with compendious analysis using machine learning is an innovative Smart Parenting Care Robot designed to ensure child safety, health, and productivity. Combining hardware and intelligent software, it features a central processor, DC/servo motors for movement and meal delivery, a camera for monitoring, and sensors to track heart rate and temperature. Advanced AI analyzes visual data to detect excessive screen time, issuing voice alerts, while speech recognition enables educational interactions. Emergency sensors notify parents via mobile alerts during falls or health irregularities, ensuring timely response. The robot automates essential arenting tasks like meal delivery, and real- time health monitoring, reducing parental stress and promoting a structured, engaging environment for children. Scalable and in- teractive, it bridges technology and caregiving, making it ideal for modern parenting. This comprehensive solution supports child development and safety even in a parent's absence, integrating real-time monitoring, learning support, and emergency response into one smart system.

Index Terms—STM32, embedded systems, heartbeat sensor, temperature sensor, IoT connectivity, sensor fusion, actuator control

1. Introduction

The AI driven multimodal interactive humanoid for child- care with compendious analysis with machine learning delivers a comprehensive solution for modern childcare by integrating robotics, embedded systems, and artificial intelligence into one multifunctional platform. Centered on an STM32 microcon- troller, the system unifies sensors, actuators, and intelligent software to provide continuous health monitoring, autonomous mobility, emergency response, and interactive emotional sup- port. Heartbeat and temperature sensors monitor vital signs

Identify applicable funding agency here. If none, delete this.in real time and present results on an LCD for immediate parental awareness, while an emergency switch enables rapid alerting in critical situations. Mobility is achieved with DC motors controlled through an H-bridge driver, allowing the robot to navigate autonomously or respond to remote com- mands to reach a child when needed. The design incorporates three dispensary units capable of delivering medication, food, or first-aid supplies on demand, which makes the robot a practical assistant for daily caregiving tasks and minor med- ical needs. For social and emotional engagement, a Gemini chatbot analyzes the child's mood and conducts conversational question-and-answer sessions, providing companionship when parents are not available. To promote healthier digital habits, a machine-learning-enabled camera detects cellphone usage and helps parents monitor and manage screen time by identifying prolonged or inappropriate gadget use. Together, these features form an integrated caregiving platform that combines real- time monitoring, proactive assistance, and intelligent interac- tion. The The AI driven multimodal interactive humanoid for childcare with compendious analysis with machine learning enhances safety through continuous vital-sign tracking and emergency alerts, supports physical wellbeing by dispens- ing essentials, and fosters emotional wellness via empathetic conversational AI. By automating routine caregiving tasks and offering timely interventions, the system reduces parental workload and improves response times in urgent situations. This project demonstrates the practical potential of combining embedded hardware, sensor fusion, actuator control, and ma- chine learning into a compact, reliable caregiver. Ultimately, the Parental Caring Robot represents a promising direction for future childcare technologies by delivering safety, engagement, and convenience, while boosting parental peace of mind.

II. SYSTEM MODEL

A. Problem Statement

One Parents face difficulty in ensuring their children's well- being, safety, and productivity, especially when away from home. The increasing use of digital devices by children poses a challenge to proper health and development. Parents need a system that can monitor their children's activities, provide timely nutrition, track health metrics, and assist in studies without their constant physical presence. Proposed System

- The To develop a robotic system for smart parenting, capable of child activity monitoring and health supervision.
- To provide timely food delivery and ensure healthy eating habits using automated systems.

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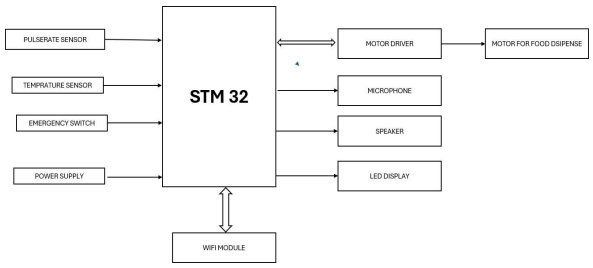
• To alert parents in case of emergencies like child falls or health deterioration.
• To detect excessive mobile usage and warn the child. • To assist children in homework and studies through AI-based voice assistance.
• To create a system capable of notifying parents about critical conditions through mobile alerts.

2. *Block Diagram*

- Two nodes and a control system. Micro-controller (Ar- duino UNO), node MCU, temperature sensor lm35, gas sensor mq2, sound sensor, IR sensor, fire sensor, and ZigBee form the initialnode.
- The second node contains an Arduino UNO microcon- troller temperature and humidity sensor a gas sensor acommunication module and a ZigBee connection.
- Both nodes include an LCD to display the sensed values the computer screen and the ZigBee network together form the control system.



3. *Methodology*

1. Hardware Development:

- Processor will serve as the central control unit.
- DC motors will be connected to facilitate robot move- ment.
- Servo motors will manage food box operation for sched- uled delivery of meals to the child.
- Camera will be installed for monitoring child activities, including detection of mobile usage.
- Sensors (such as heart rate, temperature sensors) will be integrated for child health tracking.

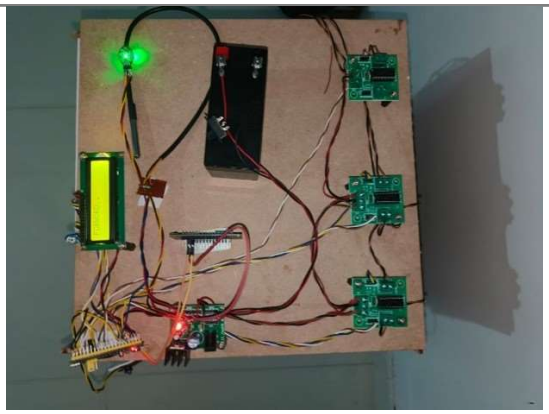


Fig. 1. Hardware Setup

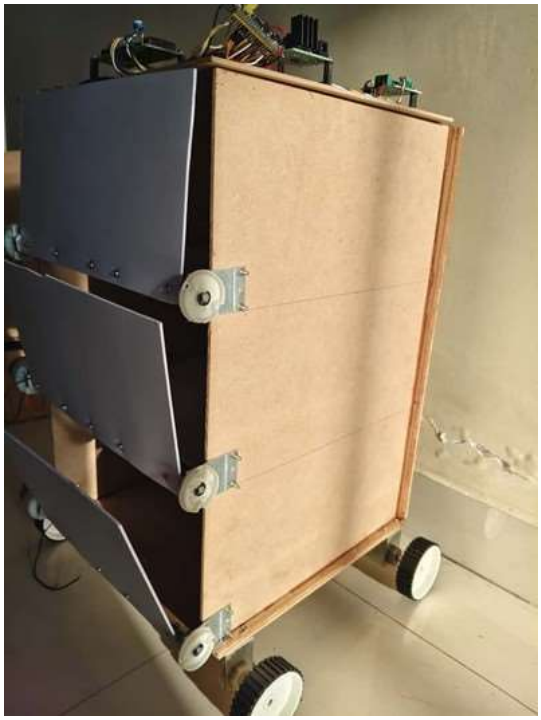


Fig. 2. Hardware Setup

- Speaker will produce audio alerts or warnings in case of improper activity, like mobile overuse.
- Emergency System: Sensors will trigger notifications to the parents' mobile devices in case of a fall or health anomaly.

D. Software Development

- The camera feed will be processed using AI algorithms to detect specific activities like mobile usage and abnormal movements.
- Voice assistance will be built using AI tools to help the child with homework or study-related queries.

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- The health monitoring system will analyze sensor data and issue warnings or alerts based on predefined thresh- olds.

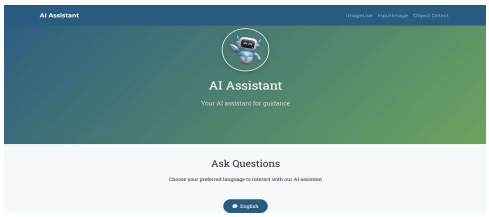

Fig. 3. AI assistance interface

- The robot's movement, food delivery, and interaction with the child will be managed through a control algorithm.

E. Integration

- All components will be integrated to work harmoniously under a Processor control unit.
- Data from sensors, cameras, and other components will be processed and appropriate actions will be triggered.

F. RESULT AND DISCUSSION

All the sensors mentioned above are implemented and worked exactly as expected. The threshold values were set toall sensors and when it went beyond the threshold value the beep sound was audible in the buzzer.

G. Outcome

It's checking for the pluserate of the child in the below figure.

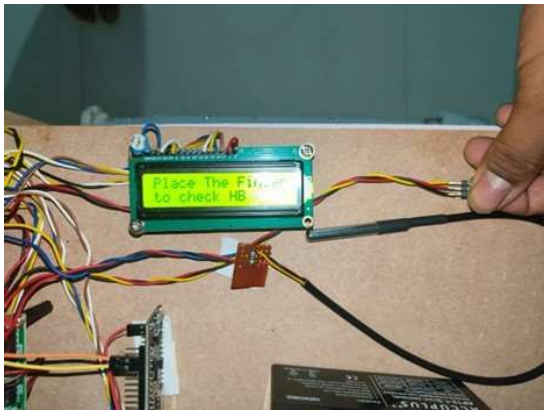

Fig.4 LCD Display

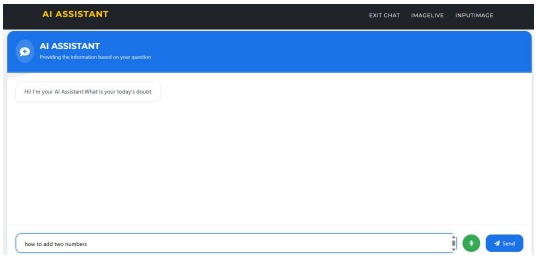

Fig. 5. Chatbox

In the above figure 5 the chaild is asking the chat box some question. That is been given to the child as homework.

Fig. 6. Answer given by the ai assistance

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