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Smart Infant Baby Monitoring System Using IOT

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Abstract: ***The Smart Infant Baby Monitoring System is an IOT-based project. The goal of this research is to lower SIDS. The primary factor in infant mortality is sudden infant death syndrome. Infants' breathing, temperature, heart rate, and digestion are abnormal. If people neglect infants, they are very likely to die. Monitoring those risk variables on a constant basis helps lower the incidence of SIDS. With the aid of IOT, this clever initiative will enable parents to provide assistance from anywhere, whether they are at home or at work. The idea of wanting and caring for infants, along with the need for sensors and cloud technologies, plays a vital role. The Internet of Things (IOT) and modules like the Raspberry Pi, temperature sensor, MAX30100 sensor, and sound sensor are all integrated into this project.. A temperature sensor measures the body's temperature, a MAX30100 measures the infant's heart rate and SPO2, a sound sensor detects crying, and a camera in a Raspberry Pi module measures body position. With the help of all those data, parents may check on their child's health from anywhere in the world. When the modules notice something abnormal, they immediately send their parents an SMS using cloud technology. By doing this, we can lower the number of SIDS.***

Keywords: IOT, Raspberry Pi, Cloud technology, Camera surveillance, Max30100.

I. INTRODUCTION

In today's fast-paced society, everyone, but particularly parents, are obsessed with their work life. Before supper, they depart the house in the early morning. As a result, they don't have enough time to care for their newborns. Parents may not have the time to rock or soothe their infant to sleep in the middle of the night Parents were unable to calm their crying baby in the middle of the night because they were unable to hear the baby. Some parents could be occupied with household chores. They can't hear their baby's screams, thus they can't immediately respond to them. Due to a relatively busy lifestyle where many women are frequently involved in domestic responsibilities as well as income-generating activities, it is becoming increasingly difficult for the majority of parents with newborn newborns to care for their babies as well as accomplish their daily tasks. Hence, mothers of newborns cannot be with them constantly. Other times, it's possible that the parents can't hear their children cry because they are outdoors gardening or having a shower. Because there are so many unforeseeable risks that these infants could encounter that could endanger them.

Most parents are forced to employ a maid to help them care for their infants. Yet, several maids have been proven to have an adverse effect on young infants as they develop, and some may even expose the infants to numerous unknown hazards that may put them in peril. Children today face various hazards, so parents must keep an eye on their kids. The neighborhoods, the internet, sexual harassment, and a lack of social skills could all be contributing factors. It can give parents security and comfort if there is a method or application that let them monitor their children remotely. The majority of parents visit the location where their child will be allowed to perform the monitoring in order to keep an eye on them. Since the job is frequently far from the child's location, it becomes challenging for the parents themselves who have been busy at work.

The number of baby deaths is caused by inadequate care. Moms of newborns are required to be away from their children for a variety of reasons. Babies' health status can be difficult to determine in such circumstances. The abrupt rise and decrease in physiological parameters has been linked to both Seemingly Life-Threatening Events and Sudden Infant Death Syndrome (SIDS). Many women are frequently engaged in both income-generating and domestic responsibilities. So, new mothers cannot always be with their infants and risk being found in severe distress. Most parents may not know that they are referring to two medically defined phrases when they think of SIDS. Both Sudden Infant Death Syndrome and Sudden Unexpected Infant Death (SUID) are types of sudden infant deaths (SIDS). Studies show that each year, between 4,000 and 5,000 infants under the age of one die from SIDS and SUID, with SIDS accounting for roughly half of these deaths. The most frequent causes of death are unintentional asphyxia, reason unknown, strangling in bed, and SIDS. Around 1,389 children died in 2020 from SIDS, 1,062 from unidentified causes, and 905 from unintentional bed-related suffocation and strangling.

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Infants under one year of age who pass away abruptly and for no apparent reason are said to have sudden infant death syndrome (SIDS), whereas infants under one year of age who pass away suddenly and unexpectedly are said to have Sudden Unexpected Infant Death (SUID) [4]. Around half of the deaths are unexplainable, so home healthcare and remote physiological data monitoring have recently become more significant due to technological advancements.

As far as we are aware, no research before the one in this one have built a smart cradle with IoT support from scratch. In order to solve this problem, a brand-new automated Internet of Things (IoT)-based baby monitoring system is developed. Parents may log into their account at any time and from any location to check their child's health. Smart baby cradle powered by IOT that would enable parents to keep an eye on and monitor their newborns when they are at home or at work and can follow each of the infants' actions from any inaccessible region of the world. The whole body of information gathered by the sensors will be kept in a database and made available periodically. Parents may be confident in the safety and wellbeing of their infants at any time and in any location with the help of all those details.

II. LITERATURE SURVEY

Using a GSM network, Savita P. Patil et al. [1] demonstrated an infant monitoring system. Temperature, moisture, pulse rate, and movement are monitored by the system, and these detected values are sent through the GSM network to the parent's mobile device.

This project, which is based on microcontrollers, was created by Soukaina Bangui, Mohammed El Kihal, and Yassine Salih-Alj. The authors have created a low-cost infant monitoring system that can recognise the sound of a baby crying and is coupled to a cradle that automatically swings when the system picks up the sound; the cradle does not stop swinging until the baby stops crying. A camera that records the video output around the infant is fixed to the top of the cradle.

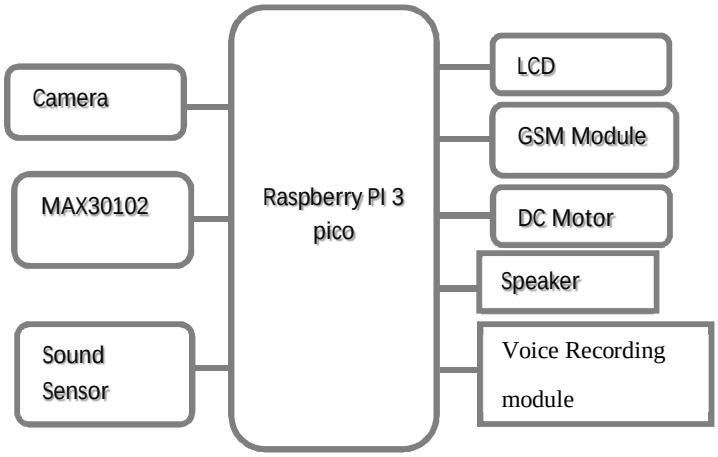
A baby monitoring system was created by Aslam Forehead Symon et al. [3] to track a baby's movements and cries. The display unit, buzzer, and camera module make up this system. When a baby moves or cries, the camera module activates, displaying the baby's movement on the display unit and sounding a buzzer to signal the baby's cry detection. Raspberry Pi 3, a camera, wet sensors, a sound sensor, a PIR sensor, a sound sensor, a DC motor, and an SMS module are used to create the system suggested in [2]. This system has several characteristics, such as video monitoring, automatic cradle swinging in response to infant screams, sensing the moisture of the baby's bed, and full monitoring of the baby's presence in the cradle.

The study "Baby Monitoring using Sensor and Wireless Camera" by Sonali Cynthia Pereira [4] offered a support system for parents who are employed full-time. The motion, temperature, moisture, and cry detection sensors used in the monitoring system. The system is equipped with a video camera that operates according to instructions given by the microcontroller and is used to capture the video when the motion detects the baby's movement. The system uses the GSM network to send alert messages to the parents as well when any of these parameters exceeds the threshold. To keep an eye on the baby's activity, the video will be shown on the screen.

III. PROPOSED SYSTEM

The proposed system involves remotely watching a baby's actions. The sensor, hardware component, cloud server, and parental application make up the majority of it. The system is built around the Raspberry Pi 3 pico, a single board computer with internet connectivity. All of the devices that interface with the RPi module are either wired or Bluetooth-enabled.

Block Diagrams



The connections for the temperature, humidity, sound, and camera sensors are shown in the top image along with the system's design, which uses the Raspberry Pi as its primary computer unit. The false shaft is moved by the dc motor using the L298N motor driver, and the message is sent to the parent through GSM.

It was chosen in order to describe the essential elements of the infant cradle so that they could be properly assembled. We also looked at the market for infant cradles that included a baby monitoring system in order to learn more about the design of the cradle. This stage involved selecting the hardware and software elements that will be utilised in the investigation.

The hardware components included the following:

1) Raspberry pi pico
2) MAX30100 sensor
3) Sound sensor
4) GSM Module
5) Voice recording module
6) DC Motor
7) Camera
8) Speaker
9) LCD

The software included the following:

1) C language

IV. RESEARCH AND METHODOLOGY

We have researched several papers and articles and went to hospitals based on survey. We found this from survey.

The parameters are as following:

Heart rate:100 to 160 BPM

Respiratory rate:40 to 60 PPM

SPO2:94% to 100%

Temperature:35.5˚C<T<36.8˚C

V. HARDWARE DETAILS

A. Raspberry PI PICO



Fig: Raspberry PI pico

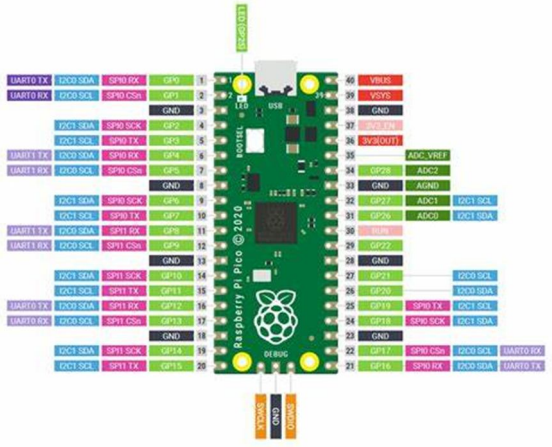
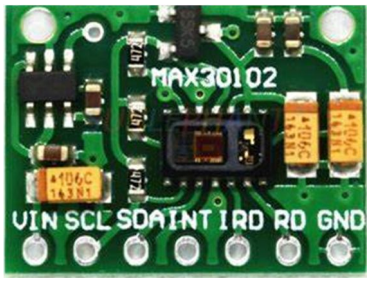


Fig: GPIO pinout

Each component of the Raspberry Pi Pico is connected to the other via wired or wireless connections, acting as a compact computer. It evaluates the values in line with the code we have given it, leading to the intended outcome. The temperature and heart rate sensors take measurements and produce an output. The erroneous parameters are sent by SMS and LCD, respectively. The baby's screams are picked up by the condenser microphone. The microphone sends a signal to the microcontroller while the baby is crying. Next, a signal to switch ON the DC motor is sent. Then the cradle swings.

B. MAX30102 Sensor



MAX30102 is a pulse oximetry and heart rate monitoring system. It is a biosensor.It is used to monitor temperature, heart rate and SPO2. In this project when a baby finger is placed on sendor, it monitors the baby's body temperature, hear rate and SPO2. If there is any abnormal parameter is noted then it sends signal to the processor.

C. GSM SIM 900A



GSM SIM 900 A is the GSM module used for GPRS/GPS communication. The module offers 900MHZ nad 1800 MHZ frequency band to send SMS. In this any abnormal parameter is noted then the SMS is send to parents mobile.

VI. RESULTS AND DISCUSSION

The results are displayed on the LCD.
If no finger is placed the it shows No finger?.



Fig: Results displayed on LCD

While reading parameters it displays as reading.



Fig: Reading is displayed on LCD

If finger is placed then the parameters are shown on LCD



Fig: Results displayed on LCD

The measured parameters calculated and if abnormal parameters are noted the SMS is sent via GSM module.

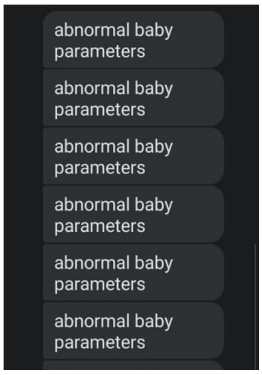


Fig: SMS sent via GSM module

The project trial has been done on a baby by monitoring health conditions using this project. The results are accurate.



Fig: Protype testing

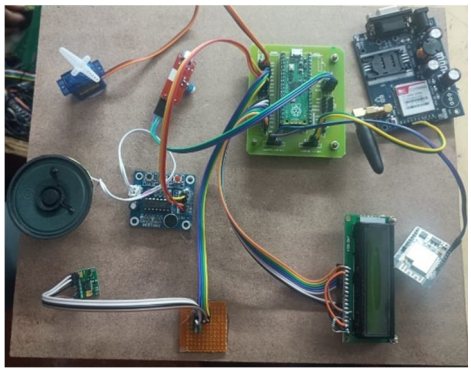


Fig: project display

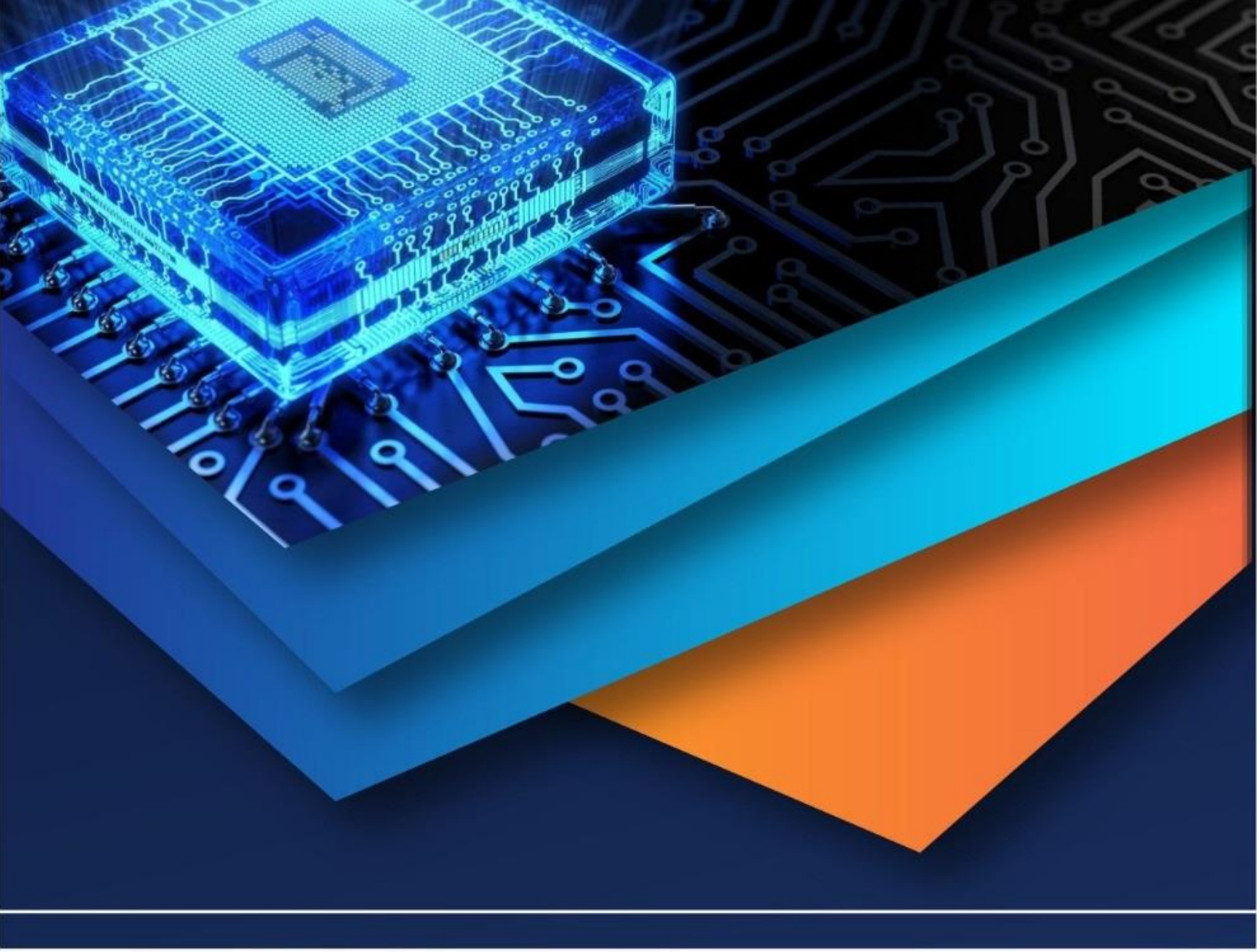
VII. CONCLUSION

With the use of wireless technology and textile sensors that make it pleasant to wear and more accurate and precise than previous sensors, the system we have suggested seeks to monitor the baby's vital indicators, including heartbeats and body temperature. There is now more information that can be broadcast via the internet to enable remote access. The camera module that is mounted to the cradle aids in continuous movement tracking and finite monitoring of the infant in a finite area.

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