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Baby Monitoring Robot Using IoT

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Abstract: ***In order to help parents who are already stretched thin, this project offers a mechanism for monitoring infants. The baby's movements and sound can be detected by this system, notably crying, and a video output of the baby's current position can be shown on a display monitor so that the mother or another responsible adult can keep an eye on the child while they are away. The motion and crying of the infant can be automatically detected by this baby monitoring device. The voice recognition module, motion sensor, and camera are all integrated into the Arduino nano module to create the hardware's overall control system. A motion sensor is also used to detect the baby's movement. The hardware devices are operated using the Arduino IDE. Baby videos that are either sleeping or playing are displayed on a display. Last but not the least, the developed hardware is evaluated to determine its capacity for detecting the baby's motion and cries as well as the video output.***
Keywords: Arduino nano, motion sensor, voice recognition module, camera, Arduino IDE software.

I. INTRODUCTION

The baby monitoring system is a type of alarm system that can track the movements and activities of infants and send an alert to the appropriate authorities about the status of the child via a mobile device or even a display. Families have had an innate need to protect their young from potential risks and perils since the dawn of civilization. However, thanks to technology advances, parents now care for their kids in different ways. Parents are currently considering implementing technology and engineering innovations in order to get advantages and benefits in terms of concerns for the safety of their infants. A sophisticated baby monitoring system can be a solution for correctly handling newborns in this day and age when parents are preoccupied with their careers rather than keeping them in child care facilities. Constantly keeping an eye on a newborn is a difficult task, and parents can't always have their children with them, especially if they are working. When parents are busy at home or at work, one option is to hire a caretaker to watch over the baby continuously. Another choice is a daycare facility. However, these two approaches might not be convenient for parents given their needs. Most crucially, in both situations, parents lack confidence in the safety of their infants. The most effective way to relieve parents' worry and tension may be to use a baby monitoring gadget. While used in this work, Arduino is an 8-bit AVR microcontroller-based board that includes an IDE, libraries, and a hardware prototype platform. This project uses an Arduino Nano module, which has a significant benefit over other IoT-based projects. The components of this baby monitoring system include a microphone to pick up baby's cries, a motion sensor to pick up baby's movement, and a camera to record baby's activity. The equipment is connected to a display, which will output both the baby's sound and video.

II. LITERATURE SURVEY

By M.Benisha, Thandaiah Prabu.R, Gowri.M, Vishali.K, Divya Priyadharshini.R, M.Anisha, Ponmozhi Chezhiyam, and C.Jim Elliot in the year 2021, "Design of wearable device for kid safety." [9] This study's technique and description use IOT to provide "smart child protection." This project aims to alert parents via SMS if a child is in danger by using a tool that children wear. The device could be a band, belt, or glove. Arduino UNO, GSM, sensors, and a panic button were all utilised. These sensors are there so that they can inform parents if a youngster is in danger. Providing children with security is an advantage. utilised at any time to find lost children. Limitations include the absence of video surveillance and of a system to shield children from inappropriate behaviour.
In the year 2020, Harshal Chaudhary, Dr. Ranjana Zinjore, and Dr. Varsha Pathak will publish "Parent-Hook: A Child Tracking System Based on Cloud URL." [7] The parent hook product, which is composed of soft cotton webbing and is meant for kid tracking if the child is misplaced or if the parent is not near the child, is introduced in this paper's description and approach. contact details for the parents, including a Cloud URL and QR code. The benefit of a safety band without a sensor or chip is that it is easy to carry and safe for youngsters. Due to its delicate cotton webbing limitations, the item may be lost or fall to the ground. [12] Who is keeping an eye on your child? By Joshua Streiff, Olivia Kenny, Sanchari Das, Andrew Leeth, and Jean Camp in 2018. "Exploring home security issues using smart toy bears." There are descriptions and methods. For youngsters ages 3-5, Fisher-Price smart toys are used here. These toys include a range of communication tools so that kids can play with them even when their parents aren't around. The toy's microphone, camera, and speaker enable game play and allow kids to interact with it.

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The camera can be controlled and accessed by parents at any time as needed, and the bear may look after the youngster in their absence. Limitations: When a child is in danger, parents are not notified. Baby cannot be constantly watched over. [14] By Ms. P. Hemalatha and Dr. S. Matilda in 2018, "Smart Digital Parenting Using Internet Off Things." Description and approach: employing IOT to keep an eye on the infant as they sleep. recognising a baby's first cry. utilises Bluetooth, Wi-Fi, 2G, 3G, and 4G. Wet sensor, cry indication, and flexi force sensor are all utilised. Benefits: Protecting children's safety offers parents confidence and reassurance that everything is okay. The restriction is that it does not alert the parent when the child is in danger.

III. METHODOLOGY

The proposed infant monitoring system's operational procedure is depicted in Figure 1. We'll be using an Arduino Nano module as the main controller in this setup. An inexpensive microcontroller the size of a credit card, the Arduino Nano can output data when connected to a monitor. The Nano form of Arduino has some advantages over a previous model, and it contains 14 GPIO (General Purpose Input/Output) pins in addition to 1 USB connector.

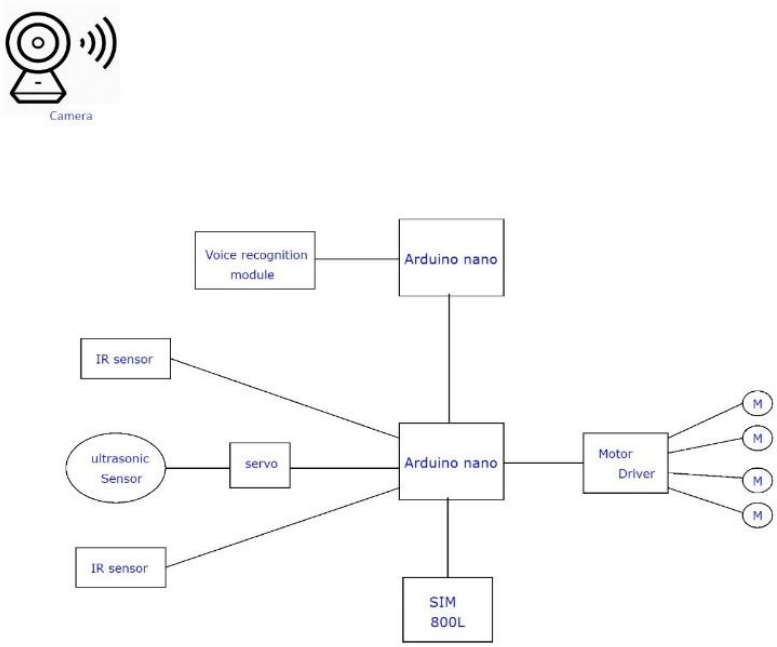


Fig 1 System Architecture

This project will use a MIC to detect infant cries and send a signal to the Arduino Nano about it. A PIR motion sensor will also be included of this system to detect the baby's movement. Pyroelectric sensors are used in PIR sensors, which can measure infrared radiation levels. Every object releases some low-level radiation, and the more heated an object is, the more radiation it produces. A camera, another distinguishing feature of this system, will also be fixed on it to capture video of the surroundings of the location where the baby will be kept. If the baby's voice is recognised, a message will be sent to the parents via the GSM module. The Camera Module is a specially created accessory. will be secured to the model using one of the two tiny sockets on the top of the board. The Video can be captured using the camera module. combining still images, slow-motion, and time-lapse video cleverness. Additionally, the system includes an LCD monitor. and awake as in hardware configuration. The MIC will send a signal to the GSM Module if it hears any sound, enabling the camera. the lights to come on, and the data collected from the camera be delivered to the in charge. when the infant moves and the PIR sensor notices it. As a result, the system would inform worried parents of their children's status via SMS as well as a video output of their current state.

Two Arduino nanos are required to manage the complete model. One Arduino nano controls the voice recognition module, and the other controls additional Internet of Things (IoT) devices like servos, IR sensors, ultrasonic sensors, GSM modules, and motor drivers. When the baby's voice is recognised by the speech recognition module, a signal is delivered to Arduino nano 1, which then transfers the signal to the GSM module through Arduino nano 2, allowing the guardian or parents to get a message regarding the baby's status. When the baby moves, IR and ultrasonic sensors are used to detect it.

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When this happens, a signal is transmitted to the main Arduino nano and the motor driver in the model moves in the direction of the baby's movement. The ESP32-CAM is a dual-mode development board for WIFI and Bluetooth that makes use of antennas built into the PCB and ESP32 chip cores. It can function as a bare minimum system independently. The camera is primarily mounted on the model, and the user can see the live output from any location using a web browser. The camera can record baby videos.

IV. HARDWARE AND IMPLEMENTATION

A. Arduino Nano

Based on the ATmega328P, the Arduino Nano is a compact, complete, and breadboard-friendly board that was introduced in 2008. In a more compact design, it provides the same connections and specifications as the Arduino Uno board. The Arduino Nano has 30 male I/O headers that are arranged in a DIP-30-like format and can be programmed using the Arduino Software integrated development environment (IDE), which is available both online and offline and is shared by all Arduino boards. The board can be powered by a 9 V battery or a type-B mini-USB connection.



Fig 2 Arduino Nano

B. Infrared Sensor(IR Sensor)

A radiation-sensitive optoelectronic component having spectral sensitivity in the infrared wavelength range of 780 nm to 50 m is known as an infrared sensor (IR sensor). Motion detectors, which are used in building services to turn on lights or in alarm systems to detect unwanted visitors, increasingly frequently incorporate IR sensors.

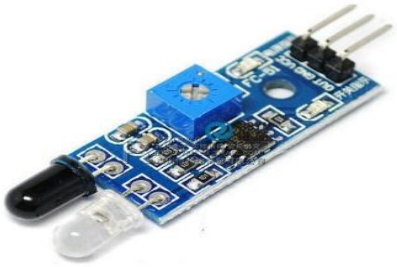


Fig 3 Infrared Sensor

C. Ultrasonic Sensor

In order for ultrasonic sensors to function, a sound wave above the range of human hearing must be sent out. The sensor's transducer serves as a microphone for receiving and transmitting ultrasonic sound. Like many others, our ultrasonic sensors use a single transducer to transmit a pulse and receive the echo. By monitoring the amount of time that passes between delivering and receiving an ultrasonic pulse, the sensor can calculate the distance to a target.



Fig 4 Ultrasonic Sensor

D. Voice Recognition Module

No more A small, simple-to-use speaking recognition board is the Voice Recognition Module. Up to 80 voice commands are supported by this speaker-dependent module. Any sound can be taught to serve as a command. Before the module can recognise any voice command, users must train it. Like a library, all voice instructions are kept in one big collection. Recognizer could import any 7 of the library's voice commands. It indicates that seven commands are active simultaneously.



Fig 5 Voice Recognition Module

E. GSM Module

A device that employs GSM mobile telephone technology to offer a wireless data connectivity to a network is known as a GSM modem or GSM module. Mobile phones and other devices that communicate with mobile telephone networks use GSM modems. To identify their device to the network, they need SIMs.



Fig 6 GSM Module

F. GPS modules

Through a technique known as trilateration, one of the GPS devices uses satellite data to pinpoint a particular location on Earth. In the meantime, a GPS receiver trilaterates radio signals to calculate the distances to satellites. Triangulation, which measures angles and is illustrated in this figure, is comparable to trilateration. Small processors and antennas found in GPS modules are used to directly receive data from satellites using specific RF frequencies. From there, it will get data from various sources, including timestamps from all visible satellites. The module's antenna can determine its position and time with accuracy if it can detect four or more satellites.



Fig 7 GPS Module

G. WeMos D1 R2

The ESP8266 is a wireless 802.11 (Wifi) microcontroller development board based on the WeMos D1 R2 Uno and is compatible with the Arduino IDE. The widely used ESP8266 wireless (WiFi) module is transformed into a complete development board in this way. This board's layout is based on a typical Arduino hardware design.



Fig 8 WeMos Wifi Module

H. ESP32-CAM

The ESP32-CAM is an ESP32-based, compact camera module with low power requirements. It features an inbuilt TF card slot and an OV2640 camera. Numerous clever IoT applications, including wireless video monitoring, WiFi image upload, and QR identification, can make use of the ESP32-CAM.



Fig 9 ESP32-CAM

V. RESULTS

The created monitoring system and the placement of each component of the device's prototype are depicted in the image below. As illustrated in the below diagram, all the parts are integrated into a single metal body.

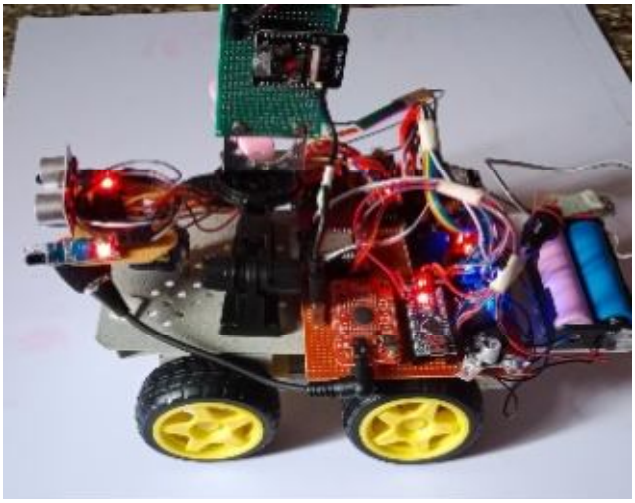


Fig 10 Baby Monitoring Model

The voice recognition module's output is depicted in the image below. The microphone won't pick up a voice while the infant is dozing off or if the baby is quiet and not making any noise, thus there won't be any output. As a result, when the baby cries or makes noises, the Arduino nano gets the signal from the microphone and processes it. The Arduino mini detects a strong signal, which indicates that the infant is sobbing. The GSM module then transmits the message to the parents' device by showing a message as the baby is crying or in danger as soon as the mic recognises the baby's voice and sends the signal. The display indicates that the infant is sobbing since the output that was discovered from the input indicates that there is an active condition.

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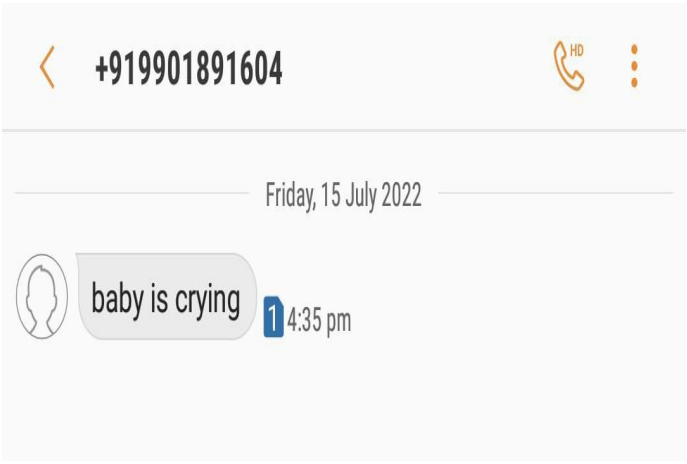


Fig 11 Message Display Screenshot

The ESP32-CAM is a dual-mode development board for WIFI and Bluetooth that makes use of antennas built into the PCB and ESP32 chip cores. It can function as a bare minimum system independently. According to the diagram below, a website has been developed to watch or verify the live output of the infant using the camera. Due to the fact that guardians may see the video from any location, it helps parents determine whether their child is safe or in any danger.



Fig 12(a) ESP32-CAM

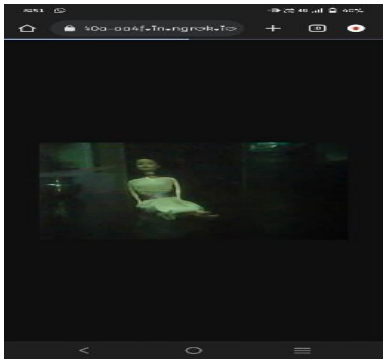


Fig 12(b) Live Video Monitoring

VI. CONCLUSION

A fresh enthusiasm had emerged following the successful completion of the article on the emergency health monitoring system utilising wearable technology, and it was decided to construct an automatic system for baby monitoring to allay the concerns of the parents. The result of that action is this project. The best way for parents to keep an eye on their children in today's hectic world is with a baby monitoring system. It is merely a method of utilising contemporary technology, with no impact on the parents' daily routines. Our goal is to create a monitoring system that will offer a high level of baby security and whose security technique is distinct, as we stated in the beginning. Due to the fact that video monitoring is distinctive and cannot be duplicated or faked, we decided to use it to protect the infant. By utilising video streaming technology, the system has successfully solved some of the drawbacks of current technologies. In this work, a baby monitoring system that can use an IR motion sensor to detect movements in a variety of settings without an operator is built. As a result, it may automatically determine the baby's position. It can also determine whether the infant is awake or asleep. Additionally, a MIC is built into the system to detect the baby's crying situation. The results of the aforementioned studies indicate that the suggested baby monitoring system has a significantly higher yield than the earlier efforts.

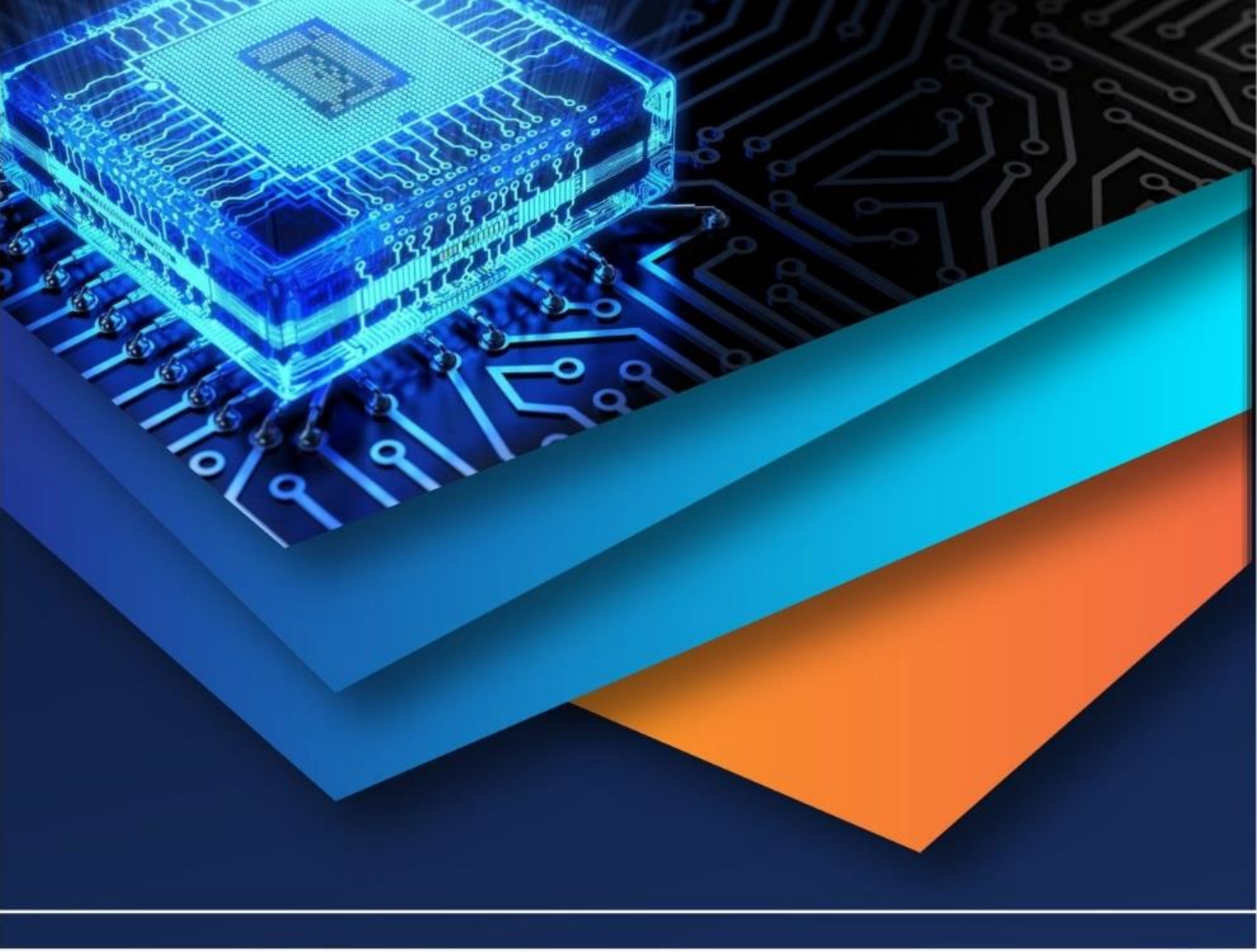
This system was created using an Arduino nano module, a credit card-sized microprocessor that has many advantages over other Internet of Things (IoT) gadgets. Additionally, the Arduino nano is a cheap chip that can make the system more affordable than other ones that are already in use. This technology has the ability to simultaneously output audio and video. It can be used at home, and when providing nursing care for infants. The parents' boredom and anxiety can be reduced with effective usage of this technique. This system also supports the baby's safety concern. Even though this system is now in use, it can still be modified and improved.

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