



Leveraging IOT Technology for a Smart Cradle System

TEAM UNKNOWN

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1. ABSRACT

In today's world, there is the availability of high-speed internet, and the use of mobile phones has increased worldwide which indeed resulted in the rise of the popularity of IoT. One such important concept of the same is the use of mobile phones by working parents to watch the activities of the baby while babysitting. This project presents a Smart Cradle System which helps parents monitor and ensures the comfortability of their baby. This cradle swings automatically on detection of baby cry sound. Also, it will give alerts on the phone of the parents if baby's crying continues, and the baby needs personal attention. if the mattress in the cradle is wet which if not changed may lead to discomfort to the baby. We have also created a clean web app to go with the system connected to our database, which can be used by the users to monitor the baby. We have fine-tuned our parameters to measure precise reading and accounted for edge corrections to manage false positives.

Keywords: Internet of Thing, HealthCare, Arduino, ESP32, Firebase, HTML5, Web application.



2. INTRODUCTION

Today's lifestyle is fast paced. Most of the working parents find a bit difficult to manage work along with babysitting. They cannot keep an eye on their child all the time and is hard after long working hours. In such a case it might not be possible to keep the baby happy by manually swinging the cradle. Baby's safety will also be on the back of their minds if they have hired a babysitter. Hence this is where our product comes into picture. This cradle system is proposed to make life easier for the parents and create a safer environment for the baby. This cradle system consists of following points.

1. Automatic swinging of cradle starts on the detection of baby cry or baby movement.
2. Sends an email notification when baby is crying or if the baby has wet the bed.
3. Informs the parents if mattress is wet and the baby needs attention.

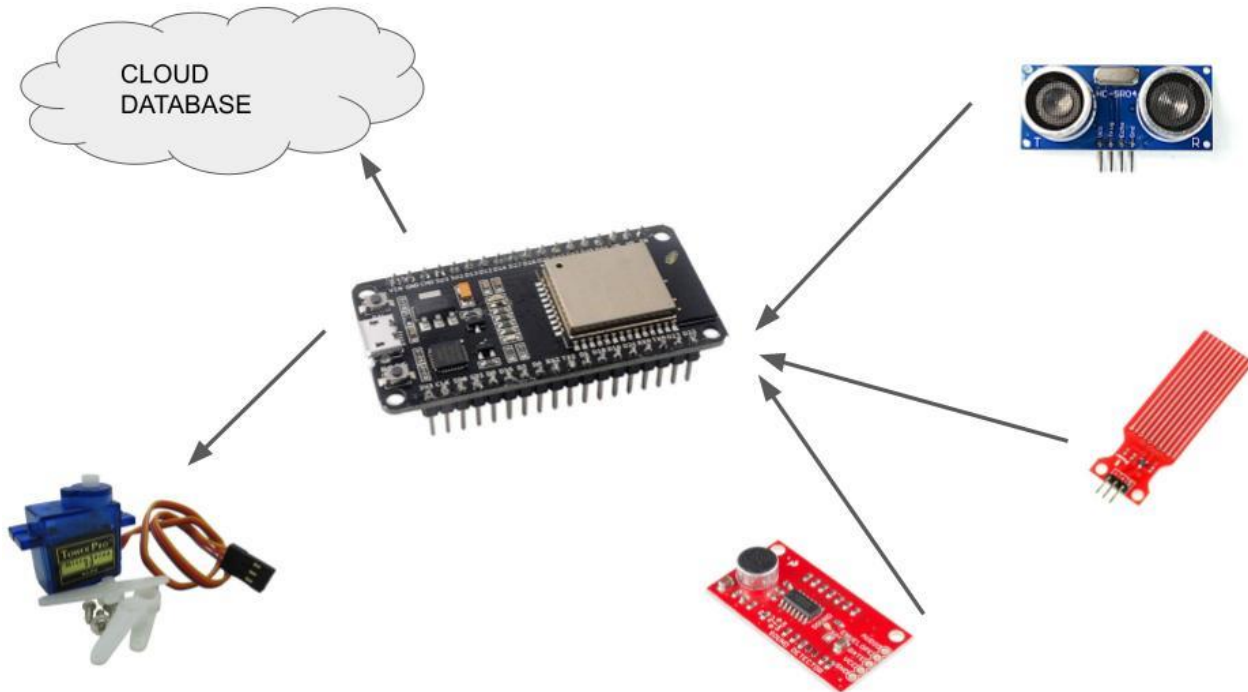
Notifying the parents if the bed is wet or not helps keep a healthy environment near the baby. We have also set up an email system that helps notify the parents about the baby's status. The benefit of such an alert is that the parent can get to know the baby's status anywhere, anytime because of the internet. We are using multiple sensors to detect these factors inside the cradle and send data into the cloud. Our website which we have hosted on AWS then reads these changes and alerts the parents. We have associated each device to a specific parent using the device ID which parents register on the website when signing up.



3. LITERATURE REVIEW

[1]. Mohamed Y. E. Simik, Abdeldime M.S Abdelgader, Feng Chi and Randa S. I. Saleh, proposed a thought for an automatic warning device for wet Diaper. They design system using a sophisticated RF transceiver and GSM system to sound an alarm on the detection of moisture within the diaper to alert the intended person to change the diaper. [2]. Misha Goyal and Dilip Kumar, presents a design and implementation of cheaper E-Baby Cradle that swings automatically when baby cries, it is a cry analysing system which can automatically detect the baby cry voice and accordingly the cradle swings till the baby stops crying. Also, their system has an inbuilt alarm that indicates if either the mattress is wet or if the baby starts crying. [3]. Dr.M.Levy, Deepali Bhiwapurkar, Gokul Viswanathan gives a concept of system that cites infant monitoring system with Real-Time alerts to folks using GSM technology. Cry detector system identifies the infant cry and swings the cradle. this method use of servo motor to swing the cradle. Here, parents can control the speed of cradle in step with their requirement. The ultrasonic sensor is employed for detecting movements of the infant. When this sensor does not work properly Accelerometer is employed. When there will be no movement some stipulated time then notification is sent to parents. Here it uses sound sensor used for detection of baby cry and send data send to the microcontroller. [4]. Ruchi Khant, Goram Nail, Milind Trivedi, J.M. Rathod gives hint about automated cradle with upgraded specifications like wet detection, Music generation, Fan facility and remote controlling facility. The automated cradle is supplied with two different modes based on speed, i.e., low speed and high-speed mode.

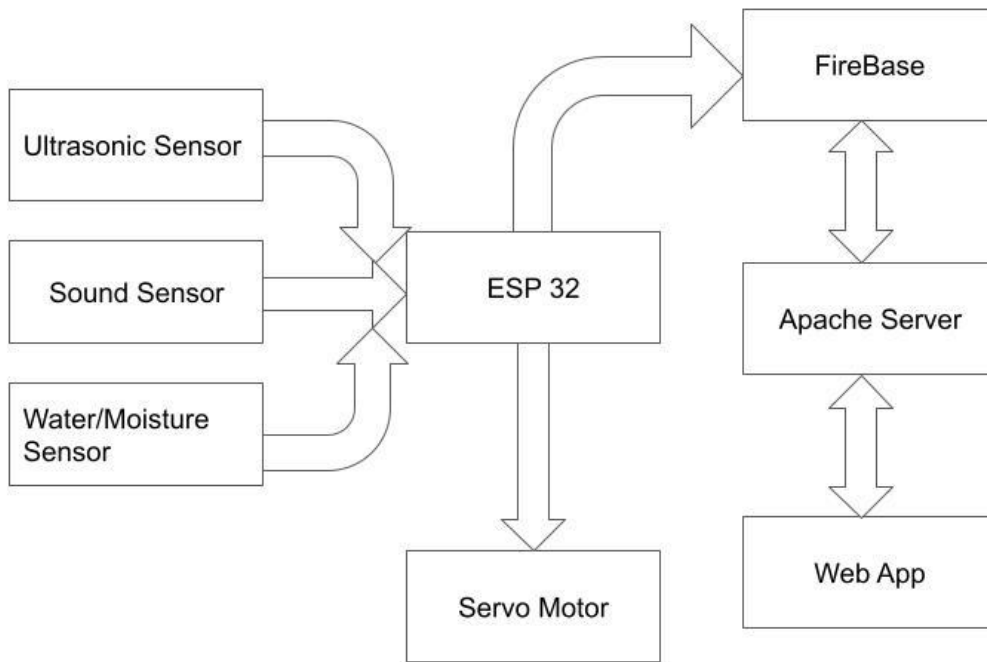
4. PROPOSED METHODOLOGY



The ESP 32 is a microcontroller with Wi-Fi and Bluetooth features embedded. We leverage these features to connect the controller to the cloud for our data storage needs. It also has 34 GPIO which can be used to connect multiple sensors. We have used a total of 3 sensors namely the HC-SR04(Ultrasonic Sensor), Water Sensor, Sound Detector. We have also used a Servo Motor to rock the baby cradle on conditions such as if the baby is crying or awake. The Ultrasonic Sensor would measure the fluctuations in the distance values in the cradle to figure out if the baby is awake and moving. The Water sensor would detect the presence of moisture on the bed and communicate with the Esp that the baby has wet the bed. The Sound Sensor would pick up the sound of the baby crying. In the cases where the baby is detected to be crying or awake the cradle will start to rock using the servo motor attached to the cradle, Esp would also update the database which would then trigger a notification to the parents.



5. ARCHITECTURE AND COMPONENTS



Components

1. ESP 32

ESP32 is the name of the chip that was developed by Espressif Systems. This provides Wi-Fi (and in some models) dual-mode Bluetooth connectivity to embedded devices. While ESP32 is technically just the chip, modules and development boards that contain this chip are often also referred to as “ESP32” by the manufacturer.





2. Ultrasonic Sensor

An ultrasonic sensor is **an instrument that measures the distance to an object using ultrasonic sound waves**. An ultrasonic sensor uses a transducer to send and receive ultrasonic pulses that relay back information about an object's proximity. The fluctuations in the distance values are then used to detect if there's motion present.



3. Sound Sensor

The Sound Detector is a small and quite easy to use audio sensing board with three different outputs. The Sound Detector not only provides an audio output, but also a binary indication of the presence of sound, and an analog representation of its amplitude. The 3 outputs are simultaneous and independent.



4. Water Sensor

Water sensors detect the presence of water and, when placed in locations where water should not be present, a leak.



5. Servo Motor

A **servomotor** (or **servo motor**) is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity, and acceleration.





This system then takes in the received values from the sensors, processes them. If the baby in the cradle is detected to be crying or not asleep it will send commands to the servo motor to rock the cradle. These detections are also uploaded into a Firebase real-time database using the firebase library. This is only a 1-way connection. We have also created a web App for parents to log in to view all the details about the children. This website is secured using an SSL certificate and hosted on Amazon's EC2 using Apache Server. This makes the application full stack. We have used HTML, CSS, JavaScript for the website and using jQuery and AJAX calls to fetch data from the database. We are using Email-js a JavaScript library to send out email notifications to the parent if the child wets the bed or starts crying.

6. IMPLEMENTATION

Esp 32 will take in time values from ultrasonic sensor to calculate the distance. Fluctuations in these distance values will signal us whether the baby is awake. If we sense that the baby is awake, we send this data into our firebase database. Similarly, we detect Sound in the cradle to check if the baby is crying and update our database and if we detect moisture above a certain threshold, we can send an alert into the database that the baby has wet the bed.

```
Delay Over
Received Servo Control o/p
0
Baby is Asleep
Entered soundSensor o/p
Water Level: Not wet Enough
0
Entered waterSensor o/p
Motion Detected !!
0.00
PASSED
PATH: /motionSensor
TYPE: boolean
Rocking the cradle stopped !!
Delay Over
Received Servo Control o/p
0
Baby is CRYing !!
10
Entered soundSensor o/p
```

We are using Firebase as our database, which is a Real-time database which is then used by our web app to display data about the child. Firebase has good libraries which helped us integrate it into our server-side as well as Esp side easier. We have created a simple yet sleek Web application that the parents can log into using their account which displays data about their child. We are using Amazon Web services EC2 instance to host the website. We are mapping each device with a device ID and when the user registers the device the user gets associated with that device. We have also added an email alerting system to our website which will send notifications to the user who needs to be alerted about the babies' activities.



Smart Cradle System

HELLO, STEVE !

Logout



The baby is not crying.



The bed is dry.



The baby is asleep.



7. CONCLUSION AND FUTUTRE SCOPE:

Baby care is an extremely important problem worldwide. Although parents looking after their baby themselves is the best way to go about it but considering the need of present world this system is designed. Our smart cradle system is cost effectives and easy to operate which helps working parents to manage their work.

Internet of Things brings the smartness among the devices. Our project presents the several types of sensors and actuators which helps make our cradle automatic. The study of several types of sensors help to achieve the smartness of cradle with additional features to the cradle and these sensors can be used for securing toddler. The end goal is to try and make life easier for parents and create a safe and healthy for the infant when the parents are not around.

We plan to add a micro camera to the system for visual observation of the cradle. Also, we plan to add 2-way audio to listen to the child or speak to the child to comfort them.



8. REFERENCES

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