Online Doctor Consulting System in Smart baby Cradle: A Step towards Innovation

Soumyadeep Ghosh[1], Soma Boral[2], Arun Kumar Mondal[3]

Abstract: **A global public health emergency coronavirus disease-19 (covid-19), is currently occurring. It is more difficult for new born whose parents are both working since they are unable to spend as much time with their children. It is an urgency to take them to the doctor's office when their infant becomes ill. Since there is no vaccine for children beyond the age of eleven, it is risky to bring them to hospitals and they need special care for their health. As a result of the COVID-19 epidemic, we have integrated this online video doctor consulting system in this paper's smart baby cradle system for infants, removing the requirement for them to visit a clinic for a check-up. So, we developed a method for online video health monitoring that enables clinicians to see patients.**

Index Terms**: IoT, video conference system, online consultancy, web application, Smart Baby Cradle**

I. INTRODUCTION

AS the number of working parents in modern families grows, they are unable to spend as much time with their infants, resulting in a considerable gap [1]. To close this gap, we created the Smart Baby Cradle and health monitoring system, which enables parents to connect with and watch over their infants while also enabling them to see a doctor online whenever they need to, from anywhere. The goal of this project is to create a doctor-patient handling management system that will assist physicians in their job while also allowing patients to plan visits and track their health [2][5]. Smart technology has recently spread throughout the world. Baby care service is a field that could also implemented these smart technologies by means of embedded system [6].

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The goal of this project is to create a doctor-patient handling management system that will assist physicians in their job while also allowing patients to plan visits and track their health [2][5]. Technology can be used by doctors to manage online appointment scheduling. Patients can reserve any open spaces online in their name. The system deals with scheduling data for many doctors on various dates and at various times. Each time a patient sees a physician, the physician enters the patient's medical data into a database. The user can review their entire medical history whenever they like the next time they check in [3][4]. A sneak peek of the patient's medical history is accessible to the doctor.

II. COMPONENTS REQUIRED

The proposed system is designed and implemented based on several new technologies modules that are both efficient and low cost. The modules and sensor used in the implemented system [7]:

a) Arduino megaDHT11– Temperature and Humidity Sensor
b) PIR Sensor
c) Moisture Sensor
d) Bread Board
e) Mobile Phone
f) DC Motor
g) OV7670 camera module
h) TFT LCD 3.5” Touch Screen Display Shield
i) Piezoelectric sensor/Solar panel
j) Fan
k) Alarm
l) 18V Battery
m) LM7805 IC 5V Voltage Regulator IC
n) MAX3102 Pulse Oximeter Heart Rate Sensor Module
o) GPRS Module

III. WORKING PRINCIPLE

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A. The whole operation of the smart cradle system is shown in the diagram in figure 1 below. Several sensors, including a sound detector, a temperature sensor, a humidity sensor, a wetness detector, a PIR sensor, an OV7670 cam-module, a heart rate monitor, an oximeter, and a piezoelectric sensor are used to track the child's movements when they are placed in the cradle.

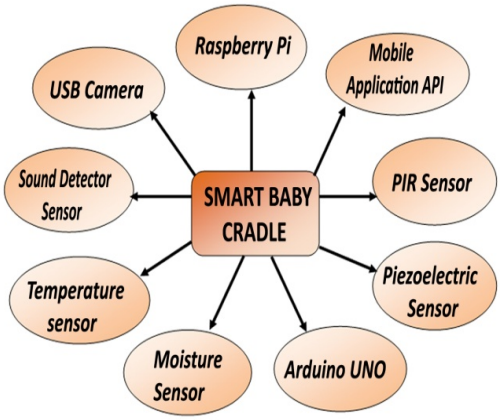


Fig 1: proposed diagram of smart cradle system

B. The cradle is equipped with an alarm system that sounds in two different circumstances: first, when the pad is wet, which is essential for the baby's health; and second, when the infant continues to cry for a prolonged period of time, which may indicate that the baby wants attention.

C. The cradle also has the ability to measure the temperature and amount of moisture around the baby, alerting the owner to the value via SMS or phone calls.

D. In addition, we've provided video enchantment choices so that parents can watch what their children are doing. While parents are gone from their babies, they can use mobile applications to monitor and operate the cradle

E. If the baby becomes ill, parents can use the video conference system's online doctor consulting system, which allows the doctor to see the infant as well as obtain heart rate and oximeter level data, as shown in figure 2 below.

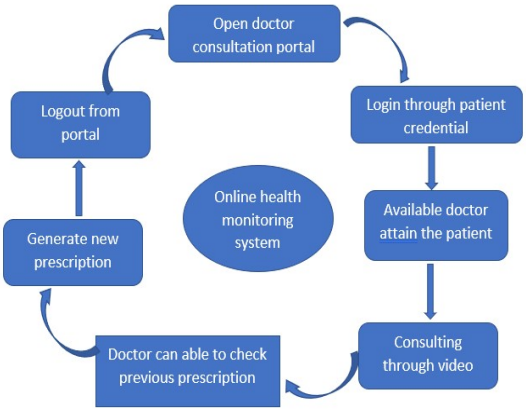


Fig 2: Workflow of online doctor consultation

IV. COSTS ANALYSIS

According to the survey conducted by the Bureau of Electrical Energy in India, there are around 18 million agricultural pump sets, and around 0.5 million new connection per year are installed with an average capacity of 5HP. Total annual consumption in the agriculture sector is 131.96 billion kWh (19% total electricity consumption)

TABLE 1
Cost Analysis of the Project

Name of the components	Quantity	Cost (Rs.)
Arduino mega	1	2500
DHT11 sensor	2	240
PIR Sensor	1	100
Bread Board 400 pins	2	150
Johnson 200RPM DC Motor	2	740
OV7670 camera module	1	180
TFT LCD 3.5" Touch Screen Display Shield	1	1000
Solar panel-17v	2	1800
Fan	1	100
Alar	1	30
12V Battery	4	150

LM7805 IC 5V Voltage Regulator IC	2	50
GPRS Module	1	300
Connecting wires	20	20
Total Cost		7590

We made our project at a cost of [Rs. 7590+ Rs 400 (allowances)] = 7990/-. We would take a profit of 25% and will sell to market a very cheaper price of 10599 rupees. In market this product with less features as compared to our proposed system is available at approx. 13999 rupees.

V. FEATURES AND FUNCTION OF SESNORS AND MOCULES

A. Cradle system

When the Sound sensor crosses the threshold level, the Cradle Swing is activated. The standard DC Motor assists in swinging the Cradle.

Algorithm for cradle swinging:

Step-1: Start the System.
Step-2: Check if the baby is crying or not.
Step-3: If yes, it triggers DC Motor which leads to swinging of the Cradle.
Step-4: It also sends the alert message for the same.
Step-5: Parents can also turn On / Off the Cradle Swing using the Android Application.

B. Moisture Detector Sensor

This Sensor, depicted in Figure 3, determines if the baby's diaper is moist or dry. If moisture is detected, it will send an alert message to the parent (and nanny). This helps to keep the baby in a safe and clean environment.

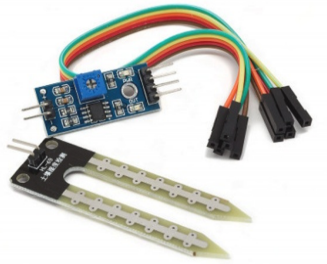


Fig 3: Moisture sensor

Algorithm for checking diaper wetness:
Step-1: Start the system.
Step-2: Keep checking if the baby's Diaper is Wet or Dry.

Step-3: If yes, notify the same to the parent (&nanny) via message.
Step-4: It also send message to parents (&nanny) that the baby's diaper is wet.

C. Temperature Detector Sensor

Figure 4 shows a sensor that measures the steady temperature change within the cradle. It notifies parents about the temperature change.

Fig 4: NTC Thermistor Temperature sensor

Algorithm for Temperature checking:
Step-1: Start the System.
Step-2: Keep checking the Temperature of Baby's surrounding.
Step-3: If yes, then check whether it changes with given range of temperature.
Step-4: If yes, then turn ON the fan
Step-5: It also sends temperature value to parents (&nanny) as a message alert.
Step-6: Parents can also turn On / Off the fan using the Android Application

D. PIR (Motion Detection) Sensor

In this system, this sensor aids in the detection of motion. It decides if the infant is sleeping or not. An alarm message is provided to the parent if any odd activity is noticed. The sensor diagram is shown in figure 5 below.

Fig 5: PIR sensor

Algorithm for Motion detection:

Step-1: Start the System.
Step-2: Check if there is any movement in the Cradle.
Step-3: If motion is detected, then check if the movement occurred continuously or frequently.
Step-4: If motion detected continuously then message to parents (&nanny) that baby is not comfortable.

Step-5: Else motion detected frequently then message to parents (&nanny) that baby is sleeping.

E. *Sound Detector Sensor*

This sensor, shown in Figure 6, aids in the detection of the baby's sobbing sound. It compares the baby's sobbing to a threshold level to determine whether he is crying because he is hungry or for other reasons. If the baby screams for an extended period of time above the time limit established by the parents, a notification will be sent to the parents or nanny.

Fig 6: Sound Detector Sensor

Algorithm for crying detection:
Step-1: Start the System.
Step-2: Check if there is any sound detected in the Cradle.
Step-3: If sound is detected, then check if the sound frequency is high or low compared to threshold frequency.
Step-4: If high then swing the cradle at gentle speed and play lullaby song and start playing animated video on display.
Step-5: Else frequency is low then message to parents (&nanny) that baby feels hungry or need attention and play animated video on display.
Step-6: It also send message to parents if the baby is crying.

F. *Piezoelectric Sensor*

Sensor in figure 7, is responsible for charging the battery. It will charge the battery using a voltage step up module. This will contribute to energy conservation.

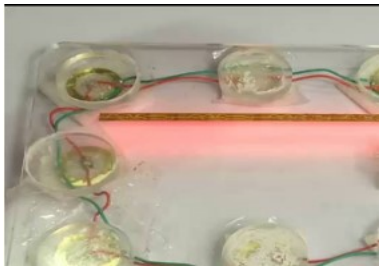


Fig 7: Piezoelectric sensor connection

Algorithm for piezoelectric sensor:
Step-1: Start the System.
Step-2: Check if the battery needs to charge or not.
Step-3: If it needs, then charge the battery by piezoelectric sensor.

G. *OV7670 CAM Module*

Figure 8 depicts a module that is used to keep an eye on the new-born via live video communication. In addition, this module is utilised to communicate with parents and nannies. Wi-Fi, Bluetooth, and a 2MP camera are all included in one module.

Fig 8: ESP32CAM Module

H. *MAX3102 Pulse and Oximeter Heart Rate Sensor Module*

Figure 9 depicts a sensor solution that combines a pulse oximeter and a heart rate monitor. It's an optical sensor that uses a photodetector to measure the absorbance of pulsing blood after emitting two wavelengths of light from two LEDs, one red and one infrared..

Fig 9: Max30100 pulse and oximeter sensor

Algorithm for piezoelectric sensor:
Step-1: Start the System.
Step-2: Check baby pulse and oximeter level.
Step-3: Then measured reading to parents through SMS alert system.

I. GSM Module

Figure 10 depicts a GSM module, which is a circuit that allows mobile phones and microcontrollers to communicate. It sends SMS, MMS, and voice messages through a mobile network. The GSM GPRS extension enables high data transmission rates. GSM uses the time division multiple access mechanism for transmission.

Fig 10: GSM 900A module

VI. REQUIREMENTS FOR ONLINE DOCTOR CONSULTING

6.1 Software Requirements:

- Windows Xp, 7,10
- SQL 2008
- Visual studio (any version)

Automatic cost calculation: The system computes the total fee for parking based on the user's chosen booking time.
Cancellation of reservations: Users may cancel their reservations at any moment by logging into the system.

Advantages of using online consulting system:

- There is no need to visit a doctor's office.

6.2 Hardware Components:

- Processor – minimum Dual Core
- Hard Disk – 50 GB
- Memory – minimum 1GB RAM

It may have occurred so many times that you or someone you know requires quick medical assistance but is unable to obtain it for whatever reason. The Health Prediction system is an online consultation and end-user support initiative. In this study, we present a system that allows users to obtain real-time health advice from an intelligent health care system online. Various symptoms, as well as diseases and illnesses related with those systems, are input into the system. In the event that the system is unable to deliver accurate findings, it advises users to have a blood test, an x-ray, or whatever report it decides is related to the user's symptoms so that they can post a picture of that report the following time they check in. A doctor login is now available on the system, and the uploaded images are being received. Users can communicate with the system about their symptoms and difficulties. It then looks at the user's symptoms to see if there are any illnesses related with it. To determine which sickness is most likely to be the cause of the patient's symptoms in this instance, we employ sophisticated data mining tools.
Modules:

- Admin Login: The system is overseen by the administrator, who also manages the reservations.
- User login and registration: Users must first register before they can log in.

The user can view the availability of appointments by clicking on spaces.

- Online appointment booking: Users may make appointments for the desired time and date.

- The user can discuss their disease and have live video interactions with doctors to obtain the necessary pharmaceutical prescription.
- Doctors can provide priority care in an emergency case until the patient can be brought to the hospital.
- The user can look for doctor's help at any moment.

Disadvantage of using online consulting system: Everything has some disadvantage so like this online consulting is also having:

- At least one doctor must be online to assist the patient, and a huge database is required.

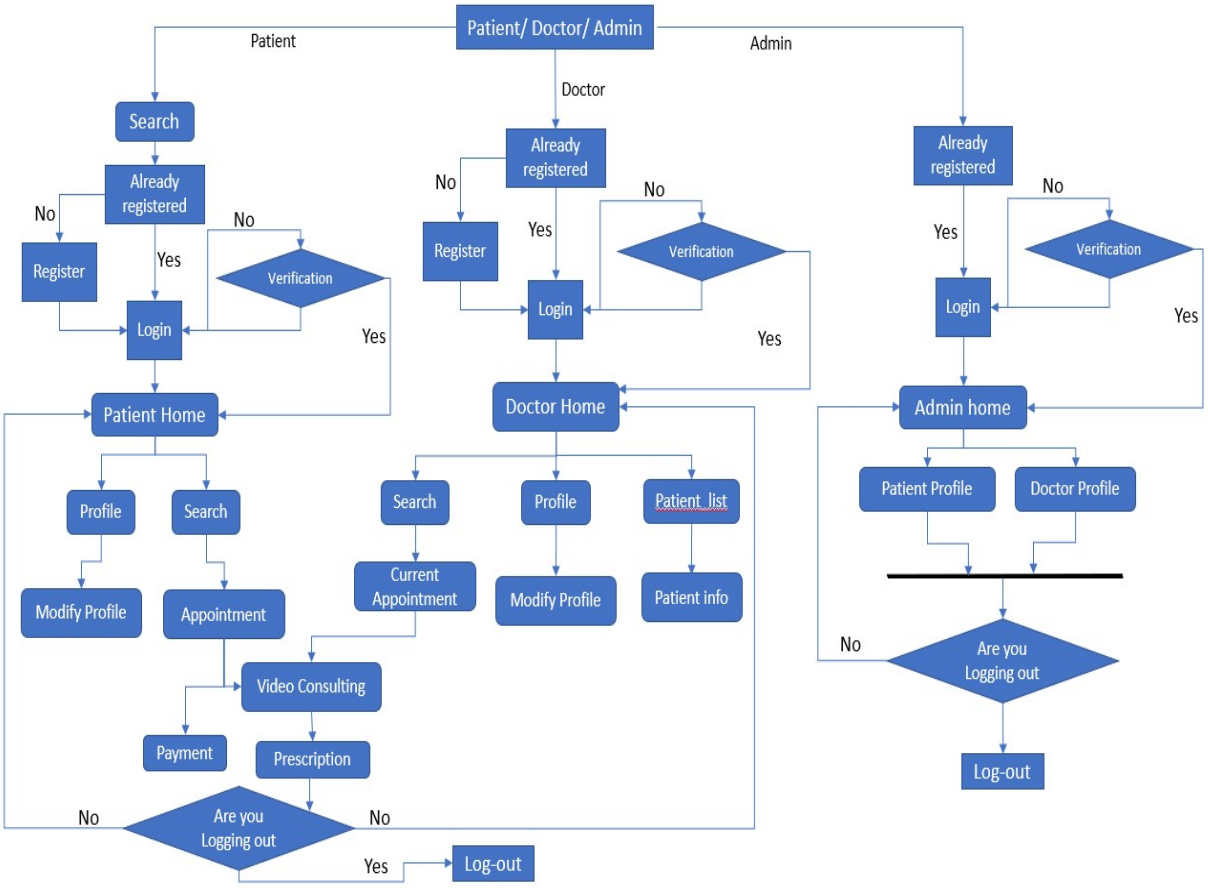
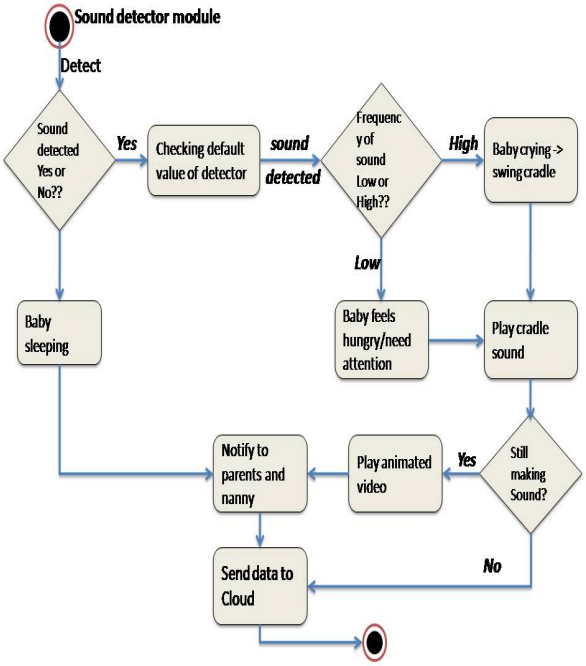


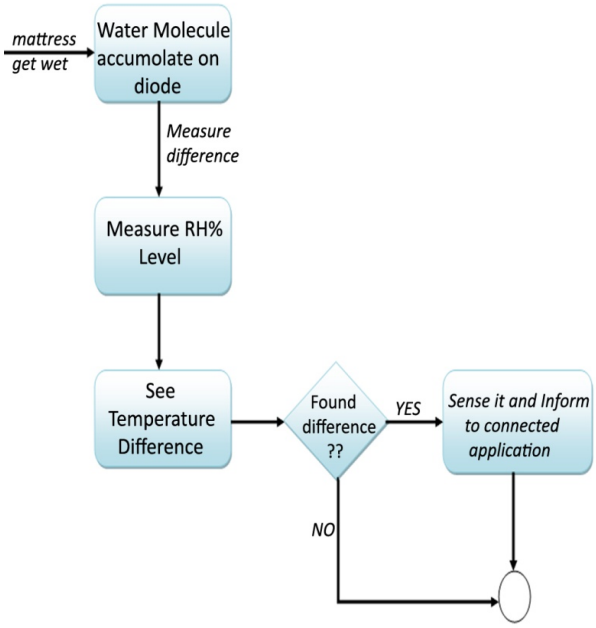
Fig 11: Flow diagram of online doctor consultation

VII. FLOWCHART OF SOME SENSOR USED IN THE PROJECT:

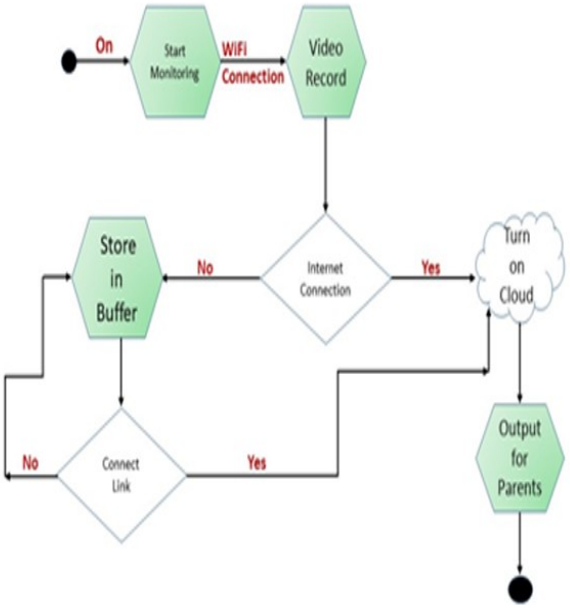
7.1 Flowchart of Sound detector sensor:



7.2 Flowchart of Wetness detector:



7.3 Flowchart of OV7670 cam module:



VIII. SAFETY PROCEDURE:

Babies tend to put things into their mouth. Sensors and other circuit components might contain compounds which are harmful if not poisonous. So, to prevent this we are giving a covering to the wearable sensor to prevent the harmful effect to baby if they put sensor in mouth. We are using components like latex, vinyl, and nitrile for making rubber type cover over the sensor through which sensor can work efficiently as well as save to use in baby cradle.

IX. COMPARISON

Our proposed system is far better than others available products and it is also going to available at very affordable price so that everyone can use it. The comparison table between our proposed smart cradle and smart cradle system shows that our proposed system is much better than the other one.

Table 2: Comparison table of our project with other work

Features	Our proposed smart baby cradle	Smart Cradle System [3]
Baby movement detection	✓	✓
Alarm system	✓	✓
Sound detector System	✓	✓
Temperature measurement sensor	✓	✓
Wetness detection sensor	✓	✓
Video player system	✓	×
Video monitoring system	✓	✓
SMS alert system	✓	✓
Music player system	✓	✓
Auto rechargeable system	✓	×
Heat rate measuring sensor	✓	×
Spo2 measuring sensor	✓	×
Online doctor consulting system	✓	×

X. FUTURE SCOPE

In a word, the project's future scope is around the preservation of information pertaining to:

- We can provide more advanced software for Doctor Appointment System, as well as additional features.
- Integrate numerous load balancers to distribute the system's loads
- Design the master and slave database structures to reduce database query overload
- Implement a backup mechanism to take regular backups of the codebase and database on multiple servers.

XI. CONCLUSION`

In order to emphasise the significance of Online health check-up Consultancy for all patients worldwide, a review of the literature was done. Additionally, the covid-19 system was created to assist patients in performing their own tests and receiving therapy for those who are afflicted. This system includes several guidelines to maintain everyone's safety and health. Lastly, more research is required to create v models for services and care. Along with a smart cradle with a baby monitoring system over IoT has been designed and fabricated to monitor a baby's vital parameters, such as crying condition, humidity, and ambient temperature. A smart baby crib has been designed and implemented based on several new technologies

XII. REFERENCE

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XIII. BIOGRAPHIES

Soumyadeep Ghosh born in Janai, West Bengal, India on April 02, 2002. Pursuing Bachelor of Technology degree on Electronics and Communication engineering from Guru Nanak Institute of Technology, West Bengal, India.
He recently a student of 3rd year, previously he published his paper in Prepare@4u, CCMNT-2022, and ICESD-2021 conference. He worked on nanotechnology, VLSI, robotics and artificial intelligence.

Mr. Ghosh received best paper presentation and best paper award in AICTE sponsored CCNMT-2022 conference. He also received a special award for being the department topper in college.

Soma Boral born in Kolkata, West bengal, India on March 29, 1985. She graduates from College of Engineering and Management,Kolaghat and studied from Haldia Institute of Technology, West Bengal. She further pursuing her Phd degree from Maulana Abul Kalam Azad University, West Bengal, India.

Her employment experience includes the assistant professor of Guru Nanak Institute of Technology, West Bengal from February 22,2010 to till date. Her special field of interest include MIMO Ad-hoc network.
Ms. Boral received Grant from UGC for Research Project on Analysis of the Impact of Channel Noise on MIMO ad Hoc Network Utility Maximization for QoS provisioning of 2years duration, received on March 18, 2014.

Arun Kumar Mondal born in Behala, Kolkata, West Bengal. India on December 31, 1962. He gradutes from University of Calcutta, West Bengal and further studied and complete PhD degree from Jadavpur University, West Bengal.

His employment experience includes the Sonodyne Electronics Co. Pvt.Ltd., and Bells Control Ltd. He also a lecturer in Murshidabad College of Engineering and Technology from 4.5 years and he currently a professor and head of the department in Guru Nanak Institute of Technology.
Dr. Mondal special field on interest includes Radiophysics and Electronics and Communication.