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Smart Child Monitoring Device (S-Cmd)

Pushpendra Kumar Pateriya
School of Computer Science & Engineering
Lovely Professional University, Phagwara, Punjab
Pushpendra.mnnit@gmail.com

Dr. Parminder Singh
School of Computer Science & Engineering
Lovely Professional University, Phagwara, Punjab
Parminder.16479@lpu.co.in

Jitesh R U
School of Computer Science & Engineering
Lovely Professional University, Phagwara, Punjab
jiteshudaya18@gmail.com

Shivam Gumber
School of Computer Science & Engineering
Lovely Professional University, Phagwara, Punjab
shivammaangumber@gmail.com

Abstract—In this era most of the families are nuclear family, and husband wife both work to cope up with the needs of family. So it becomes tough for the parents to monitor their baby or infant all the time. In such a situation working parents hire a babysitter and pay a handsome amount of salary to her. Parents want to monitor babysitters also because they do not trust them completely. Few of the baby monitoring tasks (i.e. ambience monitoring, skin temperature monitoring, strangers' recognition, abnormalities monitoring, and instant alert generation etc.) can be done using IoT enabled technological solutions. In this paper we have proposed a smart child monitoring system which can monitor a baby effectively, can generate instant alerts and save baby health related data on cloud for further analysis.

Index Terms—Child Monitoring, IoT, Child Safety

I. INTRODUCTION

Acommon problem, the parents have to face is to take care of their babies or toddlers. They cannot pay proper time for their babies. Babies require 24×7 attention of their parents, which is a bit difficult for working parents.

With present, female assistance of the efforts energy in the industrialized countries has unbelievably expanded, appropriately influencing new born kid care in several households. Both the guardians have to work due to the substantial cost of living. Notwithstanding, despite all they've to take care of the kids of theirs, by doing this growing exceptional burden as well as worry, especially of the mother. Working guardians cannot usually consider the infants of theirs. They often send their kids to the relatives or family memberslike parental figure while they're working. A number of guardians pressure with the health of the kids under the careful eye of others. Appropriately, they return home to always keep a watch on the kids throughout their spare time, for example, coffee or lunch break.

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An infant checking framework which could screen the children's state constant is recommended taking proper care of these problems.
The prototype model of the room contains a movement sensor, gas sensor, voice recognizer and other electronic devices connected to Arduino. The room appliances are working with coordination of sensors and Arduino.
Parents can setup the electronic devices to work according to the conditions they have given, and they can control these devices by their mobile phones even when they are away from the baby room.

This particular device, a SmartChild Monitoring System using IoT which is going to assist the parents with checking the child regardless if they're away from home and determine each activity of the Baby from any far off corner of the globe. It's an innovative, defensive and savvy monitoring system to allow for a new born kid in an effective fashion.
This particular device considers all of the subtleties needed for baby monitoring and ensures a timely messaging/alert system to support the baby.Smartness/intelligence developed in the proposed model with the utilization of innovations/philosophies which include Internet of Things (IoT) (Modules as Arduino UNO, Temperature and Humidity detecting), Cry Detecting Mechanism, Live Video Surveillance, Cloud Computing (Data Storage) and user-friendly Android application (for User Controls). Therefore to distinguish each movement of Baby, different Sensors/Modules are actually linked to aCradle: Temperature and Humidity Sensing Module for sensing the wetness of the bed, a Camera with the Cradle for live video film as well as Cry Detection Circuit to record and store Cry Patterns. Every bit of the information that is been taken from the sensors/modules will be storedon Cloud (Firebase) and broke down at regular interims.
All together this is a good platform to make an automatic baby care room.
The prime objectives of thedesigned system areas follows:
a) **To monitor ambience and air quality of the room:** The ambiance and the air quality of the room play an important role as the environment of the room must be comfortable and accurate as per the children adaptive nature. This project will enable to maintain and suggests the lightambience of the room and also it will check the air quality as smoking can be injuries to child's health and thus the smoke detection is necessary and if it will detect any smoke than it will give the notification or alarm alert to the parents.
b) **Regular monitoring of skin temperature/fever:**Baby's cannot express their feelings and thus we can't know that when they are feeling cold or hot, they generally cry to communicate and express themselves. This project will providea real time skin temperature monitoring and alerting system.
c) **Remote surveillance through camera controlled by mobile or WebApp:** The proposed system enables the parents to monitor the child through the camera because it

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will give them more satisfaction.Nowadays the camera plays a crucial role in terms of safety and enables us to survey through mobile app.

d) **Stranger recognition inside the room:** Generally it is noticed that the baby feels uncomfortable with the strangers and crimes against children like kidnapping are increasingday by day, to avoid this situation and in order to protect child the child monitoring system will work actively, if the camera detects any stranger it will buzz the alarm and send the emergency message(s)/notification(s) to all the emergency contacts.

e) **Regular health patterns recording and abnormalities monitoring:** The health of the baby will be monitored regularly by the system. It will be followed by sensing the temperature, the baby's sleep and monitoring etc. If any abnormalities are noticed than the system will send the notification to the parent.

f) **Data analysis through web application (multiple usersupport):**

Sleeping pattern of the baby will be plotted in the form of a graph using the data retrieved. The diet time and schedule will also be monitored accordingto the data analysis which will be done through mobile application.

g) **Instant Alert through SMS/notification on the Application:** In any emergency situation or if any abnormalities found the smart child monitoring system will instantly send the alert message, email and notification to the parents.

II. LITERATURE REVIEW

For parents continuous active monitoring of their kids is an important task. There has to be an eye to monitor a baby all the time.This is very sensitive and important issue. Therefore, many models have been proposed in recent past. Few of them are based on video surveillance alarming/monitoring systems, good supplement to the children care. [9]

Recent advances in Internet of Things (IoT) provideenough support todesign advanced devices or accessoriesas a viable solution for the real-world problem of child monitoring.[2]

It has become increasingly difficult for parents and/or guardians to monitor a single child or groups of children by human effort alone.[4][5]

There are many artificial intelligent enabled devices available in the market.

Allb [10], a wise wearable device for baby is available in the market. It is a hand band with screen that uses the soaring IoT development to interface you anyplace, any time.Originally made with paediatrician, allb allows you and your family to figure out the condition of your kid constantly through your smart phone as well as cautions you when something happens unusual. From zero to two years, you can make use of allb to advantageously figure out the condition of the baby.It liberates you from anxiety, which means you are able to focus on buying a charge out of the time with your kids.

Allb can also screen the breathing of your child and sends a caution to your mobile phone if the baby's breathing becomes abnormal.

TigerEye T1 is also one of the portable baby monitoringdevices with a security alarm system built-in. The TigerEye T1 from TigerTech installs in less than 2 minutes and provides real-time

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720P HD video of your baby from your nursery, direct to your phone. Its powerful motion & sound sensors alert you when your baby wakes up or starts to cry, and its speaker and mic allows you to hear every sound your baby makes and speak to your baby or play lullabies remotely. The Portable TigerEye T1 allows you to simply unplug it and move it any other room in your home along with your baby. But these devices are costly enough and most of the parent may not be able to afford it.

There can be a cost effective solution designed to provide effective smart baby monitoring device.

One of the primitive tasks of the product is to detect the motion of the baby's body, it can have been done using a PIR sensor.

PIR sensor is a sensing device that generates the output in 0 and 1. The efficiency and speed of it are very high it generates very little amount as compared to other available solutions in the market. [3]

Installed video camera, on the other hand, can capture the movement and or occurrences of events for later playback. PIR sensor activates the camera when it detects motion; the camera starts then and records the scene. Raspberry pi device generates alerts to the owner of a possible intrusion having a display on the screen and sends an alert.[6]

A critical situation of a high fever, if parents get to know high fever a little later where manual monitoring is planned then it can lead to serious consequences, but this device senses the baby's temperature and generate instant alerts to the parents.

Using such devices parents can monitor the body temperature of the baby 24 hours especially at nights. [1]

A desired baby monitoring system for a parent is that senses temperature, heartbeats, and body movement accurately. Author has proposed such a device in [8].

III. PROPOSED SYSTEM

Wise Baby Monitoring System is a solution which is going to help parent to monitor the babies of theirs from remote location. It's an innovative, protective and smart Cradle System to nurture an infant in an effective manner. This particular process considers all of the small information necessary for the attention & safety of the Baby of the cradle. The style of smartness & originality comes with the usage of technologies/methodologies which include Internet of Things (IOT).

To identify each & every activity of Baby, various Sensors/Modules are actually connected to the Cradle: Temperature and Humidity Sensing Module for detection of Wetness of the bed, A Camera in addition to the Cradle for live video footage.

Hardware Used:

The Hardware Consist of various components. Various components are assembled on a cradle and these all component make it a complete system.

Various components used are:

- **Arduino UNO R3:** The Arduino Uno is actually an open source microcontroller board resolute by the Microchip ATmega328P microcontroller and formed by Arduino.cc. It is

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equipped with sets of simple and computerized input/output pin which may be interfaced to various extension sheets as well as various circuits.



Figure 1 Arduino UNO R3

- Temperature Sensor (LM 35 or DHT: It is used to measure the temperature of the baby cradle. It can be interface with any microcontroller like Arduino, Raspberry Pi etc.

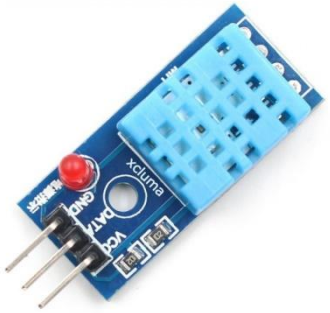


Figure 2 Temperature Sensor

- **PIR Sensor:** A passive infrared sensor is a sensor that estimates infrared light emanating from objects in its field of view.



Figure 3 PIR Sensor

- **Sound Sensor:** It is used to detect the intensity of sound in the room.

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Figure 4 Sound Sensor

- **Air Quality Detector Sensor:**When the air is clean the air quality detector sensor demonstrates low conductivity. If the target flammable gas exists around the sensor, then the sensor demonstrates higher conductivity along with the gas concentrationrising.



Figure 5 Air Quality Detector Sensor

- **Raspberry pi 2B plus:** The Raspberry Pi is an ease, credit card. It can do all that you'd anticipate that a work station should do, from perusing the web and playing superior quality video, to making spread sheets, word-processing, and playing games.



Figure 6 Raspberry pi 2B Plus

- **Moisture Sensor:** it is a straightforward water sensor can be utilized to recognize dampness when the dampness shortage module yields a significant level, and the other way around yield low. Utilize this sensor delivered a programmed plant waterer gadget, so the plants in your nursery without individuals to oversee customizable affectability blue advanced potentiometer alteration. Working voltage 33v-5v module double yield mode, the advanced yield is straightforward, increasingly precise simple yield a fixed jolt opening for simple establishment.

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Figure 7 Moisture Sensor

- **Node MCU:** It incorporates firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and device which depends on the ESP-12 module. The term "NodeMCU" as a matter of course alludes to the firmware as opposed to the advancement units. The firmware utilizes the Lua scripting language. It depends on the eLua Project, and based on the Espress if Non-OS SDK for ESP8266. It utilizes many open source ventures, for example, lua-c json.



Figure 8 Node MCU

The Designed Software/Middleware:

The Application has an interface to get information regarding baby's cradle like room temperature, moisture etc. The first page has Login and Signup options.

- Sign up– A pop up dialog box will appear on clicking the Sign-Up button. It will ask for the username, password and email. It also some validations for the fields and checks whether the user is existing or a new one. It will prevent existing users from signing up again. The verification link is also sent after the user has successfully signed to their given email account.
- Log in – A pop dialog box will appear which will ask for the username and the password which the user has already set. If the user has forgotten the password, then the option for forget password is also there. A link will be sent which will provide an interface to reset the password.
- Dashboard: A graphical user interface provides information regarding, critical records observed. It has graphs to show values of temperature humidity and smoke of room on particular date at particular time.

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- Baby Cam: It is used to live updates of baby using camera which is fixed in cradle.
- Moisture: It shows t the moisture readings in the diaper and alert by notification when it crosses the fixed threshold.
- Sound: It shows the sound readings of baby like crying sound in the cradle and give alert by notification when it crosses the fixed threshold.
- Temperature: It shows the temperature readings of the cradle and gives alert by notification when it crosses the fixed threshold.
- Motion Detection: It shows the motion detection readings of baby when he makes movement in the cradle.
- Smoke: It shows the smoke readings of the cradle and give alert by notification when it crosses the fixed threshold.
- Humidity: It shows the humidity readings of the cradle and give alert by notification when it crosses the fixed threshold

System Design

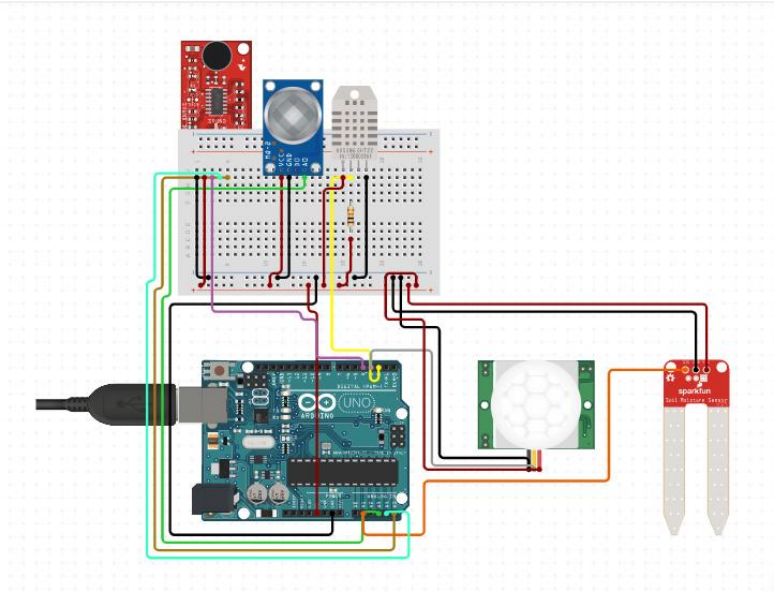


Figure 9 Connection Diagram of the Device



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Figure 10 Designed Device

Product Definition

This Product, a Smart Child Monitoring System utilizing IOT which will assist the Parents with monitoring their kid regardless of whether they are away from home and distinguisheach movement of the Baby from any far off corner of the world. It is a creative, shrewd and defensive Monitoring System to sustain a newborn child in a productive manner. This framework considers all the moment subtleties required for the consideration and insurance of the Baby in the support. The plan of savvy and advancement accompanies the utilization of advances/procedures which incorporate Internet of Things (IoT) (Modules as Arduino UNO, Temperature and Humidity detecting), Cry Detecting Mechanism, Live Video Surveillance, Cloud Computing (Data Storage) and User Friendly Web program (for User Controls). Therefore as to understand each activity of Baby, different Sensors/Modules are actually appended to the Cradle: Temperature and Humidity Sensing Module for location of Wetness of the bed, A Camera with the Cradle for live video film as well as Cry Detection Circuit to break down Cry Patterns. Every one of the info that is been taken as a result of the sensors/modules will likely be put away in Cloud (Thing Speak) and examined at regular interims. A Health Algorithm is used to these datasets to obtain info about the body situation that is helpful as any regular side effects of a malady could be distinguished efficiently.

IV. EXPERIMENTAL RESULTS

The following results are achieved:

1) Ambience of the room is monitored by smoke sensor, humidity sensor and temperature sensor. The sensors readings data is stored in firebase database. The alert is generated by web application through notification.

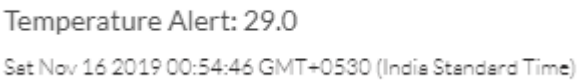


Figure 12Notification of temperature

2) Moisture of baby's diaper is measured by moisture sensor. If the sensor reading is below 500 it generates an alert using SMS saying critical value is observed. This SMS is an indication that a baby check is required.



Figure 13 SMS alert of moisture

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3)Remote surveillance through camera using web application which enables parents to monitor their child without being present and keep a check on child whenever they want.

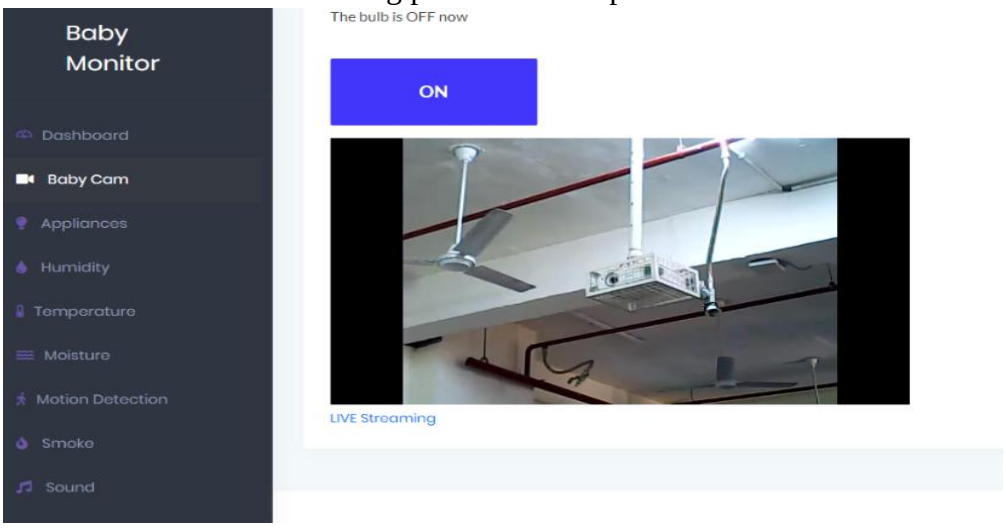


Figure 114Baby cam

4) Motion detection of baby by PIR sensor. An alert is generated whenever baby make any movement and it is notified to the parent through web application.

Record ID	Device	Status	Time	Value
-LsXii-0ioYK_LcLCZI4	Motion Sensor	Critical	Thu, 31 Oct 2019 17:51:33 GMT	1

Figure 15Motion Detection Records

5)The baby cry detection is achieved using LM358 sound sensor. If value of sensor reading is above threshold value i.e. 35, it notifies the user using application.

1	Sound Sensor	critical	Sat Nov 16 2019 15:04:55 GMT+0530 38 (India Standard Time)
1	Sound Sensor	very critical	Tue Nov 19 2019 09:51:43 GMT+0530 192 (India Standard Time)

Figure 16 Critical records

6) Graphical representation of last 5 sensor values with their date and time is shown on home page of the web application.

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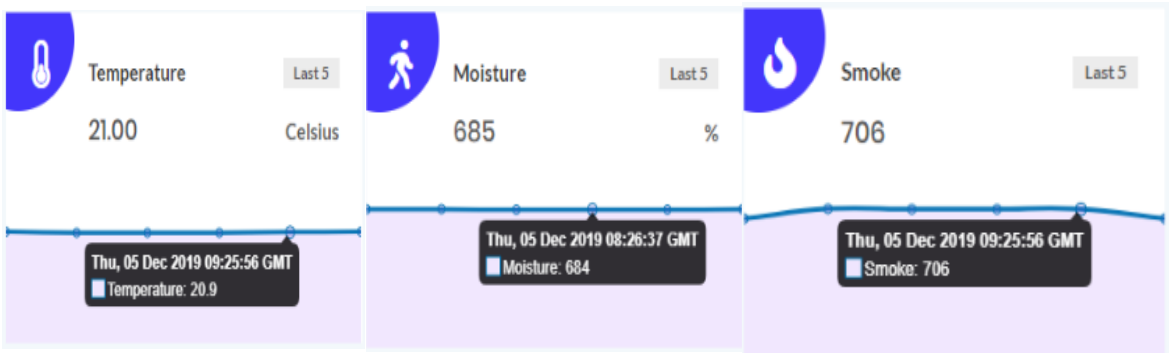


Figure 17Graphical representation

V. CONCLUSION AND FUTURE SCOPE

The designed device is effective enough to meet the set requirements of a proactive baby monitoring system. Results have been shown in previous section.

Despite its wide use, our system could be improved in following ways:

- More sophisticated sensor readings.
- System latency can be increased.
- More secure data in the current system.
- The specifically designed sensor could be used.
- The server can handle a more number of users.
- Range of the sensors can be improved
- Accuracy can be increased.

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