International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 03 | Mar 2021 www.irjet.net p-ISSN: 2395-0072

IOT BASED BABY MONITORING SYSTEM USING RASPBERRY PI

JIM MATHEW PHILIP[1], SATHYA M[2], VISHAL S[3], NAVEEN K[4]

[1]*Assistant Professor, Department of CSE, Sri Ramakrishna Institute of Technology, Coimbatore, Tamil Nadu, India*
[2,3,4]*Students, Department of CSE, Sri Ramakrishna Institute of Technology, Coimbatore, Tamil Nadu, India*

Abstract - *This project proposes the idea of automatic caretaker room for a baby. The main motive of this idea is to save time and energy of very busy parents. Working people are very busy these days. They do not have enough time to properly take care of their babies. So, the whole room is set up as it can sense the activities of the baby and work according to requirement. Parents can save their time and energy as they don't have to go and check their baby again and again until they don't get any information about baby. The idea of this scenario is accomplished by using sensors and a microprocessor. The sensors attached to the microprocessor sense the room condition and also monitor the activity of the baby. It works based on the condition we apply to it. Entire data will be visible to the user and get notified about the status of the baby*.

Key Words: IoT, *Automatic caretaker room,* Raspberry Pi, Web camera, Temperature, Microphone.

1. INTRODUCTION

In recent times, with the IT sector boom, and the emergence of nuclear families and the capitalistic world requiring both the parents to be a part of the workforce, maintenance of a work-life balance, having a family, and raising a kid have become formidable tasks, requiring humongous effort. The process of having and raising a baby is faced with many difficulties, and with the busy world around it's hard even to assign a full time or part time baby sitter. Baby care has become a task for large number of millennials. The baby monitoring system is equipped with sensors that monitor the levels of humidity and temperature, the presence of poisonous gases, presence of flame, smoke. The system also senses the presence of a third person in the room or in the baby's proximity. The system also detects if the baby is uncomfortable and plays sounds to sooth the baby. The limitations of the existing system range from being slow, to not having real time updates are all taken care of in this baby monitoring system. The system has a live video and audio relay to the parents and the parents are also provided with the master control of turning on or off the system. This System has a Raspberry pi at its heart to which all the sensors are tethered. This System can be effectively put into use for shorter periods of time when the baby is asleep or doesn't move much.

2. LITERATURE SURVEY

Harshad Suresh Gare et.al., [1] author proposed a system which is used to monitor whether the baby is crying or not. This system has various sensor such as Sound sensor, DHT11, Wetness sensor, PIR, LM35, Gear motor, GSM module all are controlled by the Arduino microcontroller. Sound sensor is used to detect whether baby is crying or not. If baby is crying gear motor is used to swing the cradle. Wetness sensor is used for finding wetness. Addition to this, system has the ability to monitor baby body temperature, room temperature and detect the motion of an object by using PIR sensor. All the data from various sensor is collected from the sensor and transferred to the controller. If baby cries or cradle is wet alert message is sent to parents by using GSM module. Limitation of this system are there is no camera attached to this system, so parent cannot see the baby movement.

Toshaljeet Kaur et.al., [2] author proposed a system which uses various sensors and a microcontroller. This system uses PIR sensor to monitor the movement with the particular range. Here Gas sensor is used to detect smoke, methane and other dangerous and flammable gases. It is an analog gas sensor. Microphone module is used to detect the sound and gives a digital input to Arduino. All these data are passed to Arduino microcontroller and processed. if anything happens alert message is passed to the parents by using GSM module. This system uses entire room to monitor the baby. This system has some drawbacks such as this system don't have camera to record the activity of a baby. This system does not check the wetness of the baby.

Savita P. Patil et.al., [3] author proposed a system which monitors baby temperature, pulse rate, Moisture and its movements using various sensors. All those sensors connected to microcontroller and GSM module. Two pairs of copper electrodes are placed under the baby's bed to detect the moisture. The temperature sensor and motion sensor are position in the shock of a baby. The output from all the sensors is displayed continuously in LCD screen. Pulse rate sensor is measured from the baby finger using optical sensor. If the bed moves or if the baby moves away from the bed or move the sensor from the finger the system will not work properly.

It will be uncomfortable for the baby to sleep with these sensors. Alert message is sent when the baby is in danger.

Aslam Forhad Symon et.al., [4] author proposed a system which monitors the baby activity and ensures the safety. This system can detect the baby's motion and sound; especially crying and video output of baby's present position can be displayed on a display monitor so that the parents can see the activity of the baby. They don't need to stay near to the baby. This system is also powered by raspberry pi which controls all the sensors attached to it. This system has cry detection and motion detection. MIC is used to detect the baby crying and PIR sensor is used to find the moment of the baby. This system has PI camera which gives us the video of the baby. This proposed system can provide an easier and convenient way for busy parents in terms of taking care of their babies.

Prof.P. Rekha et.al., [5] author proposed a system which consist of various sensors such as the moisture sensor, the temperature sensor and the sound sensors are used which senses the wetness, temperature, and the sound, this data either weak signal get amplified through the amplifiers this data gets stored in the raspberry pi and gets processed. In addition, this system is given with web camera which provides the live video of the baby. LCD display is used here to display the sensor values and WIFI sever unit provides a live update. All the sensor values are shown in web page. To provide additional support the buzzer unit is used which consists of the RF Transmitter, Receiver, Encoder Decoder and an Alarm. Trough cloud forecasting and Wide Area Network the resulting data of the baby conditions can be monitored using web applications and also can control the situation from a remote area anywhere from the world.

Rachana Palaskar et.al., [6] author proposed a system which swings automatically when baby cries, it has a cry analyzing system which detects the baby cry voice and accordingly the cradle swings till the baby stops crying. The cradle swings right rotate in right-handed direction for three seconds and then in anticlockwise direction for three second. If mattress is wet or the cries continuously then parents get intimated that baby needs attention by sending message. The baby is monitored by web camera and the parent can have video recorded activity of the child. It detects facial expressions (sleeping, dazing, crying and laughing), temperature and automatically sends message about baby is safe or not.

Madhuri P. Joshi et.al., [7] author proposed a system which supports video monitoring. This system swings the cradle when baby cries. This happens for some time and the cradle stops and again check for the baby sound. Alert message is sent to the parents if baby cries continuously. Rotating Toy is attached to make baby calm. Baby cradle is a bed for an infant which sways as it is connected to motor. Noise Sensor is used measures the intensity of sound. Signal Conditioning id used for Amplification of electrical signal. Moisture Sensor, Buzzer, Driver Circuit and motor is also used. Android application is used for monitoring the baby movements.

Dina M. Ibrahim et.al., [8] author proposed a system which monitors the baby using raspberry pi device. This system shows the live video and play some audio and room temperature and humidity is also detected in this system. A TensorFlow open-source library based on machine learning used for sleepy or awake feature. Cry detection feature is used in which the pain score must be within range 0.02 (68%) to 0.01 (89%) to results that the baby is crying. Firebase Real-time Database stores and synchronizes the measured data with NoSQL cloud database.

3. EXISTING SYSTEM

There are few existing products like Intelligent baby cradles those products are a kind of conventional model where they use a constant mechanism to soothe the baby's distress. The method of swinging the cradle follows an East to West mechanism which leads to Shaken Baby Syndrome. This creates a shearing and tearing motion between the tissues of the white matter and grey matter of the brain serves as the major cause for the damage of Intelligent quotient and cognitive function. Many existing baby monitoring systems in the market are not comfortable and they are costly so it is not affordable by all the people and the system developed for the entire room has some drawbacks. It does not have live video footage. The parents can only get text message if anything happens. Most of the system are wearable it makes child to feel uncomfortable and this disturbs the baby from sleeping. The existing system mainly focus on the cradle part. This system will be helpful for the baby below 2 to 3 years. Existing system has various advantages and disadvantages.

4. PROPOSED SYSTEM

In our proposed system we have used lot of sensors to monitor the activity of the baby. Sound detection sensor detect the baby sound which is similarly to our Ears. However, what's different as that a sound sensor consists of an in-built capacitive microphone, peak detector and an amplifier (LM386, LM393, etc.) that's highly sensitive to sound. LDR sensor used to sense the light intensity present inside our room. If room does not have sufficient light then the LED will be turn on to

prevent baby from crying. A Gas sensor is used to sense toxic gas presence in the room, if any toxic gas present inside mail will be sent to the parents. Another important and common sensor in the monitoring system is the Camera. The Baby Monitoring system checks for the room temperature or the temperature around the baby, and if the temperature exceeds a threshold of 40, it sends a notification to the parents in the form of a mail. If the temperature is below the threshold limit it keeps on checking the temperature regularly. The System also keeps a live tab of the sound around the baby, if the baby is sensed to be crying, the system plays audio/music to soothe the baby, and also sends out a notification to the parents. All the texts / alerts are sent to the parents so that they can check on the baby through the live video feed, and act upon it even if the system fails. Whenever a particular sensor detects something, a proper mail / alert is sent to the parents or guardians so that they can act accordingly. Also, there is always a live video feed of the baby, which helps in further assurance of the wellbeing of the baby. Fig -1 shows the block diagram.

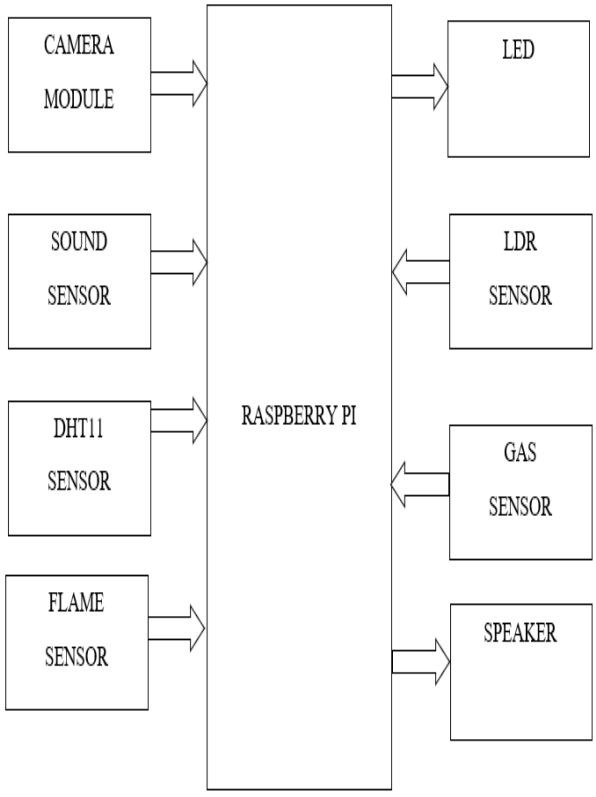

Fig -1: Block diagram

5. WORKING PRINCIPLE

The baby monitoring system has a raspberry pie at its heart. The various sensors such as the temperature and humidity sensor, flame sensor, gas sensor, PIR and LDR are all connected to the raspberry pi. There is also the camera which is used to relay the live video feed of the baby to the parents. The mic in the system senses if the baby is crying and plays sounds or music to sooth the baby if its crying. The various sensors in the system altogether help in monitoring the safety of the baby. The gas sensor senses the presence of toxic gases in the atmosphere around the baby. The LDR is used to maintain the light intensity around the baby, the red light in the system turns on if there is no sunlight detected. The flame sensor helps in detecting any possible flame or smoke in the room. There is always a live video and audio relay to the parents which helps in monitoring the baby. The parents can also turn the system on or off at their convenience.

5.1 Raspberry Pi

Fig -2: Raspberry pi

From Fig -2, raspberry pi 3 is used in the baby monitoring system. The raspberry pi 3 is equipped with a quad code 1.4 GHz Broadcom processor and a 1 GB RAM. It also comes with a camera port for connecting a raspberry camera, and also a full-sized HDMI port for connecting HDMI peripherals. The raspberry pi 3 comes with a DSI port for connecting a touch screen system, and a 100 base ethernet and a micro-SD port for loading an operating system and storing data.

5.2 Camera module

Fig -3: Camera

From Fig -3, A web camera is a device that captures images, video and relays the captured info to another person, device through the internet. The images are captured in real time using Charge coupled detectors (CCD) and transmits the data almost instantaneously, as there is no memory to store the data. The captured image is converted into JPEG and transmitted across the internet using FTP.

5.3 Light Dependent Resistor

Fig -4: Light Dependent Resistor

From Fig -4, A LDR is a light dependent resistor, also known as a photoresistor or a photo conductive cell that changes its resistance when light falls on it. Using LDR the light intensity in the room is monitored, if the light intensity drops too low, the system turns on its light.

5.4 DHT11 sensor

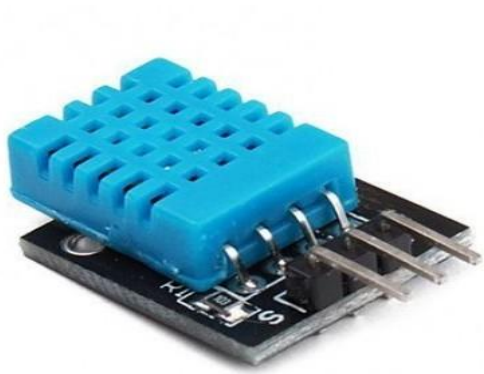

Fig -5: DTH11

From Fig -5, The DHT11 sensor is used to monitor the levels of humidity and temperature in the room. The temperature is measured by this sensor and is converted into electronic data, to monitor the alterations and changes in the temperature and humidity. DHT11 has an accuracy of 2 degree and its temperature value between 0 to 50 and humidity of 20 to 80% which has 5% accuracy. This sensor is connected to raspberry pi and processed.

5.5 Gas sensor

Fig -6: Gas sensor

The MQ-6 can detect gas concentrations anywhere between 200 to 10,000 ppm. This sensor is highly sensitive and has a fast response time. The sensor's output is an analog resistance. The working mechanism is very simple, the heater coil is powered with 5V, a load resistance is added, and the output is connected to an ADC. MQ-2 presents itself with difference in values to various kinds of gases and various concentration gases. So, when using this component, the adjustment of sensitivity is necessary.

5.6 Flame sensor

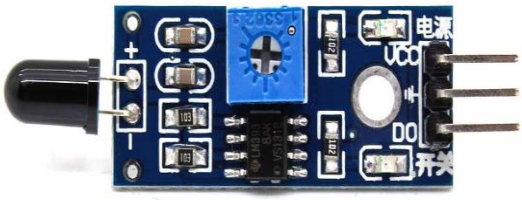

Fig -7: Flame sensor

From Fig -7, A flame detector sensor is used to sense the presence of smoke or flame in a room on detection of a flame, the sensor can either set off an alarm or, close a valve, or this sensor is even used to know if a flame is burning inside of some complex industrial machinery. A flame sensor can usually detect a flame or smoke faster than a smoke detector because of the mechanisms

5.7 Sound sensor

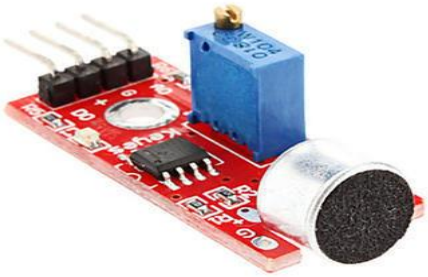

Fig -8: Sound sensor

From the Fig -8, sensor is used to detect the amplitude of sounds. The sound sensor provides an easy way to detect sounds around it and is generally used for detecting the intensity of sound. The system consists of a microphone, an amplifier, peak detector. When the microphone detects a sound, it processes an output signal voltage which is sent to an IC, raspberry pi in this case, which converts the input audio signals to electronic signals for processing and monitoring.

6. RESULTS

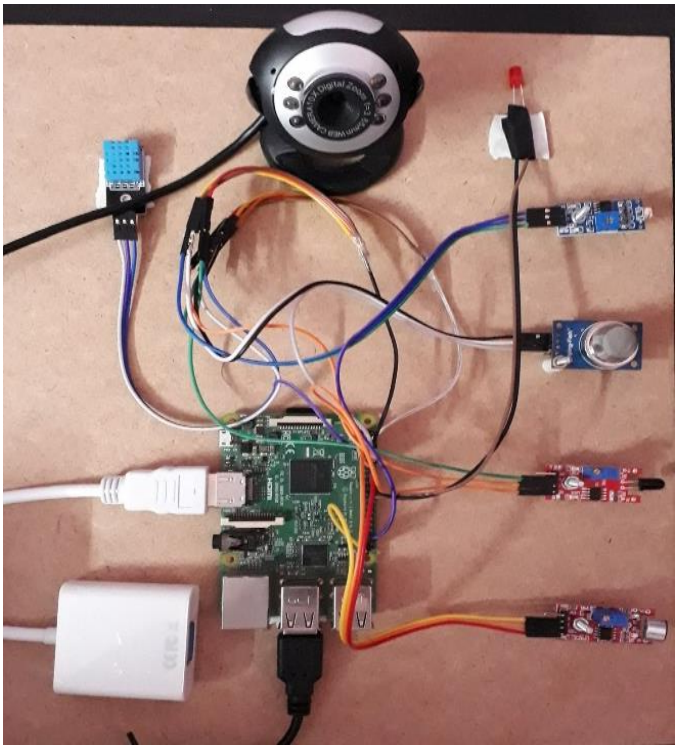

Fig -9: Hardware setup

Hardware components are arranged and connected to work in a successful manner. The hardware arrangement setup is displayed in the Fig-9. Sound sensor is connected to raspberry pi with the help of jumper wires. Sound sensor has three pin GND, VCC, Digital output pin these are connected to GPIO pin present in raspberry pi. Flame Sensor has 4 pins, three pins such as VCC, GND and digital output pin is connected to the respective GPIO pin in raspberry pi. Gas sensor also has four pins in which three of them is connected to raspberry pi to power the gas sensor and to get the readings. LDR sensor has three pins two of them for the power and one for the digital output and based on the reading the LED will turn on or off. LED is connected to the GPIO pin of raspberry pi. DHT11 sensor has three pins to transfer data to the raspberry pi and for powering the sensor. Monitor is connected to the HDMI port present in raspberry pi. We can use HDMI to VGA, by using a HDMI to VGA adaptor. Keyboard and mouse are connected to navigate through UI. RJ45 cable is plug to the raspberry pi in order to provide an internet connection.

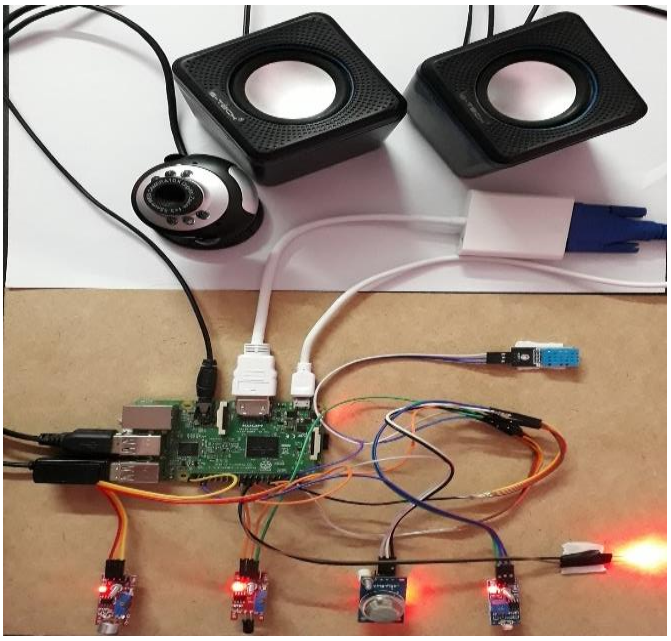

Fig -10: Working model

In the Fig -10, entire setup is configured and powered up with the raspberry pi power adaptor. Raspberry pi has a small LED which will turn on to indicate that raspberry pi is in working condition. All the sensor attached to the raspberry pi will get turned on. Red colour LED will be turned on to indicate that sensors are in working condition. When the program is executed the LED will be turned on or off based on the condition we apply to the raspberry pi. Music will be played when sound sensor is Sense the sound and play for some time. Again, it will start to detect the sound from the baby.

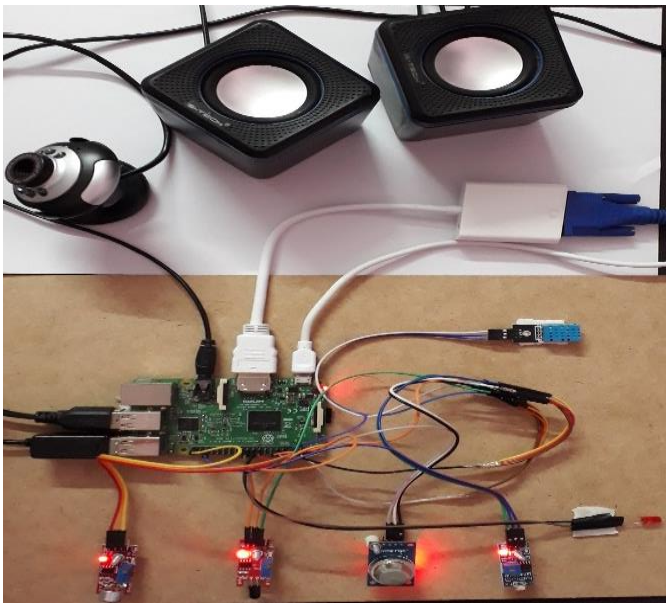

Fig -11: LDR Working model

LDR sensor attached to the raspberry pi sense the light intensity present inside the room and if the light present inside the room is not sufficient then the LED will get turned on. From the Fig -11 The LDR sense the light intensity and turn off the LED. As room has the sufficient light. From this we can prevent from baby crying or prevent from baby getting scared.

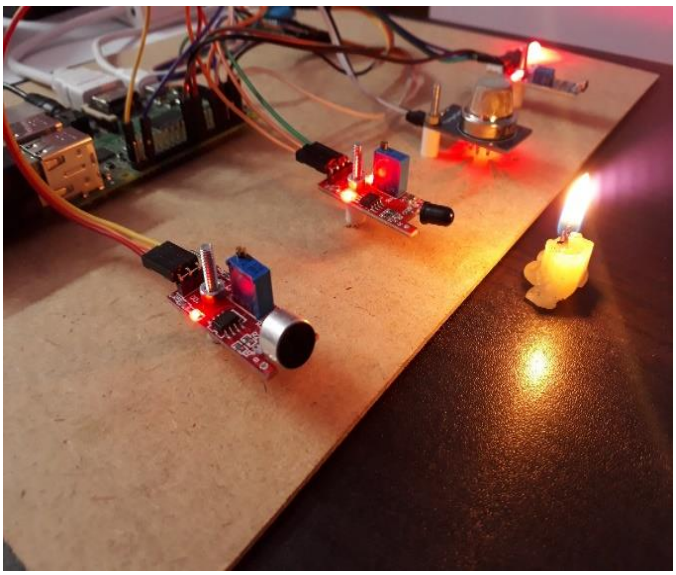

Fig -12: Flame detection

In the Fig -12 fire detection sensor is tested with candle. The candle is played Infront of the Fire detection sensor. The sensor detects the fire and send an alert message to the parents. This will help the parents to get notified if the any fire accident happened in the room.

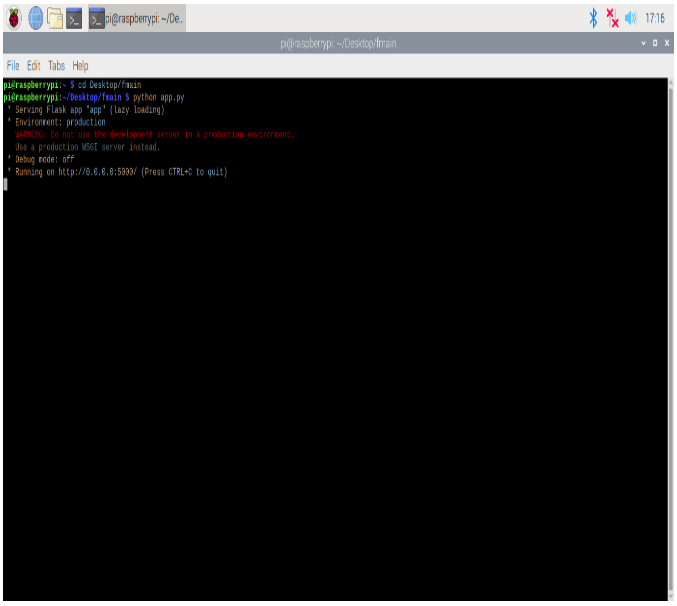

Fig -13: Code execution

From Fig -13 python program is compiled and executed with no errors. All the sensors get turned on and data will be processed in raspberry pi with the help of the Python program.

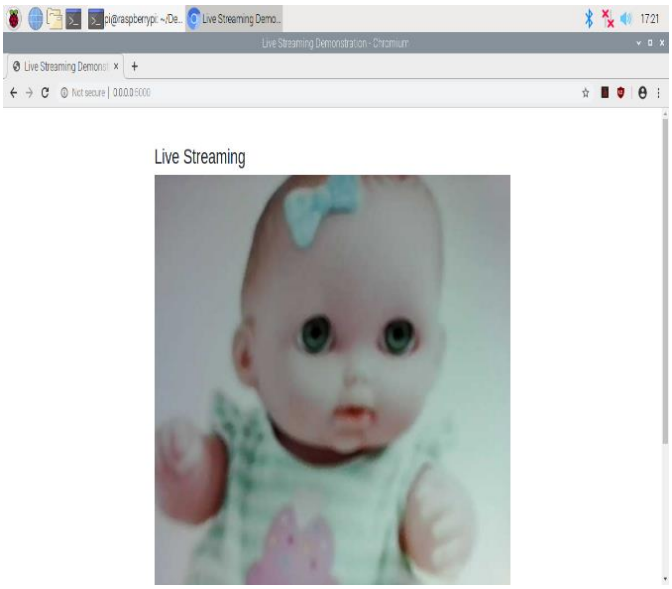

Fig -14: Live video

In the above fig -14, after successful execution of the program, the Live video footage will be displayed in the webpage.

Fig -15: Sensor Data output

From the above Fig -15 all the sensor data is displayed in the webpage. The sensors go live after the python code is executed. And if Gas, sunlight or fire is detected, the baby monitoring system functions accordingly.

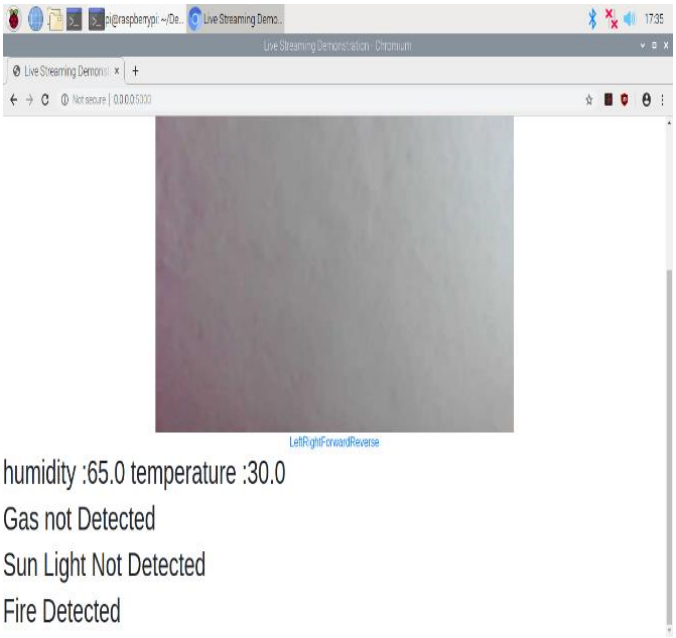

Fig -16: Fire detected

In the fig -16 there is no sunlight detected by the sensors, and the baby monitoring system turns on the red light installed in the system. This helps in maintaining the light intensity around the baby so that the baby won't be intimidated by the lack of light.

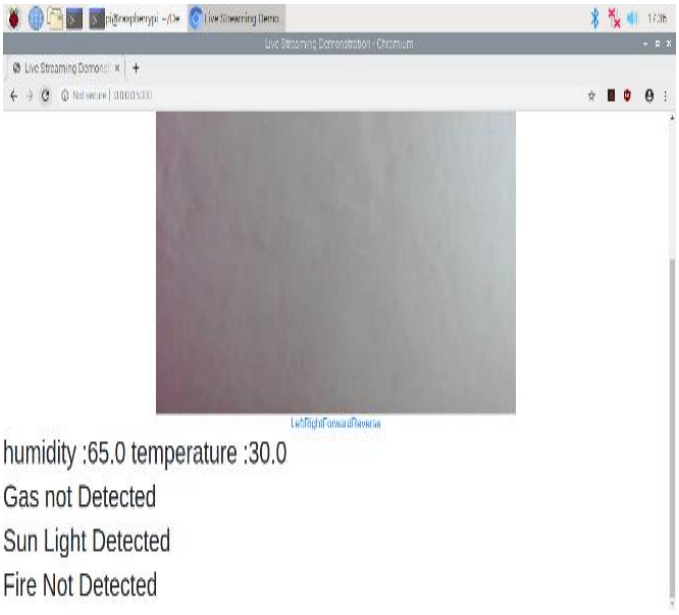

Fig -17: Sun light detected

From the above Fig -17 there is sun light detected by the LDR (light dependent resistor) which further makes the system to turn off the Red light that was previously ON.

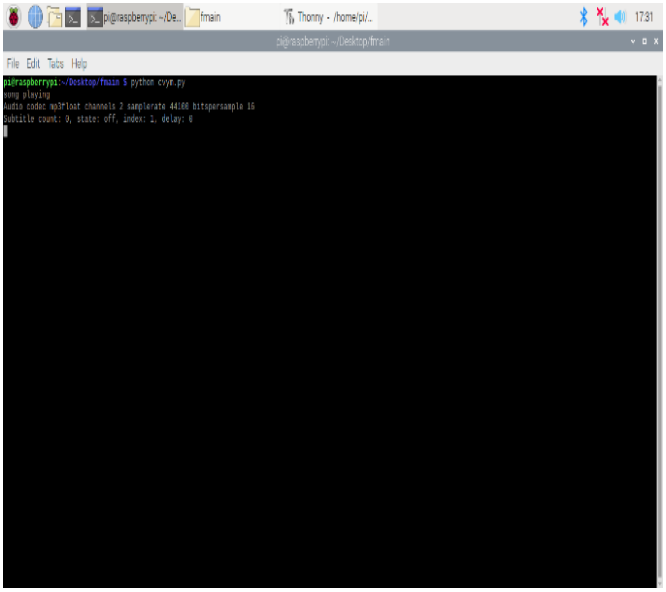

Fig -18: Audio detection

In the fig -18 the system plays sounds through the speaker to sooth the baby. The song/sound helps in making the baby feel at home.

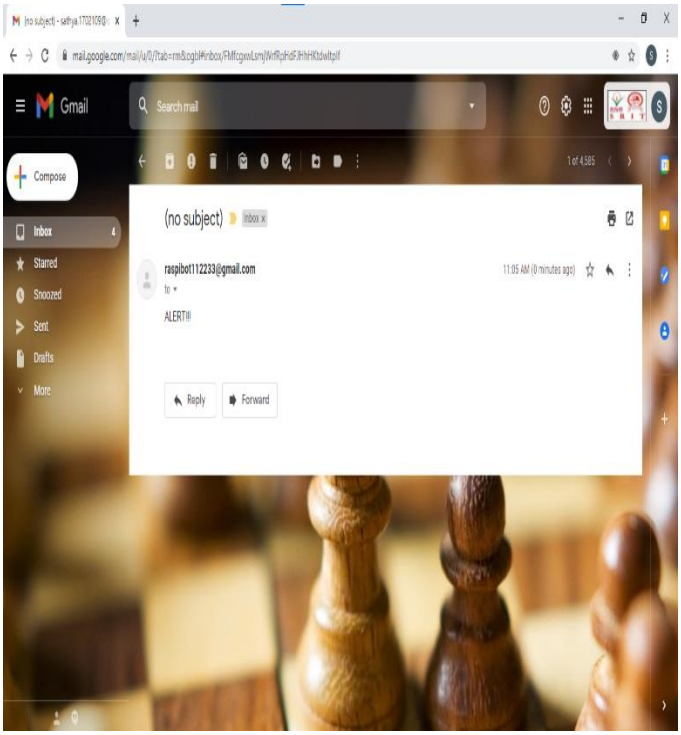

Fig -19: Alert Mail

Form the above fig -19 the mail alerts are transmitted to the parents or guardians as soon as some anomaly is detected by the sensors. This helps in the parents, guardians to act accordingly.

7. CONCLUSION

The modern-day workforce comprises of working parents. Baby monitoring system helps in monitoring the baby without direct help from any human in the times of busy working schedule for both the parents. The baby monitoring system is equipped with live video relay to the parents, so that, in case of exceptions, the parents or the guardian can act accordingly. The baby monitoring system utilized the entire proximity of the room to ensure that the baby is safe from any external elements. This system is equipped with the various sensor to endure the safety of the baby and make the parents aware of what happening around the baby. This system overcomes from the drawbacks faced in the existing system and also given additional features. Fire detection sensor detect any fire. If anything happens mail will be sent to the parents. By this parent will be stay updated about the baby. LDR sensor used in the system sensed the presence of light in the room. If sufficient light is not present LED get turn on. This helped to stop baby from crying and prevented from getting scared. Room temperature and humidity is also get monitored and displayed. Which ensure that room is ideal for the baby to feel comfort and relaxed. If baby cries it is detected and plays a song or any audio clip, this helped baby to claim down. Gas sensor detect if any toxic gas is present inside the room or not. As toxic gas can easily harm the baby, if detected at the begin stage. We can save baby from getting injured. Web camera helps us to monitor the activity of the baby. This makes us stay connected to the baby. The room condition is checked for the comfortable for the baby. All the sensors attached in the system is checks the room condition and the detect condition of the room and baby. If anything is found mismatched, mail will be pass to the parents. This helps the baby from getting any problem and also helps the parents to stay updated about the baby and its condition. This makes the working parents to feel free and stress free.

8. FUTURE SCOPE

Baby monitoring system can be added on with any number of additional sensors like PIR sensor which can detect the third person entering the baby room. This system can be improved by adding Image processing to detect the objects that baby hold and the object around the baby. By image processing we can identity the person presents inside the room and information can be transferred to the parents. LCD display can be attached to display parents live video to claim the baby. Along with the mail, GSM message can send to parents. In order to double check that information is passed to the parents. Android application can be created to get all the sensor data. As smart phones play a vital role, developing an android

application will help us to stay connect with the baby and easier to use. The scope of development of Baby monitoring system based on Raspberry pi is vast and a lot of improvements can be performed based on the availability of technology and needs.

REFERENCES

[1] Harshad Suresh Gare, Bhushan Kiran Shahane, Kavita Suresh Jori, Sweety G. Jachak, "IoT Based Smart Cradle System for Baby Monitoring," International Journal of Creative Research Thoughts (IJCRT), Volume 8, Issue 3 March 2020.

[2] Toshaljeet Kaur, Meenakshi Mittal, Harpreet Singh, "The Baby Monitoring Room Prototype Model Using IOT", International Journal of Advanced Research in Science and Engineering, Volume No-2, April 2018.

[3] Savita P. Patil, Manisha R. Mhetre, "Intelligent Baby Monitoring System", ITSI Transactions on Electrical and Electronics Engineering (ITSI-TEEE), Volume -2, Issue -1,2014.

[4] Aslam Forhad Symon, Nazia Hassan, Humayun Rashid, Iftekhar Uddin Ahmed, S M Taslim Reza, "Design and Development of a Smart Baby Monitoring System based on Raspberry Pi and Pi Camera", 4th International Conference on Advances in Electrical Engineering, 28-30 September, 2017.

[5] Prof.P. Rekha, K. Suganya, "Smart Baby Monitoring Cradle System Using IOT," International Journal of Innovative Research in Science, Engineering and Technology, Vol. 9, Issue 3, March 2020.

[6] Rachana Palaskar, Shweta Pandey, Ashwini Telang, Akshada Wagh, Ramesh M. Kagalkar, "An Automatic Monitoring and Swing the Baby Cradle for Infant Care," International Journal of Advanced Research in Computer and Communication Engineering Vol. 4, Issue 12, December 2015.

[7] Madhuri P. Joshi, Deepak C. Mehetre, "IoT Based Smart Cradle System with an Android App for Baby Monitoring", Third International Conference on Computing, Communication, Control and Automation (ICCUBEA), 2017 .

[8] Dina M. Ibrahim, Mohammed Ali A. Hammoudeh, Sadaf Ambreen and Sajid Mohammadi, "Raspberry Pi-Based Smart Infant Monitoring System", International Journal of Engineering Research and Technology, Volume 12, Number 10, 2019.

[9] Hemant Prakash Shanbhag, Rajat Vivekanand Gajinkar, Vishal Vaman Kamat, Anal Ballullaya, "IoT based Baby Monitoring System using Raspberry Pi," International Research Journal of Engineering and Technology (IRJET), Volume: 07 Issue: 04, APR 2020.

[10] Muhammadu Sathik Raja M.S, Dhaksinamoorthi S,Elavarasan V,Gokul A, Manju R, "Advanced Monitoring Of Incubator Using IOT Based Automated Alert System," International Journal of Innovative Research in Advanced Engineering (IJIRAE), Issue 03, Volume 6, March 2019.

[11] Samson Dauda Yusuf , Lumbi Williams Lucas , Umar Ibrahim , Maleshesh, Markus Jones , Loko Abdulmumini Zubairu, "Construction and Implementation of Raspberry Pi Based Baby Monitoring System," International Journal of Research and Innovation in Applied Science (IJRIAS), Volume IV, Issue II, February 2019, ISSN 2454-6194.

[12] Suman Maloji, S. Malakonda Sai Lokesh, K. Nikhil Sai, M. Vasavi Prasanna, M. K. Ashwaq and 6S. Arunmetha, "An Innovative Approach for Infant Monitoring System Using Movel S.Odi Based Iot System," International Journal of Advanced Science and Technology Vol. 29, No. 6, (2020), pp. 3623 – 3630.

[13] Dr.P.P.Halkarnikar ,Rutik Bankar ,Vishal Salve ,Tejas Gavali, "IOT based intelligent baby care system with a web application for baby monitoring," International Journal of Engineering and Techniques, Volume5, Issue6, December2019.

[14] Prof. A.B. Tupkar, Prajwal. Chahare, Shubham. Rade, Rushikesh. Wakade, Snehal. Bahirseth, "Development of IoT Based Smart Baby Cradle," International Advanced Research Journal in Science, Engineering and Technology Vol. 7, Issue 1, January 2020.