Smart Cradle 21st Century Parental Care Innovation

Mr. Vipin Kiruba[1], Mr. Vignesh Manikam[2], Mr. Vignesh Manoharan[3], Mr. Ikram N[4]

[1,2,3]B.E Student, Electronics and Instrumentation Engineering, BAIT-Sathy
[4]Professor, Dept. of Electronics and Instrumentation Engineering, Bannari Amman Institute of Technology,
Tamilnadu, India

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Abstract - *Smart Cradle is an innovation that is used to make babies sleep peacefully. By swinging into side by side motion it makes that comfortable for the baby and make the baby sleep. In this 21st century parents cannot swing the cradle manually by putting a lot of efforts. by putting a lot of efforts. And when the baby is in the cradle parents need to monitor the baby 24/7. The idea proposed is used to monitor the baby 24/7 live with parents smart phone and take care of the baby. A Node MCU ESP288 microcontroller will be used to assemble all the sensors and hardware component required. Monitoring the cradle in Live will be accomplished to take care of the babies. On the off chance that any action, for example, pee or child awakening from rest happens a notification through an MQTT server will be sent to the parent's device. This innovation also have extra features such as swinging the cradle automatically and also manually by android devices via geared motor mechanism and MQTT server monitoring. Also, some extra highlights, for example, watching in Live by Node MCU camera. Use of various sensors such as LM35 for sound detection, Sensors for Humidity and temperature etc. add to productivity of cradle. In this 21st century parents and care takers cannot make their whole time investing in taking care and monitoring of their babies, so this smart cradle will do the job efficiently for parents and caregivers.*

Key Words: Smart cradle; geared motor; MQTT server; sound detection ; microcontroller; Node MCU camera; swinging; Humidity and Temperature; android device; Node MCU microcontroller.

1.INTRODUCTION

In the beyond couple of a very long time there has been a critical ascent to the quantity of female cooperation in power to industrialization. Because of which a lot of female laborers need to avoid home to deal with regular routine. Because of which dealing with baby has now turned into a test for such females.

Such females need to depend on third individual to deal with the child. Mother consistently stresses over the prosperity of the child.

By research we found that in India and some other industrialized country the both guardians/parents go work and further care for the infant which increase responsibility to both guardians/parents. A framework is applied and that can notify parents with an update about baby during disease or in any unusual activity, during ordinary everyday practice,

can be extraordinary assistance to such families as they can stress less over the child and focus on work difficulties. In addition to this, any unusual activity can be carried out immediately and an notification will be given with respect to the sensor detection and can be dealt with promptly. Generally The baby cries when he/she is hungry, goes away from rest, feels unwell or needs a change of diaper. So in this proposed model we put forward the idea of a fairly experienced support to screen the previously mentioned exercises, track down its goal and give an alarm to the guardians.

This suggested framework will give the guardians loosening uptime and permit them to take less worry over prosperity in case the child when they are away as they can get update about status of baby inside the support. The other benefit is that alarm messages will be given on event of any movement that is unusual and distinguished by sensors. Notification will be given by MQTT server in which Live Monitoring is an integral part. In this way, we can monitor certain biomedical limitations of the newborn.

Further this paper is divide into 13 sessions. Session Two describes about the literature survey. Session Three gives information about components used. Session Four gives the clear block diagram. Session Five has Proposed Design information. Session Six contains algorithms and results of the cradle. Session Seven gives the Novelty. Session Eight gives advantages of the cradle. Session Nine gives the limitations. Session Ten gives uses of the cradle. Session Eleven gives the scope of paper in future. Session 12 and 13 has the reference and conclusion.

2. LITERATURE SURVEY

There are different medical services and wellbeing the executive framework intended to take care of soundness of grown-ups and matured individual. They can screen different wellbeing status, naturally send cautions and furthermore have numerous highlights. However, this framework can't be essentially put under training for babies as they should be utilized under alert. Not at all like grown-ups, babies require something else entirely to medical services as they are absolutely reliant upon their parents. Newborn children can't give communication about comfortless as their best way to communicate inconvenience is by crying and moving. Subsequently, an extraordinarily planned medical care framework is expected to deal with the babies. It would bit by bit diminish stress over parents/guardians particularly

mothers. In help to above hypothesis creators have created framework which depends on mobile GSM framework. Indispensable child boundaries, for example, internal heat level monitoring by LM35 sensor, pulse utilizing IR transmitter, respiratory rate by utilizing Piezo sensor situated on babies' chest are detected, separated and given to microcontroller. A wet sensor to recognize pee condition in the support and any remaining information is given to microcontroller. Creators likewise proposed a thought of mounting a camera on the support, so the parents/guardians can get live pictures of the baby inside the support when they are away. A speaker correspondence framework to assist with quieting the child by hearing the parent's voice. Additionally, a versatile toy over the child dozing region to facilitate the child. A distant subsystem with GSM module gets information and sends it to microcontroller for handling.

In Paper [1] The Author had Insisted and thought of having an android application for the child monitoring. The real swing behind the auto swing activity is distinguished as (sound degree of (X)=20log(Vin/V0)db). Calculation for the equivalent is contemplated. The disadvantages of this paper are children information cannot be put away and there is no data set to store the information of the child. This framework is programmed and parents/guardians cannot able to control the system by their smart phone, or they cannot operate physically by their devices.

In Paper [2] The Author had made support swing or oscillate automatically without guardian/parents Intervention or Automated by the sensors. The Slider-wrench instrument is utilized to change rotational movement into translational movement through a turning driving bar, The lead-corrosive battery, A movement indicator is a gadget that distinguishes moving articles, especially individuals, Sound sensors that recognizes the two decibels [dB] and changed decibel [dBA]. A decibel is an estimation of sound strain. The impediment of this paper are it makes more commotion because of which child gets upset. The proposed framework isn't talented enough for dealing with sound.

In Paper [3] Author chose to make a Cradle that ought to be controllable by a PDA, just as send information to it, like video/sound transfer. It ought to have a programmed method for consoling the child assuming the parent can't move to the child immediately. After thinking of two or three elements. They have utilized a Micro-regulator, Wi-Fi module safeguard, Router, Stepper engine, Speaker, microphone. The downsides of this paper are Baby's curiousness: Beside the danger of electrical shock, the parts might tumble off or be broken by the child and the child may even attempt to chomp or eat the parts. Guardians' concerns: Parents consider the security gives impressively more than highlights items.

In Paper [4] The Author has planned a disturbing framework structure that will signal the guardians/keepers of the babies exercises. The gear will be to such an extent that it will fit the greater part of the normal supports or dens. The framework will contain sensors that will distinguish child's exercises and alert their parents/guardians. The constraint of this paper are this framework doesn't have any swing system or rock movement. They have utilized Wi-Fi module which must be utilized for specific region.

In Paper [5] The creator has given childcare framework which can screen the child's bedwetting, developments, and interior temperature. According to scientist there are helpful ways of assuaging and calm the child like Suckle a child, Rocking movement, singing a melody. The equipment that is being utilized in the task are PIR sensor, Motor safeguard, Arduino GPRS , UNO safeguard, Surface temperature sensor, Wet sensor(PCB designed), Power source (9 Volt battery powered battery), Geared engine. The downside is Sound locators are not utilized accordingly strong discoveries is preposterous like crying and different exercises of child. Camera and Toy is missing, so the video match is nonsense.

In Paper [6] The Author propose a planned determination record depicts the plan subtleties of the brilliant child support model. The last smart child system item will likewise follow this plan archive, yet the electronic parts will be changed to more compelling and incorporated gadgets. In this archive, every one of the plans will consider the client and wellbeing necessities that were referenced in the utilitarian detail. The prerequisite marks in this report compare to the useful particular necessity names. The restriction are Baby's curiousness: Beside the danger of electrical shock, the parts might tumble off or be broken by the child and the child may even attempt to nibble or eat the parts. Guardians' concerns: Parents consider the wellbeing issues considerably more than the elements items.

In Paper [7] The Author has given numerical estimation for the revolution of the support. The Author has determined rotational degrees, speed, any remaining info factor that are liable for swing development and given a solitary numerical equation. The creator has thought about the plan determination of the lodging. The maker has contemplated the arrangement assurance of the housing to zero in on security of child. The downside of the venture are it fundamentally centers around plan particular and thus ignores the wide range of various variables of the support.

In Paper [8] Author presents a plan of a Baby Monitoring System dependent on the GSM system. This framework screen fundamental boundaries, for example, internal heat level, beat rate, dampness condition, development of a baby and utilizing GSM network this data is moved to their folks. Equipment parts that were gathered are Temperature Sensor, Pulse Rate Sensor, Moisture Detection Sensor, LCD screen, GSM Module, Motion Sensor, Controller. The limits are framework doesn't have support or bunk and no stone movement is utilized. It makes inconvenience to the child.

In Paper [9] the Author has given the cradle, component of programmed swinging when child cries. To record children

temperature, to video record motion of child, to detect looks and naturally send message when child is protected or not. The downsides are it utilizes AI to detect feelings henceforth the framework cost increments and improvement time is more it doesn't contains the bunk and parts are mounted on the bedding. Another US Patent no 6,43,747 (Altenhofen)[10] claims that parents/guardians can record messages which can be sent to child unit to alleviate or quiet the child.

Our system will be able to monitor and control the cradle when the baby urinates or when the baby is crying and sends alerts to parents and they can control it by MQTT server login. It is also capable of capturing live video through Node MCU camera. It can also activate-deactivate the mobile toy and start-stop the cradle swing through client device(mobile phone).

This is an extension hybrid model of the ideas proposed in the above mentioned papers.

3. COMPONENTS

The below Fig. 1 shows a detailed description about the components and connection of the cradle we have designed and the detailed explanation of the components is given as follows.
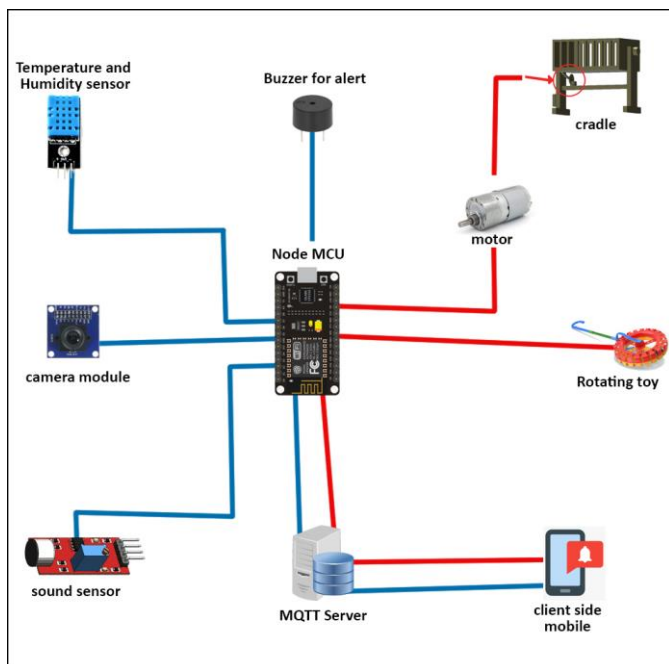

Fig -1: CONNECTION OF COMPONENTS

3.1 Node MCU

It is a microcontroller board based on ESP8266 Wi-Fi SoC. It has 17 GP input/output pins I2S, I2C, PWM, UART, LED Light, IR Remote Control and Button programmatically.

3.2 Temperature and Humidity sensor

It is used to detect moister condition of the cradle bed. At the point when the child makes moister content in the bed because of pee, it will convey the signal to Node MCU and Node MCU will be processed further.

3.3 Camera Module

Camera module records the babies activity in a live process and send signals to MQTT through Node MCU so that parents/guardians can view the video Live.

3.4 Sound Sensor

Sound sensor module allows you to capture when sound has exceeded a particular dB. Sound detection is done via a microphone. We used noise sensor to detect the cry of the baby.

3.5 Buzzer

A Buzzer is used to trigger and alert the nearby people/guardians when any of inputs triggers the Node MCU.

3.6 MQTT Server

Client/parent has a MQTT login and this server is connected to Node MCU so that parents can activate the cradle, get notifications by the time Node MCU gets inputs, can lively watch baby through camera, and also can store babies data in the server automatically.

3.7 DC Motor

The Dc Motor given here rotates 360 degree but due to the design which we made it acts like a piston and makes the cradle swing.

3.7 Rotating Toy

A Rotating toy is used here for baby entertainment purpose and it can be manually activated by parent/guardian through phone.

4. BLOCK DIAGRAM

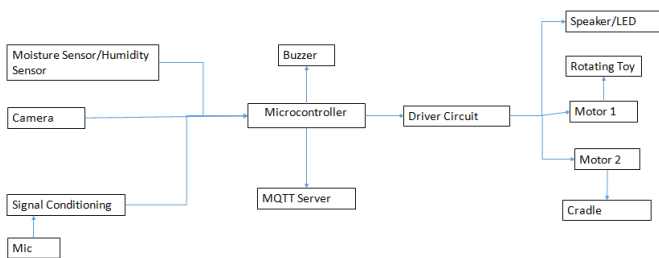Below shown figure 2 shows the block diagram of our proposed design.

Fig -2: CONNECTION OF COMPONENTS

5. PROPOSED DESIGN

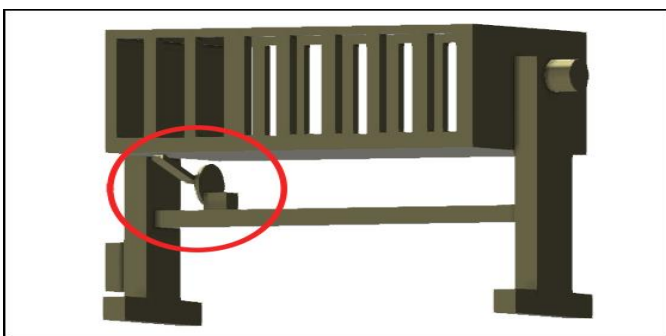The below Fig. 3 shows our new proposed design for the cradle which replace two servo motors into one DC Motor

Fig -3: 3D MODEL OF PROPOSED DESIGN

6. ALGORITHM FOR THE DESIGN

The below Algorithm is used for the baby cradle to work on the way we suggested. In order for the system to work successfully, it needs wonderful calculations such as algorithms. Let say 3 algorithms have been taken into such as

- Algorithm 1: Setting up of Threshold value according to need.

setting the values for each sensor.

- Algorithm 2: Trigger for Alert.

If the sensor value exceeds the threshold value then the appropriate alert trigger should start. These actions comes under this algorithm.

- Algorithm 3: Activating Remote Monitoring on Request.

The live camera feed will be activated upon the request from the user. As displayed in above algorithm - Algorithm one is utilized to set value of preset which is utilized to contrast input esteems from sensors with observe whether the condition is fulfilled or not. In Algorithm two, input esteem (for example Scan Value) from various sensors like sound sensor and Temperature and humidity sensor is taken and

threshold value is compared. If output Value is maximum than threshold value, it implies cry dB of sound identified in the event of Sound sensor or it notify when the cradle has moister in case of moisture sensor. In the case buzzer is initiated and an alarm is then conveyed through the cloud server to the guardian/parents mobile. For conveying from microcontroller to MQTT server, as microcontroller Node MCU controller is used here.

This whole Algorithms is divided into following algorithms whose explanation is given below.

6.1 STEPS TO BE CARRIED OUT FOR CRY DETECTION

STEP 1: Start

STEP 2: Detect for Sound

STEP 3: If Sound is detected for longer duration (approx. 1minute) then send message to parent device and Activate Buzzer

STEP 4: Parents/Admin can able to switch of the BUZZER after being notified by the notification or it can also be turned off manually by the caretaker/parent who is nearby.

6.1.1 Results for cry identification

A sensor was arranged with Node MCU microcontroller to recognize when child is crying. Beginning understanding when there was no clamor were roughly 0-100. In any case, when the clamor of child crying was distinguished perusing value expanded and Buzzer beeps to show that the child is crying.

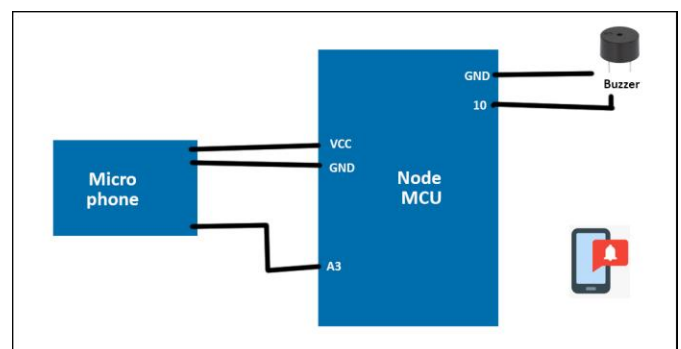Below Fig 4. shows the deployment diagram for cry detection

Fig -4: SOUND DETECTION SYSTEM

6.2 STEPS TO BE CARRIED OUT FOR MOISTER DETECTION

STEP 1: Start

STEP 2: Detect Moister condition

STEP 3: If moister content is detected then send message to parent device and Activate Buzzer

STEP 4: Parents/Admin can able to switch of the BUZZER after being notified by the notification or it can also be turned off manually by the caretaker/parent who is nearby.

6.2.1 Results for wet identification

A Temperature/Humidity sensor was arranged with Node MCU to distinguish urine condition for the child. Beginning understanding when the sensor was dry was roughly 200-500. A few of water drops were spill on the sensor to make it wet. Following of wetting the sensor, there was a caution tone on the Buzzer to demonstrate the wet condition.

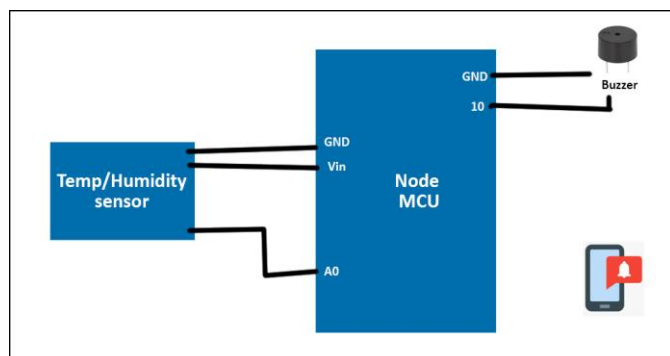Below Fig 5. shows the deployment diagram for moister detection

Fig -5: MOISTER DETECTION SYSTEM

6.3 ARCHITECTURE OF MQTT

As API keys are Unique it will be safe to transfer data from one device to another. We are creating channels for each device and an Unique API keys will be generated for each devices. Those API codes will be inserted in the code to get connected with the devices.
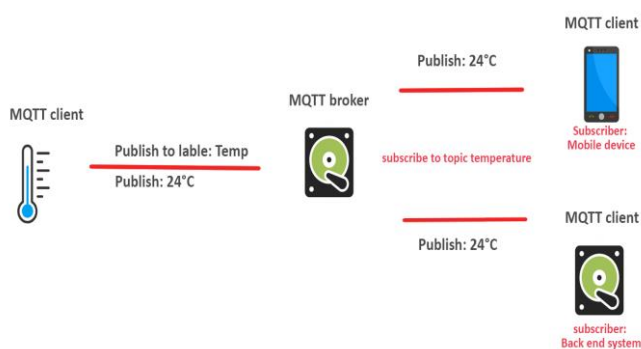
Below Fig 6. shows the Architecture of MQTT.

Fig -6: MQTT Architecture

7. NOVELTY OF THE IDEA

There is no live camera in a cradle so far and so we have installed it and There is no MQTT server Data Base installed so far. so, we have installed it for data fetching purpose. A cradle which can be accessed from anywhere especially for mothers who are far away for work and their baby is with their Husband.

8. ADVANTAGES

The board can work on a 6-20 volts. The suggested range is 7-12 volts. It is a smart thought to append switch in series with this battery so you can wind down your Node MCU or turn ON. It saves times as parent doesn't need to take care of the new born all the time as it sends ideal cautions in type of Notifications and alerts. It is not difficult to utilize on the grounds that it doesn't needs any additional information on equipment and programming and furthermore it needn't bother with any human association to shake the support. It has simple interface and the support can be worked by MQTT server. Because of shrewd support guardians/parents get leisure time and any surprising action of the child will send ready notification to parents/guardians.

9. LIMITATIONS

It needs MQTT availability all through for sending cautions. The cleanliness state of the support ought to be dealt with by the actual parent. Although cradle is sufficiently skilled to screen the child yet it doesn't comfort the child however much mother does. Parts of support are delicate and it ought be managed carefully. Serious harm to the parts of the support might expand the danger of child getting a shock. It can't detect feeling of the child, so commotion sensor can't separate between child's snicker and cry.

10. APPLICATIONS

The Node MCU is the core of the framework and it is utilized to screen every one of the movement and the support can be utilized in maternity emergency clinic to deal with number of infants as it is hard for predetermined number of emergency clinic staff to deal with every one of the children, in such situation the cradle child support can be utilized to help the medical clinic staff for dealing with infants. It very well may be valuable for guardians/parents when both mother and father are working. It can likewise be utilized in metropolitan family as house spaces are little and guardians are inside the span of the support. The support likewise helps in lessening hazard identified with children. Any action of child will notify parents/guardians. Action of child incorporates activity like crying, pee and different developments and furthermore when the child is alert from the rest. It can likewise be utilized in day care focuses.

11. FUTURE SCOPE

Modules of Live monitoring, urine detection and noise detection have been implemented. Our future extension incorporates modules of including an AI which can be utilized to identify the feelings of the child, when he is exhausted or crying. Likewise an AI camera will be connected to see the development of the child inside the support. Every one of the parts of the support will be synchronized with MQTT server which will be utilized to speak with smart cradle and notification/activating will be used as a medium of communication.

12. CONCLUSION

Proposed thought of smart support is a more affordable and simple to utilize framework. It can assist with working on the nature of newborn child care framework. This framework will give guardians/parents affirmation that their babies is all around dealt with. The consistent catching and observing of different biomedical boundaries of the child assists the mother with understanding child's inward wellbeing status. As MQTT is utilized it causes the client to convey for longer distance. It is a helpful framework to screen the child medical care from any distance.

13. REFERENCES

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BIOGRAPHIES

Vipin Kiruba, Bachelor of Engineering, Electronics and Instrumentation Engineering, Bannari Amman Institute of Technology, Tamilnadu, India.

Vignesh Manikam, Bachelor of Engineering, Electronics and Instrumentation Engineering, Bannari Amman Institute of Technology, Tamilnadu, India.

Vignesh Manoharan, Bachelor of Engineering, Electronics and Instrumentation Engineering, Bannari Amman Institute of Technology, Tamilnadu, India.

Professor, Dept. of Electronics and Instrumentation Engineering, Bannari Amman Institute of Technology, Tamilnadu, India.