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Solar Powered Infant Incubator for Assessment in Healthcare System

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Abstract: ***Monitoring baby health status in incubator is a necessary task and need more attention. Huge number of issues was happened previously like improper oxygen supply, theft of child and mishandling in continuous monitoring. Hence a proper automatic system should be needed for monitoring a baby in incubator with reduced human interaction. This can be achieved through sensors and projected as proposed system. Here temperature, humidity, heartbeat, pressure and accelerometer sensor are used to check baby body condition and if any drastic change is identified in it will be automatically intimated through buzzer. If any unauthorized person is picking up the child it will be detected by IR sensor and automatically door will be closed. Another major issue is the current status of a child is not transparent to respective parent here all the details gathered from the sensors will be automatically loaded in cloud through IoT which can viewed by their parent as well as doctor to analyze current status of the baby. The whole process is controlled by Raspberry PI and for continuous monitoring solar panel is added that provide power supply for our system sequentially without any interrupt. Hence it clearly shows that our proposed system achieves the objective of our work and protects baby both in physical and health based parameters.***

Keywords: Infant incubator, health monitoring, cloud storage, Raspberry PI, and solar panel.

I. INTRODUCTION

With the development of the human society and the modern technology, the problem of the care for the new born baby has been focused by more and more people. And the traditional infant incubator can only provide a relative safety environment for the new born babies. With the change in the life style, most of the parents are so busy with the work that they have less or no time to take better care of their babies. Considering the situation, the traditional infant incubator may not provide more reliable care to the babies. In this way, a new kind of infant incubator should be researched which can self-adaptively change the environment based on a series of sensors and real-timely monitor the vital signs for the baby. As the technology of Internet and network is studied by more and more scholars, the Internet of Things has been developed [1].

A. Neonatal Intensive Care Unit

Neonatal emergency unit known as escalated care nursery particularly being taken care of by untimely or sick babies. Infants who need escalated clinical consideration are regularly conceded into an uncommon space of the medical clinic called the neonatal emergency unit. The NICU consolidates cutting edge innovation and prepared medical care experts to give particular consideration to the littlest patients. Infant incubators are important equipment in which we can saved life of many number of those born prematurely. Infant incubator assists doctors to monitor all the different aspects around the child environment, it used to make them similar conditions to those that were in the ideal conditions inside the mother womb. Infant incubators Helped to preserve the life of premature babies and reducing the death among the infant baby. Raspberry PI is a microcontroller used in our work [2].

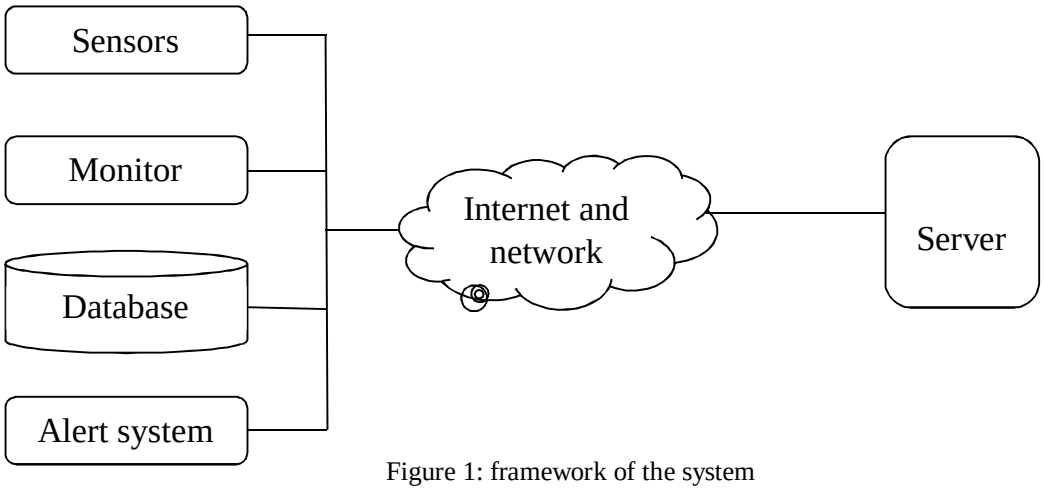


Figure 1: framework of the system

Temperature and humidity are two of the most important aspects that need to be monitored to provide healthy environment for the infants. Increasing or decreasing the body temperature for the infants might contribute in several health issues, for instance, hyperthermia in neonates can lead to increase in the oxygen requirements, dehydration and apnea [3]. Likewise, as the temperature increment the air dampness increment. As indicated by that, the temperature and stickiness ought to be observed constantly in babies' hatchery to give reasonable climate and to keep up stable centre temperature of the child at 37^{o}C.

The Internet of Things (IoT) is an organization framework dependent on the Internet and the data innovation arose with the improvement of the organization innovation and equipment. The programmed distinguishing proof and data sharing are accomplished by the utilization of the IoT [1].

In this project, patient's pulse, internal heat level, circulatory strain and body developments are checking utilizing raspberry pi. Raspberry pi is a processor for utilized in numerous iot applications. Raspberry pi is chips away at linux stage. The expense is additionally low. The gpio pins are utilized for interfacing among sensors and raspberry pi. Raspberry pi and web association is another imaginative innovation in medical care frameworks. Subsequent to interfacing web to the raspberry pi it go about as a worker. At that point the worker is consequently sends information to the website page. At that point these boundaries (pulse, internal heat level, circulatory strain rate and body developments) are observed. In the event that these boundaries are goes to strange it will naturally turns on the bell and send data to particular youngster parent or specialist.

II. LITERATURE SURVEY

B. Radhika, V R Sheshagiri Rao (2019), presents the neonatal hatchery is a mechanical assembly that gives a shut and controlled climate for the food of temperature children. In any case, as of late, numerous untimely infants have lost their lives because of absence of legitimate checking of the hatchery that prompts mishaps (spillage of gas and overheating causing short circuits and at last, the blasting of incubators).This project manages the savvy plan of an installed gadget that screens certain boundaries, for example, beat pace of the child, temperature, mugginess, light inside the hatchery. In the event that any varieties happens in the comparing boundaries (heartbeat, temperature and mugginess), than the boundaries will control by utilizing lights and fans inside the hatchery. Furthermore, the readings will constantly observing in LCD and sends the subtleties to the relating specialist or attendant by utilizing GSM and the child will screens persistently through site page. The guardians, specialists or medical caretaker will screen the child from anyplace by utilizing IOT. By constantly observing and controlling the boundaries we will give proficient and safe working of a hatchery.

Hitu Bansal et.al (2015), depicts The preterm newborn child care is perhaps the main ,agent and delicate region in the Bio-clinical field. Preterm child requires encompassing precisely comparable as in the belly to adapt to the outside climate. To give the comparable climate as in the belly newborn children must be kept in a gadget known as Incubator. A baby hatchery gives stable degrees of temperature, relative dampness. Air temperature must be kept up around 35ºC. The general dampness ought to follow set qualities as per the brooding day number. The motivation behind this undertaking is to plan and carry out a shut circle control framework to manage the temperature and moistness inside a neonatal hatchery. Additionally it is utilized to screen and control the light and oxygen level in the hatchery. Microcontroller and PID regulator will be utilized for executing the equipment. The shut circle control framework is a blend of sensors and actuators that works simultaneously to give a steady warm climate inside the hatchery.

Dhaksinamoorthi S et.al (2019), presents the neonatal hatchery is a contraption that gives a shut and controlled climate for the food of untimely children. Yet, as of late, numerous untimely infants have lost their lives because of absence of legitimate observing of the hatchery that prompts mishaps (spillage of gas and overheating causing shortcircuits and in the long run, the blasting of hatcheries). This task manages the savvy plan of an installed gadget that screens certain boundaries, for example, beat pace of the child, temperature, moistness, fundamental measure of gas and light inside the hatchery. The subtleties are sent as a message to the specialist or attendant through IoT, with the goal that legitimate moves can be made ahead of time, to keep up the able climate inside the hatchery and guarantee security to the newborn child's life. Along these lines, the goal of this task is to defeated the previously mentioned downsides and give a protected and moderate system for observing the hatchery.

Erwin Sutanto et.al (2020), presents the current innovation pattern of IoT and Smart Device, there is an opportunities for the improvement of our newborn child hatchery in reacting to the genuine child's condition. This work is attempting to see that chance. First is by breaking down of open child voice information base. From that point, a technique to discover child cry order will be clarified. The methodology was beginning with an examination of sound's force from that WAV documents prior to going further into the 2D example, which will have highlights for the AI. From this work, around 85% exactness could be accomplished. At that point along with sensors, it would be valuable for baby hatchery's advancement by using this proposed arrangement.

Abdul Latif et.al (2021), talks about a hatchery room is molded to keep the temperature warm so the child feels great. A temperature screen framework for the hatchery room set independently from where the official works is an issue. It sits around. Temperature finder plan for newborn child hatchery which has consistent temperature is important. A LM35 sensor as a temperature locator was utilized in the plan. The sensor was introduced in a 100 x 80 cm room. The identified temperature was shown on the LCD and PC in the staff room. Temperature (°C) is changed over by an Arduino Uno microcontroller into an ADC (Analog Digital to Converter) esteem. A few LM35 sensors were mounted in rooms to recognize the temperature.

Mochamad Sofiyan Mardianto et.al (2019), portrays a baby hatchery has been planned with temperature and dampness control utilizing Arduino dependent on the ATMega2560 microcontroller utilizing the Arduino programming language for temperature, stickiness control, button settings, and seven-section show. The working principleof this newborn child hatchery is to keep up the temperature conditions inside the hatchery by using the DS18B20 sensor module to quantify temperature and stickiness inside the hatchery, optocoupler sensor to guarantee the wind stream fan is turning, strong state transfer to control the AC supply flow of warming component, likewise electric flow sensor and LM35 sensor utilizes for observing input flow utilization and temperature estimation of warming component. At the point when the temperature in the hatchery rises or diminishes, the components as a warmer and fan as a warmth spreader will work as per the directions of the microcontroller ATMega2560 to standardize the temperature inside the hatchery as wanted. Likewise, RTD YSI 400 arrangement as thermistor sensor for baby internal heat level estimation and 24-digit ADC ADS1232 has executed. The proposed technique is to incorporate temperature and stickiness hatchery checking frameworks and furthermore observing the child's internal heat level.

III. PROPOSED METHODOLOGY

The proposed technique child checking framework screens patient's wellbeing boundaries utilizing Raspberry Pi. In the wake of interfacing web to the Raspberry Pi it goes about as a worker. At that point the worker naturally sends information to the site. Utilizing Website username and secret word anyone can screen the patient's wellbeing status anyplace on the planet utilizing laptops, tablets and advanced mobiles.

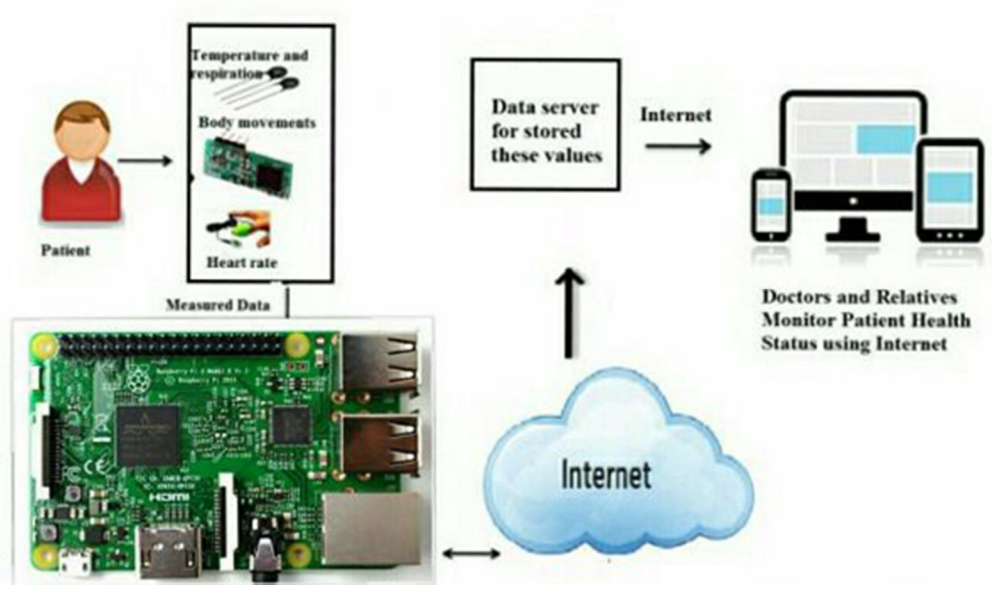


Figure 2: proposed method working flow

In this task we have temperature, pulse, Hall effect, O_2 level and heart beat readings which are observed utilizing Raspberry Pi. These sensors signals are transferred to Raspberry Pi through intensifier circuit and signal conditioning unit (scu), on the grounds that the signs level are low (acquire), so speaker circuit is utilized to acquire up the flag and communicate the signs to the Raspberry Pi. Raspberry Pi is a Linux based working framework fills in as a little pc processor framework. Here patients internal heat level, pulse Hall effect, O_2 level and pulse is estimated utilizing individual sensors and it tends to be checked in the screen of PC utilizing Raspberry Pi just as observing through anyplace on the planet utilizing web source.

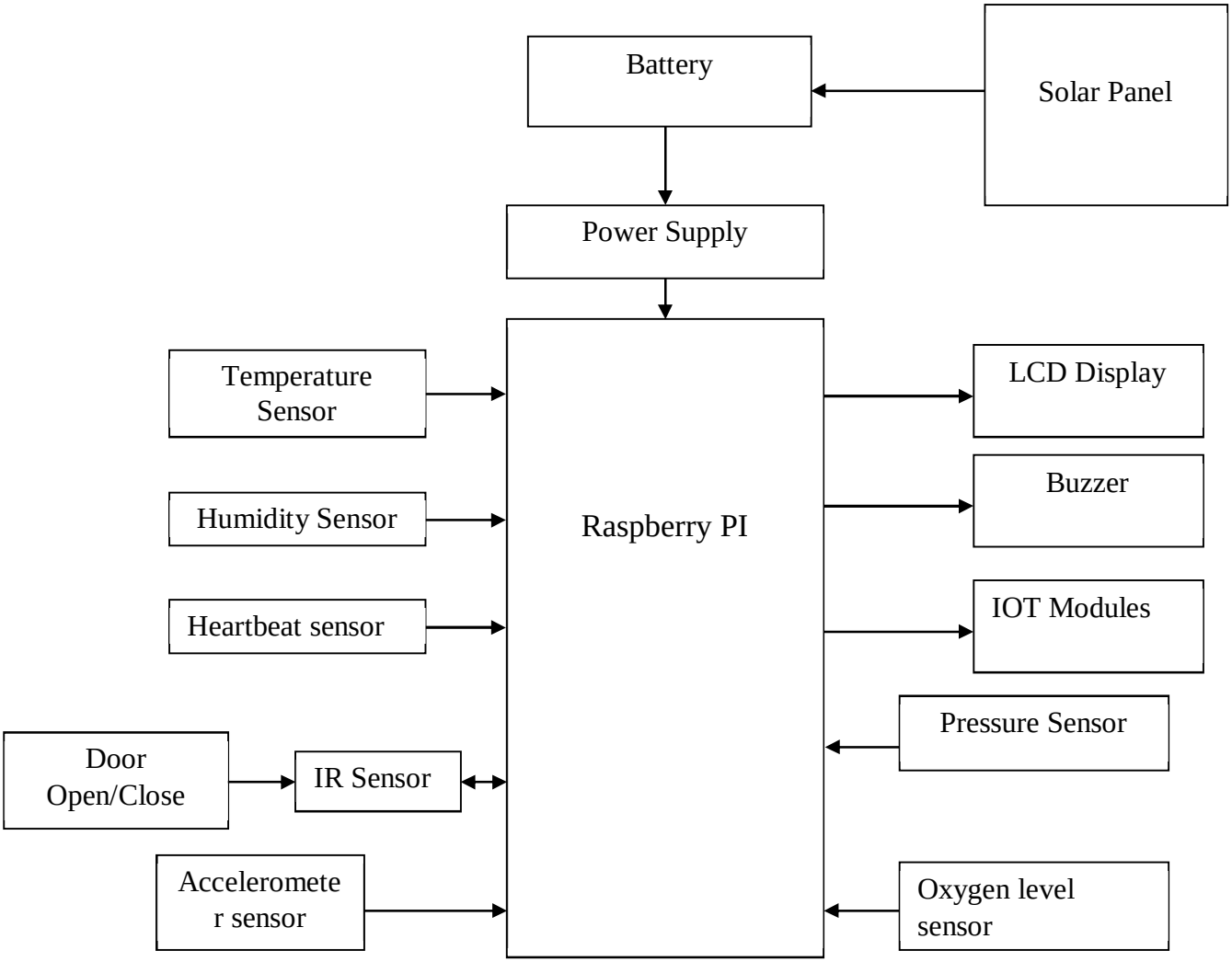


Figure 3: Block diagram of proposed work

A. System Design

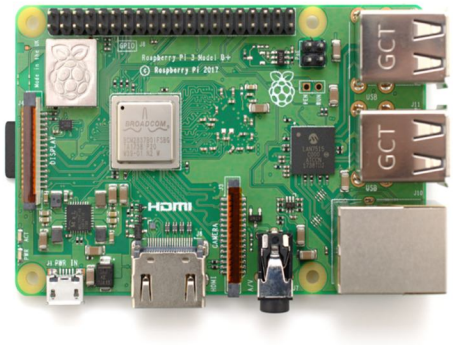
Temperature and humidity are two very important parameters that which need constant monitoring in the infant incubator chamber so that, similar to mother womb for new born baby. Temperature can be displayed in terms of degree Celsius (0C) and humidity in terms of relative humidity which is expressed as % relative humidity (%RH). Table1 shows the overall parameters which have been controlled by the system.

Mode of System Operation	Automatic Control
Temperature Range	270C-370C
Relative Humidity	>70 % R.H
Temperature of Skin	370C
Mode of Temperature Control	Air Temperature Control
Display	LCD

Table 1: Requirement of the system

B. Raspberry PI

The Raspberry Pi 3 Model B+ is the latest product in the Raspberry Pi 3 range, boasting a 64-bit quad core processor running at 1.4GHz, dual-band 2.4GHz and 5GHz wireless LAN, Bluetooth 4.2/BLE, faster Ethernet, and PoE capability via a separate PoE HAT The dual-band wireless LAN comes with modular compliance certification, allowing the board to be designed into end products with significantly reduced wireless LAN compliance testing, improving both cost and time to market. The Raspberry Pi 3 Model B+ maintains the same mechanical footprint as both the Raspberry Pi 2 Model B and the Raspberry Pi 3 Model B.



C. Temperature Sensor-LM35

LM35 device is a temperature sensor device. It is connected to Raspberry PI. The device sensors variations in temperature across it. LM35 is a basic temperature sensor, which is used for experimental purpose. It gives the readings in centigrade (degree Celsius) since its output voltage is linearly proportional to temperature. If temperature increases, the voltage across diode increases at known rate (the voltage drop occurs across base-emitter junction of transistor).

D. Humidity Sensor-DHT11

DHT11 measures relative humidity. Relative humidity is the amount of water vapour in air versus the saturation point of water vapour in air. DHT11 is a basic, ultra low cost digital humidity sensor. It uses a capacitive humidity sensor to measure the surrounding air and spits out. A digital signal on the data pin.

E. Pulse Sensor –M212

It consists of a LED light that issued to measure the pulse rate. Based on the volume of blood in the capillaries, the light gets reflected as the sensor is placed on the body. So, the amount of reflection taking place during heartbeat will be less than that with no heartbeat. Also the volume of blood inside the capillaries decreases in between heart beats, which affects the transmission of light through the tissues. This variation in transmission and reflection of light gives the analogy pulse output from the sensor.

F. Heartbeat Sensor

The new version uses the tcrt1000 reflective optical sensor for photoplethysmography. The use of tcrt100 simplifies the build process of the sensor part of the project as both the infrared light emitter diode and the detector are arranged side by side in a leaded package, thus blocking the surrounding ambient light, which could otherwise affect the sensor performance.

IV. RESULT AND DISCUSSION

A. Error Calculations

Further investigations are performed to verify the results of this paper and to make sure that the transmitted measurements are accurate and reliable. In this section, we compared our measurements to the measurements of the built-in temperature sensor of the incubator. The relative error is measured using,

$$\text{relative error} = \frac{|\text{Experimental} - \text{Theoritical}|}{\text{Theoritical}}$$

The output of the DHT11 was 34^{o}C at the time instance 13.15 sec, while the incubator temperature at that time was 35^{o}C, the relative error was 0.0285. Similarly, the DHT22 measured temperature was 37^{o}C at time 14.15 sec, while the incubator temperature at that time was 37.2^{o}C, the relative error was 0.0053

Overall setup of our proposed system:

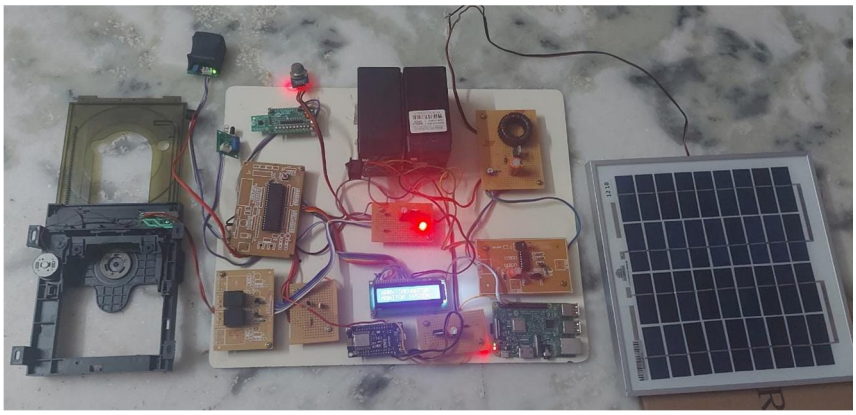


Figure 2: working system of proposed system

In the above diagram the included sensors are LCD display, raspberry Pi, heartbeat sensor, battery, pressure, oxygen level, humidity, IR and accelerometer sensors respectively and solar panel, Door close and open part. Similarly IOT module is included to get the information from the patient and it will be stored in cloud for analysing purpose which can be utilized by care taker of the particular patient.

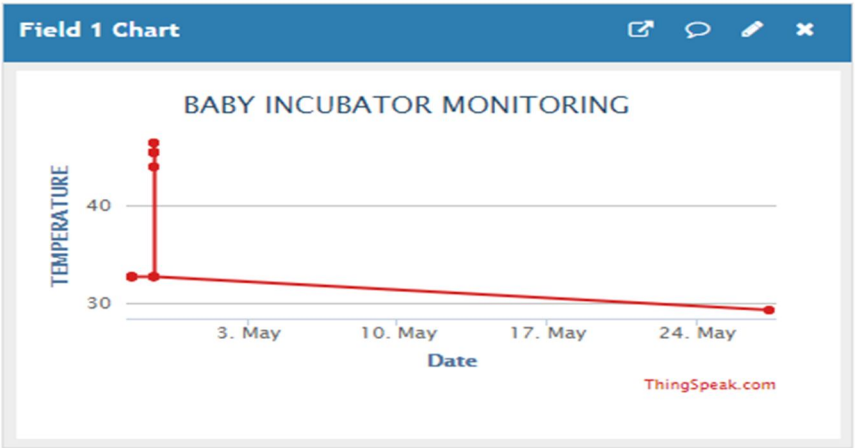


Figure 3: Temperature monitoring of proposed system in cloud

Figure 3 shows the temperature of particular patient with date is shown and decreases when the patient is not available in the incubator.

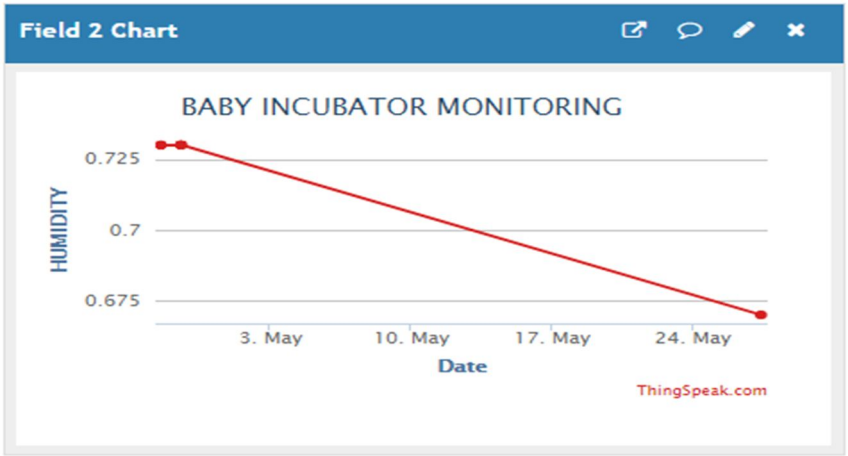


Figure 4: Humidity monitoring of proposed system in cloud

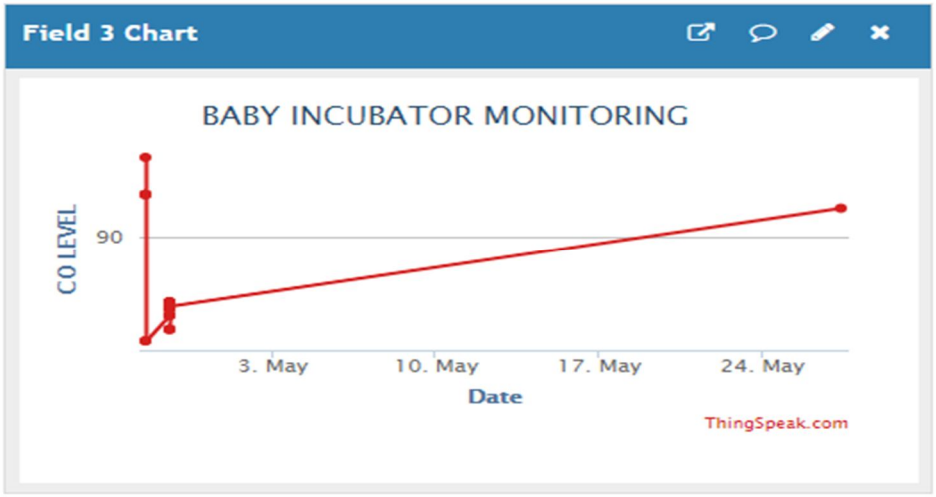


Figure 5: Oxygen level of patient shown in cloud

Figure 6: Heart beat of patient is shown in cloud

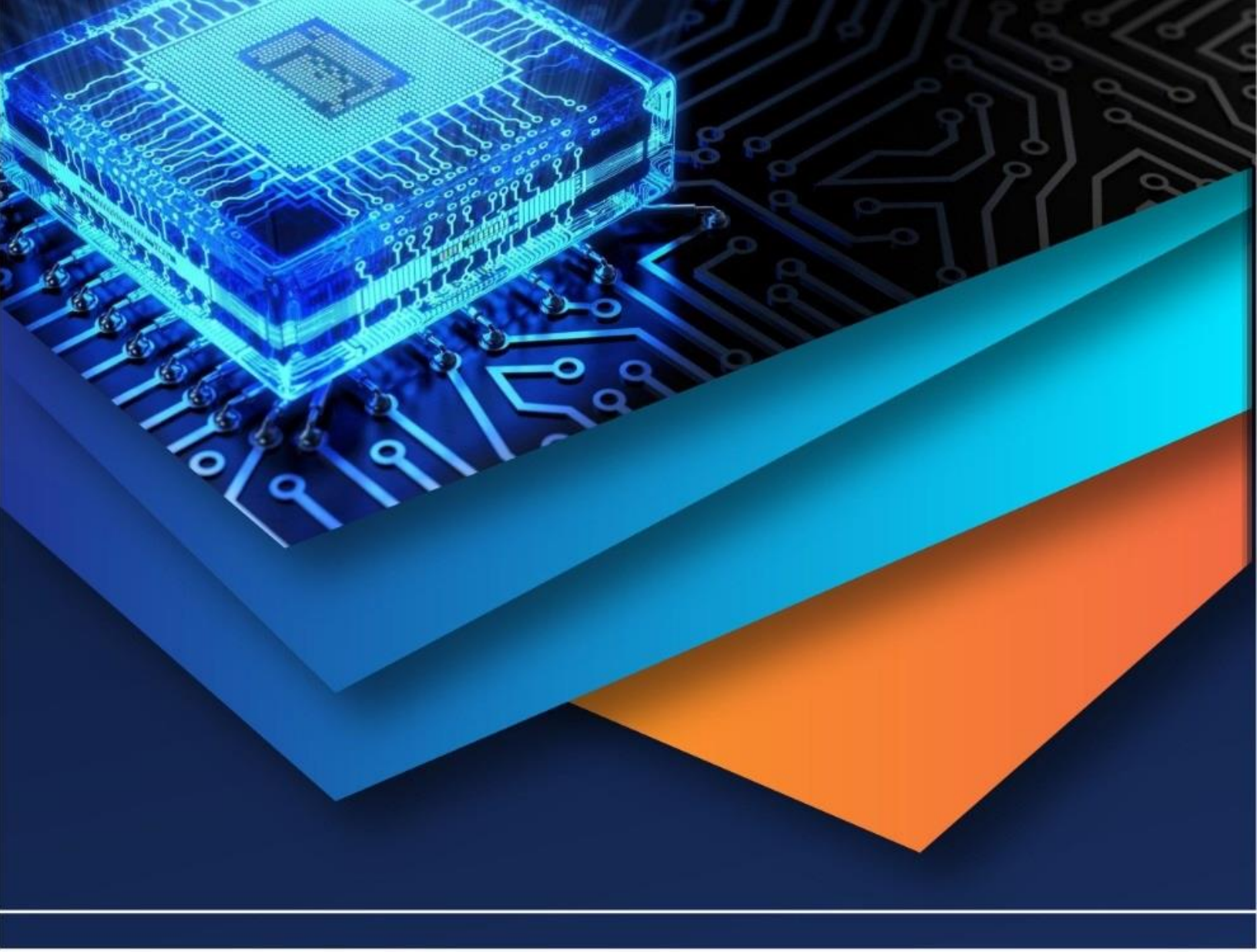
Figure 7: Pressure level of patient in cloud is shown above

V. CONCLUSION

Monitoring baby in incubator is a difficult process and need more attention because if any minute change in infant health condition will leads to drastic affect in baby health condition. Solar panel is utilized for continuous power supply to battery to make the system active sequentially. Because major damage happens due to improper power supply for incubator similarly continuous monitoring is needed manually for child health condition analysis. This health report is not seen provided to particular patient parents only doctors or other in charger is responsible for it. To know the current status of particular infant condition analysis are done accurately through different sensors and its results are shown in cloud which in included in result and discussion part can be accessed by doctor, in charger and patient. In case of change in sensor values it will be immediately indicated to respective in charger through buzzer. Hence our proposed system achieves accurate monitoring of infant body health condition continuously and intimated to respective caretaker immediately and it saves life of particular infant.

REFERENCES

[1] Tianshun Huang and Leiming Sun, “Design and Implementation of the Infant Incubator Intelligent Control System Based on Internet of Things” The Open Automation and Control Systems Journal, 2015, 7, 2223-2229.
[2] Muslim Ali, Murtada Abdelwahab, Sally Awadekreim and Suliman Abdalla, “Development of a Monitoring and Control System of Infant Incubator” 2018 International Conference on Computer, Control, Electrical, and Electronics Engineering (ICCCEEE).
[3] Ali Ghazi Shabeeb, Ali J. Al-Askery, Zainab Majid Nahi, “Remote monitoring of a premature infants incubator” Indonesian Journal of Electrical Engineering and Computer Science Vol. 17, No. 3, March 2020.
[4] B. Radhika, V R Sheshagiri Rao, “Incubator Baby Parameter Sensing and Monitoring” International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-8 Issue-7, May, 2019.
[5] Hitu Bansal, Dr. Lini Mathew, Ashish Gupta, “Controlling of Temperature and Humidity for an Infant Incubator Using Microcontroller” International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering Vol. 4, Issue 6, June 2015.
[6] 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) ISSN: 2349-2163 Issue 03, Volume 6 (March 2019).
[7] Erwin Sutanto, Fahmi Fahmi, Wervyan Shalannanda and Arga Aridarma, “Cry Recognition for Infant Incubator Monitoring System Based on Internet of Things using Machine Learning” International Journal of Intelligent Engineering and Systems, Vol.14, No.1, 2021.
[8] Abdul Latif, Afif Zuhri Arfianto, Joessianto Eko Poetro, Thanh Nguyen Phong, Elsayed T.Helmy, “Temperature Monitoring System for Baby Incubator Based on Visual Basic” journal of robotics and control vol 2, 2021.
[9] Mochamad Sofiyan Mardianto, Anggun Indra Saputra, Candra Sukma, Anas Nasrulloh, “Infant Incubator Temperature Controlled and Infant Body Temperature Monitor using Arduino Mega2560 and ADS1232” International Journal of Computer Techniques -– Volume 6 Issue 6, December 2019.
[10] A. N. Yumang, C. C. Paglinawan, M. M. Sejera, A. S. Lazam, J. C. Pagtakhan, and J. S. B. Santos, “ZigBee Based Monitoring of Temperature and Humidity of Server Rooms using Thermal Imaging,” in 2016 6th IEEE International Conference on Control System, Computing and Engineering (ICCSCE), 2016, no. November, pp. 452–454.



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