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Improved Design of IoT based Infant Incubator Monitoring and Control System

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Abstract -*This document describes the planning of the hardware module of the IoT-based Infant apparatus monitoring system. The hardware module consists of a microcontroller, Sensor data acquisition submodule, and Sensor data communication submodule. during this analysis, the microcontroller used is Arduino Uno Rev3 alongside a temperature sensing element and wetness sensing element, and gas sensing element, a wet sensing element, sound sensing element, moment sensing element, Pulse sensing element, and GSM Module. The Arduino board connected with a Sim 800 GSM Module as an information communication submodule sends sms the infant body's Sensor data monitored by the system to the medical expert. In short this work gave new techniques to plan a dependable baby hatchery utilizing UNO microcontroller.*

Key Words: GSM module, Micro-Controller, IoT, sensor data acquisition, sensor data communication

1.INTRODUCTION

A newborn kid is meant for the baby United Nations agency area unit formed untimely owing to sudden issues. within the current circumstance, guardians area unit occupied in their work and transporter. during this future generation, each the oldsters are unit required to figure for his or her money desires and additionally to seem once their babies this makes them stress particularly for girls. So, taking care of a kid is reduced. This ends up in cause issues for an infant's health conditions. If the babies don't seem to be monitored properly, their health condition is affected. this method aims to style the hardware module of IoT-based kid setup observance system. The designed device hardware module is composed of three main parts: one. microcontroller, 2. information acquisition submodule three. electronic communication submodule. during this analysis, the microcontroller used is Arduino UNO beside pulse measuring system, RTC module for information work, vital sign detector,SMS Alert because the illustration of atmosphere temperature detector, wetness detector, sound detector, a movement detector, and gas detector because the illustration of setting observance sensors, additionally, we've got did the changes in existing system we tend to provide the management module for the wetness, temperature, and lightweight condition. The Arduino board connected with a SIM 800L GSM Module as a knowledge communication submodule. This analysis additionally compared information noninheritable from this module with the information from connected measure tools. [1] has developed the design of that microcontroller used is Arduino Uno Rev3 along with a body temperature sensor and environment monitoring sensors.[2] has developed the design a prototype for verification of the temperature and relative humidity inside the infant incubator and to improve the accuracy of the sensor, as well as allowing the prototype to monitor temperature and relative humidity via IoT for teaching in medical instrumentation.[3] has developed the design and to create an incubator that can detect the abnormalities of baby's heartbeat through the baby's fingers in continuous and real timby using pulse sensor.[4] the proposed design controlling temperature and humidity are adjusted according to pre-set values similar to uterus environment values, as well monitoring the oxygen level through measure CO2 level.[5]If any variations occurs in the pulse, temperature and humidity parameters , than the parameters will control by using lights and fans inside the incubator.[6] has developed the design an android based infant incubator which could be accessed and controlled via the android application by the health professional over the Internet.[7] The approach was starting with an analysis of sound's power from that WAV files before going further into the 2D pattern, which will have features for the machine learning.[8] has developed the system by using a moving baby doll to simulate the baby moving inside the incubator.[9] has allows us to monitor the progress of the baby. Each incubator that has this system is connected to a central network based on Long Range Networks (LoRa) that allows registering the medical data in a database.[10] has developed the advanced portable and wireless-base incubator. The design is based on Wi-Fi and infrared technologies that measure the essential parameters that must be controlled.[11] has developed the fully functional incubator with precise control with respect to temperature, humidity, and airflow was developed and assessed.[12] has developed the model allows us to take into account all the thermal exchanges like radioactive, conductive, convective and evaporativeand the various interactions between the environment of the incubator and the premature newborn.

1.1 RELATED WORK

There several styles of setup for infants within the literature. In recent work, the planning of the hardware module of IoT-based kid setup monitoring system. The hardware module consists of a microcontroller, data acquisition submodule, and digital communication submodule. During this analysis, the microcontroller used is Arduino Uno Rev3 together with a vital sign detector because the illustration of biosensors and atmosphere temperature detector, wetness detector, and gas detector because the illustration of surroundings monitoring sensors. The Arduino board connected with the Associate in ESP8266 wireless local area network as a data communication submodule. This analysis additionally compared information nonheritable from this module with the information from connected measurement tools and In 2019 Paper, an example for verification of the temperature and ratio within the kid setup and to enhance the accuracy of the detector, still as permitting the example to watch temperature and ratio via IoT for teaching in medical instrumentation activity topic. The designed device composed of three main parts: [1] Input consists of five DS18B20 temperature detectors and one DHT22 wetness sensor, 2) The processor half-used NodeMCU (ESP8266) board that programming with Arduino IDE and 3) The show was divided into 2 parts: IoT and information lumberman to save lots of information into external memory before printed information to thingspeak.com. The designed device was set within the water bathtub at the side of OM-CP information lumberman tested on five to forty ° C to seek out temperature error every|for every} detector at each temperature price. The example was reprogrammed with compensation the error equations of every detector within the program and so retest with the kid setup temperature 32- forty °C. The result found that the error values were extremely attenuated. The performance takes a look at the designed device within the kid setup was compared to the setup analyzer complete Fluke medical specialty INCU II supported IEC 60601-2-19 test on 32° C and thirty-six ° C. The pattern of the temperature changes within the kid setup of the example device compared with the quality device was closely the same for each temperature. the typical temperatures and ratios measured from the example device on Steady Temperature Condition (STC) were had approximate acceptable values compared to mean values obtained from the quality instrument. All temperatures reading from the example were different from the quality device temperature but zero.5 °C, and also the ratio reading from the example was different from the ratio reading from the quality device.

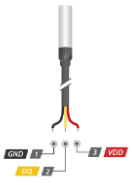
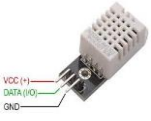
1.2 PROPOSAL DESCRIPTION

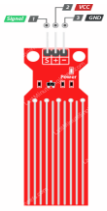
In this work, an Arduino Uno microcontroller is used to process the data from sensors. Arduino Uno is a microcontroller board with ATmega328. It has 14 input pin of digital output 6 wherein the input pin can be used as PWM outputs and 6 analog input pin, 16 MHz crystal oscillator, a USB, power jack, ICSP header, and a reset button. The proposed method uses Internet of Things for continuous monitoring of the parameters such a s Pulse, Temperature ,Humidity , RTC module for data logging ,sound sensor, movement sensor and gas sensor as the representation of environment monitoring sensors, Moment sensor, Wet sensor and Gsm module for alert SMS. If these parameters exceed from the threshold level, Initially, data is collected from the sensors and it is monitored with subjected values. Finally, alert messages sent to parent mobile phones during abnormal conditions. The measured various parameters of sensors were displayed on the mobile phone.

2. Materials and Uses

In this research Paper differents types of sensors are needed, which are for detecting heart rate, gas, sound, temperature, Humidity, Moment and wet. Given below table shows the sensor and that diagram with their uses. These sensors are interfaced with the Microcontroller

Table -1: Represent the Sensors and their Uses

Sr. No.	Type of Sensors	Diagram of Sensor	Uses
1	DS18B20		Measure temperature from - 55°C to +125°C with an accuracy of ±0.5°C in conditions
2	DHT22		Measure temperature from -40°C to 80°C and Humidity from 0% to 100% with a precision of ±1°C and ±1%

3	Heart Rate Detector- Pulse Sensor (SEN-11574)		Measure heart rate (BPM) in real time
4	Sound Sensor (LM393)		Detects intensity of sound where sound is detected through a microphone and fed into LM393 op-amp.
5	Vibration Sensor (SW-420)		Measures the total amount and frequency of vibration in a given system
6	Gas Sensor (MQ-135)		Detecting or measuring of NH3, NOx, Alcohol, Benzene, Smoke, CO2 and air quality control equipments
7	Wet (Water) Sensor		Detect the presence of water

A. Block Diagram of System

The Block diagram of the designed system consists of each hardware and software system. the diagram is as shown in Fig.1, hardware parts were assembled according to the block during this diagram. the subsequent sections give a lot of details of the parts utilized in the designed prototype. These systems are controlled automatically via sensors and microcontroller chips placed within the incubator. The diagram of the infant incubator monitor system, that used microcontroller, GSM 800, DS18B20 temperature sensors, DHT22 wetness sensing element, Wet Sensor, Pulse sensing element, Sound sensing element, and Vibration sensing element. First, we'll measure the temperature and humidity of the incubator and monitor the system using GSM 800 module to the webpage. Temperature And humidity ambient have Air temperature & humidity detector advanced with a digital signal output by using the exclusive digital-signal-acquisition technique, it ensures high reliability with the best stability.MQ-135 Gas sensing element used to detect the amount of CO2, Other gases & Air Quality within brooder. So, it provides the information about Presence of CO2 gas & Air Quality which can use it inform about oxygen levels.

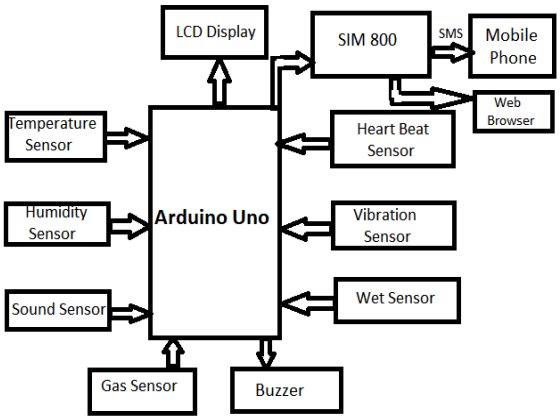


Fig. 1. Block diagram of system

B. SIMULATION RESULTS

Fig 2. Shows the overall circuit diagram which consist of Arduino uno is interfacing with LCD ,DS18B20,DHT22,Wet Sensor, Vibration Sensor, Sound Sensor, Heart beat Sensor, Buzzer, Pulse Sensor and SIM 800.

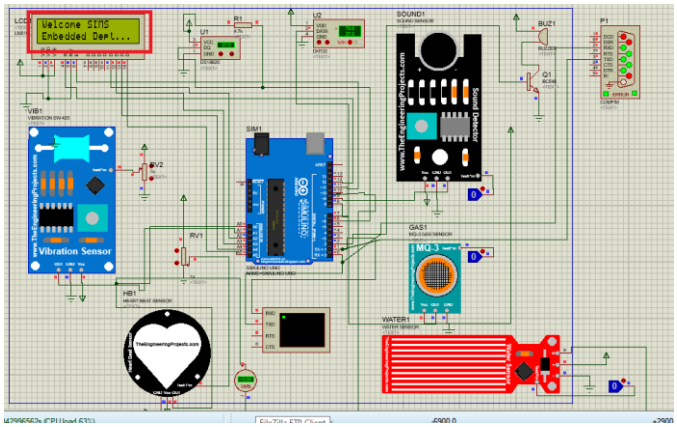


Fig.2. Circuit Diagram

Fig3. Shows the Welcome details of System when System will be Start.

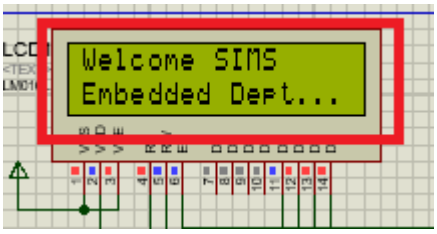


Fig.3. Initially LCD Display

Fig4. Shows the DS10B20 Temperature sensor Value 30 ,DHT22 Humidity Sensor Value 40 and Heart Beat Sensor Value is 72.

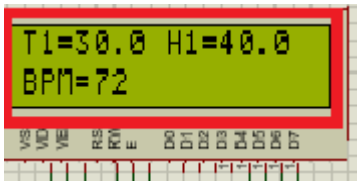


Fig4. Temperature, Humidity and Heart Beat Sensor Value

Fig5. Shows the Gas detection when any type of gases detected like Co2 and Shows no gas detection when no gas detection found.

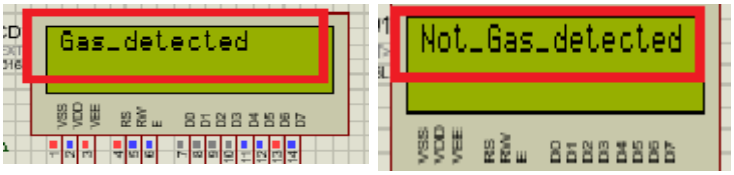


Fig5. Gas Detection

Fig6. Shows the Vibration detection when any type of Vibration detected and Shows No Vibration detection when no Vibration detection found.

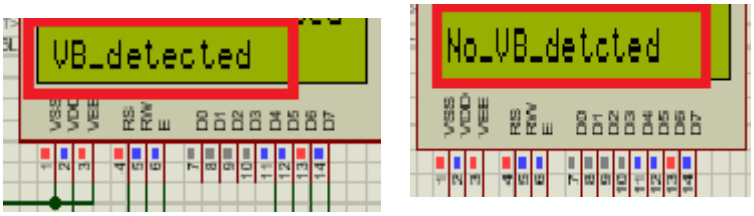


Fig6. Vibration Detection

Fig7. Shows the Sound detection when any type of Sound detected and Shows No Sound detection when no Sound detection found.

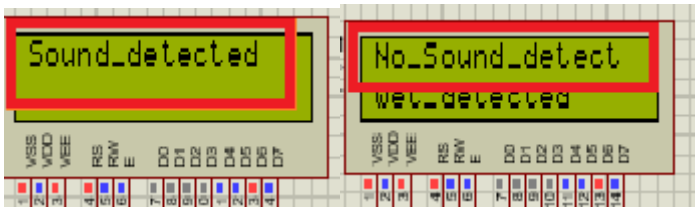


Fig7. Sound Detection

Fig8. Shows the Wet detection when any type of Wet detected and Shows No Wet detection when no Wet detection found.

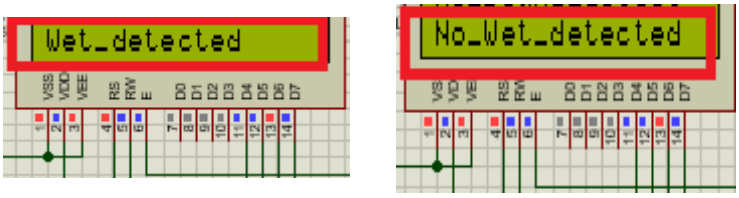


Fig8. Wet Detection

Fig9. Shows Temperature, Humidity and Heart Beat Sensor Value Alert, if the data is above/below a set point then the readings will send to mobile using GSM.

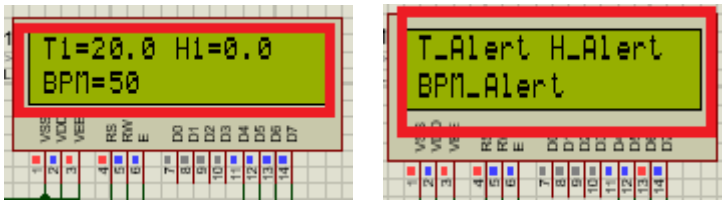


Fig9. Temperature, Humidity and Heart Beat Sensor Value Alert

Temperature=32	Humidity=55	BPM=69	No_Sound_detected	Wet_detected	Vibration_detected	Gas_Detected	09/05/2021 14:05:06 PM
Temperature=31	Humidity=52	BPM=70	No_Sound_detected	Wet_detected	Vibration_detected	Gas_Detected	09/05/2021 14:04:34 PM
Temperature=32	Humidity=55	BPM=70	No_Sound_detected	Wet_detected	Vibration_detected	Gas_Detected	09/05/2021 14:03:45 PM
Temperature=28	Humidity=52	BPM=70	No_Sound_detected	Wet_detected	Vibration_detected	Gas_Detected	09/05/2021 14:03:08 PM
Temperature=29	Humidity=51	BPM=67	No_Sound_detected	Wet_detected	Vibration_detected	Gas_Detected	09/05/2021 14:02:22 PM
Temperature=30	Humidity=49	BPM=65	No_Sound_detected	Wet_detected	Vibration_detected	Gas_Detected	09/05/2021 14:01:19 PM

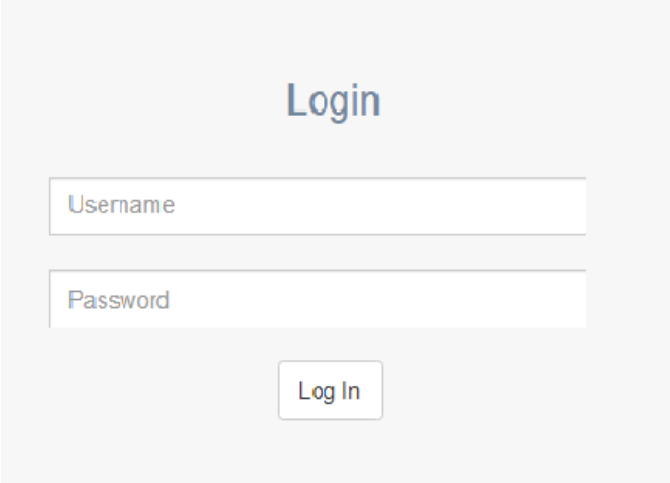


Fig. 10. Shows the login Page

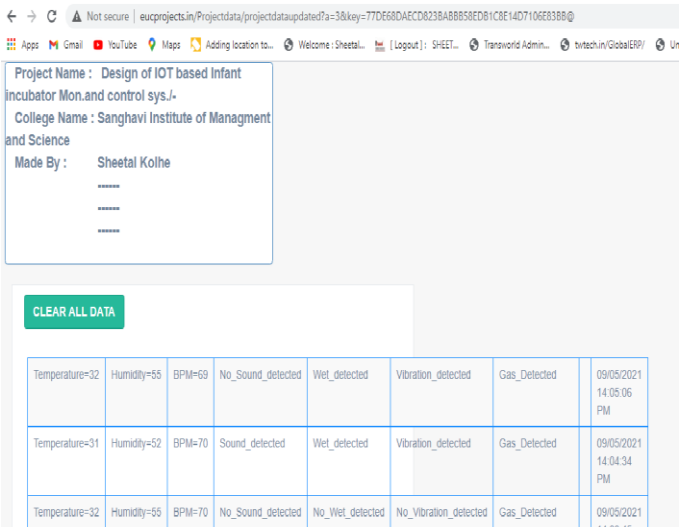


Fig 11. Shows the Home Page

Fig 10. Shows the eucprojects.in Home Page

TABLE 2. Represent the sensor values

Table 2 Shows the Temperature , Humidity ,BPM Values and also shows Wet detection , Vibration detection , Gas detection and Sound detection with respect to time. The Temperature, Humidity, BPM values are measured by the sensors.

Fig 9. Shows the temperature value, Humidity Value, BPM Value, Wet, Vibration, sound and Gas detection via eucprojects.in

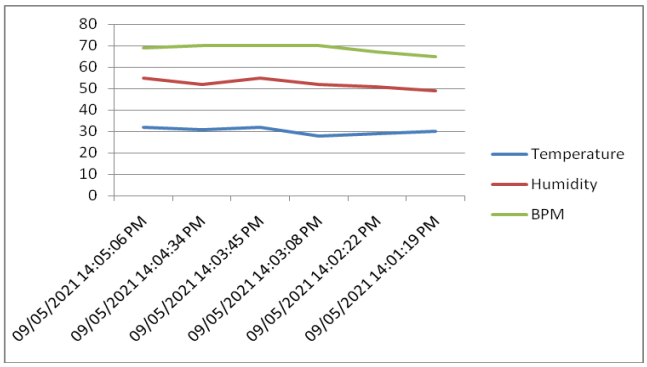


Fig 11. The data of temperature , humidity and BPM measurements via eucprojects.in

3. CONCLUSIONS

The goal of the project is to design a system, which should be easy to implement, and short-ranged. The project is implemented through the GSM SIM 800 Module, which is used to send values of Sensor's ratings on a specified mobile number & server . The continuous changes of reading are also appeared simultaneously send via SMS & IOT. This system is beneficial so that Monitoring Sensor data for problems before they occur can prevent the problems that will become major before it occurs.

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