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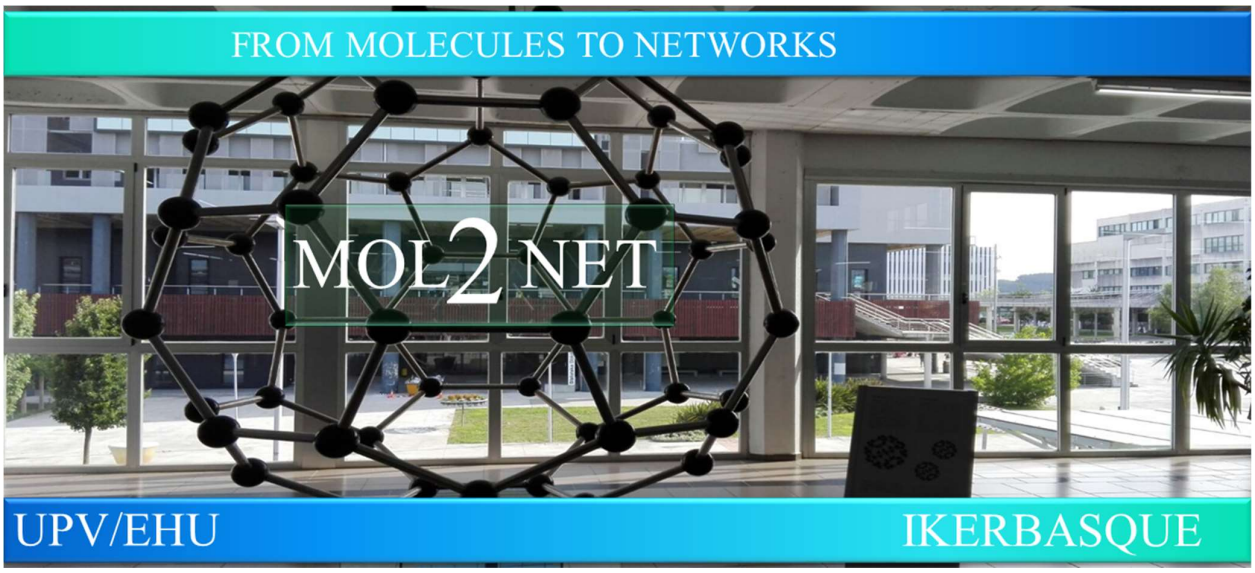

The Smart Cradle System Basis on Internet of Things

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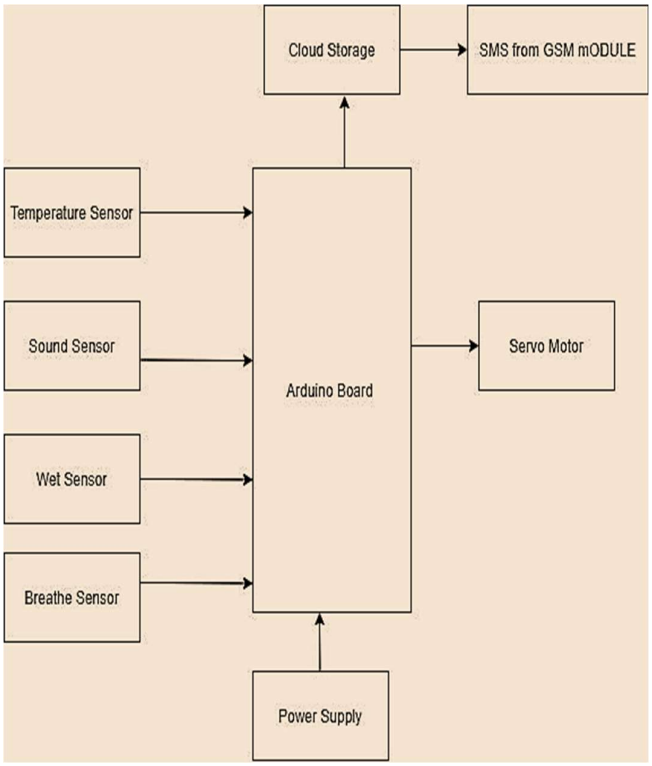
Abstract.

We all know that raising children is challenging, primarily when both parents work. It is hard to give 24 hours in such cases. Therefore, we must create something distinctive to benefit parents. Disease-causing bacteria are more likely to infect newborns. Equipment shortages may make matters worse. A model for a reliable and efficient infant monitoring system may improve neonatal care. It is a creative, safe, and innovative infant cradle. Internet of Things devices like Raspberry Pi, Arduino, Humidity & Temperature sensors, Swing Automation,

Cry Detecting Systems, Live Video Surveillance, and Cloud Services enhance smartness and innovation. The Cradle has several sensors/modules to monitor the baby's every move: a Humidity & Temperature Sensing Module to detect bed wetness, A Camera on Top of the Cradle for live video footage, and a Cry Detection Circuit to analyze Cry Patterns to activate the swinging mechanism. Sensor and module data will be stored in the cloud and analyzed regularly. A Health Algorithm is used on these datasets to collect information on natural states, which helps diagnose common illnesses. This procedure protects and cares for newborns effectively. Baby breathing problems are detected using a sensor. This sensor detects a baby's breath. Therefore, this technology improves the internet of things child monitoring for parents.

Keywords: Cradle, IoT, Raspberry Pi, Machine Learning.

Graphical Abstract



Introduction

The demand for automation, security, and comfort drives an increase in Internet-connected smart devices daily. It offers technological solutions that may advance the development of technical goods' quality, accuracy, and economic viability. It arranges sensing, actuation, and control functions to define and analyze problems, make decisions based on information at hand, and carry out intelligent action. The Internet of Things (IoT) is a communication network that emerged with the development of hardware and data networks [1]. It is built on information technology and the Internet. Automated identification and information sharing are made possible by the Internet of Things. The most crucial

component of smart devices, sensors, are used in IoT. A sensor relies on detecting items given to intelligent systems so they can take action automatically [2]. When an issue arises, a sensor detects it using external data based on the IoT and replaces it with a signal that both humans and machines can recognize. Because of how quickly time moves and how much work there is to be done, using IoT might take much work. Every sector makes use of intelligent IOT-based applications. Time savings, ease of use, and accuracy of work are the primary goals of IoT. We created a smart cradle in our system based on IOT that relies on timing and security. Soothing a baby and providing care are vital factors [3].

Nowadays, working is the norm for all people. Everyone wants to work in this world in order to survive. Both parent involvement is required to financially and economically develop the family. Child care has become a burden for parents when both parents work from home daily [4]. Most parents employ a babysitter to take care of their children. However, in the current climate, parents need help to afford the expense of a caregiver, making it hard to depend on a third party. If the mother is a stay-at-home mom, taking care of the child is essential for her to decompress. Our primary goal is to provide an excellent and happy environment for the infant. Consequently, we developed a smart cradle system based on IoT, which consists of sensors and actuators linked through the Internet and capable of communicating with one another [5].

Most newborn infant deaths in today's society are due to avoidable causes. Due to the neonatal stage, the mortality rate is more significant in the first 28 days after birth. According to data from Unicef, pneumonia (18%), complications (18%), and accidents (18%) are the top five factors that lead to mortality in children under the age of five. Before or during labor, diarrhea might happen (14% and 9%, respectively). The leading causes of mortality are malaria (7%) and malnutrition (11%), respectively [6]. The element that raises children's mortality rates and makes them more vulnerable to severe illnesses. Not all situations are handled by the parents every time. However, early detection and therapy are often either achievable or sometimes not. In order to treat, diagnose, and regulate harmful and undesired situations in newborn babies while they are still at home, smart cradle systems are required. Two of the most precious things a child may get from their parents are love and care. Nothing else will ever be able to change it. Even though the infant is still young, everyone is busy with their jobs and going through a trying time. A mother would sacrifice everything for her favorite child, even her health. She works hard to protect the infant's health. However, people must take time to unwind and rest in any situation [7].

In this work, we design a "smart cradle system" to bridge the gap between parents and kids and to make them feel safe and comfortable. Our complete solution is IoT-based and employs a deep learning model to reduce the likelihood of dangerous circumstances. In our approach, we use several

sensors to identify potentially dangerous circumstances, including temperature, sound, moisture, and breathing sensors, as well as a GSM module to alert the parent through mobile [8].

Materials and Methods

The servo motor's axis is where the cradle is intended to be mounted. When the operator flips the switch, or the audio sensor picks up the baby's scream, it swings. The components are first put on the breadboard to ensure the system functions correctly before being moved to the soldered circuit panel. When the operator hears or triggers the baby's cry, the cradle is fastened to the top part of the servo, allowing it to swing. A few crucial traits of the baby need to be examined every day. Examples of sensor-measured metrics are body temperature, sound sensor, moist sensor, and heart rate [9]. The Arduino UNO board will process the sensor readings, sending the data through the Wifi module. The baby's status will be considered as we monitor the sensor data and take the proper action.

The individual component testing was successful. Therefore, after merging the parts and making a few programming and hardware changes, the whole system was developed. A simple switch was used to transition between the manual and automatic modes. During system functioning, screenshots of the display were taken. The findings were judged to be equivalent when compared to those obtained using traditional equipment [10]. The cradle will begin to move when the baby begins to cry, and if the baby cries for more than two minutes, the cradle will send a message to the parents. However, this satisfies the fundamental standards since it may be assumed that the baby is alone in a calm environment in automatic mode. There are four sensors in the cradle system, and any one of them may be used in any situation.

If the baby cries or makes a sound, the noise sensor will recognize the frequency and start swinging. After that, provide a clear warning. A warning signal will go out if the infant has saturated the cradle's matrix. A warning signal is produced if the child's body temperature fluctuates quickly about the surrounding air temperature. Send a warning signal if the infant's heart rate is too high or a dangerous situation has arisen [10].

Results and Discussion

It is a neural network or artificial neural network. Machine learning research has grown too popular. Here, the input layer becomes another output layer. Categorization is input, passed through one or more hidden levels, and output. Our problem uses temperature, sound, moisture, and breath sensors. Audio is our input. Temperature and moisture signals determine the output name. It is a deep network because it contains many hidden layers between input and output.

Movement displays using deep neural networks might continuously gather data. Automatically detecting and segmenting movements may precede further analysis or grading. This would decrease manual data analysis and increase the usefulness of objective measurement methods. Data-driven movement displays would benefit from the ability to identify and rate movement using a few wearable sensors.

Thus, we first used a deep neural network to recognize typical movement screen movements in motion data. Our second aim was to compare optical motion take networks to wearable sensor networks. Nodes and neurons make up a neural network. Deep neural networks have tightly connected input, hidden, and output layers. Like an acyclic graph, deep networks' vertices and edges indicate neurons and weight. As a feeds forward network, it has no directed loops or cycles and is closely connected since each neuron in layer i+1 calculates the other. The procedure has expanded the hidden layer while leaving the input and output layers unchanged. Define deep network computing.

$$Let\ h\ l\ (xi)\ =\ f(W\ l\ h\ l-1\ (xt)\ +\ bl)$$

f(.) is the activation function, and h l () is a function that maps individual neurons to layer l. The layer's bias vector is b, a weight matrix. If the result is desired, a biased vector is needed. Machine learning improves weight at the lowest cost. Arduino collects data from sensors like temperature, humidity, sound, and heartbeat, and an algorithm creates a graph and tests the system. Time-varying temperature sensors set the threshold and detect the outcome. We graph the highest and minimum values and calculate a result.

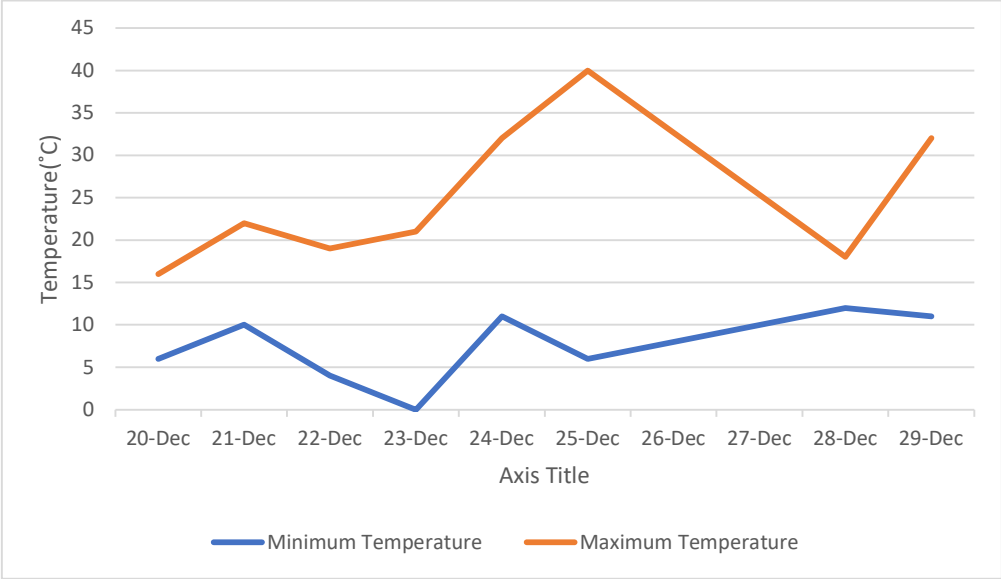


Figure 1: Temperature Sensor output values with Graph

Sound sensor detects infant crying and discomfort in this project. We graph low- and high-voltage sounds for accuracy.

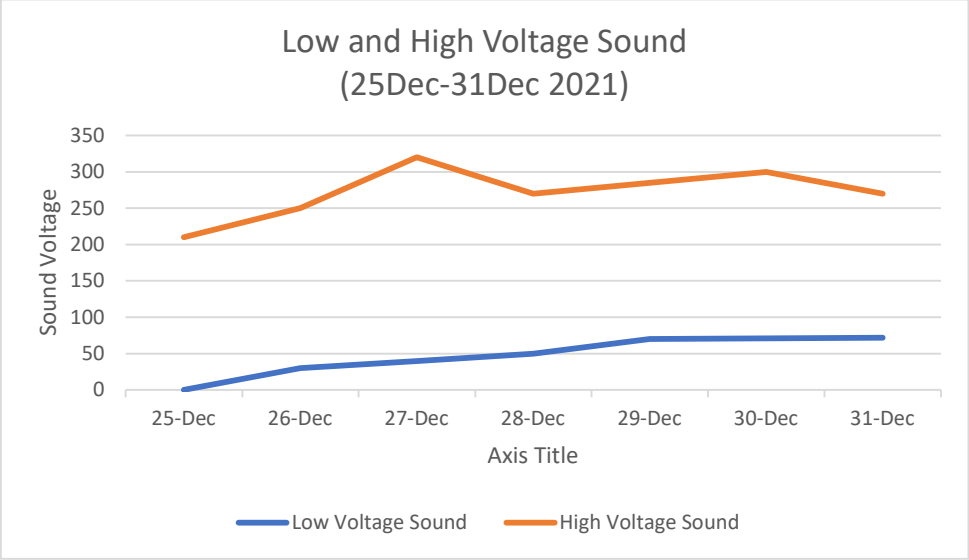


Figure 2: Sound Sensor output values with Graph

Detecting infant wetness. Arduino reads wet diapers and beds and sends an alarm message. We graph output data to test Arduino-connected wet sensor accuracy.

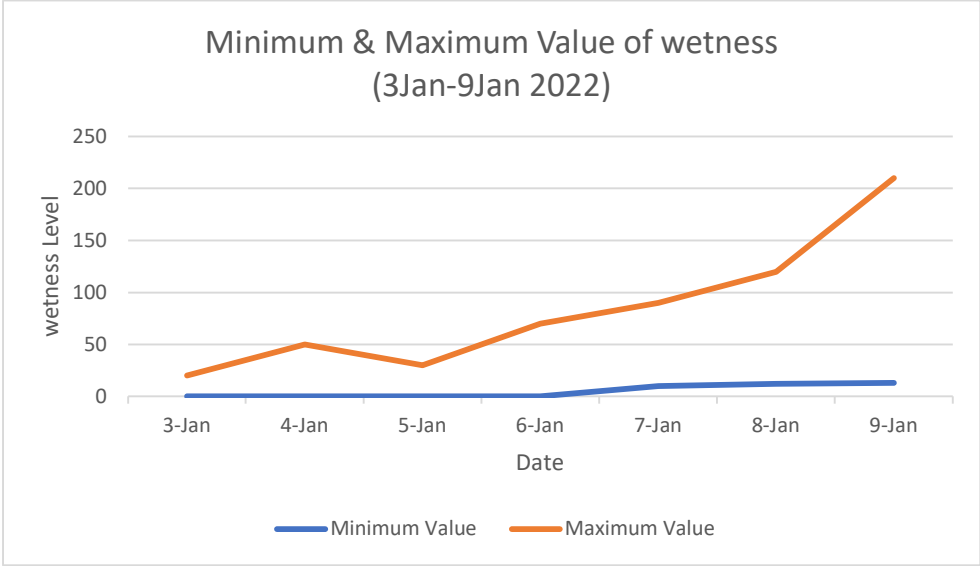


Figure 3: Wet Sensor Output values with Graph

To test our system, we build a conclusion graph for all sensors, including temperature, sound, moisture, and heartbeat sensors. All sensors connect to Arduino and produce values, which are graphed to assess system correctness.

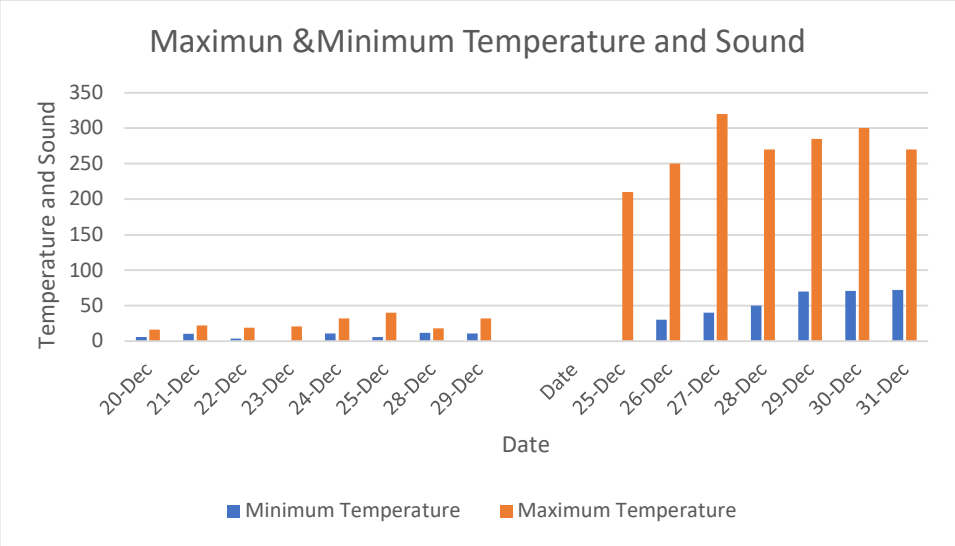


Figure 4: Output Values of Temperature and Sound Sensor with Graph

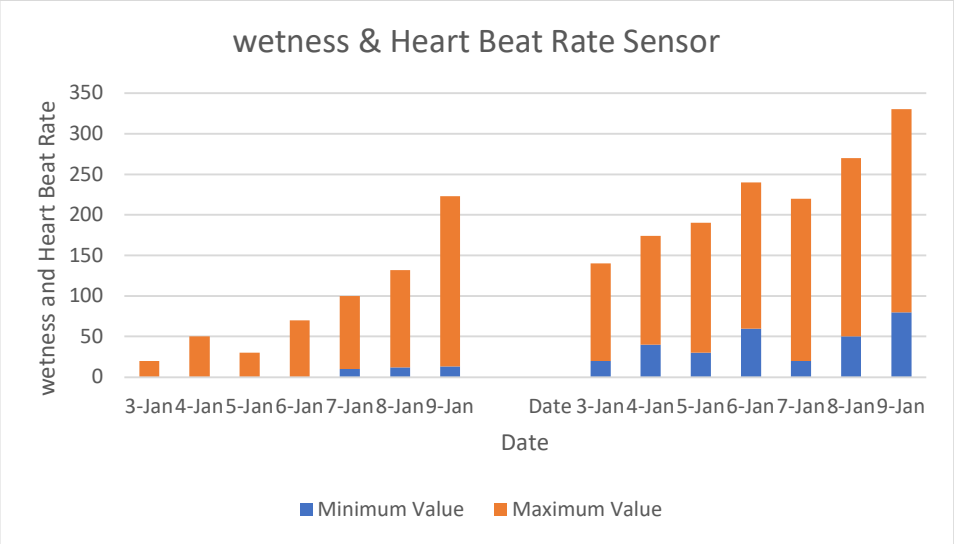


Figure 4: Wetness and Heart Beat Rate Sensor

Conclusions

Sound sensor detects infant crying and discomfort in wearable electronics, and photonics enable a new generation of health monitoring gadgets because of the sensing device and wireless communication advances. IoT gadgets are more innovative. Innovation simplifies labor. This method is more straightforward and safer for the baby. It is a way to utilize modern technologies without disrupting parents' lives. As said, our goal is to create newborn monitoring software with a unique security mechanism. Intelligent infant cradle supports are great for busy parents. It is cheap and easy. This project introduces Smart IOT Devices for kid health and monitoring to help parents identify and

monitor their children. The recommended method may help new parents improve their quality of life and safeguard babies from accidental injuries. It may help working parents and clinics care for newborns. Thus, the cradle system ensures the baby's health. The recommended strategy seeks to improve newborn care by identifying the source of the baby's crying, which is essential to satisfying the baby's requirements. This module also describes the baby's scream. This research has focused on the baby spot. This method may reduce parents' stress and boredom. This cradle will watch a newborn for two years. This article describes cradle-to-grave automation's multiple sensors and actuators. The Arduino UNO board's various sensors can track the child's posture minute-by-minute. The Arduino board alerts the caregiver of the baby's temperature, wetness, sound, and heart rate. Newborn monitoring begins with security checks of critical metrics, including monitoring systems and complete infant observation. This lets you monitor the youngster remotely.

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