# KRISHNA ENGINEERING COLLEGE
## Department of Electronics & Communication Engineering

# Synopsis
# on

# IoT based Baby Incubator

Submitted in Partial Fulfillment of the degree B. Tech. (ECE)
## by

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# ABSTRACT

In the industrial era 4.0, domestic baby incubator producers are facing the challenge of free trade of foreign products that will compete in innovation with the application of IoT technology. One of the opportunities that arise consciously or unconsciously at the NICU (Neonatal Intensive Care Unit) unit in Hospitals, in general, is that there are no facilities for parents to monitor the baby's condition inside the incubator directly. The purpose of this research project is to build a prototype of an internet-based baby incubator monitoring system based on things equipped with various sensors that will send data to the server in real-time, including the pulse rate, body temperature, weight, movement, and voice of the baby. it also monitors the temperature, humidity, oxygen level, and air pressure of the incubator. This study focused on how to develop smart portable baby incubators that can easily carry from one place to another with these features. The benefit of this research is as a driver of innovation for baby incubator products that will support the national medical devices manufacturing company.

# Introduction

In the industrial era 4.0, the main challenge of the product is the use of digital infrastructure where the internet of things (IoT) has been developed. IoT refers to physical devices, communication networks, medical equipment, and other items that can be connected using internet communication protocols. With the existing internet network, data will be collected and processed in a centralized server. Internet of Things cases is chosen since the topic grows quicker than enactment.

In the health sector, national baby incubator producers are facing challenges from imported products that will have innovation with the application of IoT technology. For that, we need an internet-based baby incubator monitoring system that will encourage the creation of competitiveness.

The purpose of this research project is to build a prototype of an internet-based baby incubator monitoring system based on things equipped with various sensors that will send data to the server in real time, including the pulse rate, body temperature, weight, movement, and voice of the baby. it also monitors the incubator's temperature, humidity, oxygen level, and air pressure. This study focused on how to develop smart portable baby incubators that can easily carry from one place to another with these features. The objectives of this research are as follows:

- Building a prototype of a baby incubator monitoring system by utilizing IoT-based communication technology and various sensor modules that are already available to be sent to the server and can be accessed on mobile.
- Capture and analyze the pulse rate, body temperature, weight, movement, and voice of the baby and also monitors the temperature, humidity, oxygen level, and air pressure of the incubator.
- Increase the safety aspect by giving a warning of problems if there are irregularities in the baby incubator environment.

The benefits of the research carried out are as a driver of innovation for baby incubator products that will support the National Medical Devices Manufacturing Company.

# MOTIVATION

Premature infants are exceptionally touchy and more often than not endure hypothermia and hyperthermia. A substantial number of newborn children in the creating scene kick the bucket because of rash inconveniences emerging due to the non-accessibility of Infant Incubators. These deaths are frequently caused because of warmth misfortune and parchedness as the rashly conceived children can't direct the temperature as the temperature of the earth changes, this can be anticipated by restorative consideration with the assistance of a hatchery. Available infant incubator suffers from the following two problems:

- Infant incubator is relatively expensive and for this reason, many healthcare centers, especially in rural areas, can't afford to buy them.

- Most incubators run on electricity, therefore when there is an acute shortage of electricity, this existing expensive baby incubator is of no use.

- And all the incubators are operated manually and we need a doctor staff who always monitors the incubators.

So, we design a rechargeable and affordable IoT-based smart incubator that automatically monitors all the data related to the infant and gives all the data to the server via the internet and if there is any problem it also gives an alert on the server. With the help of this, we can easily operate and monitor from anywhere via the help of the internet.

**Advantage of smart baby incubators:**

- Since it operates on battery, so we can easily operate it where electricity is a major issue.

- Since it is a smart incubator that is it will be connected to the internet. So, we can easily operate it from anywhere.

- It sends all the updates to the server, so from anywhere, any doctor can check the data and instruct to anyone to make changes to it.

- If there are any fluctuations in the data it sends the alert in real-time to the server.

- It will be cost-effective so that anyone can buy it easily.

# Methodology and Components

In general, this research can be divided into three parts, including the development of a Web-based Monitoring System, hardware, servers, and data analysis. The three sections, as the methodology of the system, can be seen in Figure 1.
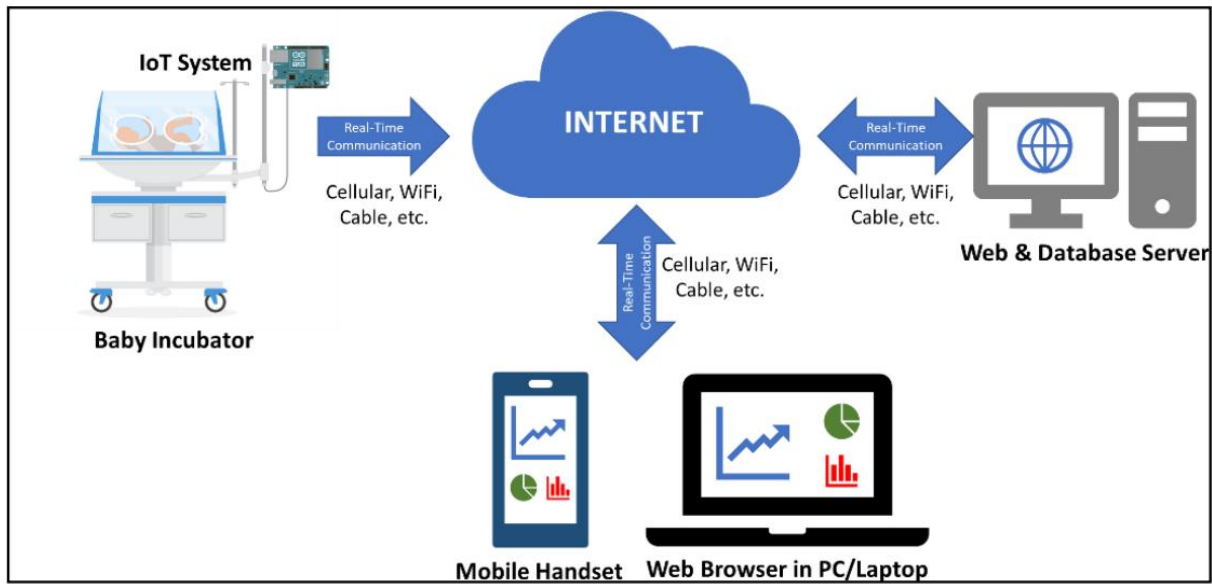


Fig. 01: Block Diagram of overall system

The developed hardware module consists of an IoT module that can be implanted or installed in a widely used Baby Incubator. Current baby incubators generally only function as regulators of room temperature and humidity in an incubator, and some also analyze air composition. From the baby himself, some data such as body temperature, and pulse signals are also sometimes only monitored manually by the midwife in charge.

This module functions to carry out automatic data acquisition from biosensors (heart rate, body temperature, body movement, blood oxygen level, etc.) and environment monitoring sensors (temperature, humidity, and pressure of the air inside the incubator). This data is then sent to the IoT server to be stored centrally. Furthermore, the information that has been stored on this server is further processed automatically by using the data analysis feature on the IoT server.

The implementation will be carried out using a low-power microcontroller system, which mainly consists of input in the form of sensors, data processing in the form of a microcontroller development board, and output in the form of a

communication module (which may be integrated into the board) and LCD. In addition to developing and implementing hardware modules, it is necessary to develop methods / digital communication protocols so that data can be sent efficiently.
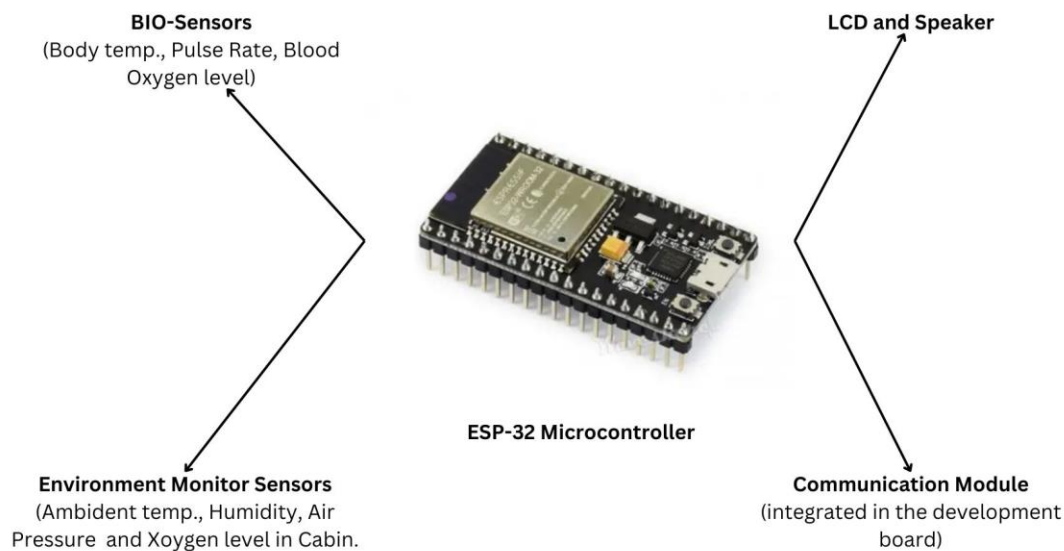


Fig. 02: Hardware module schema

Data from the IoT module will be sent to the server to be processed and displayed on the monitoring page. Data will also be periodically processed with specific algorithms to get the analysis needed, such as body temperature trends, and pulse patterns, blood oxygen levels from infants. Other data analysis that utilizes machine learning can also be done.

In the implementation of the Internet of Things Baby Incubator Monitoring System, one essential part is the server and database subsystem, which also includes subsystems that compute and analyze collected data. This system consists of a web server composed of an interface with a sensor device on the incubator, an interface with a gadget-based display and control system (mobile device) and a PC browser owned by the user, and a database to store data before sending to other subsystems for a display to users or further analysis.

On the web server subsystem, data sent by the onboard monitor will be received and then stored in the web server database. These data will then be sent to the computing and data subsystem analyzing machine-based analysis / artificial intelligence to assess the condition of the baby in the incubator and produce complete information that can be read and understood by parents as a basis for making decisions about the incubators being monitored.

# Plan of Work

Our plan of work is to build a smart IoT-based portable baby incubator that can measure the health of the baby and also the environmental condition inside the incubator.

It measures the pulse rate, body temperature, blood oxygen level, weight, movement, and the voice of the infant, it also measures the environmental condition like temperature, humidity, air pressure, etc. inside the incubators.

Our project has three main parts. These are listed below:

1. In the first part we will collect all the health-related data from the infant. For this, we will design a sleeping pad that is placed at the bottom of the incubator, this pad contains all the sensors like pulse sensors, oximeter, temperature sensors, weight sensors, etc.

2. In the second part, we will measure the data from the incubator environment. For this, we placed sensors in the incubator like air pressure sensors, temperature sensors, and humidity sensors and it also contains light to maintain the temperature of the incubator.

3. In the third all the data will send to the server in real-time to monitors on the display of the computer and the smartphone. The data will also monitor on the display of the incubator.

We will set the upper and lower limit of the data if there is any problem like increasing or decreasing the body temperature of the infant, we sent an alert to the server and also through the incubator.

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