

# Neonatal Incubation Controlling and Monitoring system using myRIO and LabVIEW

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**Abstract:** The medical industry has developed and reached new heights in the modern world as a result of technological advancements. Premature new-born child mortality rates have been brought under control. Incubators for babies play a crucial role in this. The patient's welfare is of the utmost importance. Unlike normal babies, who can regulate their body temperatures on their own, premature newborns lack the ability to monitor their temperature. As a result, they are placed in infant incubators that can regulate their body temperature. Unfortunately, it has been noticed in recent times that there is often a fault in the temperature controlling unit, which has resulted in deadly accidents resulting in the death of infants. Taking this into account, it appears to be perfectly reasonable to include a separate temperature monitoring unit that will measure the temperature of the incubation system. To address this problem, we suggest a design that will reduce issues with baby incubation. The incubator plays an important role in the medical industry; it is one of the most important things for new born premature babies to regulate their body temperature. We propose a project for infants incubator temperature sensing and controlling system, as well as nearby gas leakage sensing and live monitoring through camera. If an imbalance happens, it will transmit an alarm to the closest nursing station as well as messages to the parents.

**Keywords:** Premature infant, LabVIEW, Temperature Sensor, Gas Sensor.

## I. INTRODUCTION

The incubator is thought of as an air-conditioned room with precise specifications that we can control based on the baby's condition in the incubator. Incubators are specially designed to provide the best possible environment for newborn babies with growth issues (premature babies) or illnesses. The incubator is a dust-free, bacteria-free environment with the ability to regulate temperature, humidity, and oxygen to keep them at safe levels, such as (36°C-38°C) for temperature. The patient's welfare is of the utmost importance. Premature newborn babies, unlike normal babies, do not have the ability to regulate their body temperatures on their own. As a result, they are placed in infant incubators that can regulate their body temperature. Unfortunately, it has been noted in recent years that there is always a fault in the temperature controlling unit, which has resulted in deadly accidents resulting in the death of infants.

Taking this into consideration, it seems reasonable to include a separate temperature monitoring unit that will measure the temperature of the incubator. In the current research, we suggest adding a gas sensor unit to the incubator, which will detect nearby gas leakage. We integrated a camera to constantly monitor the baby and to know the baby's status. This may help prevent fatal accidents caused by the incubation system's temperature control unit malfunctioning.

A camera installed in the incubator constantly captures pictures of the infant, ensuring that the environment is not disrupted by regular visits. Neonate actions in the incubator and incubator parameters were controlled using Camera and Vision Assistant software with the assistance of LabVIEW 2017's.

## II. IMPLEMENTATION

### A. Temperature Sensor:

The temperature of the incubation chamber is totally measured using an LM35 temperature sensor. (Fig a) It is a reasonable option because it does not require external calibration and the coating prevents self-heating. It has more precision. Its operating voltage ranges from 4 to 30 volts. V.



Fig a. LM35 Temperature Sensor

### B. Gas Sensor:

The MQ135 Gas Sensor (Fig b) is used to detect or measure gas leakage near the incubation. It is used because it has a high sensitivity to ammonia, sulphide, and benzene series steam, as well as the ability to monitor smoke and other poisonous gases. It detects the gas and sends an alert to a nearby nursing station. The gas level within the incubation is also continually tracked using a LabVIEW waveform graph.



Fig b. MQ 135 Gas Sensor

### C. Camera Module:

The camera module is used to entirely capture the baby in real time. If there are any imbalances in the newborn, the nursing station will be notified.

### D. myRIO Hardware:

The myRIO hardware is used to accept both digital and analogue sensor signals. (Fig c) It is used in our project to connect temperature sensors, gas sensors, and camera modules to the PC's LabVIEW programming software. It supports data acquisition and signal conditioning equipment from National Instruments. Ethernet, GPIB, serial, USB, and other kinds of instruments are all supported. NI GPIB controllers and NI embedded controllers with GPIB ports are supported.



Fig c. myRIO Hardware

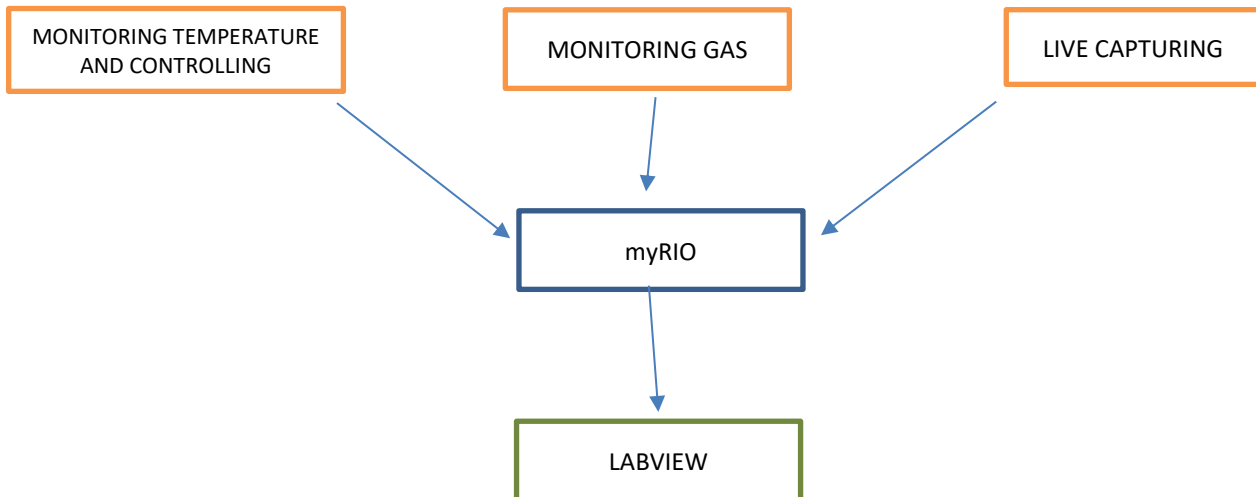
### E. LabVIEW Programming:

The process inside the incubator is controlled using LabVIEW, a graphical programming tool. Compact Field Point is used to collect data from temperature, gas, and camera modules. The Temperature Acquisition Module (TC-120) receives signals from temperature sensors, while the Analog Input/Output (AIO-610) receives signals from gas sensors. Sensor values are consistently obtained and compared to see if they are within defined limits, according to the control algorithm. The bulb is switched off if the temperature limit is exceeded. The 5v relay is used to turn the light on and off. The gas sensor output is calibrated to show the gas level of the baby's incubation system. The camera is attached to the incubator and is programmed to consistently capture pictures of the baby using LabVIEW and Vision Assistant. All of these settings, as well as the photograph, can be watched and monitored from afar.

### III. METHODOLOGY

The configuration is split into three parts: temperature monitoring in the incubator, gas level monitoring, and live video capture of the infant.

Temperature signals are read by myRIO kit, which is interfaced with the sensor, and the temperature sensor (LM35) is placed within the incubation. When the temperature of the incubation rises, the incubation bulb is turned off by a relay. A gas sensor (MQ135) is also installed inside the incubator, and the gas level is constantly monitored; if any anomalies occur, the sensor alerts the nearby nursing station. The baby's motion is captured in real time by the camera module.



Flowchart of the Project

### IV. RESULTS

MyRIO collects data from all of the sensors and interfaces it with LabVIEW programming to control the whole process. By sending the temperature out value to the relay that is connected with the bulb, the bulb is turned on when the temperature of the incubator is below 35 C and turned off when the temperature is above 38 C. When the gas level is abnormal, it generates an alert, and the Waveform Chart displays the gas level in real time.

The below mentioned labview programming is for temperature sensing unit.

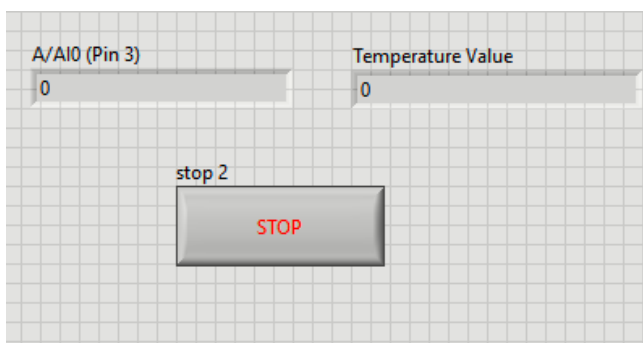


Fig a. Front Panel

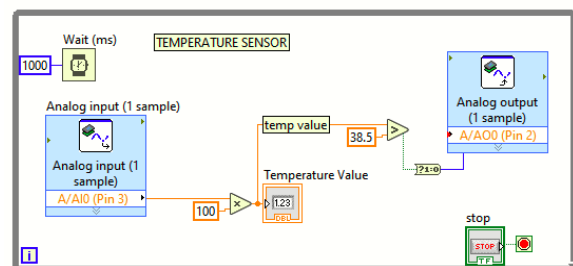
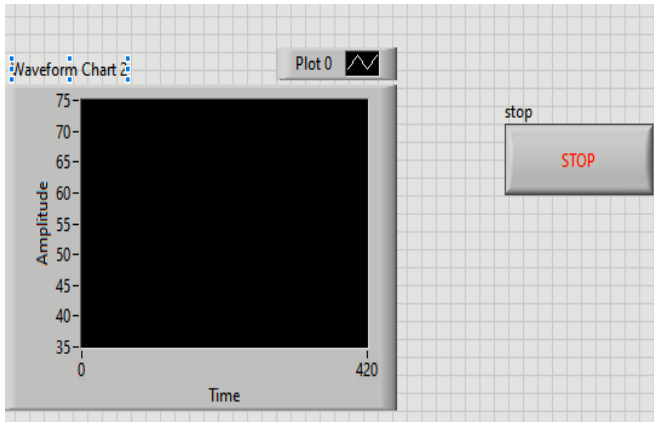
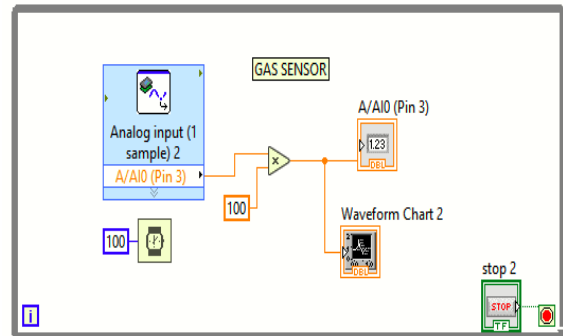


Fig b. Block diagram

The below mentioned labview programming is for gas sensing unit.



b. Block Diagram



a. Front Panel

## Results Desired and Achieved

S.No	Parameter Value	Desired Action	Achieved Action
1. Temperature	<36	Bulb ON	Bulb ON
2. Temperature	>38	Bulb OFF	Bulb OFF
3. Gas Level	<70% RH	Indicates ORANGE light	Indicates ORANGE light
4. Gas Level	>75% RH	Indicates RED light	Indicates RED light
5. Image	- Acquire Images Displayed on Front panel		

Tab.1

## V. CONCLUSION

Real time parameters like temperature, gas level, images are acquired and even danger situations can be implemented to save the life of neonatal's. Even more sensors can be implemented for wet body detection, reduce noise vibration etc. Remote monitoring and control of parameters is useful especially in case of transport incubators and also remote treatment of babies where proper medical facilities are not available. The cost incurred is the equipment cost and the effect is life saving one.

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