**1.INTRODUCTION**

Our project smart infant incubator that consists of fabric based resistive filaments that safely provide warmth to the neonate as due to pretem birth body is fat is miniscule.The Incubator temperature and humidity is carefully controlled.The main and important role of incubators is to maintain the small environment of desired temperature and humidity which minimizes the the heat loss.Once the heat loss is reduced , the nutrition given to premature babies will be utilized in organ development and weight gain.

So far our aim is to design an incubator where the incubator paramaters can be controlled using mobile app, this helps the nurse or doctor to control the temperature and humidity of the particular incubator when they are out of that place or hosiptal.

**1.1OVERVIEW**

In Early developments 1985, Infants are nursed in incubators using either air mode control or skin temperature servo control. Data are collected continuously using a computer linked monitoring system. In 1998, Water permeability of the infant's skin is an important factor in the maintenance of a controlled water and heat balance. Radiant warmers and incubators are used to maintain the temperature of the newborn infants. Incubators provide a heated environment to reduce body heat losses.

In 2016, they define and discuss some of the major challenges in the healthcare systems which be effectively tackled by recent advancement in ICT technologies. In particular, they focus on sensing technologies, cloud computing, internet-of-things and

big data analytics systems as emerging technologies which are made possible by the remarkable progress in various aspects including network communication speed, computational capabilities and data storage capacities that provide various advantages and characteristics that can contribute towards improving the efficiency and effectiveness of the healthcare services. It describes a non-pharamalogical solution, called Smart, which provides comfort through medication of a parent's physiological features to distressed neonate via an intelligent pillow system embedded with sensing and actuating functions.

**1.2 PURPOSE**

An incubator is designed to provide safe, controlled space for infants to live while their vital organs develop. Unlike a simple bassinet, an incubator provides an environment that can be adjusted to provide the ideal temperature as well as the perfect

amount of humidity. Incubators prevent hypothermia by helping the baby to maintain optimal temperature. Temperature controls on a baby incubator can be set manually or automatically based on the baby's temperature.

Baby Incubators also acts as humidifiers. This helps keep to the baby from having skin problems. Another feature of baby incubators is that they block out noise. The Neonatal Internal Care Unit(NICU) can be a busy and loud place. Incubators protect babies from noises and direct light that can disturb them ana cause sleep interruptions, increases in blood pressure, and unnecessary stress.

**2.LITERATURE SURVEY**

**2.1 EXISTING PROBLEM**

India is 2nd most populated country in the world and the birth rate is very high.According to market surveys, in India every year 26 million infants are born. Out of 26 million, 2.6 million infants are prematurely born with low birth weight(lbw). These LBW infants has to be kept in place where temperature, humidity should be controllable.But, due to lack of equpiment infants are not able to gain weight . And are dying due to lack of facilities . In rural areas, their will be no minimum facility at hosiptal for regular checkup for infants. After many years of advancement of technology **INCUBATOR** is designed. After designation incubator the death rate of LBW infants were decreased. In incubator the baby must be kept under observation every time. If there is no person at the infant we can't know whether the temperautre and humidity are maintained at threshold level. If they are not maintained then it leads to death of infant. To decrease this death rate we designed smart monitoring based on iot.

**2.2 PROPOSED SOLUTION**

To overcome this problem , we have designed infant incubator with smart monitoring . In our project we used sensors to detect the temperature and humidity of the particular incubator. If the temperature and humidity of the infant incubator increases the threshold value , then the sensor detects it and sends the alarm notification to the doctor.So that the doctors can come immediately and adjust the values of those parameters.

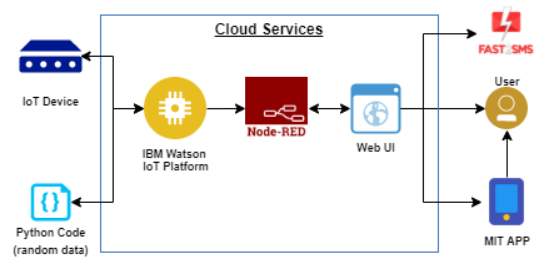
If the doctors are at far away places from incubator they monitor the temperature and humidity values at their itself. They can also control the incubator using mobile application. They can also ON and OFF the incubator whenever neccessary,and even if they are far from the incubator.

**3. THEORETICAL ANALYSIS**

**3.1 BLOCK DIAGRAM**

How does smart infant incubator works?

The brief understanding of infant ncubator is shown in the block diagram. The entire process developing the project is shown below.

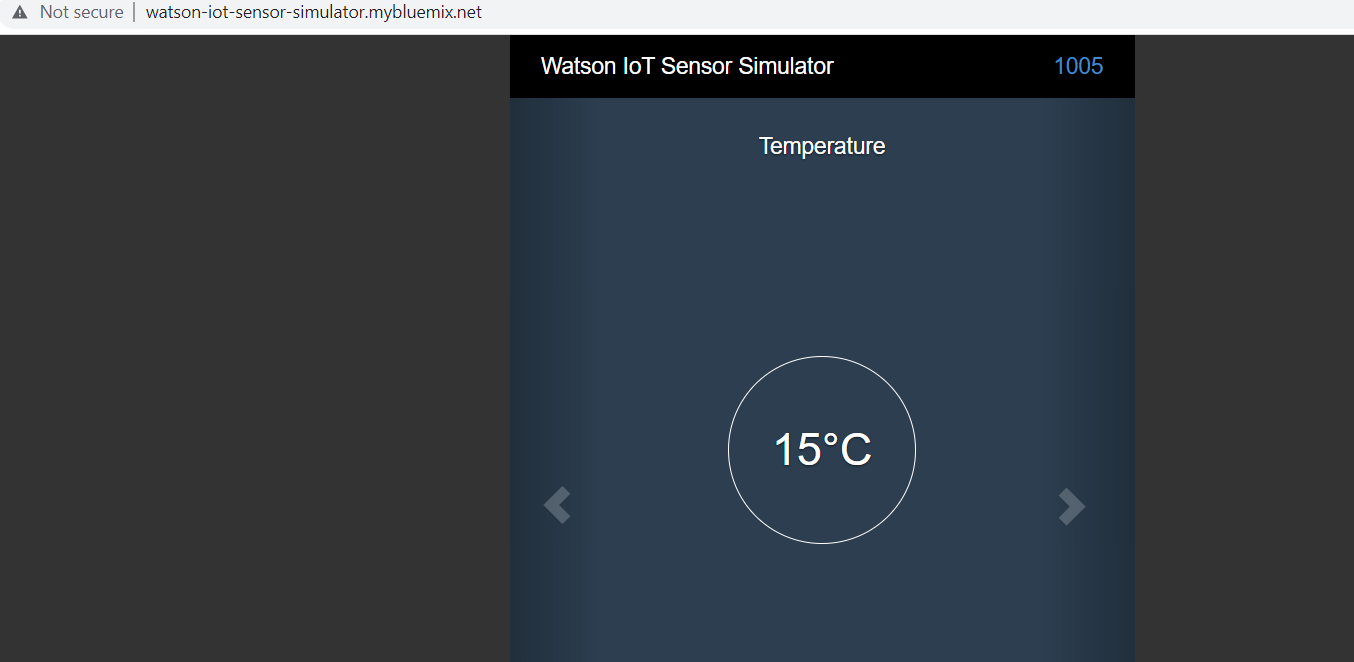


**3.2 SOFTWARE DESIGNING**

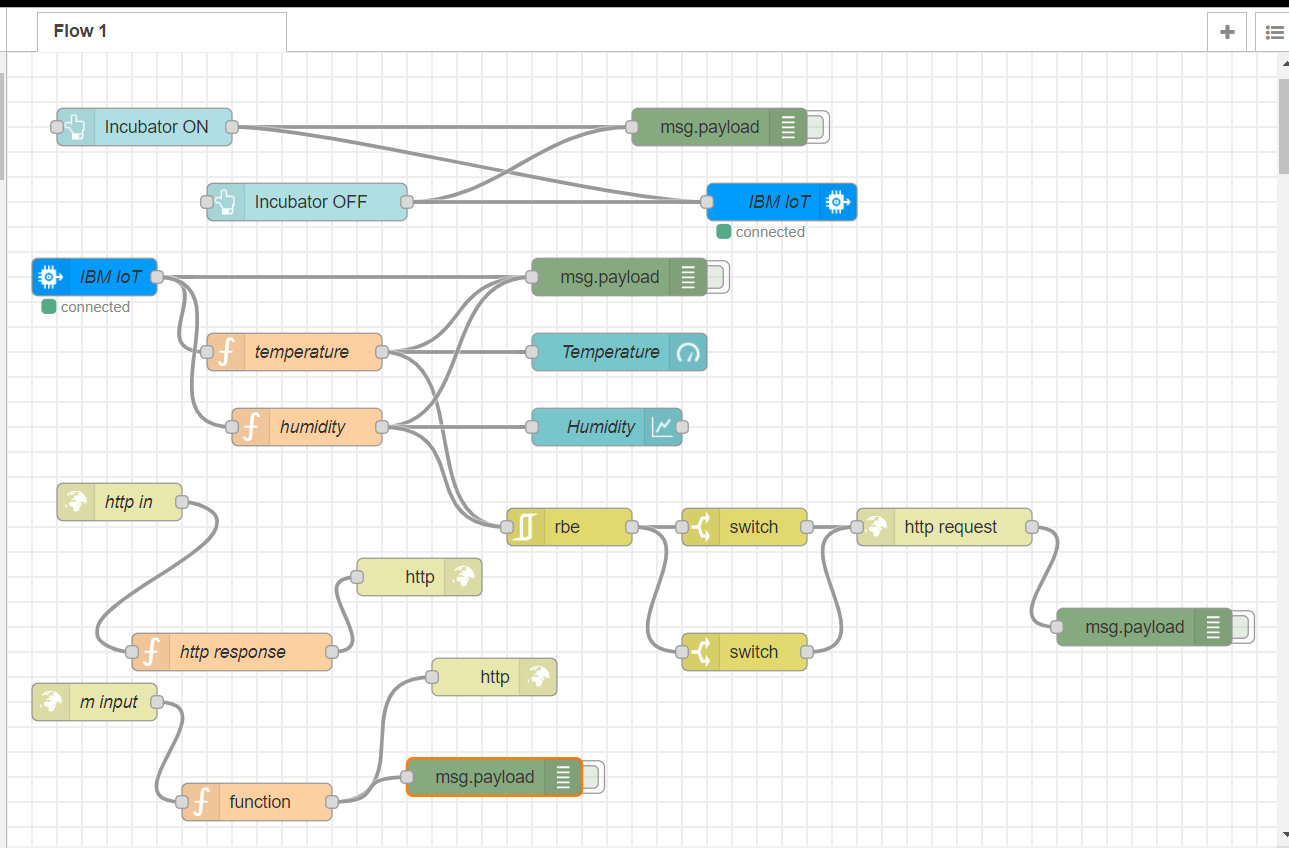
* Code for controlling the incubator.
* Code for IBM watson simulator.
* Code for random data count.
* API keys development for web application.
* API keys development for sending message alerts.
* URL development for data.

**4. EXPERIMENTAL INVESTIGATIONS**

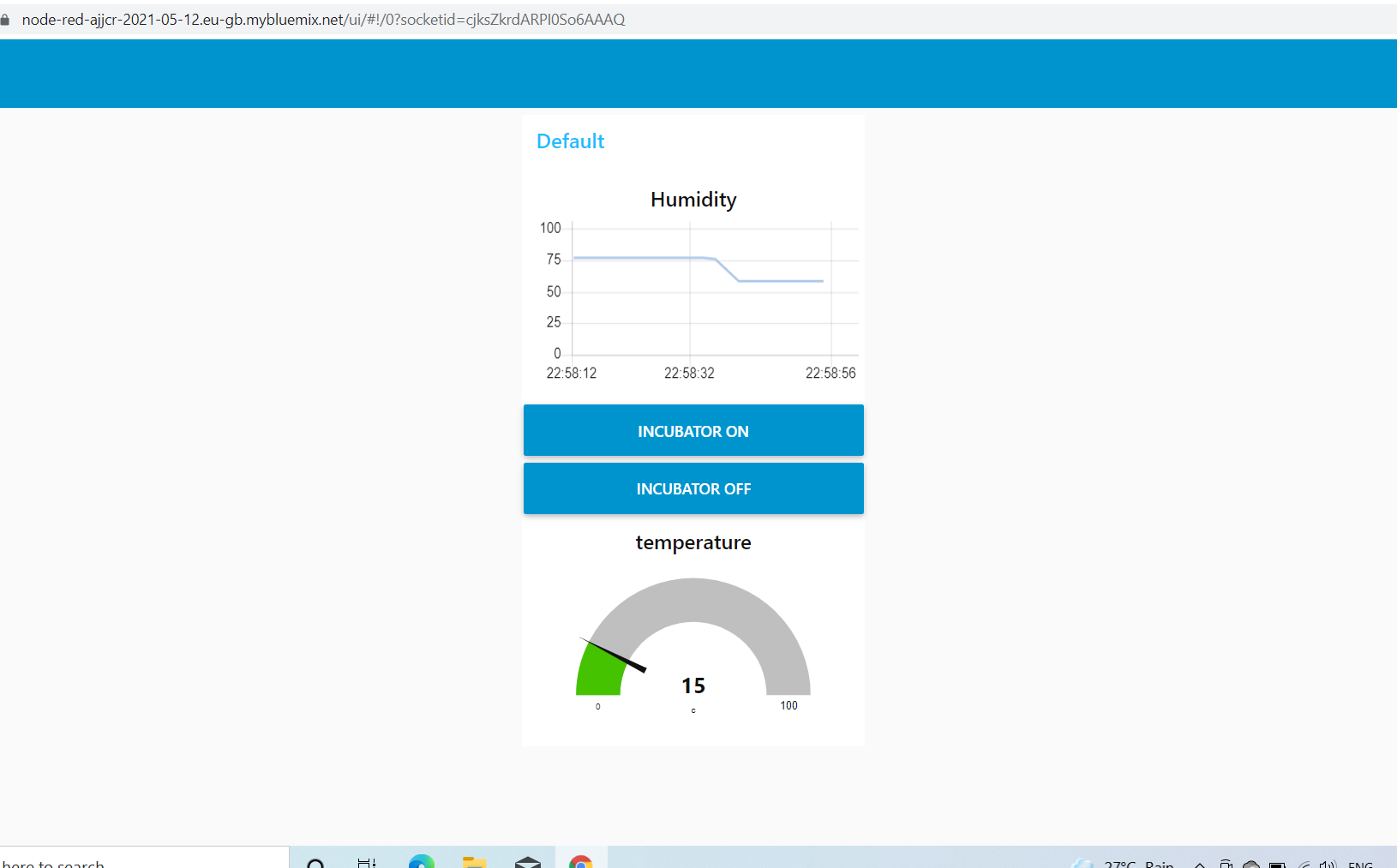
Intially we start by creating the device the to connect with the IBM watson simulator ie iot sensor by giving the device details.By making connections with watson platform,we make nodered connections and then the output of the nodered is verified in debug window.



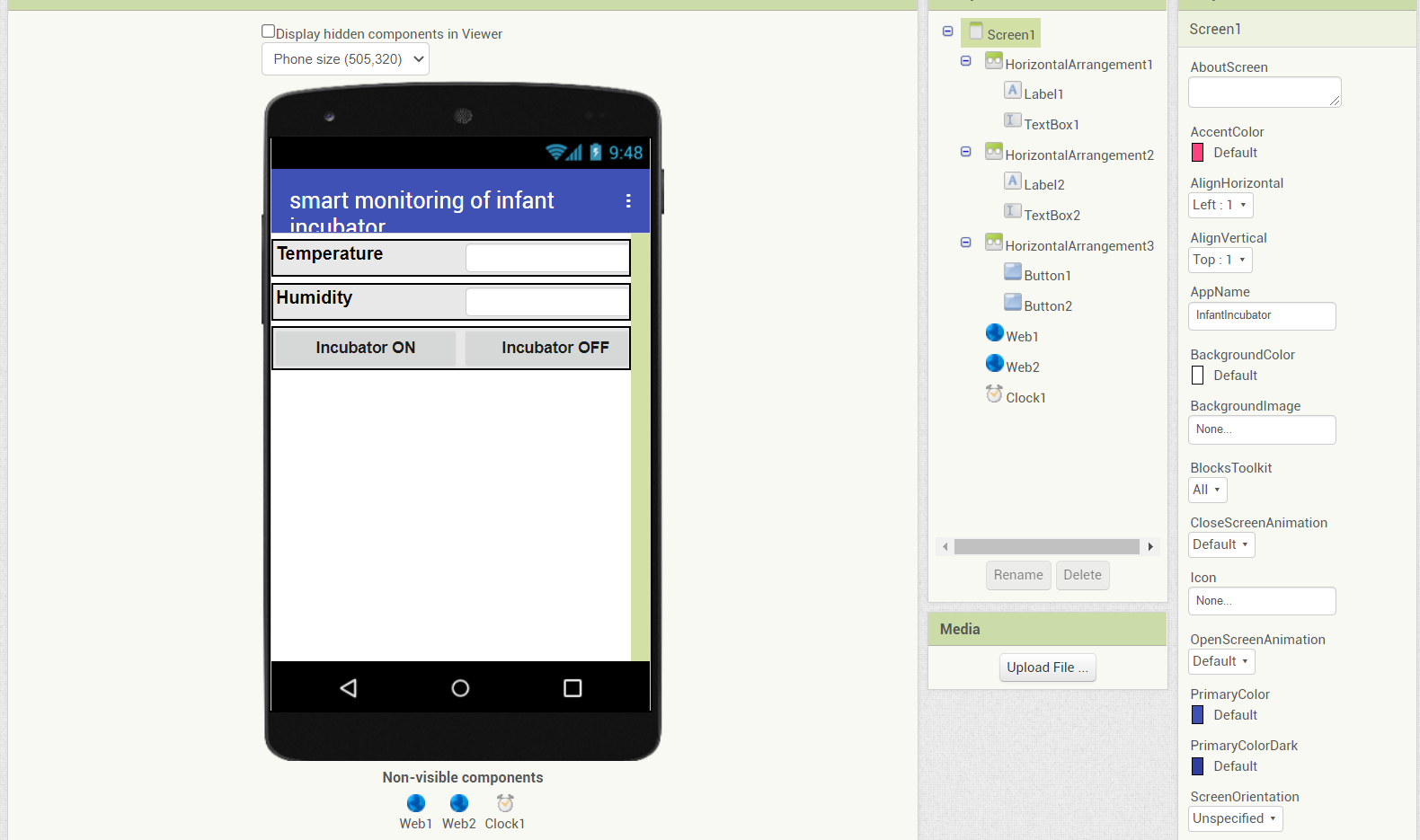
In node red, all connections are made by intially connecting to ibm iot input node. All connections and changes in each node is done and deloyed everytime. And the output of the each debug node is displayed on the debug window. The entire node red flow of the project is shown below.

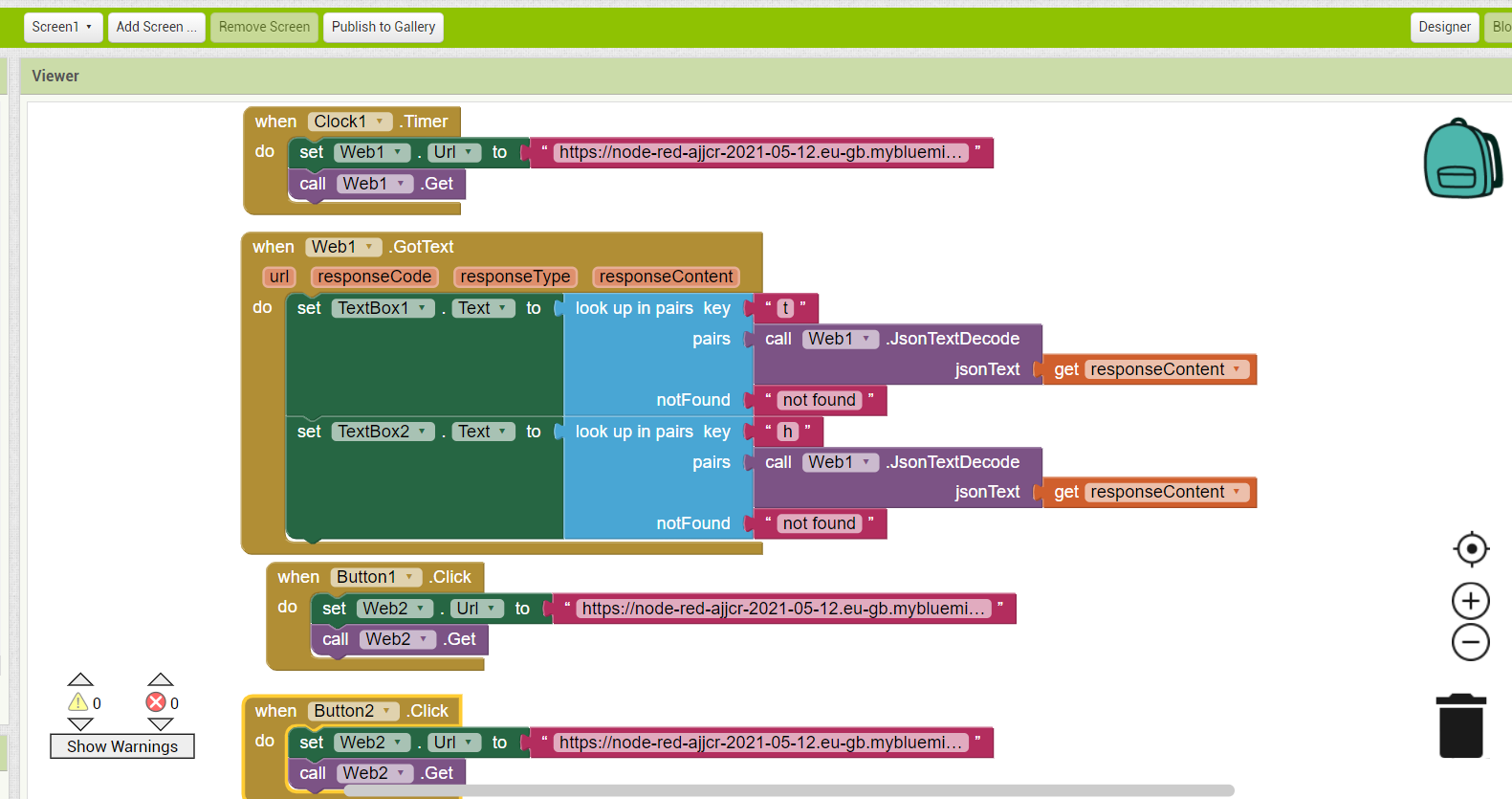


The output of the nodered flow is connected to web application(UI). By taking the url of the nodered upto .net and we have pasted on the new tab of the chrome. Then, for copied url /ui is added and the web application is developed. The web application of the nodered flow is shown below.

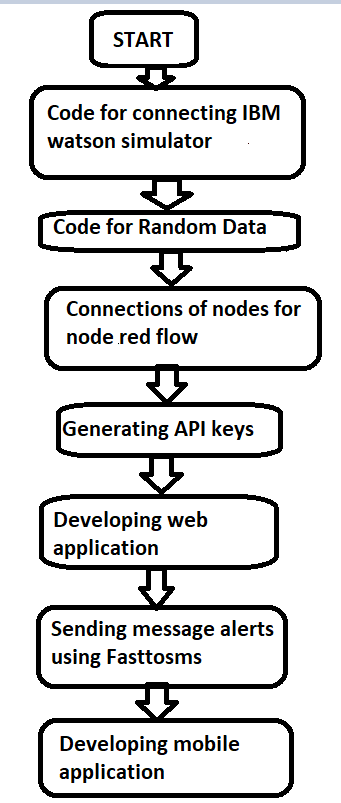


Similarly, the mobile application is also developed by using MIT App inverter. The mobile app is developed by connecting some nodes and blocks . The connection in the app inverter are shown in the below.





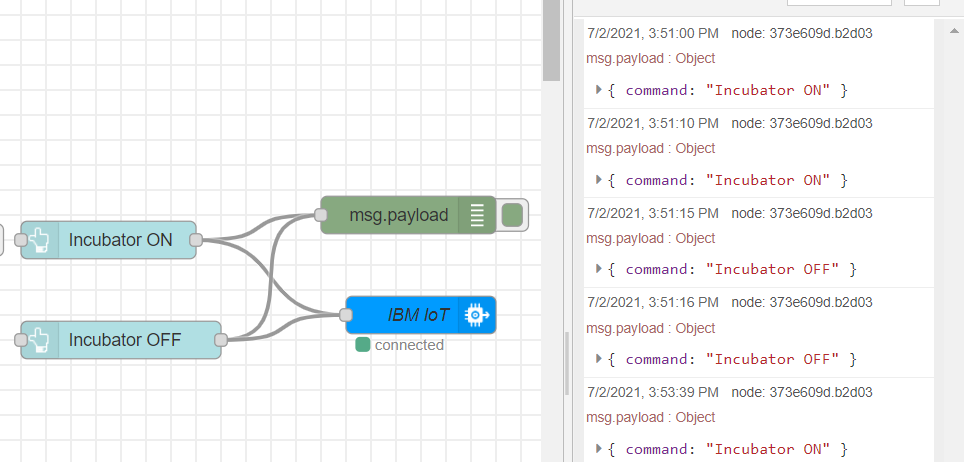
**5. FLOW CHART**

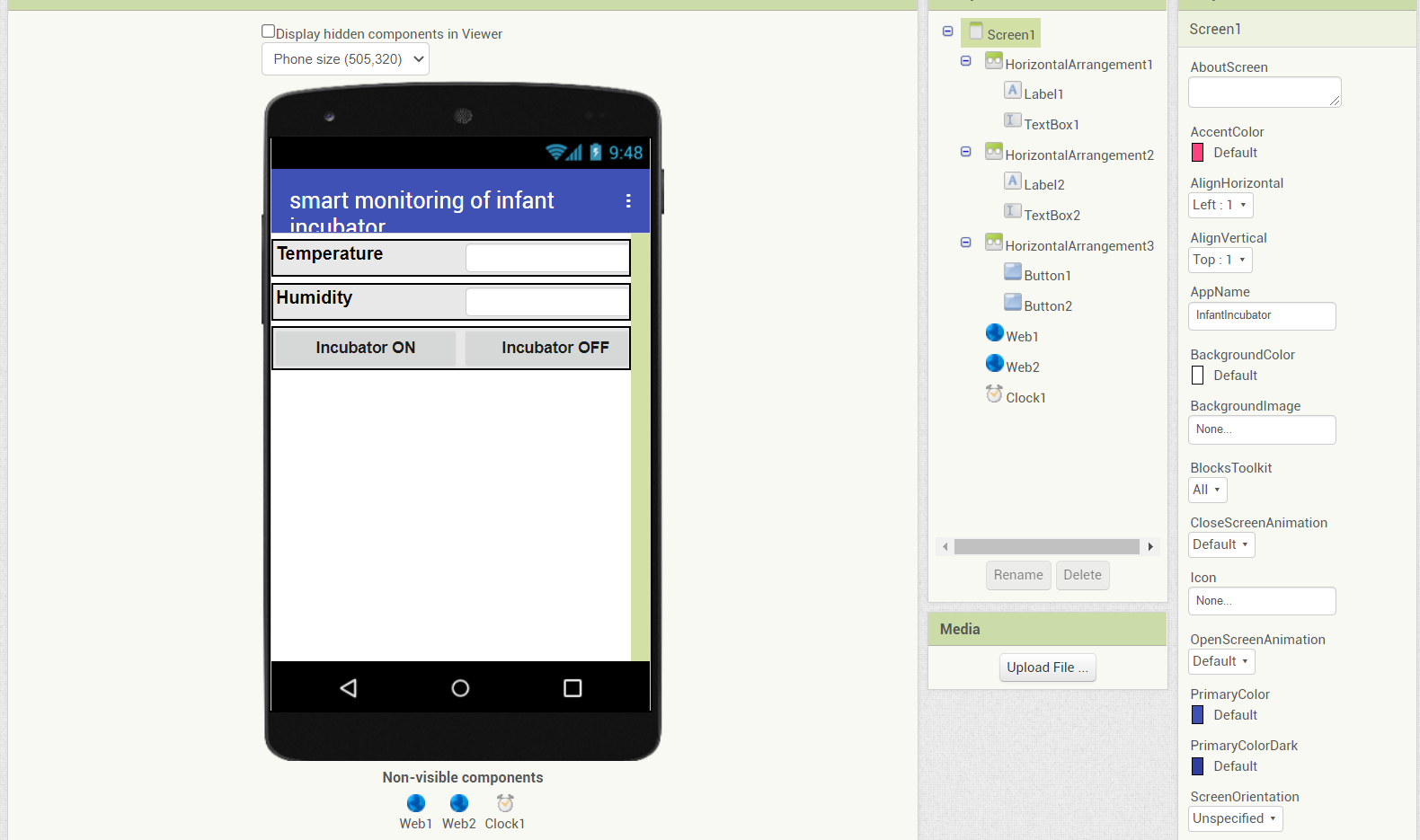


**6.RESULT**

Using the proposed system the results observed are smart monitoring for infant incubator using IBM watson simulator helps the incubators very well,getting free from death rate of infants and the weight gain of the infant can be increased by controlling the temperature and humidity parameters of the particular incubato

NODE-RED(UI OUTPUT)



MIT APP INVERTER(mobile output) 

**7. ADVANTAGES AND DISADVANTAGES**

* **Advantages**

1. Helps to save the time.

2. Manually work would be redcued.

3. It protects the baby from all disturbances and infection in the NICU.

4. Physician and nurse can control the incubator even if their away from it.

5. The neonate in this incubator can be observed well and can be handled

easily.

* **Disadvantages**

1. These type of incubators are expensive.

2. The main disadvantage of this type is it cannot maintain thermoneutral

environment if lids of the incubator is opened frequently.

3. Since, it is expensive all members cannot afford for it.

4.The baby lies in a closed hood it is difficult to access the baby for medical

procedure or care.

**8. APPLICATIONS**

* These incubators can be used in

1. Hosiptals.

2. Baby care unit.

3. Since it is expensive some type of families couldn't afford.

4. At baby sitter places.

**9. CONCLUSION**

The proposed system monitors the temeprature and humidity of the surroundings.

Temperature monitoring is done in order to keep the environment suitable for the neonate. Temperature monitoring the infant's body will help to detect many other internal diseases like infections, common cold, pneumonia have a common symptom of fever as the body temperature goes high.Humidity measures values also help in detecting of having internal problem like cold and dehydration.

But the temperature inside the incubator looses due to atmosphere or any other problems, the heating pad will not on automatically, as we didn't implement this feature.

And for continuous monitoring there should always have the facilities of power supply.

But , in many areas there is still have the problem of power cut about several times.

**10. FUTURE SCOPE**

The future work is focused on the implementation of the monitoring system to monitor all pathological parameters of the infants in all hosiptals with common physician or consultant. This paper main aim to monitoring and controlling the temperature and humidity within the incubator. As their will be given a particular set point for different parameters , the controller will automatically on if the measuring values goes below the set value and the controller will automatically off if the measuring values goes above the set value.

Their is also a possibility of replacing power source by solar cell. In rural areas there is a big problem in supplying of electricity. So this problem will also overcome in future implementation.

**11. BIBLIOGRPAHY**

<https://www.python.org/downloads/windows/>

<https://youtu.be/2xIvEuFcUJY>

<https://youtu.be/R46iK-XYKW4>

<https://youtu.be/Doh9ADU8CyU>

[http://ai2.appinventor.mit.edu](http://ai2.appinventor.mit.edu/)

<https://github.com/gnaneshwarbandari/IOT/blob/main/ibm_code.py>

<https://thesmartbridge.com/documents/projects/SmartHomeAutomationusingIBMCloud.pdf>

<https://flows.nodered.org/node/node-red-dashboard>

**12. APPENDIX**

**12.1 SOURCE CODE**

import time

import sys

import ibmiotf.application

import ibmiotf.device

import random

import json

#Provide your IBM Watson Device Credentials

organization = "nn5kou"

deviceType = "iotdevice"

deviceId = "1005"

authMethod = "token"

authToken = "1234567890"

# Initialize the device client.

T=0

H=0

def myCommandCallback(cmd):

print("Command received: %s" % cmd.data['command'])

if cmd.data['command']=='Incubator ON':

print("INCUBATOR ON IS RECEIVED")

elif cmd.data['command']=='Incubator OFF':

print("INCUBATOR OFF IS RECEIVED")

if cmd.command == "setInterval":

if 'interval' not in cmd.data:

print("Error - command is missing required information: 'interval'")

else:

interval = cmd.data['interval']

elif cmd.command == "print":

if 'message' not in cmd.data:

print("Error - command is missing required information: 'message'")

else:

print(cmd.data['message'])

try:

deviceOptions = {"org": organization, "type": deviceType, "id": deviceId, "auth-method": authMethod, "auth-token": authToken}

deviceCli = ibmiotf.device.Client(deviceOptions)

#..............................................

except Exception as e:

print("Caught exception connecting device: %s" % str(e))

sys.exit()

# Connect and send a datapoint "hello" with value "world" into the cloud as an event of type "greeting" 10 times

deviceCli.connect()

while True:

T=random.randint(0,56)

H=random.randint(0,60)

#Send Temperature & Humidity to IBM Watson

data = {"d":{ 'temperature' : T, 'humidity': H }}

print (data)

def myOnPublishCallback():

print ("Published Temperature = %s C" % t, "Humidity = %s %%" % h, "to IBM Watson")

success = deviceCli.publishEvent("Data", "json", data, qos=0, on\_publish=myOnPublishCallback)

if not success:

print("Not connected to IoTF")

time.sleep(1)

deviceCli.commandCallback = myCommandCallback

# Disconnect the device and application from the cloud

deviceCli.disconnect()

**12.2 UI OUTPUT SCREENSHOT**