# ASSIGNMENT REPORT

# ON

# "Designing prototype of IoT based Baby Monitoring System"


**BY**

**GROUP NO. – 13**

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## INTRODUCTION

Today, the number of working mothers has greatly increased. While they are away at work, parents have to leave their babies with their grandparents or at daycare centres. However, due to technical complications, it might not be possible for them to monitor their baby at all times. To provide better care, we have proposed and prototyped an IoT based baby monitoring system (IoT-BBMS). The system uses sensors to mention vital conditions such as ambient temperature, moisture and to check if the baby is crying. The prototype has been built using a cardboard box as the material for the cradle. The system also consists of a mechanism that will rock the cradle and a buzzer that will play a tune when the baby starts crying. Parents can monitor the baby's conditions via an app that displays data stored on MQTT servers and can also choose to manually switch on the rocking and music features.

## METHODOLOGY

### 1. Component Selection

The following hardware components have been used in the project:

- NodeMCU (ESP8266) - NodeMCU was selected as it has inbuilt WiFi capability which allows us to effectively communicate with the MQTT server.
- Sound Sensor (KY037) - This is used to detect if the baby is crying.
- DHT11 - This is used to measure ambient temperature and humidity conditions. If the values are above a certain threshold, the air conditioning systems are switched on.
- Servo Motor - This is used to rock the cradle.
- Camera Module (OV7670) - This is used to provide a live feed of the baby to the parents via the app.
- Cradle - A cardboard box with the legs cut out in a semicircular shape was used.
- Buzzer - This is used to play a tune/lullaby for the baby.

The following software components have been used in this project:

- Arduino IDE - To write the code for the prototype.
- Adafruit MQTT server - This is used to store the data received from the sensors and some other variables.
- MQTT-Dash - This is used to design the front-end for the application which can be used by the parents to monitor the baby.

### 2. Cradle Design

The cradle was designed using a cardboard box. The two minor flaps on the bottom of the box were cut in a semi-circular shape so that the legs can roll smoothly when the cradle is rocking as opposed to toppling (if the flaps were rectangular instead). Supports were attached to these legs to prevent them from folding inwards.

There were a few problems faced while designing the cradle. First, the cradle was pretty stable, so when the rocking mechanism was triggered, the cradle was only moving forward rather than moving rocking back and forth. To fix this, we steepened the curve on one side of the semicircular legs so that it could easily move in both directions. Second, we added stops to the cradle to prevent it from toppling if it moved too far forward.

To make it look like a cradle, we decorated it with coloured chart papers.

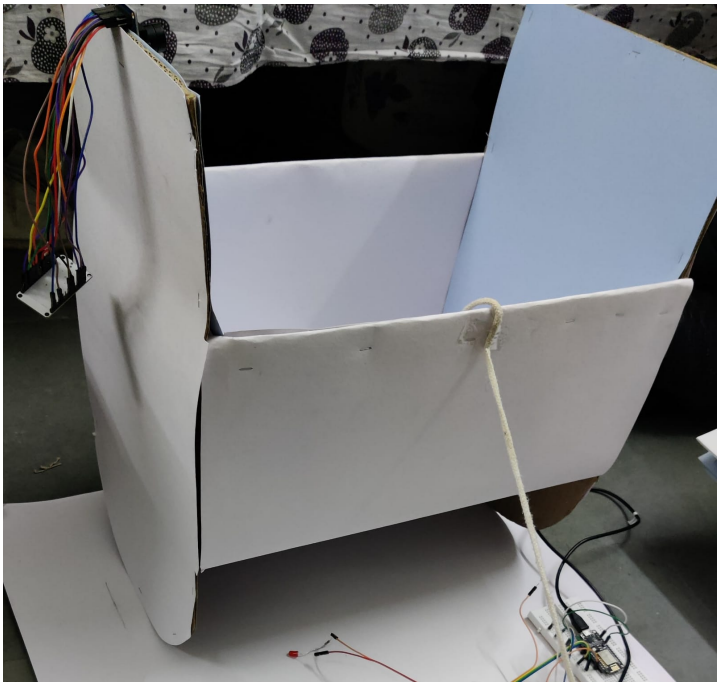


**Fig. Cradle**

3. **Rocking Mechanism**
   We have used a servo motor with a piece of string attached to it to design the rocking mechanism. The servo motor is fixed at a distance from the cradle such that the string is taut. Then, the servo motor is used to pull the cradle in one direction. Then, the servo motor goes back to its initial position. Due to the design of the cradle, it moves in the opposite direction where it is pulled at just the right moment to complete one swinging motion.

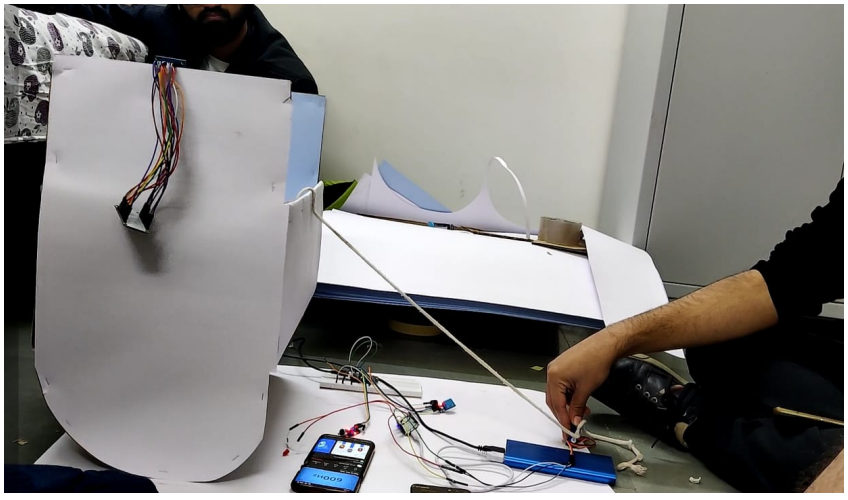


**Fig. Servo motor with string attached to it**

4. **Designing the rest of the system**
   The remaining sensors and actuators are connected to the nodeMCU using a breadboard. The sensitivity of the sound sensor is adjusted so that it only gives a high output if the sound is played close to it. After a fixed amount of time, the data from all the sensors is sent to the MQTT servers. The app then fetches this data and displays the latest values. All of the features were tested to ensure that the code is correct and that it follows the logic flow of the system. The system was working, but it had a small problem. As the nodeMCU is a single CPU, it does not support asynchronous operation. So, the rocking mechanism and the music could not be played simultaneously because the function for one would only be run after the execution of the other function was complete. To deal with this, we used two nodeMCUs - one for the rocking mechanism and the other for playing the tune.

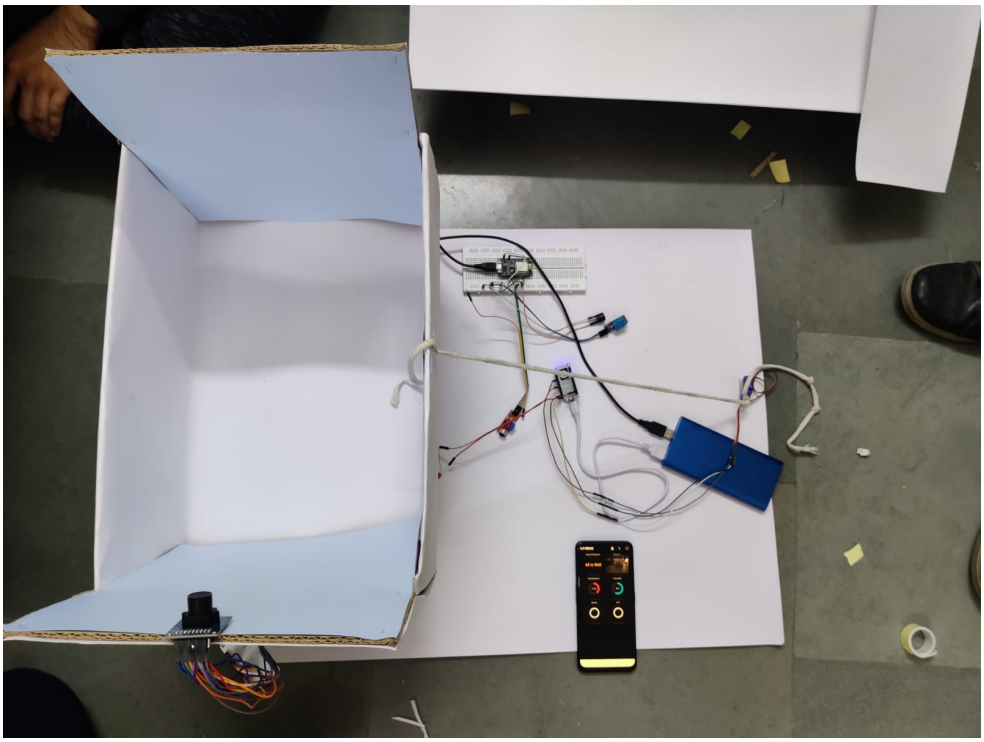


**Fig. All the sensors and actuators connected to complete the system**

5. **Designing the network**
   We used **Adafruit.io as the MQTT IoT server** for speed and ease of data uploading. The data can be accessed by the parents via the **MQTT-Dash app** which allows us to design a simple GUI quickly. Through the app, the parents can wirelessly perform remote monitoring of the baby's conditions. Any abnormal conditions (baby is crying, undesirable temperature/humidity) are conveyed to the parent so that they can take appropriate actions. The parents can also monitor the baby's condition through a camera and switch on the buzzer via the MQTT server to play tunes for the baby.

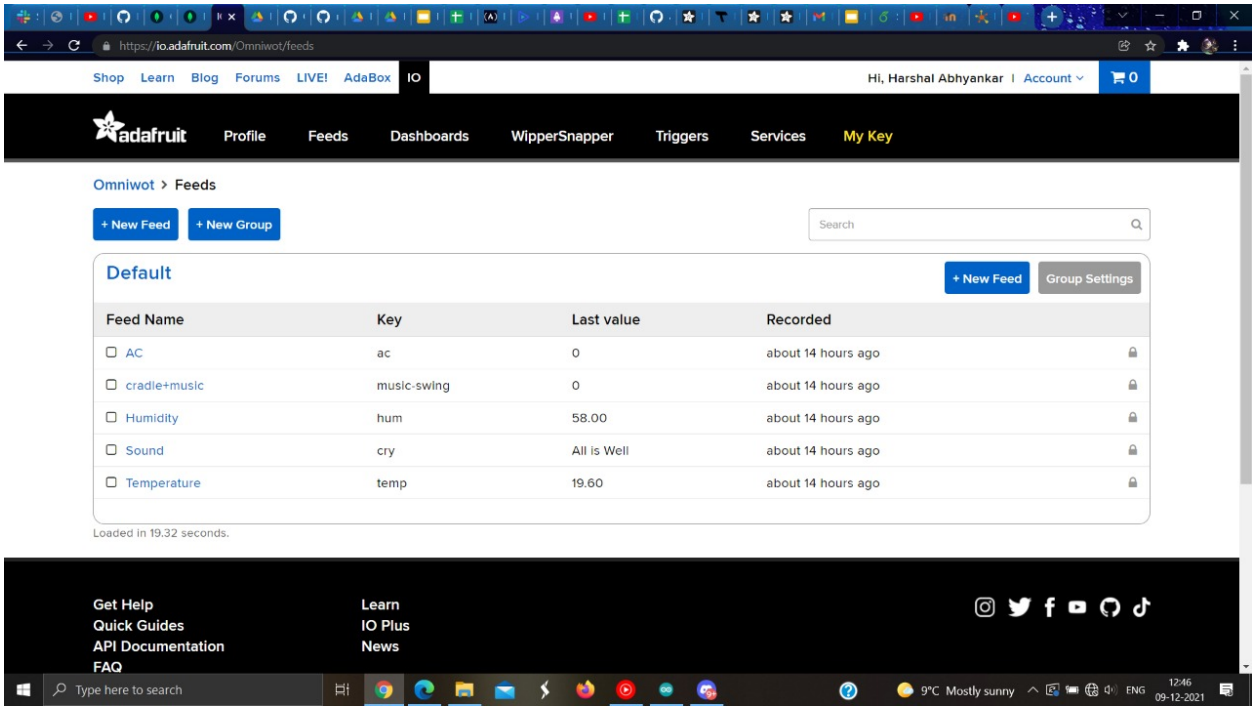



**Fig. Adafruit MQTT server**

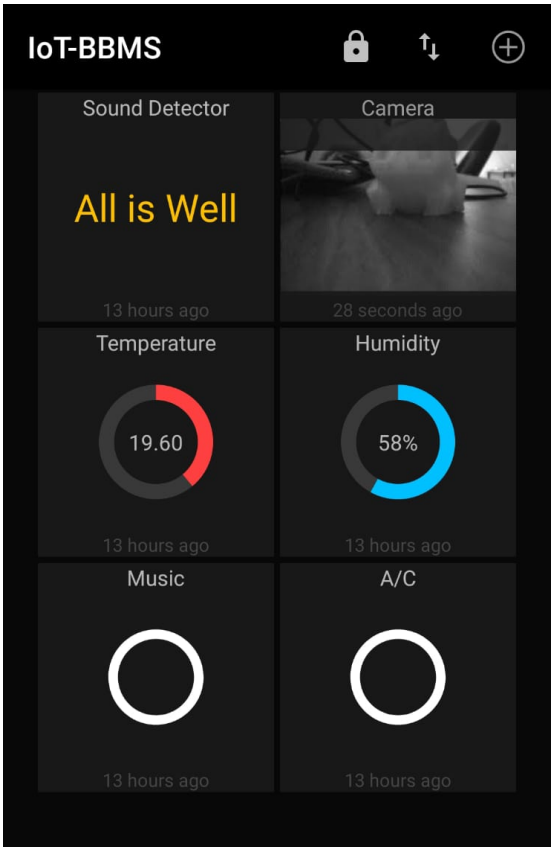
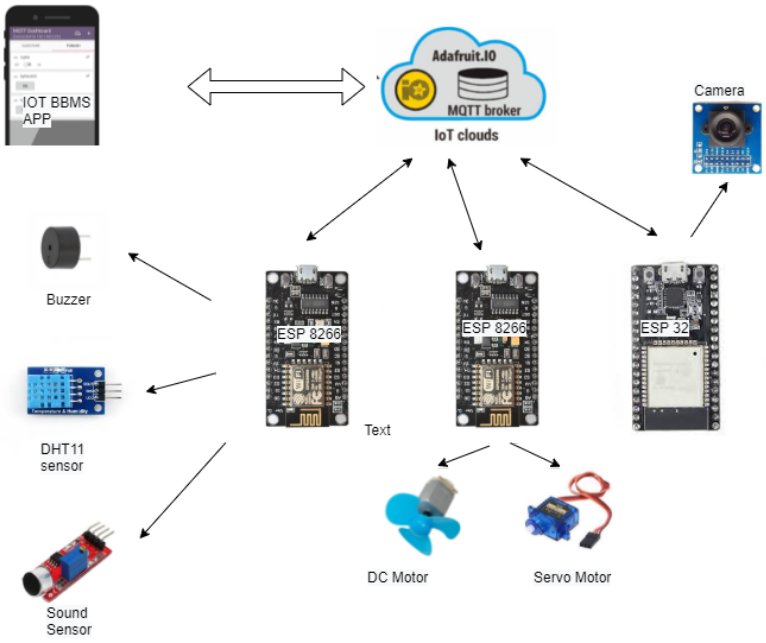



**Fig. MQTT-Dash app**

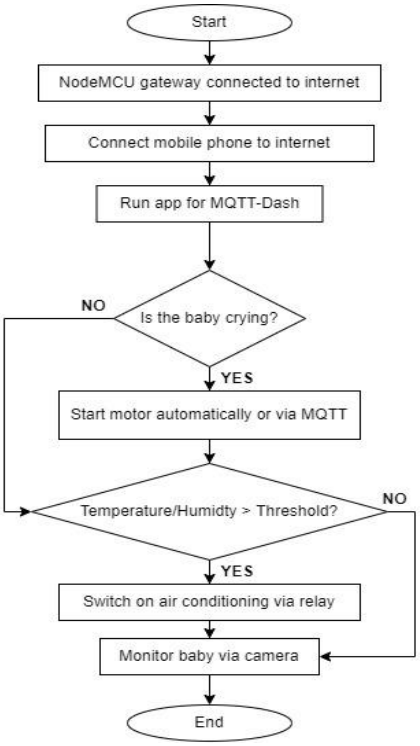
## FLOWCHART

### System flow:




IOT based Baby Monitoring System

### Logic Flow:



## CONCLUSION

We designed a smart cradle with a baby monitoring system over IoT to monitor a baby's vital parameters, such as crying condition, humidity, and ambient temperature. NodeMCU was used as the main controller board in the project's circuit design, because it had a built-in Wi-Fi module.
The finished prototype was tested by using a mobile phone with a constant sound to imitate the crying of the baby.
When the sound was played for a few seconds, the cradle started swinging because of the system's assumption that the baby was crying due to the detected sound. A notification was sent to the mobile phone of the parents to signal that the baby is crying. The temperature and humidity of the surroundings were measured, and the air conditioning system was turned on if the measured temperature was above a certain threshold.