6.1 Overall System Implementation and Testing

After completion of the components' testing, the overall system is mounted step by step. The whole system consists of four parts namely:

1. Transmitter side
2. Receiver Side
3. Monitoring
4. Alarm

6.1.1 Transmitter

The sensors' data are collected on Arduino Uno and transmitted through the Lora module using AT commands. The data collected on the microcontroller are printed on the serial monitor..

The base is made of concrete and the support is made of polyvinyl chloride. The mounting process is shown below.

Figure 6-20: Mounting of base structure

The fully implemented transmitter is shown below.

Rain Sensor

Circuit Box
(microcontroller
and Reyax)

Ultrasonic
sensor
and
DHT22

PVC
tube

Flowmeter
immersed in
river

Wire cable
connected to
soil moisture
sensor on river
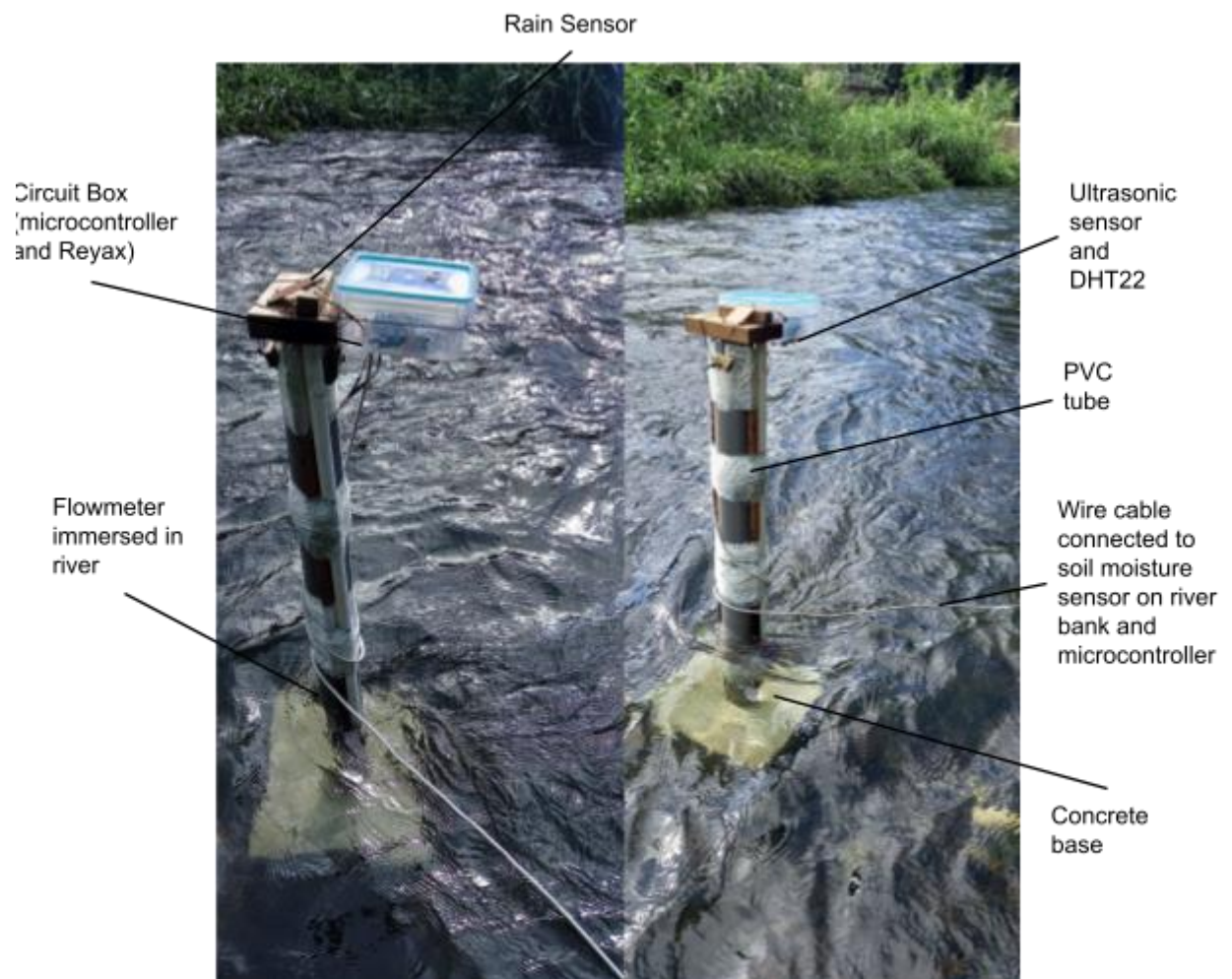bank and
microcontroller

Concrete
base

Figure 6-21: Transmitter

The different sensors used are namely:

1. Ultrasonic
2. Flowmeter
3. Temperature and Humidity
4. Rain
5. Soil Moisture

The sensors' data are collected from the Arduino and sent to the receiver side using the LoRa module as a string message.

6.1.2 Receiver

The receiver receives the data in the form of a string. The string is then broken down into individual variables to store each sensor data. The receiver side is shown below.
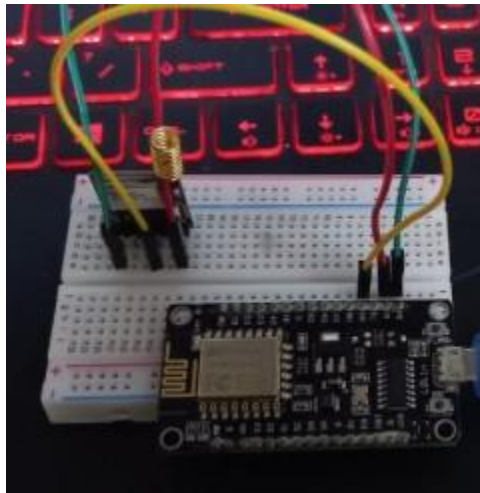

Figure 6-22: Receiver

The received data printed on the serial monitor is as follows.

```
+RCV=0,35,90.60%23.20%52.82%128.00%55.00%2%0%,-121,-35

Humidity:
90.60
Temperature:
23.20
Water Level:
52.82
Flowrate:
128.00
Soil Moisture:
55.00
Rain percentage:
2
Rain yes no:
0%
```

Figure 6-23: Receiver data on serial monitor

6.1.3 Monitoring on Blynk and Cayenne

The received data is monitored on two IoT platforms namely:

(i) Cayenne

An html server is created to allow easy access to the user. He simply has to click on the link to access his/her dashboard.
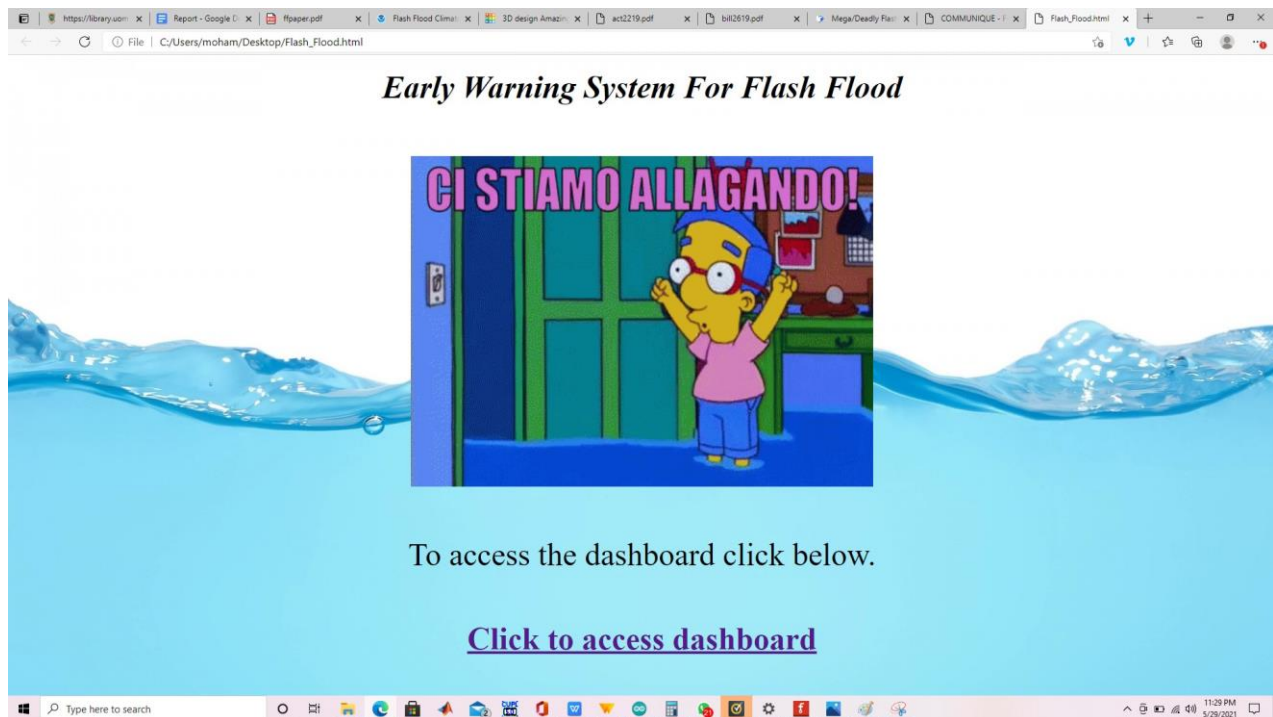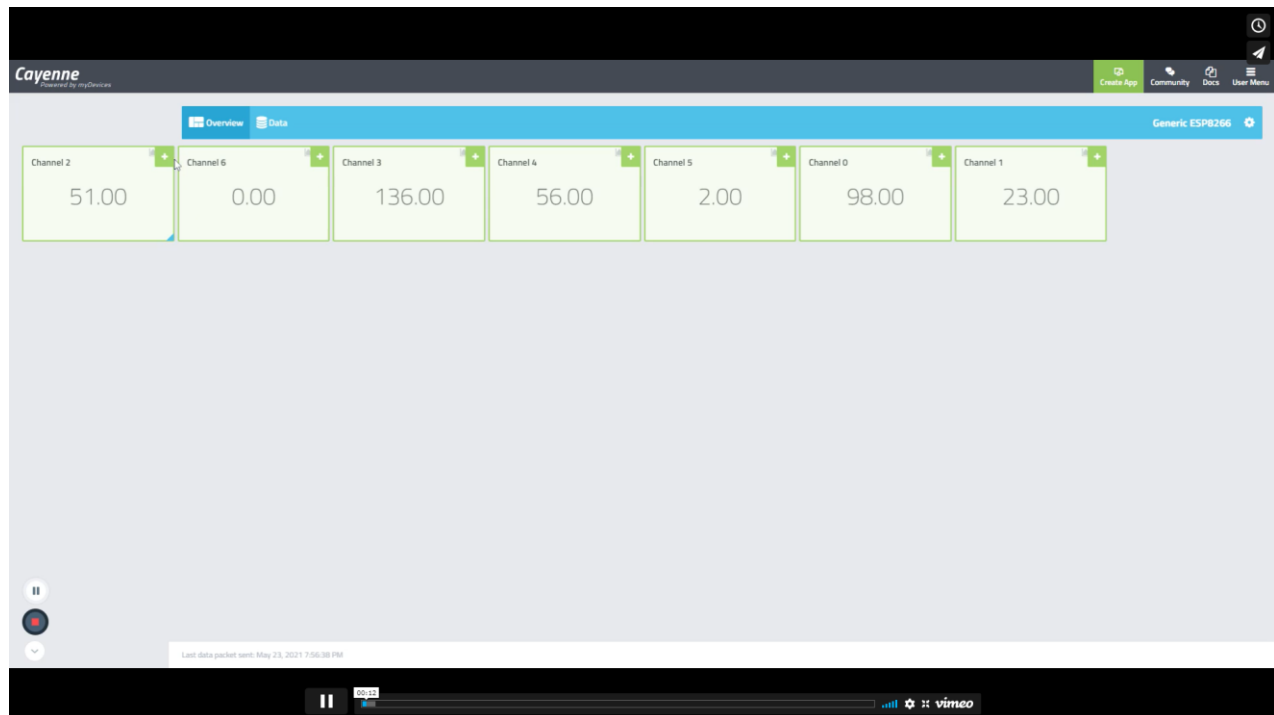

Figure 6-24: html server to access cayenne dashboard

The data can be accessed through the Cayenne dashboard once the link has been clicked.
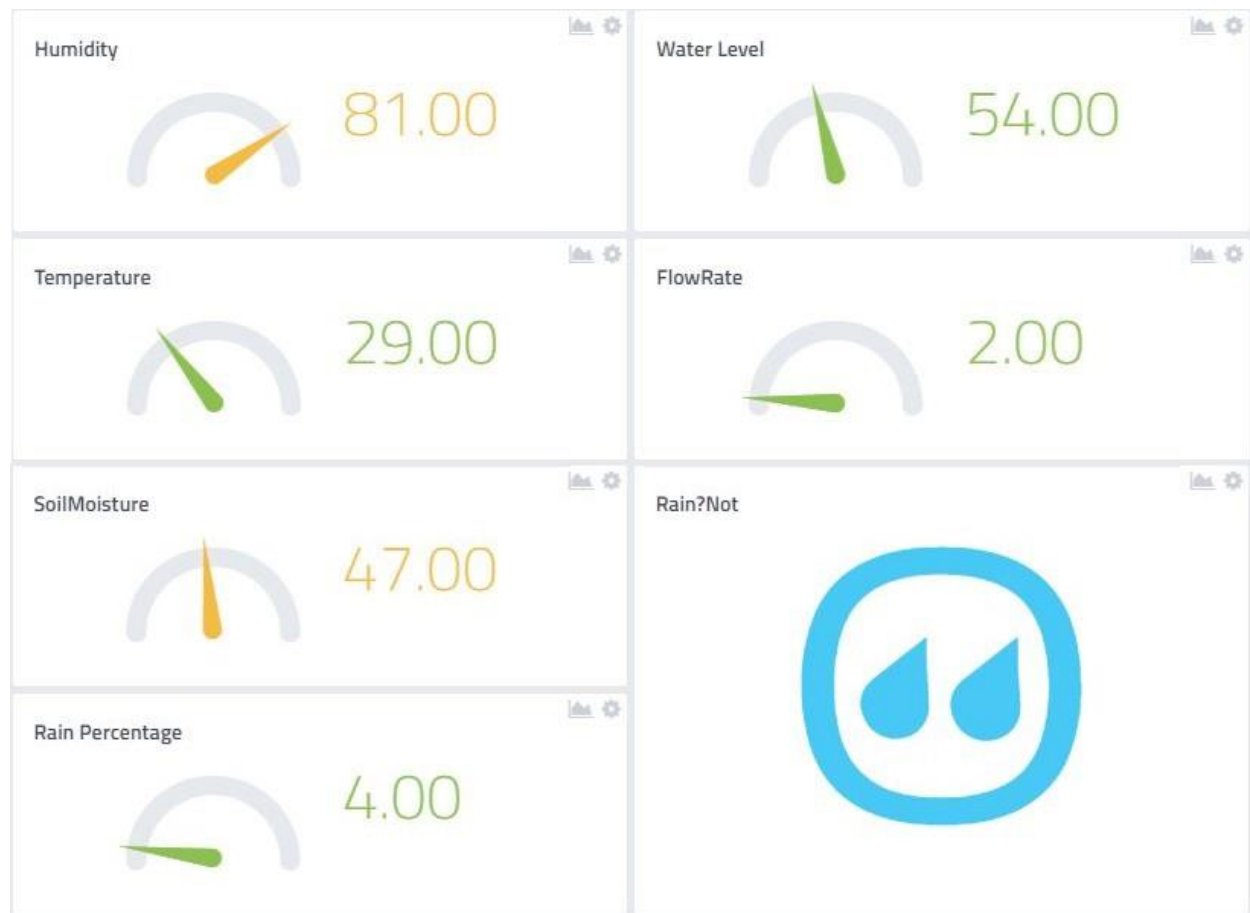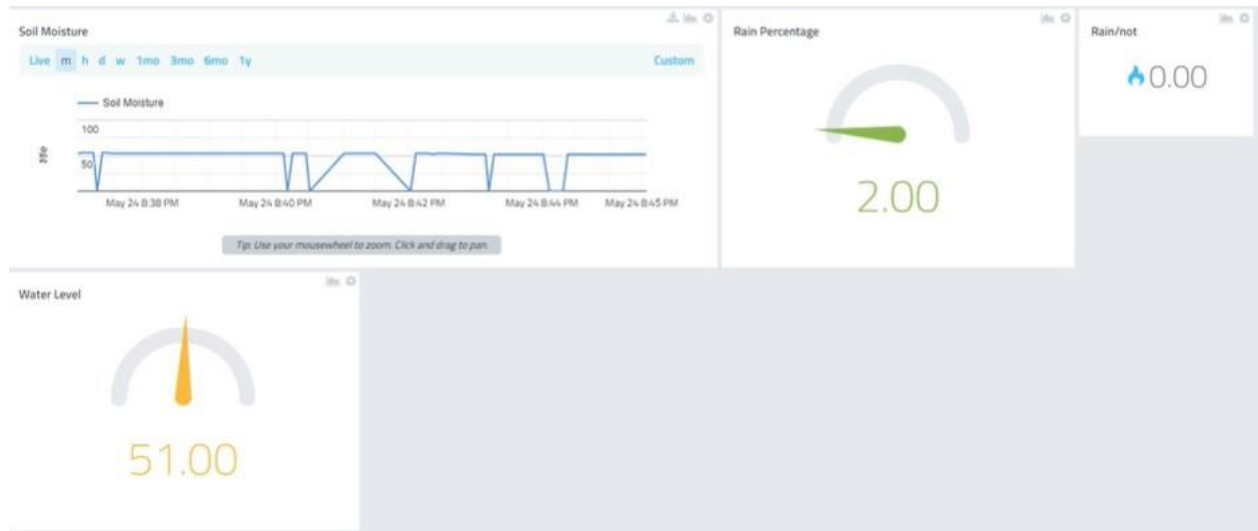
Soil Moisture
Live **m** h d w 1mo 3mo 6mo 1y   Custom

— Soil Moisture

100
50

May 24 8:38 PM   May 24 8:40 PM   May 24 8:42 PM   May 24 8:44 PM   May 24 8:45 PM

Tip: Use your mousewheel to zoom. Click and drag to pan.

Rain Percentage
2.00

Rain/not
0.00

Water Level
51.00

Humidity
81.00

Water Level
54.00

Temperature
29.00

FlowRate
2.00

SoilMoisture
47.00

Rain?Not

Rain Percentage
4.00

Figure 6-25: Sensors' data on Cayenne dashboard

(ii) Blynk

The data collected is displayed on the Blynk application as shown below.

Figure 6-26: Sensors, Data on Blynk application

6.1.4 Alarm System

Three methods are chosen for predicting flash floods.

(i) Choosing a threshold value for the water level

(ii) Choosing a threshold value for the flow rate

(iii) Choosing a threshold value for the soil moisture

When the threshold values are exceeded, an SMS is sent from cayenne.The threshold value chosen during testing was 52 cm. When the water level exceeded this predefined value an SMS was sent as shown below.
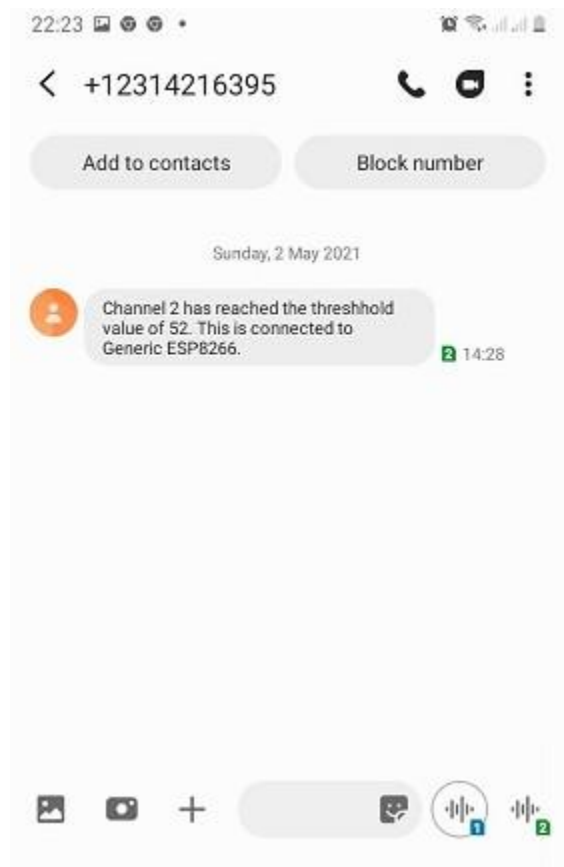

Figure 6-27: SMS alarm when threshold value was exceeded

For testing purposes, the threshold value for the soil moisture sensor chosen was 70.

Figure 6-28: Choosing threshold value on Cayenne to send email and SMS

When the threshold value was exceeded an email and an SMS was received. The soil moisture sensor was connected to channel 51 on Cayenne.
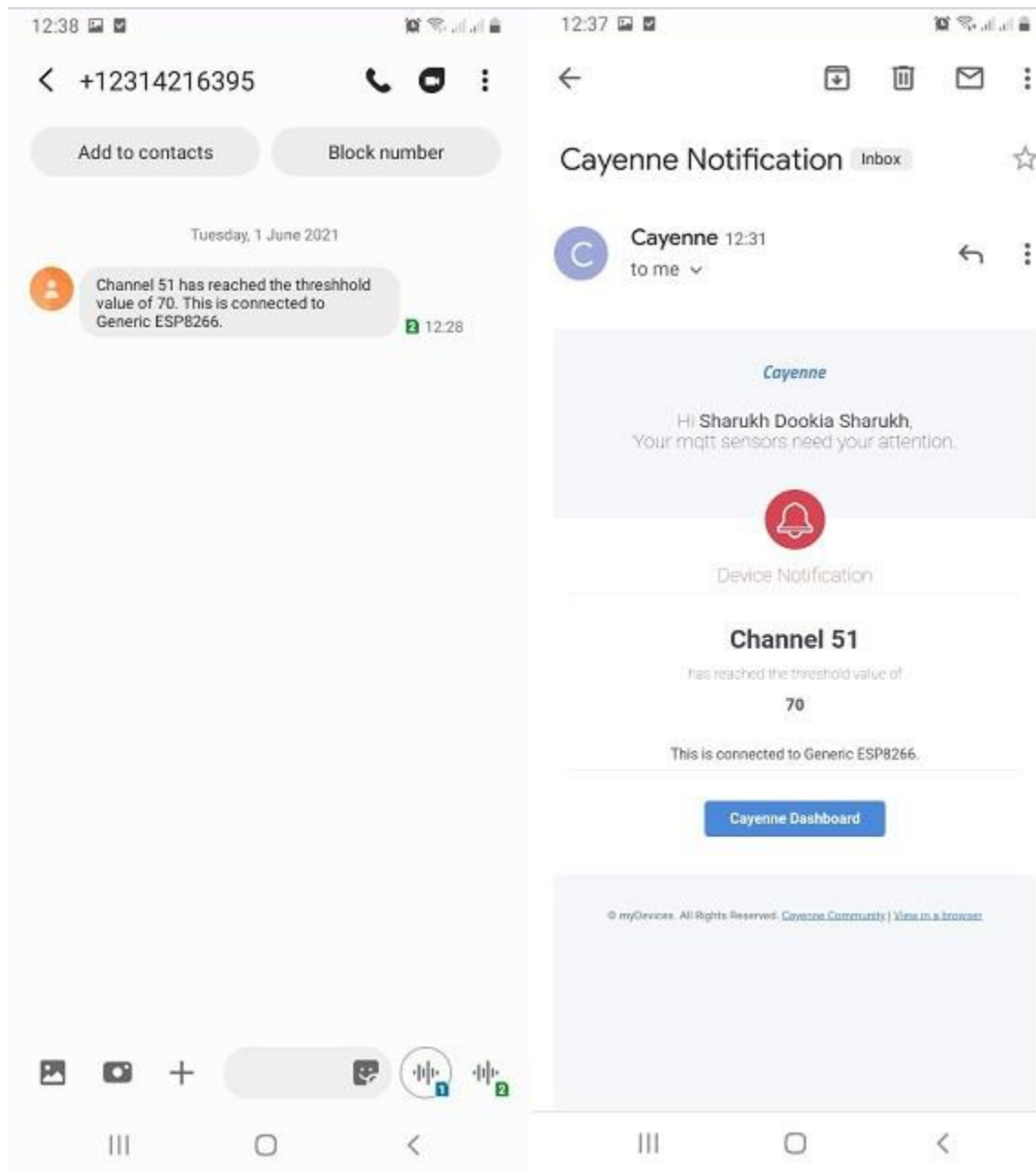

Figure 6-29: Cayenne Notification when threshold value is exceeded