Course Project Documentation
CS684 Project

Data Visualization in IoT

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Table Of Contents

1. Introduction

Data visualization is the mechanism of taking the data from various sources like sensors and represent it in a human friendly manner so that it will be easy to visualize it.

One of the best way to represent complex data is through the means of graph. Various types of graphs help us in visualizing various types of data. For example bar chart help us in comparing frequency, pie chart help us in getting idea of percentage of different components.

In this project we will make a dashboard which will contain widgets using which we can visualise data coming from sensors in real time.

We are building the dashboard in Vue.js which is a javascript framework. Vue.js is completely component based so it help us in making our dashboard more modular and easy to program.

We have focused on decoupling of data source and components i.e. no data source is hard coded in the dashboard and user have choice to input the datasource.

While building the system we have used DHT22 sensor and a ESP8266 board which is connected through e-yantra IoT framework. We have installed mongoose OS , using which we are receiving sensors reading at a URL which contain json shadow data. We are using this shadow data to plot the graphs.

The final dashboard is user friendly with ease to drag and resize widgets.

2. Problem Statement

We are building a data visualization framework for IoT in which user can push his/her data from various data sources and visualize it using various widgets on a single platform. So it's a very general solution for all visualization problems.

This framework will provide various functionalities like widgets can be resizable and draggable. User can move the different widgets on the screen. User can also add,delete and group together widgets according to his/her choice.

Generally framework contains only few widgets to represent data but this framework provides various widgets like gauge, line, battery, text, map etc. Most important problem solved by this framework is decoupling of data sources and widgets. User can choose any number of data sources. Main goal is to make complicated data understandable visually. We have worked on JSON data and Device Shadow to represent in various widgets. But various data sources like DynamoDB and websocket can be added easily.

3. Requirements

3.1 Hardware

- ESP8266 board
- Sensors - DHT22 (Humidity, Temperature) , Soil Moisture etc.

3.2 Software

- Text editor like VS Code for javascript
- Vuejs framework for javascript
- Various libraries like plotly, ChartJS
- E-yantra platform for shadow data

4. Implementation:

A) Functionality:

a)Specifying data source:- User have option to add or remove data source of his choice. Once a datasource is added we can access its json. We can then choose the key which contain the result of the sensor which we want to visualise. The Datasource added is passed to the widgets by means of passing properties between components and triggering events.

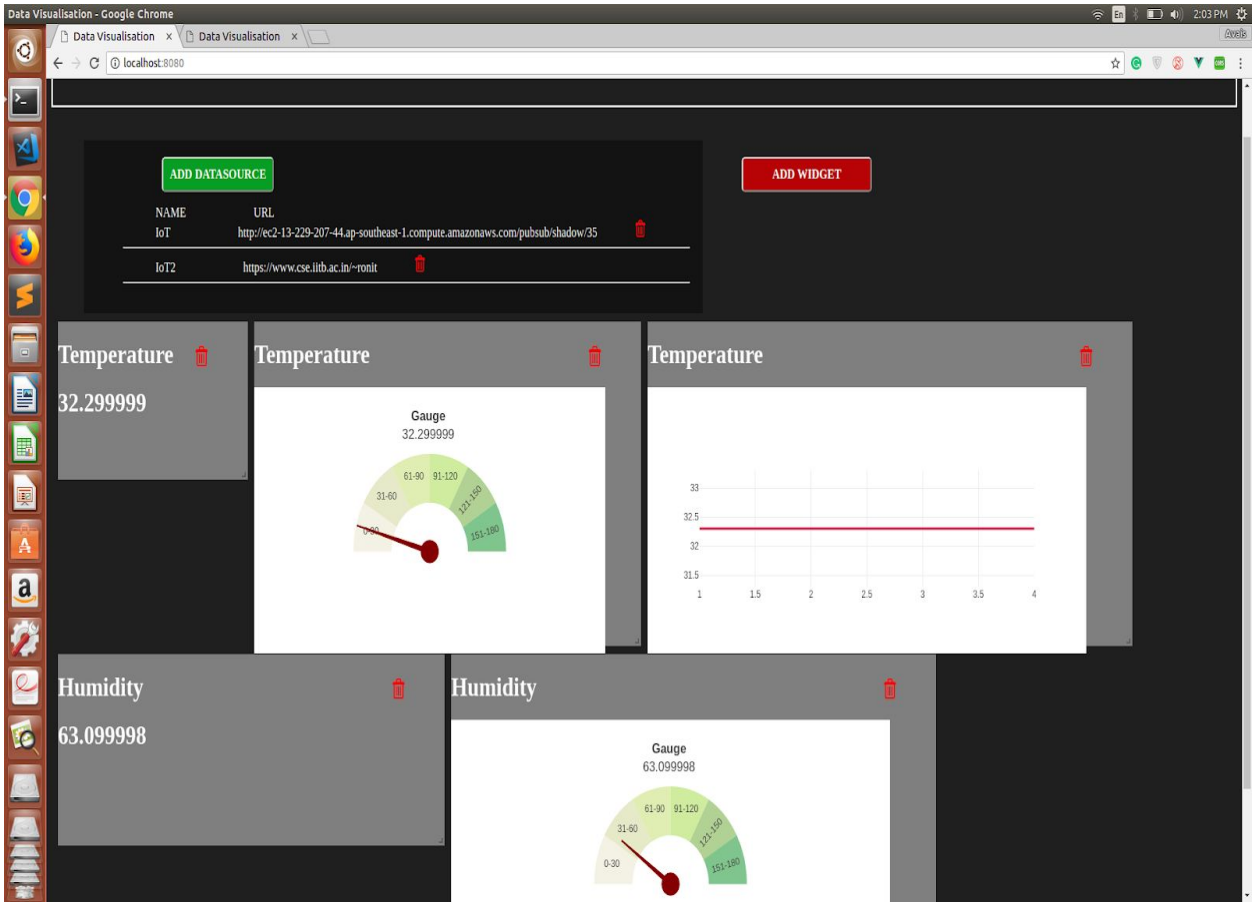
b)Adding widgets:- Add widget button opens a modal dialog box. It contains:-

- A textbox to enter the name of the widget
- a dropdown to choose type of widget we want
- a dropdown to help user to choose the datasource
- a dropdown to help user select the key in the datasource which we want to visualise.

Once the user have successfully entered all the details the widget will appear showing real time readings of the sensor which is connected through a IoT framework.
Currently we have added widgets like gauge, line plot for real time and past data , text, battery ,and Maps for visualising location.

5. Testing Strategy:

We have tested our system on DHT11 AND DHT22 sensor. We have also tested the dashboard on various browsers like google chrome and mozilla firefox.
We have also testes it for various data sources



6. Discussion of System:

A) What are worked as per plan?

- Ability to add data sources.
- Ability to choose key from data source.
- Ability to choose and add widgets.
- User friendly Environment
- Easy Drag and drop of widgets
- Easy resizing of widgets.

B) What we added more than initial problem statement?

- We added few extra widgets like Maps and line plot for past data

(C) Changes made in plan:

- We were not able to add all planned widget
- We have currently only implemented on shadow json data
- We were not able to add settings for each widget.

7. Future Work:

- In our current implementation we have only implemented few widgets , we can add more variety of widgets like scatter plot, bar chart.
- We can add feature to add different data source like dynamoDB and socket.
- We can use materialize CSS for better UI
- We can add feature to customize each widget.
- Saving/Exporting state of dashboard
- Integrating it to e-yantra IoT platform.

8. Conclusions:

We were successfully able to build a data visualization dashboard in which we can add generic json data source and visualise by means of few widgets like gauges and line plot.