Universität Rostock
Traditio et Innovatio

GeoForum MV 2021

Konzeption und Implementierung einer WebGIS-Lösung für Sensordaten zur Überwachung der Gesundheit von Stadtbäumen

Universität Rostock
Agrar- und Umweltwissenschaftliche Fakultät
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Einführung
Beispiel Rostock

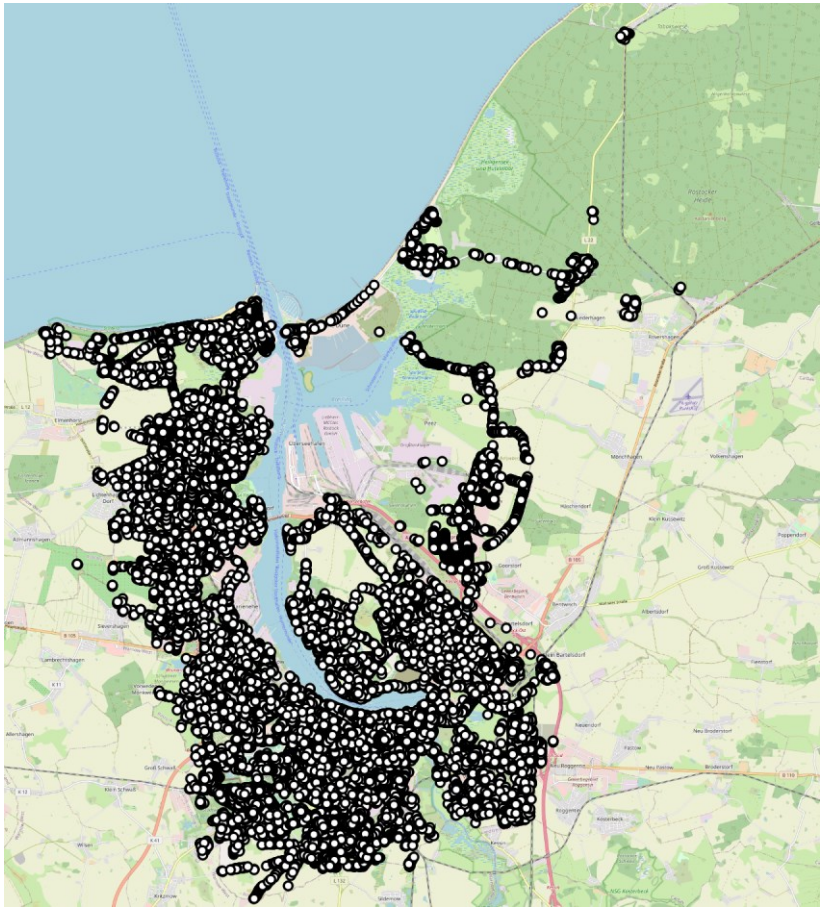
Hanse- und Universitätsstadt Rostock

- 70.499 Bäume im Stadtgebiet (Stand: 27.08.2021)[1]
- 210 Mitarbeiter:Innen im Amt für Stadtgrün, Naturschutz und Landschaftspflege (Stand: 2019)[2]

- Beispielrechnung jährliche Inspektion:

$$\frac{70.499 \times 1\text{h}}{210\text{MA} \times 10\%} \approx 3.357{,}1\frac{\text{h}}{\text{MA}}$$

$$\frac{3.357{,}1\frac{\text{h}}{\text{MA}}}{1.642{,}1\frac{\text{h}}{\text{a}}\ [3]} \approx 2\frac{\text{a}}{\text{MA}}$$



Quellen: [1] https://www.opendata-hro.de/dataset/baeume | [2] https://docplayer.org/183409707-Modellstadt-rostock-umwelt-und-freiraumkonzept-mit-eigener-strategie-in-die-umsetzung-dr-ute-fischer-gaede.html | [3] https://www.deutschlandinzahlen.de/tab/deutschland/arbeitsmarkt/arbeitszeit/jahresarbeitszeit

Bildquellen: Screenshot QGIS

argus electronic gmbh

argus electronic gmbh
Messtechnik & Automation

Elektronische Steuerungs- und Messsysteme aus Rostock
Gegründet 1994 von Rolf Pohlmann

PiCUS Tension:
Sensoren zur Erfassung der Saugspannung (pF-Wert)

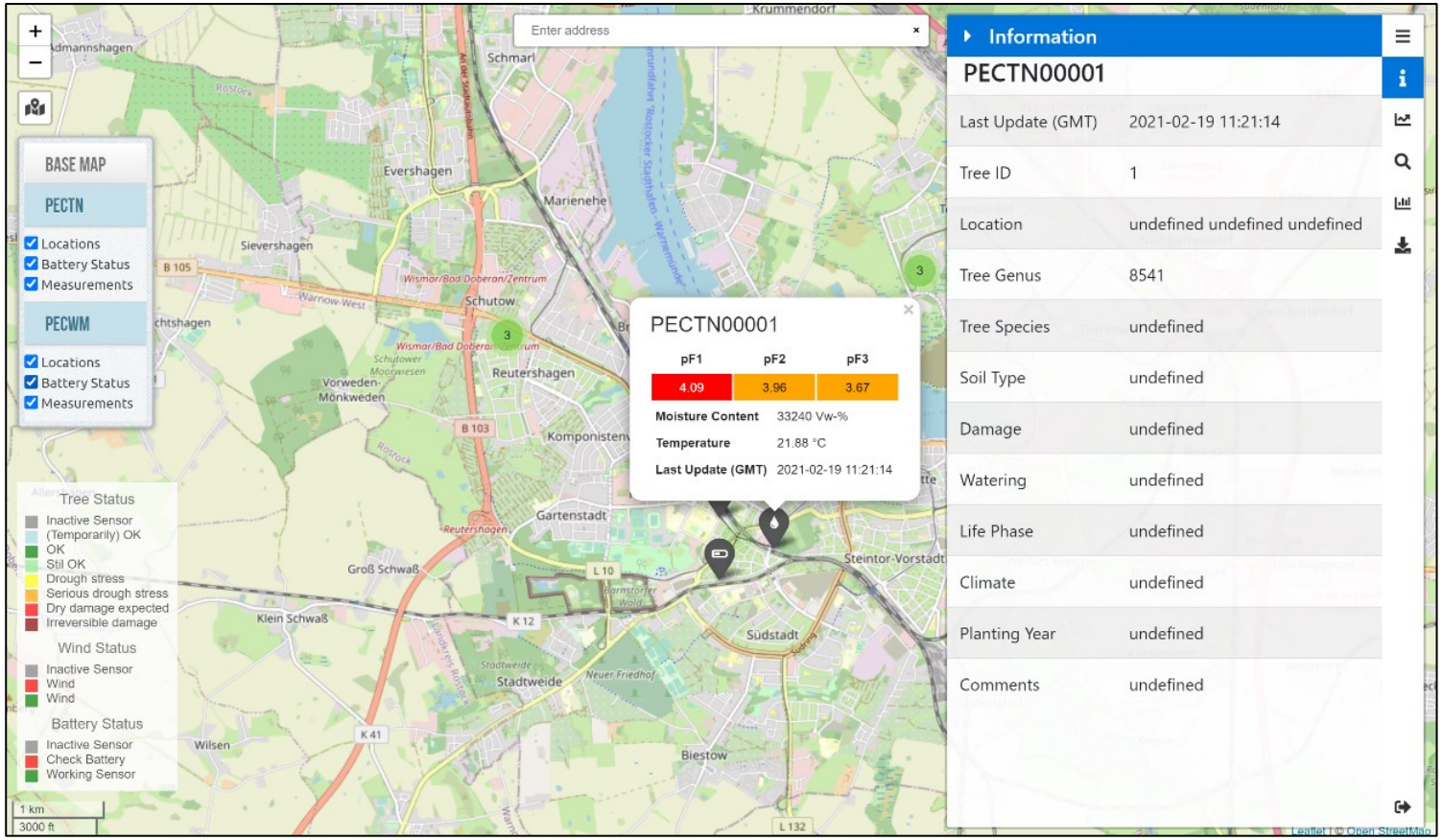
PiCUS Windsensor:
Sensoren zur Erfassung der Windgeschwindigkeit

PiCUS Environmental Cloud (PEC):
Online-Datenspeicher für erfasste Messwerte

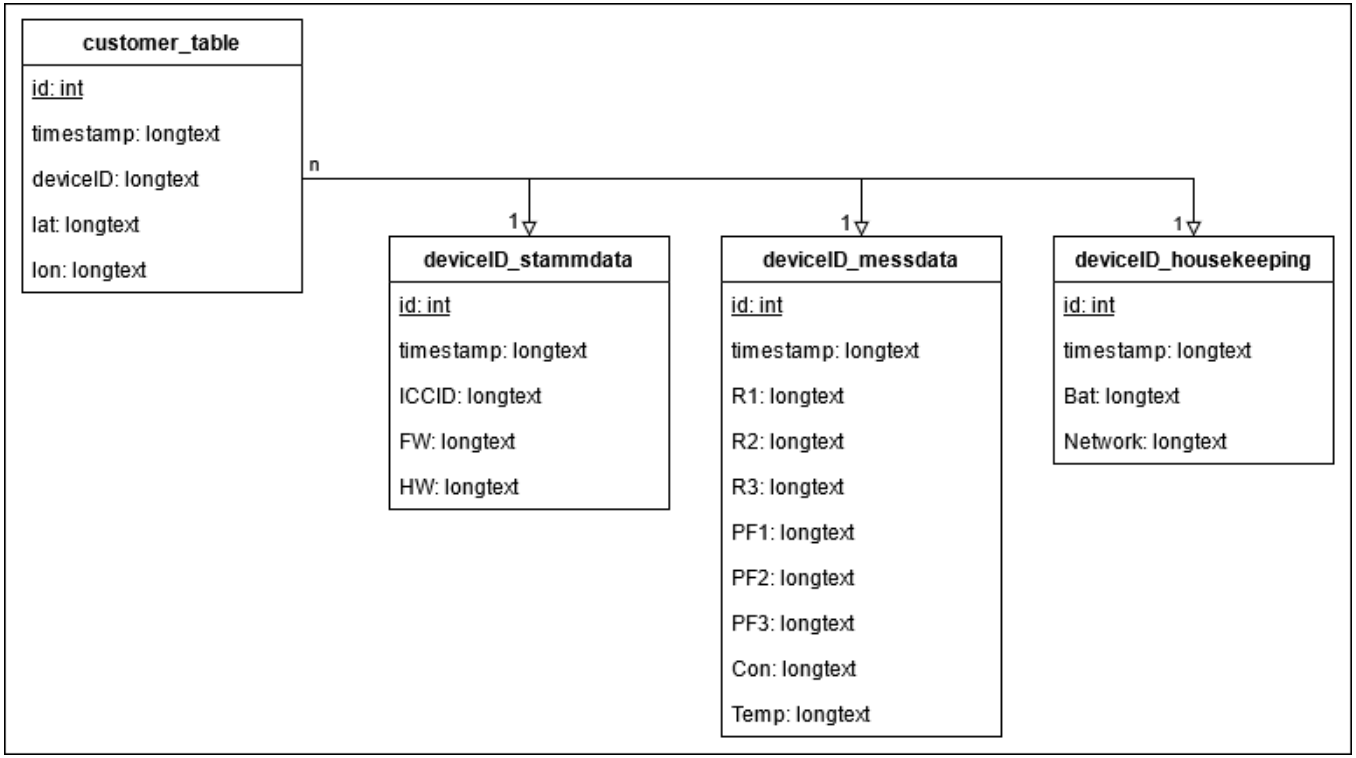
Quellen: Tension: https://www.argus-electronic.de/de/bauminspektion/produkte/picus-tension | Windsensor: https://www.argus-electronic.de/de/bauminspektion/produkte/picus-windsensor | PEC: https://www.argus-electronic.de/de/bauminspektion/picus-environmental-cloud-pec

Bildquellen: Logo: https://www.argus-electronic.de/extension/site_argus-electronic/design/argus-electronic_user/images/sprites.png | Tension: https://www.argus-electronic.de/var/argus-electronic/storage/images/media/images/baummesstechnik/pec.tension/picus-tension-draussen-1/12821-1-ger-DE/picus-tension-draussen-1_reference.jpg | Windsensor: https://www.argus-electronic.de/var/argus-electronic/storage/images/media/images/baummesstechnik/picus-windsensor/windsensor-mast-2-1/12973-3-ger-DE/windsensor-mast-2-1_reference.jpg

WMS zur Datenvisualisierung



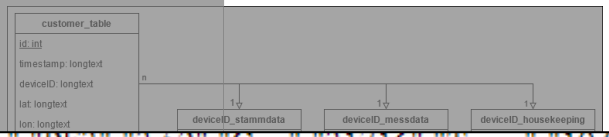
Datenbankstruktur



Lösungsansatz für dynamisches Auslesen der Datenbank

```
// search in general table for query
$infoGeneral="WITH $table_name AS ( SELECT m.*, ROW_NUMBER() OVER (PARTITION BY deviceID ORDER BY id DE
SC) AS rn
FROM $user AS m ) SELECT id, deviceID, lon, lat FROM $table_name WHERE rn = 1  ;";
$sqlGeneral=($infoGeneral);

// check if there are results
```

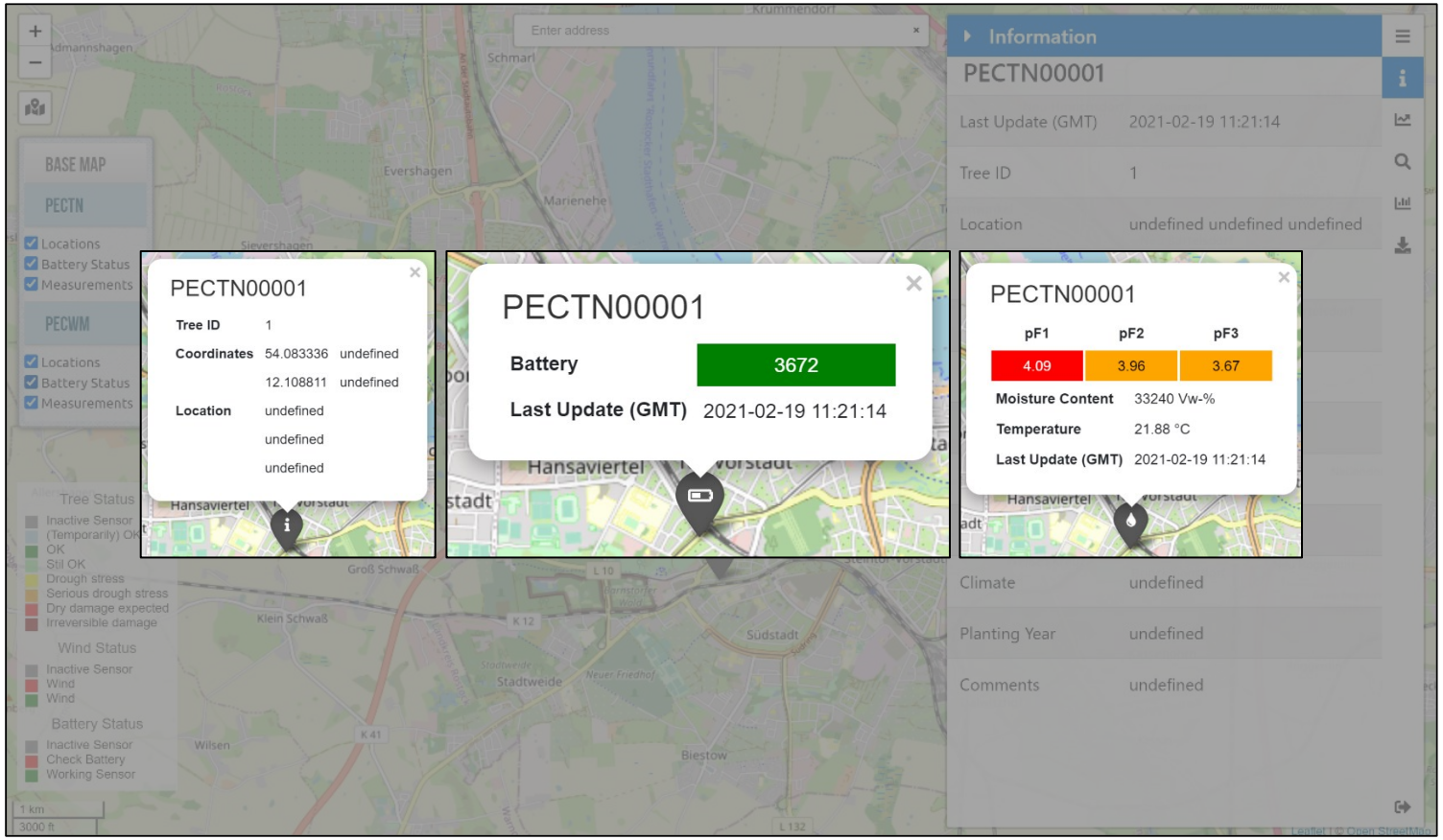


{"0":"PECTN00001","timestamp":"1612576800","PF1":"3.98","PF2":"3.75","PF3":"3.52","Con":"31716","Temp":"19.99"},
{"0":"PECTN00001","timestamp":"1612573200","PF1":"3.98","PF2":"3.76","PF3":"3.52","Con":"31736","Temp":"20.13"},
{"0":"PECTN00001","timestamp":"1612569600","PF1":"3.98","PF2":"3.76","PF3":"3.52","Con":"31752","Temp":"20.28"},
{"0":"PECTN00002","timestamp":"1607957515","PF1":"5.64","PF2":"2.09","PF3":"6.03","Con":"3023","Temp":"23.23"},
{"0":"PECTN00002","timestamp":"1607957515","PF1":"5.64","PF2":"2.09","PF3":"6.03","Con":"3023","Temp":"23.23"},
{"0":"PECTN00002","timestamp":"1607955715","PF1":"5.65","PF2":"2.14","PF3":"5.78","Con":"936","Temp":"-0.08"}

```
        $tempArrayGeneral = $rowGeneral;
        $allvalues = array_values($tempArrayGeneral); //saves the value of the table fields
        if ($allvalues[1]!="SM0000000000"){
            $sid=$allvalues[1]; //saves sensor id value

            $tableNameMeas=$sid.'_md'; //varaible table name md for every iteration
            $tableNameHdk=$sid.'_hk';//varaible table name housekeepingdata for every iteration
            $tableNameStd=$sid.'_sd';
            // next search in measurement table for query
            $infoMeas="SELECT timestamp, PF1, PF2, PF3, Con, Temp FROM $tableNameMeas order by
            id  desc limit 1";
            $sqlMeas=($infoMeas);
```

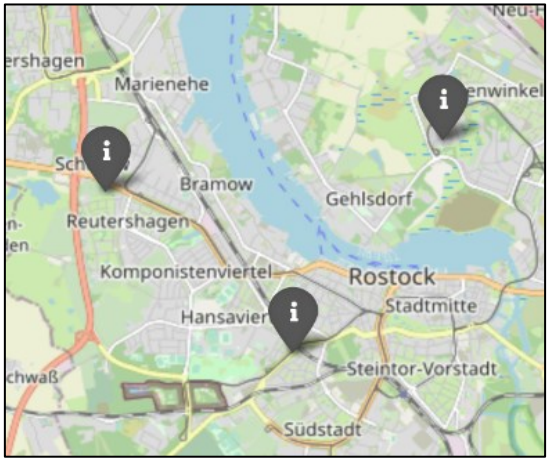
Benutzeroberfläche des WMS



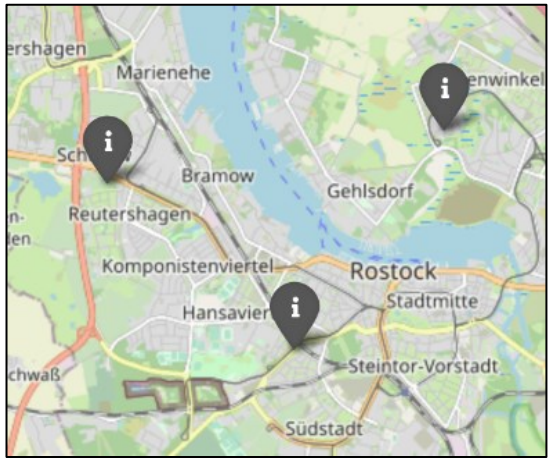
Bildquellen: Leaflet-Logo https://leafletjs.com/docs/images/logo.png

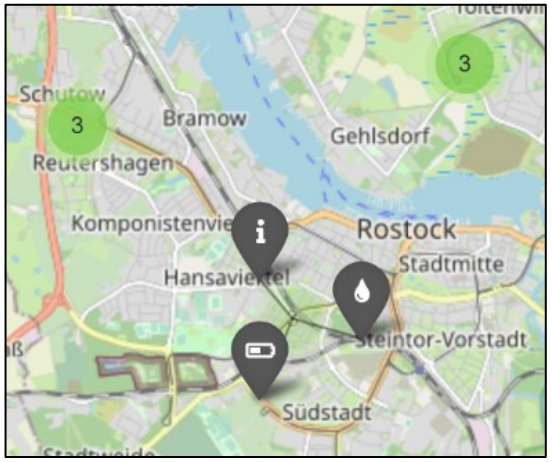
Leaflet Marker und Erweiterungen

Anwendung
Leaflet.markercluster



Anwendung
Leaflet.FeatureGroup.
SubGroup





Vorbereiten der erhobenen Messwerten

```
// building chart data object
for (var i = 0; i < jsondata.length; i++) {
    var row = Object.values(jsondata[i]);
    var marker = row[0];
    markers.push(marker);
    // loop once for each value
    for (var k = 0; k < values.length; k++) {
        // make a unique marker-value label
        var value_field = values[k];
        var label = getLabel(marker, value_field);

        // only add to object if unique, return index
        var index = add(pfSide, label, marker, value_field);
        var x = (row[1] * 1000);
        var y = parseFloat(row[k + row_offset]);

        pfSide[index].data.push({
            x: x,
            y: y
        });
    }
```

{"0":"PECTN00001","timestamp":"1612576800","PF1":"3.98","PF2":"3.75","PF3":"3.52","Con":"31716","Temp":"19.99"},
{"0":"PECTN00001","timestamp":"1612573200","PF1":"3.98","PF2":"3.76","PF3":"3.52","Con":"31736","Temp":"20.13"},
{"0":"PECTN00001","timestamp":"1612569600","PF1":"3.98","PF2":"3.76","PF3":"3.52","Con":"31752","Temp":"20.28"},
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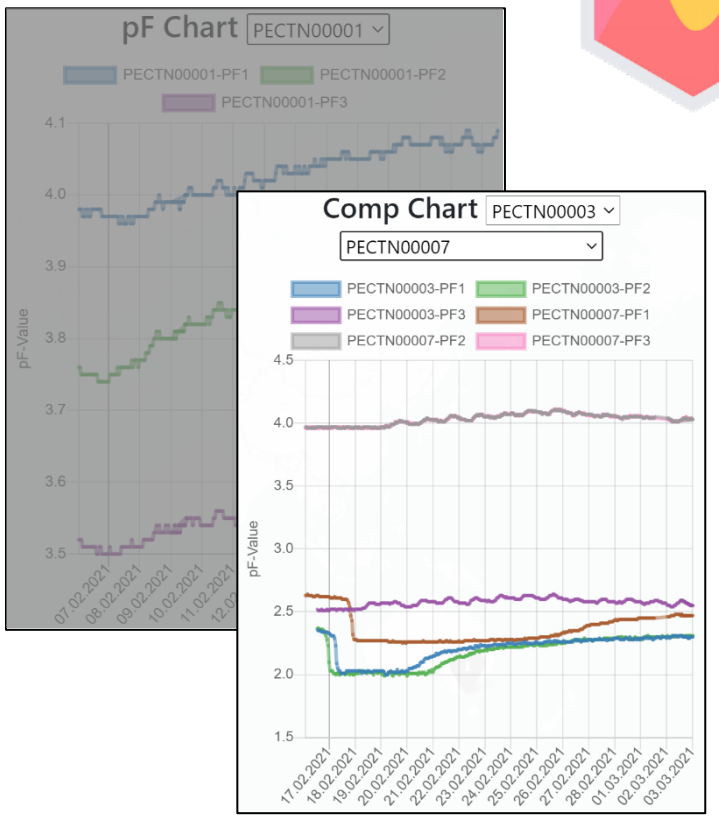
{"0":"PECTN00002","timestamp":"1607957515","PF1":"5.64","PF2":"2.09","PF3":"6.03","Con":"3023","Temp":"23.23"},
{"0":"PECTN00002","timestamp":"1607955715","PF1":"5.65","PF2":"2.14","PF3":"5.78","Con":"936","Temp":"-0.08"}

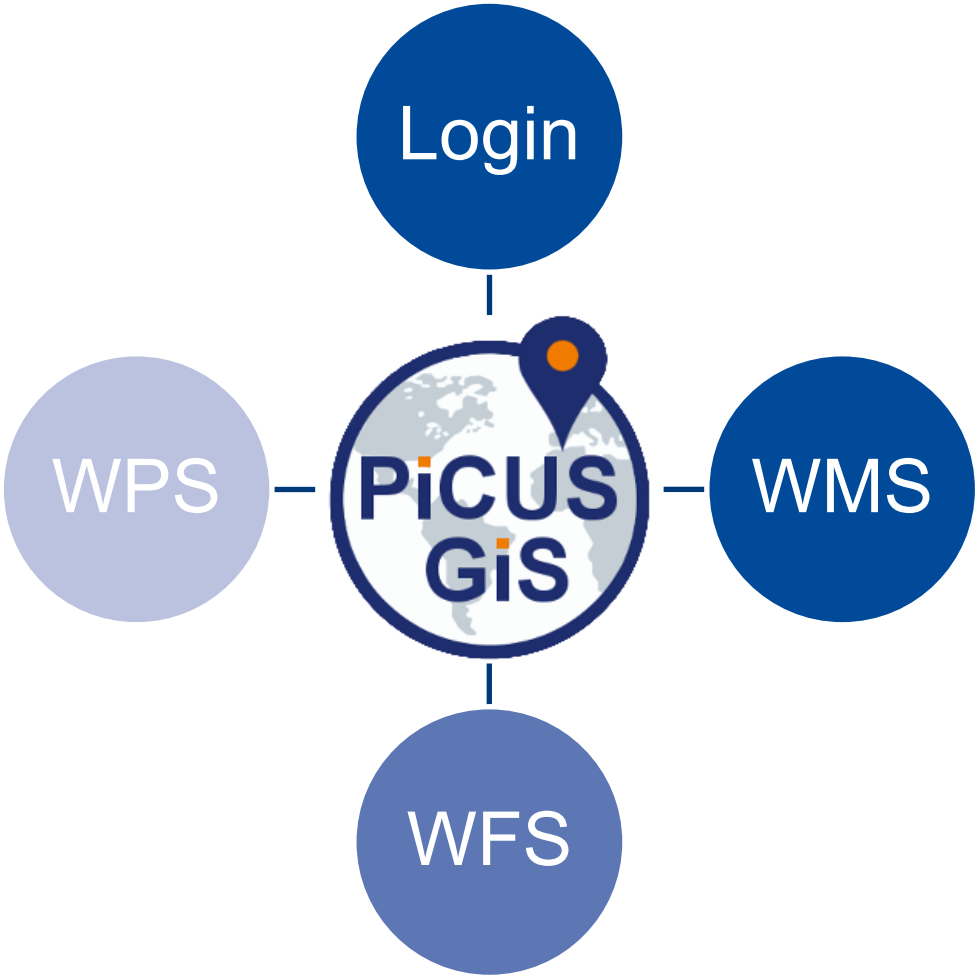
Rendern der Diagramme aus den erhobenen Messwerten

```
$("#side-drop").change(function () {

    var d = document.getElementById("side-drop");
    var dSelected = d.options[d.selectedIndex].value;
    dropData = compSide.filter(function (el, index, arr) {
        return el.marker === dSelected;
    })

    // change colors for comapring data
    for (var i = 0; i < dropData.length; i++) {
        if (dropData[i].label === dSelected+"-PF1") {
            dropData[i].backgroundColor = 'rgb(166,86,40, 0.25)';
            dropData[i].borderColor = 'rgb(166,86,40, 0.5)';
            dropData[i].hoverBackgroundColor = 'rgb(166,86,40, 0.75)';
            dropData[i].hoverBorderColor = 'rgb(166,86,40)';
        } else if (dropData[i].label === dSelected+"-PF2") {
            dropData[i].backgroundColor = 'rgb(153,153,153, 0.25)';
            dropData[i].borderColor = 'rgb(153,153,153, 0.5)';
            dropData[i].hoverBackgroundColor = 'rgb(153,153,153, 0.75)';
            dropData[i].hoverBorderColor = 'rgb(153,153,153)';
        } else if (dropData[i].label === dSelected+"-PF3") {
            dropData[i].backgroundColor = 'rgb(247,129,191, 0.25)';
            dropData[i].borderColor = 'rgb(247,129,191, 0.5)';
            dropData[i].hoverBackgroundColor = 'rgb(247,129,191, 0.75)';
            dropData[i].hoverBorderColor = 'rgb(247,129,191)';
        }
    }

    // generate newData with data of dropdown 1 and data of dropdown 2
    newData = filtered_data.concat(dropData);

    // update chart.data.datasets with combined data
    chart.data = {
        datasets: newData,
    };
    chart.update();
});
```



Bildquelle: Chart.js-Logo https://avatars.githubusercontent.com/u/10342521?s=200&v=4

PiCUS GiS
Überblick



Bildquellen: PiCUS-Logo https://picus.tree-inspection.cloud:9020/PicusGis/img/login/gis_logo_trans.png

Zusammenfassung

PiCUS Messtechnik für Baumuntersuchungen

- Umfangreiche und teils automatisierte Erfassung von Faktoren zur Baumkontrolle
- Zeitersparnis durch automatische Erfassung einzelner Parameter
- Erleichterter Zugang zu Messdaten durch WMS
- Intuitives Interpretieren der Messwerte durch Diagramme

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Vielen Dank für die Aufmerksamkeit!