ESP32 station

0.1

Generated by Doxygen 1.9.1

Chapter 1

Class Index

1.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

Chapter 2

File Index

2.1 File List

Here is a list of all documented files with brief descriptions:

Chapter 3

Class Documentation

3.1 measurements Struct Reference

Public Attributes

- float humidity = NAN
  Humidity level in %.
- char * time
  Time in "yyyy-MM-dd HH:mm:ss" format.
- float batteryLevel = NAN
  Battery level in %.
- float temperature = NAN
  Temperature in ℃.
- float pressure = NAN
  Pressure in hpa.
- float altitude = NAN
  Altitude in meters.
- uint32_t gasResistance = 0
  Gas resistance.
- sps30_measurement spsData
  Contains data from sps30 sensor.

The documentation for this struct was generated from the following file:

- src/datastruct.hpp

3.2 statusStruct Struct Reference

Public Attributes

- bool cardAvailable = true

  Whetever or not SD card is available.
- bool bmeAvailable = true

  Whetever or not BME680 is available.
- bool rtcAvailable = true

  Whetever or not RTC module is available.
- bool spsAvailable = true

  Whetever or not is sps30 sensor is available.
- bool problemOccured = false

  Whetever or not problem occured.

The documentation for this struct was generated from the following file:

- src/statstruct.hpp

Chapter 4

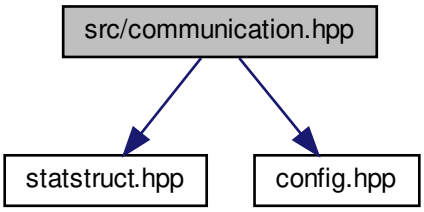
File Documentation

4.1 src/communication.hpp File Reference

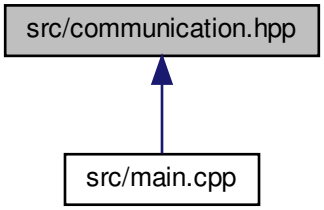
This file contains function for communication with server.

```
#include "statstruct.hpp"
#include "config.hpp"
```

Include dependency graph for communication.hpp:



This graph shows which files directly or indirectly include this file:



Functions

- void callback (String &topic, String &payload)

  Callback function for MQTT client.
- bool uploadData (DynamicJsonDocument &doc, char ∗topic)

  Function for uploading measurment data to MQTT topic on server.
- void log (const char ∗message, bool newLine=true, const char ∗topic=LOG_TOPIC)

  Is used to print log output to serial communication.

Variables

- MQTTClient **mqttClient**

4.1.1 Detailed Description

This file contains function for communication with server.

4.1.2 Function Documentation

4.1.2.1 callback()

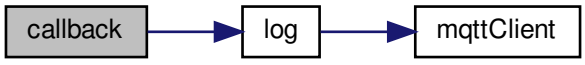
```
void callback (
            String & topic,
            String & payload )
```

Callback function for MQTT client.

Parameters

toopic	MQTT topic name
payload	content

Here is the call graph for this function:



4.1.2.2 log()

```
void log (
            const char * message,
            bool newLine = true,
            const char * topic = LOG_TOPIC )
```

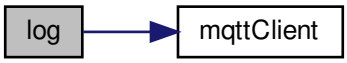
Is used to print log output to serial communication.

If connection to server is available log is also sent to MQTT topic.

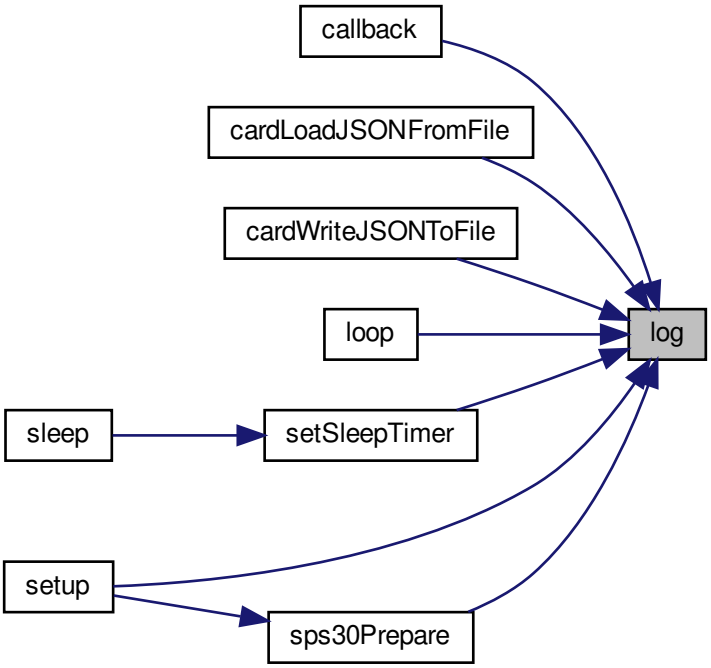
Parameters

message	Content of log
newLine	Whetever or not print log to new line in serial communication DEFAULT VALUE = true.
topic	MQTT topic name DEFAULT VALUE = LOG_TOPIC.

Here is the call graph for this function:



Here is the caller graph for this function:



4.1.2.3 uploadData()

```
bool uploadData (
            DynamicJsonDocument & doc,
            char * topic )
```

Function for uploading measurment data to MQTT topic on server.

Parameters

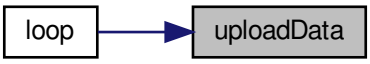
doc	JSON document with data.
topic	MQTT topic name.

Returns

Wherever or not upload was successful.

Here is the call graph for this function:

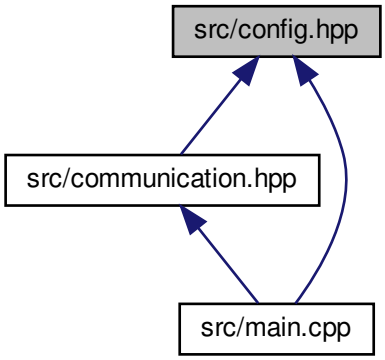
Here is the caller graph for this function:



4.2 src/config.hpp File Reference

This file holds config values such as server ip, delay values, pin values etc.

This graph shows which files directly or indirectly include this file:



Macros

- #define DEBUG 1

  Turns on or off debug logs in serial communication.
- #define SSID "Damian"

  < Wi-Fi SSID.
- #define WIFI_PASSWD "Ahoj123123"

  NTP server address.
- #define NTP_SERVER "0.cz.pool.ntp.org"

  MQTT client ID.
- #define MQTT_ID "esp32"

  MQTT client name.
- #define MQTT_NAME "esp32"

  MQTT server IP address.
- #define MQTT_SERVER "192.168.0.38"

  MQTT server port.
- #define MQTT_PORT 1883

  Station hostname in local network.
- #define HOSTNAME "esp32"

  MQTT packet size in bytes.
- #define MQTT_PACKET_SIZE 512

  Topic name for logs.
- #define LOG_TOPIC "esp32/log"

  Topic name for measured data.
- #define DATA_TOPIC "esp32/data"

  Topic name for error reports.
- #define REPORT_TOPIC "esp32/report"

  Quality of service (QoS) for MQTT publish communication.
- #define MQTT_PUB_QOS 1

  Quality of service (QoS) for MQTT subscribe communication.
- #define MQTT_SUB_QOS 1

  Connection timeout.
- #define **MQTT_TIMEOUT** 5000
- #define uS_TO_S_FACTOR (uint64_t)1000000

  < Holds amount of uS in second.
- #define TIME_TO_SLEEP_DEFAULT (uint64_t)60

  Amount of seconds for station to sleep when battery level is in level 1.
- #define TIME_TO_SLEEP_ONE (uint64_t)60

  Amount of seconds for station to sleep when battery level is in level 2.
- #define TIME_TO_SLEEP_TWO (uint64_t)300

  Amount of seconds for station to sleep when battery level is in level 3.
- #define TIME_TO_SLEEP_THREE (uint64_t)600

  Define upper level of battery.
- #define UPPER_LEVEL 90

  Define middle level of battery.
- #define **LOWER_LEVEL** 80
- #define MEASUREMENTS_COUNTER 1

  < Specifies how many measurments to make before uploading data.
- #define BAUD_RATE 115200

  Battery analog pin value.
- #define BATTERY_PIN 32

SD card CS pin.

- #define SD_CS 5

  JSON document buffer size in bytes for measured data.

- #define JSON_DOC_SIZE_MEASUREMENTS 512

  JSON document buffer size in bytes for error report.

- #define JSON_DOC_SIZE_STATUS 192

  Full path of storage location.

- #define **STORAGE_LOCATION** "/station"
- #define SEA_LEVEL_PRESSURE 1034

  Sea level of current location of station.

- #define GMT_OFFSET_SEC 3600

  GMT offset in seconds.

- #define DAYLIGHT_OFFSET_SEC 3600

  UTC daylight offset.

- #define CPU_SPEED 80

  CPU speed in MHz Recommended speed is 240, minimum is 80.

4.2.1 Detailed Description

This file holds config values such as server ip, delay values, pin values etc.

4.2.2 Macro Definition Documentation

4.2.2.1 DAYLIGHT_OFFSET_SEC

```
#define DAYLIGHT_OFFSET_SEC 3600
```

UTC daylight offset.

Is used to set time from NTP server.

4.2.2.2 GMT_OFFSET_SEC

```
#define GMT_OFFSET_SEC 3600
```

GMT offset in seconds.

Is used to set time from NTP seWho Will Save Us Nowrver.

4.2.2.3 MEASUREMENTS_COUNTER

```
#define MEASUREMENTS_COUNTER 1
```

< Specifies how many measurments to make before uploading data.

Baud rate for serial communication.

4.2.2.4 SEA_LEVEL_PRESSURE

```
#define SEA_LEVEL_PRESSURE 1034
```

Sea level of current location of station.

Is used to calibrate sensors.

4.2.2.5 SSID

```
#define SSID "Damian"
```

< Wi-Fi SSID.

Wi-Fi password.

4.2.2.6 uS_TO_S_FACTOR

```
#define uS_TO_S_FACTOR (uint64_t)1000000
```

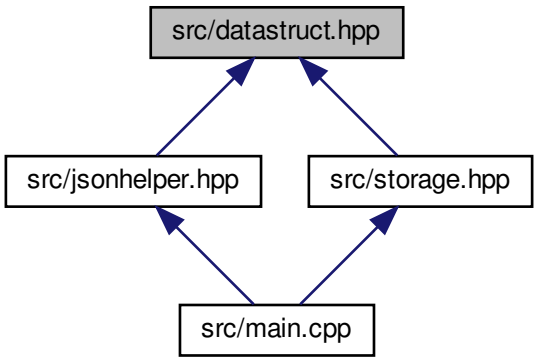
< Holds amount of uS in second.

Default amount of seconds for station to sleep.

4.3 src/datastruct.hpp File Reference

Holds structure measurements.

This graph shows which files directly or indirectly include this file:



Classes

- struct measurements

4.3.1 Detailed Description

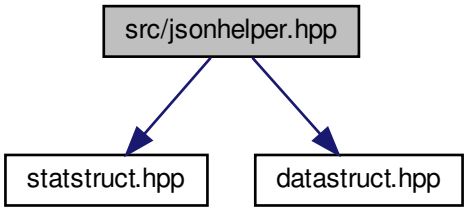
Holds structure measurements.

4.4 src/jsonhelper.hpp File Reference

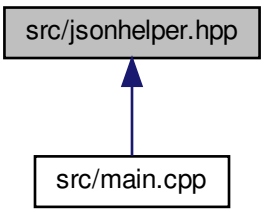
Contains functions for working with JSON document.

```
#include "statstruct.hpp"
#include "datastruct.hpp"
```

Include dependency graph for jsonhelper.hpp:



This graph shows which files directly or indirectly include this file:



Functions

- void addEventToJSON (DynamicJsonDocument &doc, measurements &event)

  Append measurements to JSON document.
- void addEventToJSON (DynamicJsonDocument &doc, statusStruct &status)

  Append status to JSON document.

4.4.1 Detailed Description

Contains functions for working with JSON document.

4.4.2 Function Documentation

4.4.2.1 addEventToJSON() [1/2]

```
void addEventToJSON (
            DynamicJsonDocument & doc,
            measurements & event )
```

Append measurements to JSON document.

Parameters

doc	JSON document with data
event	struct with measurement data

Here is the caller graph for this function:

4.4.2.2 addEventToJSON() [2/2]

```
void addEventToJSON (
            DynamicJsonDocument & doc,
            statusStruct & status )
```

Append status to JSON document.

Parameters

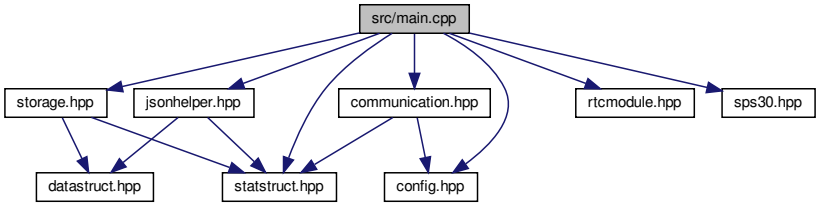
doc	JSON document with data
status	struct with status data

4.5 src/main.cpp File Reference

Main file.

```
#include "communication.hpp"
#include "statstruct.hpp"
#include "jsonhelper.hpp"
#include "rtcmodule.hpp"
#include "storage.hpp"
#include "config.hpp"
#include "sps30.hpp"
```

Include dependency graph for main.cpp:



Functions

- SDFS card (SD)

  SD card module.
- MQTTClient mqttClient (MQTT_PACKET_SIZE)

  MQTT client.
- void setupWifi ()

  Is used to attempt to establish Wi-Fi connection.
- void measure (measurements &data, RTC_DS3231 &rtc, Adafruit_BME680 &bme)

  Get reading from all available sensors and modules.
- double readBatteryLevel ()

  Read battery level.
- int setSleepTimer (float batteryLevel)

  Determine and set the time to put station to sleep.
- void backup (DynamicJsonDocument &doc)

  Save JSON document on SD card.
- void sleep (float batteryLevel)

  Prepare MCU for sleep, set deep sleep interval according to battery level.
- void setup ()

  Setup function Is used to setup pin modes, MCU, and inicialize sensors and modules.
- void loop ()

  Main loop function.

Variables

- RTC_DATA_ATTR unsigned int offlineCounter = 0

  Offline counter stored in internal RTC memory of ESP32, counts how many times station measured.
- WiFiClient wifiClient

  Wi-Fi client.
- RTC_DS3231 rtc

  RTC module.
- Adafruit_BME680 bme

  BME680 sensor.
- statusStruct status

  Struct that contains availability status for each sensor or module.

4.5.1 Detailed Description

Main file.

4.5.2 Function Documentation

4.5.2.1 backup()

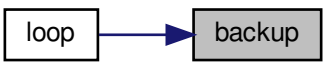
```
void backup (
            DynamicJsonDocument & doc )
```

Save JSON document on SD card.

Parameters

doc	

Here is the caller graph for this function:



4.5.2.2 measure()

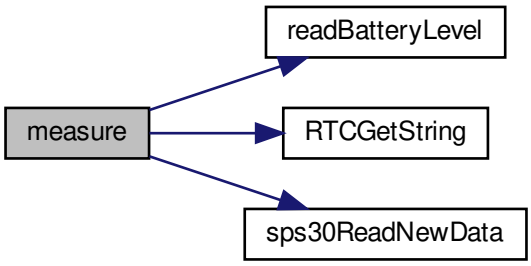
```
void measure (
            measurements & data,
            RTC_DS3231 & rtc,
            Adafruit_BME680 & bme )
```

Get reading from all available sensors and modules.

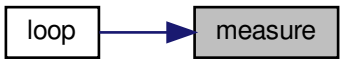
Parameters

data	Data Struct in which measured data is stored
rtc	rtc module
bme	BME680 sensor

Here is the call graph for this function:



Here is the caller graph for this function:



4.5.2.3 readBatteryLevel()

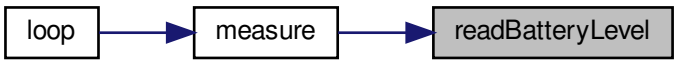
```
double readBatteryLevel ( )
```

Read battery level.

Returns

battery level in %

Here is the caller graph for this function:



4.5.2.4 setSleepTimer()

```
int setSleepTimer (
            float batteryLevel )
```

Determine and set the time to put station to sleep.

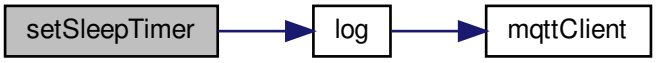
Parameters

batteryLevel	battery level in %

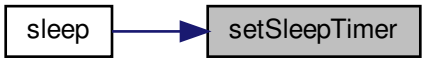
Returns

Sleep mode

Here is the call graph for this function:



Here is the caller graph for this function:

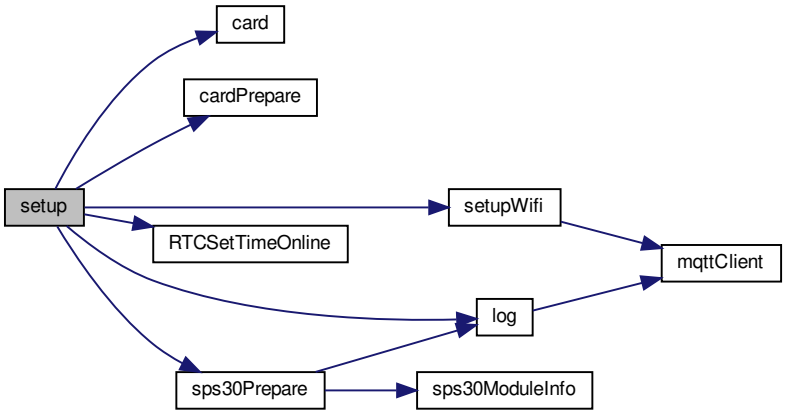


4.5.2.5 setup()

```
void setup ( )
```

Setup function Is used to setup pin modes, MCU, and inicialize sensors and modules.

Establish Wi-Fi connection and connection to MQTT broker. Here is the call graph for this function:



4.5.2.6 sleep()

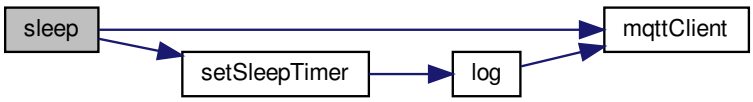
```
void sleep (
            float batteryLevel )
```

Prepare MCU for sleep, set deep sleep interval according to battery level.

Parameters

batteryLevel	Battery voltage level in %.

Here is the call graph for this function:



4.5.3 Variable Documentation

4.5.3.1 offlineCounter

```
RTC_DATA_ATTR unsigned int offlineCounter = 0
```

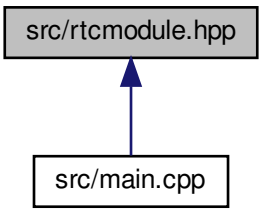
Offline counter stored in internal RTC memory of ESP32, counts how many times station measured.

Maximum amout of measurements is specified by MEASUREMENTS_COUNTER macro.

4.6 src/rtcmodule.hpp File Reference

Function for working with RTC module.

This graph shows which files directly or indirectly include this file:



Functions

- void RTCSetTimeOnline (tm &timeStr)

  Set time in RTC module from BTP server.
- char * RTCGetString ()

  Get string representation of time in "yyyy-MM-dd HH:mm:ss" format.
- char * **RTCGetTimestamp** ()

Variables

- RTC_DS3231 rtc

  RTC module.

4.6.1 Detailed Description

Function for working with RTC module.

4.6.2 Function Documentation

4.6.2.1 RTCGetString()

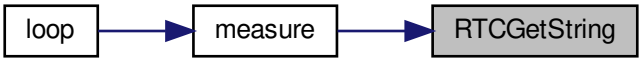
```
char* RTCGetString ( )
```

Get string representation of time in "yyyy-MM-dd HH:mm:ss" format.

Returns

string representation of time

Here is the caller graph for this function:



4.6.2.2 RTCSetTimeOnline()

```
void RTCSetTimeOnline (
            tm & timeStr )
```

Set time in RTC module from BTP server.

Parameters

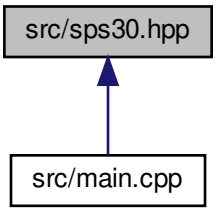
timeStr	time struct

Here is the caller graph for this function:

4.7 src/sps30.hpp File Reference

Function for working with sps30 sensor.

This graph shows which files directly or indirectly include this file:



Functions

- bool sps30Prepare ()

  Inicialize sps30 sensor.
- bool sps30ReadNewData (sps30_measurement &data)

  Read new data from sps30 sensor.
- const char * sps30ModuleInfo ()

  Get string representation of serial number and firmware version of sps30 sensor.

4.7.1 Detailed Description

Function for working with sps30 sensor.

4.7.2 Function Documentation

4.7.2.1 sps30ModuleInfo()

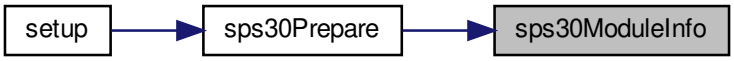
```
const char* sps30ModuleInfo ( )
```

Get string representation of serial number and firmware version of sps30 sensor.

Returns

string representation of serial number and firmware version of sps30 sensor.

Here is the caller graph for this function:



4.7.2.2 sps30Prepare()

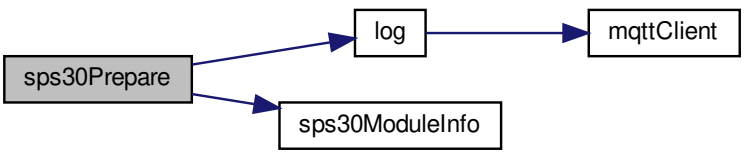
```
bool sps30Prepare ( )
```

Inicialize sps30 sensor.

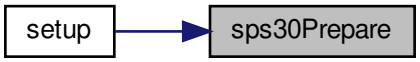
Returns

Whatever or not initialization was successful.

Here is the call graph for this function:



Here is the caller graph for this function:



4.7.2.3 sps30ReadNewData()

```
bool sps30ReadNewData (
            sps30_measurement & data )
```

Read new data from sps30 sensor.

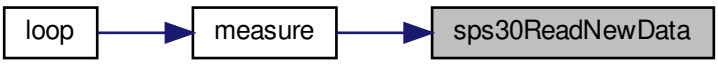
Parameters

data	sps30 data struct.

Returns

Whatever or not measurment was successful.

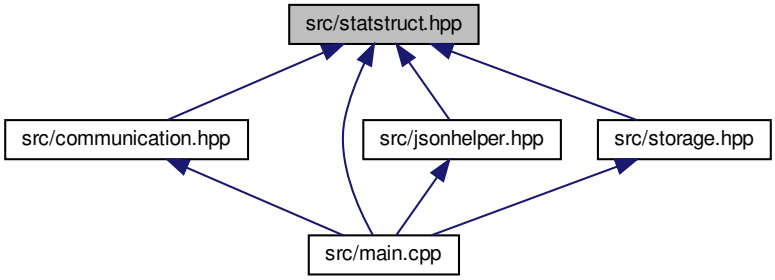
Here is the caller graph for this function:



4.8 src/statstruct.hpp File Reference

Holds structure statusStruct.

This graph shows which files directly or indirectly include this file:



Classes

- struct statusStruct

4.8.1 Detailed Description

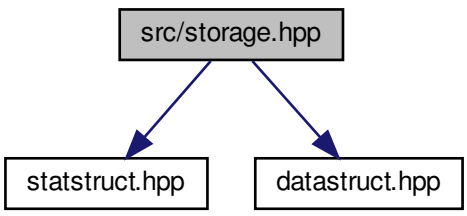
Holds structure statusStruct.

4.9 src/storage.hpp File Reference

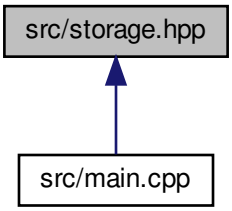
Function for working with storage and JSON documents.

```
#include "statstruct.hpp"
#include "datastruct.hpp"
```

Include dependency graph for storage.hpp:



This graph shows which files directly or indirectly include this file:



Functions

- bool cardPrepare ()

  Inicialize and prepare SD card.
- bool cardWriteJSONToFile (DynamicJsonDocument &doc, const char ∗fileName)

  Store measured data into file on SD card.
- bool cardLoadJSONFromFile (DynamicJsonDocument &doc, char ∗fileName)

  Load measured data from file on SD card.
- bool cardClearFile (const char ∗fileName)

  Delete file on SD card.

Variables

- SDFS **card**

4.9.1 Detailed Description

Function for working with storage and JSON documents.

4.9.2 Function Documentation

4.9.2.1 cardClearFile()

```
bool cardClearFile (
            const char * fileName )
```

Delete file on SD card.

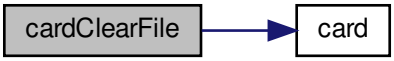
Parameters

fileName	Full path to file

Returns

Whatever or not operation was successful

Here is the call graph for this function:



4.9.2.2 cardLoadJSONFromFile()

```
bool cardLoadJSONFromFile (
            DynamicJsonDocument & doc,
            char * fileName )
```

Load measured data from file on SD card.

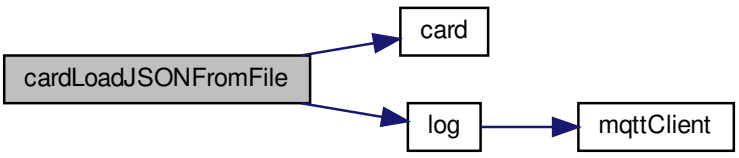
Parameters

doc	JSON document into which data is stored
fileName	Full path to file

Returns

Whatever or not operation was successful

Here is the call graph for this function:



4.9.2.3 cardPrepare()

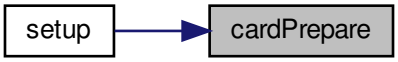
```
bool cardPrepare ( )
```

Inicialize and prepare SD card.

Returns

Whatever or not initialization was successful

Here is the caller graph for this function:



4.9.2.4 cardWriteJSONToFile()

```
bool cardWriteJSONToFile (
            DynamicJsonDocument & doc,
            const char * fileName )
```

Store measured data into file on SD card.

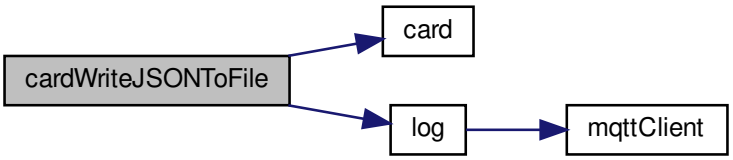
Parameters

doc	JSON document with data
fileName	Full path to file

Returns

Whatever or not operation was successful

Here is the call graph for this function:



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