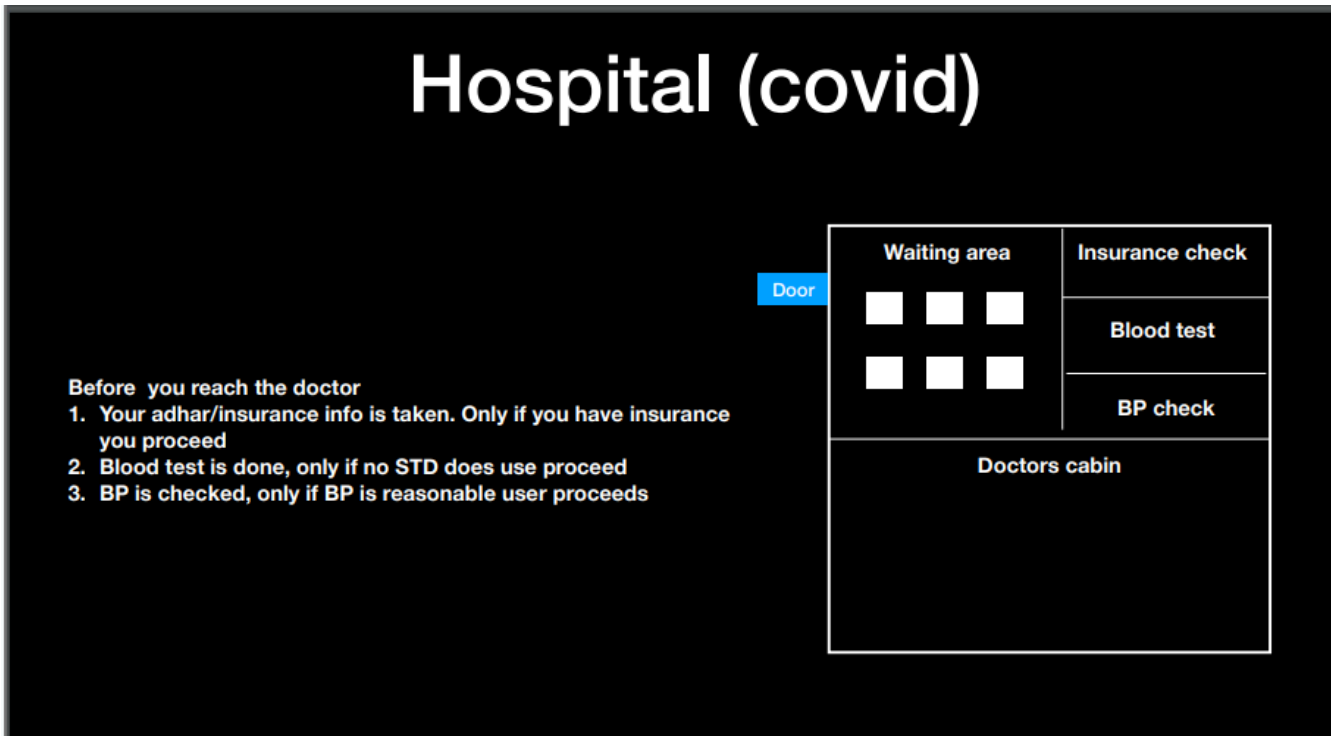
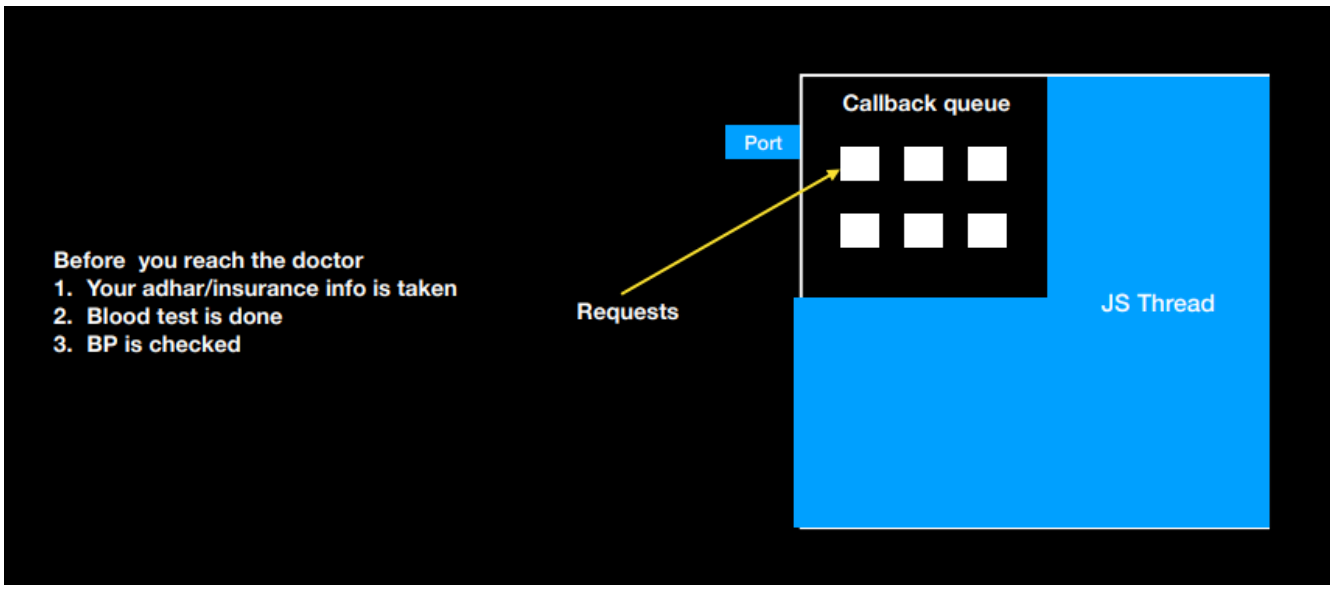
ZOD and Middleware

Lets see the example of the hospital.





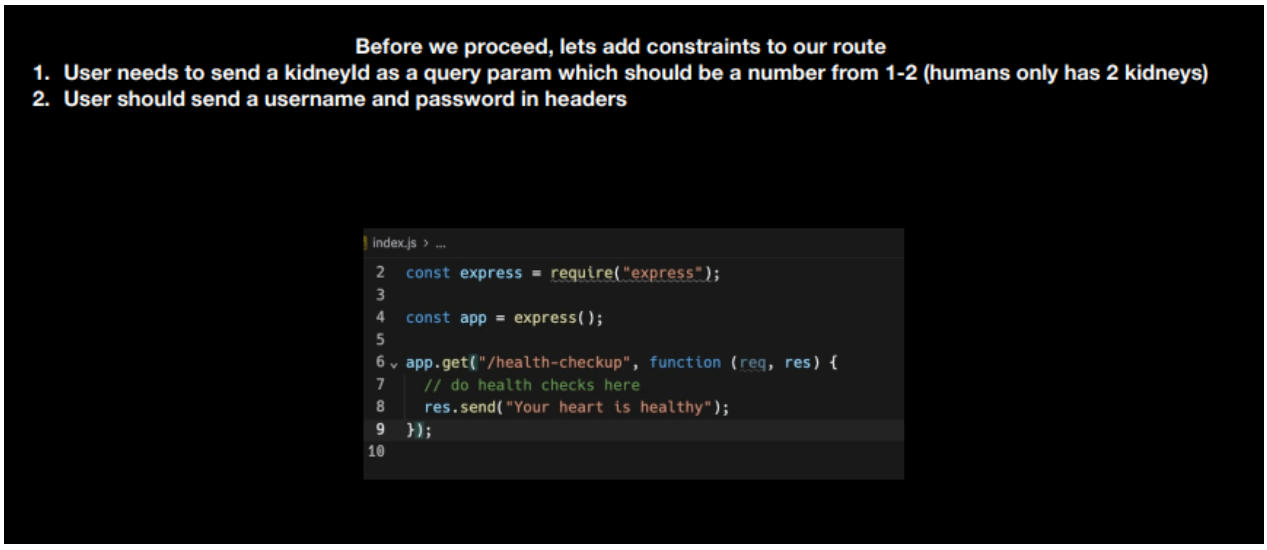
Equivalent code:

```
const express = require('express');
const app = express();

app.get('/health-checkup',function(req,res){
    // do health checkup
    res.send("Your heart is healthy")
})
```

How do you do

1. Auth checks? (Does this user have funds to visit the doctor)
2. Ensure input by the user is valid (BP / blood tests)

Middleware use is to do **prechecks** (either authentication and input validation(have they entered correct input))



There are three ways to send input:

1. query parameter
2. headers (we can see this in POSTMAN)

3. body

Lets first see the non-efficient way to do it

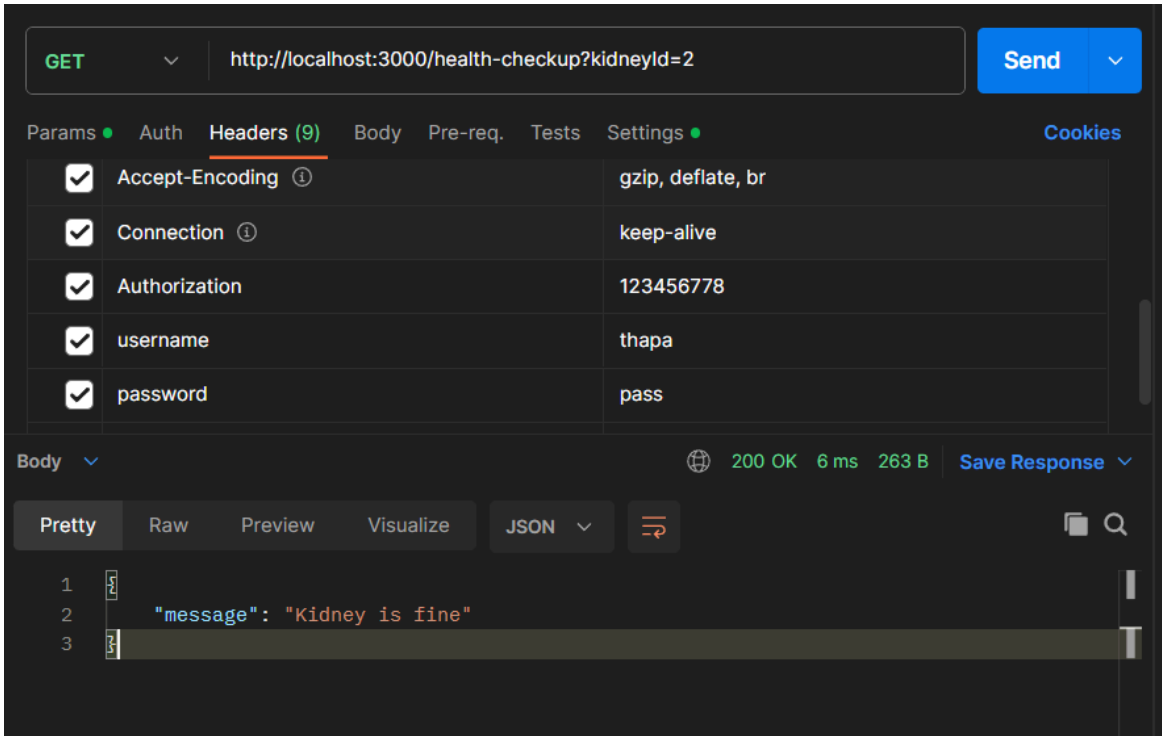
```
const express = require('express');
const app = express();

app.get('/health-checkup',function(req,res){
    // do health checkup
    const kidneyId = req.query.kidneyId;
    const username = req.headers.username;
    const password = req.headers.password;

    if (username != "thapa" && password != "pass"){
        res.status(401).json({
            message: "User does not exist"
        })
        return;
// early returning
    }
    if(kidneyId !=1 && kidneyId !=2){
        res.status(411).json({
            message:"wrong inputs"
        })
        return;
    }
    //Do something with the kidney here

    res.send("Your heart is healthy")
})
```

This will check only if we have a single user, but LinkedIn has millions of users.

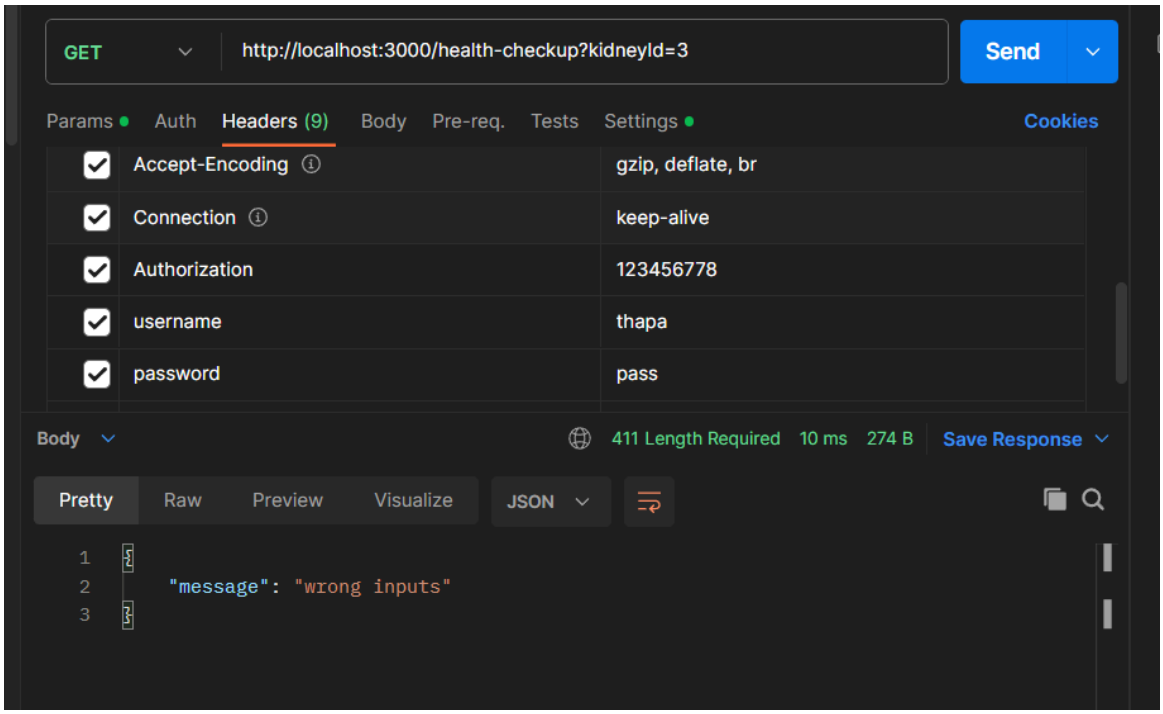
Now see the different responses

Observe the Different status code return

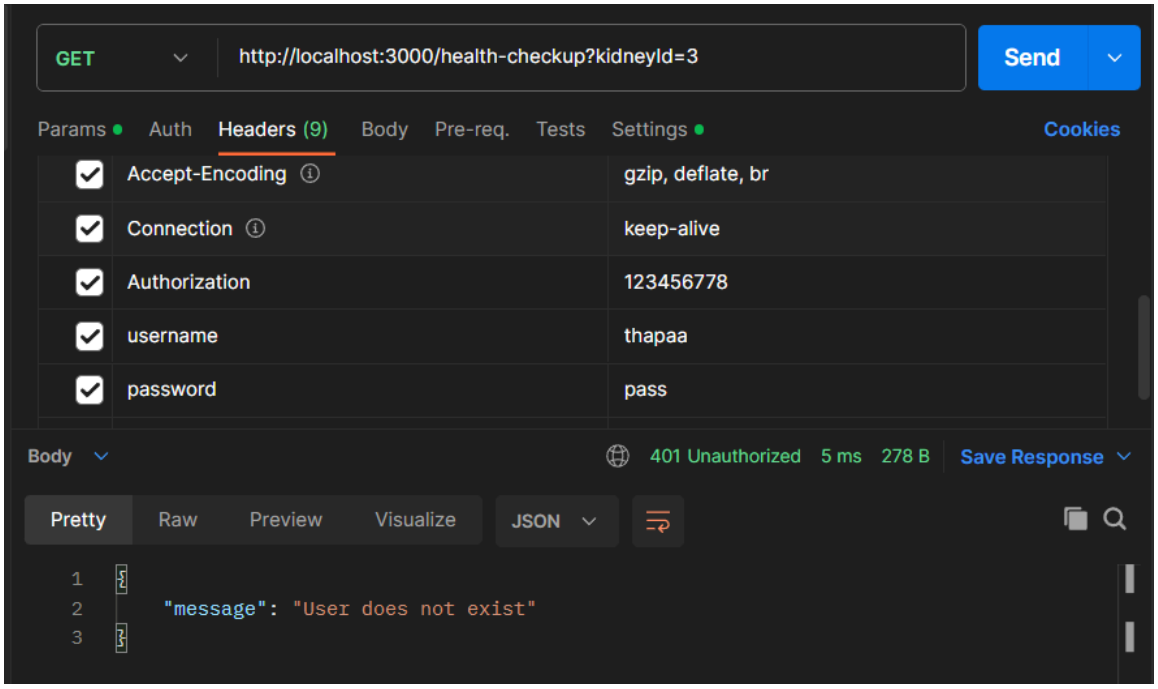
1. **200**


GET
http://localhost:3000/health-checkup?kidneyId=2
Send
Params
Auth
Headers (9)
Body
Pre-req.
Tests
Settings
Cookies
Accept-Encoding
gzip, deflate, br
Connection
keep-alive
Authorization
123456778
username
thapa
password
pass
Body
200 OK
6 ms
263 B
Save Response
Pretty
Raw
Preview
Visualize
JSON
{
"message": "Kidney is fine"
}

2. 411


GET
http://localhost:3000/health-checkup?kidneyId=3
Send
Params
Auth
Headers (9)
Body
Pre-req.
Tests
Settings
Cookies
Accept-Encoding
gzip, deflate, br
Connection
keep-alive
Authorization
123456778
username
thapa
password
pass
Body
411 Length Required
10 ms
274 B
Save Response
Pretty
Raw
Preview
Visualize
JSON
{
"message": "wrong inputs"
}

3. 403



What if I tell you to introduce another route that does Kidney replacement and Input need to be same?

Then if we do it without the middleware we have to write the following code

In this solution we are repeating code violating (**DRY).**
Writing this logic for suppose 20 route is bad and if we have to change something then this we tiresome

index.js > app.put("/replace-kidney") callback > ...

```
const express = require("express");

const app = express();

app.get("/health-checkup", function (req, res) {
  // do health checks here
  const kidneyId = req.query.kidneyId;
  const username = req.headers.username;
  const password = req.headers.password;

  if (username != "harkirat" && password != "pass") {
    res.status(403).json({
      msg: "User doesnt exist",
    });
    return;
  }

  if (kidneyId != 1 && kidneyId != 2) {
    res.status(411).json({
      msg: "wrong inputs",
    });
    return;
  }
  // do something with kidney here

  res.send("Your heart is healthy");
});

app.put("/replace-kidney", function (req, res) {
  // do health checks here
  const kidneyId = req.query.kidneyId;
  const username = req.headers.username;
  const password = req.headers.password;

  if (username != "harkirat" && password != "pass") {
    res.status(403).json({
      msg: "User doesnt exist",
    });
    return;
  }

  if (kidneyId != 1 && kidneyId != 2) {
    res.status(411).json({
      msg: "wrong inputs",
    });
    return;
  }
  // do kidney replacement logic here

  res.send("Your heart is healthy");
});
```

Upto one extent we will solve **DRY** by making function and doing function call inside the routes.

Slightly better solution will be this.

```
function usernameValidator(username, password){
    if(username != "thapa" || password != "pass"){
        return false;
    }
    return true;
}

function kidneyIdValidator(kidneyId){
    if(kidneyId !=1 && kidneyId !=2){
        return false;
    }
    return true;
}

app.get('/health-checkup',function(req,res){
    // do health checkup
    const kidneyId = req.query.kidneyId;

    if (!usernameValidator(req.query.username, req.query.password)){
        res.status(401).json({
            message: "User does not exist"
        })
        return;
    }
    if(!kidneyIdValidator(kidneyId)){
        res.status(411).json({
            message:"wrong inputs"
        })
        return;
    }
    //Do something with the kidney here
```

```
    res.send("Your health is healthy")
})

app.put("/replace-kidney", function(req, res){
    // do health checks here
    const kidneyId = req.query.kidneyId;
    const username = req.headers.username;
    const password = req.headers.password;

    if (!usernameValidator(req.query.username, req.query.password)){
        res.status(403).json({
            message: "User does not exist"
        })
        return;
    }

    if(!kidneyIdValidator(kidneyId)){
        res.status(411).json({
            message:"wrong inputs"
        })
        return;
    }
    // do kidney replacement logic here

    res.send("Kidney replaced successfully")
})

app.listen(3000)
```

Any change need to be done only on functions now and now we dont have to do it inside the route

Optimal Solution is **Middleware**

Middleware

We can give a range of callback function while making a route

Example

```
app.get("/health-checkup",function(req,res){

},function(req,res){

})
```

Now how will be know which function will be called?

```
const express = require('express');
const app = express();

app.get("/health-checkup",function(){
    console.log("Hi from the first function")
},function(req,res){
    console.log("Hi from the second function")
})

app.listen(3000)
```

Terminal:

:

PS C:\Users\NTC\Desktop\Dev\Week3> node

"c:\Users\NTC\Desktop\Dev\Week3\Zod_Middleware\practice.js"

Hi from the first function

Why doesn't the second function is called

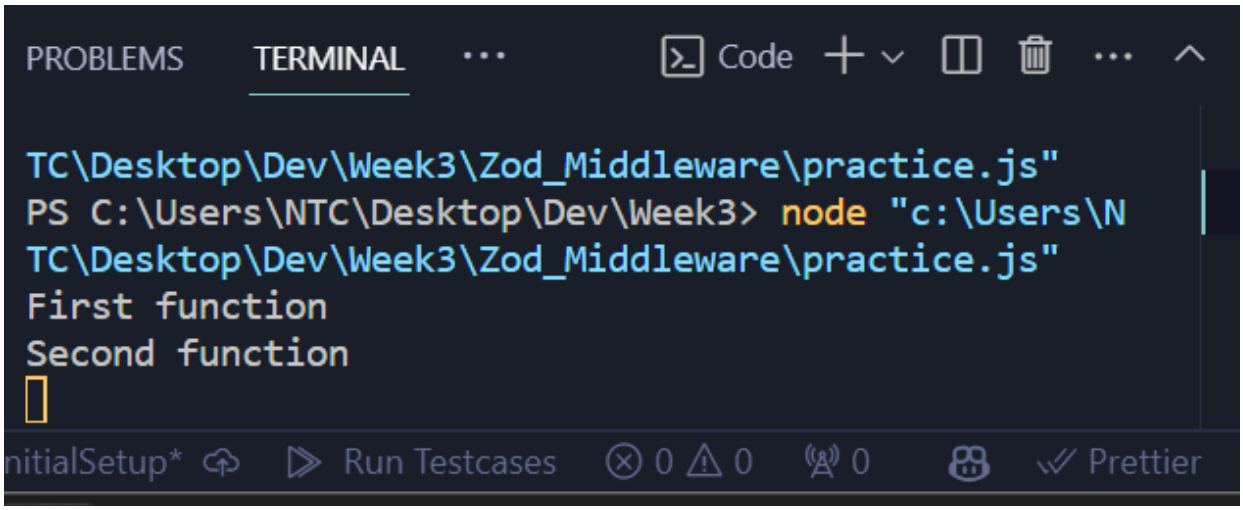
Now actually in the function parameter inside the route, we also pass the next, we will call next() when everything is alright in the first function and then it will call the second function.

Example

```
const express = require('express');
const app = express();

app.get("/health-checkup",function(req,res,next){
    console.log("First function")
    next()
```

```
},function(req,res){
    console.log("Second function")
    res.send("Doone")
})
app.listen(3000)
```

Terminal



Actual syntax of route handler

```
const express = require('express');
const app = express();

// middleware just like any other function
function userMiddleware(req,res,next){
    let username = req.query.username;
    let password = req.query.password;
    if(username != "thapa" || password != "pass"){
        res.status(403).json({
            // if condition is not met get lost
            msg:"Invalid user",
        });
    } else{
        // on the route definition after this function pass next() then
only any other function after it defined will be called
        next();
```

```
    }
};

function kidneyMiddleware(req, res, next){
    if(kidneyId !=1 && kidneyId !=2){
        res.status(403).json({
            msg: "Incorrect input",
        });
    }else{
        next();
    }
}

app.get("/health-checkup",userMiddleware,kidneyMiddleware,
function(req,res){
    // do something with health checkups here
    res.send("Your Basic health is okay")
})

app.get("/kidney-check",userMiddleware,kidneyMiddleware,
function(req,res){
    // do something with kidney here
    res.send("Kidney check-up is done")
})

app.get("/heart-check",userMiddleware,function(req,res){
    // do some heart check ups
    res.send("Your heart is healthy")
})

app.listen(3000)
```

Q/Na

1. We cannot respond to http twice
2. Express library is not promisified
3. res.send() is to send text

4. rate limiting : if we allow a person to send only certain no. of request this also comes in middleware
5. We dont need to return in middleware
6. Generally , ideally res.send() wil be last but still after this we can log something
7. **Finding no. of request from middleware**

```
const express = require('express');
const app = express();

// rate listening
let numberOfRequests = 0;

// popular example of middlepoint
function calculateRequest(req,res,next){
    numberOfRequests++;
    // counting the load in our system
    console.log("Number of requests: ", numberOfRequests);
    next();
}
app.get("/health-checkup",calculateRequest,function(req,res){

})
app.get("/kidney-check",calculateRequest,function(req,res){

})
app.listen(3000)
```

Calling any of the two routes will count no. of requests.

Terminal:

```
PS C:\Users\NTC\Desktop\Dev\Week3> node "c:\Users\N
TC\Desktop\Dev\Week3\Zod_Middleware\practice.js"
Number of requests:  1
Number of requests:  2
Number of requests:  3
Number of requests:  4
```

app.use()

Example To get the post request handler body. **app.use(express.json())**

If we use this the first thing which will be done is that request will go to wherever the this function returns (it act and get post body)

Here we are calling express.json() because it return a function.

It simply means that this middleware will be called everywhere.

Usecase:

If we know that a middleware will be used everywhere then we will use **app.use(middlewareName)**

```
const express = require('express');
const app = express();

let numberOfRequests = 0;
function calculateRequest(req,res,next){
    numberOfRequests++;
    console.log("Number of requests: ", numberOfRequests);
    next();
}
app.use(calculateRequest);
// now this middleware will be called for every request, after this line

app.post("/health-checkup",function(req,res){
    res.json({
        message:"Health checkup is done"
    })
})
app.get("/kidney-check",function(req,res){

})
app.listen(3000)
```

Even though we haven't pass the middleware or function calculateRequest it still counts the no. of request when ever we pass any of two routes (eq http://localhost:3000/health-checkup)

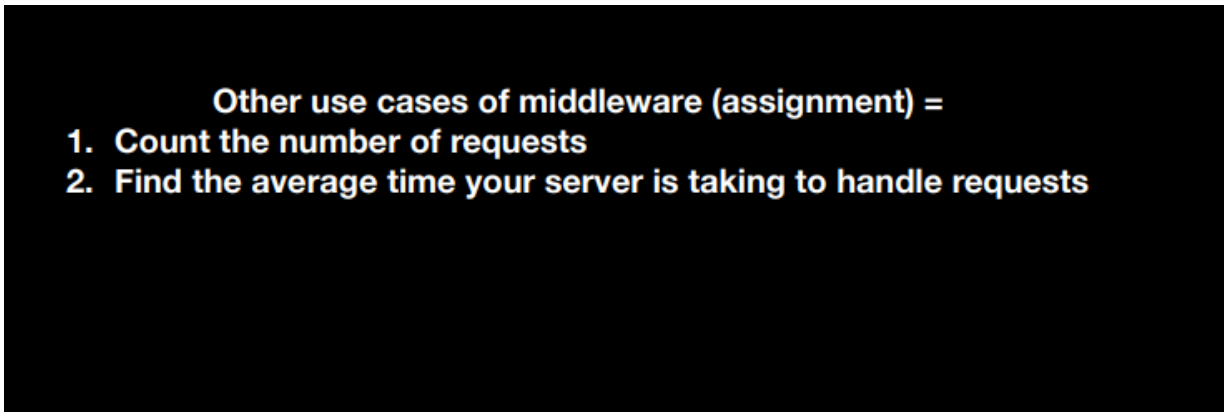
Terminal:

```
PS C:\Users\NTC\Desktop\Dev\Week3> node "c:\Users\NTC\Desktop\Dev\Week3\Zod_Middleware\practice.js"
Number of requests:  1
Number of requests:  2
Number of requests:  3
Number of requests:  4
```

If we dont use next() then response ("Health checkup is done") will not be sent.

Why we have to specify **body** only? Not req.headers or req.query?? Why!!! Simply because we dont know what will body contain it can be html, json, text. We use **app.use(express.json())** that is **express.json()** middleware because we are saying that we are expecting body as json please handle it.

Assignment

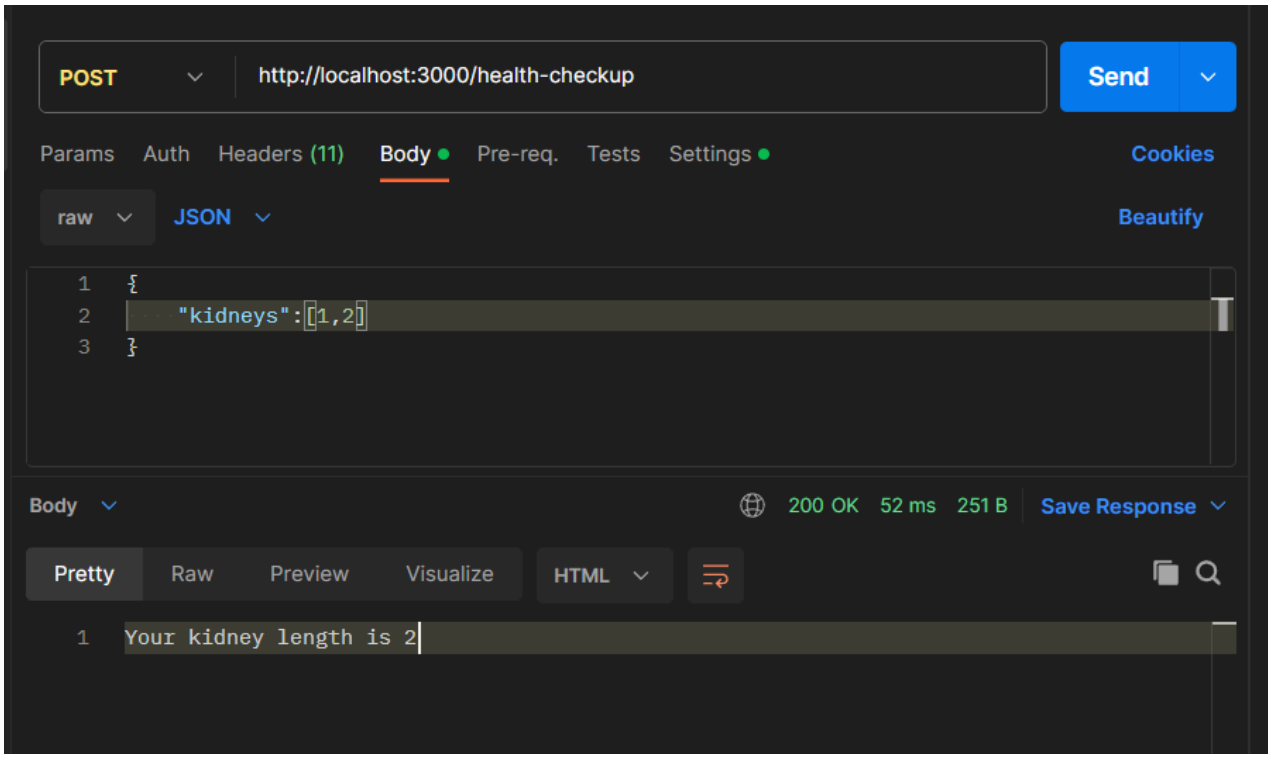


Why do we need input validation??

Let’s see an example

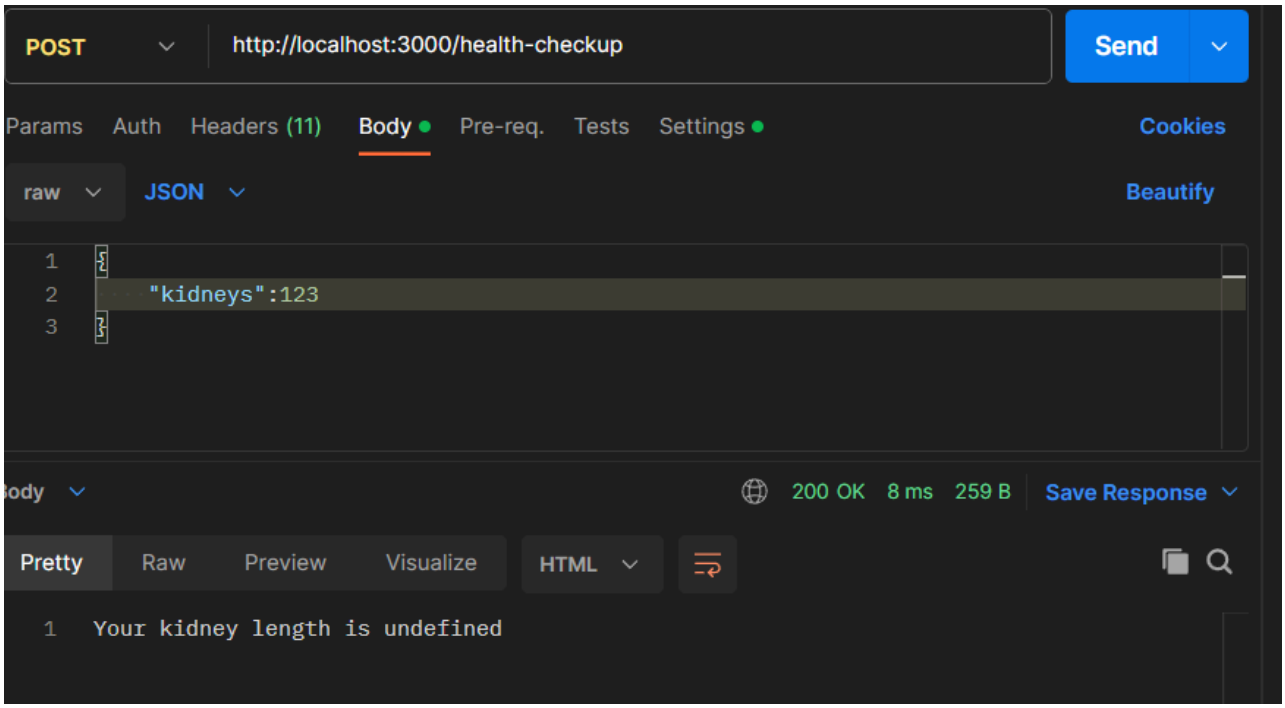
```
const express = require('express');
const app = express();
app.use(express.json());

app.post("/health-checkup",function(req,res){
    // do something with the health checkup
    const kidneys = req.body.kidneys;
    const kidneyLength = kidneys.length;

    res.send("You have kidney is " + kidneyLength)
});
app.listen(3000)
```

Let's send post request



It is our job to handle errors , since backend is in the web then user can send post request with rubbish thing in the body not according to the type mentioned and 100 different things. **We must handle it!**

There can be several different error etc.



Hence we must do input validation , **to prevent server from crashing.**

By seeing error Random error good can crash the backend server.

We have to check. Ten different check whether there is some input or not, is it array of numbers , or they send array or not .

If we simply write input validation by doing if else then it will get ugly and look unclean. We will use the **zod** library

```
if(!kidneys){
        res.status(400).send("Please provide kidneys")
    }
```

Error handling middleware

There is another type of problem is that the if we dont do anything person who send request can see the exception message send by the system. This will expose **backend logic. Express also take care of it in production one.**
Another way is .
global caches.

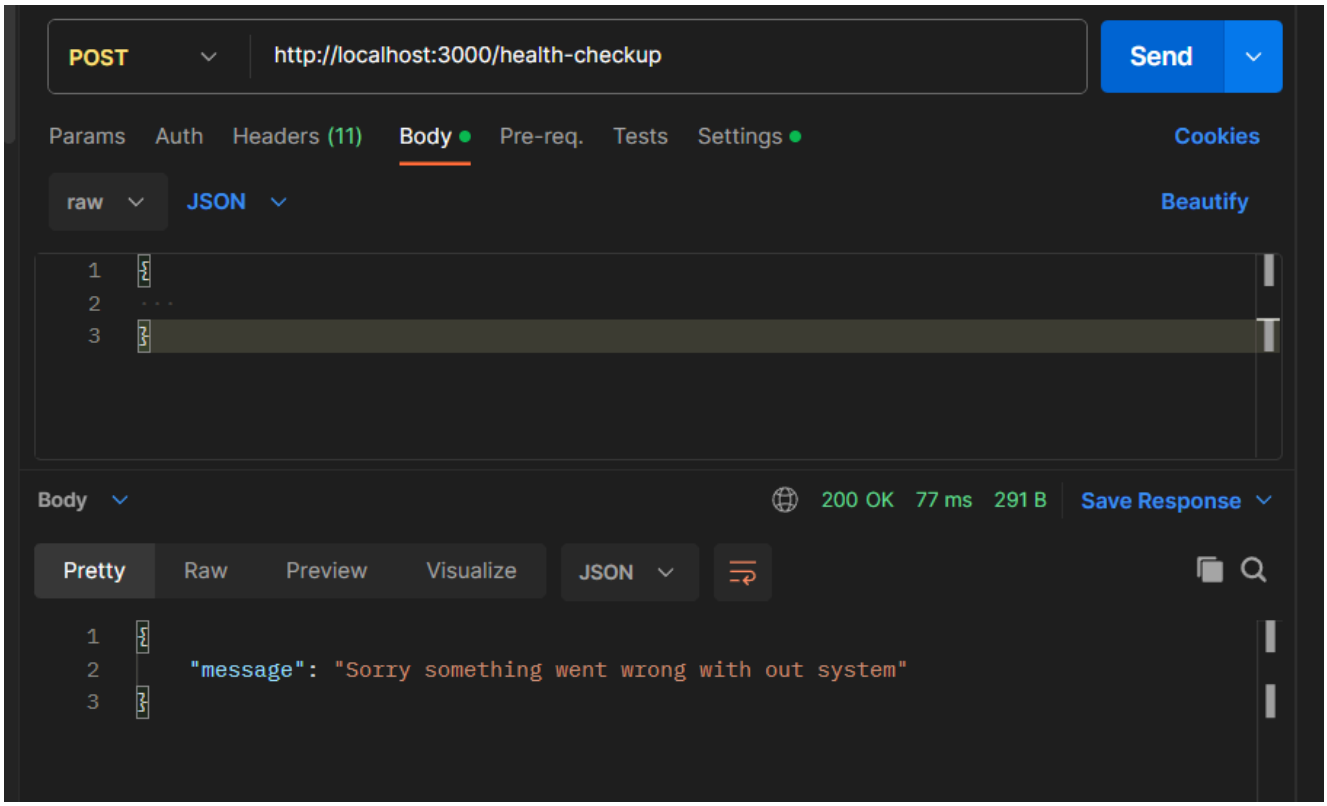
Code:

```
const express = require('express');
const app = express();

app.use(express.json());
app.post("/health-checkup",function(req,res){
    // do something with the health checkup
    const kidneys = req.body.kidneys;
    const kidneyLength = kidneys.length;

    res.send("Your kidney length is " + kidneyLength)
});

// global caches
// another middleware that take 4 input except of three
// whenever there is any exception in routes it is send here
// by this we hide the exception from the user
app.use(function(err,req,res,next){
    res.json({
        message:"Sorry something went wrong with out system"
    })
})

app.listen(3000)
```

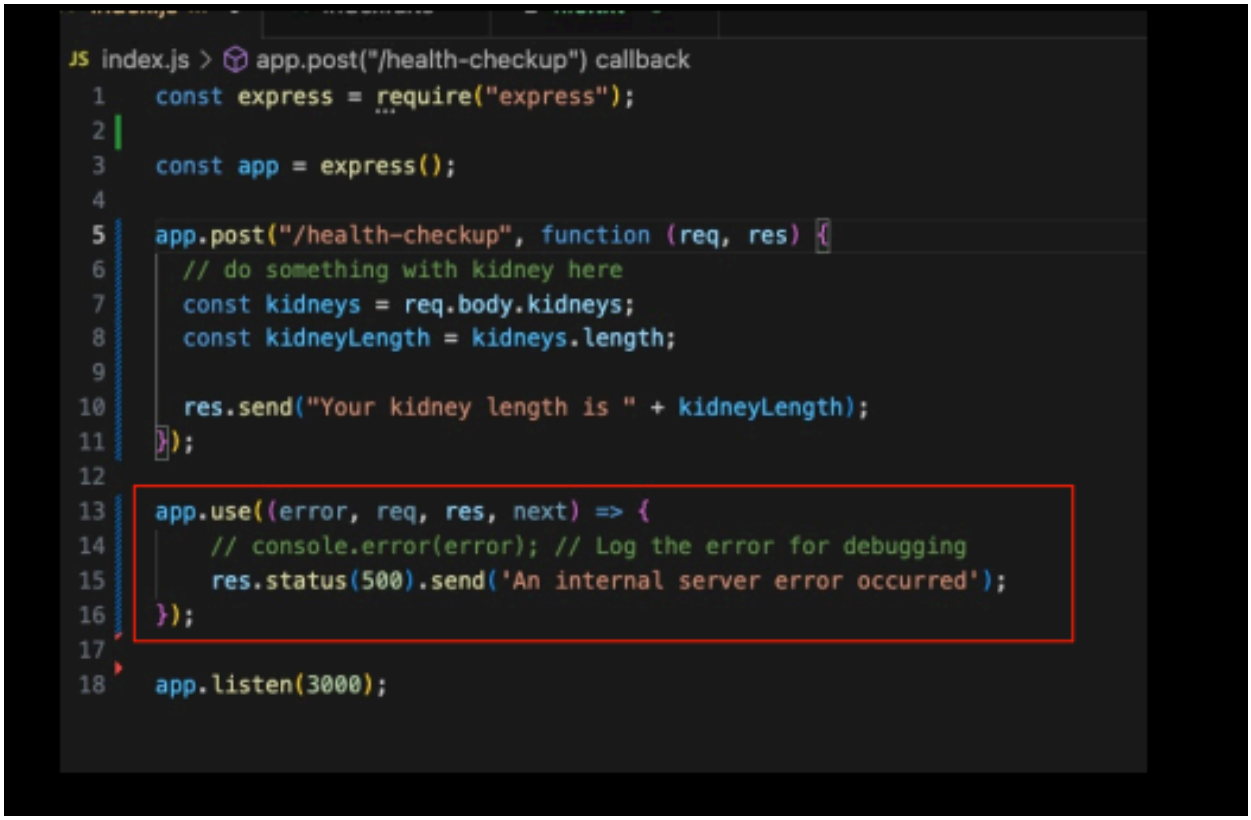
For example here in the below example we have send an empty json

```
errorCount++;
```

We keep track of how many time exception were thrown and also log the exception and once we get suppose 100+ exception then we inform developer of it . To fix the system



Error handling middleware: is a special type of middleware function in Express that has four arguments instead of three (‘(err, req, res, next)’). Express recognize it as an error-handling middleware because of these four arguments.
Global caches : help you give the user a better error message



What is the use of next

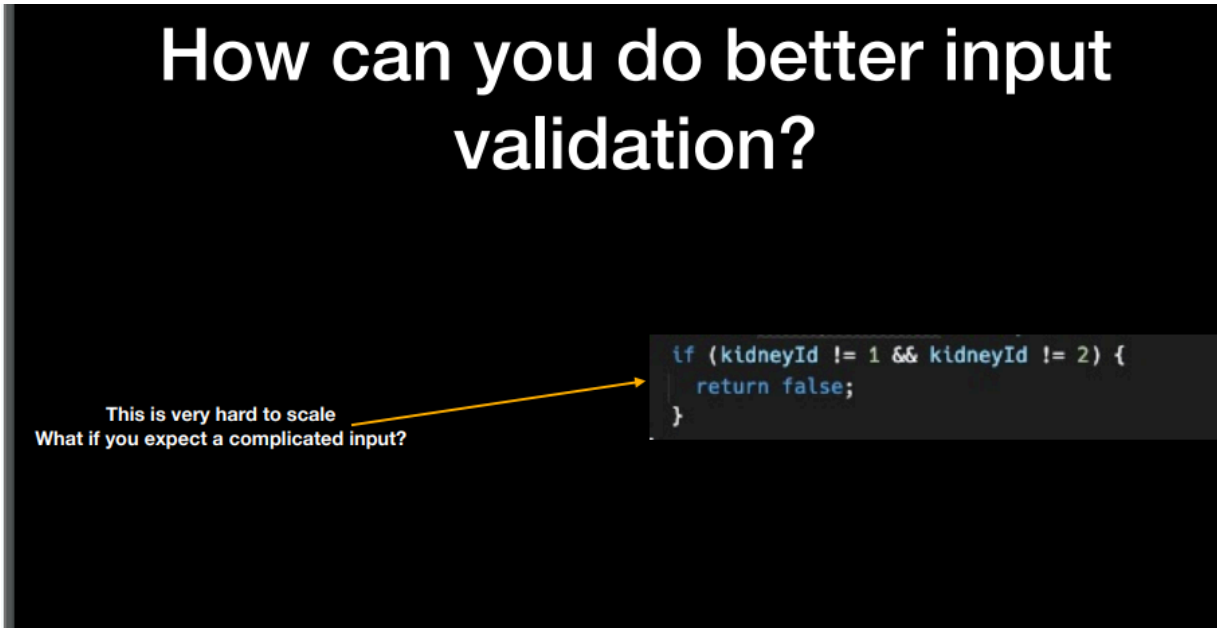
It can be that one function logs the error to the server

The second function can do is that it count no. of exception and inform the developer when exception floods to much

The third function can simply display some error message to the user

Zod

How can we do better input validation??



It is quite hard to track no. of input validation

Here comes the input validation library

Zod is one of the popular library

Zod

Schema validation

We install it by doing

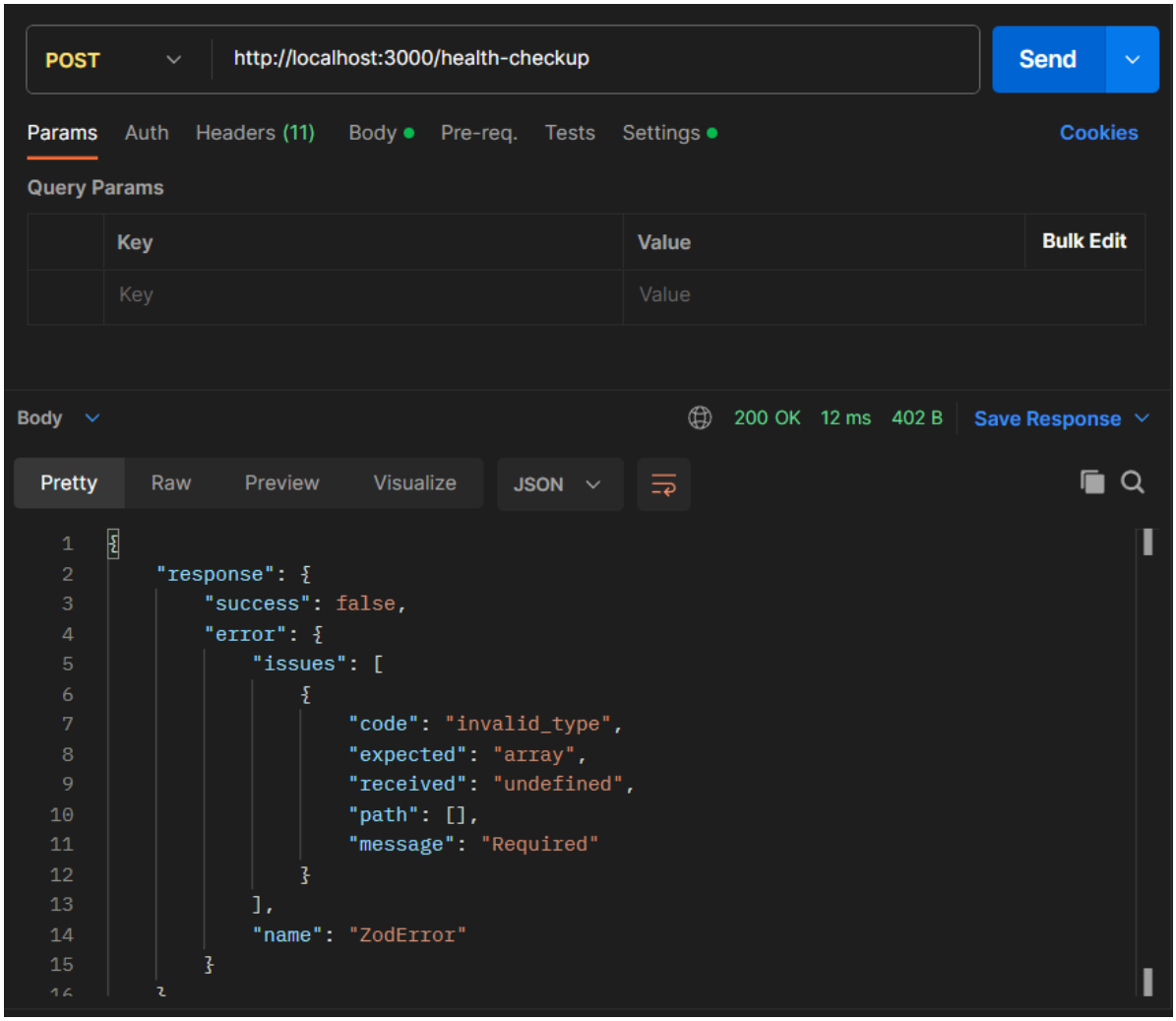
npm install zod

By using Zod we are parsing the data from the end user its like are you (the user) sending me the correct data this is what **Zod** does

Code:

```
const express = require('express');
const zod = require('zod');
const app = express();
const schema = zod.array(zod.number())
//This much is enough to make zod understand what be schema(structure or basically type of input) of our input, for example here we want input as an array of numbers
```

```
app.use(express.json());
app.post("/health-checkup",function(req,res){
    // do something with the health checkup
    const kidneys = req.body.kidneys;
    const response = schema.safeParse(kidneys);

    res.send({
        response
    })
});

app.listen(3000)
```



Zod give us everything , validation success or not and bunch of error message .

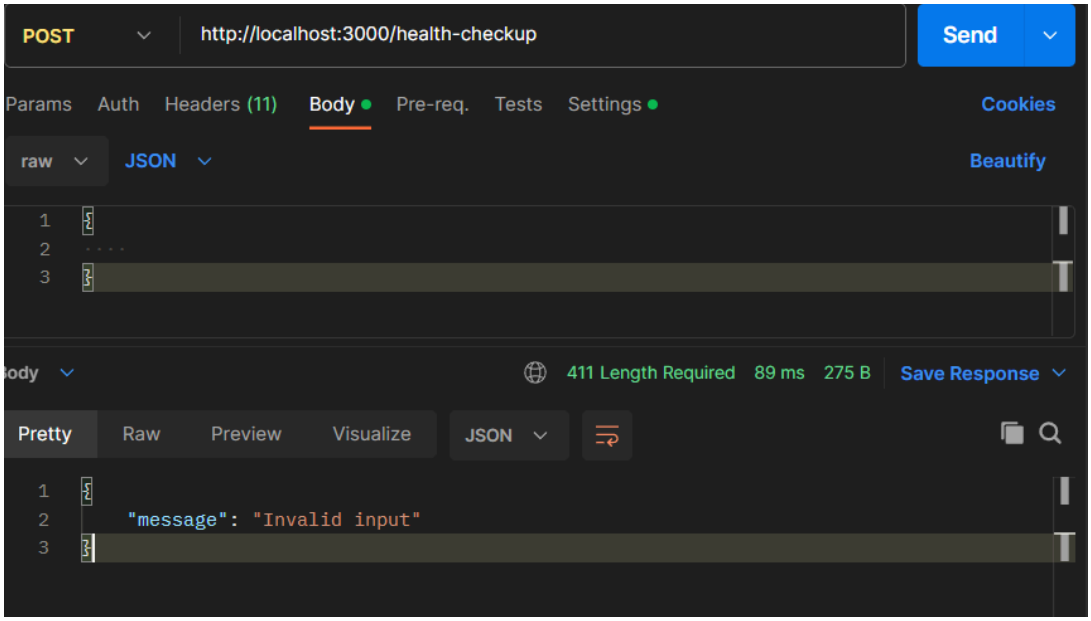
It is very useful to send error messages to the user.

Lets observe the information send by the zod and then we do some changes in code

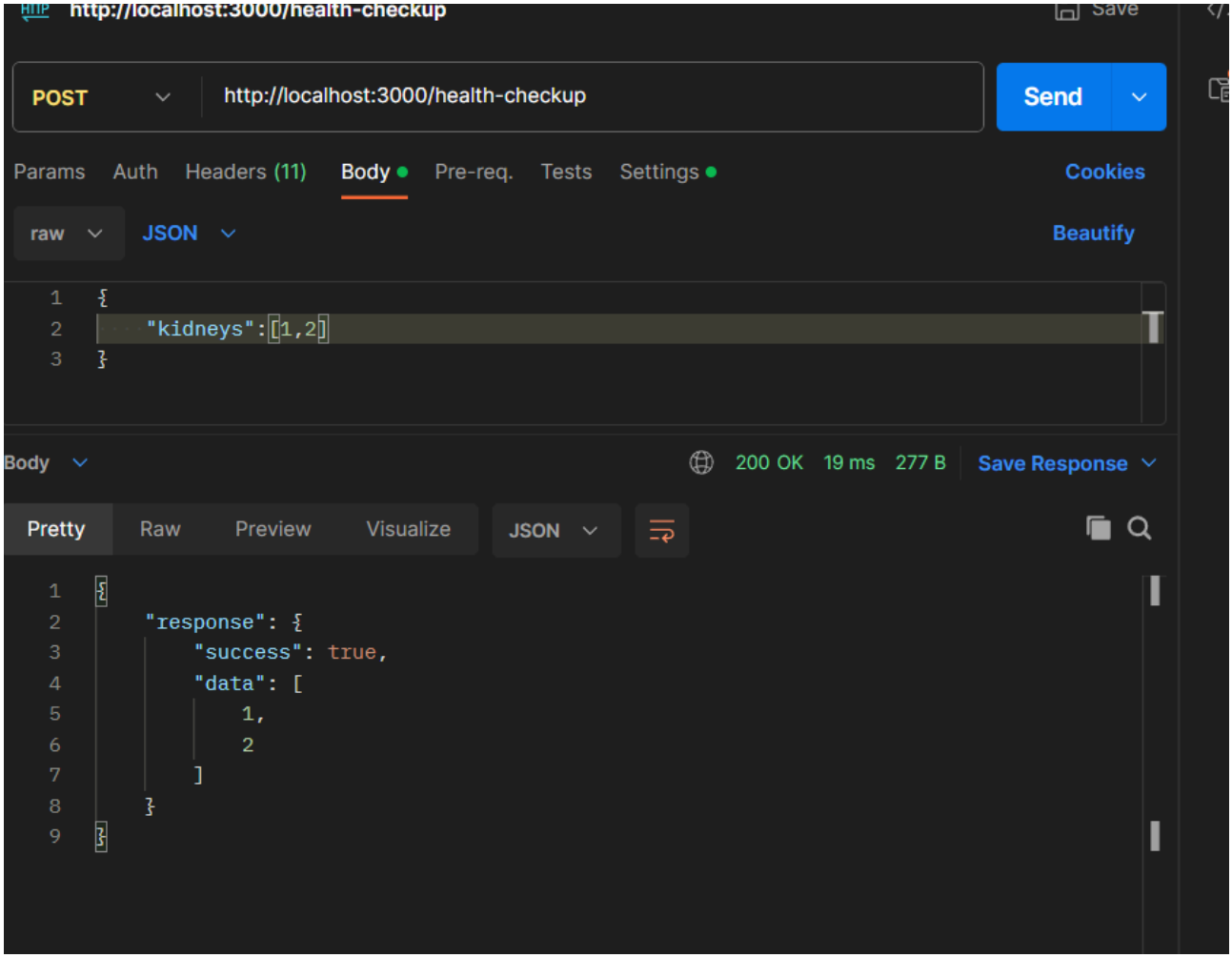
```
app.post("/health-checkup",function(req,res){
    // do something with the health checkup
    const kidneys = req.body.kidneys;
    const response = schema.safeParse(kidneys);

    if(!response.success){
        res.status(411).json({
            message:"Invalid input"
        })
    }else{
        res.send({
            response
        })
    }
});
```

And now lets call the it in postman

1. response.success is false



2. response.success is true



Describing the schema is crucial and hard part.

Eg email : this is suppose to be string with an @ symbol in between

password: atleast 8 letters

country: “IN”,”US”

Lets write zod schema for these

```
const schema =zod.object({
    email: zod.string(),
    password: zod.string(),
    country: zod.literal("IN").or(zod.literal("US")),
```

```
    // literal is used to specify that the input should be exactly the
same as the value passed in the literal
    // usage of "or" is the syntax of zod
    kidneys: zod.array(zod.number())
})
```

Simple example

```
const zod = require('zod');
//If this is an array of strings,return true, else return false
// function validateInput(arr){
// if(typeof arr != "object" && arr.length >=1 && typeof item !=
"string"){

// }
// }

// using zod
function validateInput(arr){
    const schema = zod.array(zod.number());
    const response = schema.safeParse(arr);
    return response.success;

}
console.log(validateInput([1,2,3,"sbc",5]))
```

Terminal

False

Write zod schema for the following.

email : this is supposed to be a string with an @ symbol in between

password: at least 8 letters

const z = require(“zod”)

const schema = z.object({

email: z.string().email(),

password: z.string().min(8)

})

https://zod.dev/?id=introduction To learn more about zod

Example:

```
const zod = require('zod');

function validateInput(obj){
    const schema = zod.object({
        email: zod.string().email(),
        password: zod.string().min(8).max(20),
    })
    const response = schema.safeParse(obj);
    console.log(response);
}

validateInput({
    email:"abcdefgh@gmail.com",
    password:"abcdefgh"
})
validateInput({
    email:"abcdefgh@gmailcom",
    password:"abcdefgh"
})
validateInput({
    email:"abcdefgh@gmail.com",
    password:"abcdefghabcdefghabcdefgh"
})
```

Terminal:

```
PS C:\Users\NTC\Desktop\Dev\Week3> node "c:\Users\NTC\Desktop\Dev\Wee
k3\Zod_Middleware\practice.js"
{
  success: true,
  data: { email: 'abcdefgh@gmail.com', password: 'abcdefgh' }
}
{ success: false, error: [Getter] }
{ success: false, error: [Getter] }
PS C:\Users\NTC\Desktop\Dev\Week3>
```

Understanding zod in Http server

```
const express = require('express');
const zod = require('zod');
const app = express();

function validateInput(obj){
    const schema = zod.object({
        email: zod.string().email(),
        password: zod.string().min(8)
    })
    const response = schema.safeParse(obj);
    console.log(response);
    return response;
}

app.post("/login",function(req,res){
    const response = validateInput(req.body);
    if(!response.success){
        res.json({
            msg:"Your inputs are invalid"
        })
        return;
    }
})
app.listen(3000)
```

Q/na

1. Why do we call express.json() like this inside app.use?
   app.use(express.json())

We use it because it is something like this

```
function middleware(){
    return function(req, res, next){

    }
}
```

2. app.use () put in all the routes
3.

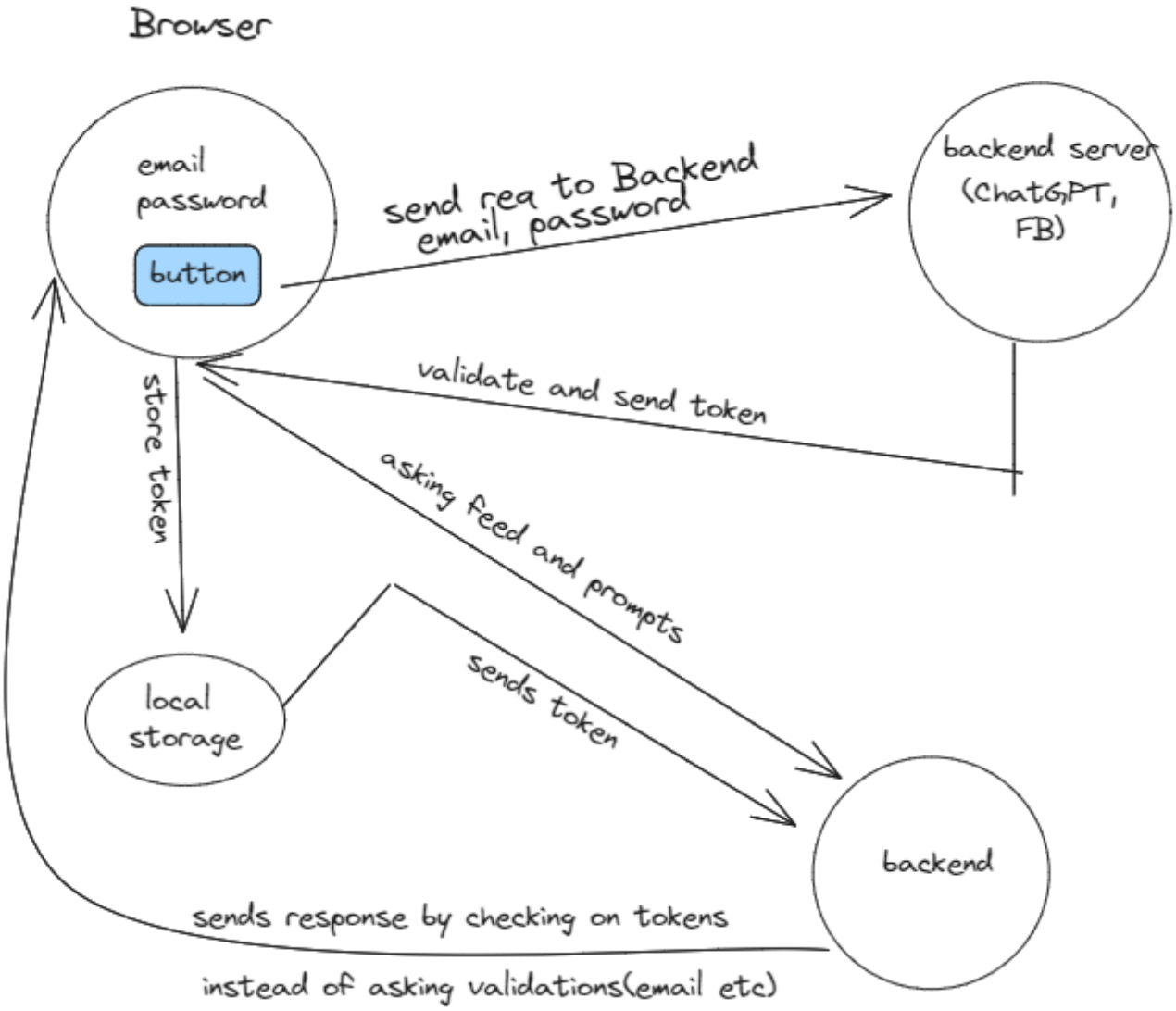
Intro to Authentication

As we can tell by now, anyone can send requests to your backend They can just go to postman and send a request. How do you ensure that this user has access to a certain resource??

Dumb way – Ask the user to send username and password in all requests as headers.

Slightly better way —

1. Give the user back a token on signup/signin
2. Ask the user to send back the token in all future requests
3. When the user logs out, ask the user to forget the token (or revoke it from the backend)



Note: Check 1:47:00 to see how you can use somebody else token and use it to send a request from POSTMAN or elsewhere

Q/Na

1. What will the zod send when we input the wrong email address?

```
const express = require('express');
const z = require('zod');
const app = express();

const schema = z.string().email();
```

```
const response = schema.parse("abccxsd")
console.log(response.errors);
```

Terminal

……

……

```
  issues: [
    {
      validation: 'email',
      code: 'invalid_string',
      message: 'Invalid email',
      path: []
    }
  ],
  addIssue: [Function (anonymous)],
  addIssues: [Function (anonymous)]
}
```

2. Understanding global caches

Let see an example

Code:

```
const express = require('express');
const app = express();

app.get('/',function(req,res){
    console.log(req.body.kidneys.length);
    res.json({
        msg:"done"
    })
```

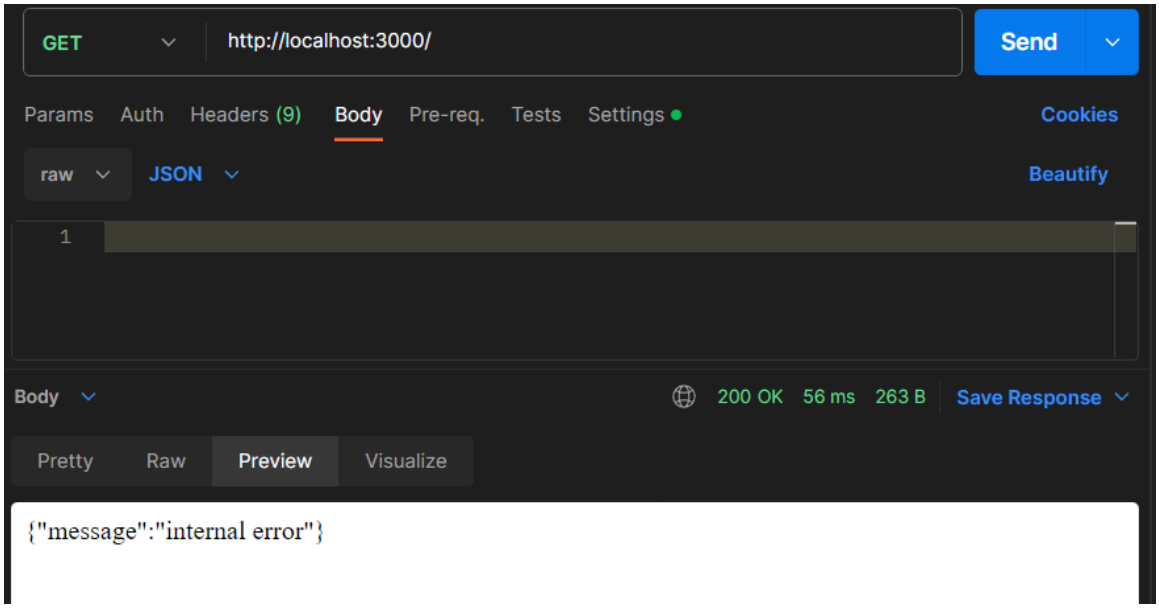
```
})

app.listen(3000)
```

Now if we send a get request, since get request is trying to access something undefined it will throw an error

This is a bad error to send to user. We keep the code as it is but at the end add app.use(function(err, req, res, next))

```
app.use(function(err,req,res,next){
    res.send({
        message:"internal error"
    })
})
```

Terminal:



3. How can we make sure that email end with google.com

z.string().email().endsWith('@google.com')

4. How can we use bunch of middleware together

```
const middleware = [express.json(),userValidator, kidneyValidator];

app.get('/',...middleware,function(req,res){})
```

5. req in global can be use many usecase eg Which user is facing problem , or which ip
6. Whenever we are sending sensitive data we send via headers

   For get request we use query

   For post request we use body
7. We can use same backend for app and web
8. Sending data from middleware

function middleware(req, res, next){

    req.user=1

```
}
app2.get("/",middleware,funciton(req,res){
        console.log(req.user);
})
```

9. Middleware are synchronous they are asynchronous only if there is a asynchronous function like setTimeout inside it.

Eg

```
function middleware(req,res,next){
        req.user = 1;
        setTimeout(function(){
                next()
        },1000)
}
```

10. Where we write middleware is important , generally the thing is that first we have the initial middleware and then route and then global cache.
    A exception in any route can only reach middleware below (app.use()) not above hence the position of global catch is important

11. What is the use of next() in route handler?

12.
```
app.get("/",...middleware, function(req, res){
    res.json({
        msg:"Done"
})
})
```

    Although we may think that res.json() will do early return but it doesn't it is just a function. We as developers should not write anything generally after res.json() but this function doesn't early return

13. function middleware(req,res,next){

```
    if(abc){
        res.send()
        next()
        // this will result in error, because we send and call the function
also
    } else{
    }
}
```

Another example (correct usage)

```
    if(abc){
        res.send()
    } else{
        next()
    }
}
```

14. We can also use try catch in route