Web Application Development for Industrial Engineers

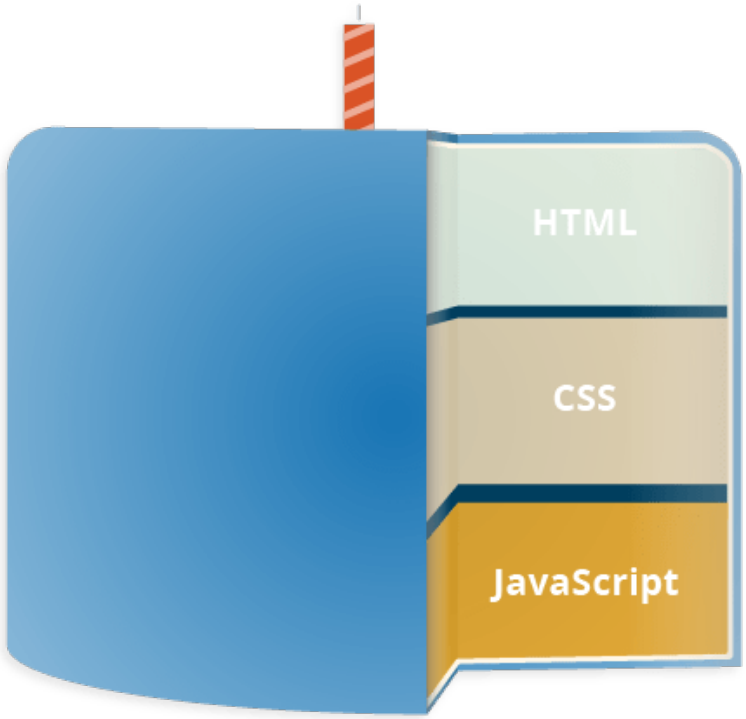
การพัฒนาเวปแอปพลิเคชันสำหรับวิศวกรอุตสาหการ

JavaScript

- JavaScript is a scripting or programming language
- Allows implementation of complex features on web pages.
  - Content updates
  - Animation
  - Interactive maps
  - Audio/video contents

3 Layers in Web Technology

- `HTML` : markup language
  - Defining structure
- `CSS` : stylesheet language
  - Apply styling to HTML content
- `JavaScript` : scripting language
  - Add dynamics to content



HTML

```
<p>Player 1: Chris</p>
```

CSS

```css
p {
  font-family: 'helvetica neue', helvetica, sans-serif;
  letter-spacing: 1px;
  text-transform: uppercase;
  text-align: center;
  border: 2px solid rgba(0, 0, 200, 0.6);
  background: rgba(0, 0, 200, 0.3);
  color: rgba(0, 0, 200, 0.6);
  box-shadow: 1px 1px 2px rgba(0, 0, 200, 0.4);
  border-radius: 10px;
  padding: 3px 10px;
  display: inline-block;
  cursor: pointer;
}
```

JavaScript

```
const para = document.querySelector('p');

para.addEventListener('click', updateName);

function updateName() {
  let name = prompt('Enter a new name');
  para.textContent = 'Player 1: ' + name;
}
```

- https://codepen.io/nnnpooh/pen/poWopXd

What just happened?

JavaScript allows

- Storing value inside a variable (user input).
- Performing operations on variables (joining text).
- Running code in response to certain `events` occurring on a web page (click event).
- Updating content shown in the page.

Application Programming Interfaces (APIs)

- Extra functionality on top of client-side JavaScript language.
- APIs are ready-made sets of code building blocks for developers.

Types of APIs

- Browser APIs
  - Functionalities built into web browsers
- Third Parties APIs
  - Functionalities built by vendors

Browser APIs

- `DOM` (Document Object Model) API
  - Allows manipulation of HTML and CSS.
- `Geolocation` API
  - Retrieves geographical information.
- `Canvas` and `WebGL`
  - Allows creation of animated 2D and 3D graphics.
- `Audio` and `Video` APIs
  - Enables multimedia.

Third Parties APIs

- Line APIs
- Facebook APIs

Add JavaScript to the page

- Inline
- External file

Inline

HTML

```
<head>
  <script>
    //   JavaScript goes here
  </script>
</head>
<body>
  <button>Click me</button>
</body>
```

Inline

JavaScript

```
document.addEventListener('DOMContentLoaded', function () {
  function createParagraph() {
    let para = document.createElement('p');
    para.textContent = 'You clicked the button!';
    document.body.appendChild(para);
  }

  const buttons = document.querySelectorAll('button');

  for (let i = 0; i < buttons.length; i++) {
    buttons[i].addEventListener('click', createParagraph);
  }
});
```

External file

- Create an `index.html` file with `<button>Click me</button>`
- Add `<script src="script.js" defer></script>` in `header` tag.
- Create `script.js`

External file (cont.)

- Add

```
function createParagraph() {
  let para = document.createElement('p');
  para.textContent = 'You clicked the button!';
  document.body.appendChild(para);
}

const buttons = document.querySelectorAll('button');

for (let i = 0; i < buttons.length; i++) {
  buttons[i].addEventListener('click', createParagraph);
}
```

Script loading strategies

- All the HTML on a page is loaded in the order in which it appears.
- Sometimes, your code won't work if the JavaScript is loaded and parsed *before* the HTML you are trying to do something to.

Inline Script

- For the inline example, the loading is done through

```
document.addEventListener("DOMContentLoaded", function() {
  ...
});
```

- This is an `event listener`, which listens for the browser's `DOMContentLoaded` event.
- The JavaScript inside this block will not run until all html content is loaded.

External file

- In the external example, the `defer` attribute tells the browser to continue downloading the HTML content once the `<script>` tag element has been reached.

```
<script src='script.js' defer></script>
```

- The code in `script.js` will not run until all html content is loaded.

Comment

- Single line

```
// I am a comment
```

- Multi-line

```
/*
  I am also
  a comment
*/
```

Prototyping (ลองอะไรง่ายๆ)

- Developer tools console
- Quokka (no browser API)

Guess Game

https://ie-software-dev.netlify.app/codes/t06_js/t03_guess_game/

Functionality

- Let player enter a number.
- Check whether the number is correct.
- Inform the play if the guess is too high or too low.
- Stop the game after 10 trials.
- Player can reset the game after winning or gameover.

HTML

```
<h1>Number guessing game</h1>

<p>Guess the number between 1 and 100.</p>

<div class="form">
  <label for="guessField">Enter a guess:</label>
  <input type="number" id="guessField" class="guessField" />
  <input type="submit" value="Submit guess" class="guessSubmit" />
</div>

<div class="resultParas">
  <p class="guesses"></p>
  <p class="lastResult"></p>
  <p class="lowOrHi"></p>
</div>
```

Link with JavaScript

- Create `script.js`
- In HTML `<header>` add

```
<script src='script.js' defer></script>
```

Add varibles

```
let randomNumber = Math.floor(Math.random() * 100) + 1;
const guesses = document.querySelector('.guesses');
const lastResult = document.querySelector('.lastResult');
const lowOrHi = document.querySelector('.lowOrHi');
const guessSubmit = document.querySelector('.guessSubmit');
const guessField = document.querySelector('.guessField');
let guessCount = 1;
let resetButton;
```

Variable

- Store data and reference
- Declare variable with `let`

Variable (cont)

- From the script

```
let randomNumber = Math.floor(Math.random() * 100) + 1;
```

- The variable `randomNumber` is assigned a random number between 1 and 100, calculated using a mathematical algorithm.

Constant

- Constants are also used to name values.
- Unlike variables, you can't change the value once set.
- Declare constant with `const`

Constant (cont)

```
const guesses = document.querySelector('.guesses');
const lastResult = document.querySelector('.lastResult');
const lowOrHi = document.querySelector('.lowOrHi');
```

- These constants are each made to store a reference to the results paragraphs in our HTML.
- Constants store `references` to parts of our user interface.
    - The text inside some of these elements might change, but the reference does not change.

Constant (cont)

```
const guessSubmit = document.querySelector('.guessSubmit');
const guessField = document.querySelector('.guessField');
```

- The two constants store references to the form text input and submit button.
- They are used to control submitting the guess later on.

Variable (cont)

```
let guessCount = 1;
let resetButton;
```

- `guessCount` stores a guess count of `1`
  - Used to keep track of how many guesses the player has had
- `resetButton` stores a reference to a reset button
  - doesn't exist yet (but will later).

Browser objects

- In JavaScript, most of the items you will manipulate in your code are `objects`.
- An `object` is a collection of related functionality stored in a single grouping.
- Let's focus on the built-in `objects` that your browser contains.
    - They allows you to do lots of *cool* things.

Browser objects (cont)

- Get a reference to a browser object

```
const guessField = document.querySelector('.guessField');
```

- Do something with it (run in `script.js`, not console.)

```
guessField.focus();
```

- Insert value (has to be number due to `<input type="number" .../>`)

```
guessField.value = 1;
```

Add content to a field

- Get a reference to `<p>` object

```
const guesses = document.querySelector('.guesses');
```

- Add content

```
guesses.textContent = 'Where is my paragraph?';
```

- Styling

```
guesses.style.backgroundColor = 'yellow';
guesses.style.fontSize = '200%';
guesses.style.padding = '10px';
guesses.style.boxShadow = '3px 3px 6px black';
```

Function

- Functions are reusable blocks of code that you can write once and run again and again
  - saving the need to keep repeating code all the time.
- For example, let put this code into `script.js`

```
function checkGuess() {
  alert('I am a placeholder');
}
```

- You can run `checkGuess()` from the console.

Operators

- Try from the console.

Operator	Name	Example
`+`	Addition	`6 + 9`
`-`	Subtraction	`20 - 15`
`*`	Multiplication	`3 \* 7`
`/`	Division	`10 / 5`

Text Operation

```
let name = 'Bingo';
name;
let hello = ' says hello!';
hello;
let greeting = name + hello;
greeting;
```

Shortcut

```
name += ' says hello!';
```

is the same as

```
name = name + ' says hello!';
```

Comparison operator

Operator	Name	Example
`===`	(Strict) equality	`2 === 2`
`!==`	Non-equality	`2 !== 3`
`<`	Less than	`2 < 3`
`>`	Greater than	`3 > 2`

```
function checkGuess() {
  let userGuess = Number(guessField.value);
  if (guessCount === 1) {
    guesses.textContent = 'Previous guesses: ';
  }
  guesses.textContent += userGuess + ' ';

  if (userGuess === randomNumber) {
    lastResult.textContent = 'Congratulations! You got it right!';
    lastResult.style.backgroundColor = 'green';
    lowOrHi.textContent = '';
    setGameOver();
  } else if (guessCount === 10) {
    lastResult.textContent = '!!!GAME OVER!!!';
    lowOrHi.textContent = '';
    setGameOver();
  } else {
    lastResult.textContent = 'Wrong!';
    lastResult.style.backgroundColor = 'red';
    if (userGuess < randomNumber) {
      lowOrHi.textContent = 'Last guess was too low!';
    } else if (userGuess > randomNumber) {
      lowOrHi.textContent = 'Last guess was too high!';
    }
  }

  guessCount++;
  guessField.value = '';
  guessField.focus();
}
```

Conditionals

```
if (guessCount === 1) {
  guesses.textContent = 'Previous guesses: ';
}
```

- The simplest form of conditional block starts with the keyword `if`
  - then some parentheses,
  - then some curly braces.
- Inside the parentheses we include a test.
  - If the test returns `true`, we run the code inside the curly braces.
  - If not, we don't

```
if (userGuess === randomNumber) {
  // ...
} else if (guessCount === 10) {
  // ...
} else {
  // ...
}
```

- The first `if(){ }` structure checks whether the user's guess is equal to the `randomNumber`.
- Then `else if(){ }` structure checks whether this turn is the user's last turn.
- Then `else { }` structure only run if neither of the other two tests returns `true`.
    - The player didn't guess right, but they have more guesses left.

```
if (userGuess === randomNumber) {
  lastResult.textContent = 'Congratulations! You got it right!';
  lastResult.style.backgroundColor = 'green';
  lowOrHi.textContent = '';
  setGameOver();
}
```

- If the conditional test is `true` (player has won).
- Show the player a congratulations message with a green color
- Clear the contents of the Low/High guess information box
- Run a function called `setGameOver()` *(not yet defined)*.

```
else if (guessCount === 10) {
    lastResult.textContent = '!!!GAME OVER!!!';
    lowOrHi.textContent = '';
    setGameOver();
```

- If the conditional test is `true` (user's last turn.)
- Show a game over message.
- Clear the contents of the Low/High guess information box.
- Run a function called `setGameOver()` *(not yet defined)*.

```
else {
    lastResult.textContent = 'Wrong!';
    lastResult.style.backgroundColor = 'red';
    if (userGuess < randomNumber) {
      lowOrHi.textContent = 'Last guess was too low!';
    } else if (userGuess > randomNumber) {
      lowOrHi.textContent = 'Last guess was too high!';
    }
  }
```

- The code will run when the player didn't guess right, but they have more guesses left.
- Perform another conditional test to check whether the guess was higher or lower than the answer
- Display a further message as appropriate to tell them higher or lower.

Events

- We have a nicely implemented `checkGuess()` function
  - but it won't do anything.
- We want to call it when the `Submit guess`.
- We need an `event`.

Events (cont)

- Events are things that happen in the browser
  - a button being clicked
  - a page loading
  - a video playing, etc.
- We can then response to an event by which the blocks of code (`function`) are run.
- The constructs that listen out for the event happening are called `event listeners`.
- The blocks of code (`function`) that run in response to the event firing are called `event handlers`.

Add event listener

```
guessSubmit.addEventListener('click', checkGuess);
```

- We are adding an `event listener` to the guessSubmit button.
- This is a method that takes two input values (called `arguments`)
  - the type of event we are listening out for (in this case click) as a string
  - the code we want to run when the event occurs.
- Note that we don't need to specify the parentheses when writing it inside `addEventListener()`.

Current bug

- If you guess the correct answer or run out of guesses, the game will break.
- This is because we've not yet defined the `setGameOver()` function that is supposed to be run once the game is over.

setGameOver

```
function setGameOver() {
  guessField.disabled = true;
  guessSubmit.disabled = true;
  resetButton = document.createElement('button');
  resetButton.textContent = 'Start new game';
  document.body.append(resetButton);
  resetButton.addEventListener('click', resetGame);
}
```

```
guessField.disabled = true;
guessSubmit.disabled = true;
```

- Disable the form text input and button by setting their `disabled` properties to `true`.
- This is necessary, because if we didn't, the user could submit more guesses after the game is over, which would mess things up.

```
resetButton = document.createElement('button');
resetButton.textContent = 'Start new game';
document.body.append(resetButton);
```

- Generate a new <button> element.
- Set its text label to "Start new game".
- Add it to the bottom of our existing HTML.

```
resetButton.addEventListener('click', resetGame);
```

- Sets an `event listener` on our new button.
- When the button is clicked, a function called `resetGame()` is run.

`resetGame`

```
function resetGame() {
  guessCount = 1;

  const resetParas = document.querySelectorAll('.resultParas p');
  for (let i = 0; i < resetParas.length; i++) {
    resetParas[i].textContent = '';
  }

  resetButton.parentNode.removeChild(resetButton);

  guessField.disabled = false;
  guessSubmit.disabled = false;
  guessField.value = '';
  guessField.focus();

  lastResult.style.backgroundColor = 'white';

  randomNumber = Math.floor(Math.random() * 100) + 1;
}
```

```
guessCount = 1;
```

- Puts the `guessCount` back down to 1.

```
const resetParas = document.querySelectorAll('.resultParas p');
for (let i = 0; i < resetParas.length; i++) {
  resetParas[i].textContent = '';
}
```

- Empties all the text out of the information paragraphs.
- We select all paragraphs inside `<div class="resultParas"></div>`.
- We loop through each one, setting their `textContent` to `''` (an empty string).

`for` Loops

- Allow you to keep running a piece of code over and over again
- Until a certain condition is met.

`for` Loops (cont)

```
for (let i = 1; i < 21; i++) {
  console.log(i);
}
```

A `for` loop takes three input values (arguments):

- A starting value `i = 1`
  - You could replace the letter i with any name you like.
- A condition `i < 21`
  - The loop will keep going until `i` is no longer less than `21`.
  - When `i` reaches `21`, the loop will no longer run.
- An incrementor `i++`
  - Add `1` to `i` after every iteration.

Back to the code

```
const resetParas = document.querySelectorAll('.resultParas p');
for (let i = 0; i < resetParas.length; i++) {
  resetParas[i].textContent = '';
}
```

- This code creates a variable containing a list of all the paragraphs inside `<div class="resultParas">` using the `querySelectorAll()` method
- Then it loops through each one, removing the text content of each.

```
resetButton.parentNode.removeChild(resetButton);
```

- Removes the reset button from our code.

```
guessField.disabled = false;
guessSubmit.disabled = false;
guessField.value = '';
guessField.focus();
```

- Enables the form elements.
- Empties and focuses the text field.

```
lastResult.style.backgroundColor = 'white';
```

Removes the background color from the lastResult paragraph.

```
randomNumber = Math.floor(Math.random() * 100) + 1;
```

Generates a new random number so that you are not just guessing the same number again!