Software Quality Engineering – SE3002 : Q#02

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Augmented Reality

Testing techniques for Augmented Reality Applications

Augmented Reality:

The word augment means to make something greater by adding into it. Augmenting Reality means to add something into reality / real world. "When we add digital objects into real world, it is called as augmented reality".

Examples:

Pokémon go, Snapchat filters, angry birds AR, etc.

Tools:

Mostly tools used to experience AR are AR cameras, AR glasses, smartphones etc.

Applications and Testing Techniques Of AR:

1. **AR Smart Glasses**:

AR smart glasses are wearable digital glasses that add digital objects into the reality when we look through it. These digital Objects can be 3d images, text, animations or videos. A few examples are:

- Google glass
- Microsoft HoloLens
- Oculus Quest
- Raptor AR Headset

Applications:

AR smart glasses are used in medical field, entertainment Industry, path tracking, banking Applications, smart shopping etc.

Testing for AR smart Glasses:

1. **Beta testing:**

Companies use beta testing by distributing prototypes into specific audience. Then they collect the reviews and refine and reshape the product.

2. **Lab testing:**

Before the product is launched, it is tested and verified in the companies' laboratories where the lens, Operating system, eye-tracking, voice control and all the related features are tested separately. Read more at link.

2. Heads Up Displays: HUDs

It is a on screen display that enhance the user's experience by displaying the stats of the device that is being used. HUD has many applications.

Applications:

HUDs are mainly used in the field of path tracking, route displaying, location displaying. They are mainly used in vehicles.

Testing Techniques for HUD:

1. Lab testing:

Companies who manufacture HUDs keep in view all the visual elements that can affect the device e.g., Luminescence, contrast, brightness, ambient conditions, image positions, distance detection, focal lens working etc.

This is a generic testing technique used by companies which requires both photometric and dimensional data to enhance and ensure the correctness and preciseness of information displayed to the user.

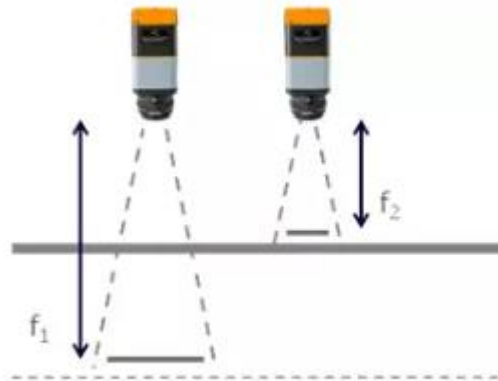**Tool:** The tool used to test this is "Pro Metric imaging system".

2. Fully Automated Testing:
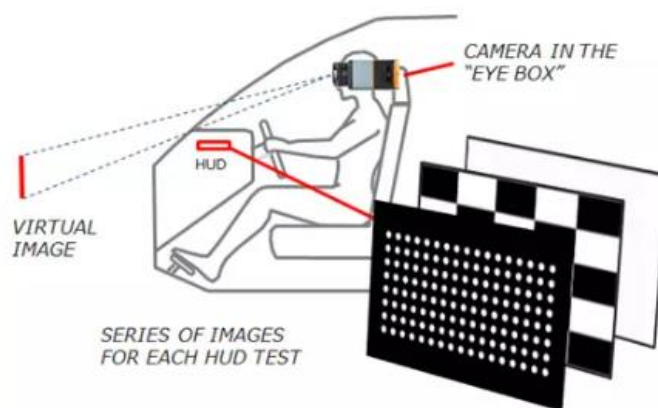
Illustration of a HUD measurement system, where software API is used to control and test multiple test patterns in sequence.

3. Image Distance and Location analysis:

This technique uses distance of the ahead object to project image at a focal distance of the user.

Tool:
The tool used for this purpose is Radiant ProMetric imaging system.

Other Testing methods:
There are also metrics defined against which HUDs can be tested.
- SAE JI 757-1
- SAE JI 757-2
- ISO
- TC 22
- SC 35
- WG3

3. Handheld Applications:

Devices on which AR applications are installed are known as handheld Applications. E.g., Smartphone apps.

4. Other Applications:

AR is used in Medical, science, classroom education, public safety, tourism, path tracking, route tracking and mobiles. All these applications have their own separate way of testing AR. Some companies follow international standards and opt for direct testing, whereas other companies opt for indirect and subjective testing approach.

The subjective measurements include cognitive walkthrough, beta testing, Observation, heuristic evaluation, lab observation. Direct testing include testing against international standards.
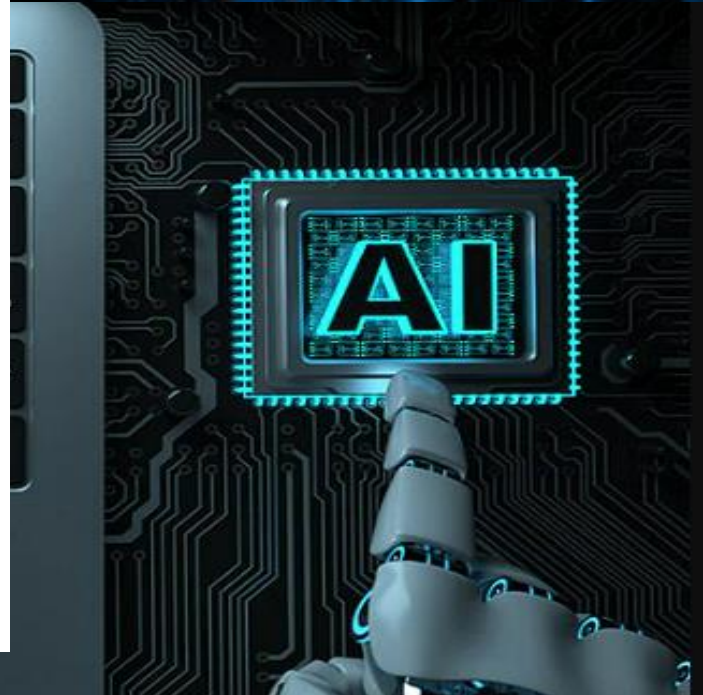
Artificial Intelligence

Testing techniques for AI based Applications

Artificial Intelligence

Artificial Intelligence or AI is intelligence generated by machines. When a human like feature is integrated in a machine, it is known as AI integration. These machines perform human like tasks and display intelligence which is a trait of living organisms.

Examples and applications:
- Expert systems
- Voice recognition
- Machine vision
- Natural language processing
- Route tracking
- Face detection
- Text editors and auto-correct
- Chatbots
- Search and recommendation algos
- Digital assistance
- Healthcare
- Gaming
- Banking systems
- Smart home devices
- E-commerce
- Space exploration
- Smart typing etc.
- Autonomous vehicles
- Data security
- Social Media
- Automotive Industry
- Robotics
- Entertainment Industry
- Education
- Software Testing

Applications which use AI
- Google Maps

- Snapchat, Facebook, YouTube recommendation engine
- Google, Bing and other search engine
- Twitter
- Google keyboard typing suggestions
- Tesla Self driving cars
- Siri
- Cortana
- Google Assistant
- Alexa
- Elsa Speak
- Socratic
- Fyle
- DataBot
- Hound
- Youper

Testing techniques and tools:

1. **Voice recognition:**

Companies test voice recognition method by the following ways:

- Validating response time (Tool used: Appium).
- Injecting an audio file and measuring the response time.

Another tool is also used for voice testing i.e., Perfecto Lab. The following script is used to test google voice assistant.

```
driver.context("NATIVE_APP");

                        WebDriverWait wait = new WebDriverWait(driver, 30);
                        AndroidElement voiceIcon = (AndroidElement) wait.until(
                        voiceIcon.click();
                        AndroidElement searchSong = (AndroidElement) wait.unti]

                        injectAudio(driver, "PRIVATE:example_text_1_plus_1.mp3'
Here's the function responsible for the audio injection
        private static void injectAudio(AndroidDriver<AndroidElement> driver, {
                Map<String, Object> params = new HashMap<>();
                params.put("key", path);
                driver.executeScript("mobile:audio:inject", params);
            }
```

2. **Route tracking:**
   Google maps uses route tracking. It is tested through Dijkstra algorithm and
   prims algorithm.

3. **NLP Testing**
   Syntactic analysis is used to test Natural Language. There are many tools
   available to test this.

4. **Face detection:**
   The method used for this type of testing is called as testing recognition.
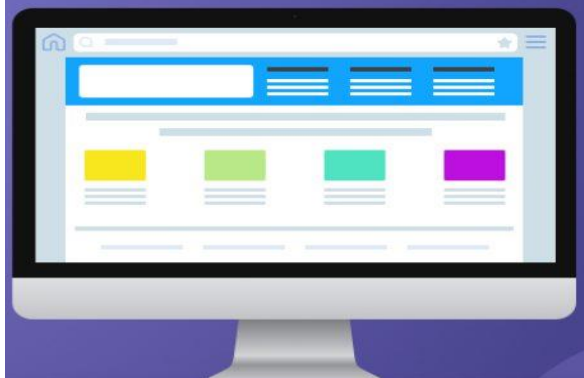
Web Applications

Testing techniques for Web Applications

WEBSITE

Web Applications:

A web application is an interaction between a user and a browser connected to the internet to perform a task or a function.

Testing Techniques:

Web Applications Testing are divided into 2 types:

1) Automated Web Testing
2) Manual Web Testing

Manual Web Testing includes assessing or testing Web Applications without utilizing the assistance of computerized testing instruments. The fundamental reason for manual testing is to guarantee that the application has no mistake and the analyzer finds out about how the application would look like according to the client's viewpoint. It includes

1. Functional testing checks whether the application is performing according to the customer's desires.
2. Regression testing is used to ensure that new functionality does not affect performance or results measured, before adding new functionality and to determine whether or not the system still works the same.
3. UI testing involves checking whether the given application is similar to the expected design
4. Compatibility testing includes testing the application's compatibility in different environments like Mac, Windows etc.
5. API testing involves using API to test different areas of security, reliability
6. Usability testing checks the "look and feel" of the application.

Automated web testing involves using tools to describe the structure of an application. The tools include:

1) Selenium
2) Ranorex
3) Watir
4) Sahi

Reasoning:

Web applications are used by different users, they are made to serve a purpose and maybe used again and again. People who are not well versed on how to use a computer may also use these applications, the use of simple UI has to be ensured also.

API is almost included in every app and that needs to be coherent with the application they are being paired up with. All the above testing satisfy the parameters that are being used in Web Applications
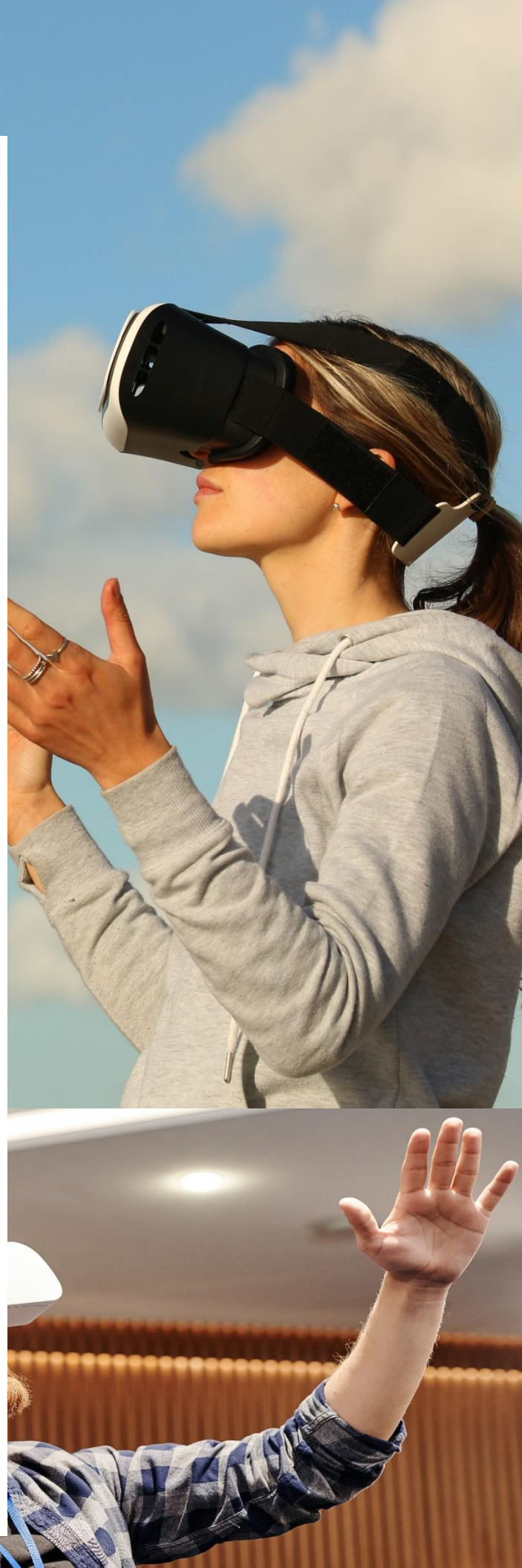
Virtual Reality

Testing techniques for VR based Applications

Testing techniques for virtual reality applications:

1) Trial and Error approach as the name states involves testing different scenarios and accepting those which are feasible and can be implemented. As VR applications are developed based on the perception of the people testing it, it can vary from person to person.

2) Recording sessions can also be insightful as they provide opinions of everyone that is involved in developing the app. These members can also help in viewing and identifying errors and provide useful feedback that can be useful to improve the app. When the app is developed, further functionality can also be included to enhance the application

3) Automated testing tools can also be used to enhance the quality of the VR app as they have built in tools which ensures smooth development of the app.

4) Motion sickness testing is a very crucial part in a VR application as VR is basically the enhanced version of the real world, in collaboration with virtual objects. For someone who has never experienced VR, it is difficult for them to actively and immediately get used to the application. This may cause motion sickness and dizziness. We need to ensure that the application being developed is easily understood by the human brain and that it can cope with the application easily.

5) End to End testing is to test the VR application overall to see where upgrades can be made and what blunders or bugs can happens during the reproduction which can be fixed or eliminated sooner rather than later of the application.
   Examples:
   1) Healthcare e.g. cognitive behavior therapy where patients having mental issues tackle them in a controlled environment.
   2) Entertainment e.g. using oculus or PlayStation VR to experience planets and different galaxies or maps that are introduced into the new generation of video games.
   3) Digital Marketing also uses the aid of VR e.g. retailers can show customers how a product will look inside their house without physically delivering

Tools for Testing VR applications:

1) SteamVR Performance Tool
2) 3600 EYETRACKERTM software solution
3) Unity testing tool

Reasoning:

The VR is totally based on human perception of objects in collaboration with the virtual objects. We have to involve human psyche when testing different applications of VR. These tools helps to define a stable environment in which a VR application can be tested.
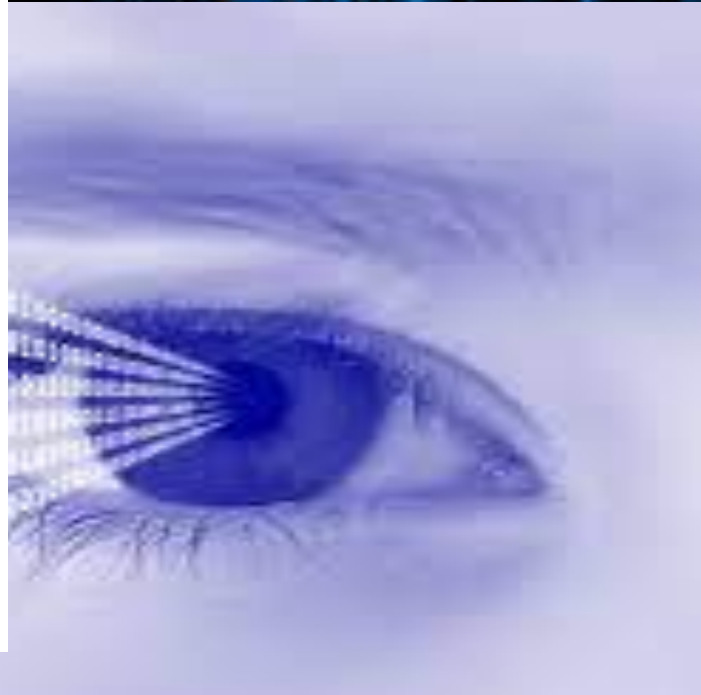
Image Processing

Testing techniques for Image processing based apps

Testing techniques for image processing applications:

Algorithm testing can be used as it simply applies an algorithm to marked images. Image marking takes an image from the given database or dataset and marks important features of the image which is then used in algorithm testing.

Examples:

1) It can be used for medical image retrieval e.g. it can be used to detect breast cancer. Since clinical use calls for exceptionally prepared picture processors, these applications require critical execution and assessment before they can be acknowledged for use.

2) Traffic Sensing technologies includes the use of VIPS(Video Image Processing System) which detects when a car entered a specific zone and when it left the zone. It can also record the license plate and type of the car alongside the speed of the car with which it was moving for.

Tools to test image processing applications:

- Tensor flow
- Pytorch
- OpenCv
- Caffe

Android / IOS apps

Testing techniques for Android /IOS based apps

Testing techniques for Android/IOS apps:

1. Functional testing checks whether the application is performing according to the customer's desires.
2. Usability testing checks the "look and feel" of the application and ensures that the application is efficient, promises effectiveness and satisfaction
3. Interface testing includes that the GUI has all the options as specified in the requirements
4. Compatibility testing is used to check the behavior of the apps on different platforms to see if it gives optimal performance that is expected from the app. Compatibility testing can be cross platform, cross browser, database testing, device configuration testing.
5. Performance testing helps to analyze the behavior of the application under some workload. It can be further divided into load testing, stress testing, stability testing, volume and concurrency testing.
6. Security testing is used to ensure that application maintains privacy of user's data and cannot be easily breached by some 3rd party.

Tools for testing IOS/Android applications:

For functionality testing: Appium, Selendroid, Robotium, Ranorex.

For usability testing: Reflector, User Zoom, Loop.

For mobile application interface testing: iMacros, FitNesse, Jubula, Coded UI, LoadUI.

For compatibility testing: CrossBrowserTesting, BrowserStack, Browsera, Litmus, Rational ClearCase, Ghostlab.[1]

Examples:

Dropbox, Gmail, WhatsApp are all examples of Android/IOS apps.

Reason:

All the web apps mentioned above are used every day by large number of users, handles constant load and maintains security by using end-to-end encryption while also being usable and compatible with different platforms.

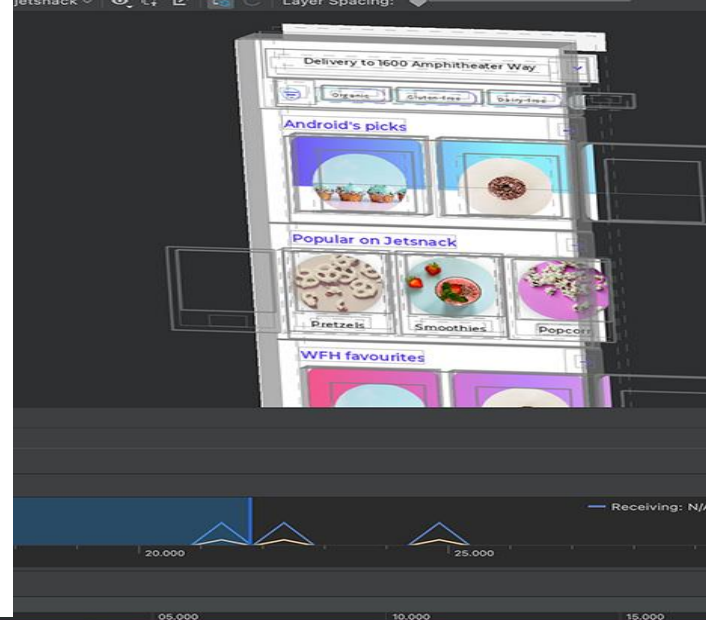[1] How to Test a Mobile Application [Step by Step] | Testbytes

IOT based Apps

SEPTEMBER 23

Testing techniques for IOT based apps

TESTING TECHNIQUES FOR IoT BASED APPLICATIONS

Edge Testing:

It ensures collaboration as well as real-time analysis using algorithms at the edge of a network, which might get interrupted by sufficient capability, reliability and bandwidth.

Privacy and Security Testing:

This type of technique ensures security such as data protection, trust in cloud computing, encryption, decryption as well as identity identification.

Network Impact Testing:

This type of testing measures quantitative and qualitative aspects of performance of an application in real time network environment and conditions.

End User Application Testing:

The End User Application Testing involves the checking of all of the use cases (functional as well as non-functional) of an application, majorly usability.

All the above-mentioned techniques can be used to test IoT based applications.

EXAMPLES:

1. Home Automation Appliances specifically dishwashers, clothes dryer and refrigerators etc.
2. Smart Transport System specifically traffic signal control systems, automatic number plate recognition systems etc.
3. Intelligent Waste Management System that uses IoT based smart bin sensors.

REASONING:

As all the above-mentioned examples such as Home Appliances and Traffic Control Systems are crucial to security, network conditions as well as usability (because of everyday use) , therefore these techniques are used to test the security, usability and any type of crashes that occur due to network issues.