



EDDVISAR

Augmented Reality within Web Technology

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OBJECTIVE

Provide an alternative way to get information about a location using current trends in Augmented Reality as an interaction modality

USE-CASE SCENARIO

Tourists usually want additional information at different locations they are visiting. By providing easy-to-access information in an engaging way, this can encourage tourism at different locations and lead to increasing tourism revenue

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Augmented Reality within Web Browser Technology



Canary



Chrome



Nightly



Firefox



Edge



Opera



- This project requires WebRTC that support only Android version 5.0 (Lollipop with api level 21) and higher level. And, For Android version KITKAT (Android 4.4) and lower versions, It does not support “WebRTC” because it does not have “WebView”.

COMPONENTS OF END-TO-END WEB BASED AUGMENTED REALITY SOLUTION

Web Technology:

WebRTC GetUserMedia

WebGL

CSS

SVG

HTML5 canvas

JavaScript API

JSON

Hardware & Software:

Estimote device (Communicate via Eddystone protocol)

Graphics Driver

Camera

3D:

Geometry and Math Utilities

3D Model Loaders and models

Lights, Materials, Shaders, Particles

Animation

BEACON

- Bluetooth Low Energy (BLE) devices
- Broadcast a signal at a defined interval with a defined data packet
- Do not rely on a client connection, just a regular, public broadcast
- Low power - some run off USB, some run off batteries with lifetimes in months to years

ESTIMOTE



Eddystone



iBeacon

- A device that supports beacon signal by using iBeacon and Eddystone protocol
- Based on Bluetooth 4.0 Low Energy - BLE (Bluetooth Low Energy)
- Can send messages to all smartphones
- Send message or data via UUID, URLs and Telemetry
- Support for iOS version 7 and higher & Android version 4.3 and higher

EDDYSTONE PROTOCOL



Data Packet
(31 bytes)

Prefix Data
(11 bytes)

Frame Data
(20 bytes)

Eddystone-UID
(20 bytes)

Frame Type, Tx power
(4 bytes)

Namespace
(10 bytes)

Instance
(6 bytes)

Eddystone-URL
(6-20 bytes)

Frame Type, Tx power
(3 bytes)

URL Data
(17 bytes)

Eddystone-TLM (Telemetry)
(14 bytes)

Frame Type, Battery Status, Temperature or ETC.
(14 bytes)

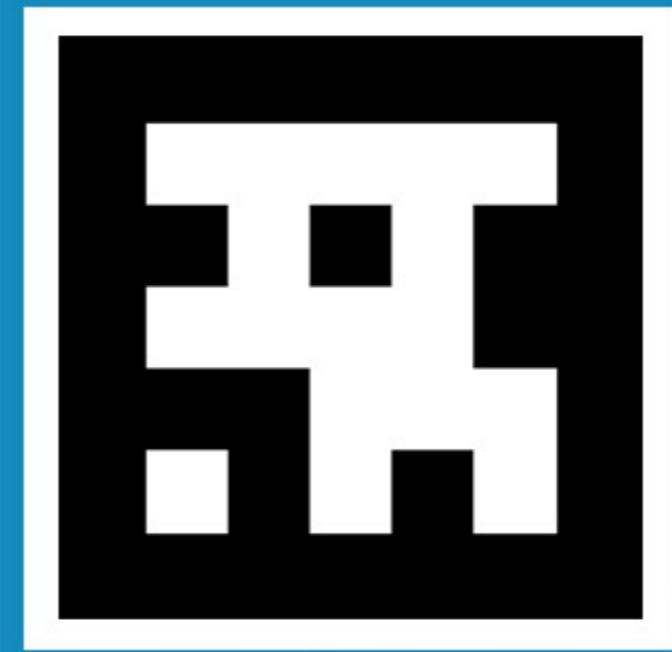


DEMO

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PHYSICAL WEB

The Physical Web



Augmented Reality

Within Web Browser Technology



BEACON

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- Broadcast a signal at a defined interval with a defined data packet
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IBEACON

- Bluetooth Low Energy (BLE)
Protocol created by Apple
- First ever official BLE protocol
- Officially supported by iOS
- Must have Application installed
- Sends messages only through
UUID ***



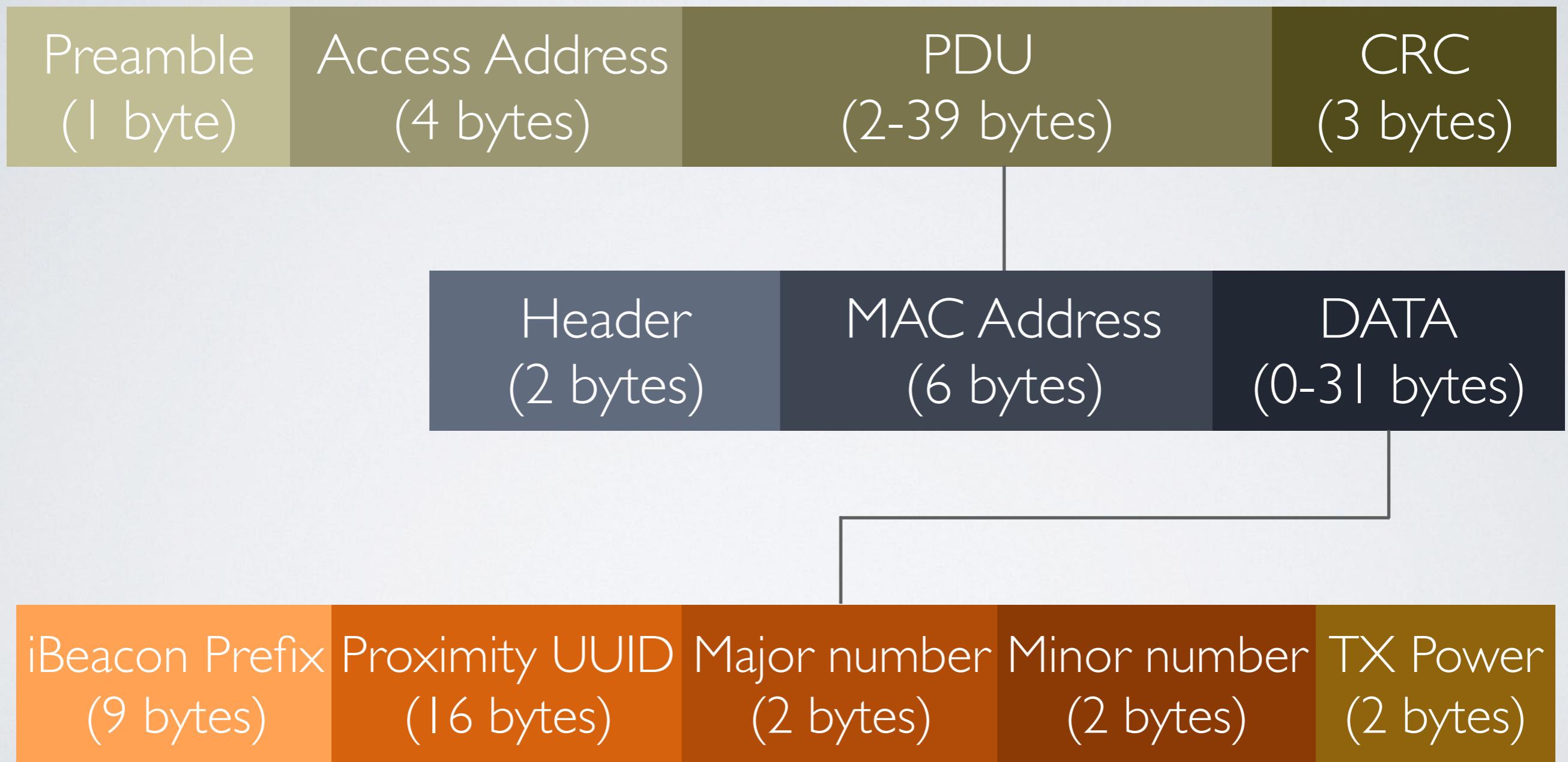
iBeacon

EDDYSTONE

- Bluetooth Low Energy (BLE) Protocol created by Google
- Open protocol - Available for everyone
- Official support for iOS and Android
- Does not require Application installed
- Supports for 3 different data packets**



IBEACON PROTOCOL



EDDYSTONE PROTOCOL



Data Packet
(31 bytes)

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Frame Type, Battery Status, Temperature or ETC.
(14 bytes)

EDDYSTONE VS.IBEACON

- Eddystone and iBeacon - UID (Unique Identifier)
 - Namespace as UUID
 - Instance (6 bytes) in Eddystone is similar to Major and Minor in iBeacon
- Eddystone - URL
 - Maximum 17 bytes - 17 Characters
- Eddystone - TLM (Telemetry)
 - Battery voltage
 - Temperature
 - Number of packets since last reboot
 - Beacon uptime since last reboot

ESTIMOTE

- A device that supports iBeacon and Eddystone protocol
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ESTIMOTE CLOUD

estimote cloud Beacons > Beacon Settings Logged in as civystreet1994@gmail.com

Beacons AR-1 Edit Settings

Nearables

Apps

Locations

Analytics

Profile

AR-1

Name: AR-1
Color: Icy Marshmallow
Geo Location: Unknown
Indoor Location: Unknown
Tags:

Battery: 16 months
Basic Battery Saving: Off
Smart Battery Saving: On
Motion Detection: Off
Motion Only Broadcasting: Off
Flip To Sleep: Off
Eddystone Configuration Service: Off
Firmware Version: A3.2.0
Hardware Version: D3.4

Broadcast Packets

Eddystone URL

URL: http://bit.ly/2acJfju

Broadcasting Power: Weak (-12dBm)
Maximum Range: ~15m / 50 ft
Advertising Interval: 500 ms

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DIFFERENCES BETWEEN **CLASSIC BLUETOOTH** AND **BLE (BLUETOOTH LOW ENERGY)**

Technical Specification	Classic Bluetooth Technology	Bluetooth Low Energy Technology
Distance/Range (Theoretical Max.)	30 Meter	50 Meter
Over the air data rate	1-3 Mbit/s	1 Mbit/s
Application throughput	0.7-2.1 Mbit/s	0.27 Mbit/s
Active Slaves	7	Not defined (Implementation dependent)
Security	56/128-bit and application layer user defined	128-bit AES with Counter Mode
Network Topology	Scatternet	Scatternet

What is AR?



AUGMENTED REALITY

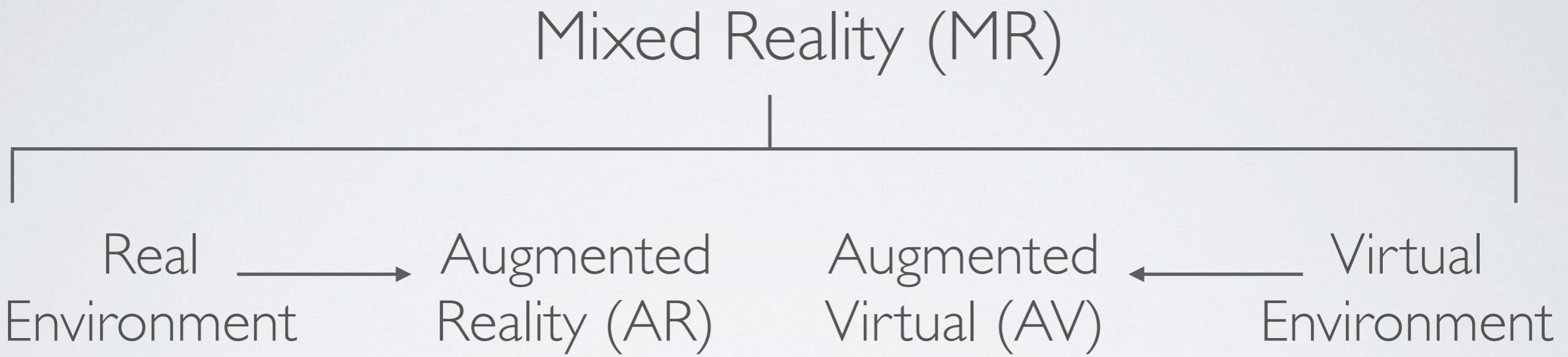
A combination of a real scene viewed by a user with a virtual scene generated by a computer that augments the scene with additional information

AUGMENTED REALITY VS VIRTUAL REALITY

- The system augments the real world scene
- User maintain the scene of presence in real world
- Needs a mechanism to combine virtual and real world
- Hard to register real and virtual

- Totally immersive environment
- Senses are under control of the system
- Need a mechanism to feed virtual world to user
- Hard to make Virtual Reality (VR) world interesting

MILGRAM'S REALITY-VIRTUALITY CONTINUUM



Milgram coined the term “Augmented Virtuality” to identify systems which are mostly synthetic with some real world imagery added. For instance, texture mapping video onto virtual objects.

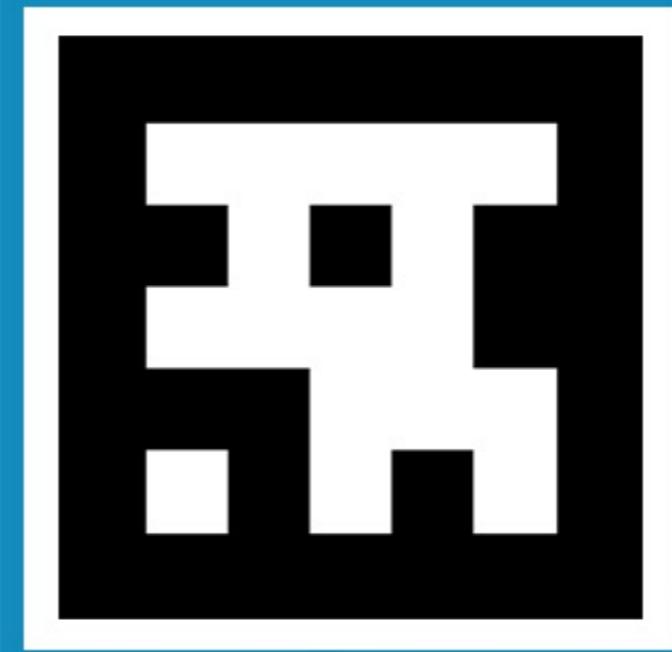
PHYSICAL WEB FOR BEACON

- Part of the Internet of Things (IOT)
- Interaction on demand
- Allows users to communicate with physical objects
- Enables to see a list of URLs being broadcast by objects in the environment around



PHYSICAL WEB

The Physical Web



Augmented Reality

Within Web Browser Technology



BENEFITS OF WEB

- No need for Android version and iOS version
- Easier to learn
 - More standard
 - Less varied

HTML



BENEFITS OF NATIVE

- Better controls on running platform
 - e.g. Can't read webcam in iOS browser.
 - But Possible in iOS native
- More efficient
 - Native typically runs faster
 - Less latency
 - More battery life



CHOOSING BETWEEN NATIVE AND BROWSER



It depends on the goals

- For serious, long term project, Native may be better
- For Fun, Short term project, Go for Web Browser Technology

“APPLICATION” INDEPENDENT USE-CASE

- AR in an application is already used
 - Users need to have an application installed
 - Requires a data connection (WiFi or cellular), which cannot be assumed
 - With increasing number of apps growing users may be hesitant to install additional apps
- This project is run on only “Web Browser”
 - Android and iOS have “Web browser” pre by default



COMPONENTS OF END-TO-END WEB BASED AUGMENTED REALITY SOLUTION

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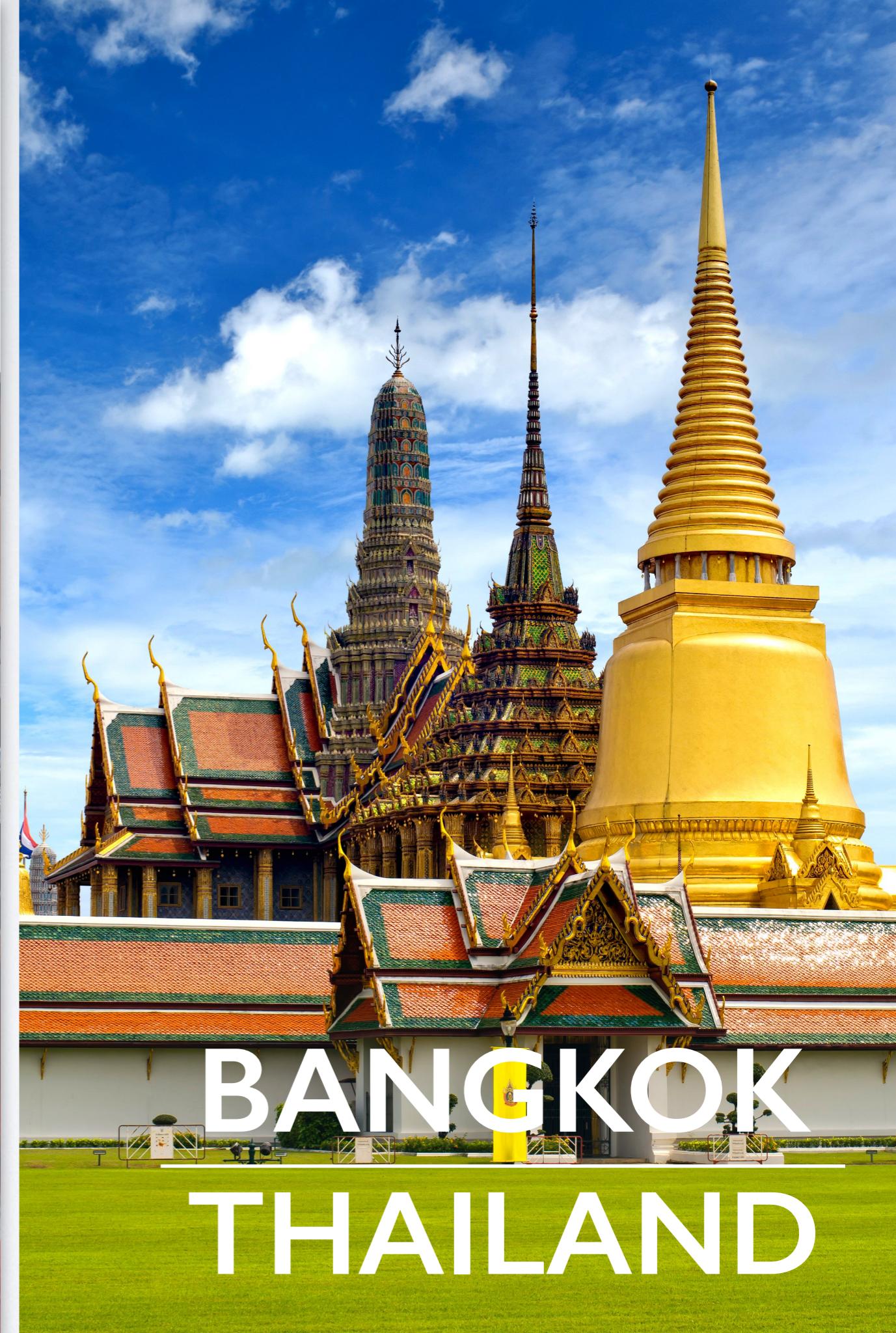


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KYOTO
JAPAN



BANGKOK
THAILAND

WEBRTC

(WEB REAL-TIME COMMUNICATION)

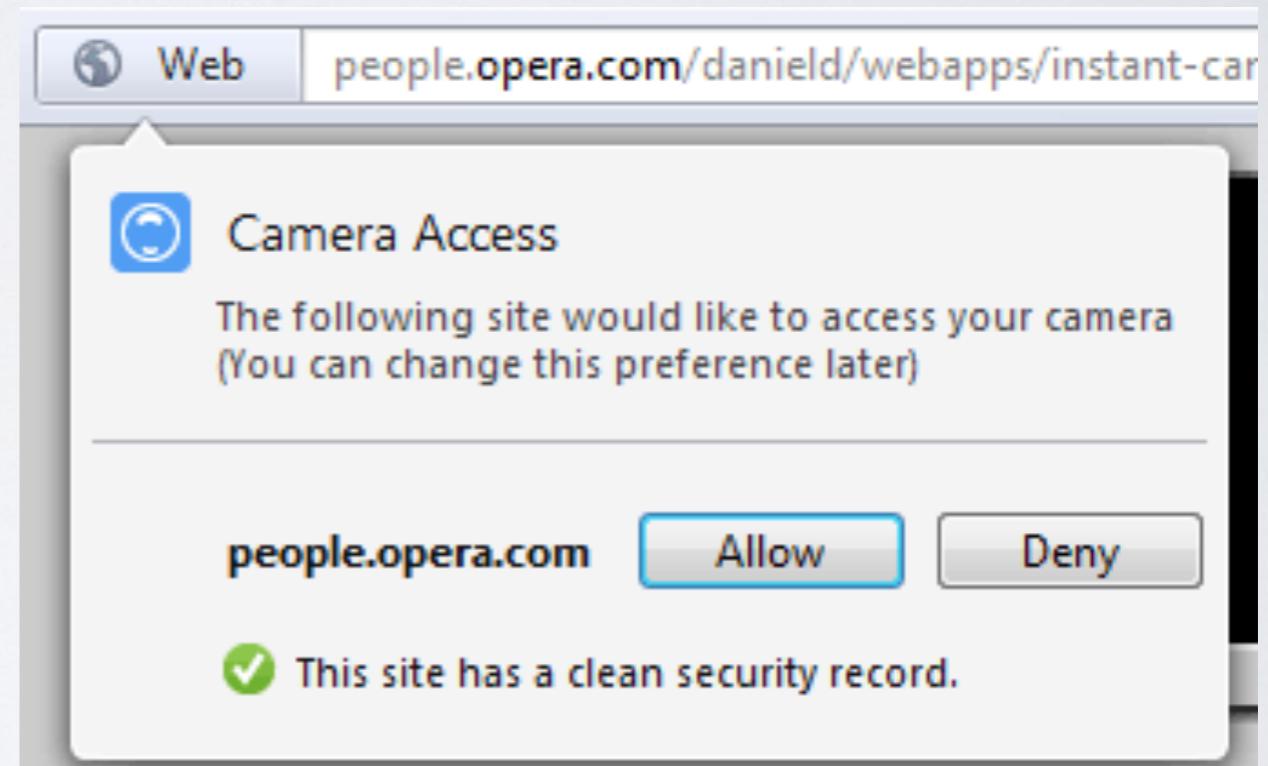
- Open-Source
- MediaStream or getUserMedia: One of WebRTC API that accesses data stream.
- Technology that enables audio/video streaming and data sharing between browser clients (peers)
- No need to install plug-in or third party software

MEDIASTREAM OR GETUSERMEDIA

WebRTC (Web Real-Time Communication)

Support:

- Chrome desktop 18.0.1008+
- Chrome for Android 29+
- Opera 18+
- Opera for Android 20+
- Firefox 17+
- Microsoft Edge



GETUSERMEDIA

WebRTC (Web Real-Time Communication)



Canary



Chrome



Nightly



Firefox



IE



Edge



Safari



Opera

getUserMedia



- WebRTC support only Android version 5.0 (Lollipop with api level 21) and higher level. And, For Android version KITKAT (Android 4.4) and lower versions, It does not support “WebRTC” because it does not have “WebView”.

WEBGL

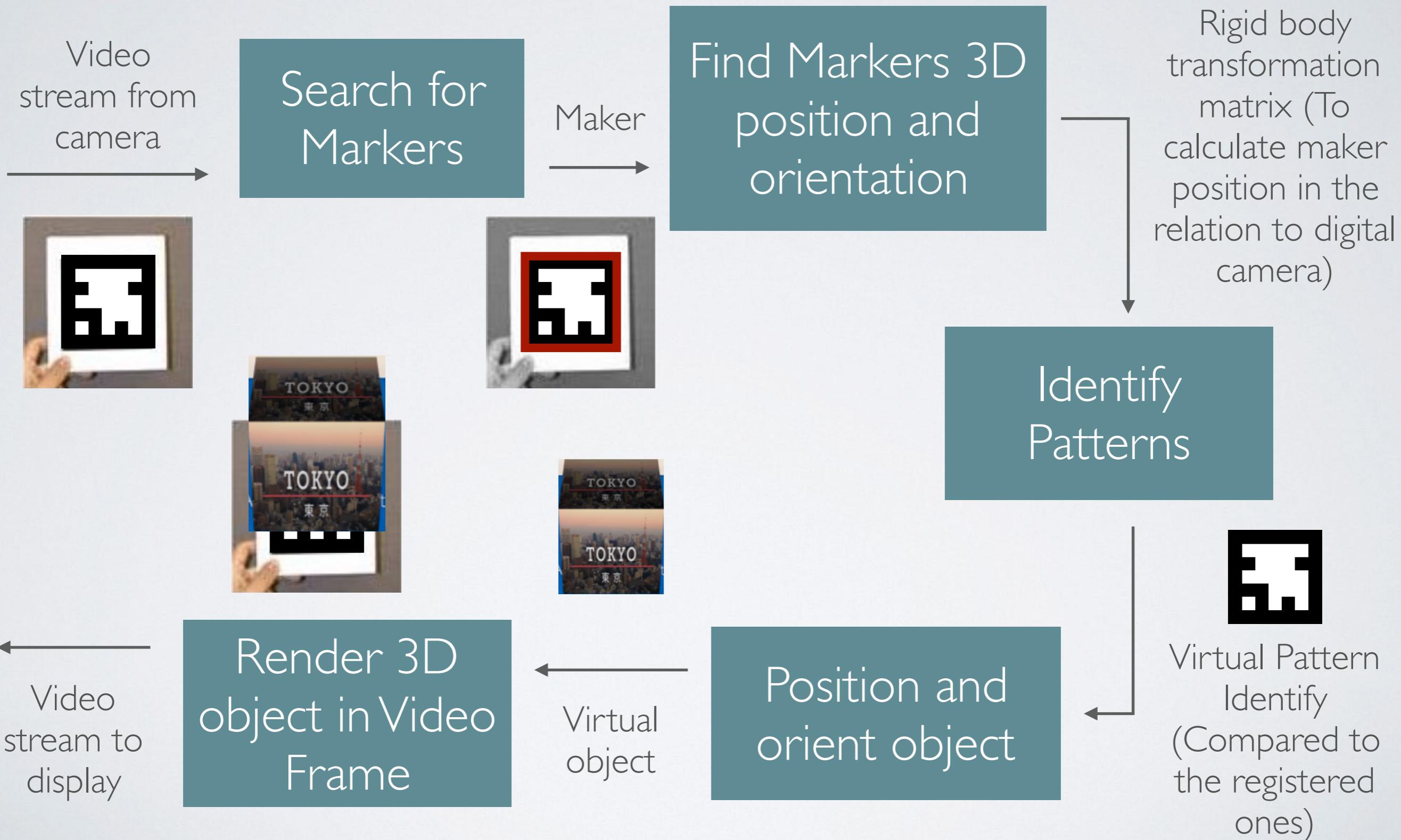
(WEB GRAPHICS LIBRARY)

- JavaScript API for rendering interactive 2D or 3D computer graphics for Augmented Reality
- No need to install Plugins
- Uses GPU (Graphics Processing Unit) acceleration - Support for iOS, Android 4.0 (Ice Cream Sandwich) and higher
- Cross platform and works on all major Desktop and Mobile Browsers

LIBRARIES FOR BROWSER AR

- Three.js: Library that makes WebGL easy to use whether it be 2D or 3D graphics (Lights, Shapes, Cameras, Textures, Materials, Geometries, etc.)
- Awe.js: Library that makes Augmented Reality application easier.
- JSARToolKit: Open-Source JavaScript Library that makes video AR tracking using canvas elements.

HOW AR WORKS?



BROWSER AUGMENTED REALITY TECHNOLOGY

- Location based AR
- Target or Marker based AR

LOCATION BASED ISSUES

- No Web Browsers have implemented library for beacon detection
- Web browser can not receive “Signal Strength” of Beacon
- Can not get accurate location
- Problem: Does not know how to adjust the size of each object in Augmented Reality
- Solution: Combine 3 methods which are Geolocation, Device orientation, and Pedometer to solve the problem



GEOLOCATION

- To know the distance between current position of user and Estimote
- Calculate the distance between two points specified by Latitude and Longitude using Haversine Formula
- Get the current geographical position of user (Latitude and Longitude)

Haversine formula: $a = \sin^2(\Delta\varphi/2) + \cos(\varphi_1).\cos(\varphi_2).\sin^2(\Delta\lambda/2)$

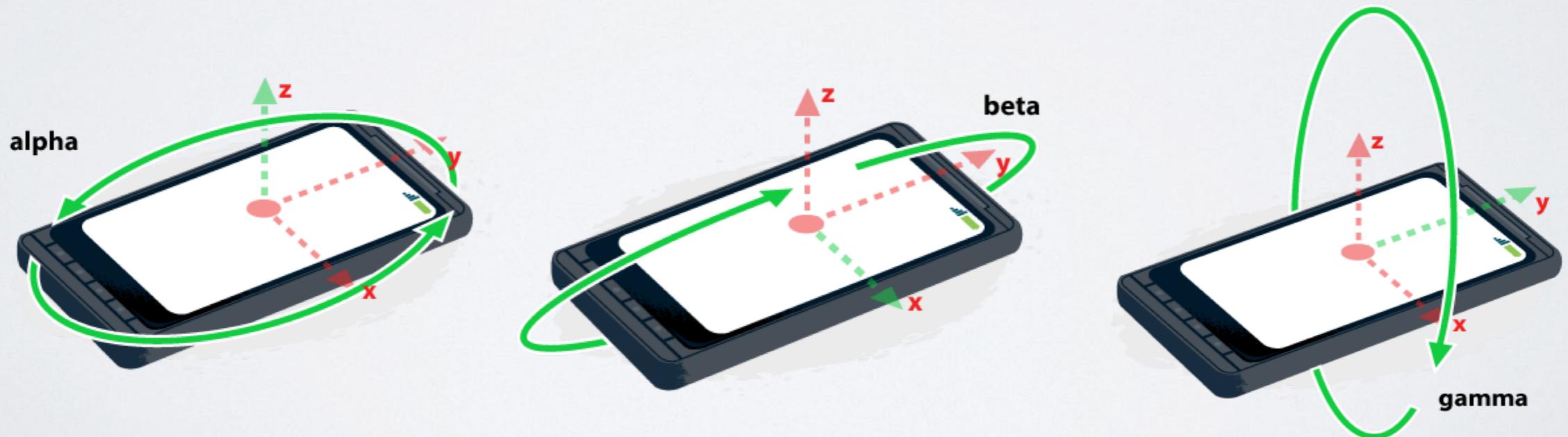
$c = 2.\text{atan2}(\sqrt{a}, \sqrt{1-a})$

$d = R.c$

where φ is latitude, λ is longitude, R is earth's radius (mean radius = 6,371km)

DEVICE ORIENTATION

- To know which direction user is walking at that time
- Supports accelerometers, gyroscopes, compasses and other hardware designed to determine capture motion and orientation data
- The Alpha angle represents rotation around the z-axis,
The Beta angle represents rotation around the x-axis,
The Gamma angle represents rotation around the y-axis



PEDOMETER

- To know how many steps that a user walks in order to resize objects
- Use the concept of accelerometer of device
- Result of counting has an approximate error of 10%
- Use DeviceOrientation events in JavaScript APIs for development

TARGET BASED ISSUES

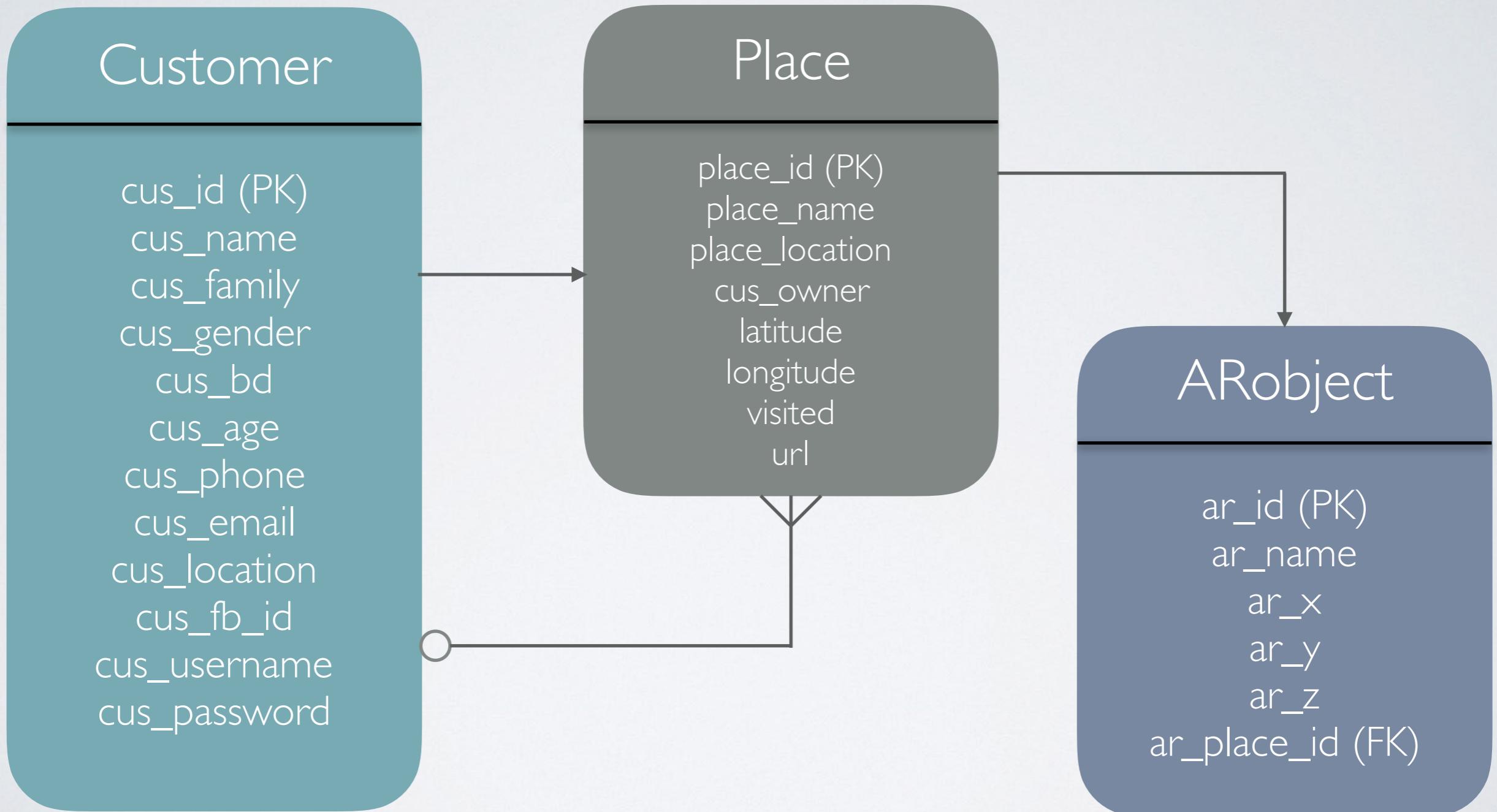
- The QR-code is limited.
- Target-based specific on QR-code.
- Aruco library can generate only 1,024 patterns of QR-code

AR DATABASE MANAGEMENT



Using MySQL as a core database

DATABASE DESIGN



DATA DICTIONARY

Customer			
A person profile and information			
Field Name	Data Type	Constraint	Description
cus_id	int	PK	Unique number for each person
cus_name	var char		Name
cus_family	var char		Lastname
cus_gender	var char		Gender
cus_bd	date		Birthday
cus_age	int		Age
cus_phone	var char		Phone number
cus_email	var char		Email
cus_location	var char		Person address
cus_fb_id	var char		Facebook ID
cus_username	var char		Username for EddvisAR
cus_password	var char		Password for EddvisAR

DATA DICTIONARY

Place			
Place general information			
Field Name	Data Type	Constrain	Description
place_id	int	PK	Unique number for each place
place_name	var char		Place name
place_location	var char		Address of that place
place_owner	var char	FK	ID of the owner
latitude	int		Latitude position
longitude	int		Longitude position
visited	int		Number of users visited
picture	var char		URL for each place (iBeacon)

DATA DICTIONARY

arobject			
Augmented Reality (AR) information			
Field Name	Data Type	Constrain	Description
ar_id	int	PK	Unique number for each AR
ar_name	var char		Augmented Reality name
ar_x	var char		X position for placing the AR
ar_y	var char		Y position for placing the AR
ar_z	var char		Z position for placing the AR
ar_width	int		Width of the AR
ar_height	int		Height of the AR
ar_place_id	int	FK	ID of the place which AR is in

FACEBOOK DEVELOPER FOR MANAGE USER ACCESS

facebook for developers

Products

Docs

Tools & Support

News

Videos

Search

My Apps



Facebook Ads for Apps

Grow your app by reaching a larger audience and increasing your installs.

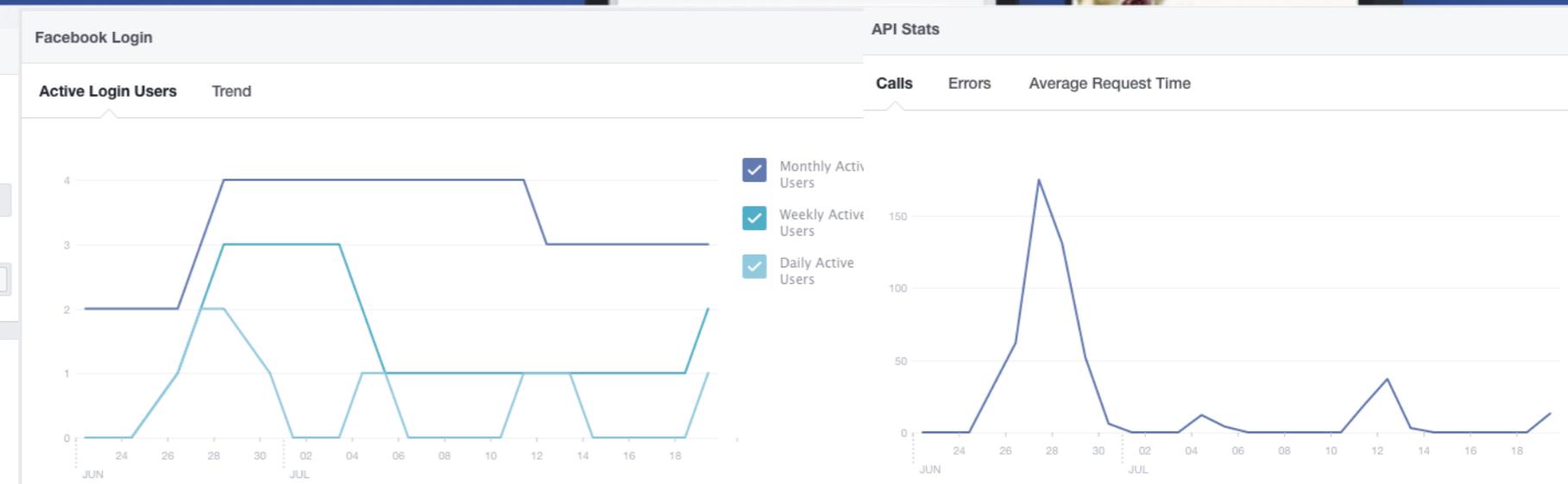
Create Ad



Dashboard

EddvisAR •
This app is public and available to all users [?]
API Version [?] App ID
v2.6 142869452798048
App Secret
***** Show

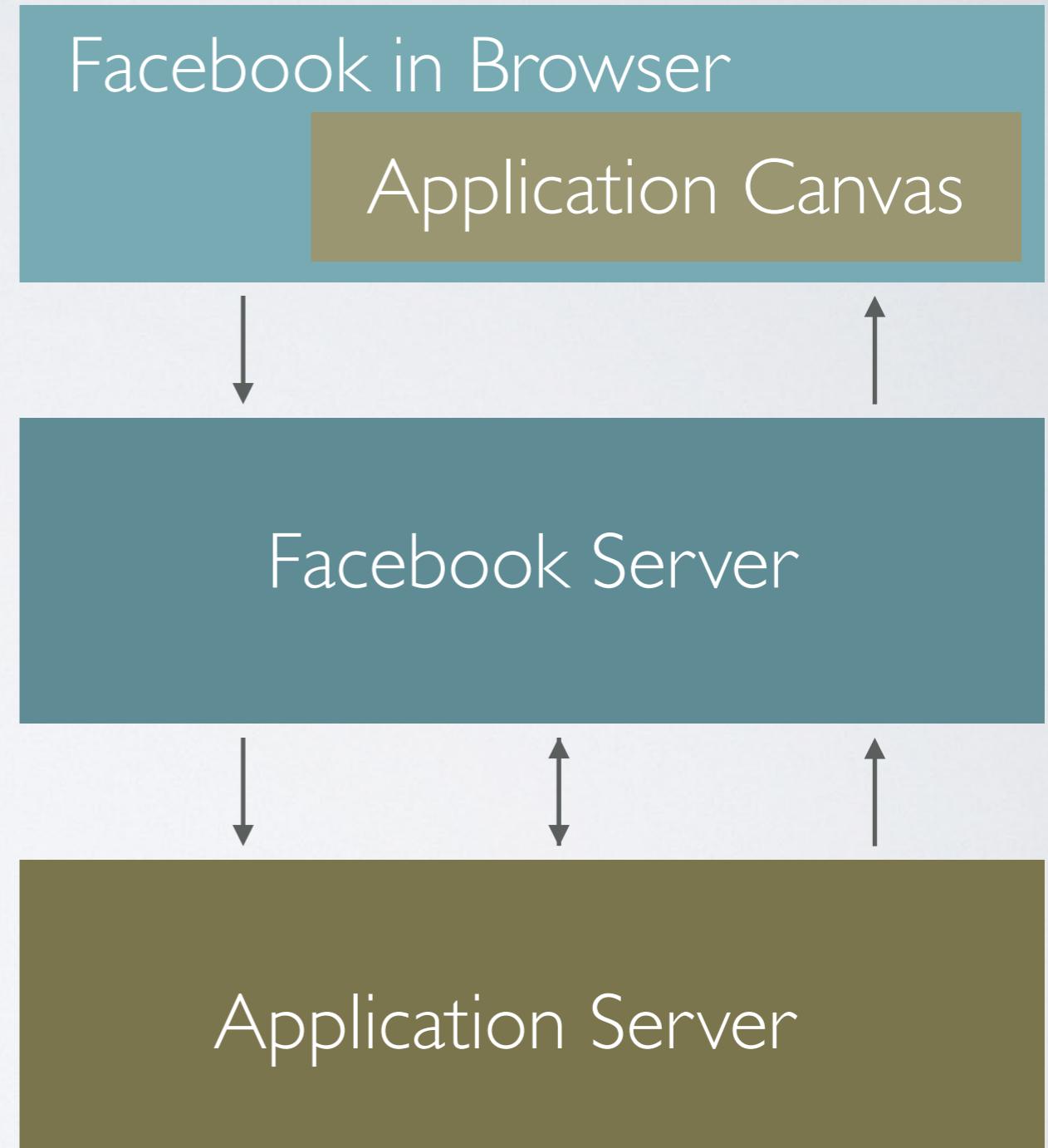
Get Started with the Facebook SDK
Use our quick start guides to set up the Facebook SDK for your iOS or Android app, Canvas game or website.
Choose a Platform



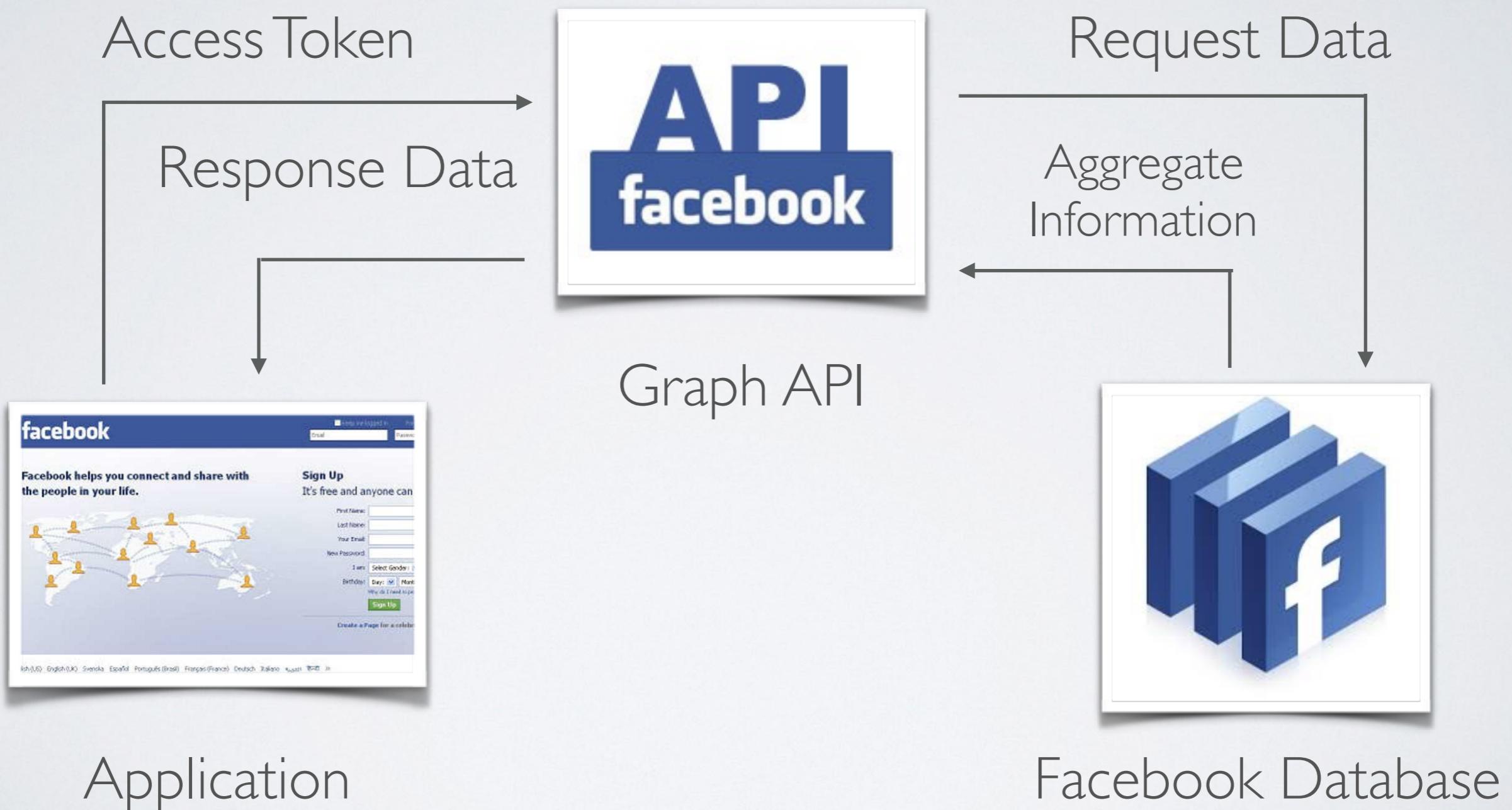
FACEBOOK DEVELOPER

Canvas

1. Browser makes request
2. Facebook calls web server
3. App Calls Facebook API
(optional)
4. App returns FBML
(Facebook Mark Language)
5. Facebook renders FBML
to HTML



GRAPH API FACEBOOK



REFERENCE

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- [2] Estimote Developer website (Documentation), “Eddystone” ,
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<http://estimote.com/> , visited on 27/7/2016.
- [4] Petermunro website, “WebRTC getUserMedia” ,
<http://petermunro.org/webrtc/#slide1> , visited on 27/7/2016.
- [5] Explainthatstuff technology website, “Pedometer technology” written by Chris Woodford. , <http://www.explainthatstuff.com/how-pedometers-work.html> , visited on 27/7/2016.
- [6] Alcimar Barbosa Soares I, Adriano de Oliveira Andrade, Edgard Afonso Lamounier Júnior and Alexandre Cardoso, Faculty of Electrical Engineering, Federal University of Uberlândia, Brazil, Intech open science open minds website, <http://www.intechopen.com/books/> , visited on 27/7/2016.



THANK YOU

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POSITION X,Y,Z IN DATABASE

