GPS Signal Authentication using QZSS Signal

Dinesh Manandhar, R. Shibasaki

Center for Spatial Information Science (CSIS)

The University of Tokyo, Japan

dinesh@iis.u-tokyo.ac.jp

Can You Trust GPS Position & Time Data?

Yes, You can…

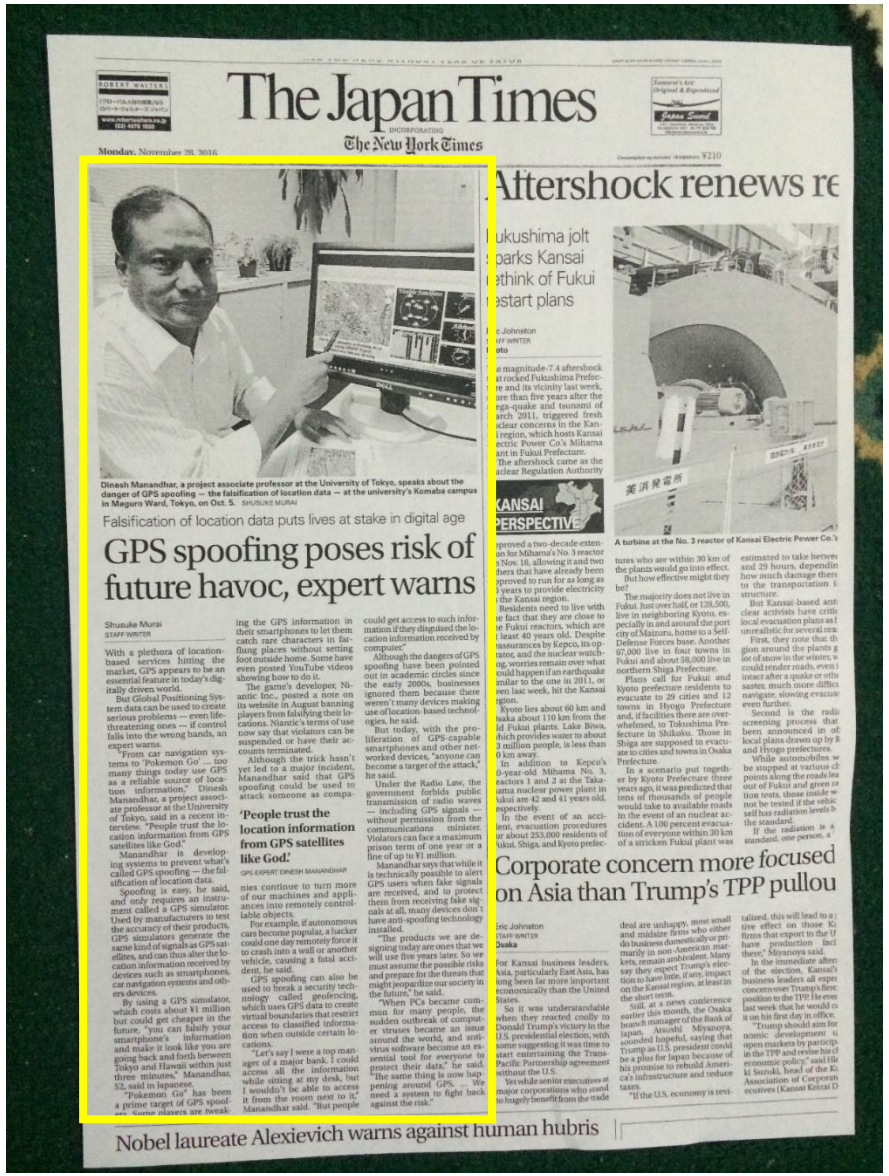
…But Need to Verify

Because of Spoofing Issues

Dinesh Manandhar, The University of Tokyo, Japan, dinesh@iis.u-tokyo.ac.jp

GPS Spoofing Poses Risk of Future Havoc

NOV 28, 2016



The Japan Times

The New York Times

Monday, November 28, 2016

Aftershock renews re

ukushima jolt
parks Kansai
ethink of Fukui
start plans

Dinesh Manandhar, a project associate professor at the University of Tokyo, speaks about the danger of GPS spoofing — the falsification of location data — at the university's Komaba campus in Meguro Ward, Tokyo, on Oct. 5. SHUSUKE MURAI

Falsification of location data puts lives at stake in digital age

GPS spoofing poses risk of future havoc, expert warns

Shusuke Murai
STAFF WRITER

With a plethora of location-based services hitting the market, GPS appears to be an essential feature in today's digitally driven world.

But Global Positioning System data can be used to create serious problems — even life-threatening ones — if control falls into the wrong hands, an expert warns.

"From car navigation systems to 'Pokemon Go' ... too many things today use GPS as a reliable source of location information," Dinesh Manandhar, a project associate professor at the University of Tokyo, said in a recent interview. "People trust the location information from GPS satellites like God."

Manandhar is developing systems to prevent what's called GPS spoofing — the falsification of location data.

Spoofing is easy, he said, and only requires an instrument called a GPS simulator. Used by manufacturers to test the accuracy of their products, GPS simulators generate the same kind of signals as GPS satellites, and can thus alter the location information received by devices such as smartphones, car navigation systems and others devices.

By using a GPS simulator, which costs about ¥1 million but could get cheaper in the future, "you can falsify your smartphone's information and make it look like you are going back and forth between Tokyo and Hawaii within just three minutes," Manandhar, 52, said in Japanese.

"Pokemon Go" has been a prime target of GPS spoof-

ing the GPS information in their smartphones to let them catch rare characters in far-flung places without setting foot outside home. Some have even posted YouTube videos showing how to do it.

The game's developer, Niantic Inc., posted a note on its website in August banning players from falsifying their locations. Niantic's terms of use now say that violators can be suspended or have their accounts terminated.

Although the trick hasn't yet led to a major incident, Manandhar said that GPS spoofing could be used to attack someone as compa-

'People trust the location information from GPS satellites like God.'

GPS EXPERT DINESH MANANDHAR

nies continue to turn more of our machines and appliances into remotely controllable objects.

For example, if autonomous cars become popular, a hacker could one day remotely force it to crash into a wall or another vehicle, causing a fatal accident, he said.

GPS spoofing can also be used to break a security technology called geofencing, which uses GPS data to create virtual boundaries that restrict access to classified information when outside certain locations.

"Let's say I were a top manager of a major bank. I could access all the information while sitting at my desk, but I wouldn't be able to access it from the room next to it," Manandhar said. "But people could get access to such information if they disguised the location information received by computer."

Although the dangers of GPS spoofing have been pointed out in academic circles since the early 2000s, businesses ignored them because there weren't many devices making use of location-based technologies, he said.

But today, with the proliferation of GPS-capable smartphones and other networked devices, "anyone can become a target of the attack," he said.

Under the Radio Law, the government forbids public transmission of radio waves — including GPS signals — without permission from the communications minister. Violators can face a maximum prison term of one year or a fine of up to ¥1 million.

Manandhar says that while it is technically possible to alert GPS users when fake signals are received, and to protect them from receiving fake signals at all, many devices don't have anti-spoofing technology installed.

"The products we are designing today are ones that we will use five years later. So we must assume the possible risks and prepare for the threats that might jeopardize our society in the future," he said.

"When PCs became common for many people, the sudden outbreak of computer viruses became an issue around the world, and anti-virus software become an essential tool for everyone to protect their data," he said. "The same thing is now happening around GPS. ... We need a system to fight back against the risk."

Nobel laureate Alexievich warns against human hubris

KANSAI PERSPECTIVE

A turbine at the No. 3 reactor of Kansai Electric Power Co.'s

proved a two-decade exten-
on for Mihama's No. 3 reactor
s Nov. 16, allowing it and two
thers that have already been
pproved to run for as long as
0 years to provide electricity
the Kansai region.
Residents need to live with
he fact that they are close to
he Fukui reactors, which are
least 40 years old. Despite
assurances by Kepco, its op-
rator, and the nuclear watch-
og, worries remain over what
ould happen if an earthquake
milar to the one in 2011, or
en last week, hit the Kansai
gion.
Kyoto lies about 60 km and
saka about 110 km from the
d Fukui plants. Lake Biwa,
hich provides water to about
3 million people, is less than
0 km away.
In addition to Kepco's
0-year-old Mihama No. 3,
actors 1 and 2 at the Taka-
ama nuclear power plant in
ukui are 42 and 41 years old,
spectively.
In the event of an acci-
lent, evacuation procedures
or about 253,000 residents of
ukui, Shiga, and Kyoto prefec-

Corporate concern more focused on Asia than Trump's TPP pullou

Eric Johnston
STAFF WRITER
Osaka

for Kansai business leaders,
Asia, particularly East Asia, has
long been far more important
economically than the United
States.
So it was understandable
when they reacted coolly to
Donald Trump's victory in the
U.S. presidential election, with
some suggesting it was time to
start entertaining the Trans-
Pacific Partnership agreement
without the U.S.
Yet while senior executives at
major corporations who stand
to hugely benefit from the trade

tures who are within 30 km of
the plants would go into effect.
But how effective might they
be?
The majority does not live in
Fukui. Just over half, or 128,500,
live in neighboring Kyoto, es-
pecially in and around the port
city of Maizuru, home to a Self-
Defense Forces base. Another
67,000 live in four towns in
Fukui and about 58,000 live in
northern Shiga Prefecture.
Plans call for Fukui and
Kyoto prefecture residents to
evacuate to 29 cities and 12
towns in Hyogo Prefecture
and, if facilities there are over-
whelmed, to Tokushima Pre-
fecture in Shikoku. Those in
Shiga are supposed to evacu-
ate to cities and towns in Osaka
Prefecture.
In a scenario put togeth-
er by Kyoto Prefecture three
years ago, it was predicted that
tens of thousands of people
would take to available roads
in the event of an nuclear ac-
cident. A 100 percent evacua-
tion of everyone within 30 km
of a stricken Fukui plant was

deal are unhappy, most small
and midsize firms who either
do business domestically or pri-
marily in non-American mar-
kets, remain ambivalent. Many
say they expect Trump's elec-
tion to have little, if any, impact
on the Kansai region, at least in
the short term.
Still, at a news conference
earlier this month, the Osaka
branch manager of the Bank of
Japan, Atsushi Miyanoya,
sounded hopeful, saying that
Trump as U.S. president could
be a plus for Japan because of
his promise to rebuild Ameri-
ca's infrastructure and reduce
taxes.
"If the U.S. economy is revi-

estimated to take betwee
and 29 hours, dependin
how much damage there
to the transportation i
structure.
But Kansai-based anti
clear activists have criti
local evacuation plans as
unrealistic for several rea
First, they note that th
gion around the plants g
ioc of snow in the winter, w
could render roads, even i
intact after a quake or oth
aster, much more difficu
navigate, slowing evacuat
even further.
Second is the radia
screening process that
been announced in of
local plans drawn up by t
and Hyogo prefectures.
While automobiles w
be stopped at various ch
points along the roads lea
out of Fukui and given ra
tion tests, those inside w
not be tested if the vehic
self has radiation levels b
the standard.
If the radiation is a
standard, one person, a

talized, this will lead to a
tive effect on those K
firms that export to the U
have production faci
there," Miyanoya said.
In the immediate after
of the election, Kansai's
business leaders all expr
concerns over Trump's flec
position to the TPP. He even
last week that he would co
it on his first day in office.
"Trump should aim for
nomic development t
open markets by particip
in the TPP and revise his cl
economic policy," said Ha
ki Suzuki, head of the K
Association of Corporat
ecutives (Kansai Keizai D

GPS 'Spoofing' is No Joke: Dangers of GPS Data Hacking Realized

GNSS spoofing will attain virus status, warns expert – GPS World

Hacking Global Positioning System with GPS 'Spoofing' Can Lead To Fatalities
http://www.techworm.net/2016/11/gps-spoofing-dangers-gps-data-hacking.html

Dangers of GPS spoofing and hacking for location based services

Faking of GPS Data a growing and potentially lethal danger – The Japan Times, FB

Dinesh Manandhar, The University of Tokyo, Japan, dinesh@iis.u-tokyo.ac.jp

Japan Supreme Court Ruling: GPS Tracking is Illegal without Warrant

15th March 2017

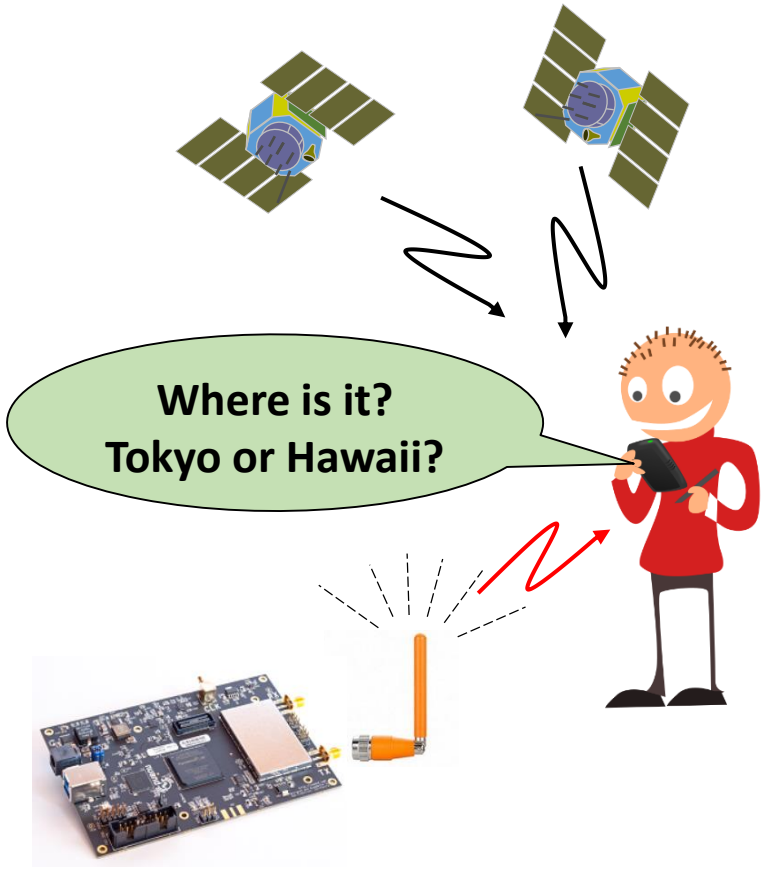
New rules might be implemented to make GPS tracking legal with warrant

But, there is also fear of GPS Signal Spoofing.

ＧＰＳ捜査訴訟の上告審判決が言い渡された最高裁大法廷。中央は、寺田逸郎裁判長＝15日午後、東京都千代田区（伴龍二撮影）

What is Location Spoofing?

- **Falsify Location Data as If it were True Location**



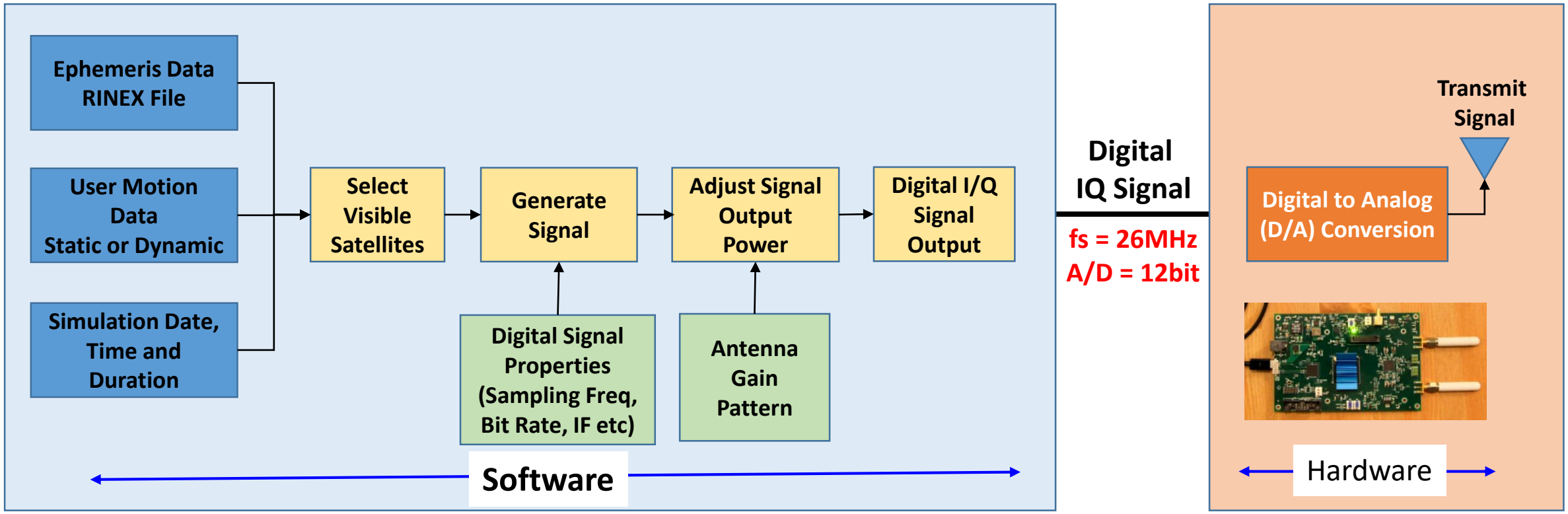
Spoofer

TOKYO
Or
Hawaii?

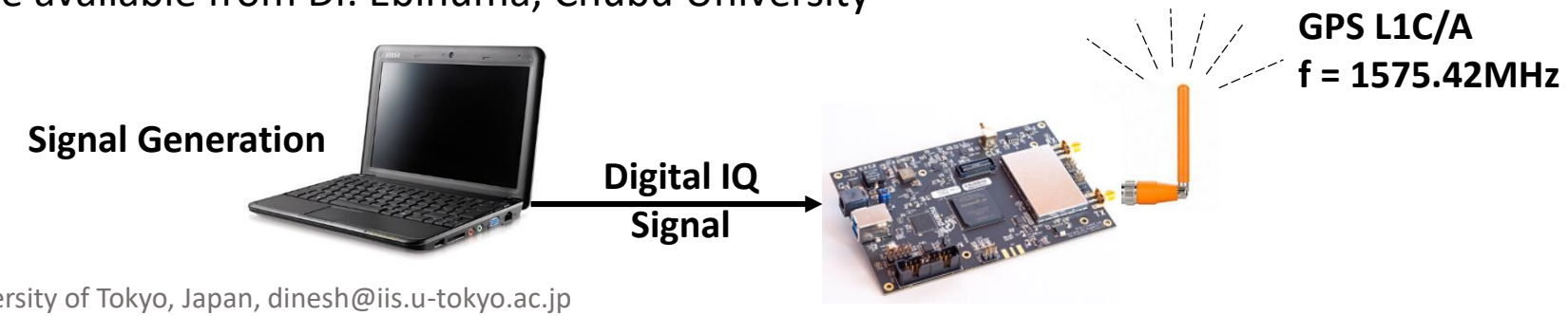
Please watch James Bond Movie "Tomorrow Never Dies"

This movie is all about GPS Spoofing

Software-Based GPS Signal Generator (Spoofer?)



Software Source available from Dr. Ebinuma, Chubu University



What is GPS Signal Authentication?

- **To authenticate or verify that a GPS signal in the receiver is actually from a GPS satellite.**

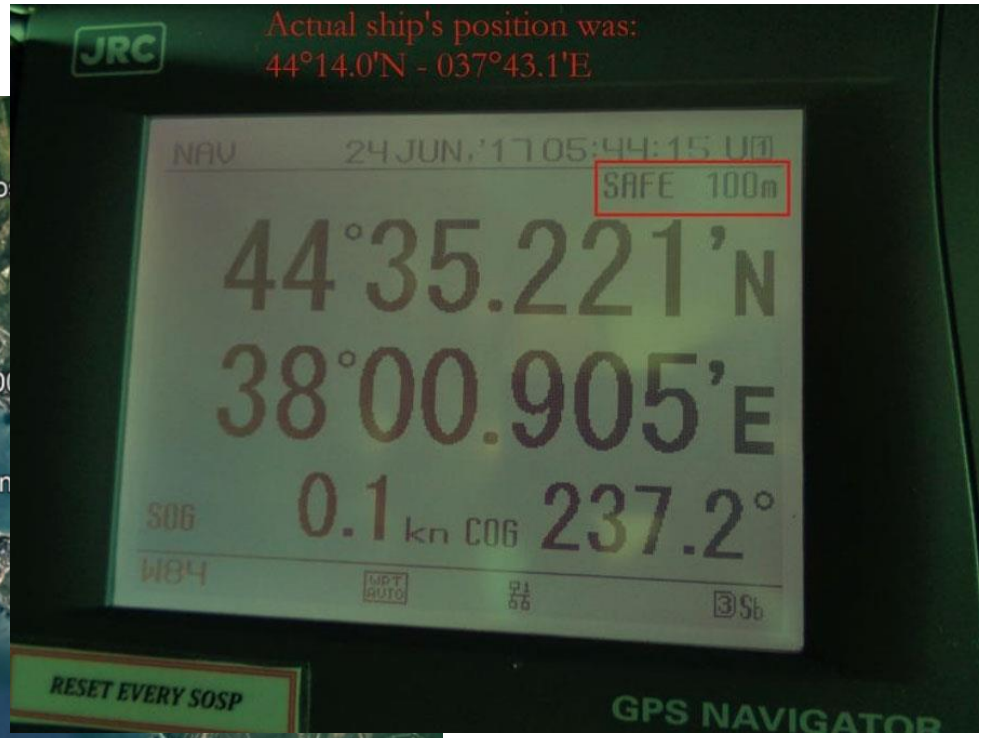
GPS Signal Authentication is necessary to detect SPOOF Signals

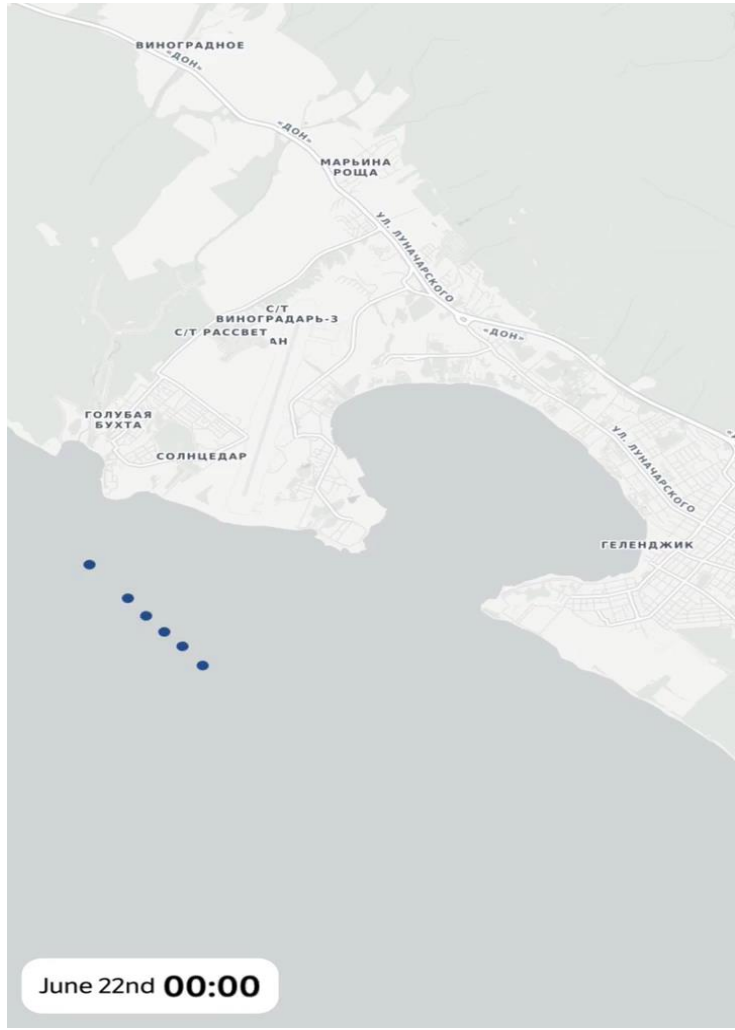
Dinesh Manandhar, The University of Tokyo, Japan, dinesh@iis.u-tokyo.ac.jp

GPS Spoofing in Black Sea?

24th June 2017

A GPS spoofing attack in June, involving over 20 vessels in the Black Sea, has been reported. *Probably the first official record of spoofing.* More…….





https://www.rin.org.uk/newsitem/4969/GPS-Spoofing-in-Black-Sea

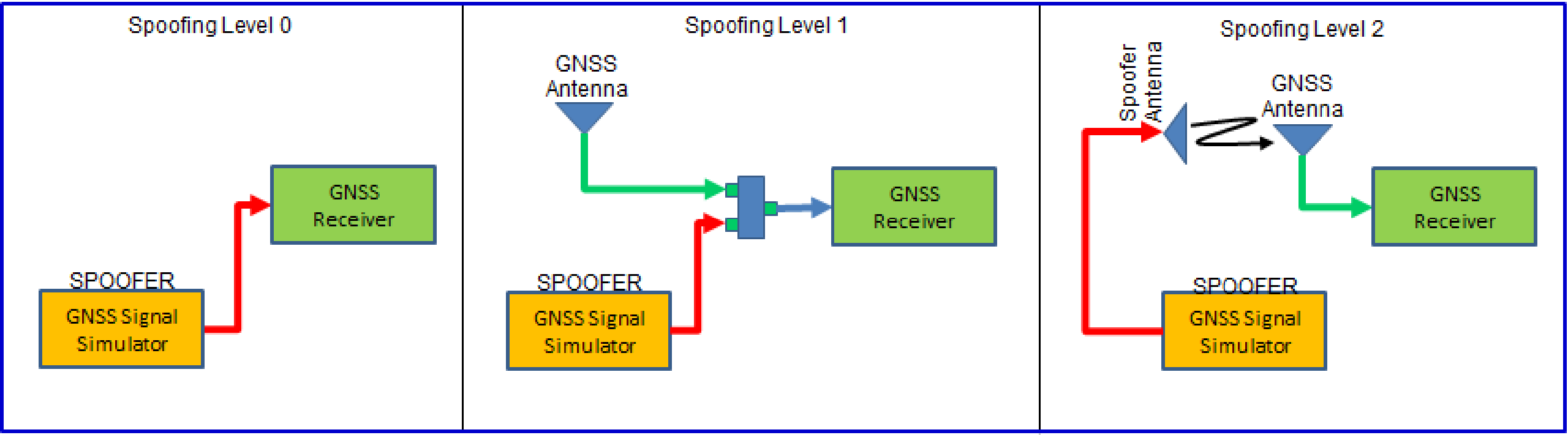
SPOOFing a Car: Is he driving the car?

Spoofing Methods

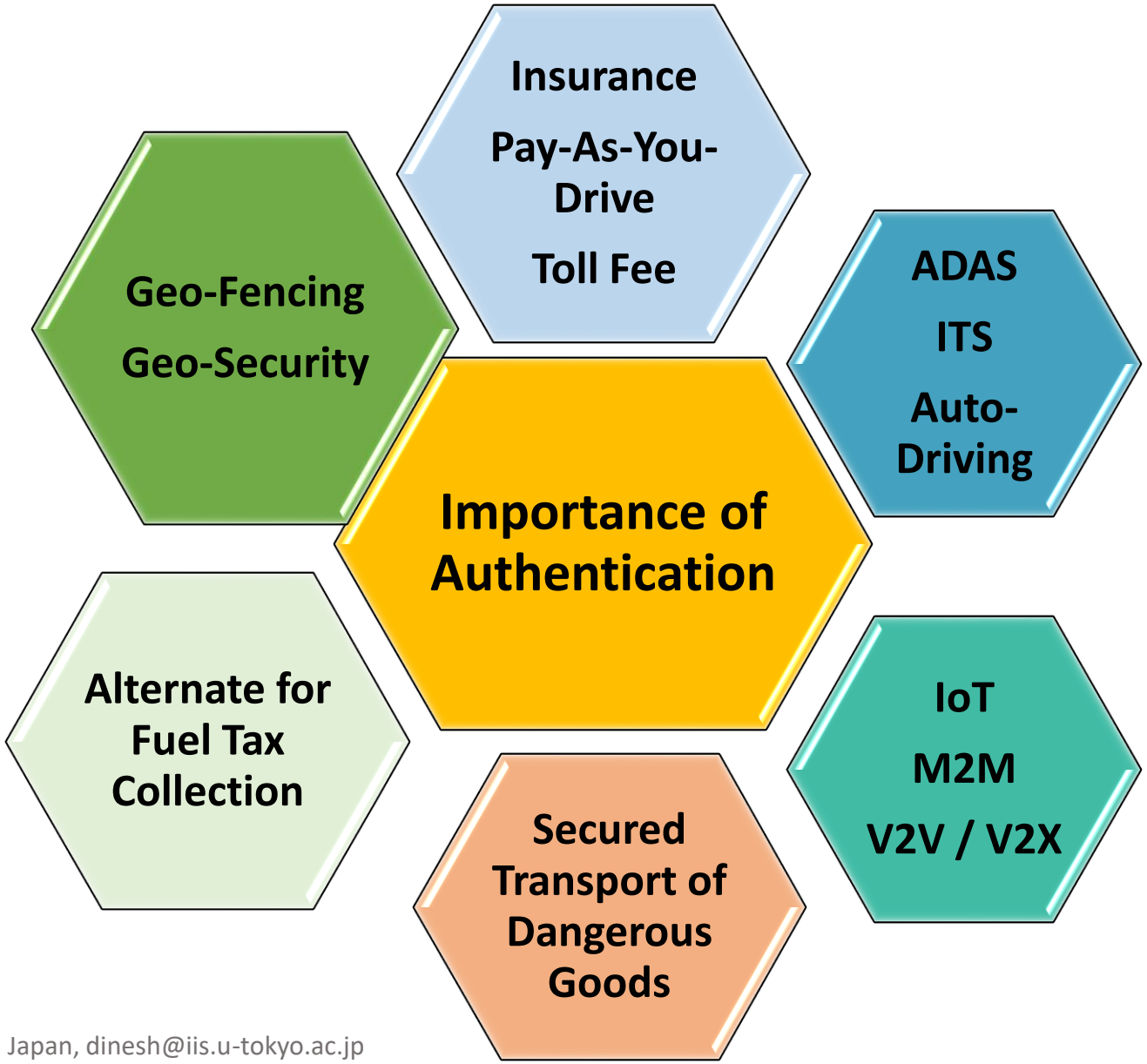
Self-Spoofing
Connect by cable, No Real Signal,

Self-Spoofing
Connect by cable, Real Signal Present

Self or 3rd Party Spoofing
Over the air transmission



Why Authentication is Necessary ?



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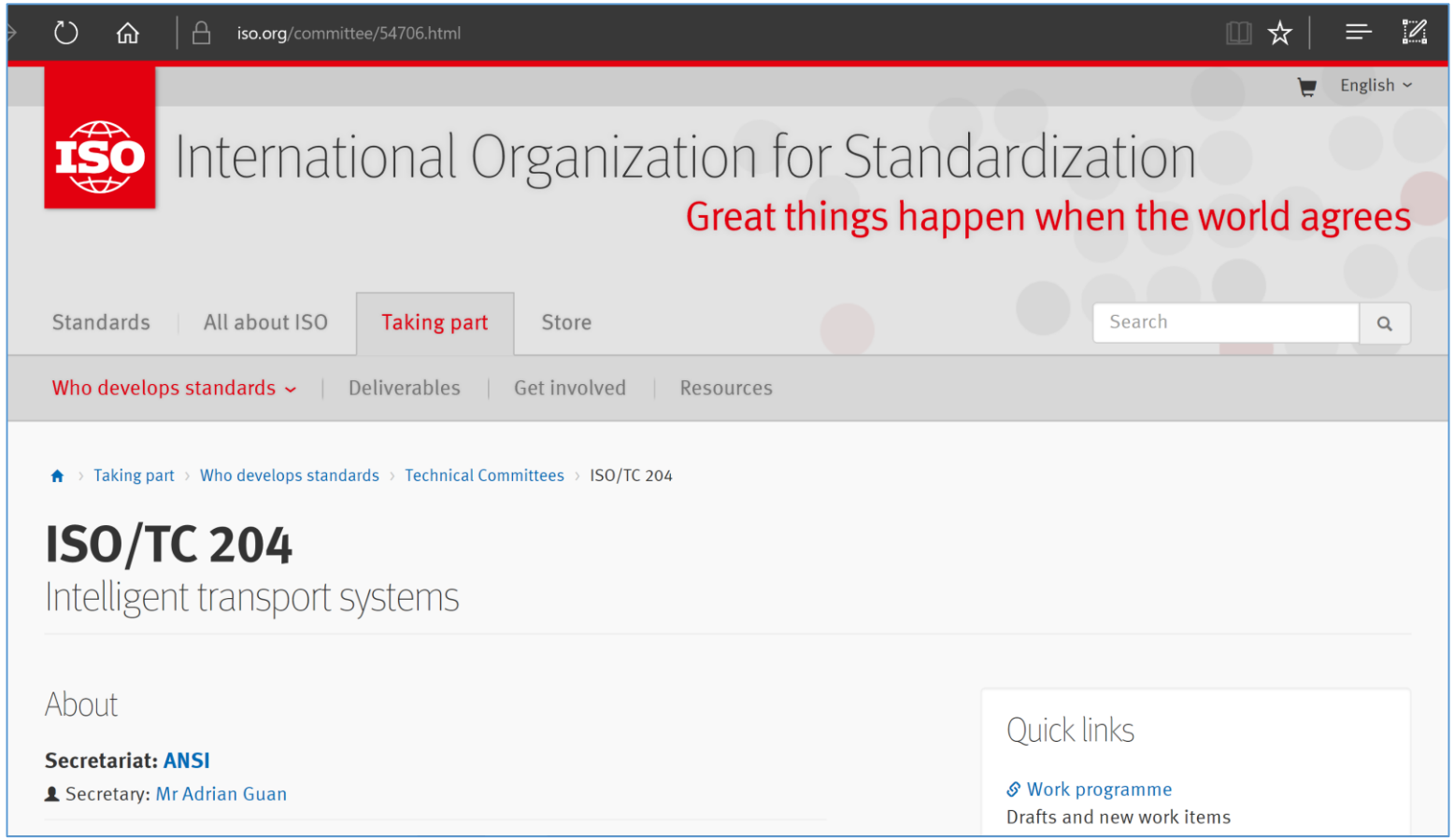
ISO/TC204 WG-18

- **Discussions in ISO/TC-204, WG18 from this year**
  - **To Draft regulations for ITS-S related with PVT Data**



We can solve the problem of Spoofing by Signal Authentication

Dinesh Manandhar, The University of Tokyo, Japan, dinesh@iis.u-tokyo.ac.jp

Concept of Signal Authentication

Broadcast a Digital Signature Data in the QZSS Navigation Message

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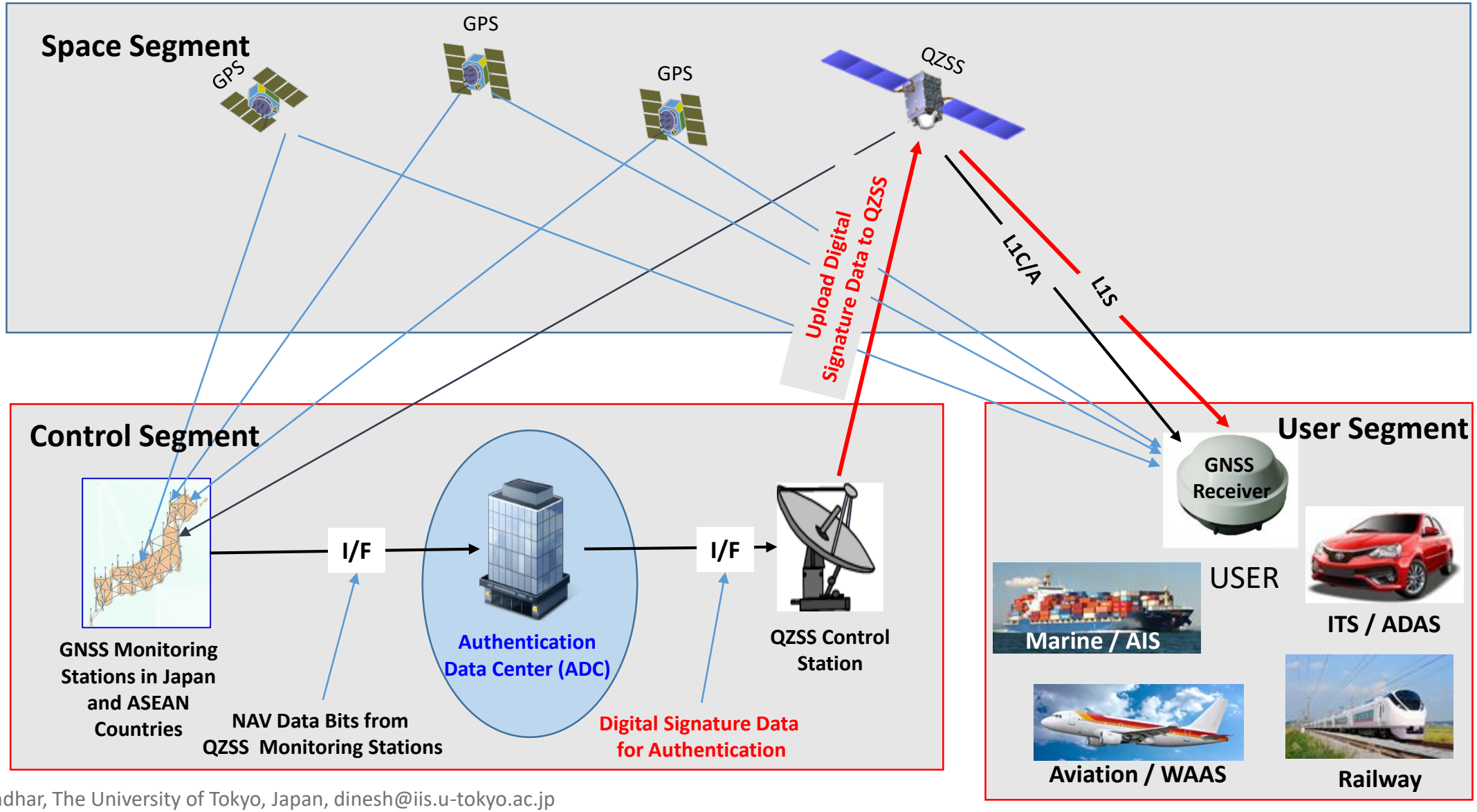
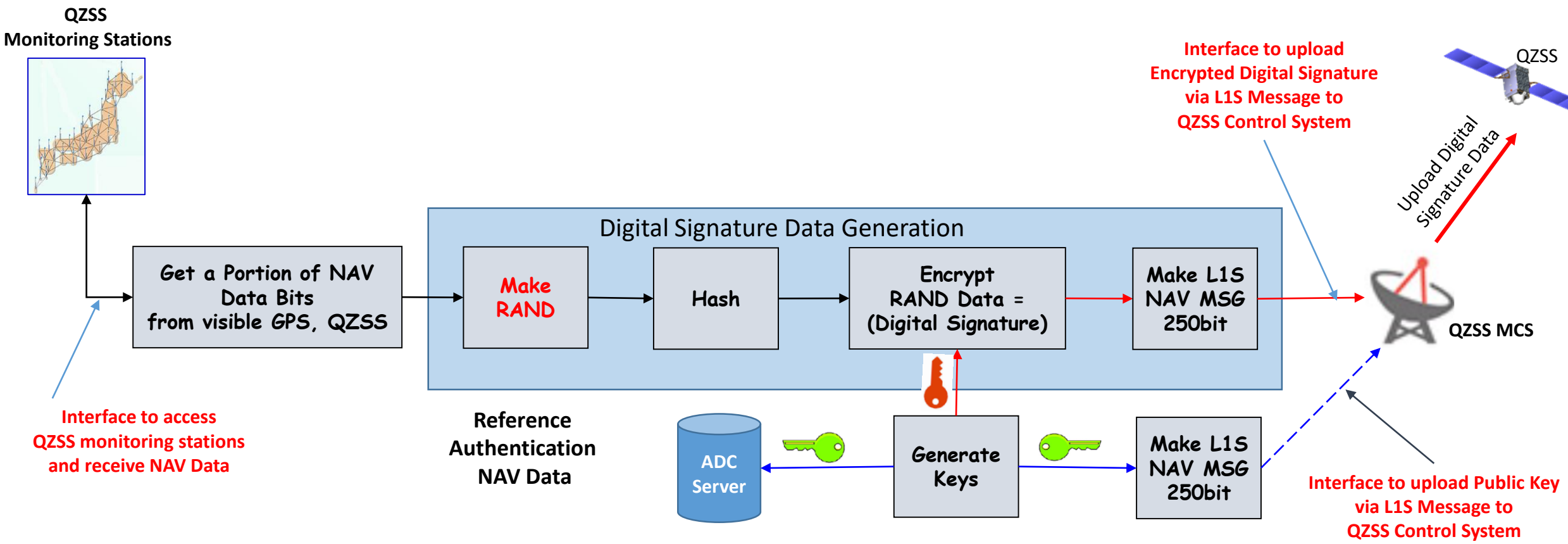
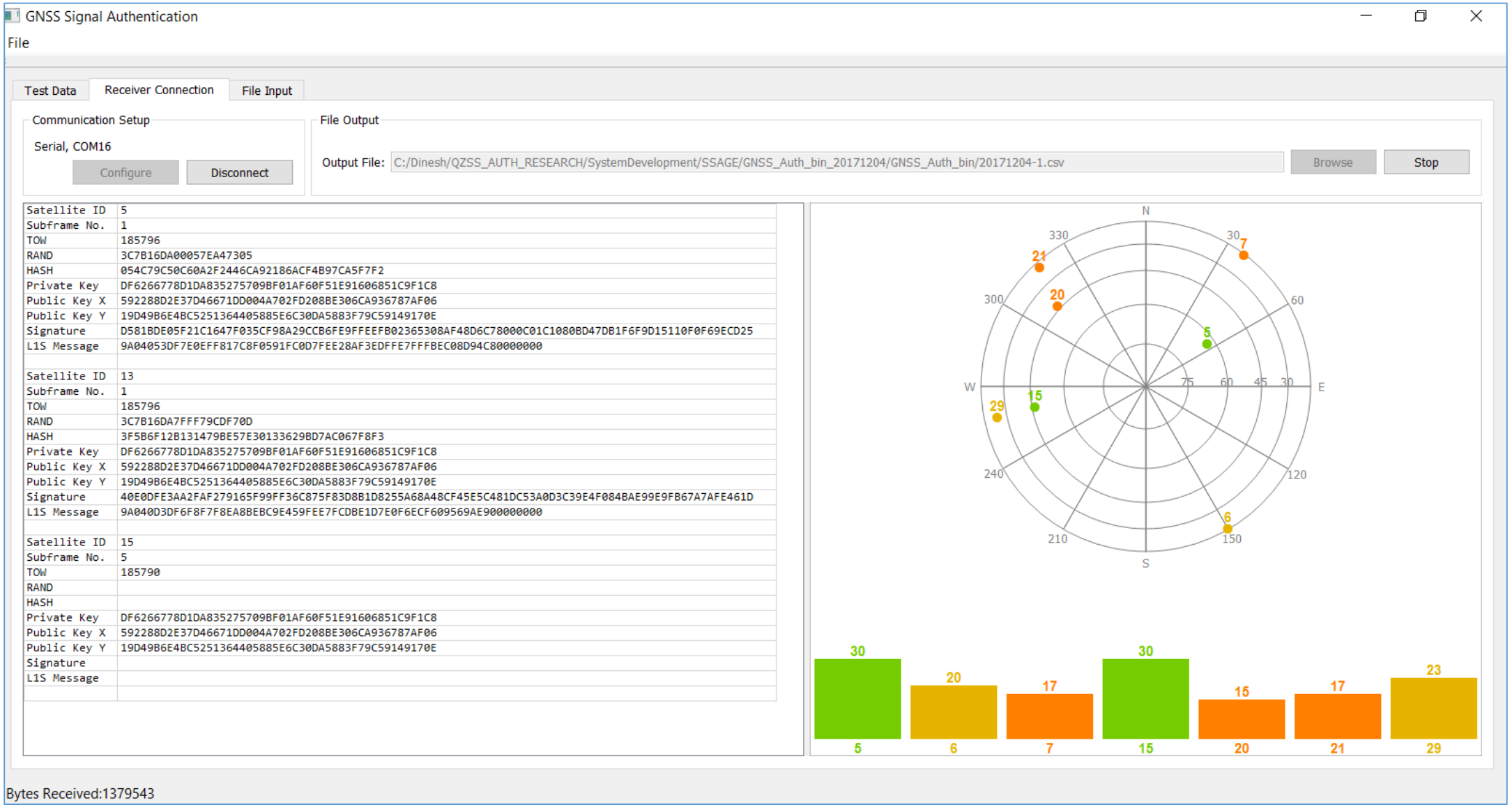
Authentication System Architecture



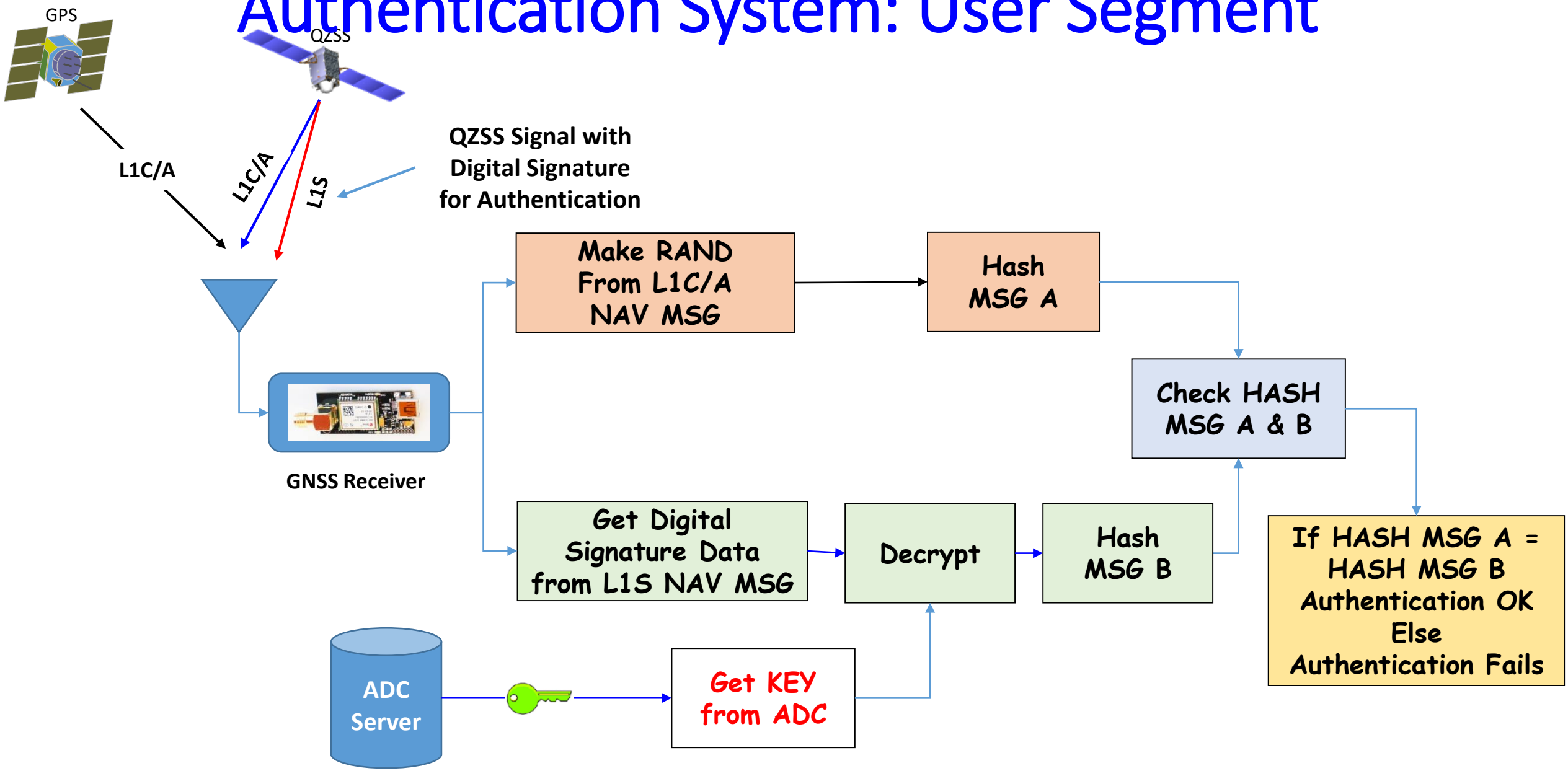
Authentication System: Control Segment Development



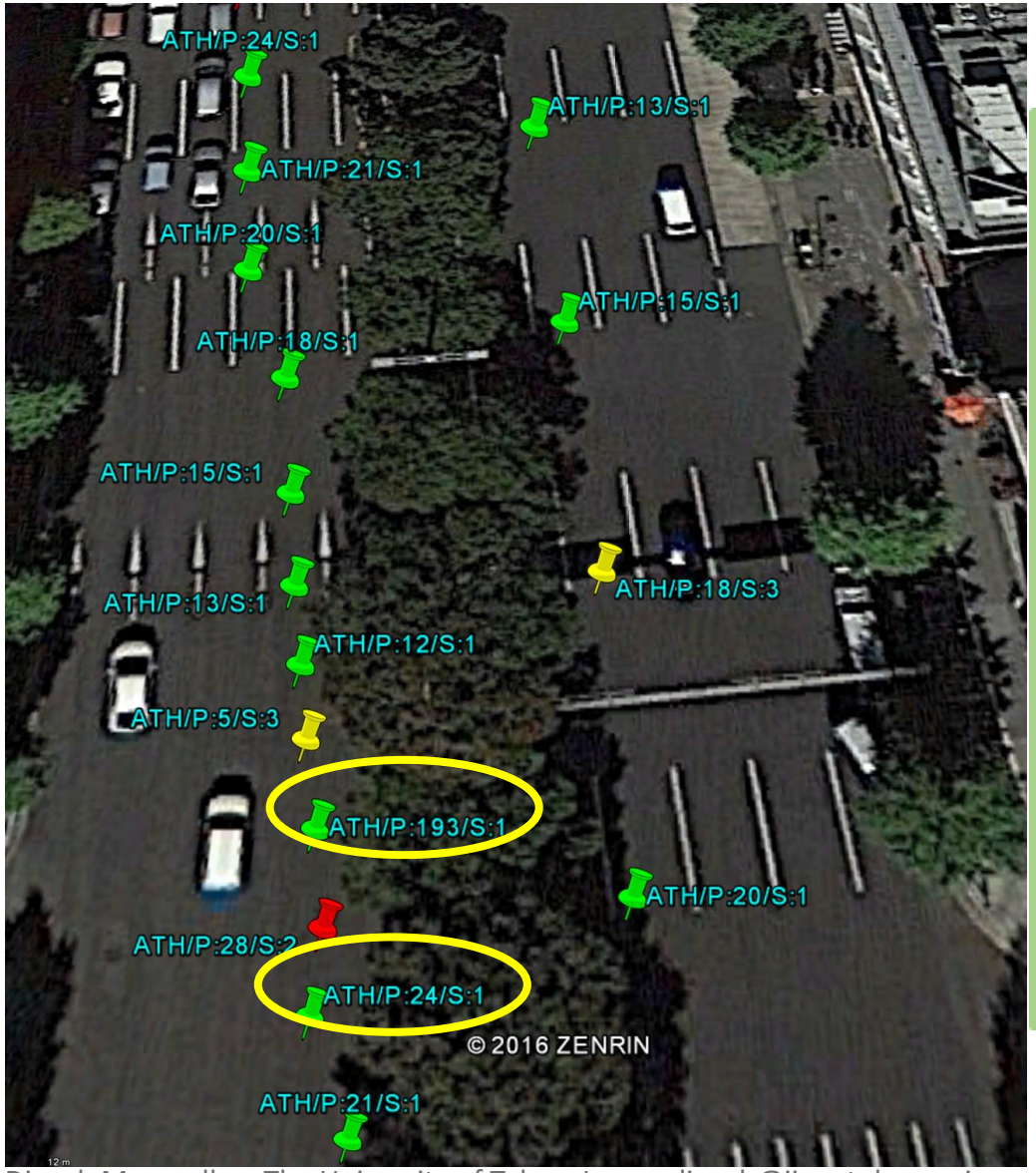
Digital Signature Generation for Authentication



Authentication System: User Segment



Real-time Authentication Test by Car Driving



ATH/P:24/S:1

Variable	Value
TIME	07:28:56
PRN_ID	24
NO of SAT	5
LONGITUDE	[redacted]
LATITUDE	
IODC	
DIST_T[m]	1026.66
DIST_P[m]	5.197
STATUS	1

Directions: To here - From here

ATH/P:28/S:2

Variable	Value
TIME	07:28:57
PRN_ID	28
NO of SAT	5
LONGITUDE	[redacted]
LATITUDE	
IODC	
DIST_T[m]	1030.07
DIST_P[m]	3.41
STATUS	2

Directions: To here - From here

ATH/P:193/S:1

Variable	Value
TIME	07:28:58
PRN_ID	193
NO of SAT	5
LONGITUDE	[redacted]
LATITUDE	
IODC	
DIST_T[m]	1034.32
DIST_P[m]	4.25
STATUS	1

Directions: To here - From here

Authentication Signal is broadcasted from QZSS L1S signal for 3 months on various occasions for Live Authentication Test.

Thanks to JAXA for broadcasting Test Authentication Signal.

Dinesh Manandhar, The University of Tokyo, Japan, dinesh@iis.u-tokyo.ac.jp

Summary

- **QZSS Signals can be used to Authenticate GPS and QZSS Signals**
  - **Other GNSS signals also possible**

- **This method can be implemented without any impact on HW**
  - **Only Software/Firmware modification in the control and user system**