THE ACADEMY OF SCIENCES OF TURKMENISTAN
OGUZ HAN ENGINEERING AND TECHNOLOGY UNIVERSITY OF TURKMENISTAN

Cyberphysical Systems Faculty
Nano And Biomedical Electronics Department

Blockchain based Cybersecurity in IoT Systems and Smart Home

GRADUATION THESIS

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THE AIM OF PROJECT:

To develop the smarter and more complicated immutable way to secure the Smart Home users, citizens of Smart City and to strengthen the Cybersecurity

The main components of a project:

- Raspberry Pi or other microcomputer
- Arduino Uno
- Esp8266
- Routers
- Switches
- Other electronic components that was build upon the whole system

Blockchain based Cybersecurity in IoT Systems and Smart Home

Muhammetberdi Jepbarov

Cyberphysical Systems Faculty

Shortly about IoT

Examples of use:

1. Autonomous systems
2. Greenhouse
3. Smart Home
4. Industry 4.0 Robots
5. Transportation
6. etc.

Great opportunities of IoT

Time saving

Recycling, Green Technology

Security & Monitoring

Data storage, Cloud platform

Big Data & Neural Networks

My experience

Few projects where I used the IoT

1. Car parking system
2. Remote controlled robots
3. Smart Home system
4. Greenhouse combined with a Smart Home
5. Wall sockets / Lights control
6. Conditioner / Heater control
7. Irrigation
8. Incubator
9. Door lock
10. Traffic Lights

mike@mike-labs: ~
File Edit View Search Terminal Help
error, device is not supported for current actionmike@mike-labs:~$ curl --header
"Content-Type: application/json" \
> --request POST \
> --data '{"command":"socket","pins":[{"command":"socket1","action":"1"},{"comma
nd":"socket2","action":"1"}]}' \
> http://192.168.1.252/esp/JsonToArg/
error, couldn't make a device typeId=2 request (connection issue)mike@mike-labs:
~$
mike@mike-labs:~$ curl --header "Content-Type: application/json" --request POST
--data '{"command":"socket","pins":[{"command":"socket1","action":"1"},{"command
":"socket2","action":"1"}]}' http://192.168.1.252:5000/esp/JsonToArg/
error, couldn't make a device typeId=2 request (connection issue)mike@mike-labs:
~$
mike@mike-labs:~$ curl http://192.168.1.252:5000/scanNetwork/
scanning donemike@mike---header "Content-Type: application/json" --request POST
--data '{"command":"socket","pins":[{"command":"socket1","action":"1"},{"command
":"socket2","action":"1"}]}' http://192.168.1.252:5000/esp/JsonToArg/
error, couldn't make a http://192.168.1.252:5000/scanNetwork/
curl: (52) Empty reply from server
mike@mike-labs:~$ curl http://192.168.1.252:5000/scanNetwork/
scanning donemike@mike-labs:~$

intel
inside

GCT
GCT
HDMI

RandomNerdTutorials
ADC0
RESERVED
RESERVED
SDD3 GPIO10
SDD2 GPIO9
SDD1 MOSI
SDCMD CS
SDD0 MISO
SDCLK SCLK
GND
3.3V
EN
RST
GND
Vin
GPIO16 WAKE
GPIO5 SCL
GPIO4 SDA
GPIO0 FLASH
GPIO2 TXD1
3.3V
GND
GPIO14 SCLK
GPIO12 MISO
GPIO13 MOSI RXD2
GPIO15 CS TXD2
GPIO3 RXD0
GPIO1 TXD0
GND
3.3V
RST
FLASH

IN
OUT
AC 220V
L
N
+3.3V
+12V
GND
+5V
SW
NANOELECTRONICS & IoT
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Cybersecurity

Breakdown of top IoT threats

Data source: unit42.paloaltonetworks.com—2020 unit 42 IoT threat Report

Security Standards

The Security layer of current version of Smart Home

Manufacturing
Distributed Database
Headquarters
MFG.EXAMPLE.COM
HQ.EXAMPLE.COM
SALES.EXAMPLE.COM
Sales

Blockchain

Programmable
A blockchain is programmable (i.e. Smart Contracts)
Distributed
All network participants have a copy of the ledger for complete transparency
Secure
All records are individually encrypted
Immutable
Any validated records are irreversible and cannot be changed
Anonymous
The identity of participants is either anonymous or pseudonymous
Unanimous
All network participants agree to the validity of each of the records
Time-stamped
A transaction timestamp is recorded on a block

Smart Home systems network with Blockchain nodes

Conclusion

The system works flawlessly using the base architecture, even if it could keep upgraded to get the client needs. The Blockchain part is implemented as a hashing, but it also requires to be developed for a better security and speed.

The availability of the Blockchain doesn't mean that it is important to use it, but it's one of the ideas and solutions that could live or probably lives somewhere in the other analogs of the Smart Home system. Every software written and every data transfer ever done has to be secured and encrypted, cybersecurity became one of the main parts in every IT field.

With this project the future development, expanding of functions, a wider range of usage and connections becomes possible. Additionally, the connection of Smart devices and Smart Home in a module-based architecture makes it much more flexible.