

# A Forensic Data Analysis of a Bluetooth Device paired with an Android-based Audio Video Navigation System

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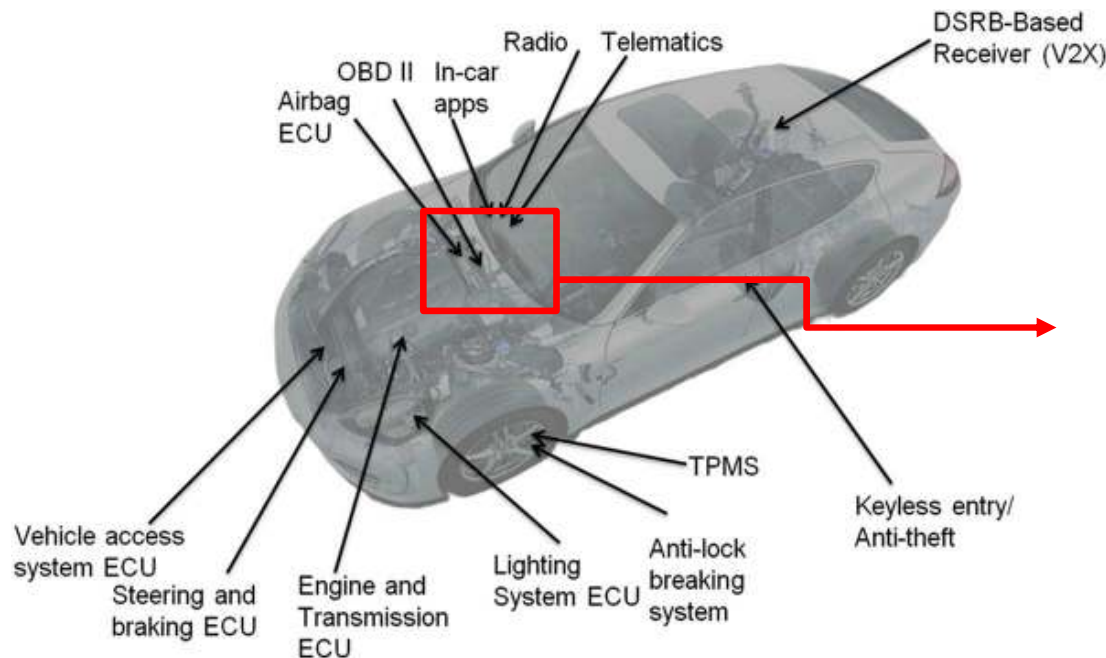
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# Introduction

- The number of traffic accidents in the death is increasing every year, Accordingly, there are growing interests in research on Car Forensics.
- Recently, Car trend (connected car, Self-driving) requires that new hardware.
  - Engine Control Unit (ECU), Transmission Control Unit (TCU), Audio-Video Navigation (AVN) record various event information including driver's behavior
- Specially, AVN provides various convenient features to a driver.
  - Usually, driver pairs own mobile device to AVN via Bluetooth to using convenient features (Call, Play music, SMS etc...)



# Collecting User Data in Android OS-Based AVN

- Target : KIA K5(Android 4.2.2, Jelly Bean)
- To collect from Android OS-based AVN, we obtained an ADB(Android Debugging Bridge) shell through USB connection
- To access userdata(/data) in android OS, we should obtain root privilege shell
  - No way for rooting Android OS based AVN System(Custom Recovery, Tool etc..)
  - Because Android developed on the Linux Kernel, We can exploit the vulnerability of the Linux Kernel to escalate privileges (CVE-2016-5195, Dirty-CoW)
- Finally, We acquired various artifacts(Bluetooth log, Media, DMB, Navigation) from userdata(/data) section

| Artifacts                             | File Location                             |
|---------------------------------------|-------------------------------------------|
| Bluetooth Logs<br>(Bluetooth History) | /data/data/com.android.provider.bluetooth |
| Media Play from USB                   | /data/data/com.android.providers.media    |
| DMB History                           | /data/data/com.lge.ivi.dmb                |
| Navigation Logs                       | /data/data/com.mnsoft.navi                |



# Analysis of the collected user data

- We mainly analyzed the data recorded by Bluetooth pairing between AVN and user mobile device
- The userdata stored in the directory name “/data/data/com.android.provider.bluetooth” of the AVN system image
- We obtained various artifacts about Mobile Device Connected to Bluetooth
  - Mac Address, Device Name, Phone Book, Recent Call History
- Because artifacts stored .db file format, we used “DB browser for SQLite” tool

| Artifacts                                             | Location and File name      | Table           | Attribute |
|-------------------------------------------------------|-----------------------------|-----------------|-----------|
| Mac Address of Mobile Device Connected to Bluetooth   | /databases/BTSetup.db       | BTDevList       | Address   |
|                                                       | /databases/BTContacts.db    | Switch_index    | dev#_name |
|                                                       | /databases/BTFavorites.db   | Switch_index    | dev#_name |
|                                                       | /databases/BTCallHistory.db | Switch_index    | dev#_name |
| Device Name of Mobile Device connected to Bluetooth   | /databases/BTSetup.db       | BTDevList       | devname   |
| Phonebook of Mobile Device connected with Bluetooth   | /databases/BTContacts.db    | Dev#contacts    | -         |
| Recent Call of Mobile Device connected with Bluetooth | /databases/BTCallHistory.db | Dev#CallHistory | -         |



# Analysis of the collected user data(Example)

- MAC Address, Mobile Device Name of Mobile Device Connected to Bluetooth

Table: BTDevList 5 entries Page 1 of 1 Export to CSV

| _id | devname         | address           | status | a2dp_st... | avrcp_s... | priority |
|-----|-----------------|-------------------|--------|------------|------------|----------|
| 62  | iPhone (Gemein) | 6C:AB:31:27:32:F9 | 0      | 0          | 0          | 0        |
| 63  | iPhone (B-Wel)  | 3C:2E:FF:A2:2F:55 | 0      | 0          | 0          | 0        |
| 65  | 스마트폰            | 34:A8:E8:20:04:21 | 0      | 0          | 0          | 0        |
| 66  | 갤럭시 노트 10       | 74:9E:F5:0D:57:33 | 0      | 0          | 0          | 0        |
| 68  | 네거프의 Galaxy S21 | 78:46:D4:51:56:1C | 2      | 2          | 0          | 1        |

- Recent Call of Mobile Device Connected to Bluetooth

테이블(T): Dev5CallHistory

|    | _id  | vcard_version | storage | type     | name | fname | nickname | tel_type | number          | date_time ▲1   |
|----|------|---------------|---------|----------|------|-------|----------|----------|-----------------|----------------|
|    | 필터   | 필터            | 필터      | 필터       | 필터   | 필터    | 필터       | 필터       | 필터              | 필터             |
| 1  | 9341 | 2.1           | 0       | DIALED   | NULL | 이영우   | NULL     | CELL     | 0102-78-...-1   | 20210728150928 |
| 2  | 9342 | 2.1           | 0       | DIALED   | NULL | 이영우   | NULL     | CELL     | 0104-607-...-43 | 20210728130845 |
| 3  | 9441 | 2.1           | 0       | RECEIVED | NULL | 이영우   | NULL     | OTHER    | 070-7872-...    | 20210727145313 |
| 4  | 9343 | 2.1           | 0       | DIALED   | NULL | 이영우   | NULL     | CELL     | 01082-...-1     | 20210727131619 |
| 5  | 9442 | 2.1           | 0       | RECEIVED | NULL | 이영우   | NULL     | CELL     | 01082-...-1     | 20210727131531 |
| 6  | 9443 | 2.1           | 0       | RECEIVED | NULL | 이영우   | NULL     | OTHER    | 031-803-...-44  | 20210727110122 |
| 7  | 9444 | 2.1           | 0       | RECEIVED | NULL | 이영우   | NULL     | OTHER    | 061-882-...-2   | 20210727105604 |
| 8  | 9445 | 2.1           | 0       | RECEIVED | NULL | 이영우   | NULL     | OTHER    | 0102-78-...-1   | 20210727094918 |
| 9  | 9391 | 2.1           | 0       | MISSED   | NULL | 이영우   | NULL     | OTHER    | 0102-78-...-1   | 20210727092133 |
| 10 | 9392 | 2.1           | 0       | MISSED   | NULL | 이영우   | NULL     | OTHER    | 0102-78-...-1   | 20210727092025 |

# Conclusion

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- We studied the collection and analysis of the communication data between KIA K5 and mobile device via Bluetooth connection
- Except Bluetooth connection history artifacts, other various artifacts exist
- We plan to investigate Navigation record, DMB records, and media usage
  - Also, plan to build automated tools for AVN data analysis

# Thank You !

"This research was supported by Basic Science Research Program through the National Research Foundation of Korea(NRF) funded by the Ministry of Science and ICT (no. 2021R1A2C2012574), also supported by Research Program funded by the Supreme Prosecutors' Office of the Republic of Korea (SPO), and supported by the MSIT(Ministry of Science and ICT), Korea, under the National Program for Excellence in SW(2017-0-00091) supervised by the IITP(Institute of Information & Communications Technology Planning&Evaluation) in 2021"

