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Research paper



A study on preventive system against recidivism of retaliatory crime using IOT-based smart watch

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Abstract

Background/Objectives: The study recognizes a seriousness of recidivism of retaliatory crimes and, in order to resolve the issue, proposes a preventive system against recidivism of retaliatory crimes by utilizing a IOT-based smart watch, which enables minimization of damage from retaliatory crimes and crime prevention.
Methods/Statistical analysis: In a discussion of retaliatory crimes and a smart watch, formal statistical figures from the National Police and the Supreme Prosecutors' Office were observed and a system module has been established, enabling minimization of damage from retaliatory crimes by additionally editing functions based on a preexisting module, a smart watch operation method for personal protection currently in-use by the National Police, so that a possibility of a retaliatory crime occurrence can be detected.
Findings: The society recently has recognized the seriousness of retaliatory crimes in relation to Stalking, dating violence and domestic violence, and has actively strived for precautionary and responsive measures against retaliatory crimes with judicial authorities. Therefore the preventive system against recidivism of retaliatory crimes by using a IOT-based smart watch let received data from victims wearing a smart watch with sensors be transferred to a monitoring module. Particularly, not only having sensors, the smart watch has additional functions to record and film the scene automatically and to minimize an error range of location tracking and appoint a specific building position. Then, a chance of possible recidivism of retaliatory crime occurrences related to the received data from a smart watch is determined within the monitoring module. If any possible retaliatory crime occurrence is expected, a crime responding module is activated, otherwise, the received data is deleted. Furthermore, the collected data from the crime responding module and from those who are wearing a smart watch are stored in an integrated DB and are used to improve countermeasures against future retaliatory crimes.
Improvements/Applications: The system can identify the chance of recidivism of retaliatory crimes in advance through a monitoring module and a smart watch equipped with various sensors. Furthermore, the crime responding module is performed in 4-phases, which ensures sufficient time for the police to be mobilized, delays criminal acts, minimize damage from the crimes and enables rapid countermeasures.

Keywords: *Smart Watch; IOT; Retaliatory Crime; Monitoring Module; Crime Responding Module.*

1. Introduction

Recently, the society has been putting its best effort to prevent crimes through cooperation among each government agencies including judicial authorities to prevent recidivism of retaliatory crimes since the seriousness of the retaliatory crimes has been recognized. However, despite the fervent effort to prevent retaliatory crimes including domestic violence and dating violence by the judicial authorities, the retaliatory crime rate and recidivism rate has consistently been increasing every year. According to the real data survey by the National Police, retaliatory crime incidences increased by approximately 38.8% in number over the past 4 years from 2013 to the mid-2017 and, for the past 5 years (2013~2017.8), the number of retaliatory crime incidences was 1,328 – that is, about 5.5 incidences every week [1].
In addition, in terms of recidivism rate of retaliatory crimes, the rate of recidivism by domestic violence criminals increased by 20 times over the past [4] years from 2012(218 criminals) to 2016(4,257 criminals) and, for recidivism of dating violence, the recidivism has reached 76.5% on average in 2014 [2], hence the seriousness of recidivism of retaliatory crimes is recognizable – but no feasible measure to prevent the recidivism is being practiced.
Thus, the paper recognizes the seriousness of increasing retaliatory crimes and recidivism and, to solve the issue, proposes a system module enabling a rapid response and prevention against retaliatory crimes by having various sensors be equipped in a pre-existing smart watch.
The preventive system against retaliatory crimes by using an IOT-based smart watch, with various sensors, consistently detect any possible abnormal body symptoms when there is a possibility of a victim with a smart watch being involved in a crime via a monitoring module, which results in a minimal loss of lives from recidivism of retaliatory crimes and a more rapid phased-countermeasure. The system implementation checks the received data from the wearer with a smart watch and various sensors through a monitoring module and activates an appropriate crime responding module to respond to each crime situation in phases when a chance of crime incidence is expected based on the confirmed data in the monitoring module. Then, eventually, the data is stored in an integrated DB so that it can be utilized for more rapid counter-measures against future possible retaliatory crimes.

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2. Related works

2.1. Discussion on retaliatory crimes and smart watches

A retaliatory crime is, when a person is heard of a report of a hate incidence or news towards a group which the person belongs to, an avenge in a form of a crime against the group member who initiated an issue [3]. That is, it can be defined as a crime to revenge surroundings or staters in response to reports, testimonies and statements by members concerned with the crime, such as victims, witnesses and testifiers, or people who are completely unrelated to the crime [4].
Categorizing the types of retaliatory crimes, there are divisions of cases which victims, such as reporters and witnesses, were the staters who reported to investigative agencies or had testified in a court regarding a criminal fact without any direct damages by criminals or victims who were previously harmed directly by criminals [5].
Currently, Korea has offered smart watches with a location tracking function for a personal protection when victims requested since 2015 to respond to retaliatory crimes including domestic and dating violence [6].
Pre-existing smart watch operation method automatically contact the pre-designated guardian at the same time of a case received through a situation room of the National police, when victims in a danger of retaliatory crimes press their smart watches, as presented from Figure 1. Then mobilization of police is performed after CCTV record and current situation are identified in the situation room of the National police and a patrol division under jurisdiction is contacted [7].

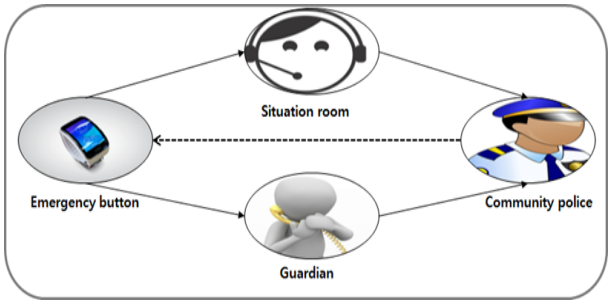


Fig.1: Smart Watch Operation Method.

2.2. Conditions of retaliatory crime occurrences and smart watch distribution

As shown in Table 1, the number of retaliatory crime incidences increased as 229 in 2012, 232 in 2013, 243 in 2014 and 339 in 2015, with a dramatic gap at the last period and 230 incidences occurred by August 2016 – being close at 1 incidence per day[8]. Furthermore, analyzing by types, victims and witnesses are exposed to the secondary violent crimes – 396 incidences for retaliatory threats, 214 incidences for retaliatory violence and 159 incidences for retaliatory injuries[9]. However, despite such increases in retaliatory crimes, distribution of smart watches is diminishing, in fact.

Table 1: Conditions of Retaliatory Crime Incidences and Smart Watch Distribution

Classification	2012	2013	2014	2015	2016 (6)
Arrest Condition of Retaliatory Crimes	229	232	243	339	230
Distribution Condition of Smart Watches	628	293	290	105	3

Moreover, each possibility of recidivism of retaliatory crimes varies by types. As shown in Table 2, it was perceivable that there is a higher chance of recidivism of retaliatory crime when the retaliatory crime has occurred in a form of stalking. In other words, the initial cause of retaliatory crimes as stalking leads to 46.9% of consistent recidivism rate that is higher than other forms of domestic violence, drunken violence and common crime [10], [11].
Therefore, retaliatory crime of a crime is highly likely to occur, and such an issue implies that the crime may be developed to more serious crime putting the victims to deaths.

Table 2: Persistency of Retaliatory Crimes by types (percentage)

Persistency of Retaliatory Crimes	Crime Type				Total
	Common Crime	Domestic Crime	Stalking	Drunken Violence	
One-time	75.2	66.7	53.1	69.7	70.5
Persistent	24.8	33.3	46.9	30.3	29.5
Total	100	100	100	100	100

3. Proposal model of a preventive system against recidivism of retaliatory crimes by using an IOT-based smart watch

Chapter 3 proposes a preventive system against recidivism of retaliatory crimes by using an IOT-based smart watch, resulting in minimal damage from a crime and even the crime prevention by allowing a precautionary forecast of retaliatory crimes through inputs of additional functions into the pre-existing smart watches of the National Police, made for personal protection uses of victims.
As shown in Figure2, The system structure consists of 4 components – a smart watch with various sensors to implement a preventive system against retaliatory crimes for a minimal damage from the crimes and quicker responses, a monitoring module to check the chance of crime incidence rate based on provided data from the smart watch, a crime responding module to appropriately deal with crime situations in phases when a possibility of retaliatory crime occurrence is expected via the monitoring module and, lastly, an integrated DB which analyzed crime process data can be stored and be used for more rapid future responsive measures against retaliatory crimes.

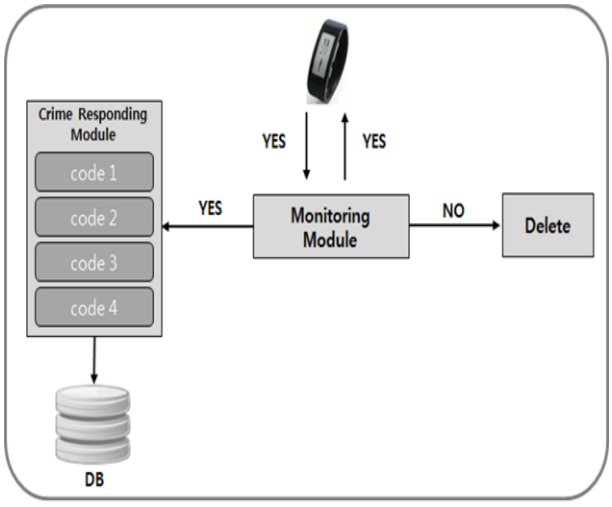


Fig. 2:.Proposed Model of a Preventive System against Recidivism of Retaliatory Crimes by using an IOT-based Smart Watch.

3.1. System components and functions

3.1.1. Smart watch

Sensors to measure pulse, heart rate, body temperature, voice and physical movement, GPS to display real-time location data and WIFI to identify an accurate location in buildings and underground passes are built in a smart watch that is worn by a potential victim of retaliatory crimes. Functions not only to forcibly receive

data, but also to automatically film and record the scene, and to generate alarming sound in case of emergency are equipped.

3.1.2. Monitoring module

The received data from the smart watch leads to determination of crime occurrence possibility, and if the chance of retaliatory crimes is identified to be feasible, a crime responding module is activated, otherwise, the received date is all deleted.

3.1.3. Crime responding module

After verification of detected data is processed by the monitoring module, the crime responding module activates 4 different phased crime responding codes appropriately in response to different situations with potential retaliatory crime symptoms identified.
Crime Responding Module activation sequence is set as follows.

1) The smart watch on the wearer generates alarming sound and activates the 1st phase crime responding code having forcible receiving mode be operated.
2) Location notification and urgent details are sent to civil crime watches near the smart watch wearer when the 2nd phase crime responding code with a text message alarm service offered.
3) The 3rd phase crime responding code is activated, automatically filming and recording the current scene.
4) Location notification and urgent details are sent to near police officers and let them be mobilized at the 4th phase crime responding code.

3.1.4. DB

The processed data since the activation of crime responding module against retaliatory crimes is stored in an integrated DB and be used to deal with future crimes. The integrated DB contains data of crime location, time and behaviors and abnormal body symptoms which are detected when the smart watch wear encounters a crime scene, therefore can be used for a comparative analysis

3.2. Proposed system model

The preventive system against recidivism of retaliatory crimes by using an IOT-based smart watch can be implemented as follows.

1) Wear a smart watch with sensors attached.
2) Transfer the date being generated from the worn smart watch to the monitoring module.
3) Verify the possibility of retaliatory crime incidence based on the received data via the monitoring module.
1) If there is no possibility of retaliatory crime incidence, the crime responding module is not activated and the received data is all deleted.
2) If there is a possibility of retaliatory crime incidence, the phased crime responding module is activated.
4) Crime responding module is activated in phases
1) Alarming sound and forcible receiving mode are activated through the smart watch.
2) Location and emergency text message notification is sent to near civil crime watches.
3) Current situation is automatically filmed and recorded.
4) Mobilization of police officers.
5) Store the captured or received data from smart-watches on wearers and crime responding modules into the integrated DB.

4. Evaluation of the proposed system

As shown in Table 3, this chapter evaluates the pre-existing module of smart watch system made by the National Police and for prevention of retaliatory crime and newly proposed preventive system module using an IOT-based smart watch in the paper, then review the operational differences and functions between the two modules.

Table 3: Evaluation of the Proposed System

Category	Existing System	Proposed System
Smart Watch	Sensors(X)	Sensors(O)
Monitoring Module	X	O
Crime Responding Module	Dualistic Operation Method	4-phased Crime Responding Code Activation Method
Integrated DB	X	O
Expected Result	Post-Counteraction Method	Preliminary Preventive Method

Above all, in terms of functions and operations of smart watches, the pre-existing module does not have sensors be attached, thus, it is difficult to minimize damages from recidivism of retaliatory crimes as pre-symptoms of retaliatory crimes are not easily detected and there is a weakness that an accurate location tracking is difficult when smart watch wearers enter inside of buildings or underground. Contrastingly, the newly proposed module can detect abnormal body symptoms from recidivism of retaliatory crime incidences by having various sensors attached and particularly designate an accurate location of building with lessened error range for location tracking via GPS and WIFI. Furthermore, as it incorporates functions to generate alarming sounds, warning text messages and to automatically film and record the scene, it can be utilized for its admissibility of evidence and responding methods against future retaliatory crimes.
Second, the proposed module has made a difference from the pre-existing module by having a monitoring module function additionally which can identify the data validity whether the received data from smart watches presents any possibility of retaliatory crime incidence. Such a monitoring module activates a crime responding module when it identifies a possibility of retaliatory crime incidence from the received data, otherwise, the received data is deleted at the point of the possibility of recidivism of retaliatory crime is being confirmed.
Third, in terms of operation methods of the crime responding module, for the pre-existing smart watch system, when a smart watch wearer press emergency button due to an occurrence of retaliatory crimes, the police identifies the criminal location and is mobilized, and additionally, when the wearer do not respond to a contact, forcible receiving mode is activated by using the phone call function attached on the device – thereby, resulting in dualistic responsive method. Though, the newly proposed module has subdivided the crime responding method into 4-phased responding method to discourage the drive of criminals to commit crimes, to minimize possible damages from recidivism of retaliatory crimes and to ensure the time for the police to be mobilized to the scene.
Fourth, not in the pre-existing module, but in the newly proposed module, by adding an integrated DB functions, all crime-responding data since an activation of crime responding module and abnormal body symptom data received from smart watch wearers in actual scenes of retaliatory crimes are stored and are used to prevent future recidivism of retaliatory crimes.
Eventually, assessing the expected effectiveness of the systems, the pre-existing modulehas had limitations to minimize damages from retaliatory crimes due to its post-counteraction method. However, the new module is expected to have better and more effective result than the other to minimize damages from recidivism of retaliatory crimes since it incorporates preliminary preventive system against recidivism of retaliatory crimes by operating phased crime responding codes when recidivism of retaliatory is potentially expected and by identifying the possibility of retaliatory incidences based on received data from smart watches with more diversified sensors and functions.

5. Conclusion

As retaliatory crimes from dating violence and domestic violence have hugely increased in recent times, personal protection measures are being strengthen through additional distribution of smart watches to crime victims. Though, the recidivism rate of retaliatory crimes is keep increasing and even leading to disastrous damage putting victims to deaths due to retaliatory crimes. Considering such consequences, preparing a proper system to rapidly respond to and preliminarily prevent the recidivism of retaliatory crime incidences seem to be more significant than ever.

Especially, according to the recent research, among recidivism of retaliatory crimes, the average rate of recidivism by dating violence criminals was 76.5%, and the rate of recidivism by domestic violence criminals was 7.9% in 2016, increased by over 2 times from 3% in 2013. Such increases in recidivism of retaliatory crimes have a high possibility of causing injuries or even losses of lives unlike other initial crimes with threats and violence, hence preliminary prevention and initial responses are critical.

Consequently, considering such seriousness, the paper proposed a module that enables a rapid initial response against retaliatory crimes by operating crime responding module in phases in response to a crime occurrence and minimizes damage from crimes via prior prediction of retaliatory crime incidences by proposing a preventive system against recidivism of retaliatory crimes by using an IOT-based smart watch to minimize the rate of recidivism of retaliatory crimes.

However, as the implementation of preventive system against recidivism of retaliatory crimes by using an IOT-based smart watch aims at preliminarily preventing crimes via prediction of recidivism of retaliatory crimes, follow-up management should necessarily be practiced through legislative measures such as modification of criminals not to commit retaliatory crimes and appropriate measures and supports to victims.

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