

A Secure Smartphone Platform for Efficient Communication in Emergency Situation

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Abstract—In this paper; we introduce novel technique in which effective communication of the Smartphone can be achieved. It is used as a platform to investigate a correlation that exists between securing the Smartphone and efficient emergency communication. We conducted to include several radio technologies, such as cognitive radio (CR). Cognitive radio deals with spectrum resources utilization. Due to the fact that, CR has the capability to adjust spectrum signals by adaptation, which means frequency channels can reorganize themselves more appropriately and also adjust themselves in signal interference issues, finally providing strong signals to process data instantly and more effectively.

General terms: Mobile technology, Design and theory.

Keywords: Secure; Smartphone; communication; emergency; cognitive radio; spectrum; sensing; signal; channel; data

1. INTRODUCTION

Emergency communication with Smartphone is most priority agenda, considered by the US government. Significance advancement has been made, concerning emergency communication with the Smartphone, since the dawn of the September eleven (9/11) terrorist attack, which affected the US and its citizens. [1]. According to Schaffer [1], a department of home land security top official, Smartphone-like capabilities have been identified as emergency communication development which has partnered with the private sector.

Over the past half century, land-mobile such as walkie talkies and other mobile phones devices were the means of communication used by first emergency-responders, the law enforcement officials, and the like. In a typical emergency situation such as earth quake, and other forms of natural disaster, the two-way radio has become indispensable for use; cell phones networks which are often used for that purpose becomes excessively overtaxed.

These land-mobile devices and other types are mostly expensive. Moreover, they do not have the average data acquiring capability which a student can afford from the cell phone. Typically, it becomes a harder task for the first emergency-responders to use, take and send pictures and videos scene with their two-way communication device.

Agencies can save a lot of money, when it comes to obtaining a benefit from the private sector. Based upon that, the government can obtain large economies of scale advantage.

A cellular network with a full capability such as Smartphone platform will be required by the first emergency-responders, which will help them communicate more effectively. Two important regulatory bodies such as Government Emergency Telecommunications Service (GET) and Wireless Priority Service(WPS) provides services by prioritizing federal , state, the local law enforcement , government and emergency calls. A public-safety proposed broadband technology has been created by the government. An amount of \$10.7 billion for national building has been estimated in Government Technology reports.

In view of this, it is prudent to think, and also make a sensible decision, and analyze appropriately where investment ought to be planned and budgeted for research. A proposed model has been decorated, focused on delivering, and is capable of being more cost effective in the long run. Comparatively, it is better than continue to try other things [1].

The issue calls for researchers to investigate on a problem for inadequate data processing which are identified with mobile devices including the Smartphone. A research conducted regarding the issue, revealed that, there is insufficient spectrum sensing [2], for radio spectrum. In another development, a research conducted revealed that, recent radio technologies have not made most resourceful use of spectrum allocations strategies [2]. According to a global research conducted, Cognitive Radio (CR) has gained the attention of most researchers who have verified that, CR is now a novel technology which can be used as a

substitute for providing more efficiently spectrum utilization of radio signals [3].

According to previously reviewed research work, cognitive radio (CR) technology has been used to control radio resources, based on adaptive behavior obedient enough to use radio resources more purposefully with its frequency band [3]. In this paper four factors will be examined, since the Smartphone efficient data acquiring capability is dependent on each factor. In addition, this paper is aimed to address means of improving a factor which has a negative impact on securing the Smartphone, and based upon this, the Smartphone is considered as user valued mobile device. The factors are interference signal source, interference sensing, spectrum sensing and interference signal detection.

2. RESEARCH METHODOLOGY

Review centric research has the capability to maximize theoretical Impact, and primarily contribute to theory based on the facts. They serve as springboard for future research, with a new approach to the topic in a more interesting manner [4]. In order to affirm this capability and also increase the chance that review-centric is viewed favorably, diverse but interrelated research elements can be incorporated in research by their authors. Some challenges and problems identified in manuscript review targeted for Government Emergency Telecommunication Service (GET), and Wireless Priority Service (WPS) should mostly be fundamental issues related to theoretical understanding in a phenomenon. Based upon that, manuscripts must exemplify significance of shortcoming and more challenges given in theories which also explains the phenomenon. In addition, a convincing case is necessary, that must be able to account for future research issues, and approach the problem in a very fundamental manner. Ideally, manuscript under review which merely concludes, calling for future research topic or additional research explanations would not be considered based on the goal of this paper. Furthermore, manuscript under review targeted for the GET, should be able to present a case more convincingly, that challenges the gaps in our understanding. These are mostly ingrained in theoretical shortcomings, more comparably than incorrect issue interpretations of the theory, measurements or even in sampling error. Meanwhile, these issues certainly must be identified and also be addressed in future research; however, they fail to explain the insight type that would be necessary to motivate scholars to invest into that [4].

3. A Typical Smartphone Platform Application

A technology application, which has recently proved useful to all mobile communication, is Life360 Smartphone. Through the use of the application, family members of individuals and victims of natural disaster have confirmed they were satisfied, and emergency

workers have been well alerted; meanwhile, victims previously found it difficult to control and touch the cell phone button [5].

An Individuals who fell as victim to a natural disaster confessed he was not able to reach anyone by using his cell phone, after he got stuck on a road in Mississippi, when he was struck by a deadly tornado which moved toward the direction of his vehicle. The complaint was that after he had made a phone call, he did not receive a signal, and became frightened, since he was heading towards the more danger, and didn't know eventually what would happen to his fate [5]. Even though, he eventually overcame the situation and later got through to reach his family. The question to ask here is how come he was using a latest technology and couldn't get through with his first attempt of using his Smartphone to call and reach his family. An issue like this sometimes seems perplexing, why must such an innovative technology like this fail to work for the first time?

Even though, the Life360 application has been reported to be working efficiently, by most of its guest who have subscribed for its use. Individuals have confessed, they have been successful and eventually bypassed jammed phone lines. Instantaneously, they have been able to receive and also send text message and emails, and regularly, were able to reach their family or the first-emergency responders.

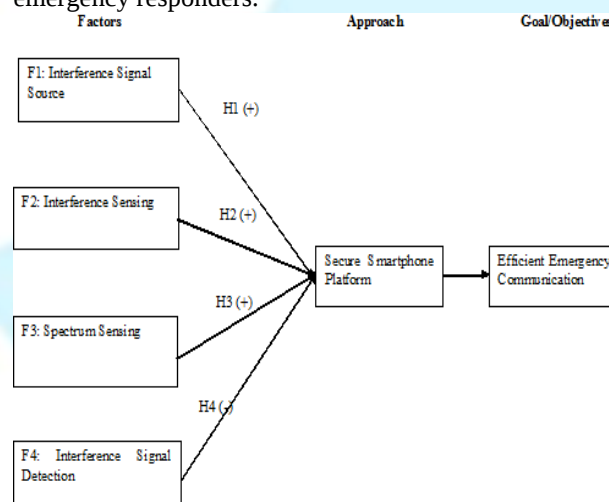


Figure 1: Structured Model for Secure Smartphone Platform for Efficient communication in Emergency Situation

The above model is aimed at reviewing some independent factors which contributes to the development of a secured Smartphone platform, intended for efficient communications delivery in emergency situation. Based on the hypothesis developed, it can be explained that, interference signal source, spectrum sensing, and interference sensing, are factors that positively affects the development of securing the Smartphone. Alternatively, interference signal detection is the only factor which negatively affects the development of securing the

Smartphone. Nevertheless, we believe enhancing interference signal source detection can be considered as a positive factor which will be hypothesized in this paper. Other intensions of this paper will also concern reviewing the correlation between secured Smartphone platform, and efficient emergency communication.

4. A SECURE SMARTPHONE PLATFORM

A secure Smartphone platform is the appropriate mobile device sought for the direction of this research. Due to the fact that there is increase in sales, popular growth and future prediction of growth. Though the Smartphone are more expensive, when compared to other mobile phones of similar functions. The sales of Smartphone shows growth of 75% during the period of 2007 and 2008 [6]. Based upon these facts, it is estimated that the device will have to be dealt more frequent by forensic examiner on regular basis. This is based on the fact that the Smartphone has been identified with multiple functions, which presupposes that information arrangement should be obtained from Smartphone analysis. In the quest for obtaining the information, evidence from the examiner must be in the way such that the evidence can be completely documented. The process of obtaining the evidence by documentation must also be repeated, and it must be able to be tested. This will also enable credibility in the methodology received by the forensic, judicial, and the law enforcement [6].

Examiners have closely followed the investigation model given by the Digital Forensic Workshop (DFRWS). The investigation model is believed to be excessively agreed upon, or an ad-hoc approach is used, when the analysis was done [6, 7].

A problem identified is that, the Smartphone forensic examination issue is not markedly matched with the approach. The DFRWS model development relied on the digital forensic in 2001, and the mobile device was not agreed upon in the process [6]. Consensually, the model could have been accepted and be used as Smartphone general guide; however, unique mobile device issues exist, that is not considered by the model. A recommendation for ad-hoc approach might not be well examined, based on the fact that there is lack of the following: peer-review, rigorous testing, and general acceptance. Consequently, none of these approaches might help in discovering data, questionable integrity, and result validity, and also, pertinent information loss [7].

By examinations, some unique issues pertinent to the Smartphone are as follows [8, 9, 10, 11, and 12]:

- Memory: Data signal can easily damage, due to the fact that there might be insufficient power for the flash memory to contain the signal.
- State of Smartphone: The state of the Smartphone can be any of the following: active, nascent,

quiescent, and semi-active. The device is considered off if only there is no battery in the device.

- Remote Communication: Data signal is subject for alteration based on the capability of the wireless communication media.
- Propriety Communication: Depending on the fact that the Smartphone is not publicly known, its trade is also not yet made known; examiners find it very difficult to understand the system completely.
- Data Processing: Data signal processing is incomplete, which also makes communication with other mobile devices such as Bluetooth, beaming and pin-to-pin be impossible.
- Technology and Advancement: Diverse technology continues to be evolving; new models released every couple of years.
- Standardization: Due to issue of standardization, approximately over fifty (50) manufactures produce various phones of varied platforms.
- Old Model Support: Older Smartphone models are always kept for references
- Accessory: The Smartphone standardized accessories include connectors, which are not yet created; the examiner need to have all accessories that accompanies the device when purchased. Increased security risk exists for the examiner to investigate remotely over wireless signal connection.
- Validity: No mobile tool has been widely accepted due to validity tool issues that persist.

5. INTERFERENCE SIGNAL SOURCE

Currently, a research in cognitive radio (CR) has focused on solving two main issues: the interference signal avoidance in radio communication, and interference sensing. Interference signal avoidance has been identified as accurate methods which include using a matched filter detection, sufficient energy detection, and cyclone – stationary detection [13]. In order to overcome the harmful effect caused by the interference for accurate transmissions, a novel sensing method used in the CR has been proposed used in [14] and [15]. In CR, users for both two ends of the communication of the Smartphone radio transmissions are concerned who will be described here as; Primary user (PU) and the Secondary user (SU). Due to the fact that usually in communication, there is transmitter and a receiver, which corresponds to the PU and the SU role. Also, the SU must make some commitment in the communication, after the PU has initiated a role. The SUs commitment in the CR system transaction is that they must continuously and intelligently search and make resourceful use of idle channel resources, through the use of dynamic spectrum allocation and access principle. Usually, the case is that, due to the lacking feature that most radio are incapable to include the intelligent search, therefore, dynamic spectrum resource allocation are absent [16].

H1: Being able to identify interference signal source, has a positive effect in a Smartphone development that is used to track emergency communication

5.1. Interference Sensing

In a typical spectrum- sensing methodology, the SU need to play a critical role, in order to avoid interference signal sensing. In order for the SU to be able to efficiently access the signal being transmitted by the PUs primary channel, two major roles are necessary. The first roles ensure that signals transmitted from the PUs primary channel, be received by the SU, and must avoid interference. The second role includes gathering previously used communication data, which have already taken place in the primary channel, in order to boost traffic predictions. A research previously conducted suggests that, existing spectrum sensing technologies are incapable of achieving a faultless spectrum [16]. Since network design issues such as physical layer development is beyond the scope of this work, we do not necessarily account on that in this project. However, we assume that sensing transactions generated as result of the SU spectrum channel would be accurate enough, that will establish a primary channel, in order for a secure communication to occur. Due to the development of time slot in our system, the SU eventually senses fully all the data in the primary channel more orderly, thereby transmitting all data which are idle in the channel, making available data for efficient signal transmissions. Based on the result of the transmission which has occurred, the SU continues sensing, and is linked to the remaining of the primary channel, used to continuously predict the channel state in the next time slot [16].

H2: in the development of a secure Smartphone platform, Interference Signal sensing and readjustment has a positive effect in efficient communication delivery in emergency situation.

5.2. Spectrum Sensing

Spectrum sensing methodology of this work can be more related to the SUs role as described previously. Based upon this, it is necessary to describe how these two (PU and the SU) relate with each other in order for them to perform their functions, as required. The SUs role can be more identified as a system that eventually gathers data and learn from its environments, in an intelligent manner such that it can really adjust to its transmissions, in order to fulfill its required criteria. Some of these criteria are link reliability-flexibility, and transmission rate -when undergoing a learning process to receive an outcome. The cognitive radio (CR) entire spectrum sensing and gaining access is categorized into four sections:1) Sniffing; 2) Learning;3) Decision; and 4)Adaptation [16].

1) Sniffing: During sniffing, the surroundings environment radio network relevant information is obtained, and also stored. The stored information includes traffic operations, bandwidth, duration, and channel quality.

2) Learning: In this learning process, analysis of statistical data is acquired, and also, the traffic modeling comprising of the PU, and parameter estimations serving purposefully as a spectrum input sensing and access strategy.

3) Decision: Decision making concerns the determination of the spectrum sensing order. Moreover, the access scheme for the next time unit slot is determined, which also depends on the input parameter values, already obtained from the learning stage.

4) Adaptation: During the adaptation of the spectrum, the transmitter and the receiver parameters are adjusted accordingly, based on the spectrum sensing and the access outputs. In describing a scenario to include the PU, and the SU role, the sniffing process is firstly considered. The SU performs some role using its system channel. The roles are identified as collecting, storing, and updating information, with regard to the target frequency band usage. In the learning process, the PUs traffic pattern will be estimated by the SU. It will also be made to cover estimation of the relevant traffic parameters, whilst it will also aim at predicting SUs traffic trend for later time slot duration. In making a decisions will influence it role in determining the optimum sensing order, which uses quality of service (QoS) requirements, each channel probability, which might be idle in the next time slot duration, and also, each frequency band, which is under consideration, and transmission capability will be determined.

In the adaptation process, it is estimated that spectrum sensing and access operation will occur. This will be dependent on the outcome received from the decision process. Moreover, adaptation process may also occur in another form. It may include tuning the transceiver parameter to instantly adapt to channel variations [16].

H3: Based upon the fore-going analysis above, spectrum sensing behavior of our Smartphone can be seen as having a positive effect, in generating the necessary sensing signals during emergency situation.

5.2.1. Signal Detection

In signal detection, sensing control effect should occur [17]. Based upon this, detection role of the PU is fully under control. It is also coordinated through the use of sensing controller, and under this, two main issues arise:

- How soon should a cognitive radio (CR) user be able to locate the available spectrum band over a wide band frequency range for transmissions?
- How often or frequently can CR user is able to sense over the spectrum, of which it is transacting, in order to be able to obtain sufficient sensing accuracy, when transmitting, and also be able to detect the primary transmission presence, over a communication channel, in order to avoid interference?

In CR system applications, such as a Smartphone, in order to obtain quick and efficient spectrum utilization, out-of-

band sensing scheme must be able to coordinate to optimize searching sequence. It must also be able to decide for out-of-band sensing, in order to stop its rule from operating [18].

Moreover, in-band sensing requires much longer sensing time, leading to high accurate sensing; hence there should be less interference. More importantly, access opportunity comes as a result of longer transmission time, which also causes higher interference, based on lacking sensing information [19]. Therefore, it is evidently clear that, selecting a proper sensing and transmission duration, in a more distributed manner is a necessary factor which must be considered in CR Smartphone applications [17]

H4: Signal Interference detection has a negative influence in our Smartphone, in case of tracing efficient signal in emergency communication

H4a: Avoiding signal interference detection, has a positive influence in our Smartphone development, in case of efficient emergency communication

Table: 1. Status Data Indicator of the Model Smartphone, with Some Network Technologies Platform (e.g. UMTS, CDM etc) [20]

Smartphone Model Indicator	Description
4G	• Full coverage with high 3G data speed (Speed is high regardless of wireless conditions). • Calls placement and answer, and data transmissions are at the same time (No carrier limitation) • Send text messages, and receive email messages and short message test (can browse the web if possible)
H+	• Full coverage with high 3G data speed (Speed is high regardless of wireless conditions). • Calls placement and answer, and data transmissions are at the same time (No carrier limitation) • Send text messages, and receive email messages and short message test (can browse the web if possible)
3G with all Brand Logo (Blackberry, Sony, Ericsson,)	• Full coverage with wireless capability • Send text messages and receive email messages at same time • Efficient phone calls placements and answering • Efficient emergency phone calls placements and getting a feedback instantly • May browse the web • Efficient in simultaneous placement of phone call, sending text messages, and browsing

GPRS	• Full coverage with wireless capability • Send text messages and receive email messages at same time • Efficient phone calls placement and getting responds • Efficient emergency phone calls placement and getting a feedback instantly • May browse the web • Efficient in simultaneous placement of phone call, sending text messages, and may browse
SMS	• SMS messages can be sent, and also received • Efficient call placements and getting a feedback • Efficient emergency phone call placement, and getting an instant feedback
SOS	• Efficient emergency placement calls
OFF Position	• Communication between two parties turned off

6. Equal Sharing Spectrum Access (ESSA)

This section specifies the ESSA framework that detects interference signal in the Smartphone. Theoretical model need to be evaluated on the SU relative performance of the PU systems, used under constant and variable bit rate (i.e. CBR and VBR) traffic assessment. Relative wisely, channels under consideration of particular sensor device (Smartphone) comprise of bidirectional N channels of the primary and the secondary users situation PU, SU respectively, which can be represented by index $1, 2, 3, \dots, N$. The set of channel is being represented by $\mathcal{V}$ are formed by both primary and secondary transmitters, and they are normally not confined in any specific state. Consequentially, any of these channels can be assessed by the transmitters, whereby they do not need to aware of the primary and the secondary systems preceding it. Since PU and SU are involved, discrete time domains i and b indexes are alternatively used. Before assigning each time slot, both PU and the SU need to determine which their sensing order must correspond. They must do this by considering each channel transmission capacity, and their probabilities of idleness (i) and activeness (a) based on next time slot occurrence. We envisage that these operations must normally occur during learning and decision stages of sensing.

Transmission capacity is hereby defined to include both PU and SU as C_n^{ia} on both bidirectional n th primary and secondary user's channels in time slots a . The variable W_n^a have been defined to indicate the n th primary and secondary channels, during the time slots i, b which uses the binary figures 0 or 1. We denote the 0 and 1 as averages of idleness and activeness in both primary and secondary channels respectively. In a manner whereby

both the PU and SU find idleness in time slots i, b , then information bits in this time slots is represented by $I(i)(a)$. Therefore, the transmission effectiveness time, occurring in one time slots, is obtained by subtracting the consumed time for spectrum handoff and sensing is denoted by $I(i)(b)$, represents the theoretical bound of both PU and SU channel capacity. In the previous research, in protecting of PU signal, the SU signal is not allowed to be transmitted on the primary channel, in order that its real state might be successfully detected. In this work, different scenario prevails; both PU and SU signals need to be protected together and are permitted transmission on each other's channels.

Based on our assumptions, the accuracy of the state channel information vector denoted by W^{ib} is for PU and the SU's in the N channels of both, with $W^{ia} = [W^{ia}, W^{ia} \dots, W_N^{ia}]$, and $W^{ia} \in W$, where W represent possible primary channel state set combinations. Both PU and the SU are believed to know each other's transmission rate on their channels. Thus the channel capacity vector C^{ia} with time slots ia is known to the PU and the SU. Each time slots is thus used to collect information by the sniffing process. The PU and the SU are used to predict each ones channels alternatively in time slot $ia + 1$ through the learning process, using recent channel state vector W^{ia} , updating the channel history record. We presume that predictor parameters of the PU and the SU adjust, which in turn is able to improve their results; but it will be possible based on their predictors design requirements. Actually we represent the predictors vector as W^{ia+1} . This account for probabilities of both primary and secondary channels idleness $P_{off}^{n,ia+1}, S_{off}^{n,ia+1}$ and activeness as $P_{on}^{n,ia+1}, S_{on}^{n,ia+1}$ during time slots $ia + 1$. The indexes of N primary and secondary channels, based on their probabilities of idleness $P_{off}^{n,ia+1}, S_{off}^{n,ia+1}$ occurring in time slots $ia + 1$ as $P_{off}^{1,ia+1}, S_{off}^{1,ia+1} \geq P_{off}^{2,ia+1}, S_{off}^{2,ia+1} \geq \dots \geq P_{off}^{N,ia+1}, S_{off}^{N,ia+1} \geq 0$. We have included the probabilities of the SU, which in contrast to the previous work do include. So, the channels idleness time of the SU is being predicted together which accounts for the average idleness time slots. Thus it is more important to take into account the true and higher outage probabilities of the PU and SU transmissions compared to the slot system scenario with fixed time units. The process can thus be formed as:

$$L: F(W^i, \alpha, \beta) \xrightarrow{R_N} W^{ia+1}, n \in \phi, W^{ia} \in \mathcal{G} \text{-----(1)}$$

L denotes learning process, and the prediction method used in the learning process is denoted by F , and R_N represents all N primary channels traffic record. The prediction method indicates the records data format. Death and birth rates periods of the primary and secondary channels are represented respectively by α and β . Spectrum-sensing sequence decrease probability of channels idleness and

activeness, on transmission consideration and efficient sensing are arranged by the PU and SU simultaneously. Modeling this process will be as follows:

$$D: G(W^{ia+1}, C^{ia+1}, \psi) \rightarrow U^*, n \in \phi \text{----- (2)}$$

The transmission requirement sets for the PU and the SU is represented by ψ . In determining the sensing sequence for the primary and secondary channels G represents ordering strategy used both by the PU and the SU. Based upon this the transmission requirements of PU and SU are considered, and the efficient sensing and the U^* represents optimum spectrum-sensing order in the decision. The step below summarizes our proposed Spectrum sensing detecting process:

6.1. ESSA Scheme

- 1) The channel statistics of each state is recovered by PU and the SU, through the sniffing process, by predictors' requirements which occur at the time slot $ai + 1$ commencement.
- 2) The probability of each channel in idleness and activeness in time slots $ai + 1$ is predicted by the PU and SU by predefined means.
- 3) The predetermined order strategy which arranges the sensing sequence time slot $ia + 1$ is as a result of the PU and the SU.
- 4) The primary and the secondary channels are sensed by the PU and the SU based on step (3) sensing order.
- 5) The first idleness and activeness channel are locked by the PU and the SU, and are available regardless of any special requirements
- 6) The remaining primary and secondary channels are continued to be assessed by the PU and the SU, which will record the state of N primary and secondary channels time slots $ia + 1$
- 7) The predictor parameter is adjusted by the PU and the SU, which is based on the sniffing outcome stage in the last time slots.
- 8) These steps are continually repeated by the PU and SU until it reaches the last time slots.

Channel ranking method is used to assess performance evaluation, and also for comparison. Based upon this, long-term statistical traffic characteristics, a critical input, to the learning process is formed as in equation (1). The mean value vectors α and β are also two inputs and they corresponds to ON and OFF of the primary and secondary channels respectively. The maximum likelihood estimation method is a good source in which the mean values could be derived, and all primary and secondary channels statistical relevant data are derived. The learning process does not include the channel state prediction process vector W^{ia} . The probabilities of channel being idle and active which is represented by

$w_{ia} + 1$ in next time slots, determines long-term statistical characteristics of channels. Considering probabilities of n th primary and secondary channels as $P_n + S_n$ occurring in idleness and activeness in next time slots, then $P_n + S_n$ can be written as:

$$P_n + S_n = \frac{\alpha_n}{\alpha_n + \beta_n} + \frac{\alpha_n}{\alpha_n + \beta_n} = 2 \left(\frac{\alpha_n}{\alpha_n + \beta_n} \right) \text{ ----- (3)}$$

6.2. Performance Study

Challenges have already been outlined above concerning both the PU and the SU transmission measure capturing. The performance study will evaluate the system under consideration based on two key metric performances. These are termed throughput and bit error rate (BER) signal assessment. This work is mainly concerned with transmission security, and quality of the signals assessed under the PU and the SU, which are evaluated in context of the CBR and the VBR, based on the throughput and BER. Theoretical models will be developed in them to assess the performance of the CR Smartphone. The assumption used in the upper bound, concerning the PU and the SU limited spectrum sensing, can be used for the assessment of the Smartphone and other system performance, which operates in wireless environment with signal access capability using frequency band with discontinuity at target. Different channel prediction and spectrum sensing could be compared by upper bound performance.

6.3. BER

The PU and SU targets are required to transmit R bits information during one time slot, for a CBR channel traffic assessment. The BER can be defined as means in which the PU and the SU will not be able to determine any idleness in transmission channels, which senses S primary and secondary channels, with S being the sensing threshold. The maximum channel number S of PU and SU always have the tendency

6.4. Securing the Smartphone in Emergency Communication

In emergency situation Smartphone is required to be fully secured, in order to maintain a constant data transfer. In order for Smartphone to work efficiently, data securing practices have to be in place. Urgent requirements are needed to secure the Smartphone application, so that efficient communication delivery will cause instant responds to occur from the first-emergency responders, and relatives of victims. When a secured Smartphone user and emergency responders are directly linked with each other, then efficient communication must occur, and excessive satisfaction will be derived by the government, the private sector and the individual. As it has been clearly stated previously, obtaining a secure Smartphone requires a greater effort to be made by the stakeholders involved, such as government, the private sector etc. Based upon this, necessary funds will be budgeted to the Government

Emergency Telecommunication Services (GET), and the Wireless Priority Service (WPS), to conduct more research and improve the spectrum for radio channels, so that signal could be boost in order to transfer data by the Smartphone in all emergency situation.

7. CONCLUSION

Even though, the idea of establishing a secure communication in emergency situations has been neglected, but it must be realized that greater benefit of the working of the Smartphone in emergency situation can be possible, which can also provide a tremendous benefits to the nation as a whole. This is based upon this improvement in spectrum resources that can efficiently be allocated to the Smartphone. In addition, all similar types of mobile devices, which can also serve the same purpose of the Smartphone, in emergency situations can also gain the same benefits proposed in this model. Depending on the facts that, allocation of spectrum resources are expensive when measured against all odds, yet the government must keep up the habit of focusing on the radio channel improvements strategies. The government must include all the private sector and the public such as the GET and the WPS. Moreover, it must be understood that the greater the improvements in communications factors such as described in the hypothesis, the more better and efficient can the Smartphone be working to transmit data efficiently, in times of emergency situation.

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