



Jurnal Pertahanan

Media Informasi tentang Kajian dan Strategi Pertahanan yang Mengedepankan *Identity*, *Nationalism* dan *Integrity*

e-ISSN: 2549-9459

<http://jurnal.idu.ac.id/index.php/DefenseJournal>



CONCEPTUAL DESIGN OF BOMB DETECTOR AS ANTICIPATION OF TERRORISM THREAT TO PUBLIC SERVICES

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Article Info

Article history:

Received : January 30, 2020

Revised : April 29, 2021

Accepted : April 29, 2021

Keywords:

Conceptual Design,
Bomb Detector,
Terrorism,
Public Services

Abstract

Acts of terrorism are crimes and serious violations of human rights, also the threat of violence that can cause mass casualties and destruction of vital strategic objects. This is an urgent threat that needs to be prepared by designing a bomb detector conceptual design as anticipation of the threat of terrorism in public services. This study aims to obtain operational requirements and conceptual design of bomb detectors as detection of terrorism threats in public services. This study uses a mixed-method with a systems engineering approach and a life cycle model to produce a technological design. The results of operational requirements are sensors, standards, artificial intelligence, integration capability, reliability, calibration mode, portable, and easy to maintain. The configuration design is divided into three stages, namely, 1) sensors including a camera security surveillance system vector image, metal detectors, explosive detectors, and A-jamming; 2) as a processing device, processes an order with the help of an artificial intelligence system; and 3) a security computer (surveillance), early warning, and mobile information to provide information to related agencies, especially the anti-terror unit.

DOI:

<http://dx.doi.org/10.33172/jp.v7i1.713>

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INTRODUCTION

The Indonesian national defense system is organized in a universal defense system, which involves all citizens, territories, all resources, and national infrastructure. The government carried out in a total, integrated, directed, and sustainable manner (Kementerian Pertahanan RI, 2015). The defense system in facing non-military threats places the government institutions outside the field of defense as the main element. According to the form and nature of the threats, they should be faced and supported by other elements of the nation's power (State Defense Policy of the Minister of Defense 2018) in order to be able to build a strong, respected, and highly deterrent defense force for the sake of realizing and maintaining the entire territory of the Unitary State of the Republic of Indonesia as one defense unit. The form of threat is increasingly complex and multidimensional, divided into military and non-military threats which are categorized as real and not yet real threats. These threats include separatism and armed rebellion, natural disasters, overhauling and theft of natural resources, cyber-attacks, espionage, and radicalism terrorism.

Based on the 2018 re-calibration of the Minister of Defense regarding the concept of the defense strategy of the Republic of Indonesia in facing the disruption of the dynamic development of the strategic environment, there are three priority threats, namely cyber, natural disasters, and terrorism. Terrorism is an act that uses violence or threats of violence that create an atmosphere of terror or widespread fear, which can cause mass casualties, and/or cause damage or destruction to vital strategic objects, the environment, public facilities, or international facilities with ideological, political, or security disturbance motives. Acts of terrorism are extraordinary crimes and gross violations of human rights that do not differentiate between the target and the victim. Based on Global Terrorism Database (GTD) (2018) data from year to year, mapping of terrorism cases in 2017-2018 shows that every year there is incessant bomb terror in Indonesia which results in injuries and casualties. This terrorist bomb crime occurred in various public service places, including government agencies, the private sector, tourism places, and places of worship. The results of the victim data are listed in Figure 1.

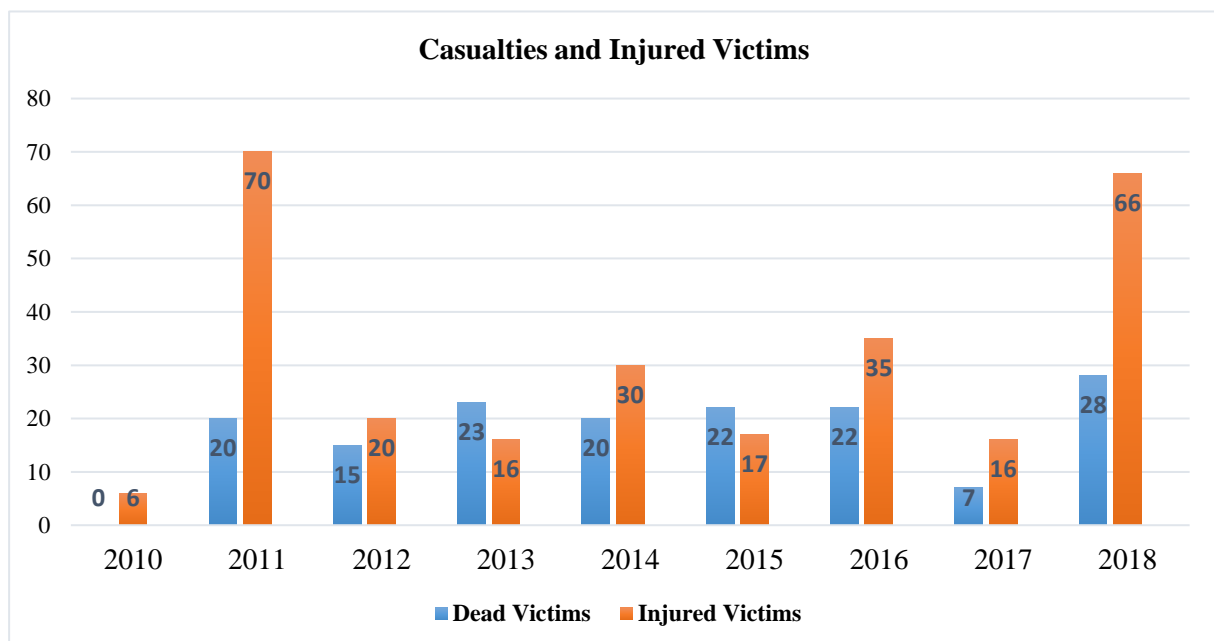


Figure 1. Total data on injuries and casualties.

Source: Global Terrorism Database (2018)

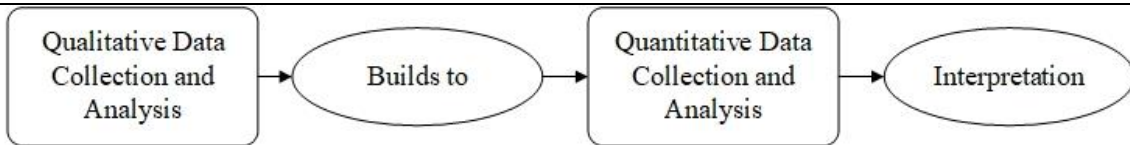


Figure 2. Sequential Exploratory Design
 Source: Creswell, 2014

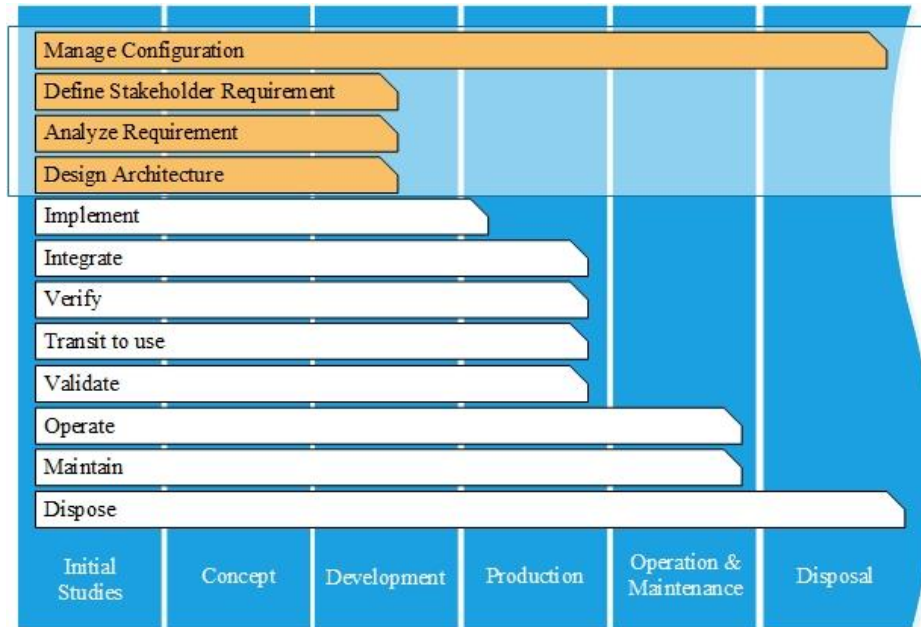


Figure 3. Phase Life Cycle Model
 Source: ISO/IEC/IEEE, 2008

Bomb explosion incidents that have occurred in Indonesia compiled by Kompas National media (2018). Occurs in the center of a crowd, shopping centers, government buildings, houses of worship, and tourist attractions. For example, what happened at JW Marriot in the Mega Kuningan area, South Jakarta 2002, the 2004 Australian embassy building, the Bali II 2005 bomb, JW Marriot and the Ritz Carlton 2009, the Az-Dzikra Mosque Cirebon 2011, the 2016 Sarinah Jakarta Bomb, the 2016 Solo Police Headquarters bomb, the Kampung Melayu Jakarta 2017, the Surabaya and Sidoarjo 2018 bombs, a suicide bombing at the Medan 2019 Police Headquarters and a bomb at the Monas Monument.

Related to this phenomenon, the need for an adequate security or prevention system in place of public servants. Like a bomb detector installed at every entrance gate of a place that is capable of detecting all kinds of material contained in the bomb. As

protection and safety for a bomb explosion somewhere. Therefore, to support the countermeasures of terrorism, there are various ways that the government has programmed based on the Republic of Indonesia Law No.5 of 2018 on National Preparedness, Counter-radicalization, and Deradicalization. As a form of national preparedness against the threat of terror bombing terrorism in public service places. Prevention needs to be done specifically, planned, directed, integrated and sustainable. Therefore, this study was conducted to get the operational requirement and conceptual design of bomb detectors as detection of terrorism threats in public services.

METHODS

This study uses a mixed-method. Sugiono (2011) states that the combination research method (Mixed Method) is a research method that combines or combines

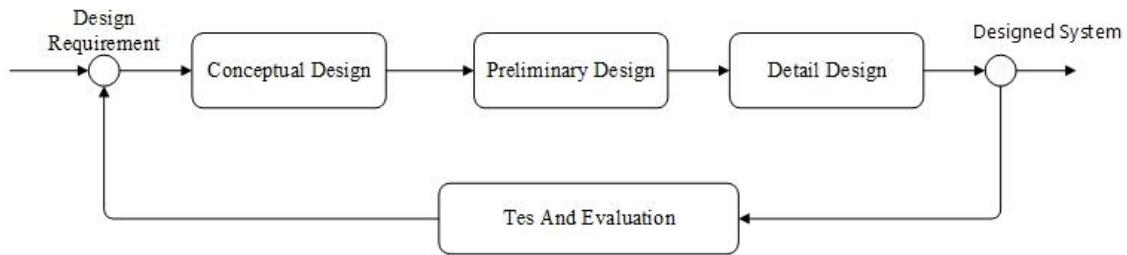


Figure 4. Engineering Design Stages.

Source: Sadraey, 2013

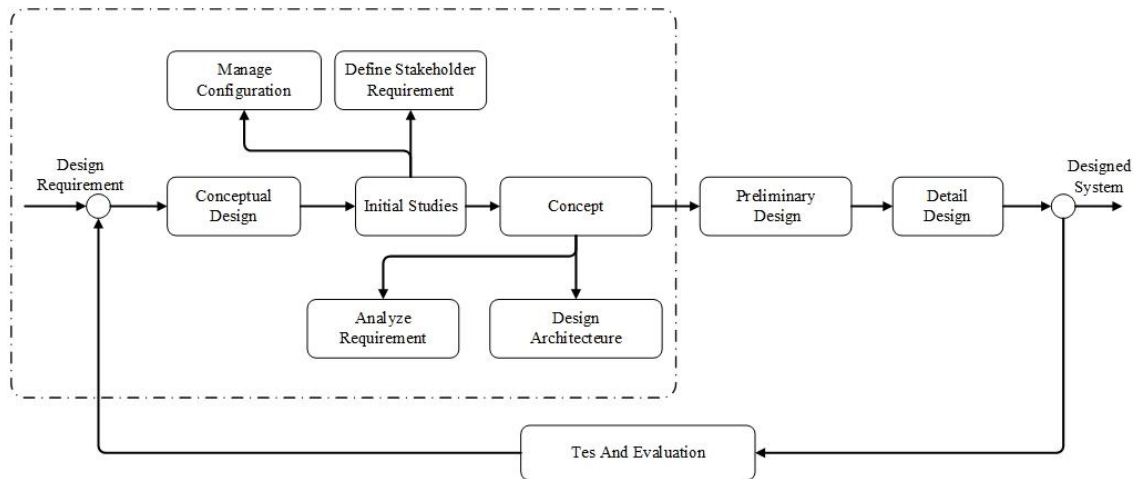


Figure 5. Combination Stages of Life Cycle Model Model and Design engineering

Source: Processed by Authors, 2020

qualitative methods and quantitative methods to be used together in research activity. The research design used the mixed-method method with a sequential exploratory type that emphasizes qualitative. Creswell (2017) states that in the first stage, qualitative data was collected and analyzed, then collected and analyzed quantitative data. The two methods are combined to produce an engineering system concept. In the qualitative stage, it is used to obtain user requirements design data based on the operating system requirements in document form. The quantitative stage is used to formulate the results of user requirements in a conceptual design in anticipation of the threat of terrorism and security in public services.

The design of this research uses the engineering design method and the Life Cycle Model as a design conceptual design stage with stages, namely design requirements, conceptual design, initial studies, concept, preliminary design, and detail design. This study only focuses on the

conceptual stage with details, namely, manage configuration, define stakeholder requirements, analyze requirements, and design architecture.

RESULT AND DISCUSSION

Bomb Detector Operation Area

The anti-terror unit is part of the existing national security and defense structure within the Polri and Indonesian Military (TNI). The Brimob Gegana Unit from Indonesian Police (Polri) secures public security and order. The Kizijhandak unit from Polri serves as the security of Very Very Important Person (VVIP), Very Important Person (VIP), and serves as a combat assistance unit. These two units play an important role in handling terror threats. By having various kinds of technology in prevention such as bomb detectors and bomb destruction technology to make the location safe and sterile from threats. Bomb Detector is a technology capable of detecting various bomb terror threats. The detector is expected to be able

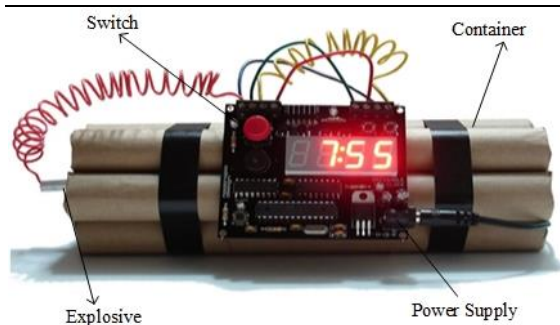


Figure 6. Bomb components

Source: Processed by Authors, 2020

to detect the components of the material contained in the bomb. The components are container, trigger, chemicals (explosive), and power supply as can be seen in Figure 6.

Operational Requirements

The bomb detector conceptual design is a concept that is tailored to the needs of the user. The capability of a bomb detector will be needed in forming a conceptual design. So that it can support the defense system from the threat of bomb terror attacks in public services. Based on data on the operational requirements of a bomb detector, they are as follows:

1. A sensor is a device that can detect physical changes such as electricity, light, force, humidity, speed, and temperature. Sensors are used as explosive detection, metal detection such as iron and copper, capable of detecting/blocking several types of frequencies, and able to monitor the movement of threats in the form of bombs from elements who have a sense of radicalism (terrorism).
2. Standard Compliance, the specification of the purpose or function to be met for the bomb detector standard. Standard specifications are bomb detection sensors, process devices as data processing to give orders, and as accurate early warning to the public and anti-terror units.
3. Artificial Intelligence (AI) capability, defined as artificial intelligence, the

ability to interpret internal data correctly. Artificial intelligence is used when sensors (explosives, metal, CCTV, and jamming) detect a bomb and will be inserted into a machine (computer) so that it can do work as humans can. This is intended to give orders following prevention and early warning standards.

4. Integration capability, the ability to integrate all anti-terror and surveillance unit systems quickly and in an integrated manner. As well as having a function as a source of information and early warning
5. High reliability, fast detection capabilities, capable of processing and analyzing data to be used as orders, and able to integrate several systems as information (early warning).
6. Calibration mode, technical calibration capability, that all measuring instruments (sensors) after passing through a mobilization or shift from one place to another, it is better to do a thorough calibration to get accuracy. To guarantee the measurement results are following the standard.
7. Portable, bomb detectors must be used in several places, especially in public services. So the need for a portable form so that it is easy to move around according to the needs of bomb threat security
8. Easy Maintenance, is an activity to keep components and equipment ready for operation. And ensure the operational readiness of all facilities required during emergency use.

Conceptual Design

The conceptual design consists of three parts, namely the determination of the architectural design (technical specifications), configuration design, and Initial Performance. This determination is based on the results of determining the user needs analysis. The following three parts to the conceptual design are as follows:

1. Design architecture as a technical specification:
 - Operating conditions (moveable)
 - Has a multi-functional power supply
 - Chemical and explosive detection
 - Metal detection (zinc, lead, copper, chrome, nickel, iron, silver, and gold)
 - Threat detection speed
 - Effective distance
 - Able to monitor the movement of threats
 - Jamming several types of frequencies
 - Integrated multiple systems
 - Good Sensitivity
 - Processing Device with artificial intelligence
 - Calibration speed
 - Able to provide early warning
 - Fast and accurate communication network.
2. Configuration design can be seen in Figure 7.
3. Initial Performance. The following is a detailed explanation of the technical specifications based on the configuration design in the image above as follows:
 - a. Power Supply, using a power supply with the type of Uninterruptible Power Supply (UPS). Which has two sources of electricity, namely the AC input voltage and the battery. The working principle is when normal electricity uses AC voltage. If there is interference or placement outside with a far range of electricity then it uses the electricity stored in the battery.
 - b. Explosives Detection, Sensor Selection Detection with the ability to detect and identify threat substances in about 20 seconds. Threats such as peroxide-based common chemicals, to build improvised explosive devices (IED) and ammonium nitrate, which are commonly used in homemade explosives such as, (RDX, PETN, TNT, Semtex, TATP, NG, ammonium nitrate, H₂O₂)
 - c. Metal detection, metal detectors can detect heavy metals such as zinc, lead, copper, chrome, nickel, iron, silver, and gold.
 - d. Seeing the Characteristics of Explosives (CCTV Cameras), Selection of a CCTV camera security surveillance system vector image capable of detecting or monitoring movement equipped with motion detection sensors.
 - e. Jamming, the selection of jamming specifications with type A jamming because it has a diameter radius of 1-60 meters. The following is the type A jamming frequency:
 - GSM900MHz: 925-960MHz, 3W
 - GSM1800MHz: 1805-1880MHz, 2W (GSM/DCS/CDMA1800MHz)
 - 4GLTE700MHz: 790-821MHz; 3W
 - 3G2100MHz: 2100-2170MHz, 2W (3GUMTS/WCDMA/TD-SCDMA/CDMA)
 - Wi-Fi/Bluetooth 2.4G: 2400-2500MHz, 2W
 - 4GWiMAX/4GLTE: 2620-2690MHz, 2W
 - VHF Radio: 135-175MHz; 2W
 - Radio UHF: 400-470MHz; 2W
4. Good sensitivity, based on the selection of standard and quality components, of course, is a technology capable of providing accurate data.
5. A processing device is a computer device that functions to process or process information and input data. includes, CCTV cameras, metal detection, explosives detection, and jamming. as well as being processed into

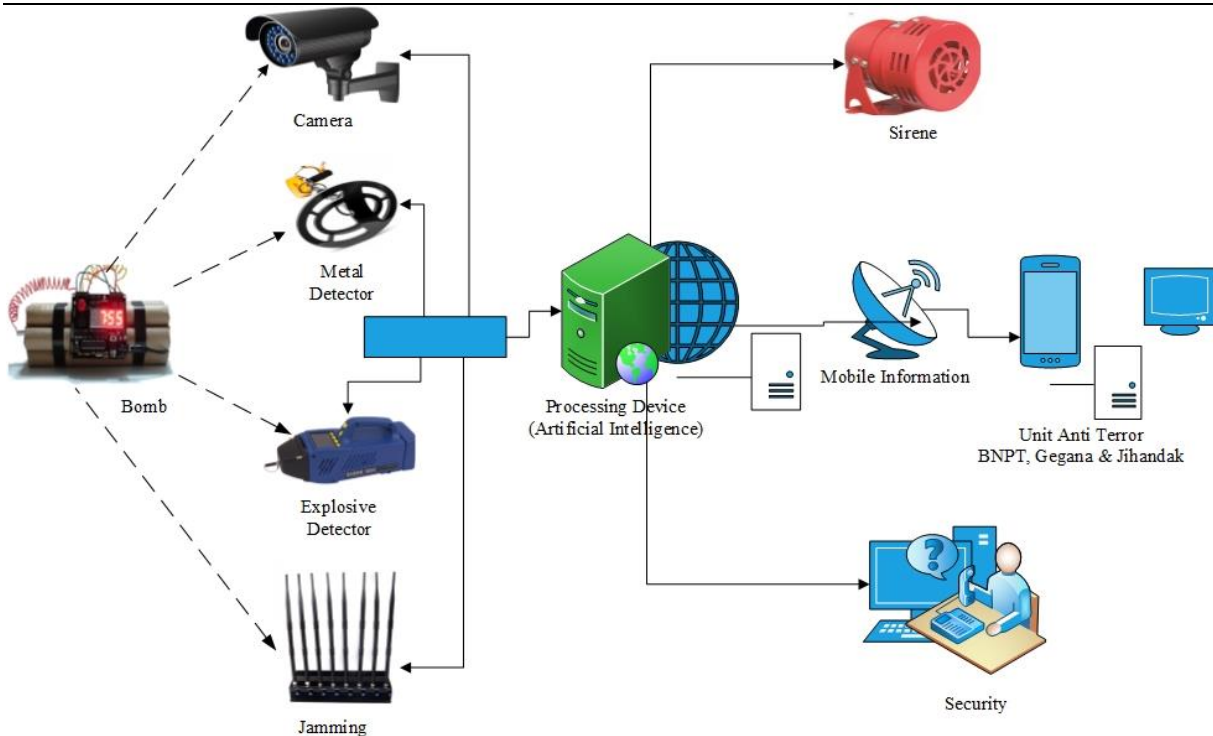


Figure 7. Bomb Detector Configuration Design
 Source: Processed by Authors, 2020

output including early warning, computer monitoring, and sending of information to the anti-terror unit

6. Early warning, using a siren as an early warning regarding the incoming bomb detector threat. This early warning is based on the results of commands from the system on the processing device.
7. Communication network (mobile information), as communication and information delivery when a bomb threat occurs using an SMS Gateway-based communication system. So that it can provide integrated information on security and anti-terror units.

CONCLUSIONS

The results of the operational requirements are power supply, explosive material detector, metal detector, camera, jamming, good sensitivity, software, processing device, receiver device, early warning, and connecting network. The configuration design is divided into 3 (three) stages, 1) first consists of sensors including a CCTV camera security surveillance system vector image, metal detectors, explosive detectors,

and A-jamming; 2) as a processing device, it processes an order with the help of an artificial intelligence system; 3) the third consists of a security computer (surveillance), early warning (sirens), and mobile information to provide information related to agencies, especially anti-terror units.

RECOMMENDATION

Academic

This research can be used as a reference related to the topic of bomb detectors or for relevant researches. It is also to support national defense and security as national preparedness. The next researcher can also use a conceptual design to develop the preliminary design of a bomb detector as an anticipation of the threat of terrorism in public services.

Government

For the government, especially the Ministry of Defense, the Police Mobile Brigade Gegana Unit, Jihandak Ditziad, BNPT, and LAPAN, this research can be used as a reference and a standard as procurement of bomb detector technology based on the

results of the operational requirements document and conceptual design (configuration design) on securing public services.

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