Application of Intelligent Monitoring System in China-Myanmar Pipeline Project

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Abstract

In order to solve the problems of difficult early warning, difficult investigation, and large investment of human and material resources in the prevention and control of third-party damage to the China-Myanmar pipeline, and to realize the visualization of pipeline lines caused by third-party damage to the pipeline, intelligent pipeline inspection, and controllable hidden dangers of external damage are the key issues. Inevitable trend; in order to solve such third-party prevention and control problems, this paper proposes a multi-directional intelligent monitoring system based on intelligent high-definition cameras, builds a visualization network of China-Myanmar oil and gas pipelines, applies an intelligent line inspection system, and promotes the intelligence of user information management and control platforms. Change the mode of pipeline prevention and control, realize the transformation of China-Myanmar oil and gas pipeline safety prevention and control from "manual defense" to "technical defense", substantially improve the effect of pipeline prevention and control, and improve the patrol efficiency of oil and gas pipelines, so as to realize the safety management and control of China-Myanmar oil and gas pipelines The goal of efficient and intelligent management.

Keywords

Risk Management and Control; China-myanmar Oil and Gas Pipeline; Third-party Sabotage; Intelligent Monitoring; Pipeline Visualization.

1. Introduction

The working environment of China-Myanmar oil and gas pipelines is relatively complex, and third-party sabotage is increasing. Construction, excavation, farming, theft and other man-made activities near the oil and gas pipelines cause damage to the pipeline structure or performance. The most prominent is the phenomenon of drilling oil and gas theft. The economic impact of the lost crude oil and natural gas is self-evident, and there are potential risks such as the danger of natural gas leakage, which is very easy to cause explosions and cause damage to the area around the pipeline[1]. casualties; the most direct impact of crude oil leakage is on the environment. Under the premise that Western countries are currently eyeing the China-Myanmar oil and gas pipeline project, if such an incident occurs, it will undoubtedly give the other party an opportunity[2]. If propaganda is carried out, then the project will not only lose the cost of environmental pollution control, but the negative attitude of

the public towards the project will be irreversible. In addition, many construction materials and facilities have been stolen from the stations and contractors along the pipeline, with serious direct and indirect losses. For example, at the first station of Kyaukpyu, two cables that had already been laid were dug up and stolen; the cathodic protection piles of the line completed in the Mandalay section were damaged to varying degrees[3]. In recent years, Mandalay to Ren'an The communication optical cable in the Qiang area has been destroyed many times; in the Kyaukpyu area, there have even been threats to security and crowds, which seriously affected the normal operation of the pipeline and posed a threat to our personnel and equipment. However, most of the conventional oil and gas pipeline risk prevention and control measures have problems such as difficulty in early warning, difficult investigation, and large investment in human and material resources[4]. Therefore, it is particularly important to upgrade pipeline safety management and control technology and propose management measures to effectively monitor third-party sabotage.

2. Third-party Sabotage of Intelligent Prevention and Control Measures in the China-myanmar Pipeline

The third-party damage of the China-Myanmar pipeline is becoming more and more serious, posing a serious threat to oil and gas companies. For example, some construction materials are damaged, which seriously affects the construction period, and the social impact is very poor. Therefore, in view of the above difficulties, combined with the multi-directional intelligent third-party prevention and control technology proposed in Chapter 4, the following measures are proposed to prevent third-party damage to the operation risk of China-Myanmar oil and gas pipelines:

2.1 Risk Classification of Pipeline Areas

To realize the implementation and application of the intelligent monitoring system, first of all, it is necessary to collect and sort out the situation information of the local area, and to classify the risks of each area. Therefore, according to the ALARP risk acceptance principle, with reference to the Australian standard AS2885.1-2009[5] "Gas and Oil Pipelines - Design and Construction" and combined with the actual situation of the China-Myanmar pipeline project, a risk matrix for evaluation was formulated, as shown in Table 1.

Table 1. Risk Assessment Matrix

influence frequency	Catastrophic	Major	Little Major	Minor	Little Minor
H	very high	very high	high	medium	low
RH	low high	high	medium	low	low
M	high	high	medium	low	very low
RL	high	medium	low	very low	very low
L	medium	low	very low	very low	very low

When the risk in the table is displayed as "extremely high" and "high", it is the risk unacceptable area; "medium" is the risk acceptable area; "low" and "extremely low" are the risk negligible area.

2.2 Prevention and Control Deployment of Risk Areas at All Levels

According to the actual situation, the areas along the pipeline are classified into high and low risk levels. This classification method is in line with the practice of CNPC[6]. That is, it is divided into five risk categories, namely: high-risk areas, high-risk areas, medium-risk areas, and low- and low-risk areas. The deployment plans for each area are shown in Table 2:

Table 2. Deployment scenarios for risk areas

Regional level	prevention and control deployment plan
High-level risk area	Military duty protection + UAV line patrol + intelligent high-definition camera + military information monitoring and management center
Higher risk areas	Police security protection + drone line patrol + intelligent high-definition camera + police information monitoring center
Medium risk area	smart camera + drone patrol line + fixed duty point
Lower risk area	Smart camera + drone patrol line
Low-risk areas	UAV line patrol

After the area is classified, for areas with a lower risk level or above, an observation point with a wide field of view should be selected in advance, and a fixed intelligent high-definition camera should be installed to initially cover the monitoring area. By identifying and identifying personnel information in key areas, the intelligent high-definition camera transmits the monitoring information to the information monitoring center and cloud storage system in a timely manner, so as to achieve "early detection, early prevention, and early treatment".

In addition to the fixed monitoring network, a mobile monitoring system should also be set up. However, for the past, which only relied on human patrols, the efficiency was low and there were detection loopholes in emergency situations. For example, some lawbreakers will take advantage of the intermittent period of patrols to carry out sabotage, and cannot achieve all-round seamless monitoring. However, through the addition of intelligent drones, human-machine joint defense is truly realized, and monitoring has no dead ends.

Of course, for ultra-high-risk control areas, multi-directional monitoring without dead ends should also achieve rapid emergency management and emergency response. For example, higher-risk areas such as the Mad Island reservoir area require not only military mobile monitoring and protection, but also intelligent drones24 For hourly inspections, there should also be high steel wire fences and high walls, lane control rods and stainless steel telescopic electric gates should be installed at the entrance of the passage; the fence should be equipped with an automatic alarm system and lighting system at the perimeter; stations and bases should be equipped with intelligent identification high-definition cameras And video intercom system, etc. [7], to achieve high-precision monitoring and control without dead ends.

2.3 Intelligent Drone Survey Selection

The China-Myanmar oil and gas pipeline project has complex terrain and different regional environments. Both the early construction and the later operation and management are great challenges. If risks are prevented in time, you should always know whether there are project constructions, high consequence areas (residential, factories, major engineering facilities) and surrounding areas, landslides, dangerous rocks, soil erosion, etc. along the pipeline, and keep abreast of the surrounding conditions along the pipeline[8]. Contribute to risk investigation for safe pipeline operation. At this time, the use of human survey, monitoring and other work not only has a long working cycle and low efficiency, but also consumes huge human and material resources. At this time, the flexible mobility of intelligent drones, multi-directional high efficiency and other characteristics can be used to select the area. survey. The geographical environment information is stored in the cloud storage computing system in the background to draw the regional model and accurately grasp the status of each key monitoring area. The specific measures roadmap is shown in Figure 1:
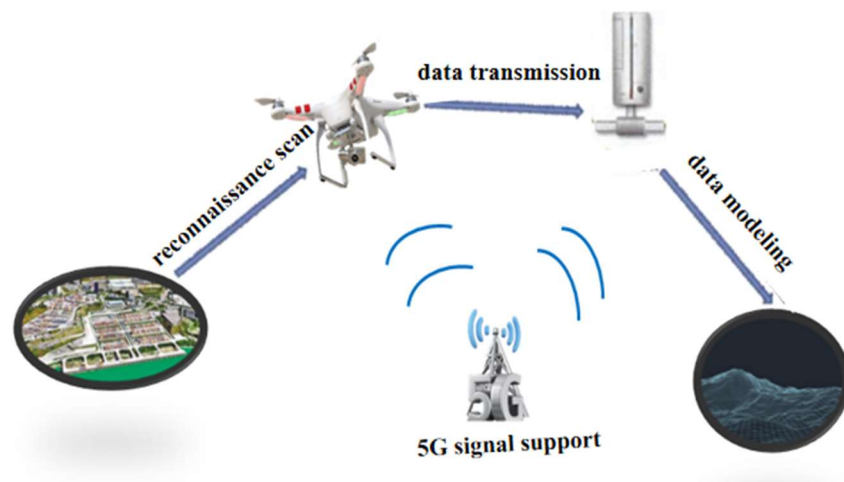
Figure 1. Regional survey and modeling ideas

1) UAV survey and scan of key areas. By utilizing the mobility and efficiency of UAVs, high-altitude scanning and surveying of target areas can be carried out, and areas with complex terrain can be efficiently surveyed and selected by drone swarms. Focus on taking pictures of key areas such as residential areas, factories, important engineering units, as well as landslide areas with high potential risks, earthquake zones, and dangerous mountains and rolling rock areas, and record their detailed geographic coordinates and real-time conditions[9]. This greatly reduces the workload of human surveying, and the high-altitude survey of UAVs not only guarantees the mobility of work efficiency, but also can more accurately and comprehensively grasp the specific situation information of the survey area.

2) Cloud computing draws the regional model. The drone scans the detection area in all directions, and the recorded area coordinates and the overview information of the risk area will be transmitted to the cloud storage computing system in the background in real time, and the transmitted area coordinates and area structure data will be calculated and analyzed, and the three-dimensional image of the construction area will be depicted. The three-dimensional model marks the coordinate information of high accident points and high potential risk areas and the accident situation, and uses big data to dynamically predict them, so as to accurately and efficiently control risk information.

3) 5G signal support. Whether it is the working area or the surrounding area, the establishment of 5G signal towers, using the high speed and strong penetrability of 5G signals, is more suitable for the mountainous terrain and obstacles in the working area of the China-Myanmar oil and gas pipeline, providing it with a stable information transmission platform. At the same time, it provides a solid foundation for the risk prevention and control of the China-Myanmar pipeline.

2.4 The All-round "Prevention-treatment" Mechanism of Human-machine Combination

The only way to truly achieve it is to monitor and deal with a seamless prevention and control route without dead ends. The combination of man-machine and all-round prevention-treatment mechanism is the most efficient and safest choice. This thinking system not only includes the above-mentioned regional prevention and control deployment plans at all levels, but also should be bypassed by analogy, and this prevention and control system should be extended to various regions.

In terms of prevention, the area survey is carried out to select observation points with a good view, and intelligent high-definition cameras are deployed. The cameras use intelligent face recognition technology. In some areas with high population density, the cameras are connected to the monitoring center by the intelligent main control board. It is also linked to the database of the local public security bureau. Once found and identified as someone who is trying a third-party sabotage, only the high-definition camera will take pictures, and the equipped voice warning device will be used to expel them, and at the same time, the crime information will be sent. To the local public security organs to

realize automatic identification and alarm. In addition, the high-definition camera also has high-strength infrared night vision capability, which can also perform normal monitoring operations at night or in the rainy season that is common in the China-Myanmar pipeline area. In addition to the monitoring network composed of fixed smart cameras on the ground, 24-hour uninterrupted intelligent drone monitoring and patrols should also be set up. Conduct quick line inspections for power transmission and oil and gas transmission lines[10]. For oil spills and oil theft, UAVs can quickly locate and complement the fixed camera network in the ground area to build a multi-directional intelligent dynamic monitoring network without dead ends.

In addition to building a multi-directional three-dimensional monitoring network, a timely and efficient processing system is equally important. Regarding the particularity of the situation of the China-Myanmar pipeline and the occurrence of wars, extreme malicious sabotage and other vicious third-party sabotage and other phenomena. It needs the cooperation of the local armed police, the police and the government. For example, for high-risk areas, it is necessary to set up monitoring sentinels and patrol troops for preventive and emergency treatment. However, simply relying on human flow monitoring has low efficiency and huge investment, and through the monitoring of the intelligent monitoring system, the combination of human defense and technical defense is achieved. When a vicious third-party damage occurs, the monitoring center will give an alarm and quickly send the location to the patrol team and monitoring sentinel, as well as to the emergency repair personnel. The drone will analyze the accident situation and the accident location in real time at the scene and wait for the emergency repair personnel. and the arrival of patrol officers. To achieve "prevention - treatment" dynamic continuous, timely stop loss.

2.5 Multiple Regulation of Intelligent Monitoring Center

As the main brain of the entire detection system, the intelligent monitoring center's main work is not only to collect and review the monitoring information fed back by the front-end equipment in real time, but also to be responsible for multi-directional control. Due to the influence of the political situation in the China-Myanmar pipeline region and the complex cultural environment, topography and other factors, the supervision and control power of the information monitoring center should be jointly managed by the military, local public security and oil and gas companies.

In the event of war, extreme malicious sabotage, oil theft and other extremely bad third-party sabotage incidents, the front-end monitoring system monitors and identifies personnel information and immediately takes pictures and collects evidence while implementing the whole process of tracking. On the other hand, the crime information is immediately submitted to the local public security organ for timely processing through the risk certification of the monitoring center of the oil and gas company. For high-risk areas, if war or malicious terrorist sabotage occurs, the monitoring center will send an alarm instruction to the police on patrol or on duty shall conduct the first-time prevention and control. Truly realize the efficient joint prevention and control of third-party destruction of man-machine.

3. Conclusion

The third-party damage prevention and control work of the China-Myanmar pipeline generally adopts traditional human or semi-manual monitoring and processing. For example, the pipeline patrol work is traditionally mainly based on manual inspection. The patrol personnel find traces of human damage during the patrol process, or When external damage is obvious, the risk situation is recorded and grasped at any time. However, in the process of crossing complex terrains such as mountains, rivers and lakes, it takes a lot of time, energy and human and material resources to rely solely on human inspections. This is not only extremely inefficient for pipeline inspection work, but also poses a certain risk to the personal safety of the staff. Combined with the intelligent monitoring system, the construction of an intelligent multi-directional video monitoring platform is a revolutionary change in the protection of oil and gas pipelines in this area. Data leaps into digitization, visualization, automation, knowledge, and intelligence. The main improvement effects include the following:

(1) By combining the intelligent monitoring system, UAVs and intelligent cameras are used to replace human inspection and survey work, achieving a breakthrough from "civil defense" to "technical defense", which greatly improves the prediction accuracy of third-party damage and risks. The accuracy of the investigation is greatly reduced, and the investment of resources is greatly reduced.

(2) Combined with intelligent surveillance video data, and make full use of emerging technologies such as artificial intelligence and big data to identify, locate, capture, and obtain evidence of behaviors that endanger the safety of ZM oil and gas pipelines, provide a basis for law enforcement supervision and comprehensive scheduling, and solve harmful cases. Provide all kinds of image, sound and data support, and trigger system alarms through the Internet of Things technology to prevent illegal construction and other behaviors that may cause damage to the pipeline, so as to achieve real-time and scientific pipeline safety management.

(3) Relying on the special situation of ZM oil and gas pipelines, using the development of intelligent monitoring equipment and intelligent cloud computing services, etc., carry out innovative research and development, and promote the Internet + new business model intelligent pipeline patrol model under the sharing economy into reality.

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