

RESEARCH ON PROTECTION DESIGN FOR PREVENTING FROM FRAUD USING TRUCK SCALES

Huang songtao, Mao shuonan, Ma yuming, Chen daosheng

JiangSu Metrology Institute, P. R. China, huang_s_tjob@sina.com

Abstract:

The cases of fraud using truck scales in trading settlement are increasing frequently in some countries. This paper comprehensively analyses the possibility of fraud using truck scales, base on the entire measurement data chain of the weighing system. In this paper, the author gives one acceptable protection solution from the point of system design, instruments design and sensor technology, which connects the new technology of MEMS.

Keywords: truck scales, fraud using, design, MEMS.

1. INTRODUCTION

In accordance with classification criteria, the weighing instruments can be divided into bench scale, platform scale, floor scale, crane scale, belt scales, hopper scales, check scales, truck scale, railway scale and other special scales categories. Among of them, the belt scales, hopper scales, check scales and special scales commonly used in the measurement of internal processes rather than the trade settlement. What the manufacturers only need to consider is ensure the accuracy of the instruments in the period of designing and using. They don't need consider the case of anti-cheating or preventing fraud using. For the bench scales and platform scales, due to national department of legal metrology which has the requirement to seal the scales, and the local measurement officer will periodic inspect or check the part of seal, it's difficult to modify these two scales without authority. But the floor scale, crane scale, truck scale and railway scale are easier to be modified because such scales are larger, difficult to seal completely, installed on the outside. And, the criminals can achieve great profit by fraud using these modified large size scales.

2. ANALYSIS ON THE MEASUREMENT INFORMATION CHAIN

In order to avoid clients' interests have been violated, consideration of how to prevent from fraud using the large-scale in the period of design is an important topic for the manufactures and measurement technology institutes. First of all, it's necessary to analyze the measurement data chain.

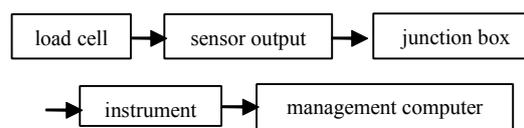


Figure 1 measurement data chain

In every link of the chain, the risk of fraud using is really exist and different. The software installed in management computer is not easy to be changed or modified for the difficult of understanding the source codes. So the risk level is not high. The risk of load cell is so high that the Wheatstone bridge may be modified by connecting an additional resistance. This kind of fraud using method is often used in a remote mode. And such exposures are often watched on TV or read in newspaper. The fraud system contains two parts, one remote control is responsible for sending the fraudulent command, the receiver executes function after getting the fraud command, then the sensor output which was added with the receiver's signal will be sent to the display. Therefore, the modified measurement data was shown on the display and recorded or printed. Not only the load cell, but also the junction box or the wire of signal output is possible to be connected an additional receiver.

In according to some new cases of truck scale fraud using, the receiver was installed in the junction box or inside of the instrument. From the outside, few marks can be seen. The only way to find the receiver is to open the junction box or the shell of instrument by a technician who familiar with the product.

3. ACCEPTABLE SOLUTION OF DIGITAL LOAD CELL AND SOFTWARE DETECTION

How to settle the problem? In OIML R76, a solution with digital load cell and encrypted communication is acceptable. And D31-General requirements for software controlled measuring instruments (2008), the latest document of OIML, has given the answer too. In fact, many manufactures' ideas are same.

Digital load cell:

Digital load cell is a late-model electric weighing technology combined with modern microelectronics technology and microcomputer technology. Most load cells which are sold as "digital load cells" are strain gauge based

analogue load cells with built-in electronics to convert the analogue output into a digital output signal. The view of most other experts is that the load cell comprised a measurement system illustrated in Figure 2 may be called digital load cell. The digital inputs include weight, status etc. The digital outputs include address, setup and parameters etc.

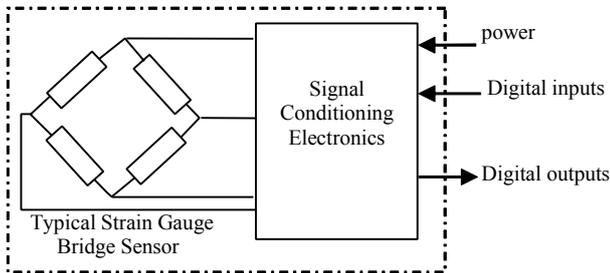


Figure 2 A schematic representation of a digital load cell

The load cells are typical strain gauge transducer and the signal conditioning electronics (SCE) is assumed to be contained in a transducer housing. The SCE may have a minimum configuration such as only an A/D converter to convert a analogue signal into the digital format for retransmission. It may assemble other electronic chips in the SCE to store various characters of load cell and optimise these characters by the use of software program. Sometimes, the load cells may utilise some of the features of the digital load cell but whose electronics are separately housed or are not dedicated to a single transducer.

Why we need the digital load cell? The answer is reducing the disturbance to the weak analogue signal which transmits in a long distance wire. At the same time, the process of digital will improve the accuracy of analogue load cell by compensating zero-temperature coefficient, creep and lag.

Although the original intention of digital load cell is not for fraud using, the digital load cell may be a good solution for preventing truck scale's fraud using.

There're only two methods for people to remote control the truck scale assembled digital load cell. The first one, assemble the receiver at the end of analogue part of load cell by breaking the envelope and shell of load cell. The second one, assemble the receiver to the digital signal wire by decrypting the communication protocol and breaking the shell of instrument.

For the first methods, manufactures may envelope the load cell with steel material for preventing the load cell from being broken easily. And for detecting load cell's status is safety or not, a warning system may show the operator a flash light or warning words on the display of instruments. Secondly, the software developers in manufacture should take the more complex encryption algorithm for preventing the protocol from being easily decrypted.

Software detection:

Sometimes, the status of broken load cell couldn't be detected immediately. Thus the client's interests would be violated for a long time. When the data shown on the display was different with the original output from the sensors of a truck scale, it is better the officer of measurement institute may get the alarm message in seconds.

For this purpose, a warning and monitoring network with modern communication technology is necessary.

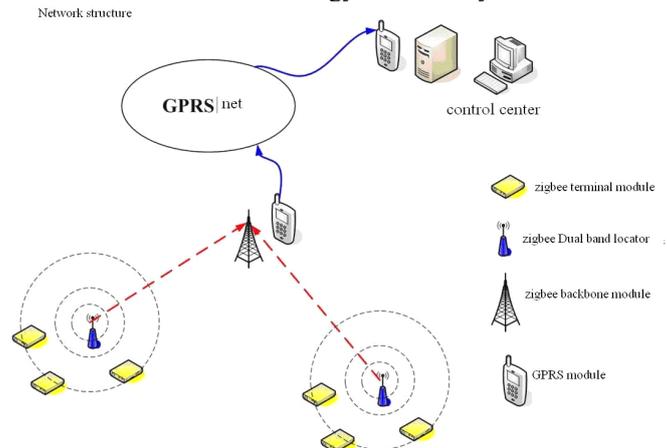


Figure3 network structure of software detection

In figure 3, the control center gets the alarm message via a wireless network. The message is transmitted from terminal software detector module, which was developed by the truck scale manufactures or the third company. Usually, a dual band locator is used to collect the information of a truck scale, such as place, time or date, weighing data. The telecom operators or mobile operators are response to transfer collected information to the control center. The core issue is the terminal software detector's performance. And the supporting laws or regulations in a country is also very important

4. CONCLUSIONS

Digital load cell provides the manufactures a good design on preventing fraud using. What the programmers to think more is enhancing the encryption algorithm. The software detection monitoring network may be useful to the department of national legal measurement. The officer could get the message in seconds even the fraud using in a truck scale was just beginning. The only problem is the hardware interface of the truck scale need be open to the zigbee modules. The best solution is to design a module or chip specially for software detection.

5. REFERENCES

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