Power Marketing Ubiquitous Learning Mode Based on QR Code of the Internet of Things

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Keywords: Internet of Things, QR Code, Ubiquitous Learning Mode.

Abstract: Based on QR Code of the Internet of Things, a ubiquitous learning mode is established to construct a new model of ubiquitous learning. This model can be applied to the job sites and trainings, which can effectively promote the application of new technologies, improve the training and learning effects, and achieve the purpose of learning at any time or any place. Based on QR Code of the Internet of Things, the basic idea of the new ubiquitous learning mode is "Discovering Problems → Scanning Code and Learning → Solving Problems → Thinking and Summarizing", which can create a learning style of "everyone learns, learns at any time, learns at everywhere".

Power system is a very complicated system, whether it is a staff in daily work, a customer in handling electric power business and use of power equipment, or a trainer in the training to learn electric power skills, they all need to know, to be familiar with and to master the knowledge and skills with a large number and wide variety of knowledge and skills which is a huge challenge for everyone. In order to complete the work well, use equipment correctly, master the skills, hard efforts is absolutely necessary. Nowadays, the continuous development of the Internet of Things is changing people's life in all aspects, and it also brings improvement to these problems in electricity. The Internet of Things shall be able to incorporate transparently and seamlessly a large number of different and heterogeneous end systems, while providing open access to selected subsets of data for the development of a plethora of digital services[1]. That is to say, a huge number of information can be easily get by the Internet of Things, so it is quite suitable to do something useful in the power system.

QR Code is a widely used technology of the Internet of things used extensively due to their beneficial properties, including small tag, large data capacity, reliability, and high-speed scanning[3]. What's more, the structural flexibility of QR code architecture opens many more possibilities to stretch the limits of data capacity further away which includes data hiding techniques, multiplexing techniques, use of color QR codes, use of data compression techniques, etc. Based on the above factors, we use the technology of QR Code of Internet of Things to build a power marketing ubiquitous learning mode to help the power system's staff and customers.

1. Problem Raised

1.1 Customer service

For Power Marketing new technologies and new services, such as electrical energy alternative, distributed power, electric vehicles, integrated energy, etc., publicity is often limited to text information in the business hall, that leads most of the customers to passive and bored. In that case, the publicity effect is not good.

Electric Power Marketing staff often work at the equipment and customers' location, such as site survey, station line loss management, power inspection, equipment fault diagnosis, charging facility operation and maintenance, etc. In the field work, employees can obtain limited information and skills from the Work Sheet, while big data in Marketing Information Systems, Collection Systems,

GIS systems, and Car Networking Platforms cannot be used to effectively support in real time. In addition, no real-time help of knowledge and skills at all, staff entirely rely on themselves.

Some of the electricity business involves lots of steps and a wide range of technologies, especially the high-voltage new connection. With limited communications, customers hard to understand the whole process, the each of technical points, every material to submit, and all of the safety inspections clearly. As a result, customers need to consult many times, what's more, errors lead to repeated business processing which greatly wasting manpower and material resources. In this situation, the service is urgent to improve.

1.2 Training and learning

State Grid Co., Ltd. has a training institution, the provincial companies also have training centers. In addition, there are some colleges and universities of electric power. Most of the training and teaching institutions use traditional training mode. This it is concentrated teaching activities. Trainees are arranged in different training and teaching places based on their knowledge and skills. In the traditional training mode, there are many training courses and many trainees in each class, which inevitably leads to trainees ' lack of initiative. It is a common phenomenon that the trainer is teaching while trainees is playing with mobile phones. Besides of this, there are many trainees who have no clear and definite goals or purpose. In general, the training effect is not good.

Take the training of calibration and use of measuring equipment as an example, this practical project involves more than ten devices, such as the standard transformer, electricity meter, transformer calibrator, load cases, voltage regulator, etc. There are also many operational skills to be mastered, which include wiring mode, operating methods, safety attention, process requirements, etc. In most cases, a number of trainers respectively explain basic knowledge, safety items, or operation essentials. In the process of explanation, the trainers try his best, but the students listen to it in a dull and boring way. Some trainees' desire for knowledge is not strong at all, so that they do not bother to ask questions because they don't think they would meet the questions in the future work.

In addition to the above, when encounter tough problems on the job sites, staff usually find the solution as easy as possible and lack reflection and summary, which will result in a poor individual developments. Then, further than that, the State Grid's knowledge base can't update new solution in time, that means staff need to solve the same problems independently.

2. Solutions

Based on QR Code of the Internet of Things, the new ubiquitous learning mode is “Discovering Problems → Scanning Code and Learning → Solving Problems → Thinking and Summarizing”, which can create a learning style of "everyone learns, learns at any time, learns at everywhere". The characteristics of this new ubiquitous learning mode is the Internet of things, Information available at any time, online guide and remote diagnosis. It will obviously help the staff to enhance knowledge and improve competence. To achieve this learning mode, information interaction is quite necessary among the Marketing Information Systems, Collection Systems, GIS systems, and Car Networking Platforms.

2.1 Application on the job sites

Customers can scan the QR Code by themselves which is posted on a device or document as shown in the Fig. 1 to get information once they feel unfamiliar with the equipment or service, then some text and audio but more videos will be displayed. In that case, the working efficiency is improved significantly so that customers will get better services and the staff's work stress will be less.

For example, we can post a relevant QR Code on the high-pressure business expansion notice as shown in the Fig. 1, and our customers can scan the QR Code to get a video and easily understand the process of power expansion and the information to be provided in each link once they don't know the next step and never need to wait and ask the staff, so the efficiency and customer satisfaction can be

improved. Here's another example, we can post a QR Code on electricity meters or charging piles of electric vehicles. Users can scan the QR Code to understand the basic information of the equipment, so as to use the facilities and equipment.

Fig.1. QR Code on the business expansion notice

The QR Code also can be posted on the equipment to facilitate staff to get equipment information and related operating processes. For example, the QR Code can be posted on the transformer in the platform area as shown in the Fig. 2, and the staff can scan the QR Code to obtain the operational information of the transformer, historical fault data, constant line loss, inspection points and other information. In that case the staff achieves a on-site learning, and a better completion of the tasks, so the result is the quality of work effectively improved.


Fig.2. QR Code on the transformer

This small QR Code of the Internet of Things will change the massed learning mode into ubiquitous learning mode, which will really realize the state of "everyone learns, learns at any time, learns at everywhere". Further than that, the new learning mode can plays a very good role in the promotion of new equipment and new technologies.

2.2 Application in Training

Electric power training covers a wide range of topics, including safety emergency, equipment characteristics, business processes, skill operations, service etiquette, etc. In the traditional training mode, trainers demonstrate the course again and again, however, trainees' learning effect is often not taught because of the unclear and indefinite goals or purpose. In the process of practice, the trainers need to answer students' questions again and again, which leads to not only "laborious" and

"time-consuming", but also exhaustion. For example, when the same operation question is asked for more than 20 times in a row, emotional pollution and impatience is inevitable.

In addition, trainees' internal motivation is insufficient and learning initiative is not high. What's more, the mobile phone is more and more widely used in today's society. It is really convenient for our life and make our life better and better, but it also has a great influence on the trainees and the training. The most obvious influence is the less interest in learning and more in the mobile phone games. In response to this situation, most of the training institutions and schools disable the mobile phones during class. This method may solve the problem of mobile phone games but not the problem of low learning initiative.

As the saying goes, dredging is better than blocking. The new ubiquitous learning mode tries to turn the trainees' interest in the mobile phone games into interest in learning. trainees use their mobile phone to scan the QR Code posted on the equipment as shown in the Fig. 3 and they get well-targeted information to learning. The information may be a few word , a short period of recording or a short video, that will never make trainees tired. In that way, trainees' interest in learning is increased and training effect is improved.

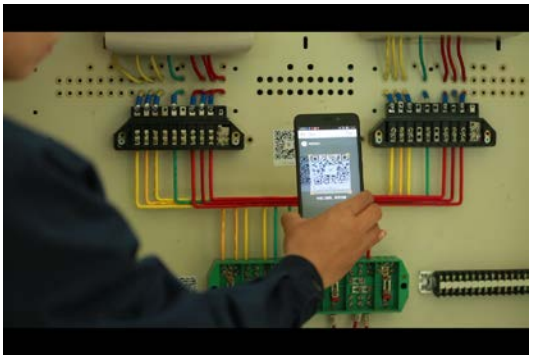

Fig.3. QR Code in Training

Take the training of installation the energy meter as an example, we have developed " Micro Class and Self-learning System Based on the QR Code of the Internet of Things". This Micro Class and Self-learning System includes the usage of tools and methods of operation, process requirement, basic knowledge and so on. Once the trainees encounter problems, they don't need wait and ask trainers, they find the answers themselves by scan the QR Code posted on the training equipment and learn the knowledge by the words, recording or video. The trainers' learning has strong pertinence and the learning effect improves accordingly.

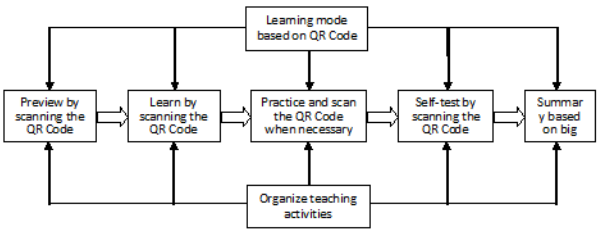

Fig.4. QR Code in Teaching Process

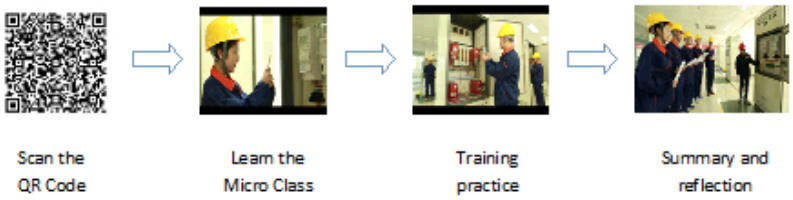

Fig.5 QR Code in Learning Process

Beyond the learning, the other training process can be combined with the QR Code. Through all of the learning, preview, learn, practice, test, summary, we can use the QR Code to turn the traditional learning mode into intelligent. As show in the Fig. 4 and Fig. 5, the whole training process is changed by the usage of QR Code. Trainees preview, learn, practice, test by themselves and would pay more attention to the things they need or unfamiliar with. By the end of training process, summary will be more targeted because trainers can get the trainees' learning situation Learning accurately with the big date of the scanning the QR Code.

By using the QR Code and a knowledge base including a wide range of knowledge and skills of power marketing ,a "wisdom" platform is established. A great deal of knowledge, such as safety emergency, equipment characteristics, business processes, skill operations, service etiquette, etc. can be easily realized in the online learning by scanning the QR Code, improve the training and learning effect, and effectively promote the promotion and application of new equipment and technology.

3. Application Practice

In order to verify the feasibility of the ubiquitous learning mode, State Grid of China Technology College applied this mode in the Power Marketing Training Department, built a small experimental platform and completed the practice of ubiquitous learning mode based on QR Code of the Internet of Things. During the application process, the needed trainers decreased by 6 and each trainee reduced usage of more than 100 pieces of papers, that is to say, more than 200,000 RMB was saved and the trainees' learning effect was remarkably improved while the trainers' fatigue and repeated instruction were reduced. Besides of the practice results, this ubiquitous learning mode obtained the consistent high praise and won several prizes of education a few month earlier.

The practice results, the high praise and prizes make us more confident to build a training platform of the Internet of Things for the whole Stat Grid. On the basis of practice, we have several innovative ideas as follows.

Build a real "Encyclopedia of Electric Power".

Encourage all the staff to upload their own knowledge and skills with the points-based system. Once they upload the unique knowledge, they will get the points which they can use to learn some high quality courses or buy some physical object. Once the points-based system works, relying on the large number of staff, a real smart cloud platform, a real "Encyclopedia of Electric Power" will be built in a very short time.

Implement the remote diagnosis.

Through the mobile phone client, a learning style of "everyone learns, learns at any time, learns at everywhere" is built but there is always some new questions that never met before and staff can get help from the "Encyclopedia of Electric Power" anymore. Besides of the "Encyclopedia of Electric Power", our Stat Gird also has many experts with solid theory and rich experience. Staff can get remote diagnosis from the online experts so that staff have no need to do difficult jobs on one's own, the experts provide strong support.

New application of "O2O" and reversal classroom teaching methods.

The ubiquitous learning mode based on QR Code of the Internet of Things would change the teaching methods of training institutions into "O2O" mode and build a "flipped classroom". In that

mode and classroom, trainers are no longer indoctrinators, but guiders. In other words, they don't teach or organize the training any more, they just keep the trainees to learn in a safe way and solve problems which is not involved in the "Encyclopedia of Electric Power". The main job of trainers is "diagnostic learning" and "help students learn", not teaching any more. In the end, all the trainers

We should change from teaching and speaking in class to students' "guided learning", use cloud data to become "customer-service" online tutors.

Each network work site and equipment can be posted with the QR Code, then a really ubiquitous learning model is built, which can improve work and learn effect and save time. Once all the staff is encouraged to make and upload the Micro Class of power equipment, system operation, business process, work cases and new technology application into the Network University of the State Grid one by another, a really "smart" State Grid Cloud comes out, so as to form a big database of knowledge and promote the application of new technology and equipment.

In a word, this ubiquitous learning model can be applied to electric power training centers and electric power supply job sites, it will create a learning style of "everyone learns, learns at any time, learns at everywhere". More language versions would be developed to help the staff of other countries work easily and accurately, even promote the development of the global energy interconnection and “One Belt and One Road”.

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