UCODE-Based Coding of Industrial Classification for National Economic Activities

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Abstract. The UCode is one of the most important code methods in IoT. The Industrial Classification for National Economic Activities (ICNEA) is a classification standard of economic activities drafted by State Statistical Bureau. Based on the analysis of the coding of UCode and Identification code, from the principal of uniqueness of coding and principal of locality of word field’s information processing, we present a map method to code the alphabet and decimal digital of the ICNEA by binary UCode, and if finally result scheme of ICNEA code in the format of UCode. This scheme extends the application scope of the UCode.

1. Introduction
The Internet of Things (IoT) is emerging as the major trend in shaping the development of the next generation of information networks after the Internet [1-3]. The IoT can sense the environment by sensor, acquire the data by ADC, transmit the data by network equipment, process the data by computer, make decision by server, signal the actor, so as to realize the independent response of the Internet of things to physical events and trigger action with or without manual intervention. Identification function is fundamental to the IoT to discern the interesting objects, and the UCODE presented by the UID center is the potential and powerful scheme to apply in IoT [4]. It has important significance to single item management in IoT. The Industrial Classification for National Economic Activities (ICNEA) is a classification standard of economic activities drafted by State Statistical Bureau [5]. And the ICNEA is usually applied in information processing and information interchange of macro management in the fields of statistics, planning, finance, taxation, industry and commerce. Except to the single item identification in the field of IoT, the industry classification code of national economy based on the object’s attributes plays a role function in a statistical sense. So it is meaningful to analyze and study the implement scheme of ICCNE code in the format of UCode.

2. UCode Analysis
UCode is the coding scheme for ubiquitous computing architecture which bring by Ubiquitous Identification center. Its aim is bring the interesting objects into the category of Ubiquitous Identification architecture by using the UCode coding, thus the objects can be identified and for further processing. The UCode coding scheme [6] describe as following table 1:

| Ver  | Top Layer Domain | Class     | Second Layer Domain | Identification |
|------|------------------|-----------|---------------------|----------------|
| 0000 | 0x0000H-0xffffH   | 1001-1110 | 8+16n,[0,5]         | 96-16n,[0,5]   |

Table 1: UCode (128 basic width) Structure
The Class Code indicates the boundary between the Second Level Domain Code (SLDc) and the Identification Code (Ic). If cc’s most significant bit is 1, the UCode is 128 bits, and the total length of SLDc and Ic is 104. If cc's most significant bit is 0, the UCode is an extended code consisting of 256 bits or more. In the structure of 128bit length, the length of SLDc will increase with the step of 16 bits while the length of Ic will decrease with the step of 16bits. The Class Code (CC) how to determine the structure of SLDs and Ic are described as table 2:

Table 2: The CC and the structure of SLDc and Ic

| CC   | SLDc-Ic          |
|------|------------------|
| 1000 | Reserved         |
| 1001 | SLDc-8           | Ic-96   |
| 1010 | SLDc-24          | Ic-80   |
| 1011 | SLDc-40          | Ic-64   |
| 1100 | SLDc-56          | Ic-48   |
| 1101 | SLDc-72          | Ic-32   |
| 1110 | SLDc-88          | Ic-16   |
| 1111 | Reserved         |

Usually, the coding adhere to the following principal: Firstly, for the unique identification of coding, it is important for that the space of UCode must not less than the object space. Finally, for the efficiency of coding, the coding space ought to just large than the object space.

3. Industrial Classification for National Economic Activities Coding based on UCode

Industrial Classification for National Economic Activities (ICNEA)[5] is a economic activities classification standard that is drafted by State Statistical Bureau and specify the classification and code of the social economical activities. And the ICNEA is usually applied in information processing and information interchange of macro management in the fields of Statistics, planning, finance, taxation, industry and Commerce. Industrial classification for national economic activities adopt the homogeneity principle of the economical activities to partition the national economy industry. Thus each of the industry class is partitioned by the nature of economic activities other than the criterion of establishment, accounting system or department management of the economical activities. The basic unit of industry category is adopted the criterion of industrial activity unit, and is suitable for the production statistics.

Industrial classification for national economic activities adopts the linear classification method and hierarchical coding method, which classify the national economic industry as the hierarchies of section class, division class, group class, and subclass. The code of the industrial classification for national economic activities consists of one Latin alphabet and four Arabic numbers. In which, the section class is coded as a Latin letter from A to T; the division class is denotes as two Arabic numbers and increase from 01; the group class is consists of three digital based on the two numerals of section class; and the subclass includes four Arabic numbers based on the three numeral of group class. For example, in section class, the “I” code denotes of “information transmit, software and information technology service”; under the “I” section class, there is a division class “65”, which express the “software and information technology service”; following the “I65” division class, the “I653” describe the “information system integration and IoT service” group class; and under the group class, there exists subclass of “Internet of Things Technology Service” and coded as “I6532”.

For the code method of the industrial classification for national economic activities, firstly, we need transform the section class code “A to T” into the UCode binary code; following, we will transform the division class, group class, and subclass code into UCode binary code respectively. We need code the twenty Arabic letters of “A to T” and ten decimal numbers of “0 to 9” into the binary code of “0 and 1”. So there need five bits of UCode to denotes one Latin letter or decimal digital base on the coding theory.
of information theory. The UCode-based coding scheme of industrial classification for national economic activities show as table 3:

Table 3: UCode Coding Scheme of ICNEA

| UCode | 00000 | ... | 01001 | 01010 | ... | 11101 | 11110-11111 |
|-------|-------|-----|-------|-------|-----|-------|-------------|
| ICNEA | 0     | ... | 9     | A     | ... | T     | Reserved    |

For the coding of industrial classification for national economic activities, when we take into account the hierarchy and category statistical character of classification, we specify five bits to the section class, division class, group class, and subclass, respectively. So the coding scheme need twenty five bits binary code of UCode to express the code of industrial classification for national economic activities. For an application system, there always need to identify the single item of product or service, which needed in the quantitative analysis of the statistical of industrial classification for national economic activities. As for the single item identification, one may be interested in the producer of product or provider of service, another may think the timestamp of the product or service is critical. For the producer, there is about thirty million judicial entities and seventy million individual businessmen. So we need twenty seven bits UCode to express the total producers or providers. As and in the statistical meaning, the time cycle usually in month. So we need sixteen bits to denote the year and four bits express the month. Finally, we need the item identification to identify the product or service which a judicial entity or individual businessman to produce or provide monthly, we can assign twenty bits to the item identification and it’s space is 1048576 per month.

For the ICNEA code I6532, it denotes the IoT Technical Service Activities, the code scheme of ICNEA code 16532 based on UCode is illustrated in the table 4:

Table 4: UCode Coding Scheme of ICNEA code I6532

| Ver | TLD | cc | SLD | Ic |
|-----|-----|----|-----|----|
| 0000 | 0x1234H | 1001 | 0x12H | ICNEA-25 bits | YYYYMM | Single Item-20 bits |
| I6532 | 0x202006H | ... |

The implement scheme of the industry classification code of national economy coding using UCode can implement various statistical application in the Ubiquitous Identification System.

4. Conclusion
Based on the analysis of the UCode structure, this paper presents an implement scheme of the industry classification code of national economy coding. Thus we can category the industry classification code of national economy into the UCode field, and extend the application scope of UCode. It is useful for the IoT to apply to the interesting object for the subject in the statistical sense.

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