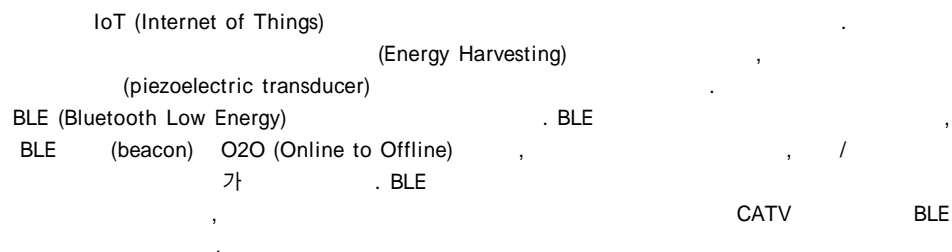IoT   Smart Sensor

*

Study on the Design Method of the Energy Harvesting Smart Sensor for Implementing IoT Service

Ho-Deok Jang*

IoT (Internet of Things)   .
                              (Energy Harvesting)   ,
                (piezoelectric transducer)   .
    BLE (Bluetooth Low Energy)   . BLE   ,
    BLE   (beacon)   O2O (Online to Offline)   ,   ,   /
                                    . BLE
                    ,   CATV   BLE
                    .

Abstract   This paper investigated the design method of the smart sensor for implementing IoT (Internet of Things) service. The power supply of sensor consistently acquiring data is based on the energy harvesting technology and designed with piezoelectric transducer not affected by surrounding circumstances. The wireless communication interface for the transmission of data is designed with BLE (Bluetooth Low Energy). BLE is highly adequate wireless communication technology for low power consumption and short distance wireless communication. The main application of BLE is beacon whose usage range is extended from O2O (Online to Offline) service, navigator based on indoor positioning technology, and anti-theft/lost child prevention service to mobile game. This paper studied the method to extend wireless coverage for complementing the short wireless transmission distance of BLE. The wireless sensor network based on CATV network is proposed for the easy construction of BLE sensor network and extended wireless coverage.

Key Words : BLE, CATV, Energy Harvesting, IoT, O2O, Smart Sensor, WOC

1.   ,   ,   .
                                                                        IoT
                            '   [1], [2]   ,
                    ,
    ,   ,   .   .   IoT
                ,

,

.   ,   ,

.

.   IoT   ,   PMIC
,   ,   ,   (Power Management IC),
RF   (capacitor)   .
(Energy Harvesting)   ,
[3],[4],[5],[6].   .   PZT-5H   ,
1.1Vrms~17.3Vrms
[9].

. IoT

.   ,

.

,

CATV

.
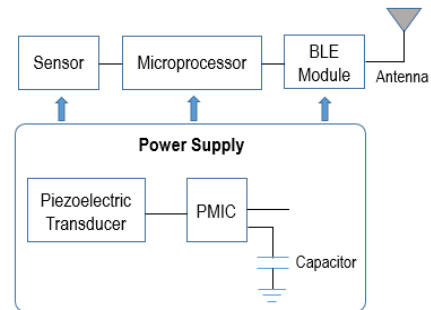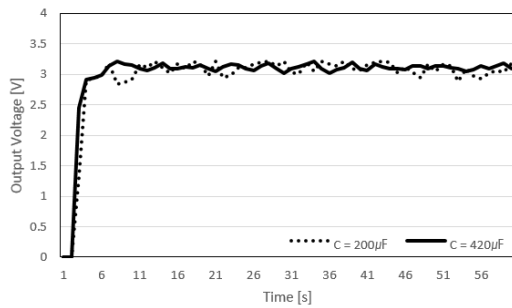

1.
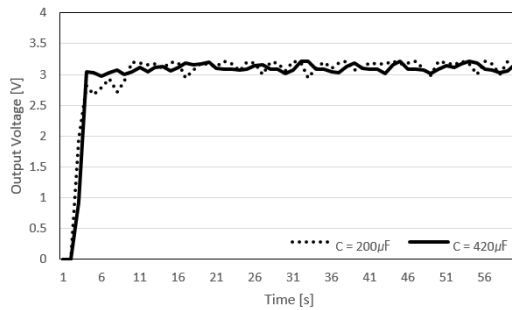Fig. 1. Smart sensor powered by piezoelectric transducer

2.

1   ,   ,
, BLE   ,   1.55V
.   .

,   3.27 V   , 95%
(3.11V)

BLE   .

. BLE   3dBm   ,   3.11~3.27V   .
(RSSI: Received Signal Strength   2~6   (sensing interval)
Indication)   −61dBm   .   PMIC   .

2.1   ,   3.1V   .
CS   (capacitance)   PMIC
.   ,   200
1   (solar cell)[7],   420   2

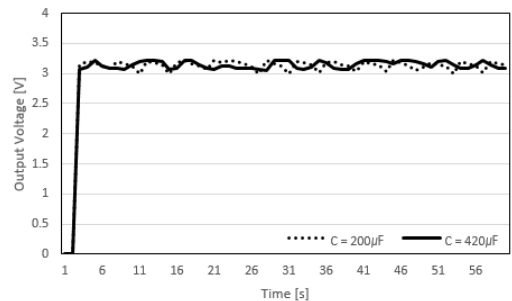[8]   .   (=RC)
,   .
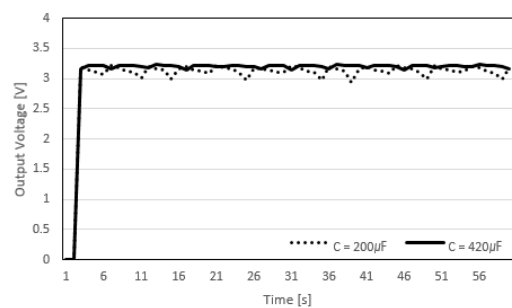
2. PMIC (sensing interval : 1.5s)
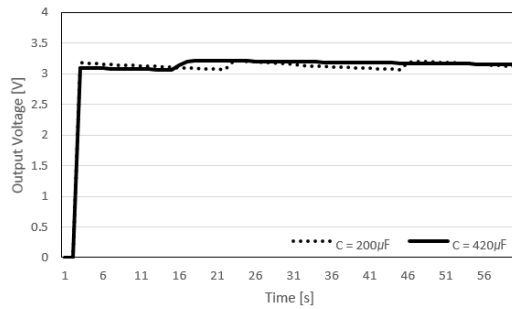Fig. 2. Output voltage of PMIC (sensing interval : 1.5s)

3. PMIC (sensing interval : 2s)
Fig. 3. Output voltage of PMIC (sensing interval : 2s)

4. PMIC (sensing interval : 2.5s)
Fig. 4. Output voltage of PMIC (sensing interval : 2.5s)

5. PMIC (sensing interval : 3s)
Fig. 5. Output voltage of PMIC (sensing interval : 3s)

6. PMIC (sensing interval : 6s)
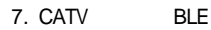Fig. 6. Output voltage of PMIC (sensing interval : 6s)

2 6 PMIC ,
1.5 6 4

4 .

2.2 BLE
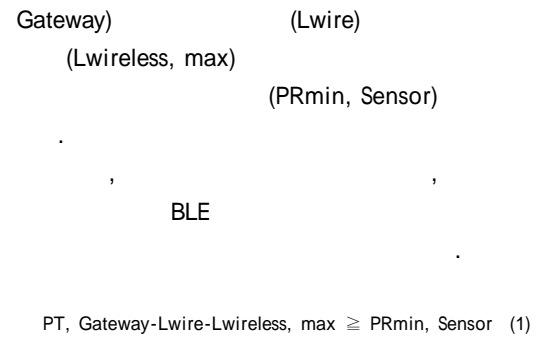
BLE
. BLE
Peripheral , Central
gateway ,
.
BLE 100m .
10m~100m
[10]. BLE
IoT ,
. BLE

. CATV

11   1

.

그림 7. CATV   BLE
Fig. 7. Network diagram of BLE sensor network based
on CATV network

CATV   WOC (WiFi
over Coax)   그림 7
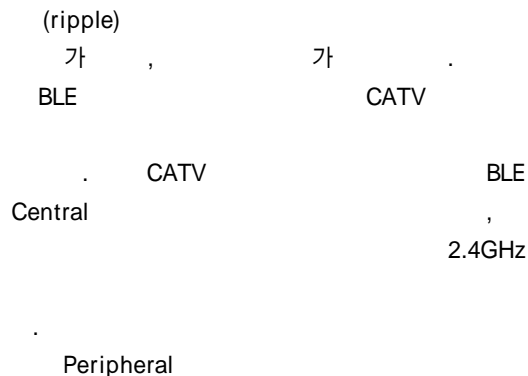   . WOC   WiFi AP
        (duplex filter)   WiFi
    CATV   [11].
    CATV   WiFi   .
WiFi   CATV   Tapoff
    STB (Set-Top Box)
              .   WiFi
              WiFi
,   CATV   CATV
        STB   .
CATV   5C, 7C
      [12]. 7C   , 2.4GHz
      0.223dB/m
              [13].   ,   ,
                        WOC
          WiFi
            .   , WOC
WiFi

    . WOC
                        ,
      , WiFi AP

                        .

      7   CATV   BLE
Central   (gateway)
              CATV   . 2.4GHz
ISM (Industrial, Scientific, Medical)
      BLE   CATV
                .
                  BLE
2.4GHz   , Peripheral
                        . BLE

                        . ,
                        1
.   (PT,
Gateway)   (Lwire)
    (Lwireless, max)
                  (PRmin, Sensor)
    .
        ,   ,
          BLE
                        .

$$P_{T, Gateway} - L_{wire} - L_{wireless, max} \geq P_{Rmin, Sensor} \quad (1)$$

3.

        ,   . IoT

            .

                        .

0.25g~0.5g

            .
3.3Vrms   ,   0.5g.
    60Hz   [7].   ,

                        3.11~3.27V
            .

(ripple)

,   .

BLE   CATV

.   CATV   BLE

Central   ,

2.4GHz

.

Peripheral

.

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스마트센서, IoT, 에너지 하베스팅