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Appendixes

Appendix A - Configuration and installing modules

An USB TTL adapter driver has to be installing to the PC before connecting adapter. USB to Serial Com port driver not install Arduino IDE unable to detect port illustrate in Figure 1.

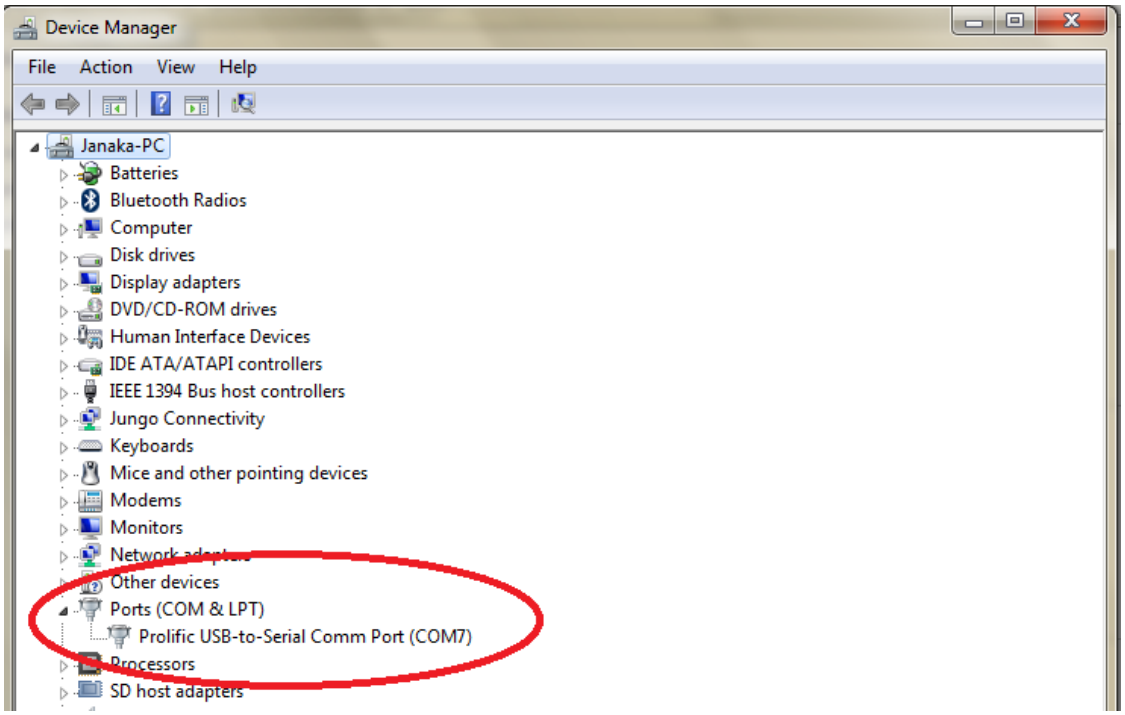

Figure 1: Device Manager

USB TTL converter Connect to the computer to upload programme and comport has to select in Arduino IDE when there was more than one com port activated illustrate Figure 2.

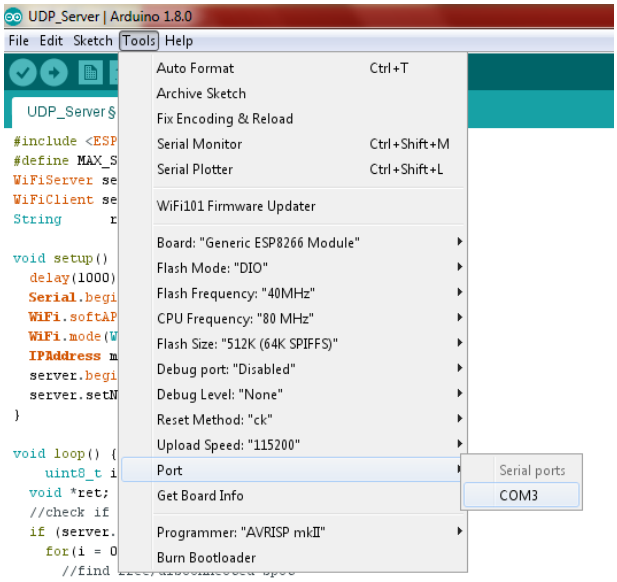

Figure 2: Com Port Selection

When connecting specific modules to Arduino IDE needs to install specific program supplied by device vender Figure 3.

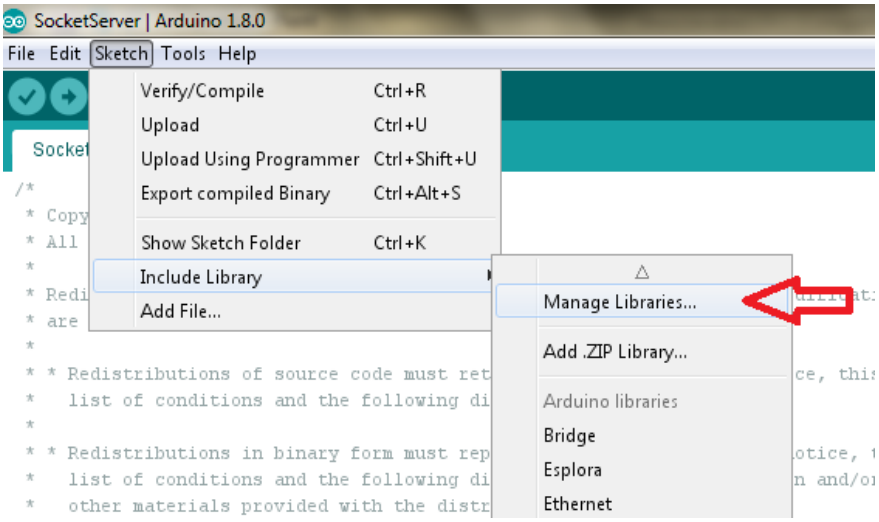

Figure 3: Include Libraries

Install ESP8266 library to Arduino IDE showing Figure 4.

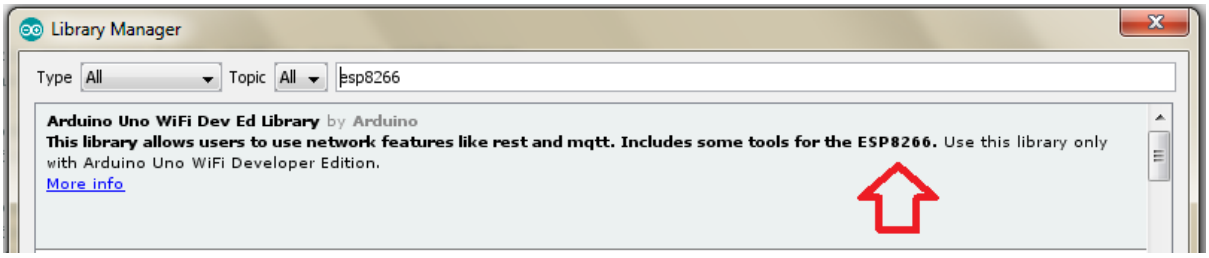

Figure 4: Install ESP8266 library

Before upload Arduino IDE, board has changed to “Generic ESP8266 Module” as in Figure 5.

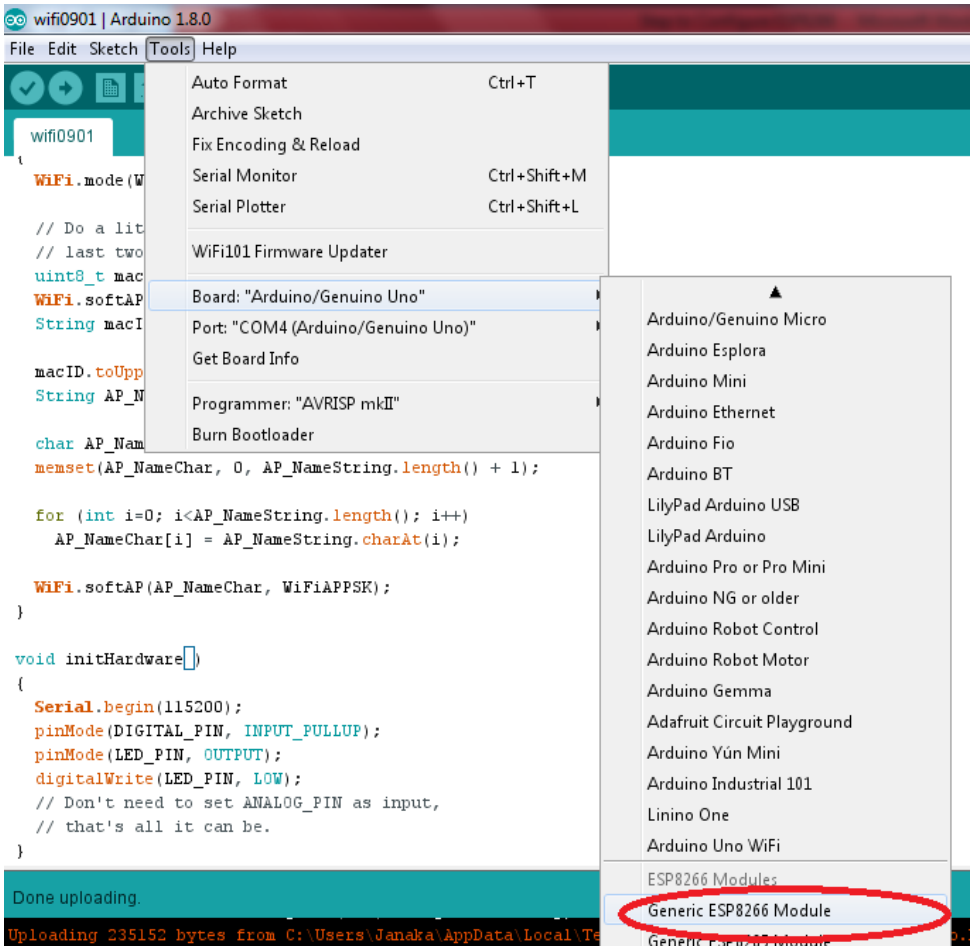

Figure 5: Generic ESP8266 Module Selection

Arduino IDE needs to install DS3231 module library supplied by device vender Figure 6.

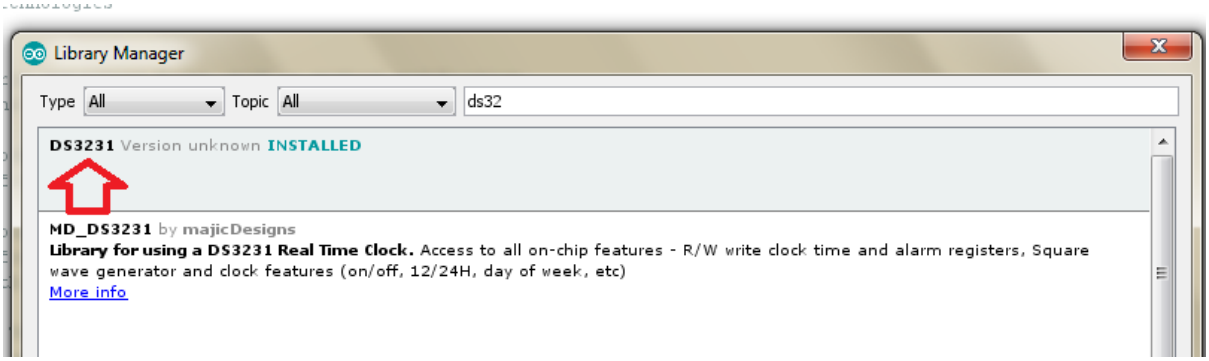

Figure 6: Install DS3231

Date and Time of the module initialization coded as follows Figure 7.

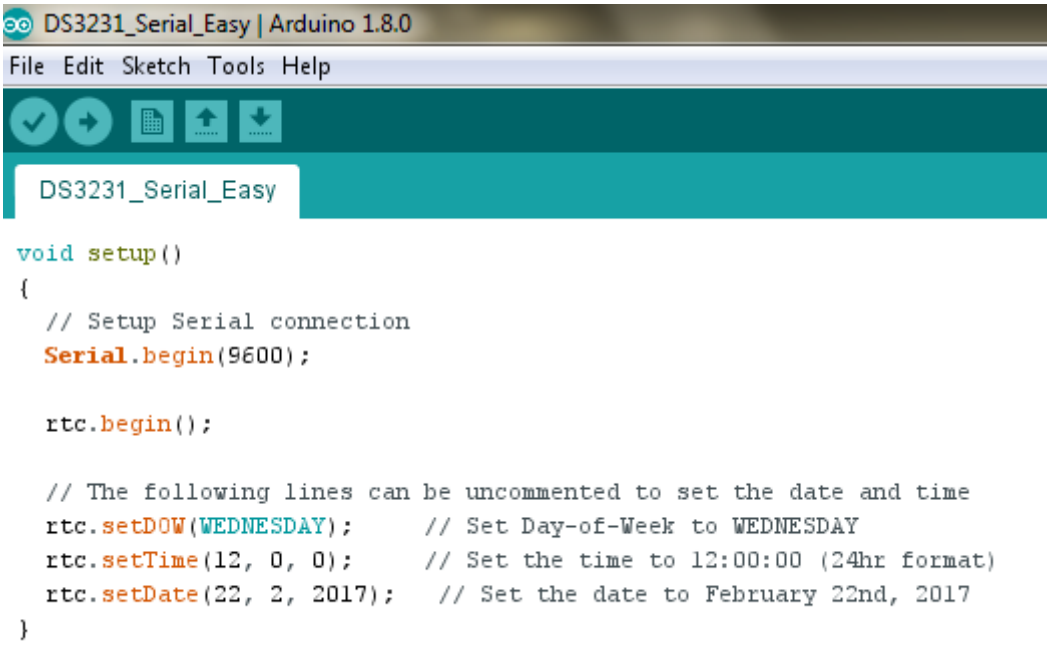

Figure 7: ESP 8266 Date and Time Module initialization

Initializing SD Card

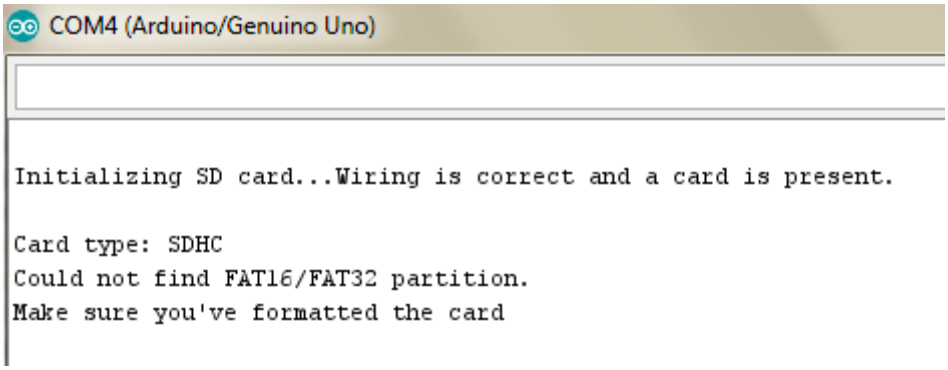

Figure 8: Initializing SD Card

Appendix B – Configuration of ESP8266 (Different Method)

1. Selection of Uno Board

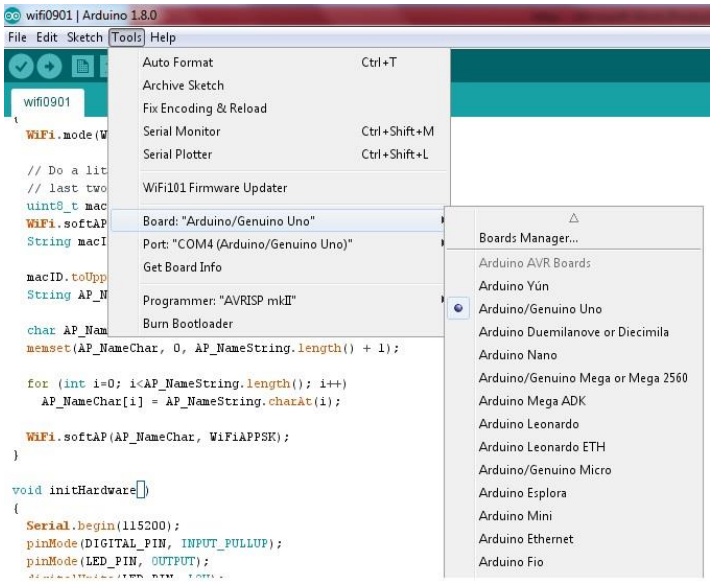

Figure 1: Selection of Board

2. Blank code Uploading to board

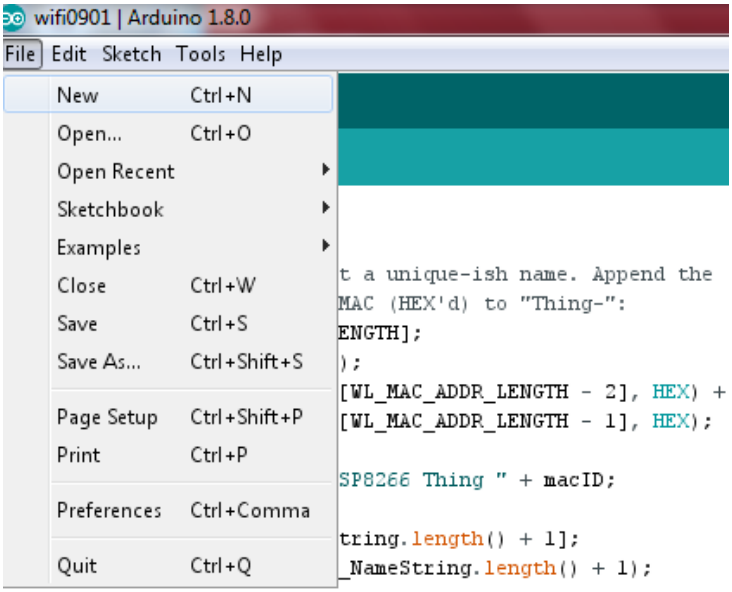

Figure 2: Selection of Blank code

3. Blank code ready for upload

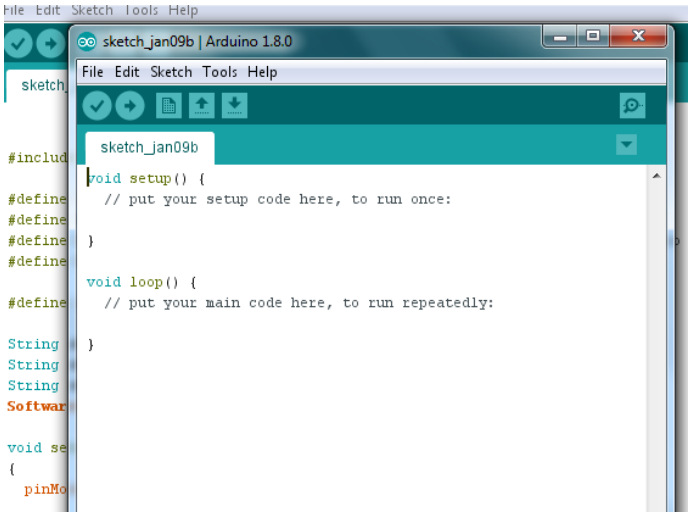

Figure 3: Blank code

4. Selection of Generic ESP8266 Module

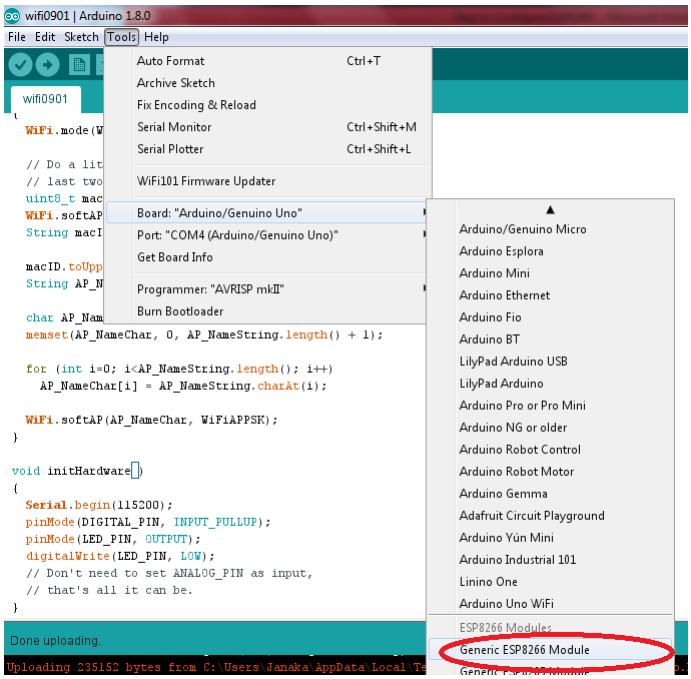

Figure 4: Generic ESP8266 Module Selection

5. Selected Generic ESP8266

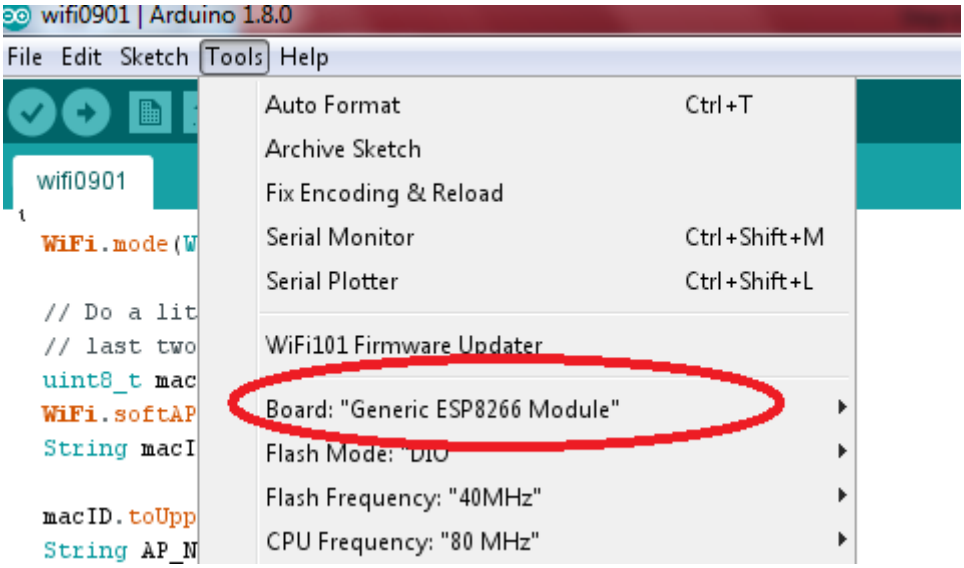

Figure 5: Generic ESP8266 Module Selected

6. Code Compilation

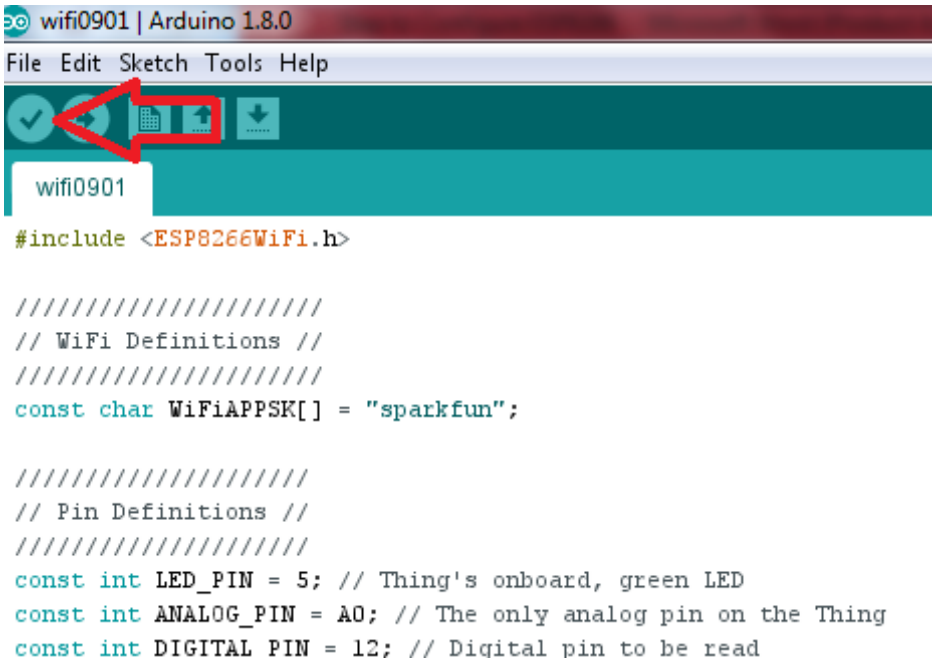

Figure 6: Code Compilation using command Button

7. Upload code in to ESP8266

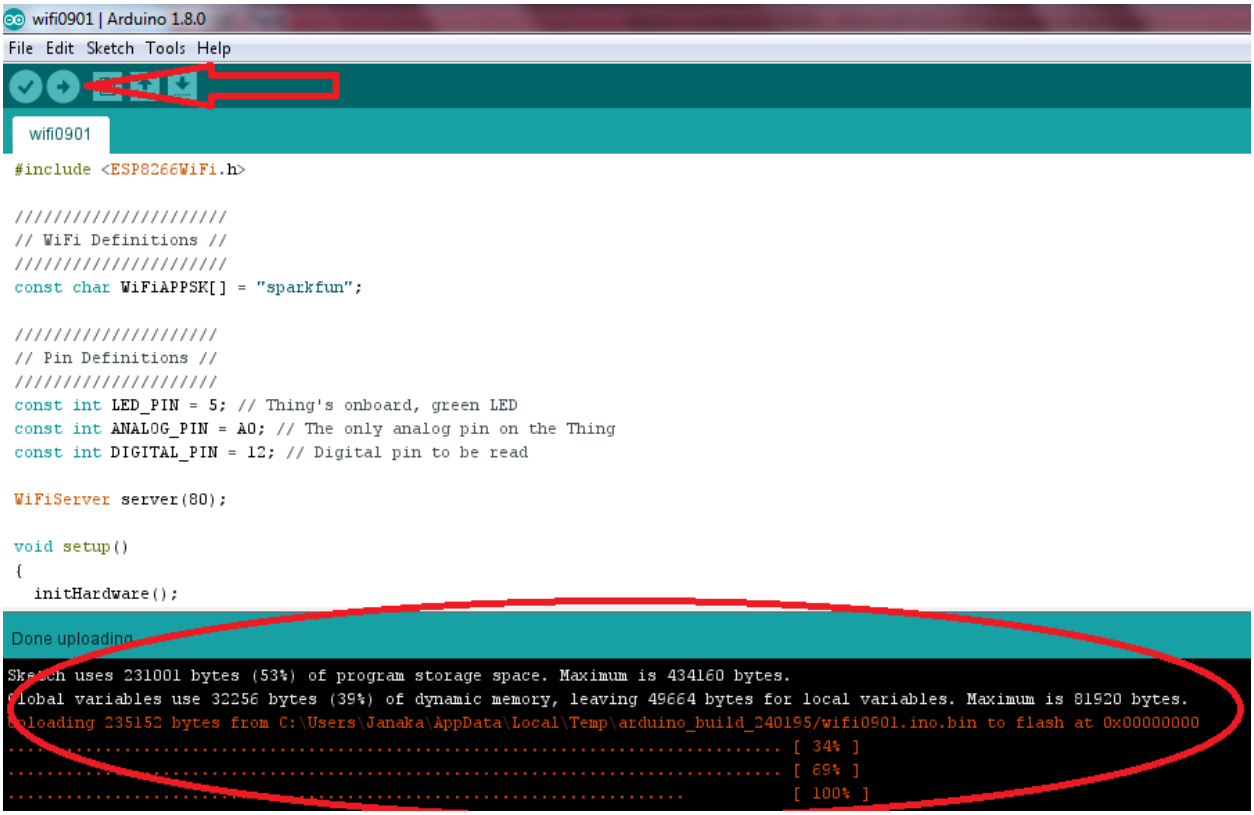

Figure 7: Code uploading to ESP8266 Module

8. Before Connecting to ESP8266 Wi-Fi

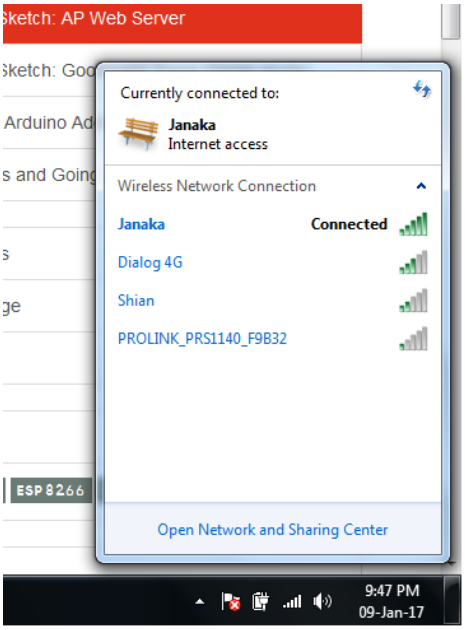

Figure 8: Before Connecting to ESP8266

9. After Connecting ESP8266 Wi-Fi

Figure 9: ESP8266 Wi-Fi connected

10. Check IP configuration

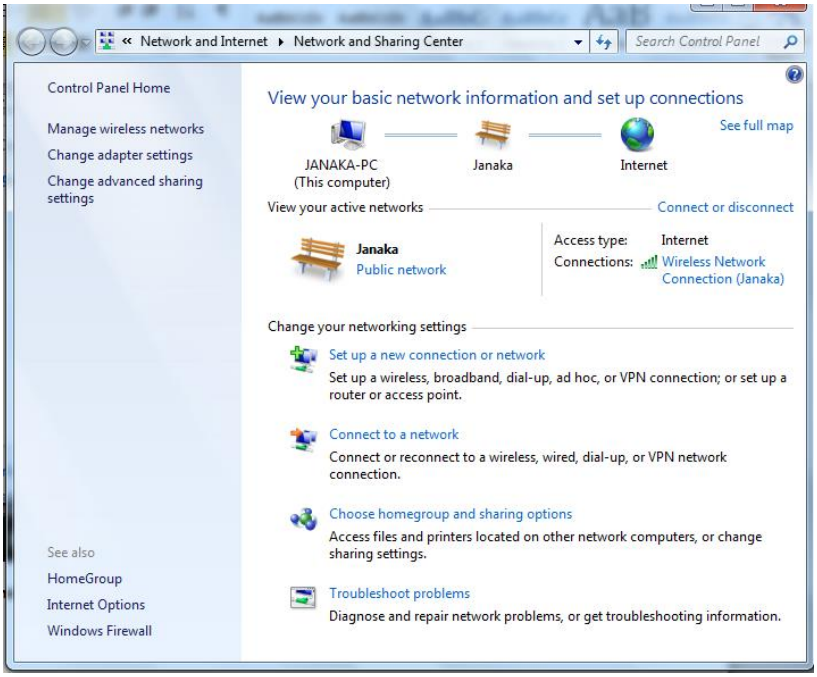

Figure 10: Network Sharing Center

11. Network and Sharing Center Properties

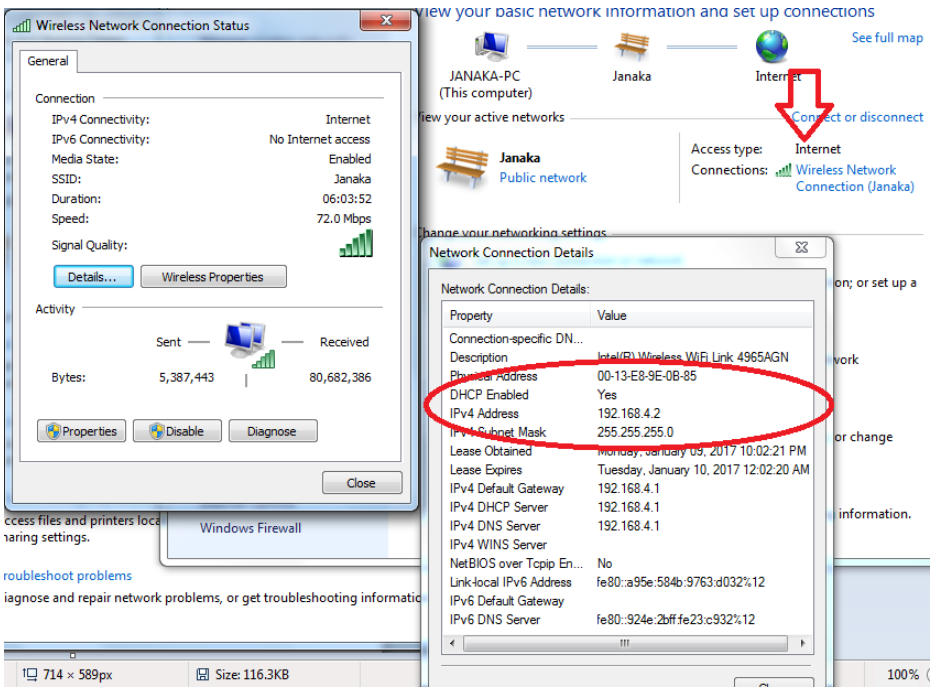

Figure 11: ESP8266 Wi-Fi Connection Details

12. Check Wi-Fi Connection using Command Prompt

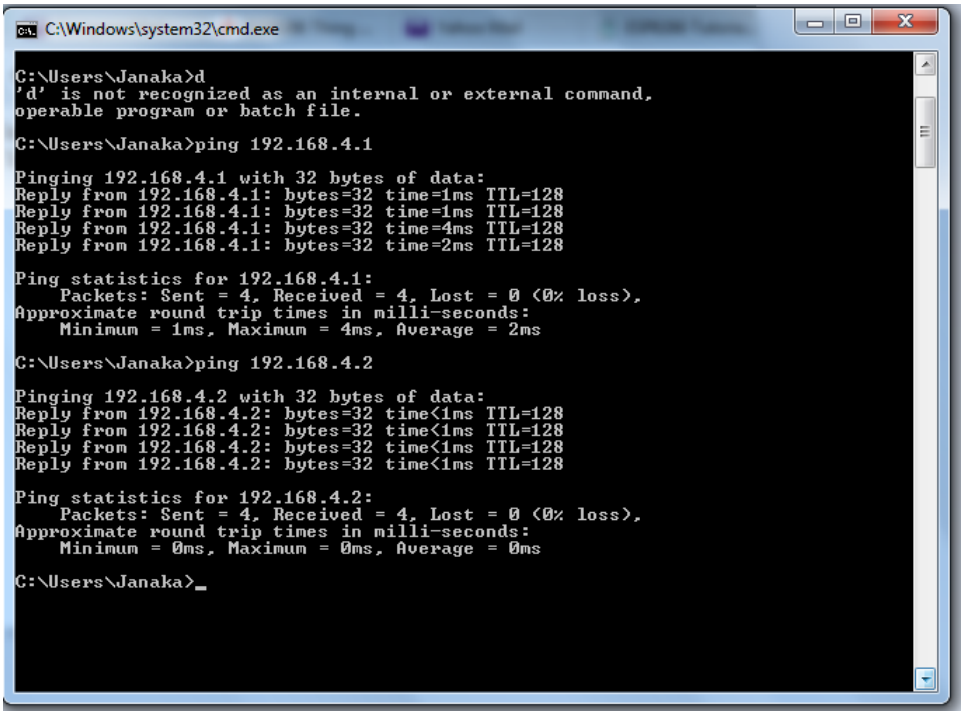

Figure 12: Check connectivity

Appendix C – User interfaces for Customer and Meter Reader Mobile Application

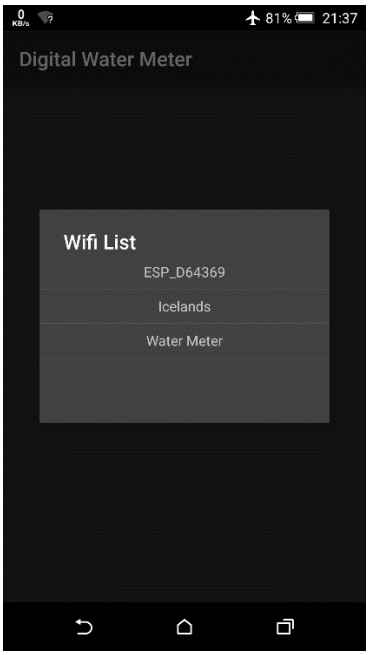

Figure 1: List of Wi-Fi connection

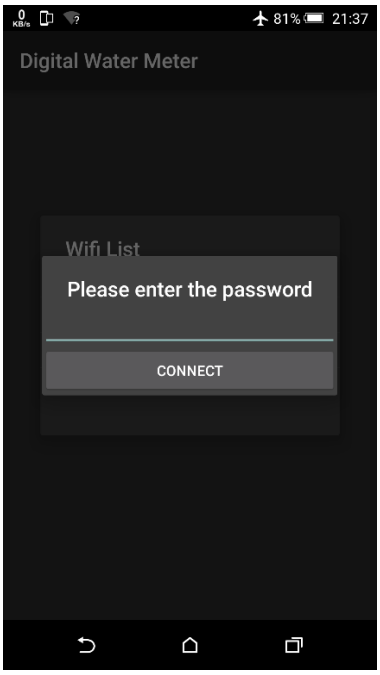

Figure 2: Logging to selected Wi-Fi

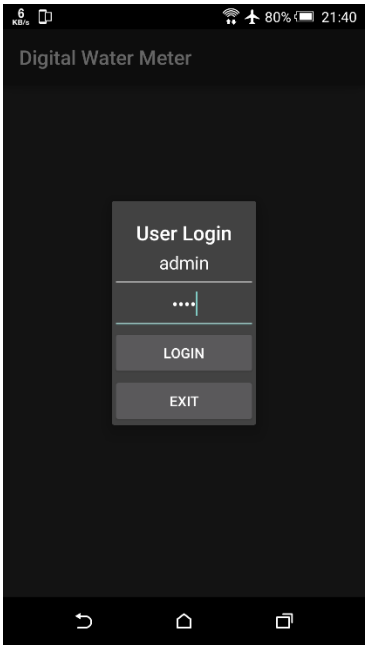

Figure 3: Admin Logging to selected Wi-Fi

Figure 4: Menu of Meter Reader

Appendix D – User interface designs for Water Board Billing Application

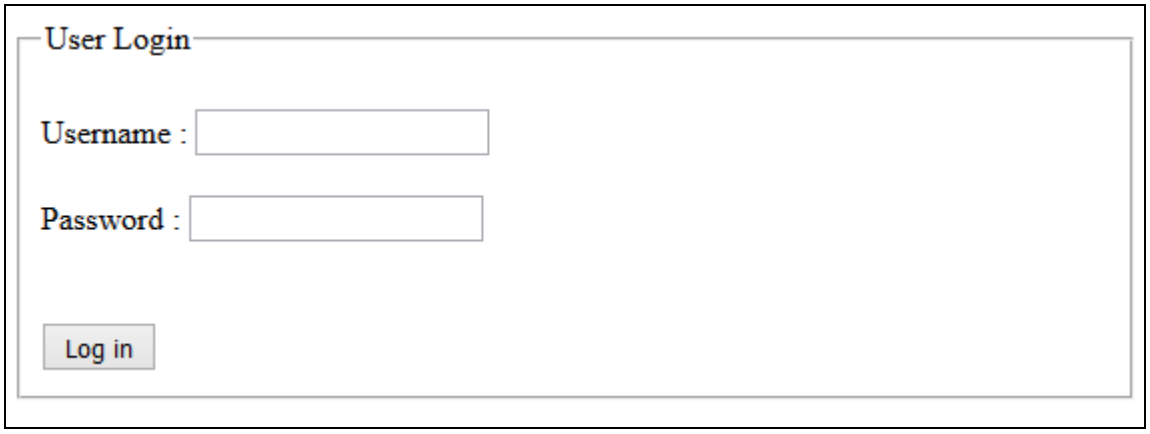

Figure 1: User Logging to the Water Board Billing System

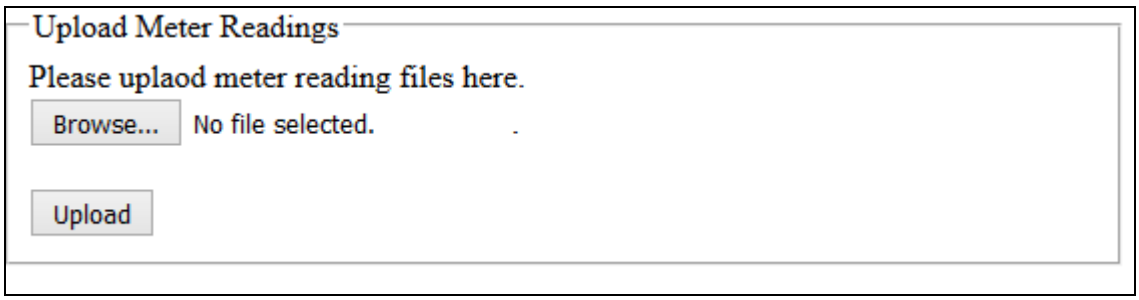

Figure 2: Upload Meter Reading Text File to Server

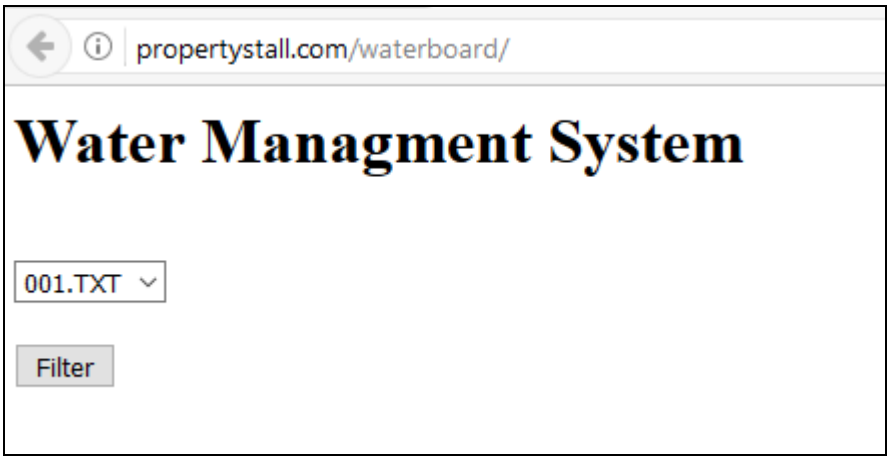

Figure 3: Select Text File to View Water Bill

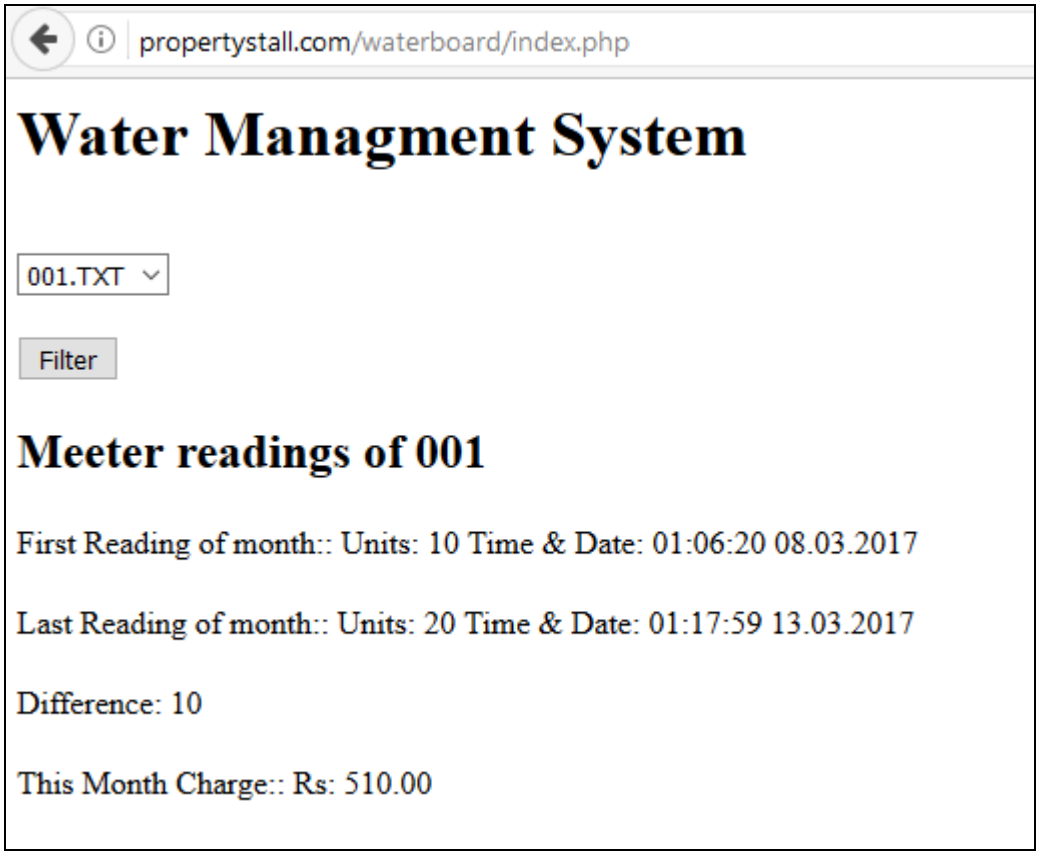

Figure 4: Current Bill for Selected Customer

Appendix E – ER Diagram

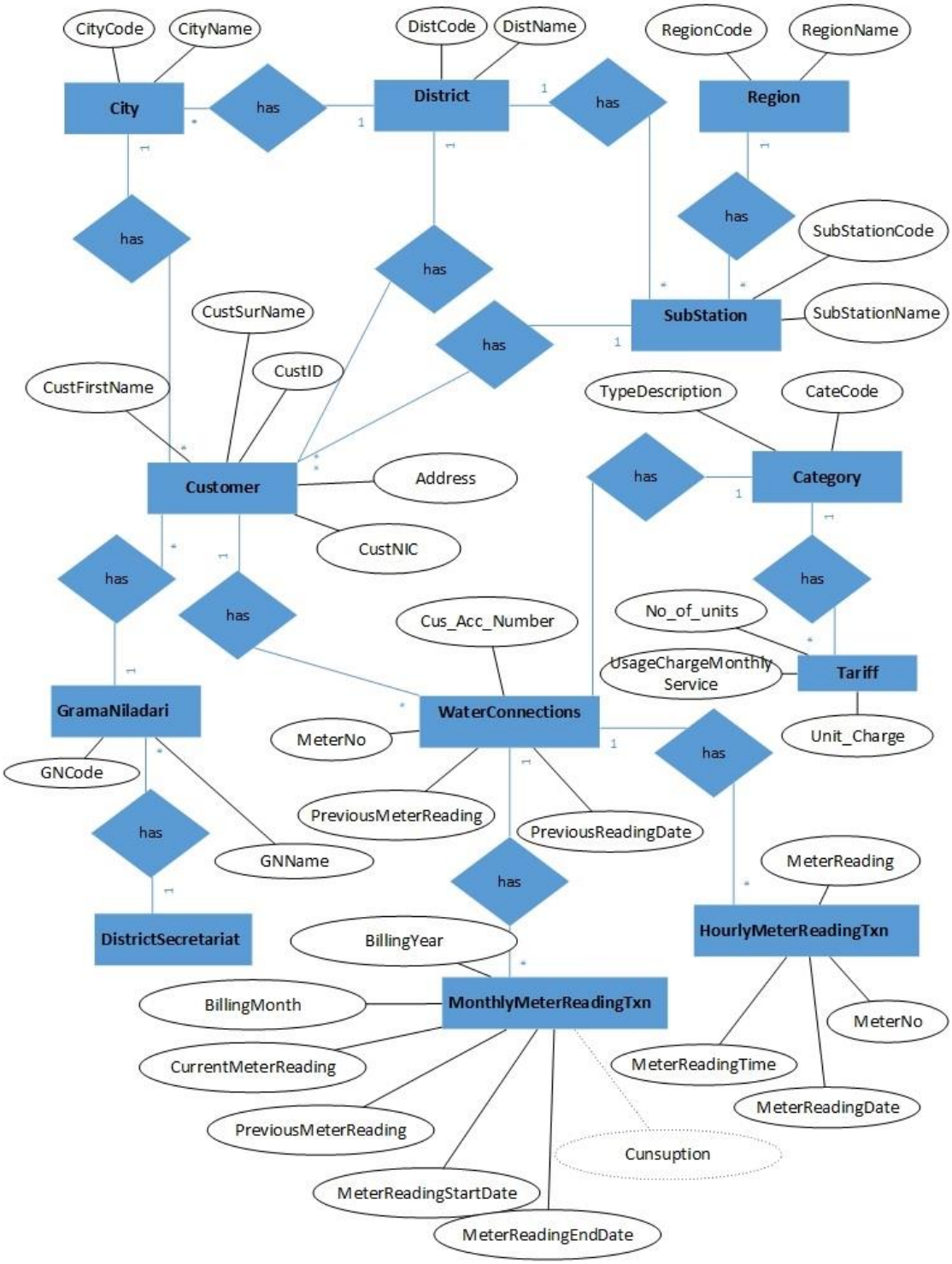

Figure 1: Water Board Billing

Appendix F – Sequence Diagram

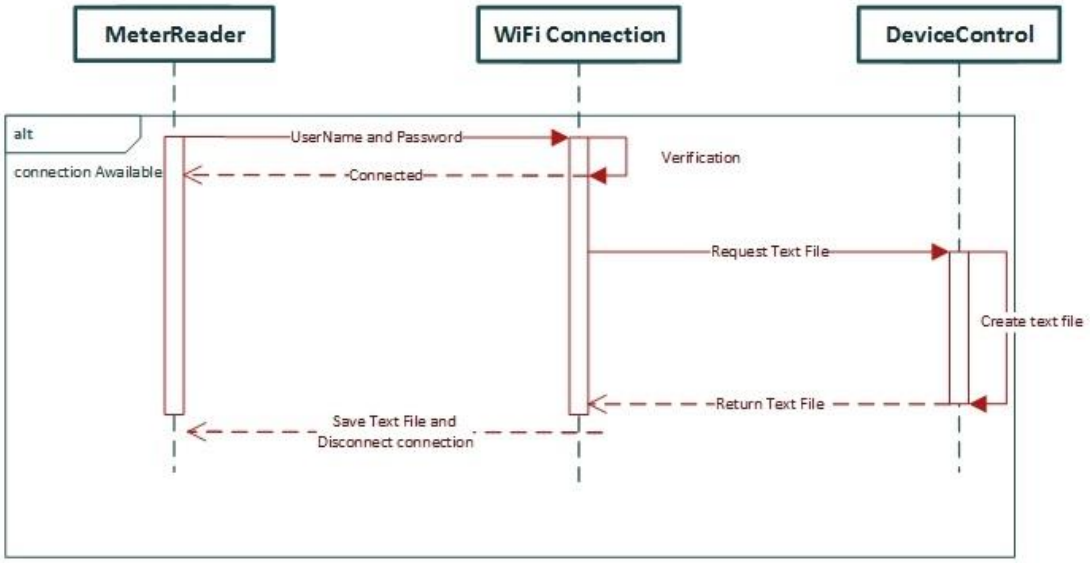

Figure 1: Meter Reader Text File Download

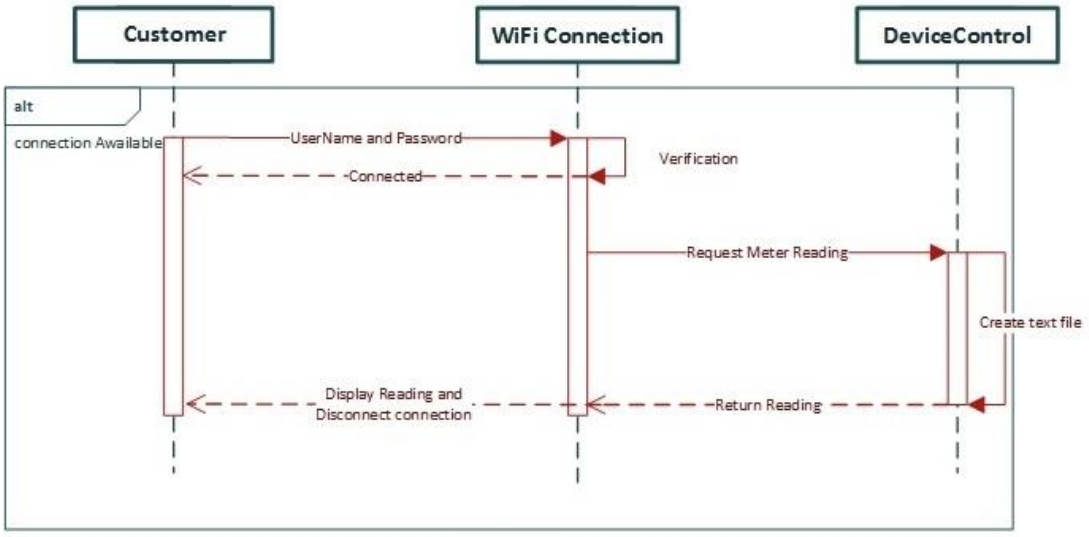

Figure 2: Customer Read Current Meter Reading

Appendix G – Use Case Diagram

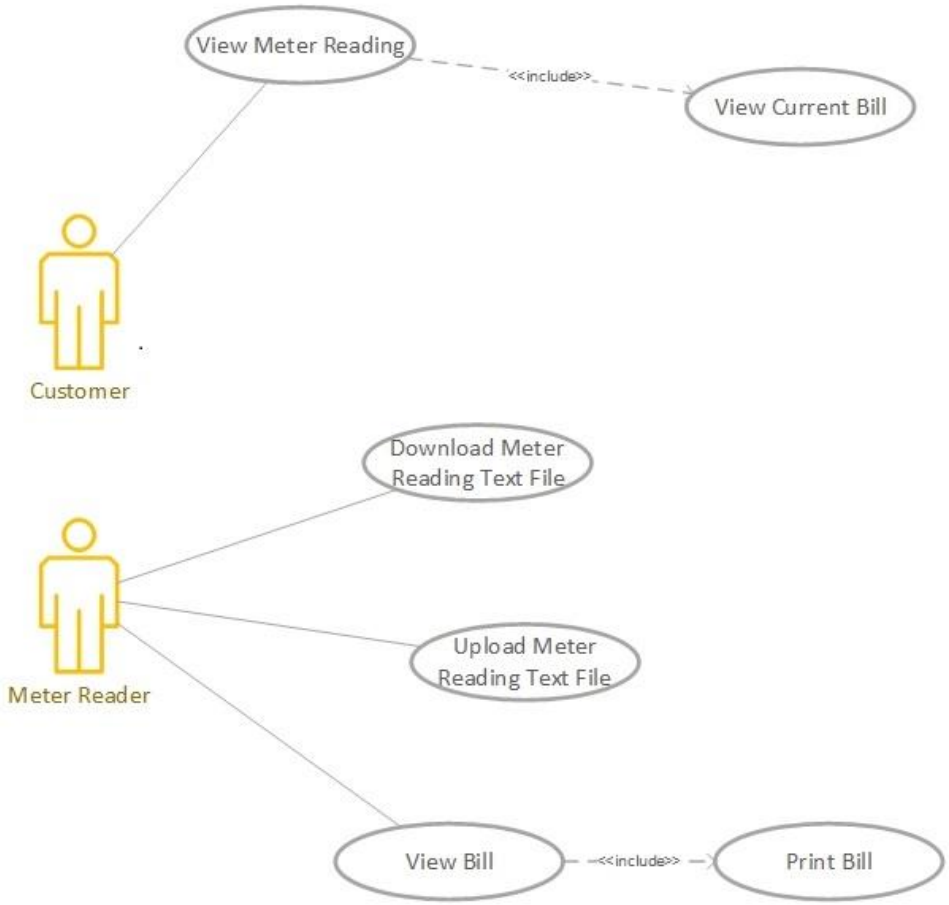

Figure 1: Use Case Diagrams

Appendix H – Flow Chart

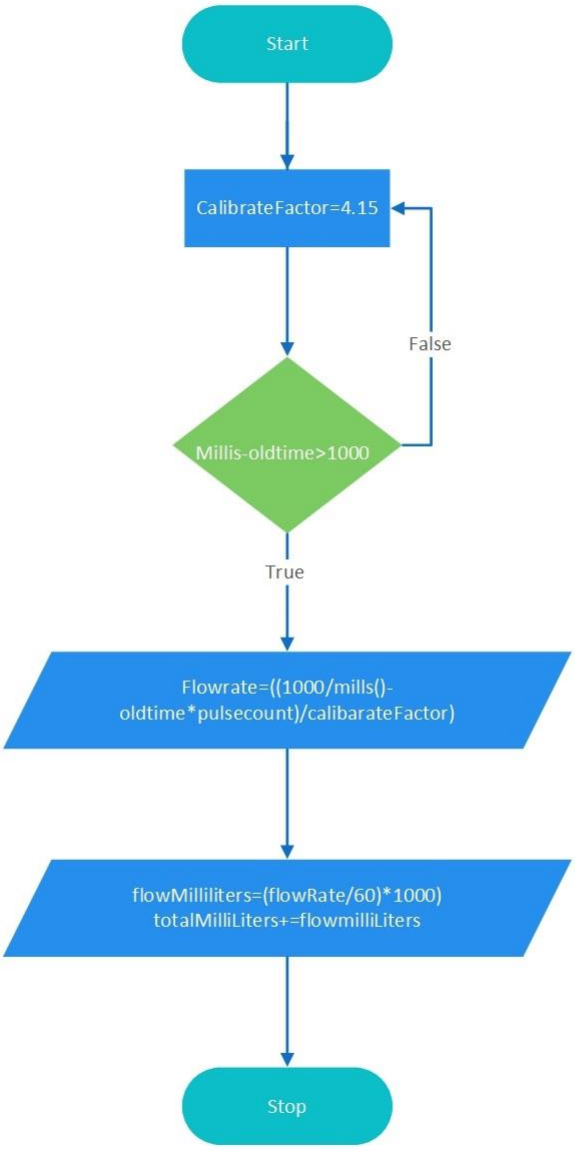

Figure 1: Water Flow Reading

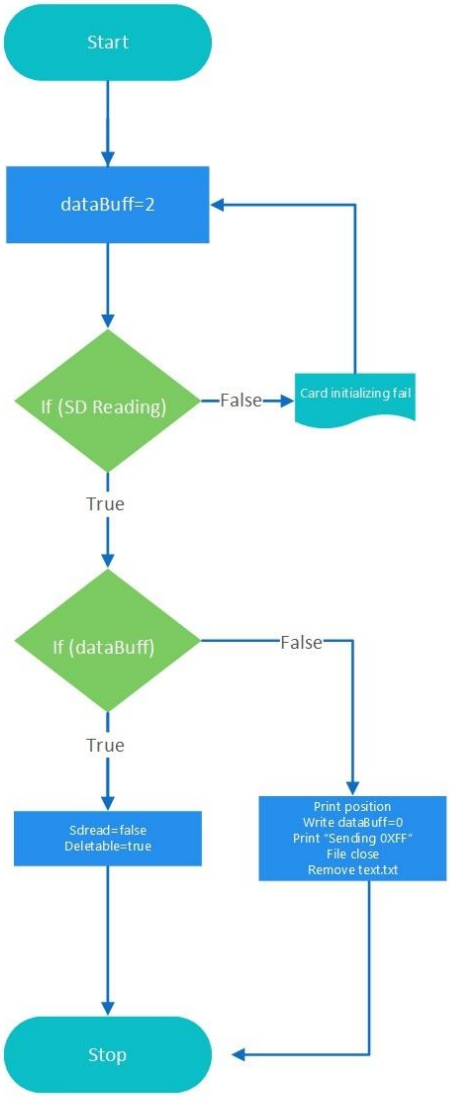

Figure 2: SD Card Reading

Appendix I – System Evaluation Forms

SWMS Evaluation of Usability – Customer Mobile Application

1 - Very poor, 2 – Poor, 3 – Average, 4 - Good, 5 – Excellent

#	Evaluation criteria	Ranking				
		1	2	3	4	5
		Very poor	Poor	Average	Good	Excellent
1	Can you understand function of the					
2	Easy to learn functions by your self					
3	Time taken to system feedback when execute function					
4	Are you happy with the information provided by the system					
5	Is system give proper feedback and massages to guide you to achieve your					

Table 1: Usability – Customer Mobile Application

SWMS Evaluation of Functionality – Customer Mobile Application

1 - Very poor, 2 – Poor, 3 – Average, 4 - Good, 5 – Excellent

#	Evaluation criteria	Ranking				
		1	2	3	4	5
		Very poor	Poor	Average	Good	Excellent
1	Does application provide adequate functions to get information on current water consumption and other information you required base on					
2	Does application giving clear expected output for your actions					
3	When comparing with existing systems for the same purpose, how would you rank this application					
4	Are you satisfied with the functionality offered by this					
5	Rank your expectation and system					

Table 2: Functionality – Customer Mobile Application

SWMS Evaluation of Overall Impression – Customer Mobile Application

1 - Very poor, 2 – Poor, 3 – Average, 4 - Good, 5 – Excellent

#	Evaluation criteria	Ranking				
		1	2	3	4	5
		Very poor	Poor	Average	Good	Excellent
1	Does system provide the final result within your expected time scope with expected quality					
2	How would you categorize system, based on this feature					
3	Look and feel when application use regular basis					
4	Overall satisfaction with this application					
5	Rank your expectation and system functionality					

Table 3: Overall Impression – Customer Mobile Application

SWMS Evaluation of Usability – Meter Reader Mobile Application

1 - Very poor, 2 – Poor, 3 – Average, 4 - Good, 5 – Excellent

#	Evaluation criteria	Ranking				
		1	2	3	4	5
		Very poor	Poor	Average	Good	Excellent
1	Can you understand function of the system					
2	Easy to learn functions by your self					
3	Time taken to system feedback when execute function					
4	Are you happy with the information provided by the system					
5	Is system give proper feedback and massages to guide you to achieve your goals					

Table 4: Usability – Meter Reader Mobile Application

SWMS Evaluation of Functionality – Meter Reader Mobile Application

1 - Very poor, 2 – Poor, 3 – Average, 4 - Good, 5 – Excellent

#	Evaluation criteria	Ranking				
		1	2	3	4	5
		Very poor	Poor	Average	Good	Excellent
1	Are you satisfied time taken to copy file, from Water Meter to Mobile device					
2	Does application giving clear expected output for your actions					
3	When comparing with existing systems for the same purpose, how would you rank this application					
4	Are you satisfied with the functionality offered by this application					
5	Rank your expectation and system functionality					

Table 5: Functionality – Meter Reader Mobile Application

SWMS Evaluation of Overall Impression – Meter Reader Mobile Application

1 - Very poor, 2 – Poor, 3 – Average, 4 - Good, 5 – Excellent

#	Evaluation criteria	Ranking				
		1	2	3	4	5
		Very poor	Poor	Average	Good	Excellent
1	Does system provide the final result within your expected time scope with expected quality					
2	How would you categorize system based on this feature					
3	Look and feel when application use regular basis					
4	Overall satisfaction with this					
5	Rank your expectation and system functionality					

Table 6: Overall Impression – Meter Reader Mobile Application

SWMS Evaluation of Usability – Water Board Billing Application

1 - Very poor, 2 – Poor, 3 – Average, 4 - Good, 5 – Excellent

#	Evaluation criteria	Ranking				
		1	2	3	4	5
		Very poor	Poor	Average	Good	Excellent
1	Can you understand function of the system					
2	Easy to learn functions by your self					
3	Time taken to system feedback when execute function					
4	Are you happy with the information provided by the system					
5	Is system give proper feedback and massages to guide you to achieve your goals					

Table 7: Usability – Water Board Billing Application

SWMS Evaluation of Functionality – Water Board Billing Application

1 - Very poor, 2 – Poor, 3 – Average, 4 - Good, 5 – Excellent

#	Evaluation criteria	Ranking				
		1	2	3	4	5
		Very poor	Poor	Average	Good	Excellent
1	Does application provide adequate functions to transfer data file and calculate water bill base on your personal experience					
2	Does application giving clear expected output for your actions					
3	When comparing with existing systems for the same purpose, how would you rank this application					
4	Are you satisfied with the functionality offered by this					
5	Rank your expectation and system functionality					

Table 8: Functionality – Water Board Billing Application

SWMS Evaluation of Overall Impression – Water Board Billing Application

1 - Very poor, 2 – Poor, 3 – Average, 4 - Good, 5 – Excellent

#	Evaluation criteria	Ranking				
		1	**2**	**3**	**4**	**5**
		Very poor	**Poor**	**Average**	**Good**	**Excellent**
1	Does system provide the final result within your expected time scope with expected quality					
2	How would you categorize system based on this feature					
3	Look and feel when application use regular basis					
4	Overall satisfaction with this					
5	Rank your expectation and system functionality					

Table 9: Overall Impression – Water Board Billing Application

Appendix J - Data Analysis - Evaluation of Customer Mobile App

Usability Participants – Customer No. of Participants - 10

#	Evaluation criteria	Marks offered					Out of 100	%
		2	4	6	8	10		
		Very poor	Poor	Average	Good	Excellent		
1	Can you understand function of the system	0	0	30	16	30	76	
2	Easy to learn functions by your self	0	0	18	32	30	80	
3	Time taken to system feedback when execute function	0	0	24	48	0	72	
4	Are you happy with the information provided by the system	0	4	30	16	20	70	
5	Is system give proper feedback and massages to guide you to achieve your goals	0	0	30	40	0	70	
		Usability					**368**	**73.6**

Table 1: Data Analysis of Usability, Customer Mobile App

Functionality

#	Evaluation criteria	Marks offered					Out of 100	%
		2	4	6	8	10		
		Very poor	Poor	Average	Good	Excellent		
1	Does application provide adequate functions to get information on current water consumption and other information you required base on your personal experience	0	0	24	24	30	78	
2	Does application giving clear expected output for your actions	0	0	12	56	10	78	
3	When comparing with existing systems for the same purpose, how would you rank this application	0	0	18	24	40	82	
4	Are you satisfied with the functionality offered by this application	0	0	12	40	30	82	
5	Rank your expectation and system functionality	0	0	36	8	30	74	
		Functionality					**394**	**78.8**

Table 2: Data Analysis of Functionality, Customer Mobile App

Overall Impression

#	Evaluation criteria	Marks offered					Out of 100	%
		2	4	6	8	10		
		Very poor	Poor	Average	Good	Excellent		
1	Does system provide the final result within your expected time scope with expected quality	0	0	18	40	20	78	
2	How would you categorize system based on this feature	0	0	12	48	20	80	
3	Look and feel when application use regular basis	0	0	24	48	0	72	
4	Overall satisfaction with this application	0	0	24	48	0	72	
5	Rank your expectation and system functionality	0	0	30	40	0	70	
		Overall Impression					**372**	**74.4**

Table 3: Data Analysis of Overall Impression, Customer Mobile App

Appendix K - Data Analysis - Evaluation of Meter Reader Mobile App

Usability Participants – Meter Reader No. of Participants - 10

#	Evaluation criteria	Marks offered					Out of 100	%
		2	4	6	8	10		
		Very poor	Poor	Ave rage	Good	Excel lent		
1	Can you understand function of the system	0	0	12	64	0	76	
2	Easy to learn functions by your self	0	0	6	64	10	80	
3	Time taken to system feedback when execute function	0	0	18	56	0	74	
4	Are you happy with the information provided by the system	0	0	30	32	10	72	
5	Is system give proper feedback and massages to guide you to achieve your goals	0	0	24	48	0	72	
		Usability					**374**	**74.8**

Table 1: Data Analysis of Usability, Meter Reader Mobile App

Functionality

#	Evaluation criteria	Marks offered					Out of 100	%
		2	4	6	8	10		
		Very poor	Poor	Ave rage	Good	Exce llent		
1	Are you satisfied time taken to copy file, from Water Meter to Mobile device	0	0	24	32	20	76	
2	Does application giving clear expected output for your actions	0	0	6	72	0	78	
3	When comparing with existing systems for the same purpose, how would you rank this application	0	0	0	24	70	94	
4	Are you satisfied with the functionality offered by this application	0	0	0	64	20	84	
5	Rank your expectation and system functionality	0	0	18	56	0	74	
		Functionality					**406**	**81.2**

Table 2: Data Analysis of Functionality, Meter Reader Mobile App

Overall Impression

#	Evaluation criteria	Marks offered					Out of 100	%
		2	4	6	8	10		
		Very poor	Poor	Average	Good	Excellent		
1	Does system provide the final result within your expected time scope with expected quality	0	0	18	56	0	74	
2	How would you categorize system, based on this feature	0	0	12	64	0	76	
3	Look and feel when application use regular basis	0	0	24	40	10	74	
4	Overall satisfaction with this application	0	0	30	40	0	70	
5	Rank your expectation and system functionality	0	0	48	16	0	64	
		Overall Impression					**358**	**71.6**

Table 3: Data Analysis of Overall Impression, Meter Reader Mobile App

Appendix L - Analysis of Evaluation – Water Board Billing App

Usability Participants – Meter Reader No. of Participants - 10

#	Evaluation criteria	Marks offered					Out of 100	%
		2	4	6	8	10		
		Very poor	Poor	Ave rage	Good	Exce llent		
1	Can you understand function of the system	0	0	36	32	0	68	
2	Easy to learn functions by your self	0	0	42	24	0	66	
3	Time taken to system feedback when execute function	0	0	6	72	0	78	
4	Are you happy with the information provided by the system	0	0	24	40	10	74	
5	Is system give proper feedback and massages to guide you to achieve your goals	0	0	36	32	0	68	
		Usability					**354**	**70.8**

Table 1: Data Analysis of Usability, Water Board Billing App

Functionality

#	Evaluation criteria	Marks offered					Out of 100	%
		2	4	6	8	10		
		Very poor	Poor	Ave rage	Good	Exce llent		
1	Does application provide adequate functions to transfer data file and calculate water bill base on your personal experience	0	0	36	32	0	68	
2	Does application giving clear expected output for your actions	0	0	30	40	0	70	
3	When comparing with existing systems for the same purpose, how would you rank this application	0	0	6	16	70	92	
4	Are you satisfied with the functionality offered by this application	0	0	24	40	10	74	
5	Rank your expectation and system functionality	0	0	30	40	0	70	
		Functionality					**374**	**74.8**

Table 2: Data Analysis of Functionality, Water Board Billing App

Overall Impression

#	Evaluation criteria	Marks offered					Out of 100	%
		2	4	6	8	10		
		Very poor	Poor	Average	Good	Excellent		
1	Does system provide the final result within your expected time scope with expected quality	0	0	24	48	0	72	
2	How would you categorize system based on this feature	0	0	36	32	0	68	
3	Look and feel when application use regular basis	0	0	36	32	0	68	
4	Overall satisfaction with this application	0	0	36	24	10	70	
5	Rank your expectation and system functionality	0	0	24	48	0	72	
		Overall Impression					**350**	**70**

Table 3: Data Analysis of Overall Impression, Water Board Billing App

Appendix M – Source code for Water Meter Device

1. Source Code run on Micro Controller

```
#include <SoftwareSerial.h>
#include <DS3231.h>
#include <SPI.h>
#include <SD.h>

#define WAIT 10
#define ARRAY 64

SoftwareSerial s1(6, 5);
DS3231  rtc(SDA, SCL);

char ch;
char clockData[ARRAY];
char tmp[ARRAY];
char dataBuff[1];

byte statusLed    = 8;
byte sensorInterrupt = 0;  // 0 = digital pin 2
byte sensorPin       = 2;

// litre/minute of flow.
float calibrationFactor = 4.15;
volatile byte pulseCount;
float flowRate;
unsigned int flowMilliLitres;
unsigned long totalMilliLitres;
unsigned long oldTime;

unsigned long waittime = WAIT;
bool sdReading = false;
bool deletable = false;
unsigned long currentPos;
File water;


void setup() {
  // put your setup code here, to run once:
  Serial.begin(9600);
  s1.begin(9600);
  rtc.begin();

  pinMode(statusLed, OUTPUT);
  digitalWrite(statusLed, LOW);  // We have an active-low LED
attached

  pinMode(sensorPin, INPUT);
```

```
  digitalWrite(sensorPin, HIGH);

  pulseCount        = 0;
  flowRate          = 0.0;
  flowMilliLitres   = 0;
  totalMilliLitres  = 0;
  oldTime           = 0;

  Serial.print("Initializing SD card...");

  if (!SD.begin(4)) {
    Serial.println("initialization failed!");
    return;
  }
       Serial.println("initialization done.");
       water = SD.open("TEST.TXT", FILE_WRITE);

  if (!water) {
    Serial.println("SD File Open ERROR !!");
    return;
  }
       attachInterrupt(sensorInterrupt, pulseCounter,
FALLING);//water flow pin , interupt attach
       memset(clockData, 0x00, ARRAY);//cls variable
       memset(tmp, 0x00, ARRAY);
}

void loop() {
  // put your main code here, to run repeatedly:

  if ((millis() - oldTime) > 1000)   // Only process counters
once per second
  {
    detachInterrupt(sensorInterrupt);
    flowRate = ((1000.0 / (millis() - oldTime)) * pulseCount)
/ calibrationFactor;
    oldTime = millis();
    flowMilliLitres = (flowRate / 60) * 1000;
    totalMilliLitres += flowMilliLitres;
    unsigned int frac;
    frac = (flowRate - int(flowRate)) * 10;
    //Serial.print("  Output Liquid Quantity: ");
// Output separator
    //Serial.print(totalMilliLitres);
    //Serial.println("mL");
    // Reset the pulse counter so we can start incrementing
again
    pulseCount = 0;

    // Enable the interrupt again now that we've finished
sending output
    attachInterrupt(sensorInterrupt, pulseCounter, FALLING);

    if (waittime-- == 0x00) {
      waittime = WAIT;
```

```
      //save data to file, if file is reading then data copy
to tem
      if (!sdReading) {
        water.println(clockData);
        water.flush();
        Serial.println("Data Writtent to SD !!!");
        deletable = false;
      } else {
        strcpy(tmp, clockData);
      }
    }
  }
  memset(clockData, 0x00, ARRAY);
  //copy totml to clocdata
  sprintf(clockData, "%010i ", totalMilliLitres);
  //strcpy(clockData, "00000000 ");
  strcat(clockData, rtc.getTimeStr());
  strcat(clockData, " ");
  strcat(clockData, rtc.getDateStr());

  if (s1.available() > 0) {
    ch = s1.read();

    if (ch == 'd') {
      s1.print(clockData);
    } else if (ch == 'r') {
      sdReading = true;
      currentPos = water.position();
      water.seek(0);
      Serial.println("Read SD");
    } else if (ch == '0'){
      digitalWrite(statusLed, LOW);
    } else if(ch == '1'){
      digitalWrite(statusLed, HIGH);
    } else if(ch == 'c'){
      if(deletable){
        water.close();
        SD.remove("TEST.TXT");
        water = SD.open("TEST.TXT",FILE_WRITE);
        deletable = false;
      }
    }
  }

// Read SD card
  if (sdReading) {
    if(water.read(dataBuff, 1) <= 0 ){
      sdReading = false;
      deletable = true;
    }
    Serial.println(water.position());
    s1.write(dataBuff[0]);

    if(!sdReading){
      Serial.println("Sending 0xFF");
```

```
      s1.write(0xFF);   //notify end  of data
       water.close();
        SD.remove("TEST.TXT");
        water = SD.open("TEST.TXT",FILE_WRITE);//new file
    }
  }

//if data in temp write in to sd card

  if(strlen(tmp) > 0){
    water.println(tmp);
    memset(tmp, 0, ARRAY);
  }
}

void pulseCounter()
{
  // Increment the pulse counter
  pulseCount++;
}
```

2. Source Code run on ESP8266 Wi-Fi Module

```
/* Create a WiFi access point and provide a web server on it.
*/

#include <ESP8266WiFi.h>
#define MAX_SRV_CLIENTS 1

/* Set these to your desired credentials. */
const char *ssid = "WaterMeter";
const char *password = "Password";

WiFiServer server(23);
WiFiClient serverClients[MAX_SRV_CLIENTS];

String      rqData[MAX_SRV_CLIENTS];

/* Just a little test message.  Go to http://192.168.4.1 in a
web browser
 * connected to this access point to see it.
 */


void *process(String);

void setup() {
        delay(1000);
        Serial.begin(9600);

        WiFi.softAP(ssid, password);
        WiFi.mode(WIFI_AP);
```

```
        IPAddress myIP = WiFi.softAPIP();
        server.begin();
        server.setNoDelay(true);

}

void loop() {
  uint8_t i;
  void *ret;
  //check if there are any new clients
  if (server.hasClient()){
    for(i = 0; i < MAX_SRV_CLIENTS; i++){
      //find free/disconnected spot
      if (!serverClients[i] || !serverClients[i].connected()){
        if(serverClients[i]) serverClients[i].stop();
        serverClients[i] = server.available();
        continue;
      }
    }
    //no free/disconnected spot so reject
    WiFiClient serverClient = server.available();
    serverClient.stop();
  }
  //check clients for data
  for(i = 0; i < MAX_SRV_CLIENTS; i++){
    if (serverClients[i] && serverClients[i].connected()){
      if(serverClients[i].available()){

        //equest data throug wifi put index of rqData
        while(serverClients[i].available()){
        rqData[i] += (char)serverClients[i].read();
        }
      }
    }
  }
//processing data in rqData
   for(i = 0; i < MAX_SRV_CLIENTS; i++){
    if(rqData[i].endsWith("\r\n")){
      rqData[i].trim();
      ret = process(rqData[i]);
      //cls rqData
      rqData[i].remove(0,rqData[i].length());

      if(ret != NULL){

      }
    }
   }

   //check UART for data
  if(Serial.available()){
    size_t len = Serial.available();
    uint8_t sbuf[len];
    Serial.readBytes(sbuf, len);
```

```
    //push UART data to all connected telnet clients
    for(i = 0; i < MAX_SRV_CLIENTS; i++){
      if (serverClients[i] && serverClients[i].connected()){
        serverClients[i].write(sbuf, len);
        delay(1);
      }
    }
  }
}

void *process(String cmd){
  if(cmd.equals("enable")){
    Serial.write('1');
  }else if(cmd.equals("disable")){
    Serial.write('0');
  }else if(cmd.equals("disp")){
    Serial.write('d');
  }else if(cmd.equals("read")){
    Serial.write('r');
  }
  return NULL;
}
```

Appendix N – Source code for Customer and Meter Reader Mobile Application

```
using Android.App;
using Android.Widget;
using Android.OS;
using Android.Net.Wifi;
using Android.Content;
using Android.Views;
using Android.Util;
using System.Collections.Generic;
using Android.Net;

namespace WaterApp
{
    [Activity(Label = "Digital Water Meter", MainLauncher =
true, Icon = "@drawable/icon")]
    public class MainActivity : Activity
    {
        private static MainActivity instance;
        internal WifiManager wman;
        protected override void OnCreate(Bundle bundle)
        {
            var wifiMan = GetSystemService(WifiService) as
WifiManager;
            wman = wifiMan;
            base.OnCreate(bundle);

            // Set our view from the "main" layout resource
            // SetContentView (Resource.Layout.Main);

            if (!wifiMan.IsWifiEnabled)
            {
                wifiMan.SetWifiEnabled(true);
            }

            instance = this;
            FragmentManager
                .BeginTransaction()
                .Add(new WifiNetworkListFragment(), "wifi")
                .Commit();

            wifiMan.StartScan();
        }

        private void WifiConpleted()
        {
            var cMan =
GetSystemService(Context.ConnectivityService) as
ConnectivityManager;
            var wifiMan = cMan.ActiveNetworkInfo;

            if (wifiMan.Type == ConnectivityType.Wifi)
```

```
            {
                                        FragmentManager
                    .BeginTransaction()
                    .Add(new LoginFragment(), "login")
                    .Commit();
            }
        }

        private void LoginCompleted()
        {
            SetContentView(Resource.Layout.Control);
        }

        private class LoginFragment : DialogFragment
        {
            public override View OnCreateView(LayoutInflater
inflater, ViewGroup container, Bundle savedInstanceState)
            {
                var view =
inflater.Inflate(Resource.Layout.Login,container);

                var txtUserName =
view.FindViewById<EditText>(Resource.Id.txtUserName);
                var txtPassword =
view.FindViewById<EditText>(Resource.Id.txtPassword);
                var cmdLogin =
view.FindViewById<Button>(Resource.Id.cmdLogin);
                var cmdExit =
view.FindViewById<Button>(Resource.Id.cmdExit);

                Dialog.SetTitle("User Login");

                cmdLogin.Click += (s, e) => {
                    if (txtUserName.Text.Trim().Length == 0)
                    {
                        Toast.MakeText(Context, "Please enter
the username", ToastLength.Long).Show();
                    }
                    else if (txtPassword.Text.Trim().Length ==
0)
                    {
                        Toast.MakeText(Context, "Please enter
the password", ToastLength.Long).Show();
                    }else
                    {
                        if (txtUserName.Text.Trim() == "admin"
&& txtPassword.Text.Trim() == "1234")
                        {

MainActivity.instance.LoginCompleted();
                            Dismiss();
                        }
                        else if (txtUserName.Text.Trim() ==
"janaka" && txtPassword.Text.Trim() == "1999")
                        {
```

```
MainActivity.instance.LoginCompleted();
                            Dismiss();
                        }
                        else
                        {
                            Toast.MakeText(Context, "Invalid
credentials", ToastLength.Long).Show();
                        }
                    }
                };

                cmdExit.Click += (s, e) =>
                {
                    MainActivity.instance.Finish();
                };
                return view;
            }
        }

        private class WifiNetworkListFragment : DialogFragment
        {
            private static WifiNetworkListFragment instance;

            private ListView lv;

            public override View OnCreateView(LayoutInflater
inflater, ViewGroup container, Bundle savedInstanceState)
            {
                var layoutMain = new LinearLayout(Activity);
                var lstWifiList = new ListView(Activity);
                lv = lstWifiList;

                layoutMain.LayoutParameters = new
ViewGroup.LayoutParams(ViewGroup.LayoutParams.MatchParent,
ViewGroup.LayoutParams.MatchParent);
                layoutMain.AddView(lstWifiList, new
ViewGroup.LayoutParams(ViewGroup.LayoutParams.MatchParent,
(int)TypedValue.ApplyDimension(TypedValue.DensityDefault, 500,
Resources.DisplayMetrics)));

                instance = this;

                Dialog.SetTitle("Wifi List");

                lstWifiList.ItemClick += (s, e) => {
                    var sRes = e.View.Tag as ScanResult;

                    if (sRes.Capabilities.Contains("WPA"))
                    {
                        WPAPasswordEntry wpa = new
WPAPasswordEntry();
                        wpa.res = sRes;

MainActivity.instance.FragmentManager.BeginTransaction()
```

```
                        .Add(wpa,"psk")
                        .Commit();
                    }
                };
                         return layoutMain;
            }

            private void refresh(IList<ScanResult>
scanResults)
            {

                var wifiListAdapter = new WifiListAdapter();
                wifiListAdapter.ScanResult = scanResults;
                lv.Adapter = wifiListAdapter;
            }

            [BroadcastReceiver(Enabled = true)]
            [IntentFilter(new System.String[] {
WifiManager.ScanResultsAvailableAction })]
            private class WifiCalBacks : BroadcastReceiver
            {
                public override void OnReceive(Context
context, Intent intent)
                {

WifiNetworkListFragment.instance.refresh(MainActivity.instance
.wman.ScanResults);
                }
            }

            private class WifiListAdapter :
BaseAdapter<ScanResult>
            {
                public override ScanResult this[int position]
                {
                    get
                    {
                        return ScanResult[position];
                    }
                }

                public override int Count
                {
                    get
                    {
                        return ScanResult.Count;
                    }
                }

                public IList<ScanResult> ScanResult { get;
internal set; }

                public override long GetItemId(int position)
                {
                    return position;
```

```
                }

                public override View GetView(int position,
View convertView, ViewGroup parent)
                {

                    var llayout =   new
LinearLayout(MainActivity.instance);
                    var txtSSID = new
TextView(MainActivity.instance);
                    var item = ScanResult[position];
                    llayout.Orientation =
Orientation.Vertical;
                    llayout.LayoutParameters = new
ViewGroup.LayoutParams(ViewGroup.LayoutParams.MatchParent,
ViewGroup.LayoutParams.MatchParent);
                    llayout.AddView(txtSSID, new
ViewGroup.LayoutParams(ViewGroup.LayoutParams.MatchParent,
(int)TypedValue.ApplyDimension(TypedValue.DensityDefault, 100,
MainActivity.instance.Resources.DisplayMetrics)));

                    txtSSID.Text = item.Ssid.Trim().Length ==
0 ? "Hidden Network" : item.Ssid.Trim();
                    txtSSID.Gravity = GravityFlags.Center;
                    llayout.Tag = item;
                    return llayout;
                }
            }

            private class WPAPasswordEntry : DialogFragment
            {
                internal ScanResult res;
                private static WPAPasswordEntry instance;
                private bool wifiOk = false;
                public override View
OnCreateView(LayoutInflater inflater, ViewGroup container,
Bundle savedInstanceState)
                {
                    var llayout = new
LinearLayout(MainActivity.instance);
                    var txtPSK = new
EditText(MainActivity.instance);
                    var cmdGo = new
Button(MainActivity.instance);

                    llayout.Orientation =
Orientation.Vertical;

                    llayout.LayoutParameters = new
ViewGroup.LayoutParams(ViewGroup.LayoutParams.MatchParent,
ViewGroup.LayoutParams.MatchParent);
                    llayout.AddView(txtPSK, new
ViewGroup.LayoutParams(ViewGroup.LayoutParams.MatchParent,
ViewGroup.LayoutParams.WrapContent));
```

```
                    llayout.AddView(cmdGo, new
ViewGroup.LayoutParams(ViewGroup.LayoutParams.MatchParent,
ViewGroup.LayoutParams.WrapContent));

                    cmdGo.Text = "Connect";
                    Dialog.SetTitle("Please enter the
password");
                    instance = this;
                    cmdGo.Click += (s, e) =>
                    {
                        if (txtPSK.Text.Trim().Length == 0)
                        {

Toast.MakeText(MainActivity.instance,"Please enter the PSK .",
ToastLength.Long).Show();
                        }
                        else
                        {
                            var nid =
MainActivity.instance.wman.AddNetwork(

                                new WifiConfiguration()
                                {
                                    Ssid = $"\"{res.Ssid}\"",
                                    PreSharedKey =
$"\"{txtPSK.Text.Trim()}\"",
                                }

                                );


MainActivity.instance.wman.Disconnect();

MainActivity.instance.wman.EnableNetwork(nid, true);

MainActivity.instance.wman.Reconnect();
                            this.Dismiss();

WifiNetworkListFragment.instance.Dismiss();
                            SystemClock.Sleep(2000);

MainActivity.instance.WifiConpleted();
                                wifiOk = true;
                            }
                    };
                    return llayout;
                }

            }
        }

    }
}
```

Appendix O – Source code for Water Board Billing Web Application

Logging Form

```
<?php
session_start();
$Signin=$_POST['Signin'];
if(isset($Signin)){
header("Cache-control: private");
session_register("username");
include('config_main.php');
$myusername=$_POST['username'];
$mypassword=$_POST['password'];
// To protect MySQL injection (more detail about MySQL
injection)
$myusername = stripslashes($myusername);
$mypassword = stripslashes($mypassword);
$myusername = mysql_real_escape_string($myusername);
$mypassword = mysql_real_escape_string($mypassword);
$sql="SELECT * FROM users WHERE username='$myusername' and
password='$mypassword'";
$result=mysql_query($sql);
// Mysql_num_row is counting table row
$count=mysql_num_rows($result);
//If result matched $myusername and $mypassword, table row
must be 1 row
        $a       =      $_REQUEST['username'];
if($count==1){
                        $_SESSION['username']=
$_POST['username'];
                        $abc="ss";
                        session_register("a");
                        session_register("abc");
                        header("location:mkt/sign_success.php");
                        exit;
                }
                {
                echo "Wrong Username or Password";
                exit;
                }
}
mysql_close($conn);
?>

<form method="post" action="sign_insc.php">
<table width="180" border="0" cellpadding="0" cellspacing="0">
  <!--DWLayoutTable-->
  <tr>
    <td height="15" valign="top" align="left"
class="style3">User name: </td>
```

```
  </tr>
  <tr>
    <td height="25" valign="top"> <input type="text"
name="username" size=25 maxlength=50></td>
  </tr>
  <tr>
    <td height="15" valign="top" align="left"><span
class="style3">Password:</span></td>
  </tr>
  <tr>
    <td height="22" valign="top"><input type="password"
name="password" size=25 maxlength=50> </td>
  </tr>
  <tr>
    <td height="20" valign="top"><input type="submit"
name="Signin" value="sign in">      <span class="style3"><a
href="forgot.php" target="_blank">Forgot  password ?</a>
</span></td>
  </tr>
  <tr>
    <td height="15" valign="top" bgcolor="#99FFCC"><div
align="center" class="style5">Sign up here..!!! </div></td>
  </tr>
  <tr>
    <td height="34"> </td>
  </tr>
</table>
</form>
```

Bill Calculation Form

```
<?php
//include_once "dbcon.php";
print "<h1>Water Managment Sysytem</h1><br/>";
print '<form action="index.php" method="post">';
        // Get files
        if ($handle = opendir('data')) {
                print '<select name="file">';
    while (false !== ($entry = readdir($handle))) {
      if ($entry != "." && $entry != "..") {
        print '<option
value="'.$entry.'">'.$entry.'</option>'; }
    }
                print '</select>';
    closedir($handle);
        }
        print '<br/><br/>';
        print   '<input type="submit" value="Filter">';
print '</form>';
if($_POST['file']){
        $meeterid = explode(".", $_POST['file']);
        print '<h2>Meeter readings of '.$meeterid[0].'</h2>';
        $txtfile = "data/".$_POST['file'];
        // Get First line
```

```
        $lines = file($txtfile);//file in to an array
        $first_reding = explode(" ", $lines[0]);
        print 'First Reading of month:: Units:
'.$first_reding[0]. ' Time & Date: '.$first_reding[1].'
'.$first_reding[2];
        print '<br/><br/>';
                $myfile = fopen($txtfile, "r") or die("Unable
to open file!");
        while ($line = fgets($myfile)) {
                $pieces = explode(" ", $line);
                //echo $pieces[0].'-';
                //echo $pieces[1].'<br/>';
        }
        print 'Last Reading of month:: Units: '.$pieces[0]. '
Time & Date: '.$pieces[1].' '.$pieces[2];
        print '<br/><br/>';
        $unitfirst = $first_reding[0];
        $unitlast = $pieces[0];
        print 'Difference: ';
        $diff = $unitlast-$unitfirst;
        print $diff;
        print '<br/><br/>';
        print 'This Month Charge:: ';
        if($diff>0 && $diff<=5){
                print 'Rs: ';
                print number_format(($diff*50)+5, 2);
        }
        if($diff>5 && $diff<=10){
                print 'Rs: ';
                print number_format(($diff*50)+10, 2);
        }
        if($diff>11 && $diff<=15){
                print 'Rs: ';
                print number_format(($diff*50)+15, 2);
        }
        if($diff>16 && $diff<=20){
                print 'Rs: ';
                print number_format(($diff*80)+40, 2);
        }
        if($diff>21 && $diff<=25){
                print 'Rs: ';
                print number_format(($diff*100)+58, 2);
        }
        if($diff>26 && $diff<=30){
                print 'Rs: ';
                print number_format(($diff*200)+88, 2);
        }
        if($diff>31 && $diff<=40){
                print 'Rs: ';
                print number_format(($diff*400)+105, 2);
        }
        if($diff>41 && $diff<=50){
                print 'Rs: ';
                print number_format(($diff*650)+120, 2);
        }
```

```
if($diff>51 && $diff<=75){
        print 'Rs: ';
        print number_format(($diff*1000)+130, 2);
}
if($diff>75){
        print 'Rs: ';
        print number_format(($diff*1600)+140, 2);
}
fclose($myfile);       }
```

Appendix P – Text File of Water Meter Reading

Reading	Time	Date
0000000000	13:00:00	08.03.2017
0000030456	13:15:00	08.03.2017
0000070999	13:30:00	08.03.2017
0000081162	13:45:00	08.03.2017
0000131597	14:00:00	08.03.2017
0000156790	14:15:00	08.03.2017
0000207754	14:30:00	08.03.2017
0000228475	14:45:00	08.03.2017
0000259298	15:00:00	08.03.2017
0000259298	15:15:00	08.03.2017
0000259298	15:30:00	08.03.2017
0000259298	15:45:00	08.03.2017
0000259298	16:00:00	08.03.2017
0000259298	16:15:00	08.03.2017
0000279307	16:30:00	08.03.2017
0000289407	16:45:00	08.03.2017
0000289969	17:00:00	08.03.2017
0000290552	17:15:00	08.03.2017
0000291428	17:30:00	08.03.2017
0000293753	17:45:00	08.03.2017
0000314192	18:00:00	08.03.2017
0000327013	18:15:00	08.03.2017
0000335018	18:30:00	08.03.2017
0000342041	18:45:00	08.03.2017
0000347095	19:00:00	08.03.2017
0000355261	19:15:00	08.03.2017
0000367795	19:30:00	08.03.2017
0000372841	19:45:00	08.03.2017
0000372841	20:00:00	08.03.2017
0000372841	20:15:00	08.03.2017
0000378094	20:30:00	08.03.2017
0000382409	20:45:00	08.03.2017
0000398130	21:00:00	08.03.2017
0000417339	21:15:00	08.03.2017
0000434695	21:30:00	08.03.2017
0000458037	21:45:00	08.03.2017
0000488300	22:00:00	08.03.2017
0000508513	22:15:00	08.03.2017
0000508513	22:30:00	08.03.2017
0000508513	22:45:00	08.03.2017
0000508513	23:00:00	08.03.2017
0000508513	23:15:00	08.03.2017
0000508513	23:30:00	08.03.2017
0000508513	23:45:00	08.03.2017
0000508513	00:00:00	09.03.2017
0000508513	00:15:00	09.03.2017
0000508513	00:30:00	09.03.2017
0000508513	00:45:00	09.03.2017
0000508513	01:00:00	09.03.2017
0000508513	01:15:00	09.03.2017

0000508513	01:30:00	09.03.2017
0000508513	01:45:00	09.03.2017
0000508513	02:00:00	09.03.2017
0000508513	02:15:00	09.03.2017
0000508513	02:30:00	09.03.2017
0000508513	02:45:00	09.03.2017
0000508513	03:00:00	09.03.2017
0000508513	03:15:00	09.03.2017
0000508513	03:30:00	09.03.2017
0000508513	03:45:00	09.03.2017
0000508513	04:00:00	09.03.2017
0000508513	04:15:00	09.03.2017
0000508513	04:30:00	09.03.2017
0000520834	04:45:00	09.03.2017
0000526045	05:00:00	09.03.2017
0000527047	05:15:00	09.03.2017
0000527371	05:30:00	09.03.2017
0000528292	05:45:00	09.03.2017
0000542054	06:00:00	09.03.2017
0000568486	06:15:00	09.03.2017
0000598760	06:30:00	09.03.2017
0000611047	06:45:00	09.03.2017
0000620374	07:00:00	09.03.2017
0000629008	07:15:00	09.03.2017
0000629008	07:30:00	09.03.2017
0000629008	07:45:00	09.03.2017
0000629008	08:00:00	09.03.2017
0000631772	08:15:00	09.03.2017
0000652759	08:30:00	09.03.2017
0000668491	08:45:00	09.03.2017
0000685815	09:00:00	09.03.2017
0000701457	09:15:00	09.03.2017
0000701457	09:30:00	09.03.2017
0000701457	09:45:00	09.03.2017
0000701457	10:00:00	09.03.2017
0000701457	10:15:00	09.03.2017
0000701457	10:30:00	09.03.2017
0000715222	10:45:00	09.03.2017
0000715222	11:00:00	09.03.2017
0000715222	11:15:00	09.03.2017
0000715222	11:30:00	09.03.2017
0000715222	11:45:00	09.03.2017
0000715222	12:00:00	09.03.2017
0000729452	12:15:00	09.03.2017
0000745176	12:30:00	09.03.2017
0000745176	12:45:00	09.03.2017