This document is presenting a solution for Conversion Of Mechanical meters to Smart Meter to reduce UFG

Smart V3 Conversion (SVC System)

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DIGITEC SYSTEM:

INTRODUCTION

The company was registered as DIGITEC SYSTEMS in 1992 with sole proprietorship with a view to concentrate more on HIGHTECH PRODUCTS, SYSTEM & SOLUTIONS . From the beginning DIGITEC endeavors and strives for high-end technological implement and its uses throughout the country. We successfully fulfill the genuine needs of the Industry's standard test, measuring & calibration equipment & latest technological tools. Basically, DIGITEC is providing a wide range of Office automation, Data communication, Network Services, Security systems to Govt. Semi Government, financial & research organizations, private and corporate sectors as well.

The head office of the company is located at Karachi with representative in Islamabad & Lahore, which covers the Punjab and N.W.F.P area. The company has well equipped maintenance shop both in Karachi and up-country to provide after sales service and support facilities. The company is registered supplier to all government, semi-government public corporation and private industries.

DIGITEC GROUPS:
Associated firms and sister concern of DIGITEC Group are as under:

DIGITEC SYSTEMS

178 Sector 24,Korangi Industrial area Karachi

DIGITEC SYSTEMS Sales/Marketing

29E Kyaban-e-jami.DHA Phase II Ext.

OUR PROFILE AND CATALOG:
PROFILE LINK:
http://digitecsystems.com/brochure/profile.pdf
CATALOG LINK:
http://digitecsystems.com/brochure/catalog.pdf

Need:

Pakistan is fortunate of having a very Large Gas Reserves. Gas being the cheapest form of Energy is meeting the bulk of the country energy requirement and all major industries are dependent on it. Unfortunately the Metering technology for GAS has not been updated since long and we are still using Mechanical meters for this The major part of these meters are produced by SSGC at its plant in Karachi. Mechanical meters have their short comings which are listed below

1) Calibrated at a particular GAS temperature and pressure.
2) Require Visit to get a reading.
3) Prone to Different Tempering methods by the customer.

 SSGC is facing a huge revenue loss in view of almost 16% of Unaccounted for GAS (UFG) the gas that is not being billed by the utility. This huge loss has to be checked and eliminated.

The G4 V3 meter being manufactured by SSGC with a conversion into GSM communication system will come a long way in reducing UFG .

SVC System Description :

Ever since it inception Digitec has worked for provide low cost innovation to meet the customer requirements .With the same Sprit We have developed the SVC Solution for SSGC so that it can control the revenue leakages and provide a more efficiently and reliable service to the customers. Digitec has been providing GSM based solution for more than 10 years and have already developed a GSM based Tracking system with own Web Server ,Using this experience Digitec has developed the SVC Solution for SSGC .

The SVC System will be installed inside the V3 meter as a replacement to the mechanical counter unit . The SVC kit is designed in a way that it will fit into the existing V3 meter without any modification in it. The only change required is a hole to be drilled with threads so that the pressure sensor can be installed on the V3 meter (as there is no provision of mounting in the existing design) The diagraph pump that is the heart of the meter that does the actual measurement of the meter will remain as it is so there is no need for calibration of the unit with SVC installed . All the supporting hard ware of the Pump will remain the same. The Rotating shaft that come into the mechanical counter from the metering unit will be used to Generate the Metering pulses to the SVC unit.

The Micro Controller in the SVC is in Sleep mode with current consumption of less the 6uA.The Software System design is event based There are three type of events that are present .

1) Metering Pulse: As mentioned above the metering rotation signal (1.2Ltr/Rev) will be sensed by the controller and it will wake from the Sleep state to serve the metering Signal. It will update the Memory counters Check the Current GAS rate and see if it is with in the threshold if it is above then it will increment the appropriate counter for this and also the timer to record the excess load duration.

2)LCD Wake : The LCD display is in off state . If it is required to activate the display a Push switch has to be pressed on the Display. The Controller will wake as a result of the switch Update the LCD and start a LCD off timer. When the timer expires the Microcontroller will wake again and turn OFF the LCD.

3)House keep: This is a regular timer that will wake up the controller to perform different tasks like recording the pressure values , update the daily hourly reading, Upload the Daily reading of pressure and meter counters   packet at the required interval. Upload the data of excessive consumption (above set threshold) to the server.

      The entire Design Philosophy of the system is to consider the Battery a precious resource and use it most efficiently.

LCD Display :

The Unit has a 8 char x2 line LCD that is activated when the push switch is Pressed. The Display ON time Is programmable and the default 8 Sec.It can be set to a range from 3 to 12 Sec through Start Up Commands

00234123
3 5.9 .41

The First line Show the meter Reading . The first 5 five Digits show the Cubic Meter value and the last three the Liter cube value. In the Second line The first Number is the GSM signal Level of the Last transmission it can be from1-9 in this case it is 3.The Second parameter is the Battery Level which is show as 5.9 Voltage the Battery is 6.8 at the start and can operate till 4.2V.The Next Parameter is the Gas pressure which is Shown as 0.41PS I if it is above 1 psi it will show to one decimal place e.g 2.1 for 2.1 psi

SVC Server Communication Description :

Gas Meter with Hardware   Socket Server   Control Station

Data Packet   Send data
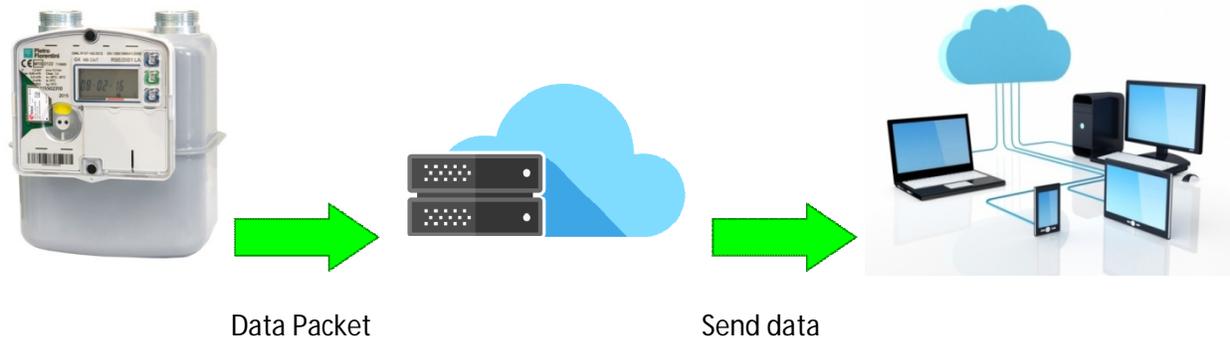
Socket Server:

The SVC unit communicates over GPRS network using Socket based connectivity. Socket is a communication method of connecting Multiple Devices to a central Server. In socket the server Listen on the TCP/IP channel for a particular port Number. The Device (Client) uses the same port number to transfer the data to the sever. The server are assigned a Static IP so there is a direct connection between the meter and the server. Use of static IP is an standard as the other option involved the DNS which will slow the communication and also introduce a critical link in the communication path. The SVC uses TCP communication .The GSM based network is different then Normal TCP/IP in the respect that the Socket has a limited life time and it will be released by the GSM network's. In order to ensure the reliability of the Packet the Server has to send an acknowledgement Packet to the SVC so that the SVC can clear the memory buffer..

Monitoring System:

For monitoring gas status or meter reading uses Server pc, which get meter reading status from socket server, it can display meter reading and check status online and manipulate it, we can also watch its hourly, day wise, monthly wise, yearly wise and specific area, distinct and city wise on search, and also can see its reports on different formats like PDF format, Microsoft Excel format and hard copy can also print by printer. Big advantage is that, its database is Microsoft SQL Server, it is strong and powerful database for store data, Data of Microsoft SQL Server has always normalized form, it makes proper data for manipulating when its occurs in this software and user authentication and authorization, it is also feature of this software, on the main screen alerts are shows on datagridview when event occurs, application control panel is also available in this software which user can setting easily.

Pilot Application:

As per the discussed requirements; for the pilot project an ASP.NET application will be provided with complete reporting and meaningful meter data that can be further used in decision making and future planning. This application will have the ability to export the data in CSV format. CSV format file can be imported into the current MDM and other oracle applications being used by SSGC. This application will receive data from the meters and insert into our database and made ready for reporting.

The Process Integration Pack (PIP) that comes pre-built into Oracle's Master Data Management (MDM) and Application Integration (AI) integration architecture allows for a User Interface (UI) for non-MDM applications to interact with MDM aware SSGC:

http://www.ronsystems.com/OraclePIP.pdf
http://www.oracle.com/us/products/applications/application-integration-architecture/overview/index.html

The SVC will leverage this UI feature for the Pilot stage.

Figure 3 illustrates the use of composite application UI to connect to any non-oracle application.
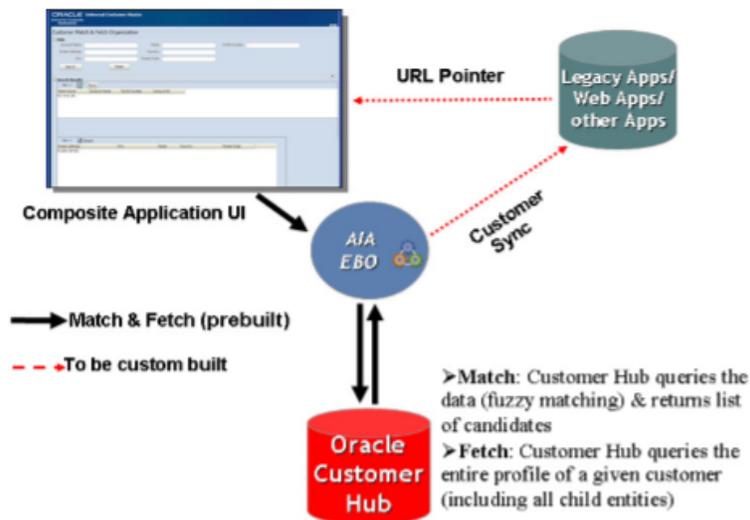
Figure 3: Composite UI for Match & Fetch

Production Software:

In the production software (final product) our application will have the ability to insert the data into SSGC application directly for which reason the SVC software shall need to be "MDM Aware".

To do so would require that MDM Hooks are implemented in SVC. The following 4 hooks are available as per the Oracle Process Integration Pack that comes with MDM:

- Pull Hooks: SSGC MDM retrieves data automatically from the SVC server
- Push Hooks: SVC Server pushes data periodically to the SSGC MDM

We plan on leveraging Push Hooks as that fits into the general framework of our software design.

Flow Diagram :

Smart Meter   Digitec Server   SSGC AIA/MDM/Smart Grid

Data Packet   Service
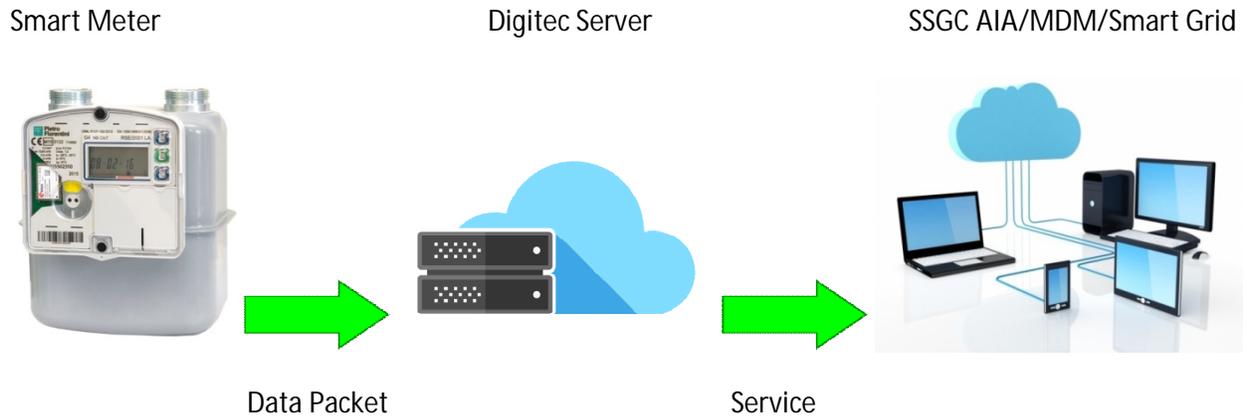
Security :

To ensure data integrity and confidentiality, all communication b/w Digitec's Socket Server and SSGC will be via HTTPS based Web services, or in the case of the MDM specified Push/Pull Hooks, via SSL (v3 onwards or TLS 1.2) encryption over the communication channel.

Reports:

Report for specific Meter IDd according to date , both reading type like gas reading and pressure reading.

Reading	Pressure	Month	Time
10443	1.63	12/25/2017 12:00:00 AM	00:02:08
10379	2.82	12/25/2017 12:00:00 AM	01:02:10
10245	1.82	12/25/2017 12:00:00 AM	03:02:06
11257	1.28	12/25/2017 12:00:00 AM	04:02:02
10325	2.17	12/25/2017 12:00:00 AM	05:02:49
10525	1.52	12/25/2017 12:00:00 AM	06:02:16
10324	1.48	12/25/2017 12:00:00 AM	07:02:55
12011	2.27	12/25/2017 12:00:00 AM	08:02:27
12125	1.59	12/25/2017 12:00:00 AM	09:02:40
13257	3.27	12/25/2017 12:00:00 AM	10:02:42
11242	2.52	12/25/2017 12:00:00 AM	11:02:12

Report for district wise, included with related customer id according to specific time duration from 7am to 3 pm.

District Name	CustomerID	Reading	Pressure	Date	Time
Korangi	1225450000	10375	0.25	12/25/2017 12:00:00 AM	00:02:06
Korangi	1354789500	10444	0.34	12/25/2017 12:00:00 AM	01:02:12
Korangi	1024141400	10542	0.54	12/25/2017 12:00:00 AM	02:02:03
Korangi	1320514000	12422	0.36	12/25/2017 12:00:00 AM	03:02:11
Korangi	1032515500	20144	0.43	12/25/2017 12:00:00 AM	04:02:09
Korangi	1201221121	30215	0.67	12/25/2017 12:00:00 AM	05:02:02
Korangi	1420502220	20212	0.52	12/25/2017 12:00:00 AM	06:02:16
Korangi	1254242114	10244	0.85	12/25/2017 12:00:00 AM	07:02:09
Korangi	1202115000	10324	0.92	12/25/2017 12:00:00 AM	08:02:02
Korangi	2012115400	15414	0.69	12/25/2017 12:00:00 AM	09:02:14

Report for specific customer id according to month wise and gas reading, pressure reading , both are selected in reading type.

Reading	Pressure	Month
20154	27.95	01/01/2017 12:00:00 AM
23456	29.65	02/01/2017 12:00:00 AM
24565	26.87	03/01/2017 12:00:00 AM
25324	19.35	04/01/2017 12:00:00 AM
23124	29.41	05/01/2017 12:00:00 AM
21215	30.65	06/01/2017 12:00:00 AM
23541	27.65	07/01/2017 12:00:00 AM
21454	28.62	08/01/2017 12:00:00 AM
25631	24.65	09/01/2017 12:00:00 AM
23654	29.67	10/01/2017 12:00:00 AM

Report for district wise according to date wise with specific time duration from 7am to 3pm.

District Name	CustomerID	Reading	Date	Time
Korangi	1023656500	10355	12/25/2017 12:00:00 AM	07:02:01
Korangi	1032546700	10522	12/25/2017 12:00:00 AM	07:02:02
Korangi	1202122000	11203	12/25/2017 12:00:00 AM	07:02:02
Korangi	1302145022	10379	12/25/2017 12:00:00 AM	07:02:02
Korangi	1203214560	10325	12/25/2017 12:00:00 AM	07:02:02
Korangi	1320546850	11023	12/25/2017 12:00:00 AM	07:02:02
Korangi	1203215460	12032	12/25/2017 12:00:00 AM	07:02:06
Korangi	1203214560	10326	12/25/2017 12:00:00 AM	07:02:06
Korangi	1420322550	11365	12/25/2017 12:00:00 AM	07:02:07
Korangi	1503265410	10565	12/25/2017 12:00:00 AM	07:02:07

Report for district wise according to month January 2017 to December 2017 with specific time duration and its shows pressure reading which are over gas flow.

District Name	CustomerID	Pressure	Month	Time
Malir	1023256400	1.63	01/04/2017 12:00:00 AM	07:01:08
Malir	1123654020	2.82	01/20/2017 12:00:00 AM	07:01:10
Malir	1212521000	1.82	01/25/2017 12:00:00 AM	07:01:48
Malir	1320214560	1.28	02/15/2017 12:00:00 AM	07:02:02
Malir	1454213021	2.17	02/27/2017 12:00:00 AM	07:02:49
Malir	1254652310	1.52	02/28/2017 12:00:00 AM	07:03:16
Malir	1232154000	1.48	03/13/2017 12:00:00 AM	07:03:55
Malir	1123542300	2.27	03/16/2017 12:00:00 AM	07:04:27
Malir	1013212450	1.59	04/02/2017 12:00:00 AM	07:04:40
Malir	1324563210	3.27	04/25/2017 12:00:00 AM	07:05:42

Graph

Its shows graph of day wise reading with specific hours from customer ID.
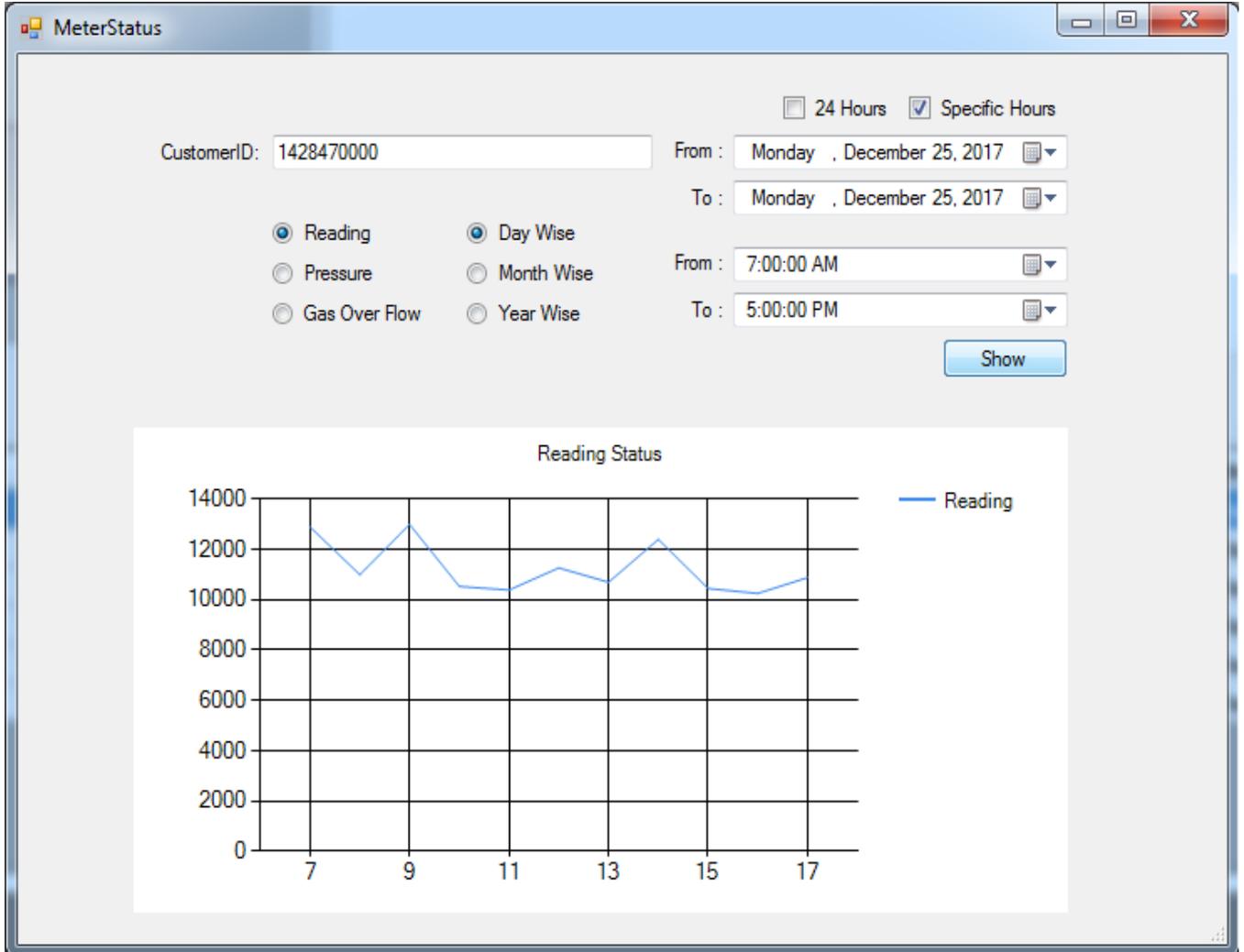
Its shows graph of month wise pressure from January 2017 to December 2017 from customer ID.
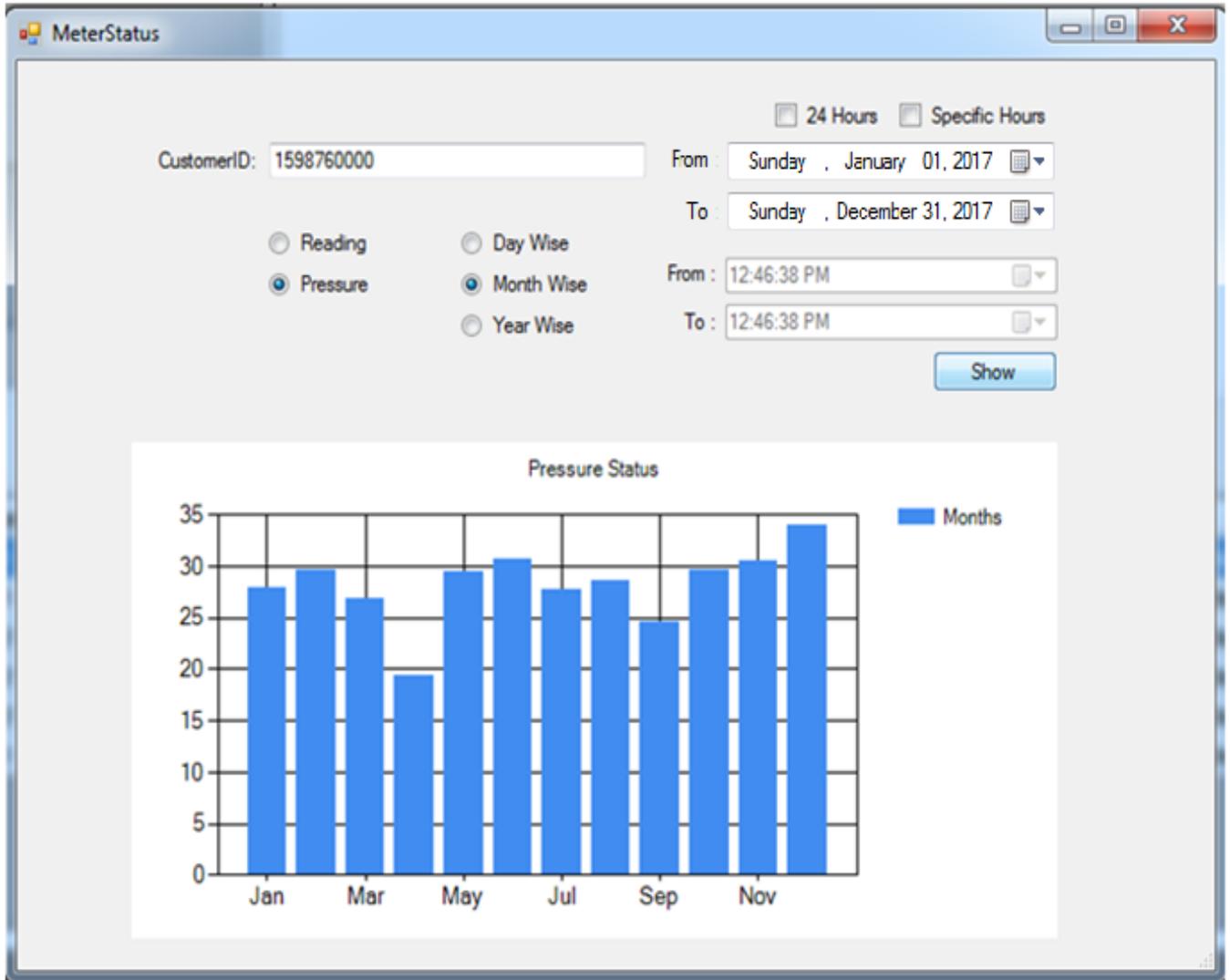
Its shows graph of day wise pressure with specific hours from customer ID.
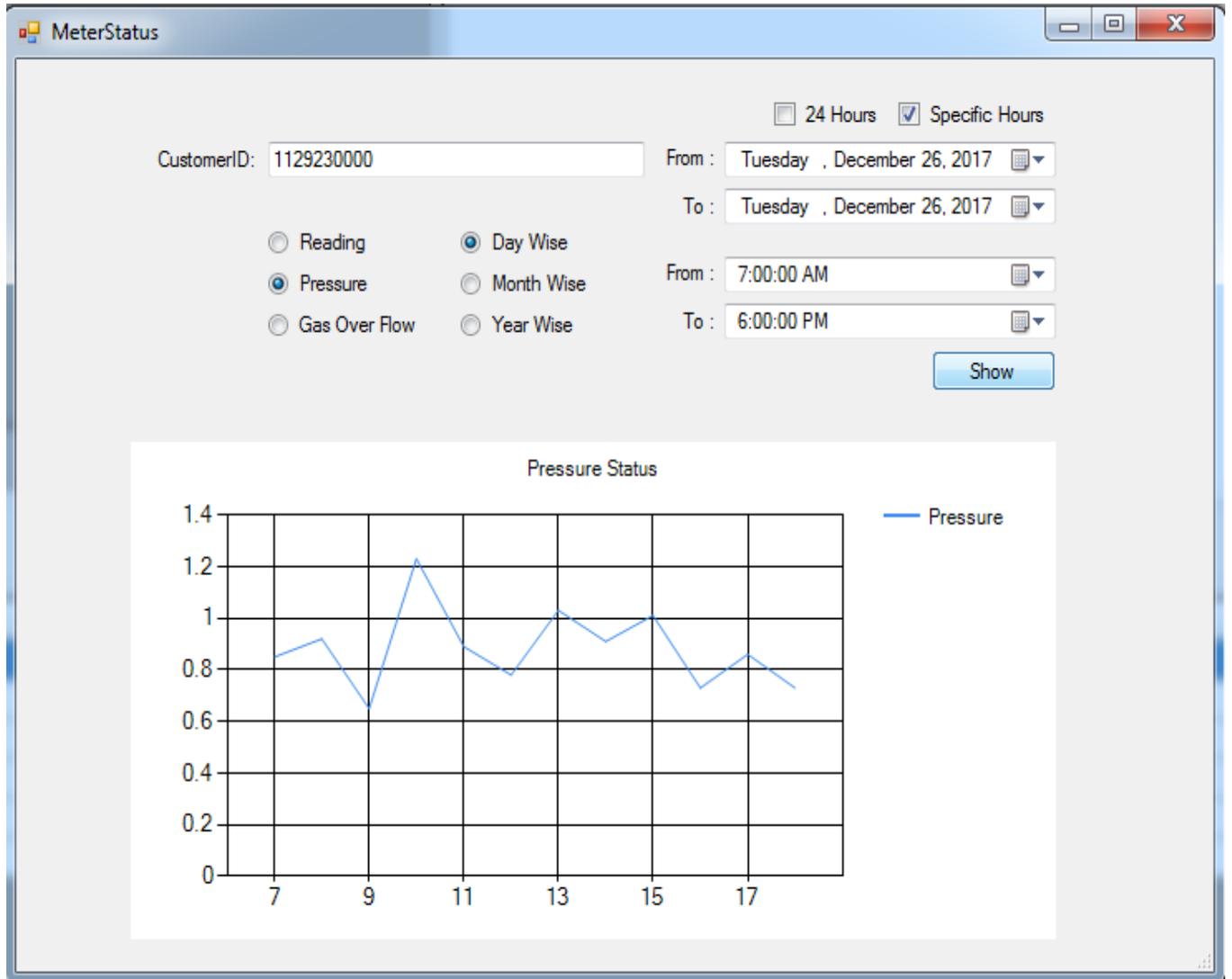
Peak Detection Report(as a output)

CustomerID	ReadingPeak	Month	TimeFrom	TimeTo
112427000	16	12/04/2017	08:08:10	08:42:23
112427000	21	12/05/2017	09:07:14	10:13:07
112427000	17	12/08/2017	20:18:17	21:24:11
112427000	19	12/09/2017	08:15:32	09:17:26
112427000	13	12/10/2017	18:54:15	19:24:02

Oversized and Undersized Report(as a output).

MeterSerial	ReadingIndex	Cumulative	Alarm	DateTime
26086244	10375	3	Over sized	12/31/2017 12:00:00 AM
27451454	10443	2	Over sized	12/31/2017 12:00:00 AM
34548946	11235	2	Over sized	12/31/2017 12:00:00 AM
24985657	11684	1	Under sized	12/31/2017 12:00:00 AM
35874454	12875	4	Over sized	12/31/2017 12:00:00 AM

Smart meter communication module Tampering(as a output).

Meter Serial	Time Stamp	Alarm Label
26086244	05/21/2017 12:45:54 AM	on
27458956	04/12/2017 04:10:04 AM	on
24566298	08/14/2017 02:07:05 AM	on
14697592	08/13/2017 11:15:40 PM	on
24616846	10/21/2017 01:24:06 AM	on

Meter Reading for billing(as a output).

Meter Serial	Reading	Time Stamp
14697592	10443	12/08/2017 09:45:54 AM
19877545	10379	12/08/2017 09:45:54 AM
24544585	11257	12/08/2017 09:45:54 AM
24587654	11562	12/08/2017 09:45:54 AM
23548756	12224	12/08/2017 09:45:54 AM

SVC Operation Description :

The SVC does not have any command or user interface apart for the LCD Switch. The entire working is server based and it is also controlled through the Server. The communication ID for the Server is the IMEI number of the GSM module which is fixed and can not be changed in any way .So the meter ID can not be alerted. The Assignment of the IMEI to the User Number is done at the server End. The Server command can alter the following Setting of the Meter

1)Upload Rate

The Upload rate is the time after which the Meter upload its memory counter to the Server (Having a Static IP) using GPRS connectivity . The SVC keep hourly consumption counter and Pressure registers. also it has Excessive Consumption counter and Time Register to record the Time the Excess load . On the basis of (one packet/Day) Daily reporting the expected Battery Live is 5 years and above. If the Upload rate is reduced then batter duration will also be less (Detail in Battery Section).The Bulk of the power consumed is when the Packets are uploaded.

2)Threshold Settings:

Different Threshold levels Like Min/Max Flow Rate .Min Max Pressure Levels. Peak Demand level ETC can be set through Server.

It is import to note that the Settings will only take effect when the SVC unit access the server. So if Daily report Time is changed it will take effect after the next reporting time .

SVC Power Up Settings :

There are some parameters that have to be set at the time of Power When Battery is connected for the first Time. The Unit will remain awake for 5 Min so that the necessary task can be performed. During this time the important parameters listed below are set through SMS commands.

1) Server IP: The Static IP to which the SVC will report.
2) Server Port : The Server Port number on Which it will report.
3) APN : Access Point Number   Each Network has its own APN.
4) SMS Command Number ,Some responses can be received by SMS on any particular Number. For testing purpose. The following are the List of SMS Commands that the Unit will serve.

Command	Code	Explanation	Response
Generate SMS	#G <number> <Msg>	Generate SMS. This command will cause the device to send a SMS to the given number and send the message to that number. e.g.**#G 03112233445 Test Message**. The device sends SMS to number03112233445 containing text "Test Message". This command can be used to Test the GSM or activate the SMS package etc.	The given number will receive the response.
Get Tower Location	#I	The Device will send a link to the Nearest Mobile tower .	www.goftrack.com/lbs2.aspx?p="); //21036@59918@410@22@Google
Change Password	#P <password>	Changes the device Password e.g. #P 1234ABC will set the device password as 1234ABC. The default is 12345. It is recommended that the User number be set first with the default password before changing the password so that the device can be set by the user if password is misplaced.	Command Served

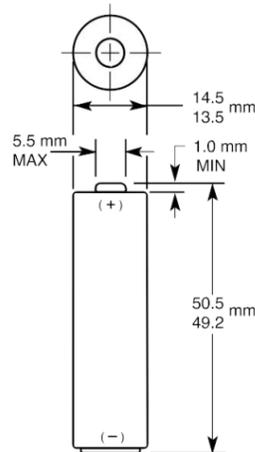| Get Status	#S	Get The Current Device Status .The Device will respond with the following information User1 Number If programmed Internal Battery Voltage (IBat) GSM ok 22 (22 is Power Level max 33) Meter Value Pressure Value Pressure High Threshold Pressure Low Threshold Flow Rate Max Password 123abc	U1 0300876543 U2 0312456789 IBat=4.2v GSM Ok 22 PW 123abc 00123789 0.32 0.44 0.25 1.5

Set Users	#U <usr1><usr2><usr3>	Set Mobile number of the user of the device.
		Usr1 is the first usr2 and usr3 are the other two user numbers
		Only One space should be given between each number
		Usr1 will receive all alerts and location messages.
		Following examples will explain the settings
		
		1)#U 03001122334 03003344553 03001122345
		 //set user1 user2 and user3 numbers
		
		2)#U 03001122334 03003344552
		 //set only user1 and user2 .
		
		3)#U 030012345678
		 //will set only user1, user2 and user3 are not set
		
		4)#U 03001122334 11 //delete usr2
		
		5)#U 03001122334 11 11 //delete both user2 and user3
			Command Served

GPRS Setting	@44 < APN >< ID>< PW>	GPRS setting command APN is the operator provided Access Point Name .ID is the user ID to be used to connect with the network .PW is the password provided by the Network provider e.g @44 internet Telenor Telenor @44 net2.APN.com If no user name or Password is required then leave the field as empty	"Command Served"
Device ID	@02 <My Name>	The device Name can be assign .It can be any 10 digit Alpha numeric value without space. This Id is used when the device is to viewed online e.g @02 TestUnit1 It is important that the ID by the same name exist on the web server in order to view the track	"Command Served"

Battery Duration:

The SVAC unit uses four AA primary DuraCell CopperTop which has a design life of 10 Years. The following is the Battery Time Calculation

1)Battery Current in Idle State   6uAHr

2) Battery Current When LCD ON   20mA x8s=160 /60/60 =.0018mAHr

.   (assuming once a Day)

3)Battery Current GSM On for One Transmissions per day

   85mA x60sec/60/60 =1.42mAHr (transmission Time 60Sec)

Total Daily Consumption = 0.006 +0.0018+1.42=1.428mAHr

Battery Life =2600/1.428 =1830 Days = 5 yr.

DURACELL®
DURALOCK POWER PRESERVE™
COPPERTOP

MN1500
Size: AA (LR6)
Alkaline-Manganese Dioxide Battery

Zn/MnO$_2$

Nominal voltage	1.5 V
Impedance	120 m-ohm @ 1 kHz
Typical weight	24 g (0.8 oz)
Typical volume	8.4 cm^3 (0.5 in^3)
Terminals	Flat
Storage temperature range	5ºC to 30ºC (41ºF to 86ºF)
Operating temperature range	-20ºC to 54ºC (-4ºF to 130ºF)
Designation	ANSI: 15A IEC: LR6

14.5
13.5 mm

5.5 mm MAX

1.0 mm MIN

(+)

50.5 mm
49.2

(−)

Dimensions shown are IEC standards

Coppertop AA Constant Current

Voltage

Service Hours

- 5 mA
- 10 mA
- 25 mA
- 50 mA

Coppertop AA Constant Current

Voltage

Service Hours

- 100 mA
- 200 mA
- 500 mA
- 1000 mA

DURACELL®
BATTERIES

Delivered capacity is dependent on the applied load, operating temperature and cut-off voltage. Please refer to the charts and discharge data shown for examples of the energy/service life that the battery will provide for various load conditions.
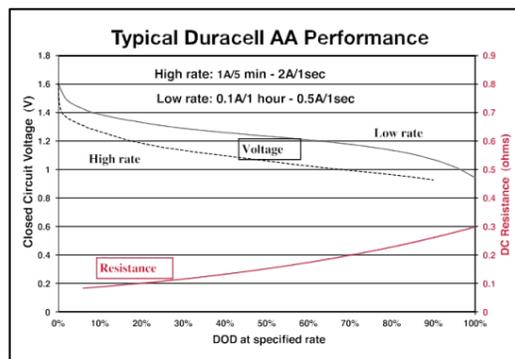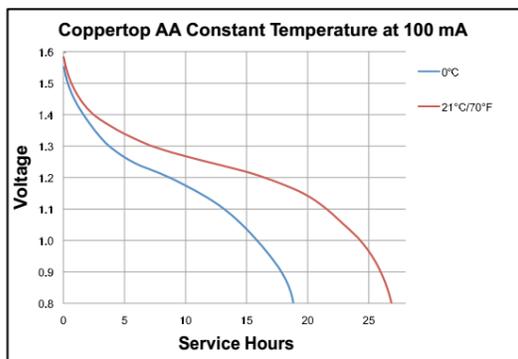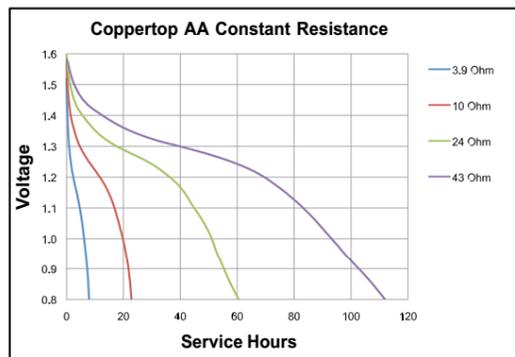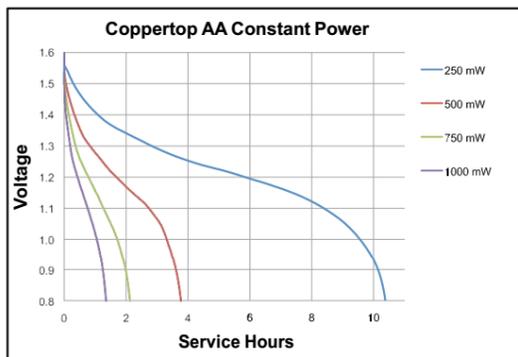
MN15CTUS0413

DURACELL®
DURALOCK POWER PRESERVE™
COPPERTOP

MN1500
Size: AA (LR6)
Alkaline-Manganese Dioxide Battery

Zn/MnO$_2$

Coppertop AA Constant Power

Coppertop AA Constant Resistance

Coppertop AA Constant Temperature at 100 mA

Typical Duracell AA Performance

DURACELL®
BATTERIES

Berkshire Corporate Park
Bethel, CT. 06801 U.S.A.
Telephone: Toll-free 1-800-544-5454
www.duracell.com

Delivered capacity is dependent on the applied load, operating temperature and cut-off voltage. Please refer to the charts and discharge data shown for examples of the energy/service life that the battery will provide for various load conditions.

This data is subject to change. Performance information is typical. Contact Duracell for the latest information.

MN15CTUS0413

Pressure Sensor:

The Pressure Sensor is MEMs based device with a very rugged construction
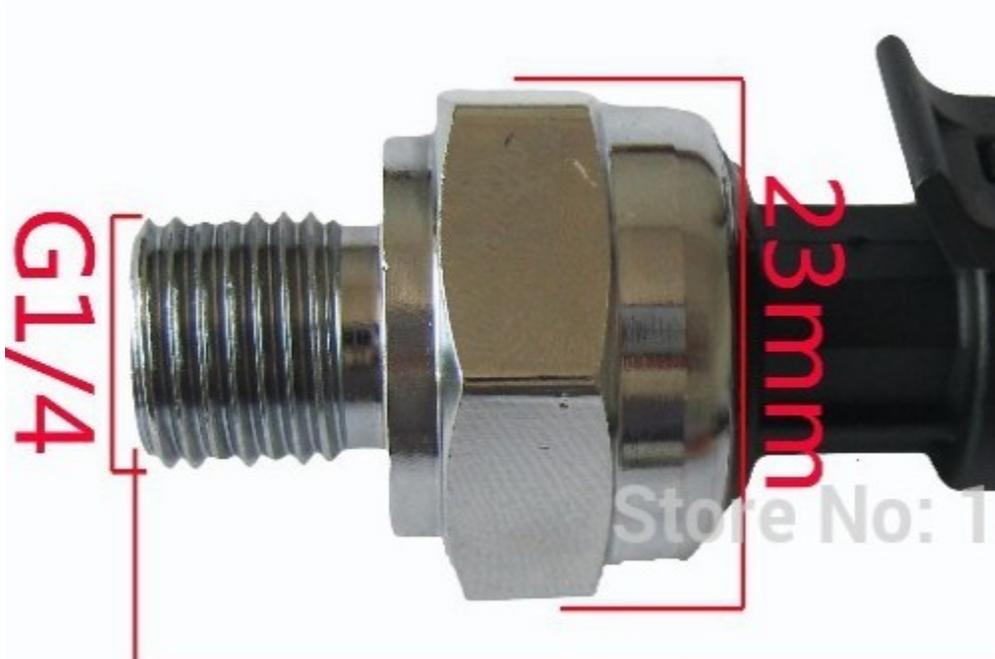
Specifications:
Working Voltage: 5VDC
Output Voltage: 0.5-4.5 VDC
Sensor material: Carbon steel alloy
Working Current: ≤10 mA
Working Pressure Range: 0-30psi
The Maximum Pressure: 2.4 MPa
Working TEMP. Range: 0-85 degrees
Storage Temperature Range: 0-100 degrees
Measuring Error: ±1.5 %FSO
Temperature Range Error: ±3.5 %FSO
Response Time: ≤2.0 ms
Cycle Life: 500,000 pcs
Application: non-corrosive gas liquid measurement

Features:
Easy removal, carbon steel connection more firmly.
Stainless steel is durable, sealed waterproof line, chips.
Wiring: red +, black -, yellow output

SVC Specification

Description	Value
Working Voltage	3.8v-8v DC
Battery	Alkaline Battery 1.5v x 4
	2600mAH
Battery Life	10Years
Operating Current in Sleep	6uA
Operating Current LCD Active	20mA
Operating Current GSM Active	80-100mA
Operating Temperature	-5degC to 70 Deg C
Battery Duration	5 Year (One Pac/Day)

CONCLUSION

This SVC system if introduced will bring about a major change in term of curtailing all the malpractices currently being performed. Further it can save valuable Time and Labor in collecting the Meter reading . Pressure Thefts That are not being monitored will be easily detected. The Data would also help in detecting Under Size and Over Size meter which will also increase the revenue. Future distribution network Planning. The QOS will improve as and Load can be distributed on the basis of the peak demands and pressure variation in the networking .