

Wireless data acquisition system for real time monitoring and controlling pump application

Bhaudip Mehta, Ujjaval Joshi, Dr.Kirit R Bhatt
 Master of Engineering, Deputy Manager, Professor
 Embedded system (E&C)
 Sardar Vallabhbhai Patel Institute of Technology
 Vasad, Gujarat 388306 Ph. No- 02692 274 489

Abstract - In the process of real time data collection, there have some problems, such as the duplication of Data, the complexity of physical cabled connection, the requirement of high speed and real time data processing and the electromagnetic interference and so on, so Goal is to develop wireless data acquisition system based on embedded system. The whole system will get data from different pump attached sensors with it and will send it to server using TCP/IP over MQTT protocol. So Aim is to improve power saving capabilities and high speed data transfer.

Keywords - MQTT protocol, IOT controller, TCP/IP, Sensors, Pumps.

I. INTRODUCTION

In this growing wireless environment, it is desirable to acquire data wirelessly and to make system free from complexity of cabling so aim is to develop wireless data acquisition system based on IOT controller which will reduce cost, size, improve power saving capabilities and high speed data transfer. In Real time there will be approximately ten thousands of pump(parallel pumping system) will be mounted at any industry or Firm so it is difficult to control and monitor this pump using man or any other devices.so this system will monitoring this pumps and send data to the cloud using Wi-Fi technology over MQTT(Message Queuing Telemetry Transport) protocol.

System overview

This system has two part main board and sensor Board Describe below.

1. **Main Board:** The Main board will have data through Wireless module which is connected serially (using uart, spi, i2c etc.) to the controller so that Wireless module will work serially. Format the sensor data and store it inside the memory. It will equipped with Wi-Fi module for making easy data transfer to cloud or server.
2. **Sensor Board:** It will mounted on each and every pump.VFD will get the sensors data from various sensor. Given to the ADC of the Controller. Convert the analog signal into equivalent digital format. Make it a frame or packet Transmit it to the main board for further processing.

Working Principle

Variable frequency drive (VFD) will acquire data from sensor which is mounted on pump, which then will be transmitted to the main Board using Serial communication.



Fig. 1 block diagram

The main board will also equipped with Wi-Fi modules that can easily transfer the data to the Cloud. The wireless communication module will act as a Serial to Wi-Fi Bridge which will communicate with MQTT broker using MQTT protocol. MQTT broker will act as a “Software as a service (SaaS)” on cloud server. The data published by the drive (client) will be stored by broker in the Cloud server for future access. It will provide gateway to cloud connected devices (like Mobile phones/ Tablets) to subscribe

the live data of remote pump. Users can access and control this pump using user interface application from remote places. The system designed to make wireless closed loop system to control the pump using various parameters.

II. PROPOSED TECHNOLOGY

MQTT (message queuing telemetry transport)^[7]

MQ Telemetry Transport (MQTT) is a publish/subscribe messaging protocol based on broker also it is light weight protocol is designed to be open, simple, lightweight and easy to implement. These characteristics make it ideal for use in constrained environments, for example, but not limited to: Where the network is expensive, has low bandwidth or is unreliable when run on an embedded device with limited processor or memory resources.

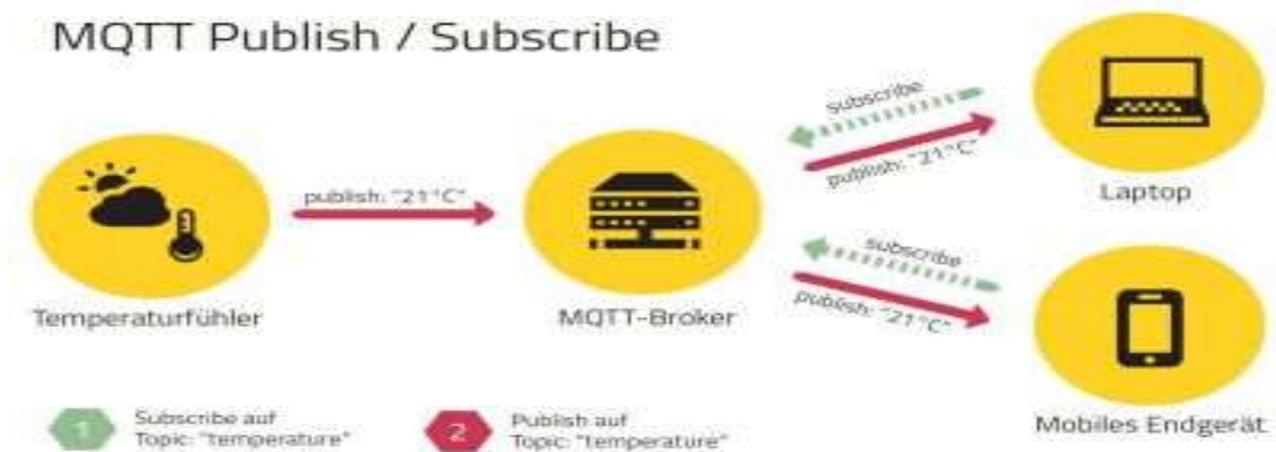


Fig. 2MQTT Publish/Subscribe^[10]

Three qualities of service for message delivery:

- "At most once", where messages are delivered according to the best efforts of the underlying TCP/IP network. Message loss or duplication can occur. This level could be used, for example, with ambient sensor data where it does not matter if an individual reading is lost as the next one will be published soon after.
- "At least once", where messages are assured to arrive but duplicates may occur.
- "Exactly once", where message are assured to arrive exactly once. This level could be used, for example, with billing systems where duplicate or lost messages could lead to incorrect charges being applied.

IOT Controller:

A complete IOT system which will use IOT controller and IOT protocol MQTT to provide 24hr service.

GS2100M^[11]

The GS2100M is a small footprint module that provides a quick, easy, cost-effective way for device and appliance manufacturers to add Wi-Fi connectivity to their products. Intended for smart energy and sensor applications, the module has 3x16 bit sigma-delta ADCs for high resolution sensor and measurement devices. The GS2100M can be used in a host-less mode (no external MCU), or hosted mode where it connects to an 8/16/32-bit microcontroller using UART, SPI or SDIO interfaces.

III. PROPOSED WORK

Live setup:



Fig. 3 System setup



Fig. 5 submersible pump



Fig. 4 Outlet

UART communication:

Tested and work on complete UART communication between pump and Main Board.

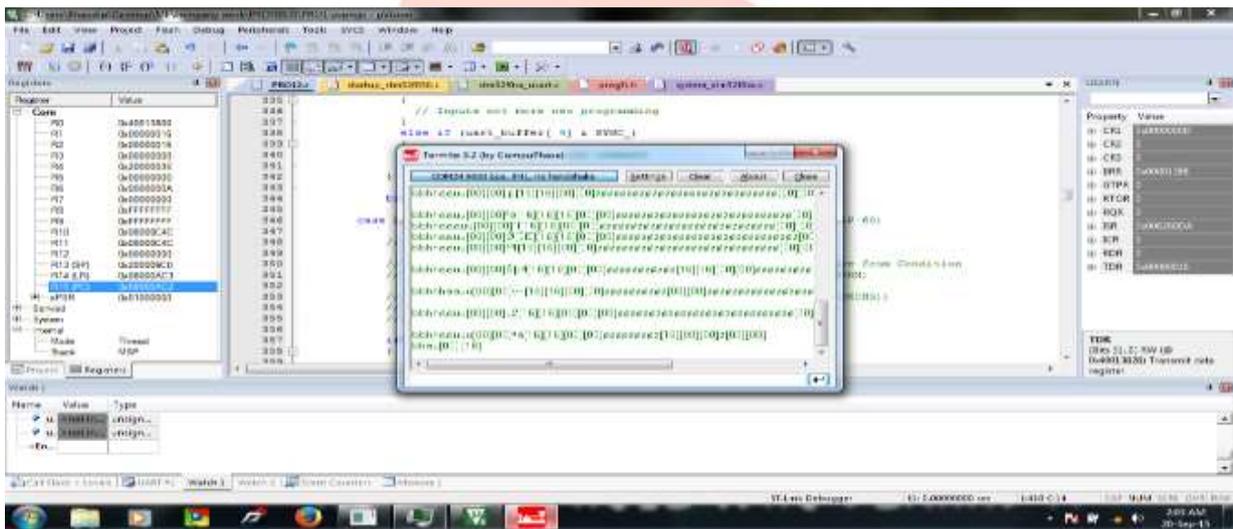


Fig. 5 Serial Communication

IV. RESULT

Below fig shows Real Time data analysis comes from the sensors attached to pump. Mention data comes from the drive and I am sending it to the virtual terminal for testing purpose. This data will be send to server and user can monitor this data.

```

63.3.02 150903 DR 000A
SP          0249
Act        00C9
Hz         1953
A          0051
Ovld      0031
LV         0302
LA         0000
DWL       014F
T          01FB
OV         7FFF
ADV        0000
CnFg      0142
SWP       0EF8
TM         0000
S0        006C
Es         0004
F1        63D1
F2        F0C8
F4         0001

```

Fig. 6 Pump Data

V. ADVANTAGES

- Low power consumption.
- High speed data Transfer.
- Continues data monitoring.
- Better controlling of system.
- Small in Size.
- More Secure.

VI. CONCLUSION

This system will provide fast controlling and monitoring at any time anywhere also it has latest technology inside it that is MQTT so updated Technology.

REFERENCES

- [1] Hermanis, R. Cacurs, K. N esenbergs and M. Greitans, "Efficient Real-Time Data Acquisition of Wired Sensor Network with Line Topology" in IEEE Conference on Open Systems (ICOS) on December 2 - 4, 2013, Sarawak, Malaysia.
- [2] CAI Jun, LIU jing-li, "A Wireless Data Acquisition and Transmission System Design" in First International Workshop on Education Technology and Computer Science on Year 2009 IEEE.
- [3] Hermanis, R. Cacurs, K. N esenbergs and M. Greitans, "Wireless data acquisition system based on ARM" in IEEE Electrical and control engineering, International conference on year 2011.
- [4] JinLin Hu guilin china 'The Design of Wireless Data Acquisition System Based on STM32 and virtual instrument' in IEEE communication , Networking and Mobile Computing (Wi-COM) ,8th International Conference on year 2012 .
- [5] Zhang Peng, Shen Minde, Feng Zhanjun 'Wireless Data Acquisition System Applied in Aircrafts' Detection' in IEEE Software engineering and service scienc,2nd international conference beijing 15-17 july 2011,262-265 pages.
- [6] Raees A. Siddiqui*, Roger I. Grosvenor, Paul W. Prickett 'dsPIC-based Advanced Data Acquisition System for Monitoring, Control and Security Applications' in IEEE 12th International Bhurban Conference on Applied Sciences & Technology (IBCAST) 293 Islamabad, Pakistan, 13th - 17th January, 2015.
- [7] Dinesh Thangavel, Xiaoping Ma, Alvin Valera and Hwee-Xian Tan," Performance Evaluation of MQTT and CoAP via a Common Middleware" in Intelligent Sensors, Sensor Networks and Information Processing (ISSNIP), 2014 IEEE Ninth International Conference on 21-24 April 2014.

- [8] https://www.google.co.in/search?q=stm32f0+discovery&espv=2&biw=1366&bih=643&source=lnms&tbm=isch&sa=X&ved=0CAYQ_AUoAWoVChMIq5-7---XyAIVIL6OCh0JWwG6#tbm=isch&q=stm32f0+discovery+to+serial+rs232+setup&imgrc=Sb1LfshHmq5RKM%3A
- [9] https://www.google.co.in/search?q=mqtt&es_sm=137&source=lnms&tbm=isch&sa=X&ved=0CAkQ_AUoA2oVChMI1Nf74vKXyAIVz1SOCh1ErOkW&biw=1366&bih=600#imgrc=OL1tNy7aPLBG4M%3A
- [10] https://www.google.co.in/search?q=mqtt&es_sm=137&source=lnms&tbm=isch&sa=X&ved=0CAkQ_AUoA2oVChMI1Nf74vKXyAIVz1SOCh1ErOkW&biw=1366&bih=600#tbm=isch&q=gainspan+370
- [11] <http://www.gainspan.com/gs2100m>

