Integration of Public Utilities On City Command & Control Centre(C-4) using IoT(Internet of Things) Platform in GIFT City

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Abstract- In this paper we have proposed the method for developing the smart city. Here we developed the water treatment plant which is handled smartly means through the internet. It consist of basic architecture of water treatment plant having programmable logic controller and Scada .In the first stage .integration of Raw water pumping station, Booster pumping station and water treatment plant and in second stage, it consist of controlling and monitoring process of city command and control centre. This process is a wireless communication process.

Keywords- Programmable logic controller, supervisory control and data acquisition, sensor, switches, wireless communication

I. Introduction-

Internet of Things represents a general concept for the ability of network devices to sense and collect data from the world around us, and then share that data across the Internet where it can be processed and utilized for various interesting purposes. The Internet of Things is not limited to industrial applications. The Internet of things (IoT) is the inter-networking of physical devices, vehicles (also referred to as "connected devices" and "smart devices"), buildings, and other items embedded with electronics, software, sensors, actuators, and network connectivity which enable these objects to collect and exchange data. The IoT allows objects to be sensed or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention. Gujarat International Finance Tech-City "GIFT City " is being developed as a global financial and IT / ITeS hub in the state of Gujarat, a first of its kind in India. GIFT has been planned as a " Smart city " with next class infrastructure using latest Information and Communication technologies. Being a Smart City, GIFT City authorities are expected to proactively monitor and manage City's Infrastructure using Information and communication technology advances for ensuring better services to the citizens .The infrastructure which need to be monitored consists of multiple utilities which are Water management system. Gujarat international finance tech-city has implemented water treatment plant which is control by a city command and control centre, city command and control centre is a common centre through which the operation performed in a water treatment plant is controlled. In a water treatment plant the water is taken from the Raw water pumping station .Raw water pumping station is a one station which is 15km away from the water treatment plant. The aerial distance is 6km between them. Booster pumping station is located between the raw water pumping station and water treatment plant. The GIFT-city try to developing the smart city but still there is no need of excess water for that booster pump is developing to boost the water from the Nabhoi raw water pumping station. The communication   between the Raw water pumping station, booster pumping station and water treatment plant is a

wireless communication. At every station there is one tower having RF module. Whatever The operation performed in a Raw water water pumping station is transferred to booster pump after that to water treatment plant and finally to the City command and control centre. If any difficulties are occurred ,then there is no need to go there that is at three station ,it can control through city command and control centre having one operator through which it can get controlled and monitored. Wireless communication, or sometimes simply wireless, is the transfer of information or power between two or more points that are not connected by an electrical conductor. The most common wireless technologies use radio waves. With radio waves distances can be short, such as a few meters for television or as far as thousands or even millions of kilometers for deep-space radio communications. It encompasses various types of fixed, mobile, and portable applications, including two-way radios, cellular telephones, personal digital assistants (PDAs), and wireless networking.. By deploying a fully operational " Centralized City Command and Control Centre " , GIFT authorities will able to see the status of various services of the GIFT city in a holistic manner and manage them on real time basis. Practically speaking , this City Command and control centre will integrate the Internet of Things implemented across various infrastructures.
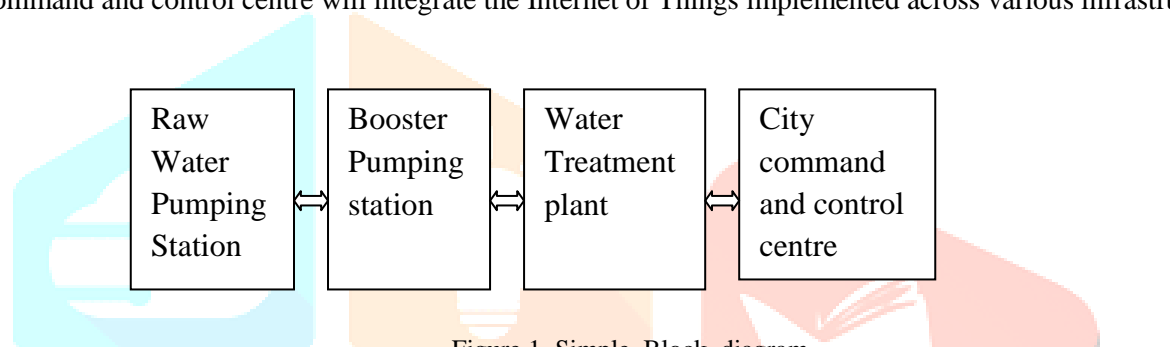

Figure 1. Simple Block diagram

II. Methodology-

The full system architecture of project is shown in below figure, it consist of detail configuration of Water treatment plant
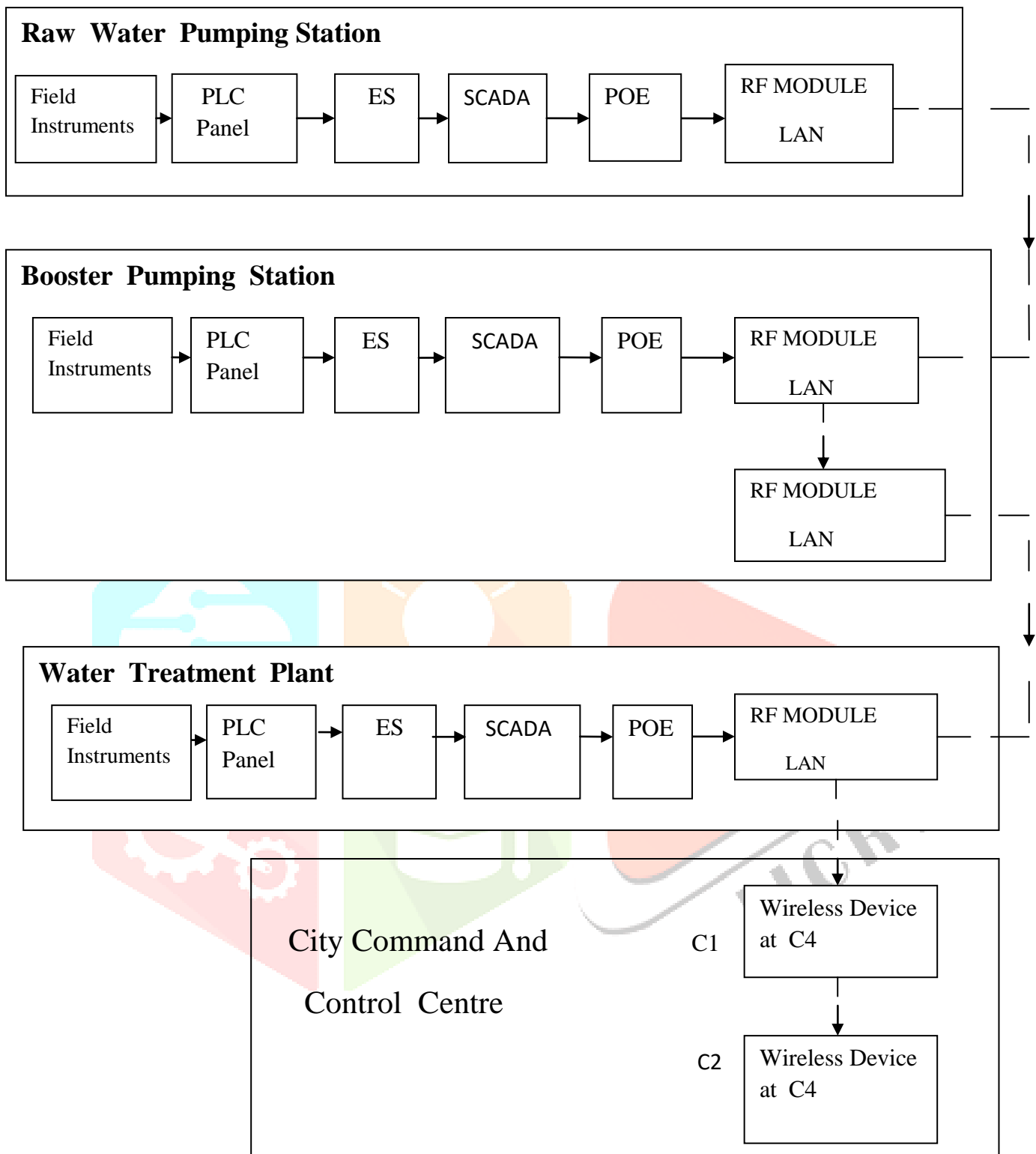
Raw Water Pumping Station

Field Instruments → PLC Panel → ES → SCADA → POE → RF MODULE LAN

Booster Pumping Station

Field Instruments → PLC Panel → ES → SCADA → POE → RF MODULE LAN → RF MODULE LAN

Water Treatment Plant

Field Instruments → PLC Panel → ES → SCADA → POE → RF MODULE LAN

City Command And Control Centre

C1   Wireless Device at C4

C2   Wireless Device at C4

Figure 2. Full system architecture

The above figure consist of instrumentation details, wireless communication, programmable logic controller, supervisory control and data acquisition system(SCADA),Ethernet switch, RF module, power over Ethernet, LAN network. The full system architecture of project is shown in above figure. It consist of Raw water pumping station ,Booster pumping station ,Water treatment plant and city command and control centre. These are connected through wireless media with radio frequency module having radio frequency . There are four wireless communication channel ,called as a Tower. In a raw water pumping station water is coming from Narmada cannel through pipe .It is necessary to check the flow of water, level, pressure etc. For that level switch, level transmitter, pressure switch, pressure transmitter ,valve, gauge are necessary. All this instruments are together call as a field instruments. The data coming from this instrument are connected to the PLC and it is read by PLC. The water coming from cannel get flow through the pipes. To check the status of the pump valves . gauges, flow meter are connected to MCC Panel. To control the pumping operation they are connected to the programmable logic controller through the MCC Panel. If the level of the sumps gets full then

1. Level transmitter sends signal to the PLC that, sumps gets full.
2. PLC gives command to MCC panel to stop the motor
3. MCC Panel gives feedback to the PLC that motor gets Starts.

Similarly , when the level of the sumps gets empty or low level. If any difficulty comes, there is no need to go at pumping station, it can controlled through common center called as city command and control centre. To make it smart, all the operation that are performed on field is graphically implemented, for that there is use of Superior control and data acquisition (SCADA) software. AT a field there is one room having a pc with SCADA software .In a SCADA software all the field structure is graphically represented, If any difficulty comes, it gets control by pressing button on a PC, no need to go at that point. The data from PLC is given to the SCADA through Ethernet switch. The data from the Raw water pumping station to other station is transferred via wireless LAN network. similarly, the process happened at each station and data gets transferred via wireless communication. In a city command and control status of all the station get control and monitored having video walls. on a video walls alarms generated, also it can check the status of sump whether it gets full or empty ,if the level of the sump is below the set point then at every station signal gets transferred either by email or message to the operator who is at a station point.

A. Raw Water Pumping Station-

Pumping stations are facilities including pumps and equipment for pumping fluids from one place to another. They are used for a variety of infrastructure systems, such as the supply of water to canals, the drainage of low-lying land, and the removal of sewage to processing sites. The basic part of water treatment plant is Raw water pumping station. Raw water pumping station is a pumping station where the water is collected from Narmada canel/River/Dam. Raw water pumping station is 15km away from the water treatment plant and aerial distance between the raw water pumping station and water treatment plant is 6km.The communication between this two station is a wireless communication.

B. BOOSTER PUMPING STATION-

A booster pump is a machine which will increase the pressure of a fluid. They may be used with liquids or gases, but the construction details will vary depending on the fluid. A gas booster is similar to a gas compressor, but generally a simpler mechanism which often has only a single stage of compression, and is used to increase pressure of a gas already above ambient pressure. Two-stage boosters are also made. Boosters may be used for increasing gas pressure, transferring high pressure gas, charging gas cylinders and scavenging. Booster pumps are usually piston or plunger type compressors.

C. WATER TREATMENT PLANT(WTP):

Water treatment plant is a plant where the water gets collected from the Raw water pumping station. It consist of one tank ,at that tank water get collected. The water from this plant is use in whole GIFT-CITY. The structure of the water treatment plant is given below..It consist of raw Water tank,, dual media filter, micron cartridge filter, backwash pump, Ro membrane etc. There are four section of water treatment plant.

- ► RAW water section
- ► filter section
- ► dosing section
- ► RO Section

RAW Section

In this, Collecting water from Nabhoi Pumping station to RAW Tank which is placed at WTP Plant at GIFT WTP Utility. This collecting water moved forward for further filtering process. DUAL MEDIA FILTER is used for the filtering process.

FILTER SECTION

Basically three DMF filter tanks available in filtering section ,which is also working on the redundant mode ,which will help to remove bad particles like sent etc. And also backwash tank, which is collecting some of water during the process which will help to do maintenance of dual media filters. Now this filtered water goes to next section which is Dosing section.

DOSING SECTION

In dosing section, add some required chemicals which will improve quality of water like PH, Chlorine. After this water goes to next filtering section. After this section water goes to final filtering section through high pressure pump which is RO section .

RO SECTION

In this there is use of two redundant base RO, during the process only one will in working mode. It require high pressure pump before RO section because during this whole process the speed of water flow will decrease, so after

RO we will get pure water which will collect in suck back tank. Water which is not able to purify will collect in WDS(Waste Disposal System) which will use for gardening purpose

III. City Command And Control Centre-

City command and control center is a one centre where the information from all the plant get collected and if any difficulty comes in a plant it is control by this centre.All the essential data such as flow,pressure,level from the water treatment plant are monitored in a city command and control center .It is also consist of ctitical alarms to check level of sump,electrical faults,pump failure,emergency shutdown is given to city command andcontrolcentre.The architecture of how the data get transferred and received from water tratment plant to city command and control centre is given below.
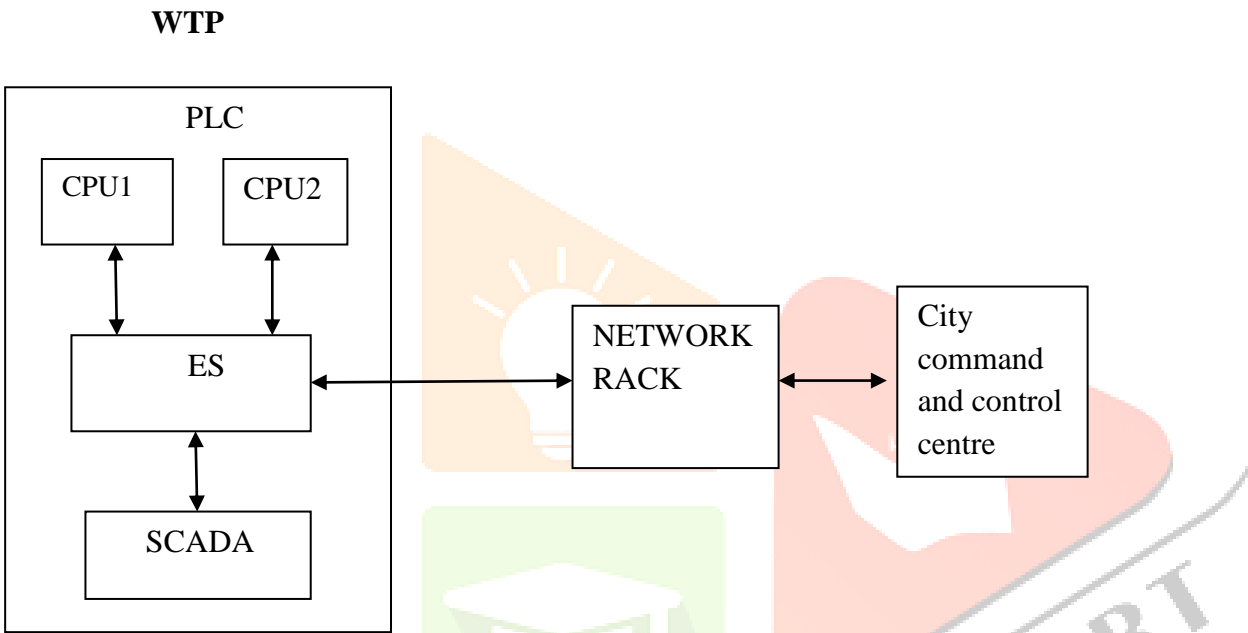
WTP

Figure 3. Architecture of city command and control centre

The communication between water treatment plant and city command and control centre is done by the network rack, it is also called as wireless communication .Network rack act as a server. All the data from the water treatment plant are connected to the network rack through plc panel. This data is given to the server of city command and control centre. If the level of wtp tank gets low, then signal goes to the city command and control centre and alarm is generated at C4,there are two operator at city command and control centre, they check the alarm signal that level of tank gets low, and sends signal to the wtp plant operator that start the motor. This is done by sending the E-mail and SMS to the operator. Then operator starts the motor. In this way the process takes place.

A. WTP To C4 process flow:

The process flow diagram from wtp to c4 is given below, it gives how the data signal get collected from wtp to c4.

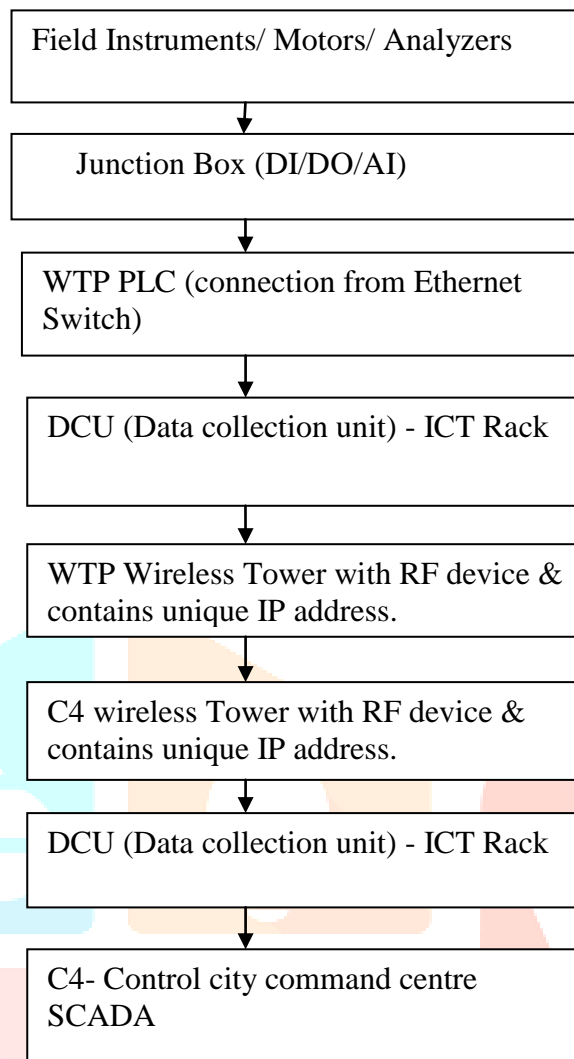| Field Instruments/ Motors/ Analyzers |
| --- |
| ↓ |
| Junction Box (DI/DO/AI) |
| ↓ |
| WTP PLC (connection from Ethernet Switch) |
| ↓ |
| DCU (Data collection unit) - ICT Rack |
| ↓ |
| WTP Wireless Tower with RF device & contains unique IP address. |
| ↓ |
| C4 wireless Tower with RF device & contains unique IP address. |
| ↓ |
| DCU (Data collection unit) - ICT Rack |
| ↓ |
| C4- Control city command centre SCADA |

Figure 4 . WTP To C4 process flow

If motor get started , first the signal goes to junction box of wtp, the signal may be digital input, digital output, analog input. Then signal go to the wtp plc. After that the signal goes to the DCU-ICT rack ,which is data collection unit. All the wtp plant data get collected in this rack. Then all the data get transferred to the wtp tower with RF device and contains unique IP address, every data has its own unique address. Then signal goes to C4 wireless Tower with RF device & contains unique IP address. this communication is called as wireless communication. Then data from the RF tower get collected in a DCU (Data collection unit) - ICT Rack of city command and control center. after that all the data is graphically controlled and monitored in a city command centre scada. In this way the data get collected and transferred through city command and control centre. If any difficulty comes at a wtp plant then alarm is generated at city command and control centre. Then operator from the city command and control centre check the signal and send the E-mail and SMS to the operator of the water treatment plant that level of tank gets low, please start the motor. In this way communication between water treatment plant and city command and control centre is done

IV. Conclusion-

We proposed the method for smart city, it means the integration of water treatment plant with city command and control centre and water treatment plant is controlled and monitored by the city command and control centre.

V. References-

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