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Water Resource Management System using IoT

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ABSTRACT: Efficient utilization of resources is vital when there is a shortage in resources and high demand. We aim to enable the customers and Resource Provider to efficiently utilize the resource based on priorities and necessities by developing a Smart Controller system to cater the need. Our Smart Controller comprises of a smart communication system which provides a means of communication between the resource consumer and the provider. Thus Smart Controller system allows remote reading of resource consumption. When there is a scarcity of resources, we enable the resource provider to sustain a well-balanced resource structure to cope with the needs of the consumers based on priorities and significances. Our Smart Controller system instead of completely terminating the resource flow to the consumer, we enable the Resource provider to share resources among the recipients. We enable them to provide minimal resource during specific hours i.e. scarcity period, so that normal life does not get affected and complete resource when resource availability is sufficient. This variable Resource supply will be implemented by controlling system from the Central office accordingly. Proper metering infrastructure is provided such that the cut-off range can set or unset in a remote and dynamic basis. The Central office can collect readings at various time intervals which can be used for billing, analysis & estimation of resources for current and future usages. This system limits manual intervention to the minimum for reading the data from the meter & Billing purposes. The user can send specific instructions through key interface like additional request for resource in case of emergency requirement. It can also be used to get billing information, shutdown timings and make complaints. The system also gives indication in case of change in the schedule.

KEYWORDS: Smart Controller System, Efficient utilization of resources, Scarcity of resources.

I.INTRODUCTION

The main objective is to develop a Smart Controller system for efficient utilization of resources and resource management such as water to overcome shortages due to limited resources and high demand. This new technology is the successor to the existing systems in place. In the existing system, the resource consumption is not measured by any means hence the amount that is being used is not known. The resource being consumed by the neighbourhood will be more than that of the owner.

In the new system, smart meter is being used which tells the exact amount of resource that is being used by each consumer. The amount of resource supplied to each consumer will be based on the amount demanded. If the amount of resource used is equal to the amount of resource demanded, then the valve will automatically shut down the supply. If the consumer still requires more resource than the consumer can demand further and the resource will be supplied more as per the demand. Due to this there would be better utilization of resources and aids in analysis which would be useful for future planning.

II.EXISTING SYSTEM

Currently the water supply to the home, industries and government buildings are done by manual approach which is controlled by Municipal Corporation of respective cities.

Disadvantages which are given below:
•Time consuming & involves manual processes in billing & resource scheduling.

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•Water may be sucked by motorpumps which lead to scarcity on low areas.
•Resources are not shared properly.
•People are not aware of theirusage.
•Governments are also unaware whether the resources are shared properly or not.

III.PROPOSED SYSTEM

Our proposed system involves a Smart Controller system for efficient utilization of resources and resource management of resources such as water to overcome shortages due to limited availability of resources and high demand. This new technology is the successor to the existing systems in place. This system aims at better utilization of resources and aids in analysis which would be useful for future planning.
This system has a set of advantages which are given below:
•Data granularity for future analysis
•Resource sharing during scarce period
•Bi directional communication useful for billing and complaint registration
•Remote maintenance
•Learn Resource information
•Reduced wastage, increased revenue.

IV.LANGUAGE PACKAGES USED

A. EMBEDDED SYSTEM PROGRAMMING

The salient features of Embedded System Programming arecode speed and code size. code size is governed byuse of programming language and available program memory whereas Code speed is governed by the timing constraints and theprocessing power. Goal of embedded system programming is to getminimum space and minimum time with maximum features.

Using different type of languages Embedded System is Programmed:
◦Machine code
◦Low level language, (assembly language)
◦High level language (C, C++, Java, Ada, etc.)
◦Application level language like VB, Scripts, MS Access, etc.

B. VISUAL BASIC 6.0

VB is a high level programming language. It has been evolved from the earlier Disk Operating System called BASIC (Beginners AllPurpose Symbolic Instruction Code). The code used in this looks like English Language.It is an easy programming language to learn.
Visual Basic 6.0 is a Visual Programming Language. These are some main divergence from the old BASIC, where the programming is executed sequentially as it is done in a text-onlymode.
In VB, programming is done in a graphical user interface environment. In the old version of BASIC, you have to write program code for each graphical object to display it on the screen, which includes its position and its color. But, In VB, you just need to drag and drop any graphical object anywhere and also can change its property using the properties windows at any time.

C. PHP (HYPERTEXT PREPROCESSOR)

PHP is a server-side scripting language. It has been designed for web development but also used as a general-purpose programming language.
"*PHP code is interpreted by a web server with a PHP processor module which generates the resulting web page: PHP commands can be embedded directly into an HTML source document rather than calling an external file to process data*". It has also evolved to include a command line interface capability which can be used in standalone graphical applications.

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D. APACHE

Apache HTTP Server, colloquially called Apache is the world's most widely used web server software. Originally based on the NCSA HTTPd server, Apache development began on 1995. Apache played a key role in the initial growth of the World Wide Web, as the dominant HTTP server, quickly overtaking NCSA HTTPd and has remained the most popular HTTP server since April 1996. In 2009, it became the first web server software to serve more than 100 million websites.

E. MySQL

MySQL is the world's most widely used open source relational database management system that runs as a server providing multi-user access to a number of databases. The SQL phrase stands for Structured Query Language.

For commercial use, offer additional functionality for paid edition. Applications which use MySQL database alsoincludes other software like TYPO3, Joomla, WordPress, phpBB, MyBB, Drupal. MySQL is also used in many high-profile products and large-scale World Wide Web products.

F. SMTP SERVER

Simple Mail Transfer Protocol (SMTP) is an Internet standard for electronic mail (e-mail) transmission. It is defined by RFC 821in 1982, later updated in 2008 with the Extended SMTP additions by RFC 5321 - which is the protocol in widespread use today.

SMTP by default uses TCP port 25. The protocol for mail submission is similar, but uses port 587. SMTP connections secured by SSL, default port is 465 (nonstandard, but sometimes it can be used for legacy reasons).

V. SYSTEM DESIGN

1. MASTER MODULE

The master module receives the reading periodically from various connections in the sensor and stores the information in the database using wireless sensor networks. The administrator authority decides the amount of water supply to individual party and their priority. The allocated resource data is sent to the customer node through the Trans receiver (ZigBee). The database consists of all the data related to the consumer. MAX 432 is used for regulating the voltage pertaining to the client system.

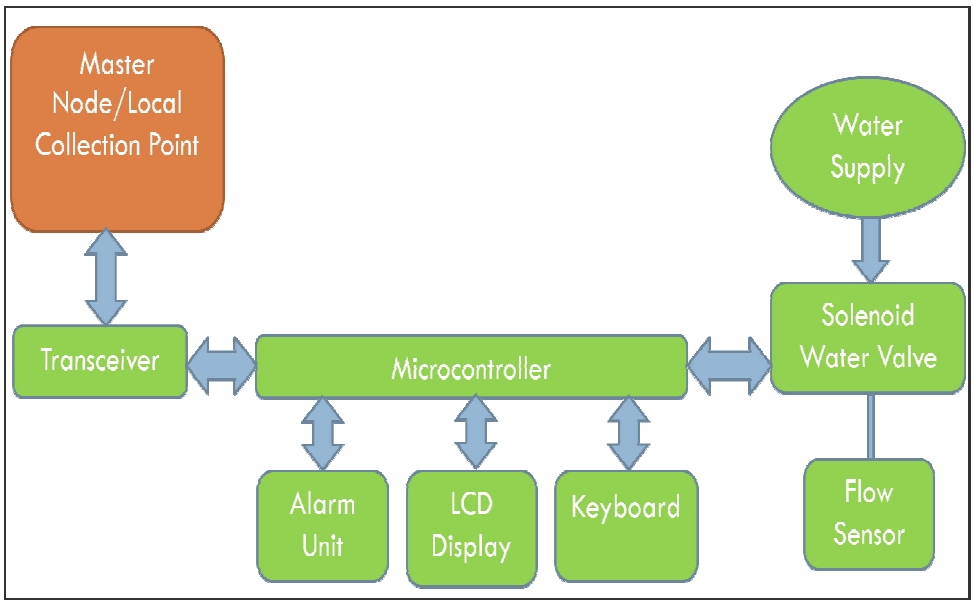

Fig. 1 Master Module

2. CHILD MODULE

The child node can communicate to the Master node and vice versa which provides information. The Microcontroller controls the LCD display, Alarm Unit and Keyboard interface. When the cut-off value is received from the Master Node, the value is set as the threshold value. The flow sensor in the node regulates and calculates the amount of water

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consumed when this value reaches the threshold value, the flow is terminated by the solenoid water valve and the microcontroller enables the alarm unit.

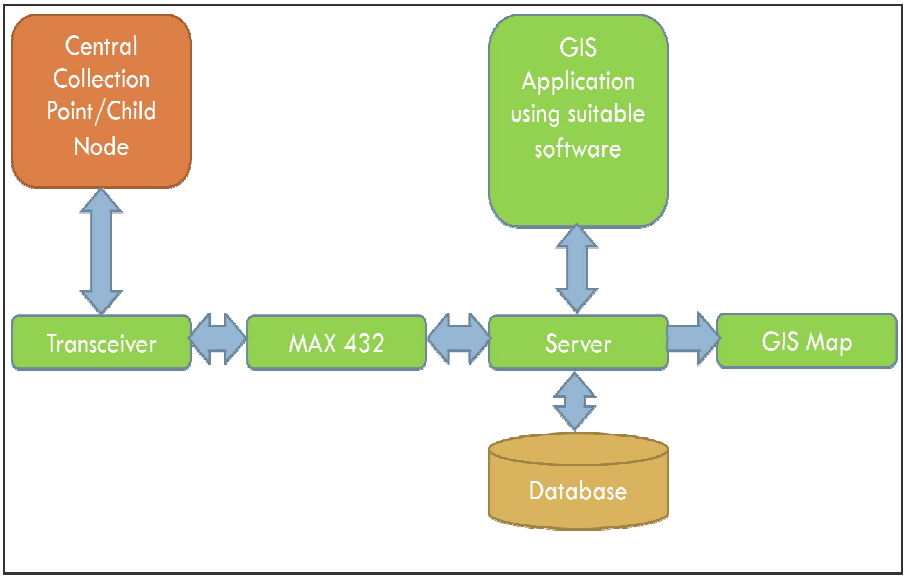

Fig .2Child Module

C. Overall Node Connection Diagram

Each child nodes are connected to a local connection point. These local connection points are connected to the Master node. This forms the Smart Controller network in its entirety.

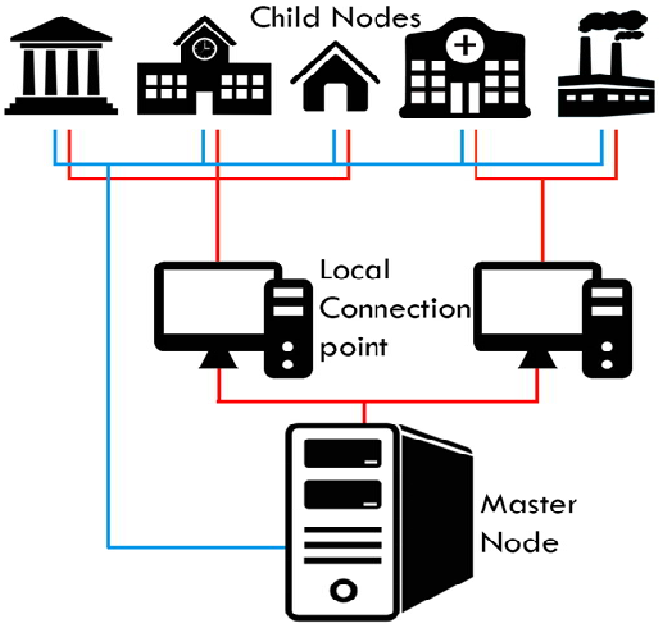

Fig 3 Overall Relationship Diagram

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VI.MODULES DESCRIPTION

1. Child Module and Master Module:
The allocated resource data (CUT OFF value) is sent to the customer node through the Trans receiver (ZIGBEE) from the Master Node. The Microcontroller controls the LCD display, Alarm Unit and Keyboard interface. When the CUT OFF value is received from the Master Node, the value is set as the threshold value. The flow sensor in the node regulates and calculates the amount of water consumed when this value reaches the threshold value, the flow is terminated by the solenoid water valve and the microcontroller enables the alarm unit.

2. Radio frequency:
The CC2500 is a low-cost 204 GHz transceiver designed for very low power wireless application. The circuit is intended for the 2400 – 24833.5 MHz ISM (Industrial, Medical and Scientific) and SRD (Short Range Devices) frequency band.
The RF transceiver is integrated with a highly configurable base band modem. The modem supports various modulations formats and has a configurable data rate up to 500kBaud. CC2500 provides extensive hardware support for packet handling, data buffering, burst transmissions, clear channel assessment, link quality indication, and wake on radio.

3. Solenoid Valve
A solenoid is a simple electromagnetic device that converts electrical energy directly into linear mechanical motion that is to open, close or to adjust in a position. It consists of a coil of wire with an iron plunger that is allowed to move through the centre of the coil. The magnetic plunger is acting directly on the valve seal to open or close the valve orifice depending upon whether the solenoid is energized or un-energized.
4. ZigBee Architecture
ZigBee is a specification for a suite of high-level communication protocols used to create personal area networks built from small, low-power digital radios. ZigBee is based on an IEEE 802.15.4 standard.
ZigBee devices can transmit and receive data over long distances by passing data through a mesh network of intermediate devices to reach more distant ones.

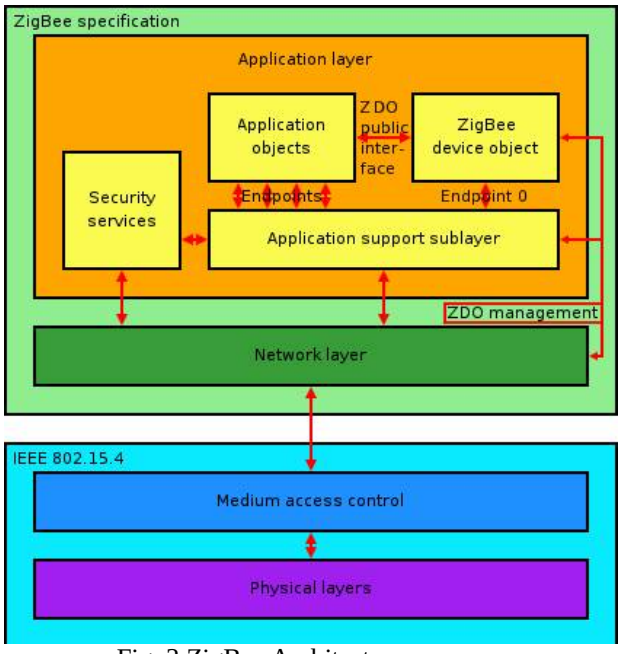

Fig. 3 ZigBee Architecture

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5. Microcontroller

The PIC 16F 877A is a stand-alone high performance microcontroller intended for use in sophisticated real-timeApplications. It has High-performance RISC CPU. Only 35 single word instructions to learn for programming this microcontroller. ExceptProgram branches remaining all has single cycle instructions. The Operating speed in DC is 20 MHz, clock input DC is 200 ns for instruction cycle.

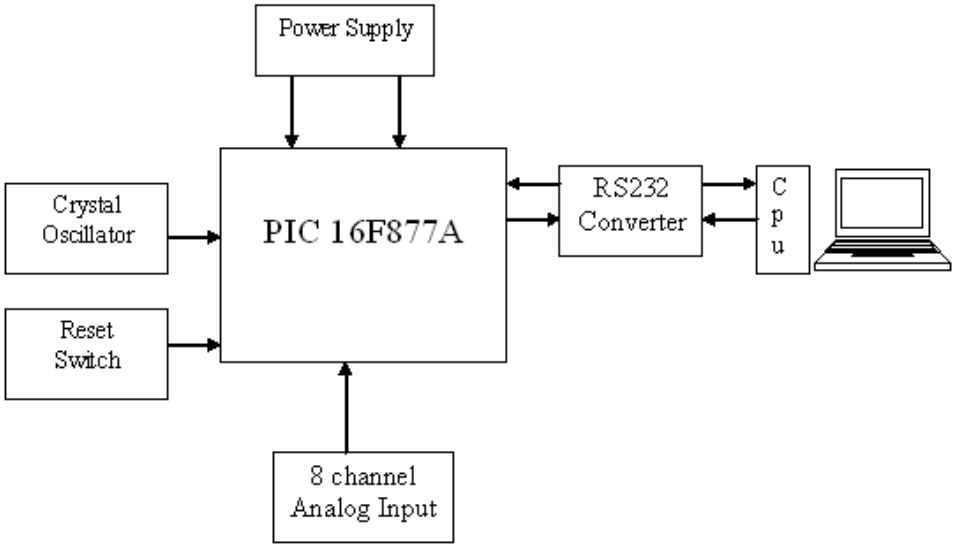

Fig4 Block Diagram of PIC16F877A

VII. SERVER MODULE AND CALCULATION MODE

We get the meter reading from the user through the child node module. We fetch the details of the customer from the database and calculate the corresponding amount for the readings which they have consumed. The readings are used and calculation part is done here. Calculation is done as per rule of Municipal Corporation of the respective cities. Readings are calculated as,

Monthly Usage (Litters)	Slab units (Liters)	Charges per unit	Fixed charge
Up to 100 litters	0-100	Rs.1.1	Rs. 20
Up to 200 litters	0-200	Rs.1.8	Rs. 20
Up to 500 Litters	0-200	Rs. 3	Rs. 30
	201-500	Rs. 3.5	
Above 500 Litters	0-200	Rs. 3	Rs. 40
	201-500	Rs. 4	
	501 & Above	Rs. 5.75	

Table 1 Server Calculation Table

As per the above table, the readings are calculated in this module Fig 5.

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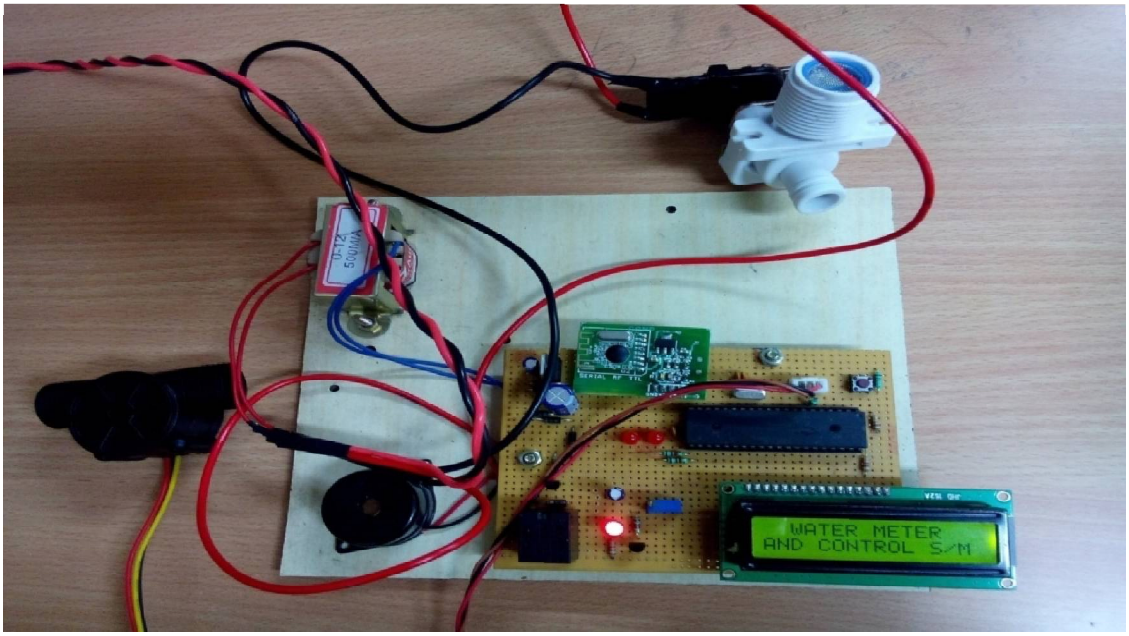

Fig 5 Hardware Implementation

VIII.SOFTWARE MODULE

Software module is implemented using Visual Basic 6.0 which serves as the Master Node. In the Display Page, we display the information pertaining to the user consumption. The consumption of resource data are displayed dynamically based on consumption time. The threshold value is fed into the microcontroller using embedded C program. When the consumed value reaches the threshold value, the alarm and LED signal is turned on and the consumer can send additional request if necessary. This information is displayed in the Page and the request can be authenticated or rejected based on the availability.

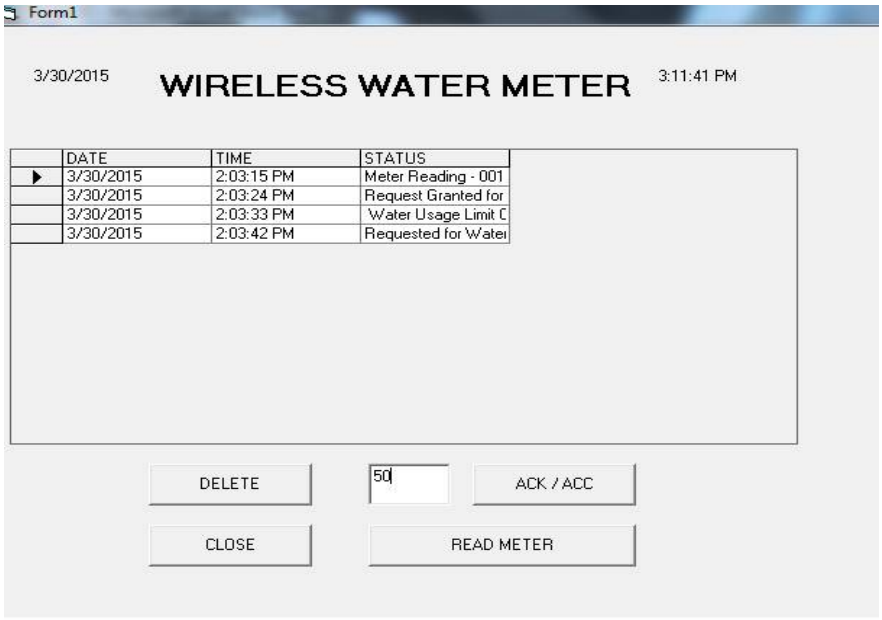

Fig 6 VISUAL BASIC 6.0

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IX. RESULT

In this project, Resource management system using wireless sensor network has been implemented and we have got satisfactory results. The flow of water which is measured by flow sensor which enables termination and restart of the flow using valves are controlled by solenoid valve. The main benefit of the proposed system is that, it removes manual intervention and control of valve for water flow from the Municipal corporations and it also reduces the theft and leakage of water that is misused and wasted by the people.

X. CONCLUSION

In our project we have developed modules to measure various parameters like water that is consumed by a single customer, amount of water that is needed for the city, amount of water that has been held by the municipal corporations, customer can get the amount of water he/she has consumed, the billing information is calculated and previous bill payments is also available in this system.Wireless sensors will play a key role in enabling the transmission and receiving of the data that is collected by the customer side and server side respectively.

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BIOGRAPHY

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