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THROUGHPUT OPTIMIZATION IN MOBILE NETWORKS USING MILP ON EB BILLING APPLICATIONS

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Abstract :

This paper describes new algorithms for throughput optimization in a mobile backbone networks. This hierarchical communication framework combines mobile backbone node, which have superior mobility and communication capability with regular nodes, which are constrained in mobility and also in communication capability. This paper develops a novel technique for maximizing this quantity in networks of fixed regular nodes using mixed-integer linear programming (MILP). MILP-based algorithm provides a significant reduction in computation time compared to existing methods and is computationally tractable for problems of moderate size. In this project our Electricity board (EB) bill data is automatically generating & sending to the EB office and we can able to paying the bill through mobile itself without using an INTERNET. Microcontroller is used to read the power reading continuously by using the sensor MOC 7811, the microcontroller internal counts the number of rotations and calculates the amount for units as per the count as per the consumer requires and it be sends through GSM MODEM. The Captured data is sent to the EB office and they will send the Current Electricity Bill of the user to the Home at the same instant with all the details regarding the usage.

***Index terms* – Automatic Meter Reading,Global System, Modem Short messaging system.**

I. Introduction

Detection and monitoring of spatially distributed phenomena often necessitates the distribution of sensing platforms. For example, multiple mobile nodes can be used to explore an area of interest more rapidly than a single mobile nodes , and multiple sensors can provide simultaneous coverage of a relatively large area for an extended period of time . This paper focuses on a hierarchical network architecture called a mobile backbone network, in which mobile nodes are deployed to provide long-term communication support for other agents in the form of a fixed backbone over which end-to-end communication can take place. Mobile backbone networks used to model a variety of multi agent systems. For example, a heterogeneous system composed of air and ground vehicles conducting ground measurements in a cluttered environment can be appropriately modeled as a mobile backbone network, as can a team of mobile robotic agents embedded to collect streams of data from a network of stationary sensor nodes. Existing techniques, suffer from intractable computation times. Furthermore, mobility of regular nodes has not been frequently addressed. This paper provides tractable solutions to the important problem of maximizing the number of regular nodes that achieve a desired level of throughput .Now a days Current electricity billing is done by labor and manual reading from houses to houses. it requires huge number of labor operators and long working hour to achieve complete area billing. The Human operator billing are prone to reading error as sometime the houses power meter is place in a location which is hard to read with naked eyes. Billing job is sometime restricted and slow down by bad weather condition.

VariousAutomatic Meter Reading (AMR) systems using Power Line Carrier (PLC) communications, Bluetooth and ZigBee are developed to address the above mention problems, the above mentioned AMR are either short in operating distant and still require some intervention of human operators or prone to error and reliability issue dueto noise and poor power quality in the transmission line has more importantly the abovementioned method does not allow distribution control. With the rapid development of Global System Mobile (GSM) infrastructure and Information Communication Technology (ICT) in the past two decades has made wireless automatic meter reading system more reliable and possible. The GSM Power Meter Reading and Distribution Control (GPMDC) System presented in this paper takes advantage of the available GSM infrastructure nationwide coverage in the country and the Short Messaging System (SMS) cell broadcasting feature to request and retrieve individual houses and building power consumption meter reading back to the energy provider wirelessly.the electric power systems had undergone negligible changes in their operating conditions.

The equipment employed for their control and monitoring. Many attempts have been made to design the energy meter with instant billing but till now the designed energy meters did not give any replacement for the system. where the user has to connect the recharge card to recharging unit, and the units will be loaded into recharge card. In this proposed work we are implementing a prepaid electricity

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meter connected to electricity office interface through GSM network.

When we use the electricity the amount which we had used is calculated by energy meter at user interface. This information is passed to microcontroller.Here we use 8051 microcontroller programmed withembedded C language. This controller decodes theinformation given by the electric meter and transmits the information to LCD module and GSM modem.GSM modem consists of a SIM card possessing unique number thattransmits the information to electricity board which again consists of a GSM modem connected to a PC. The information from the modem is decoded and data base in the PC is updated. This updated information is sent to user mobile. Now by just recharging this mobile the bill amount can be settled. A conformation message is sent to mobile about the bill settlement .The whole process is done automatically without any manual involvement hence theprobability of occurrence of error is negligibleThe importance of proposed work can be well understoodif we keep in mind the amount of electricity being stolenevery day. As a user can get his or her bill at any instant andcan even pay it at any instant, so any kind of misuse by any other person can be avoided.Thus here we can able to generate and pay the bill through cellula phone using GSM MODEM without INTERNET.

II. Literature Review

2.1. Prevailing System:

Noting that most communication bandwidth in single-layer large-scale mobile networks is dedicated to packet forwarding and routing overhead, they proposed multilayer hierarchical network architecture, as in currently used in the Internet. The two types of nodes: the regular nodes, which have limited mobility and communication capability, and mobile backbone nodes, which have greater communication capability than regular nodes and which can be placed at arbitrary locations in order to provide communication support for the regular nodes. formulated the connected disk cover (CDC) problem, in which many mobile backbone nodes with fixed communication ranges are deployed to provide communication support for a set of fixed regular nodes. The aim of the CDC problem is to place the minimum number of mobile backbone nodes such that each regular node is covered by at least one mobile backbone node and all mobile backbone nodes are connected to each other. Thus, these CDC problem takes a discrete approach to modeling communication, in that two nodes can communicate each other if they are within communication range , and otherwise cannot.

The currently prevailing system involves the user to go up to the EB office to manually pay his bills. The readings are taken using the analogue meter present in the customer's house. These readings are taken using anemployee working at the EB office. This system has a set of disadvantages which are given below:

1. Erroneous Readings – This involves errors present meter reading which are committed due to human mistakes.
2. Easy Manipulation – Since all data here are taken manually date can be easily manipulated by third parties where affect the EB office and the customer
3. Manual Labor – The amount of workforce involved in this prevailing EB system are too large as the EBpeople to visit many areas at roughly the samedate.
4. Time Consuming – This system takes a lot of time to go personally to the customer's house and take the readings.

2.2. Our Proposed System:

We assume that the throughput (data rate) that can be achieved between a regular node and a mobile backbone node is a monotonically non increasing function of both the distance between the two nodes and the number of other regular nodes that are also communicating with that particular mobile backbone node and thus causing interference. While our results are valid for any throughput function that is monotonically non increasing in both distance and cluster size, it is useful to gain intuition by considering a particular example. Building upon this continuous throughput model, we develop the mobile backbone network optimization problem as follows: given a set of N regular nodes distributed in a plane, our goal is to place K mobile backbone nodes, which can occupy thearbitrary locations in the plane, while simultaneously assigning the regular nodes to the mobile backbone nodes, such that the effectiveness of the resulting network is maximized. In this work, the effectiveness of the resulting network is measured by the number of regular nodes that achieve throughput at least _min, although other formulations (such as that which maximizes the aggregate throughput achieved by all regular nodes) are possible. Thus, our objective is to maximize the number of regular nodes that achieve throughput at least _min.). We also assume that there is no need for the mobile backbone nodes to be "connected" to one another. Thus, our model represents a "one-time" network design problem and is also suitable for cases in which mobile backbone nodes are deployable, but cant be move once they have been deployed.

The old analogue meter reading is replaced by a digital one. This keeps on updating frequently the amount of power consumed in the house in the display. This detail is then updated once in two months to the EB office using RF. The customer meter sends its data to the EB office using the RF. The EB office calculates the data and sends the amount to be paid to the customer along with the due date.

The advantages of this system are:

1. Less Labor – The vast workforce used in the earlierEB system is reduced to a very few.workforce can also be used for otherdevelopmental purposes.
2. No more Queues – The old fashioned way of Pay the bills by waiting in queues are no more

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needed as the bill can be paid via mobiles.
3. Quick updates – The amount to be paid and the duedate for the bills are sent to the customer as quicklyas possible through the wireless facility.
4. No manipulation – There can be no manipulation inthis method as the entire process is transparent to the customer.

III. Architectural Design

This radius, which we will denote as the 1-center radius, is the distance from the 1-center location to any of the defining regular nodes. For 1-center locations defined by the below representation.

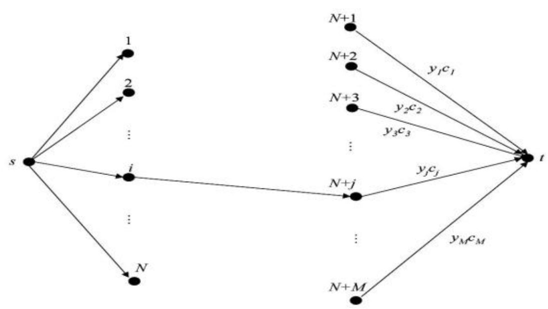

Fig.3.1 The network design problem corresponding to the joint placementand assignment problem for mobilebackbone networks. Unlabeled arc capacities are equal to 1.

3.1 Application System Design

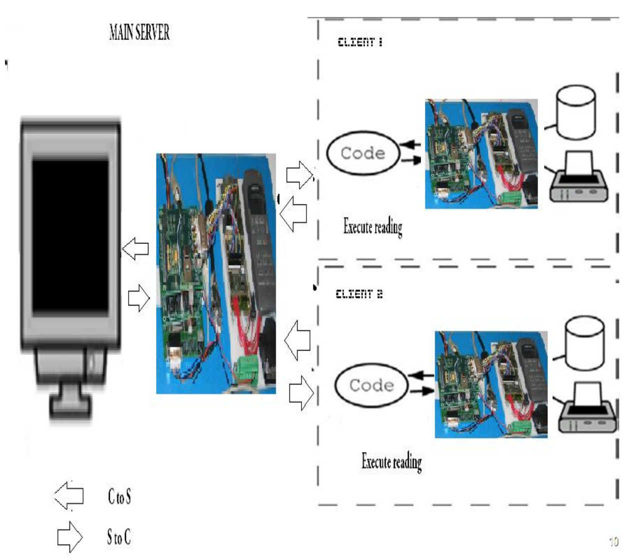

Fig-3.2Overall System architecture

3.2 Module Description:

There are two modules in the automating EB bill system. They are:

1.EB OFFICE MODULE(k):

The EB office module consists of a database at the back end for storing values which are got from the home module via RF waves. After the values are got from the home units the cost is calculated and the values are seen back to the home unit and they are displayed in the LCD display for the user to make note of it. Also the cost and amount of units are sent as a SMS to the customer's mobile phone. The data’s are transmitted and received using RFtransmitter and RF receiver. There is an encoder and decoder both at the central office and also at the individual home units. This facilitates secure transmission and reception in the system. The max232 interfacing is done forreducing the voltage flow from 7.5-15v to 0-5v .this will prevent the circuit from melting.

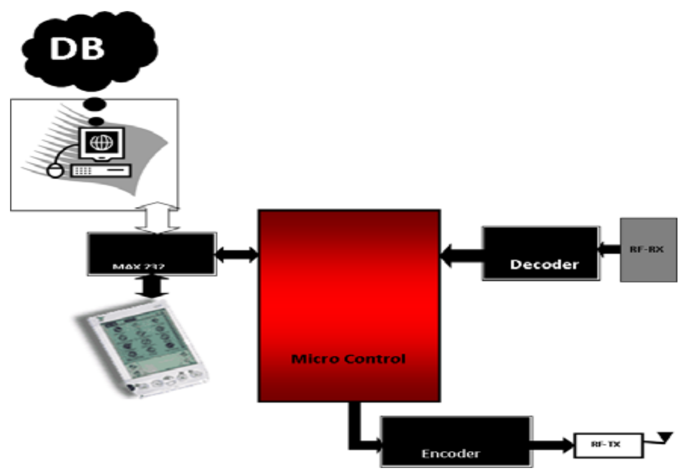

Fig-3.3 Module 1-Block diagram

2.CUSTOMER HOME MODULE(n):

The home unit consists of a LCD display unit and a decoder and an encoder..This microcontroller checks the message which reaches from the central EB office if the destination id matches its id then the work is done else the message is passed on to the next unit in the network. The home unit is connected to the EB office via RF frequency waves which transmit data to the EB office. The PIC microcontroller automatically sends the number of units consumed by the customer to the EB office after a particular duration of time say two months. This message is used to update the back end database and the computation is done. The EB office sends the bill back to the home unit which is displayed on the LCD display. The user is also intimated by a SMS which is sent to his/her mobile phone.After we saw the

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bill amont we pay the bill through the mobile phone number that we also registered in the EB ofice for safe billing.

Incaseofmismatch of EB NUMBER AND CONTACT NUMBER we cant able to pay the bill. After we pay the bill we can getthe printed bill on te thermal printer connected on our Homemodulefrom the EB office after their verification.

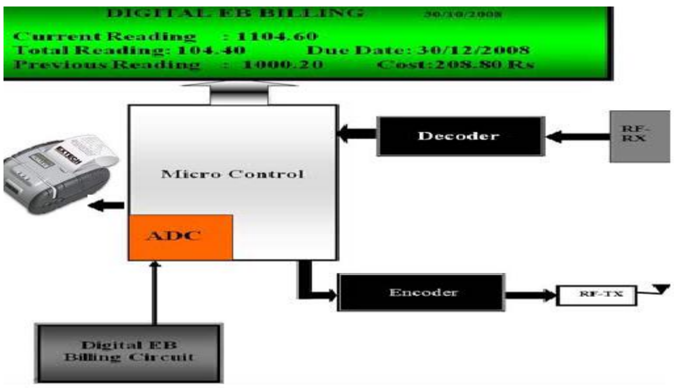

Fig-3.4 Module 2-Block diagram

IV. Stationary Regular Nodes

4.1 Approximation Algorithm

It indicates that the MILP formulation described by provides an optimal solution in tractable time for moderately sized problems. However, this type of method is demonstrated to scale poorly with problem sizes. we have shown that the network design problem on a network of the general form shown in Fig. 2 is NP-hard. Therefore, an approximation algorithm with computation time that is polynomial in the number of regular nodes and the number of mobile backbone nodes is desirable.Inthis section describes such an algorithm. The primary insight on which the approximation algorithm is based is the fact that the maximum number of regular nodes that can be assigned is a sub modular function of the set of mobile backbone node locations selected. Given a finite ground set D ¼ f1; . . . ; dg, a setFunction defined for all subsets S of D is said to be sub modular if it has the property.

4.2 Experimental Evaluation of Approximation Algorithm

A worst-case performance guarantees are quite useful; it is also worthwhile to examine the typical performance of the approximation algorithm on many problems.To this end, we have performed computational experiments on a number of problems of various degrees of complexity. Regular node locations are generated randomly in a finite 2D area, and moderate throughput value was specified (i.e., one high enough such that there was no trivial selection of mobile backbone node locations that would result in assignment of all regular nodes). The Results were averaged over a number of trials for each problem dimension. Fig. 3 shows the performance of the approximation algorithm relative to the exact (MILP) algorithm. In Fig. 3a, the average percentage of regular nodes assigned by the exact algorithm that are also assigned by the approximation algorithm is plotted, along with the theoretical lower bound for various problem sizes. In above figure, a data point at 100 percent would mean that, on average approximation algorithm assigned as many regular nodes as the exact algorithm for that particular problem size. As the graph shows, the approximation algorithm consistently exceeds the theoretical performance guarantee and achieves nearly the same level of performance as the exact algorithm for all problem sizes considered. Fig. 3b shows the computation time required for each of these algorithm, plotted on a logarithmic axis. The figure shows, the computation time required for the approximation algorithm scales gracefully with problem sizes. The average computation time of the approximation algorithm was about 15 seconds for N ¼ 100 and K ¼ 14, whereas the MILP algorithm took nearly 12 minutes to.

Solve a problem of this size. The significant improvement in computation time achieved by the approximation algorithm makes it appropriate for some real-time applications, while the exact algorithm is promising candidate for one-time design problems involving significant costs. Both the MILP algorithm and the approximation algorithm were formulated in GAMS 22.9 and solved ILOG CPLEX 11.2.0 on 3.16 GHz Intel Xeon CPU with 3.25 GB RAM.

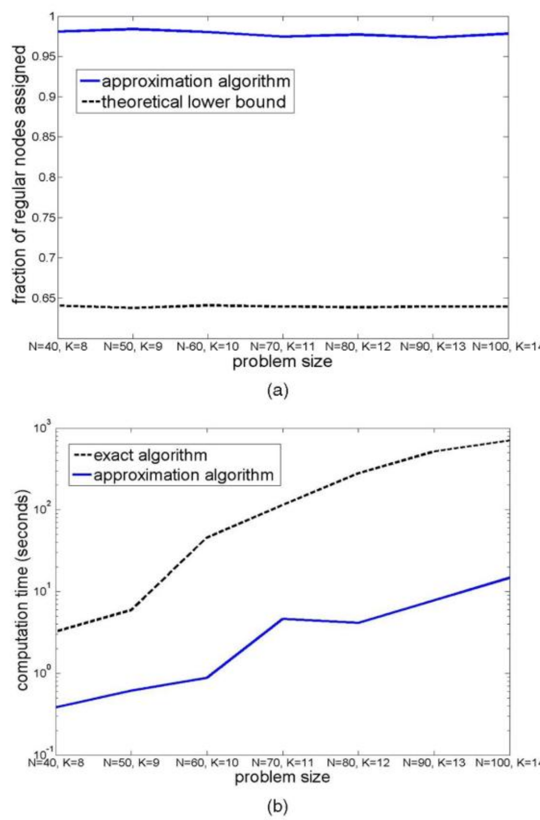

Fig.4.1 Comparison of the exact and approximation algorithms developed in the section.

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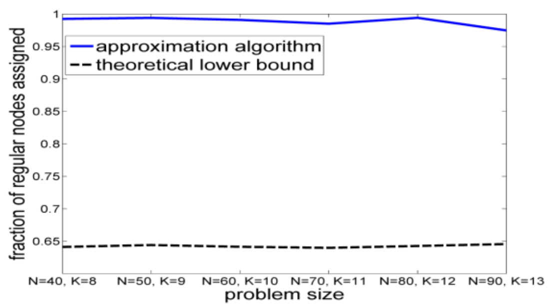
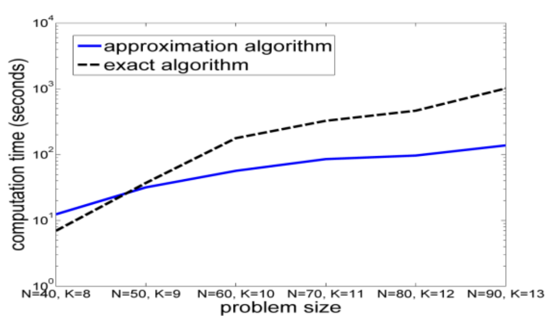
Although the MILP-based exact algorithm developed in this section significantly outperforms existing techniques in terms of required computation time, our experiments indicate that the greedy approximation algorithm achieves nearly the same level of performance with an even greater reduction in computation time (a) Performance of the approximation algorithm developed.In this paper, relative to an exact solution techniques, in terms of number of regular node assigned at the given throughput level. (b) Computation time of the approximation algorithm and the exact (MILP) algorithm for various problem sizes. Due to large range of values represented logarithmic scale is used.

V . Conclusion

This work has described new algorithms for solving the problem of mobile backbone network optimization. Exact MILP based technique and the first known approximation algorithms with computation time polynomial in the number of regular nodes and the number of mobile backbone nodes were described. Based on simulation results, we conclude that the MILP based approach provides a considerable computational advantage over existing techniques for mobile backbone network optimization. The approach has been successfully applied to a problem in which a maximum number of regular nodes are to be assigned to mobile backbone nodes at a given level throughput, and to a related problemfrom the literature in which all regular nodes are to be assigned to a mobile backbone node such that the minimum throughput achieved by any regular node is maximized.



(a)



(b)

Fig.5.1 Comparison of the exact and approximation algorithms developed in this section. On average, the approximation algorithm greatly exceeded its performance guarantee, achieving nearly same level of performance as the exact algorithm for all problem sizes considered.

In all cases, L ¼ 1:5 N. (a) Performance of the approximation algorithm developed in this section.Therelative to an exact solution technique in terms of number of regular nodes assigned at the given throughput level. (b) The Computation time of the approximation algorithm and the exact (MILP) algorithm for various problem size. Due to large range of values represented by logarithmic scale is used.

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