LAYERED SQUARE LOCATION MANAGEMENT (LSLM) SCHEME FOR MOBILE AD HOC NETWORK

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

BACHELOR OF TECHNOLOGY

IN

ELECTRICAL ENGINEERING

By

Kanhu Charan Patra (108EE079)

Samrat Suna (108EE088)

Ajit Kumar Satpathy (108EE089)

Department of Electrical Engineering

National Institute of Technology

Rourkela-769008

2012

LAYERED SQUARE LOCATION MANAGEMENT (LSLM) SCHEME
FOR
MOBILE AD HOC NETWORK

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

BACHELOR OF TECHNOLOGY

IN

ELECTRICAL ENGINEERING

By

Kanhu Charan Patra (108EE079)

Samrat Suna (108EE088)

Ajit Kumar Satpathy (108EE089)

Under the guidance of

Prof. P.K Sahu

Department of Electrical Engineering

National Institute of Technology

Rourkela-769008

2012

National Institute of Technology, Rourkela

Certificate

This is to authenticate that thesis entitled **“Layered Square Location Management (LSLM) Scheme for Mobile Ad hoc Network”,** is submitted by Kanhu Charan Patra (108EE079), Samrat Suna (108EE088) and Ajit Kumar Satpathy (108EE089) in partial fulfilment of the award of Bachelor of Technology in the Department of Electrical Engineering at National Institute of Technology, Rourkela is an genuine work carried out by them under my observation and assistance.

To the best of my awareness, the matter exemplified in the thesis has not been acquiesced to any other University / Institute for the accolade of any Degree or Diploma.

Date:

Place: Rourkela

Prof. P.K Sahu
Dept. of Electrical Engineering
National Institute of Technology

Acknowledgement

The research work associated to this thesis has been carried out at Department of Electrical Engineering, National Institute of Technology (NIT), Rourkela. This work would have been difficult without the assistance and supervision of several people, whose contribution we would like to acknowledge.

First of all, we would like to show our sincere and profound gratitude to our supervisor Prof. Prasanna Kumar Sahu, Professor of Electrical Engineering, Department of Electrical Engineering, National Institute of Technology, Rourkela, for his consistent boost and tremendous support throughout our research work and sharing his technical knowledge has led us through many difficulties easily. This thesis work would have been a difficult task to complete without profiting from his proficiency, inspiration and appreciated time and criticisms. His ceaseless motivation for new and better consequences is highly valued.

We are indebted to Dr. B. D. Subudhi, Professor and Head of the Department of Electrical Engineering, National Institute of Technology, Rourkela, for allowing us to use the necessary facilities for carrying out this thesis work.

Finally, we would like to express our heart-felt gratitude to our parents and our family members for being with us when encountering difficulties. Their loving support has been and always will be our most precious possession on earth.

Yours Sincerely,

Kanhu Charan Patra (108EE079)

Samrat Suna (108EE088)

Ajit Kumar Satpathy (108EE089)

Abstract

The population of India is 1.25 billion with 500 million of mobile subscriber. This huge change in mobile services resulted in crime hike, teenage kidnap, suicidal cases, and mobile thefts. It is only due to ease of carrying and flexibility in movement from one place to another. In a mobile network, mobile users travel at different velocity and different places. For mobile/network operator, it is useful to track each mobile user for its reference. It sometimes helps in investigational purpose, some lost and found reference. It is also useful to track exact location of the users using different technologies. This paper will focus on different location management technique, Layered Square Location Management (LSLM) functionality, and location update procedures. A model of LSLM scheme is also designed to understand the whole procedure of tracking a mobile user. The model is designed using TSOP sensor as server region and an object as mobile device. The LSLM scheme makes the mobile network more cost effective and enhances the efficiency of location management.

Table of Contents

Title	Page No

Title	Page No

List of figures

Figure No.	Description	Page No

List of tables

Table No.	Description	Page No

CHAPTER 1
INTRODUCTION

1. Introduction

Now-a-days mobile tracking is an important functionality. For this we have mobile management schemes which are DSDV [1] , WRP [2] , FSR [3], ANDMAR [4], DSR [5], AODV [6], TORA [7]) proposed within the MANET [8].

1.1.Mobility management

The Major function of a Geostationary Monitoring (GSM) or Universal Mobile Telecommunication System (UMTS) which allows mobile phones to function is Mobility Management**.** It helps operator to track the subscribers, allowing calls, SMS and additional mobile services.

1.2.Location update procedure

The location update procedure permits a mobile device to inform its network, whenever it travels from one location to the other. Mobiles are accountable for identifying location area codes. When the location area is changed with respect to the base location, a location update request is sent with its previous location, and it is known as Temporary Mobile Subscriber Identity (TMSI).

1.3.Location area

A "location area" is a bunch of base stations that are grouped combined to optimize signaling. Normally a huge number of base stations share a sole Base Station Controller (BSC) which is used in GSM, or a Radio Network Controller (RNC) which is employed in Universal Mobile Telecommunication System (UMTS. The BSC controls allocation of radio channels, receives measurements from the mobile phones, and controls handovers from base station to base station.

CHAPTER 2
LITERATURE REVIEW

2. Mobile ad hoc network

Mobile ad hoc network (MANET) [8] is an infrastructure less self-configuring networks of mobile devices connected via wireless links. MANET consists of coreless hosts that can dynamically self-organize. Ad hoc network form an arbitrary and temporary network in that region which permits devices to communicate smoothly without pre-existing infrastructure. In MANET mobile nodes can free join or leave the network at any point of time and hence it has highly dynamic network as compared wired network. Routing is an issue in MANET as the node is in motion. Because of dynamic nature of MANET result in frequent and unpredictable changes of network topology which adding difficulty and complexity to routing among mobile nodes. Several Routing protocol and algorithm has been proposed and performance characteristics carried out under different network experiment. These are:

2.1. Proactive Protocols

2.1.1. In proactive Protocol the nodes in ad hoc network must keep track of all the routes to all other nodes. So that at any time can set up path to send data pocket to destination node.

2.1.2. Disadvantage of these schemes is produce network traffic problem of mobility of nodes increases.

2.2. Reactive Protocol

2.2.1. Here nodes need not maintain the routes to all other nodes.

2.2.2. Routes will form between the nodes as per requirement.so that there is no periodic exchange of routing in formations

2.2.3. Disadvantage is routing will not possible if the size of network grows.

2.2.4. To overcome these disadvantage we have another routing protocol is called position based routing protocol

2.3. Position Based Routing Protocol

2.3.1. Each node determines its own physical position by using GPS.

2.3.2. Advantages:

2.3.2.1. No need of transmit message to keep routing

2.3.2.2. Reduced network traffic problem

CHAPTER 3
LOCATION MANAGEMENT

3. Proposed Scheme for location management

Position based routing protocols don't store the route information. Here in this proposed Layered Square Location Management (LSLM) scheme [9], we have anticipated that every node is equipped with any tracking system such as GPS through which the node can acquire its instant geographic location.

3.1. Network Structure

In this scheme, the whole network area is divided into L level of square regions. Hence, the arrangement is such that each level j square region encapsulates the level (j-1) square region and is encapsulated by level (j+1) square region. The scheme represents a concentric square target of L regions.

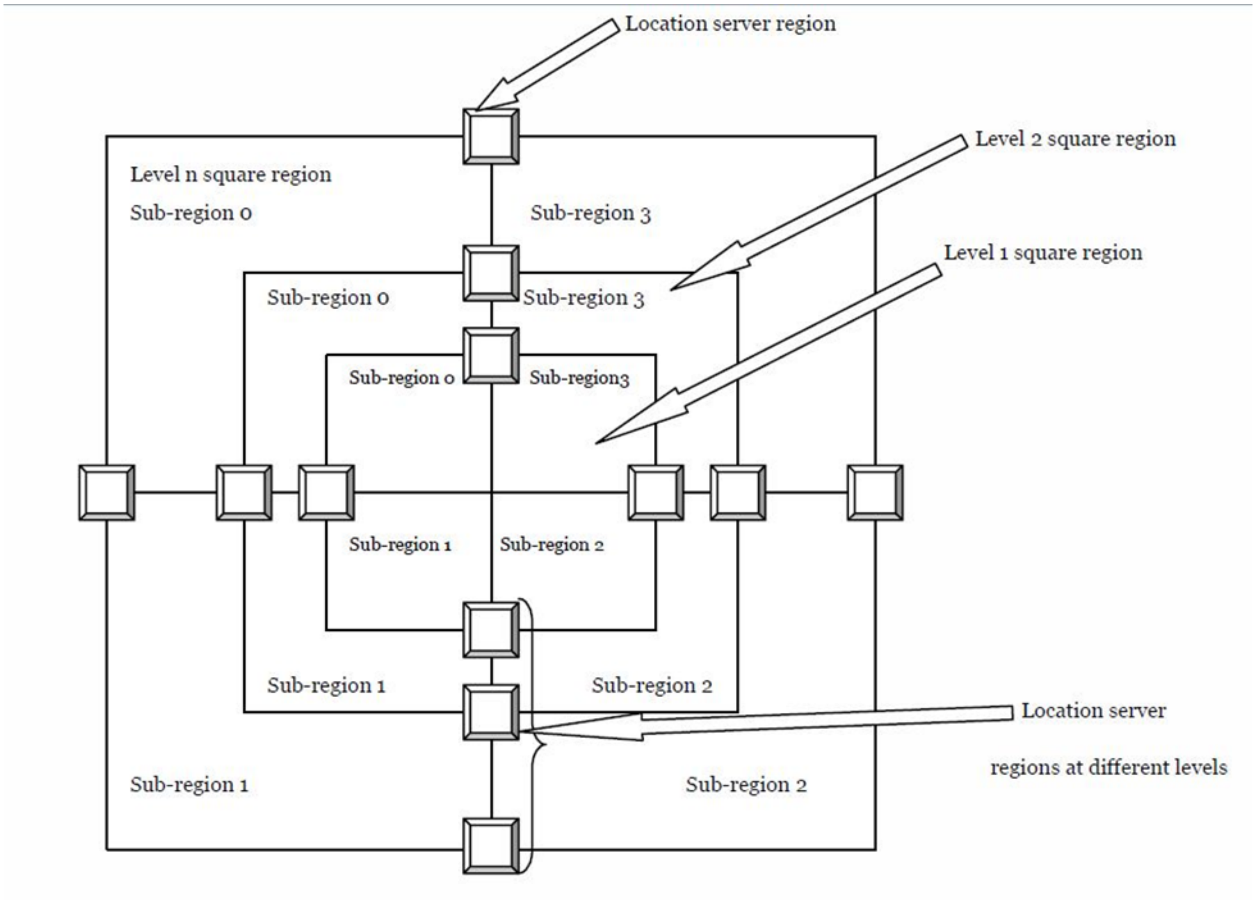

Figure 1: Complete network structure of proposed LSLM

The square region at each level is subdivided into four sub-regions: sub-region-0, sub-region-1, sub-region-2, and sub-region-3. In each level it has four location server regions. All the nodes residing in the location server region behave as location servers. These location servers are used to keep track of the location information of the node and user within it. In figure 2, the schematic of sub region and location server region are shown.

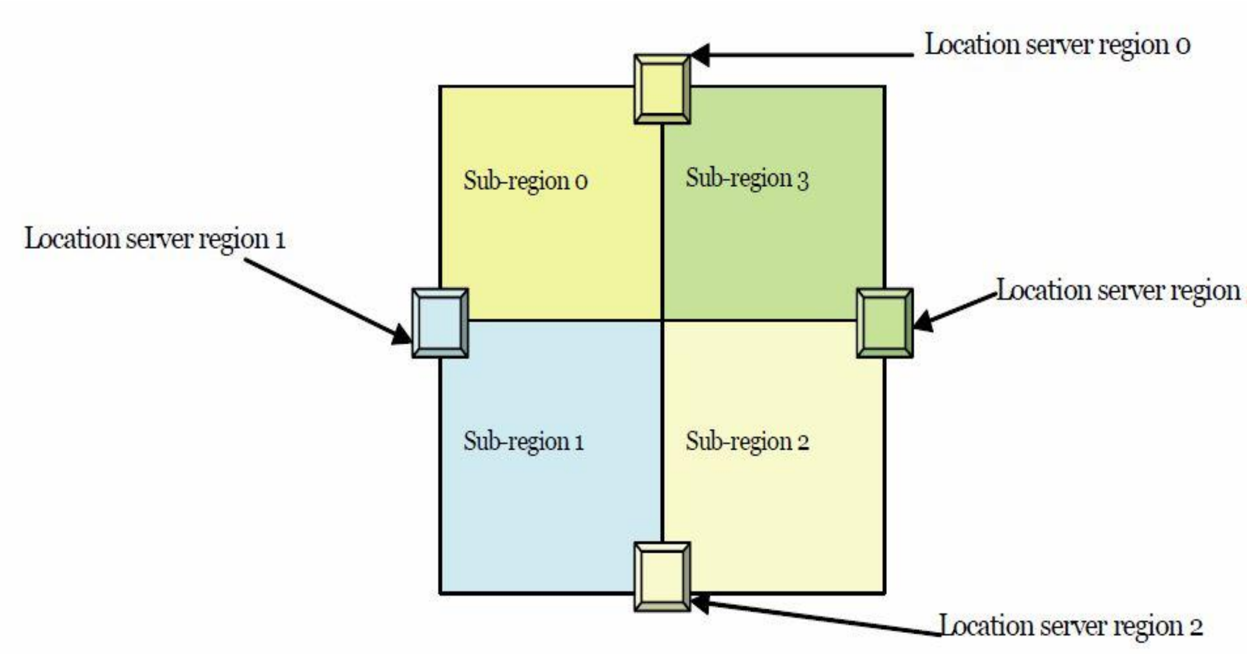

Figure 2 : Assignment of location server region

The Table 1 shows the sub-regions and its respective location server region.

Location server region 0	Sub-region 0
Location server region 1	Sub-region 1
Location server region 2	Sub-region 2
Location server region 3	Sub-region 3

Table 1 : Sub-regions and location server

3.2.Proposed scheme in MANET

When we think of MANET, we suddenly think of the frequent change of nodes and mobility of mobile users. So keeping track of all nodes and user is much more expensive task. To solve this issue we have applied multi-level location information scheme. It can be of two types:

3.2.1. Fully qualified location information

The fully qualified location information of a node has the following components.

Node-id
x-coordinate
y-coordinate
Location server-id

Table 2: **Fully qualified location information**

Location server id has three components which track the location server.

Level no.
Sub-region no.
Server-id

Table 3: Location server id

3.2.2. Relative location information

Relative location information is divided into two components. These are:

Location server id
Node id

Table 4: Relative location information

CHAPTER 4
LOCATION UPDATE

4. Location Update

Location update mechanism is divided into three categories.

4.1.Location update for node movement within sub-region

When node A moves within its current sub-region, it needs to notify those location servers that are currently in charge of this particular sub-region. This set of location servers are currently keeping track of the fully qualified location information of node A and any changes in the x and y coordinate positions of node A must be reflected to them. As A is moving within its sub - region, there will be no change in its relative location information. Therefore, node A need not inform the location servers in other sub-regions of that particular level.

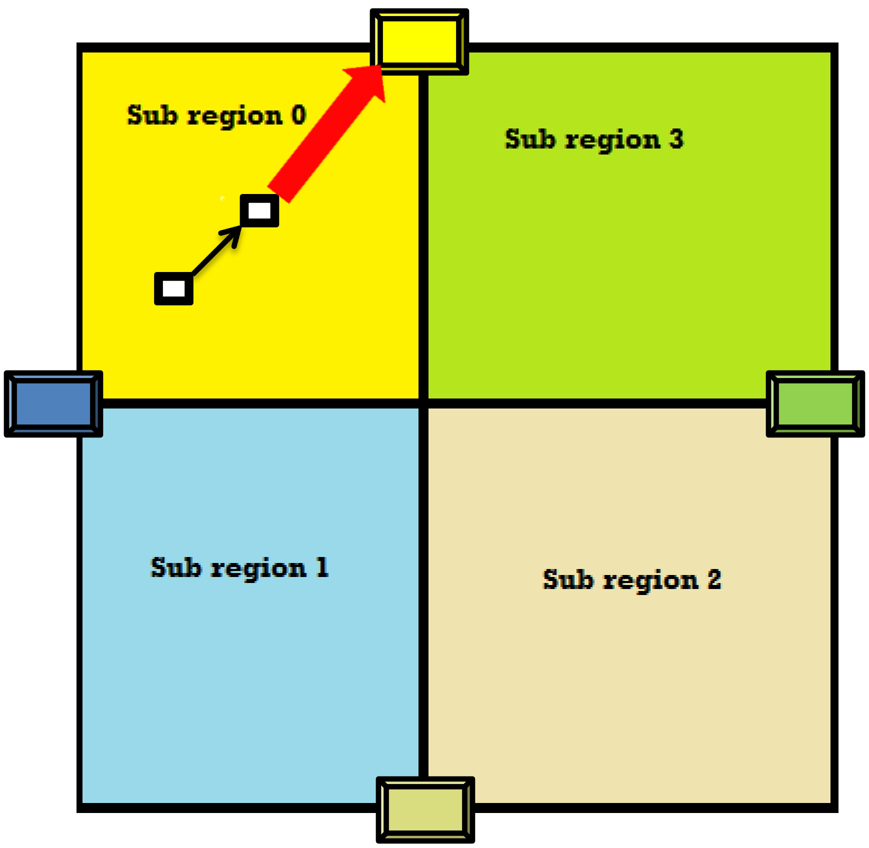

Figure 3 : Location update for node movement within sub-region

4.2.Location update for node movement between sub-regions

In this case, node A is moving from one sub-region to another within the same level j square region. After reaching the new sub-region, A probes its neighbors to get information about its new location server region. Once it gets this information, A sends its current x and y coordinate positions and the node id to the new location server region. Therefore, this new location server region needs to update the location information regarding node A from relative to fully qualified one. The new location server region then needs to send the new relative location information of node A to other location server regions, which are within the same level j square region. If they contained the old relative location information, in that case, they need to update the entry with the new relative location information of node A.

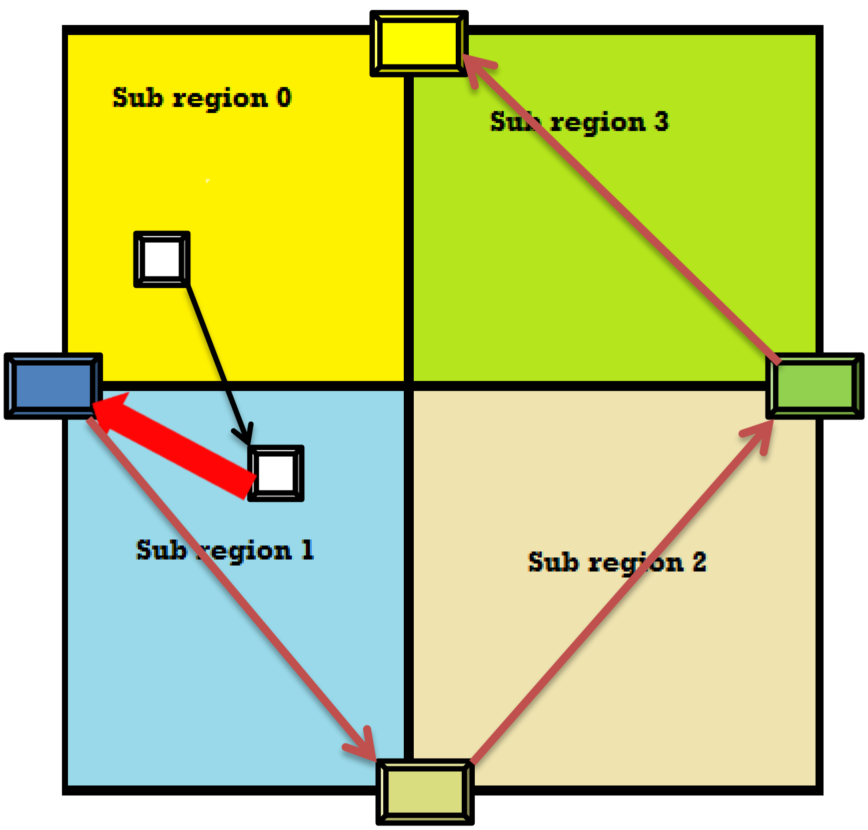

Figure 4 : Location update for node movement between sub-regions

4.3.Location update for node movement between square regions at different levels

Now, Node A moves from a square region at one level to a square region at another level. After reaching its new sub-region within its new square region, the node probes its neighbors to get information about its new location server region. Once A gets this information, it sends its previous fully qualified address and the current x and y coordinate positions to this new location server region. From node A's previous fully qualified address, the new location server region can know the previous level of the node. The previous level no. is required by the new location server region in sending the new relative address of A, (i.e., current location server id and node id) to a location server region in the previous level. Those location server regions after analyzing the current relative address of the node, find that the level no. of node A has already changed, i.e., node A is no longer in the square region at their level.

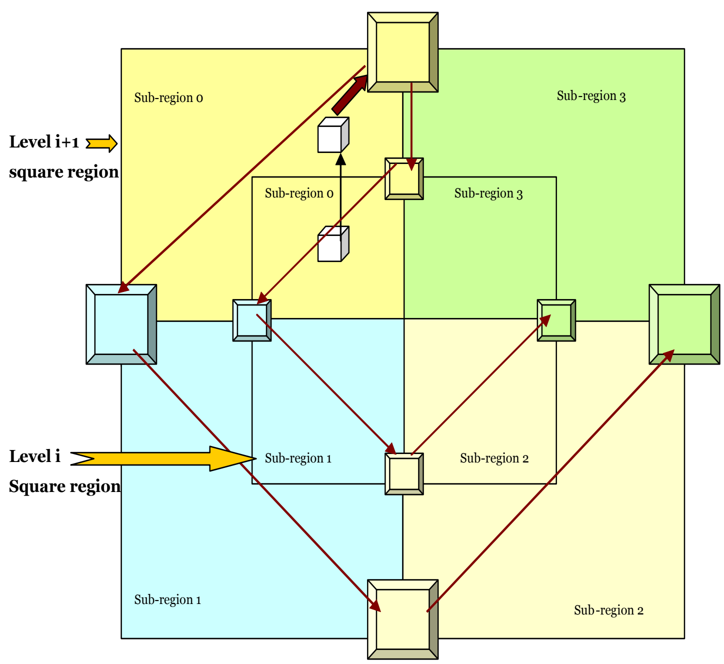

Figure 5 : Location update for node movement between square regions at different levels

The new location server region is in a square region, which is at a different level than the level of node A’s previous square region. Therefore, the new location server region must make a new entry in its location information database about the new fully qualified location information of node A. This new location server region then needs to send the new relative location information of node A to other location server regions within the new square region. Therefore, they need to make new entries in their location information database about the new relative location information of node A.

CHAPTER 5

LSLM SCHEME MODEL

5. Physical Model of LSLM Scheme

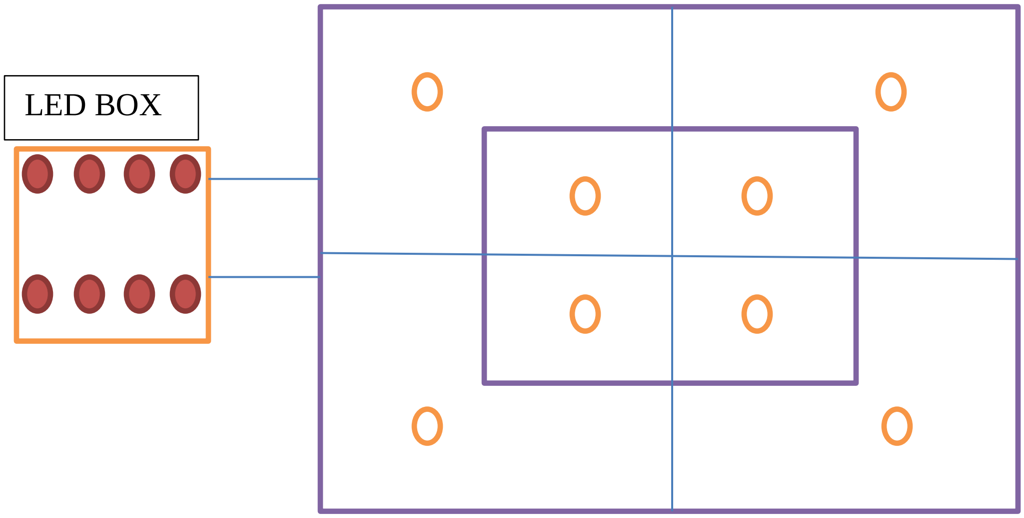

Figure 6 : Physical scheme for LSLM

The physical model of LSLM scheme consists of

5.1. TSOP Sensor

The 555 timer is used as an astable multivibrator. The frequency of the 555 is tuned using the potentiometer. The output of 555 is given to the IR transmitter. TSOP detects a frequency of 38 KHz. The output of TSOP goes low when it receives this frequency. Hence the output pin is normally high because, though the IR LED is continuously transmitting, due to no obstacle, nothing is reflected back to the TSOP. When an obstacle is encountered, the output of TSOP goes low, as the required frequency is reflected from the obstacle surface. This output is connected to the cathode of the LED, which then turns ON.

Maximum Ratings

Symbol	Quantity	Minimum	Typical	Maximum	Unit
o/p	Output Voltage	0	-	5	V
V_{cc}	Operating Voltage	4.5	5	5.5	V
GND	Ground Reference voltage	-	0	-	V

Table 5 : Maximum Rating Of TSOP Sensor

The schematic/ functional diagram of TSOP sensor is show in figure 7:

Functional Block Diagram /Schematic Diagram

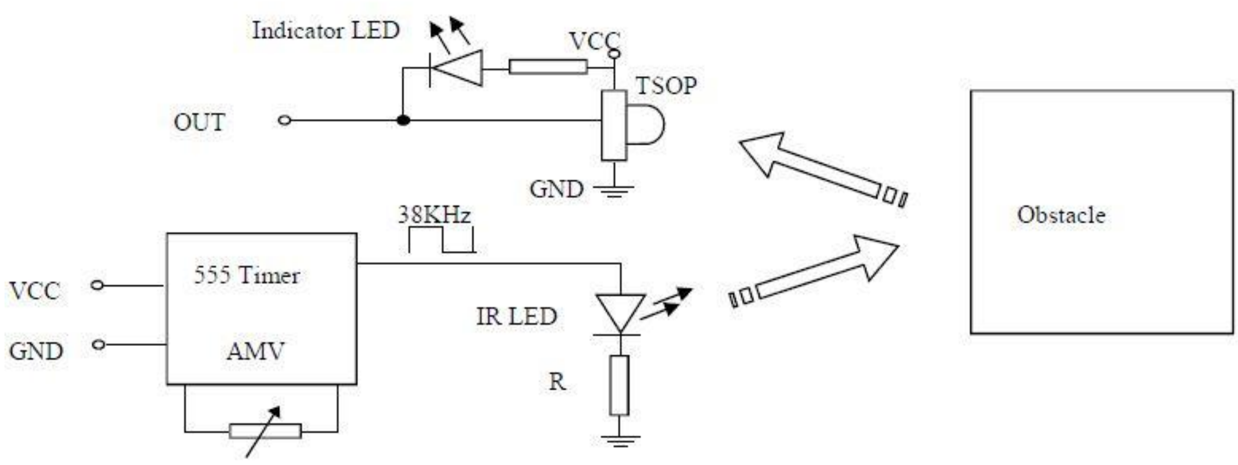

Figure 7 : TSOP Schematic Diagram

5.2. Transformer

We have used a step down transformer of rating 230/12 V. This is used to transform 230V AC to 12V AC.

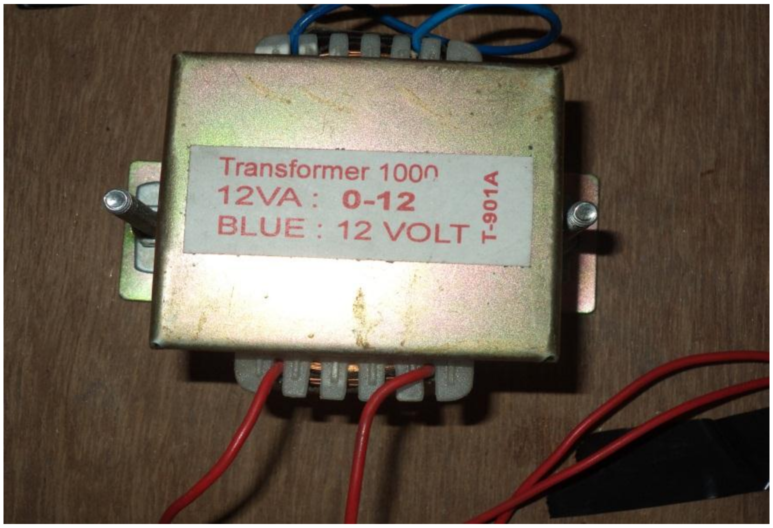

Figure 8 : Step Down Transformer

5.3. Bridge Rectifier with a Smoothing Capacitor

A diode bridge is a combination of four diodes in a bridge system that provides the same polarity of output for both polarity of input. In a bridge rectifier an alternating current (AC) is converted into Direct Current (DC) output.

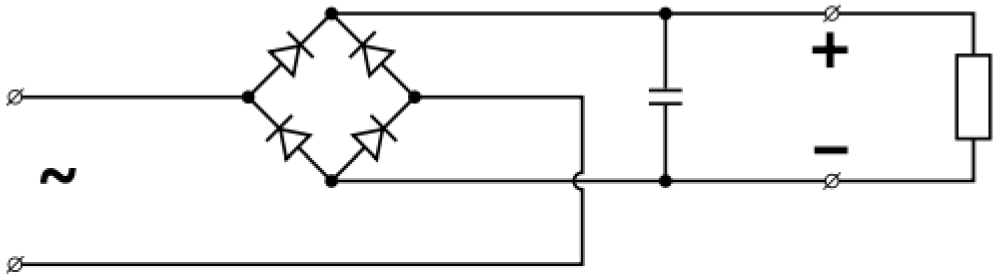

Figure 9 : Schematic bridge rectifier with smoothing diode

The purpose of this capacitor is to lessen the deviation (or 'smooth') in the output voltage, hence known as a smoothing capacitor.

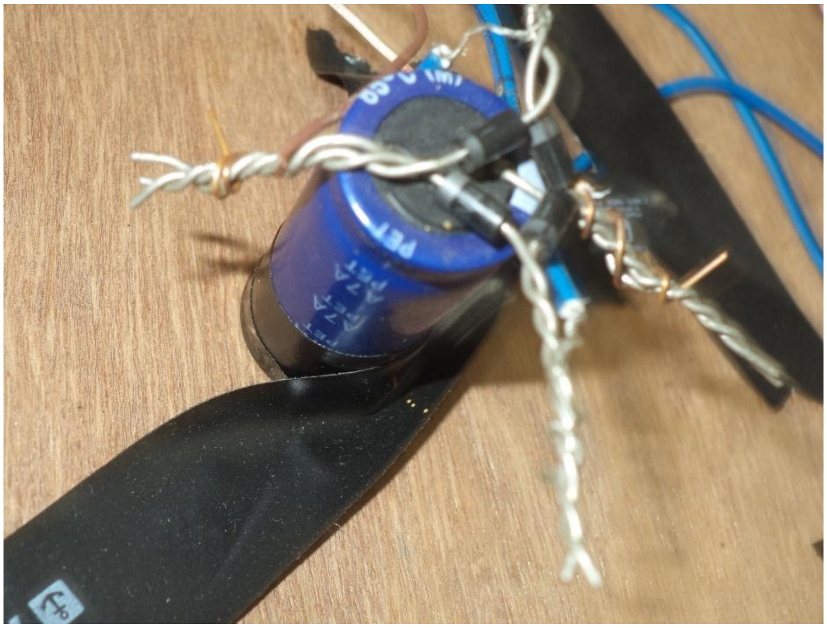

Figure 10 : Original model of Bridge Rectifier

5.4. 7805 IC

The 78xx family is commonly used in electronic circuits for a controlled power supply due to their easy usage and minimum cost. For any ICs within the family, the last two digits are replaced with the output voltage, indicating the output voltage (for example, the 7805 will produce 5 volt output, while the 7812 produces 12 volts). The 78xx line is positive voltage regulators: they produce a voltage that is positive relative to the common ground.

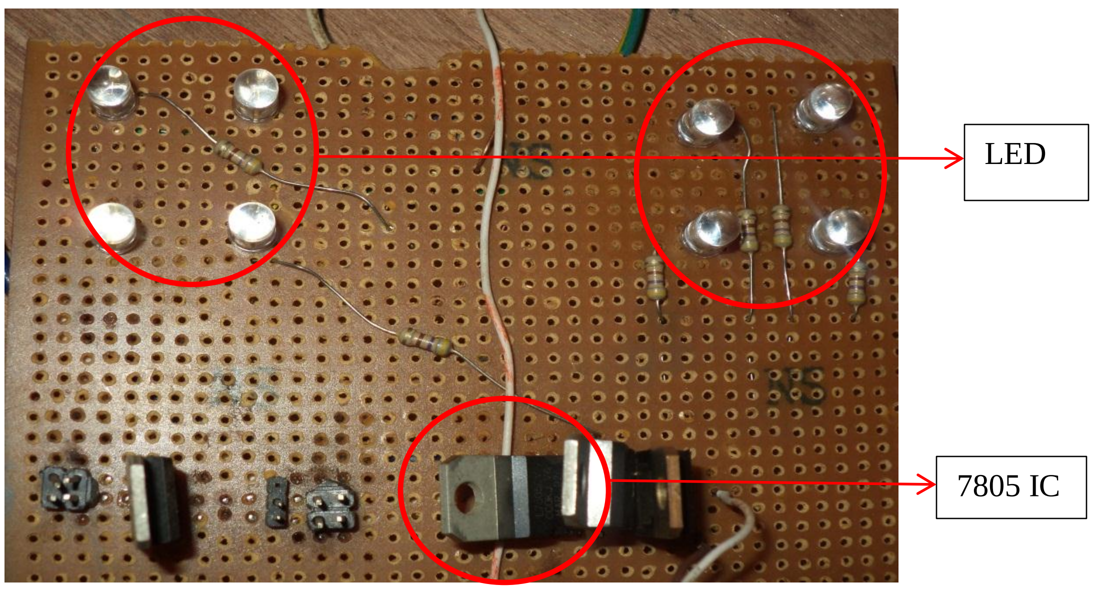

Figure 11 : LED and 7805 IC

5.5. LED

A light-emitting diode (LED) is a light source lit by semiconductor application. LEDs are used as indicator lamps in many purposes and are increasingly used for other lighting in electronics applications.

CHAPTER 6

FUNCTION OF LSLM SCHEME MODEL

6. Function of LSLM Scheme Model

The square region is divided into 2 concentric square targets. It gives rise to 2 levels of LSLM scheme. There is 1 TSOP sensor in each sub-region of each level. First, a transformer is connected to 230 V input and 12 V output is connected to the bridge rectifier with smoothing capacitor. The output of the bridge rectifier which is 12 V DC is connected to the input terminal of 7805 IC, and the output of 7805 IC is 5 V DC positive relative to the common ground. The GND and 5 V terminal of 7805 IC is connected to the GND and Vcc terminal of TSOP sensor. We have used 6 TSOP sensors. The output pin of TSOP is connected to LED cathode with a resistance of 470 Ω connected in series.

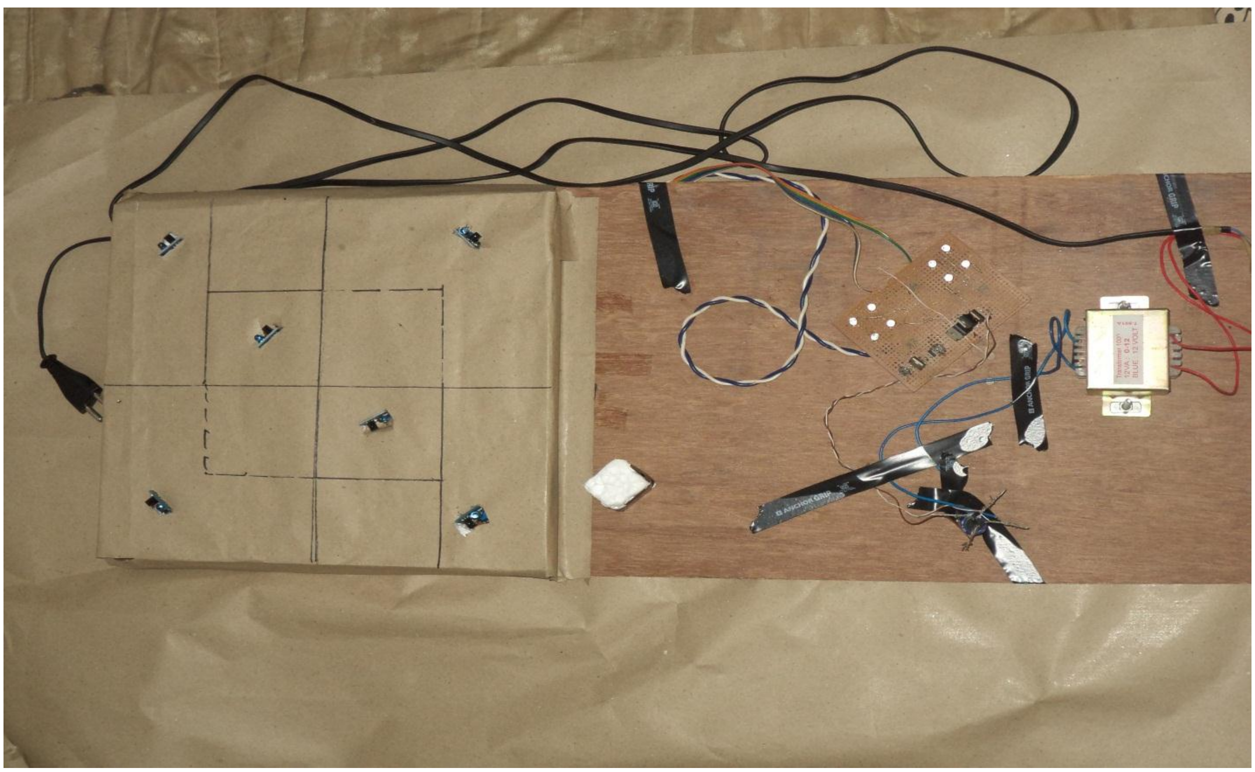

Figure 12: Working model of LSLM Scheme

Whenever an object (mobile) will move from one sub-region to another, the corresponding LED will glow in LED Box. This LED can be treated as server nodes and object as mobile.

CHAPTER 7
CONCLUSION

7. Conclusion

In this thesis, we have presented Layered Square Location Management (LSLM), a novel Scheme for the management of location information of the nodes in mobile ad hoc network. We also designed a physical model for LSLM scheme for better understanding. The LSLM scheme is useful as it is concentrated to small area and more effective server within a small region. The effectiveness of a location management scheme depends on reducing the costs associated with the major location management functions- location update. This Scheme can be implemented to track mobile users in a network and track its mobility from one place to another.

REFERENCES

[1] C. E. Perkins and P. Bhagwat, “Highly dynamic Destination-Sequenced Distance-Vector routing (DSDV) for mobile computers,” *In Proceedings of the SIGCOMM ’94 Conference on Communications Architectures, Protocols and Applications*, pp. 234-244, August 1994.

[2] S. Murthy and J. Garcia-Luna-Aceves, “An efficient Routing Protocol for Wireless Networks. ACM Mobile Networks and App. Journal,” *Special Issue on Routing in Mobile Communication Networks,* October 1996.

[3] Z. Haas and M. Pearlman, “The zone routing protocol (ZRP) for ad hoc networks (Internet Draft),” August 1998.

[4] M. P. G. Gerla and X. Hong, “Lanmar: Landmark routing for large scale wireless ad hoc networks with group mobility,” *Proceedings of the First IEEE/ACM Workshop on Mobile Ad Hoc Networking and Computing(MobiHOC),* August 2000.

[5] D. B. Johnson and D. A. Maltz, “Dynamic source routing in ad hoc wireless network,” *Mobile Computing,* vol. 353, 1996.

[6] C. Perkins and E. Royer, “Ad-hoc on-demand distance vector routing,” *Proceedings of IEEE Workshop on Mobile Computing Systems and Application,* 1999.

[7] V. Park and M. Corson, “A Highly Adaptive Distributed Routing Algorithm for Mobile Wireless Networks,” *Proccedings of IEEE INFOCOM'97,* April 1997.

[8] “Mobile Ad-hoc Networks(MANET) Working Group,” [Online]. Available: http://www.ietf.org/html.charters/manet-charter.html.

[9] K. Majumder and B. Ghosal, “A Distributed Cost-Effective Location Management Scheme for Mobile Adhoc Networks,” *International Journal of Literal Computing, IJLC,* vol. 3, no. 1, August 2006.