

Mobile Data Gathering with
Bounded Relay in Wireless Sensor
Networks

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Abstract

- Sensing data gathering is an important and fundamental issue in the Internet of Things (IoT). However, for battery-powered sensors, energy depletion is unavoidable. Using mobile sinks to collect sensing data by one-hop transmission is an effective way to prolong the lifetime of wireless sensor networks but will inevitably cause an excessive long delay time of data gathering.
- In order to reduce the delay time of mobile data gathering, it is necessary to incorporate multi-hop transmission into mobile data gathering. In this paper, a new mobile data gathering algorithm with multi-hop transmission is proposed to reduce the delay time of data gathering.

Existing system

- Sensing data gathering is an important and fundamental issue in the Internet of Things (IoT). However, for battery-powered sensors, energy depletion is unavoidable.
- Using mobile sinks to collect sensing data by one-hop transmission is an effective way to prolong the lifetime of wireless sensor networks but will inevitably cause an excessive long delay time of data gathering. In order to reduce the delay time of mobile data gathering, it is necessary to incorporate multi-hop transmission into mobile data gathering.

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Hardware requirement

- Processor - Pentium –III
- Speed - 1.1 Ghz
- RAM - 256 MB(min)
- Hard Disk - 20 GB
- Floppy Drive - 1.44 MB
- Key Board - Standard Windows Keyboard
- Mouse - Two or Three Button Mouse
- Monitor - SVGA

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Software requirement

- Operating System - Windows 7/8
- Application Server - Tomcat 5.0
- Front End - JAVA
- IDE - NETBEANS 7.1
- Back-End - HEIDISQL 3.5

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Proposed system

- In this paper, a new mobile data gathering algorithm with multi-hop transmission is proposed to reduce the delay time of data gathering. The proposed algorithm is called the Bounded Relay Combine-TSP-Reduce (BR-CTR). The BR-CTR algorithm visits the convergence area of sensors' communication ranges to reduce the number of visiting points.
- The BR-CTR algorithm is integrated with a path adjustment mechanism, which can further shorten the planned traveling path effectively. In performance evaluation, we compare the BR-CTR algorithm not only with the existing mobile data gathering algorithms with one-hop transmission but also with the existing mobile data gathering algorithms with multi-hop transmission in terms of the length of traveling path, delay time, network lifetime and buffer size requirement.

Screen short source page:



The screenshot shows a Windows desktop environment. At the top, a VLC media player window is open, displaying a video titled "Mobile Data Gathering with Bounded Relay in.mp4". Below it, the Microsoft Visual Studio (Administrator) window is active, showing a web form titled "SOURCE". The form has a yellow background and contains the following text and elements:

- Title: **Mobile Data Gathering with Bounded Relay in Wireless Sensor Networks**
- Input field: *IP Address* :
- Input field: *Select the file to Send* :
- Buttons:

The Visual Studio interface includes a menu bar (FILE, EDIT, VIEW, PROJECT, BUILD, DEBUG, TEAM, FORMAT, TOOLS, TEST, ARCHITECTURE, ANALYZE, WINDOW, HELP), a toolbar, and a sidebar with IntelliTrace and Autos windows. The Windows taskbar at the bottom shows the time as 5:50 AM on 8/16/2018, and the system tray includes network, volume, and power icons.

Destination page:



The screenshot displays a Windows desktop environment. At the top, a VLC media player window is open, showing a video titled "Mobile Data Gathering with Bounded Relay in.mp4". Below it, the Microsoft Visual Studio (Administrator) IDE is running. The main window of the IDE shows a presentation slide with the following content:

Mobile Data Gathering with Bounded Relay in Wireless Sensor Networks

SELECT RECEIVING PATH

CLICK HERE

The slide is displayed in a window titled "DESTINATION". The Visual Studio interface includes a menu bar (FILE, EDIT, VIEW, PROJECT, BUILD, DEBUG, TEAM, FORMAT, TOOLS, TEST, ARCHITECTURE, ANALYZE, WINDOW, HELP), a toolbar, and several panels: "Autos" (showing a table with columns "Name" and "Value"), "Locals", "Watch 1", "Call Stack", "Breakpoints", "Command Window", "Immediate Window", "Output", "Error List", and "IntelliTrace". The taskbar at the bottom shows the system tray with the date and time "5:50 AM 8/16/2018" and the system clock "02:26" on the left and "07:46" on the right.

LBC_DUU framework:



The screenshot displays a Windows desktop environment. In the foreground, a VLC media player window is open, titled "Mobile Data Gathering with Bounded Relay in.mp4 - VLC media player". Below it, the Microsoft Visual Studio (Administrator) window is active, showing the "LBC-DDU Framework" application. The application's main window contains a network diagram with numerous blue nodes and a "Sink Node" represented by a red antenna icon at the bottom right. The diagram is labeled "Sensor Layer" at the bottom left. The Visual Studio interface includes a menu bar with options like FILE, EDIT, VIEW, PROJECT, BUILD, DEBUG, TEAM, FORMAT, TOOLS, TEST, ARCHITECTURE, ANALYZE, WINDOW, and HELP. The taskbar at the bottom shows various application icons and system tray elements, including the time 10:21 and date 29-Aug-18.

Source ip address:



Mobile Data Gathering with Bounded Relay in.mp4 - VLC media player
Media Playback Audio Video Subtitle Tools View Help

getIPAddr (Running) - Microsoft Visual Studio (Administrator)
FILE EDIT VIEW PROJECT BUILD DEBUG TEAM FORMAT TOOLS TEST ARCHITECTURE ANALYZE WINDOW HELP
Process: [4356] getIPAddr.vshost.exe

Form1 [Design] | IntelliTrace

Form1 (Design View):
- Form1 (outer)
- button1 (on Form1)
- Form1 (inner)
- button1 (on inner Form1)

Results Dialog Box:
192.168.1.6
OK

Autos: Name, Value, Type

Error List: 0 Errors, 0 Warnings, 0 Messages

Windows Taskbar:
Ready | 02:49 | Active Windows | 5:51 AM 8/16/2018 | 07:46

System Tray:
Type here to search | 10:23 29-Aug-18

Insert ip adress :



The screenshot displays a Windows desktop environment. In the foreground, a VLC media player window is titled "Mobile Data Gathering with Bounded Relay in.mp4 - VLC media player". Below it, the Microsoft Visual Studio (Administrator) window is open, showing the "getIPAddr (Running)" application. The application window, titled "LBC-DDU Framework", features a light purple background with a "Sensor Layer" of blue dots and a "Sink Node" antenna icon. A text box at the top of the application window is labeled "IP Address" and contains the value "192.168.1.6". The Visual Studio interface includes a menu bar, a toolbar, and a Solution Explorer on the left. The Windows taskbar at the bottom shows the Start button, a search bar, and several application icons. The system tray in the bottom right corner displays the time "10:24" and the date "29-Aug-18".

Selected file send:

A screenshot of a computer desktop showing a VLC media player window. The VLC window is displaying a Microsoft Word document titled "PROJECT WORKFLOW - Microsoft Word". The document content is a form with a yellow background and a blue gradient border. The form has the following text and elements:

Mobile Data Gathering with Bounded Relay in
Wireless Sensor Networks

IP Address : 192.168.1.6

Select the file to Send : D:\PROJECTS_VIJI(18 to 19)\NEW\ [Browse]

[Send] [Clear]

The VLC window title bar shows "Mobile Data Gathering with Bounded Relay in.mp4 - VLC media player". The VLC interface includes a menu bar (Media, Playback, Audio, Video, Subtitle, Tools, View, Help), a toolbar, and a status bar at the bottom showing "Page: 1 of 2 | Words: 2/87". The Windows taskbar at the bottom shows the time as 10:27 AM on 29-Aug-18, with a search bar and various application icons.

Sensor layer:



Mobile Data Gathering with Bounded Relay in.mp4 - VLC media player
Media Playback Audio Video Subtitle Tools View Help

PROJECT WORKFLOW - Microsoft Word

Home Insert Page Layout References Mailings Review View Foxit Reader PDF

LBC-DDU Framework

IP Address : 192.168.1.6

Creating Cluster Heads

Sensor Layer

Sink Node

File transferred

Page: 1 of 2 Words: 2/87

106%

Active Windows 5:52 AM 8/16/2018

04:21 07:46

Type here to search

10:29 29-Aug-18

Send file cluster:



Mobile Data Gathering with Bounded Relay in.mp4 - VLC media player
Media Playback Audio Video Subtitle Tools View Help

PROJECT WORKFLOW - Microsoft Word

Home Insert Page Layout References Mailings Review View Foxit Reader PDF

LBC-DDU Framework

IP Address : 192.168.1.6

Sensor Nodes Forwarding Messages into Cluster Heads

The diagram illustrates a network architecture with three main components: a Sensor Layer on the left containing several clusters of blue nodes; a Cluster head Layer in the center consisting of a grid of small dots; and a Sink Node on the right represented by a red antenna tower. Arrows indicate the flow of data from the sensor clusters through the cluster heads to the sink node.

Sensor Layer Cluster head Layer Sink Node

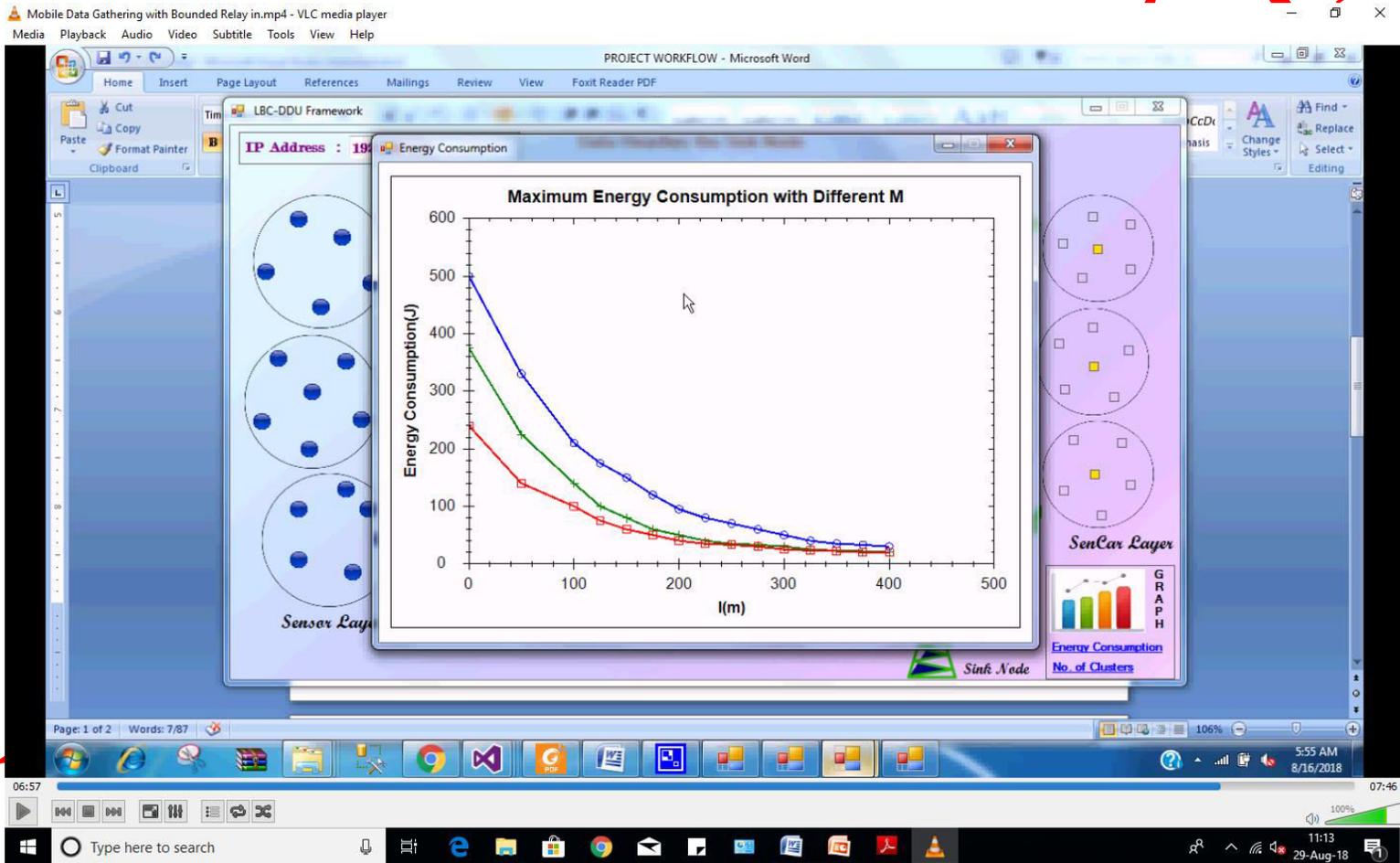
Page: 1 of 2 Words: 4/87

04:46 07:46

Active Windows 5:53 AM 8/16/2018

Type here to search

Energy consumption:



Cluster:



Mobile Data Gathering with Bounded Relay in.mp4 - VLC media player
Media Playback Audio Video Subtitle Tools View Help

PROJECT WORKFLOW - Microsoft Word

LBC-DDU Framework
IP Address : 194

Cluster

l(m)	Red Series	Green Series	Blue Series
50	2	1	1
100	5	4	3
150	9	8	7
200	15	12	10
250	20	15	13
300	28	22	18
350	35	29	28
400	40	38	37

Sensor Layer

Sink Node

SenCar Layer

GRAPH
Energy Consumption
No. of Clusters

Page: 1 of 2 Words: 7/87

07:03 07:46

11:15 29-Aug-18

File received:



The screenshot displays a Windows 7 desktop environment. In the foreground, a VLC media player window is open, showing a presentation slide. The slide has a dark green background with the title "Mobile Data Gathering with Bounded Relay in Wireless Sensor Networks" in light blue. Below the title, it says "SELECT RECEIVING PATH" in yellow, followed by a blue button labeled "CLICK HERE". At the bottom of the slide, it reads "File Received...!" and "C:\Users\Administrator\Desktop".

Behind the VLC window, a Microsoft Word document titled "PROJECT WORKFLOW - Microsoft Word" is open. The document content includes a diagram with nodes and arrows, and text such as "LBC-DDU Framework", "DESTINATION", "IP Addr", "Sink Node", and "No. of Clusters". A graph titled "GRAPH" is also visible on the right side of the document.

The Windows taskbar at the bottom shows the Start button, a search bar, and several application icons including Internet Explorer, Google Chrome, VLC, and Word. The system tray on the right shows the time as 11:16 AM on 29-Aug-18 and a volume icon set to 100%.

Conclusion

- In this paper, we propose the BR-CTR algorithm to solve the mobile data gathering problem with bounded relay consideration. The BR-CTR incorporates multi-hop transmission into mobile data gathering to reduce the delay time of data gathering.
- In the choice of visiting areas, the BR-CTR algorithm visits the overlap areas of communication ranges of “more sensors” first. In local data gathering, the BR-CTR algorithm sets a limit on the number of sensors to assist for sensors within each visiting area (i.e. the maximum number of sensors for which each sensor within the visiting area can help relay the sensing data).

References

- [1] M.Z.A. Bhuiyan, G. Wang, J. Cao, J. Wu, “Deploying wireless sensor networks with fault-tolerance for structural health monitoring,” *IEEE Trans. Comput.*, vol. 64, no. 2, pp. 382-395, 2015.
- [2] C.F. Cheng, K.T. Tsai, “Encircled belt-barrier coverage in wireless visual sensor networks,” *Pervasive Mob. Comput.*, vol. 38, pp. 233-256, 2017.
- [3] C.F. Cheng, C.W. Wang, “The target-barrier coverage problem in wireless sensor networks,” *IEEE Trans. Mobile Comput.*, vol. 17, no. 5, pp. 1216-1232, 2018.
- [4] Clique problem, https://en.wikipedia.org/wiki/Clique_problem (accessed June 04, 2018)