Thursday, July 10, 2015

XXXXXXXXXXXXXXXXX
Rockwell Automation, Advanced Technology
1 Allen-Bradley Drive
Mayfield Hts., Ohio 44124

RE: Indoor Positioning Systems (IPS) Using SWARM for Indoor Personnel and Asset Tracking

Thank you for your support to work with Bluetronix and its partners in this proposed project that inevitably benefits Rockwell and its customers. As you know, today wireless devices such as smartphones, sensors, and devices continue to proliferate, increasing exponentially each year -- it's only a matter of time before nearly every *"thing"* in our lives is connected in some manner or another. Indeed, a Machine-2-Machine world (M2M) and the Internet of Things (IoT) are upon us, but current solutions have been based upon limited conventional systems that have various limitations, such as; they can't adapt, scale, self-correct, or function peer-to-peer, share information, and a major one locate objects or personnel indoors because of indoor GPS issues.

Delivering accurate location for personnel moving about in GPS-denied areas has been ongoing issue – such as when indoors in buildings and factories – this has been very difficult to date without the use of costly infrastructure or precision mapping of facilities. Delivering seamless and ubiquitous indoor location is difficult, given that GPS is not available inside buildings. Floor plans may not be available, and relying upon accurately mapped infrastructure may not be a viable option. This lends itself well to the proposed solution previously funded by DARPA. (SWARM Location Service-Patented)

Often referred to as **(IPS) Indoor positioning system** locates assets or personnel inside buildings using *radio waves, (triangulations)* and other sensory information collected by mobile devices. There is currently no de facto standard for an IPS systems design. Instead of using satellites, IPS solutions rely on different technologies, including distance measurement to nearby anchor nodes (nodes with known positions, e.g., Wi-Fi access points), and the proposed solution does not need the use of access pts.

Designing a scalable, dependable architecture at a low cost for such large indoor tracking networks is a serious challenge. In short, future networks will be far too complex or low-cost-demanding to properly function with current engineering paradigms. Expert consensus says that the world will soon need a scalable, self-healing, self-correcting, distributed learning indoor tracking network – a network that doesn't rely on GPS, cell towers, access points, control points and hubs.

"Giants like General Electric (GE), AT&T & Cisco are projecting $15 trillion market by 2022"
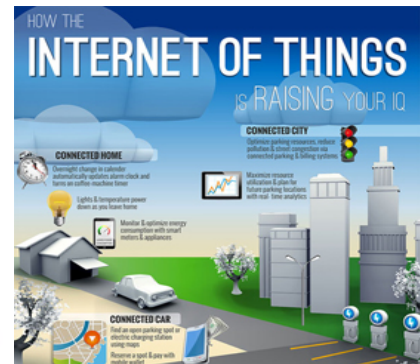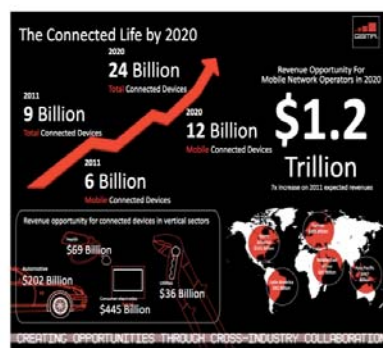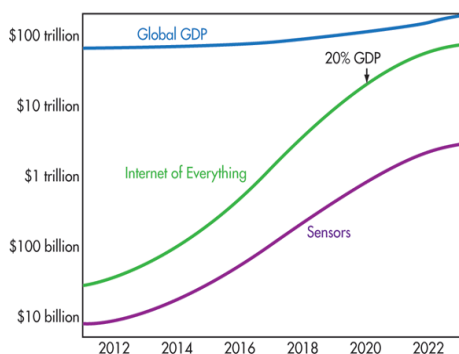
Patented SWARM Solution: Interconnectivity between devices: No access points, all peer-to-peer
Internet of Things/ M2M extended range, instant connectivity-the capacity to learn.

Industry experts now agree that within the next decade the IoT will generate multiple trillions of dollars in

Voice (440) 247.3434   PO Box 23054   Chagrin Falls, Ohio 44023   Fax (440).543.2955
innovation@bluetronix.net   www.bluetronix.net

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economic activities and could be the biggest business model ever realized. Bluetronix Inc. has successfully developed patented SWARM intelligence-based designs that emulate nature in the way biological networks operate, while self-correcting and healing themselves. The company's patented (Artificial Intelligence) SWARM based technologies and products addresses shortcomings in today's wireless communications networks such as connectivity, scalability, start-up time, set-up, access points, changes and mobility.

The Biomimicry Patented Technology

The solution? Simply just ask nature.
Millions of years ago, insects such as bees, ants, wasps and other organisms learned how to outsmart threats, find food and conserve energy by using biological principles of something called or referred to as **Swarm Intelligence (SI)**. This capability, based upon instinct and indirect communications, builds pheromones and group behaviors to solve very complex problems in nature -- and now can be used to transform wireless communications for Cellular, M2M, and IoT. At last, humans have gained the ability to mimic the phenomena of biological principles & networking to facilitate collective, adaptive systems of devices, enabling both IoT & M2M and eventually cellular to be in an ecosystem. Bluetronix has gained the ability to mimic the phenomena of biological principles and networking to facilitate collective, adaptive systems of devices, enabling both **IoT & M2M**, and eventually cellular, to operate within an ecosystem that learns and is bottom-up approach rather than top-down.

This work was supported by eight years of work efforts **& $3.5 million dollars by DARPA (Defense Advanced Research Projects Agency of U.S. Department of Defense),** and others like U.S. Army, U.S. AF and NASA funding to date. The firm's designs also provide biological networking, optimization and location service, smart grid, inter-car connectivity, mobile payments and Big Data search-and-find capability. The Company is now seeking strategic partners for market and licensing for M2M, IoT, smartphones, mobile payments, tracking devices and wireless sensors, with pending products and services in areas of healthcare, industrial, property management, mobile payments, cellular and energy.

SWARM INTELLIGENCE (SI) is an artificial intelligence **(AI)** structure and platform based upon biological networks that the company has a group of patents that can add intelligence to communications, wireless sensors, monitors, instrumentation, personnel, asset tracking and many other related equipment.
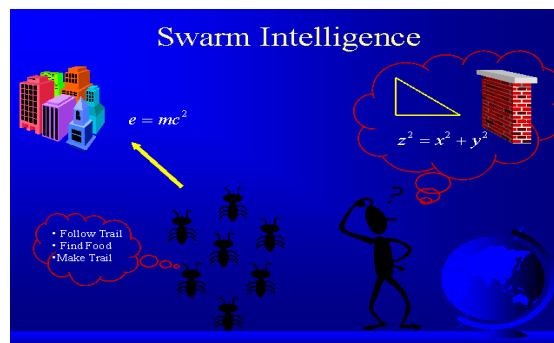
Whether you are tracking five, fifty, five hundred or even 5,000 items, and now available are U.S. patented SWARM Intelligent beacons (a format the size of a postage stamp) that work indoors **without GPS,** *using patented radio communication triangulations and biological intelligence (an industry first).* This streamlines the process of monitoring, maintaining, and managing the organization's valuable property assets that keep an organization running efficiently. Enterprises face a variety of challenges, including increasing financial pressure, regulatory mandates, and production efficiency. Many of the problems which contribute to these challenges today share common causes - *a lack of visibility into the real-time location service, status and condition of inventory, locations of assets, staff, equipment and other associated problems.* These SWARM smart beacons facilitate enterprises to INCREASE EFFICIENCY, TIGHTEN SECURITY AND INTEGRATE WITH ERP,

ASSETS & INVENTORY MANAGEMENT, SECURITY, TRANSPORTATION SYSTEMS, AND DELIVERS EFFICIENT LOCATION CONTROL INFORMATION AT A TOUCH OF A BUTTON. Also, another industry first (U.S. patented) is the use of *SWARM mobile ad hoc communications,* this technology enables each device (tracking sensors) to communicate through each other and learn locations through proximity of others; building pheromones like biological networks in nature.

From manufacturing sites to warehouses, to hospitals, to various manufactures an accurate indoor tracking for inventory visibility and personnel is critical to optimizing management processes and reducing unnecessary losses stemming from lost assets, non-tracked personnel and equipment. This patented secure SWARM intelligent beacons enables inventory tracking in real-time of items that enter or leave an area, such as a store, warehouse, factory floor or a centralized distribution area. This system automatically alerts relevant staff of the whereabouts of needed personnel in any area. **SWARM Intelligent beacons a**re the most powerful technology for managing inventory because of its ability to reduce the time it takes to perform inventory, thereby providing enterprises with real time visibility into their inventory. These kinds of improvements in inventory time allow SWARM beacons users to take immediate advantage of the inventory data and make real-time decisions on stock availability and location of needed equipment. Data gathered through real-time personnel tracking and inventory to streamline operations and reduce overall costs.

Bluetronix patented **SWARM Intelligent beacons** can pinpoint the exact location of a specific inventory or asset item and doesn't require any special proprietary hardware (compatible with iOS and Android devices). (Windows 10 coming shortly). An electronic leash can be put on items leaving a defined area with alarm. Some SWARM intelligent beacons solutions for Inventory Management and Tracking benefits are:

Quickly locate critical employees and equipment, within seconds on a Smartphone or tablet screen.
- Reduce inventory time
- Reduce looking for critical employees
- Track maintenance with time, date, repair action and etc. on any equipment by the exact personnel
- Achieve real-time physical inventory of assets, enhancing productivity by monitoring assets
- Improve security and safety by keeping assets out of unauthorized areas and monitoring personnel.

SWARM Intelligent patented beacons can are used for Authentication and Indoor and Outdoor Tracking purposes. These benefits include:
- Credential verification system and real-time updates
- Man-down tracking
- Proximity based authentication, location, tracking and authorization of assets and personnel

Patented Swarm Intelligent Inventory & Personnel Management Wireless Tracking Systems

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innovation@bluetronix.net   www.bluetronix.net

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Benefits

- SWARM eliminates the massive costs and deployment delays of traditional wireless solutions
- Quickly deployed and reconfigured – operational within hours—no set-up, turn-on nodes self-set-up
- SWARM deploys virtually anywhere in a factory or building (Instant tracking)
- Rugged enclosures for demanding applications and changing conditions
- Portable can be redeployed to new locations as comm. needs change –<u>learns as it operates</u>
- High throughput wireless network enables multiple applications including SCADA, internet access, email, voice- tracking and video surveillance
- Unparalleled safety and security—instant set-up with mobile ad hoc capability developed for DARPA/Military (Patented)—military robust, secure, redundancy, ext. range, location service, tracking

Asset & Personnel Tracking

SWARM Intelligent beacons can pinpoint the exact location of a specific inventory or asset item and doesn't require any special proprietary hardware (compatible with iOS and Android devices). (Windows 8.1 coming shortly). An electronic leash can be put on items leaving a defined area with alarm. This also integrates GPS as well.
Some SWARM intelligent beacons solutions for Inventory Management and Tracking benefits are: (patented)

Quickly locate critical equipment, assets, and employees within seconds on a Smartphone or tablet screen.
- Reduce inventory time
- Achieve real-time physical inventory of assets, enhancing productivity by monitoring assets
- Deliver more timely information for decision making and managing
- security by preventing assets from leaving premises, keep assets out of unauthorized areas or hands.

Scalable Installation

With SWARM wireless connectivity, networks can be quickly, easily and inexpensively modified to meet an enterprise's changing needs. A SWARM wireless network offers the flexibility to painlessly add or eliminate sites or to secure additional bandwidth by rearranging existing equipment or inserting additional nodes. Scale to 1000s of connections without Internet or security risks and track all equipment. *(Patented)*

Integrated Monitoring & SCADA

The ability to monitor activity in on-site with moving personnel is critical. Data from the well location such as wellhead measurements, gas pressures, flows, temperatures, and leakage monitoring are sent via the wireless network. On-site monitoring and control also allows users to monitor personnel in facilities in response to changing system demands. Quite often there are lower-production wells that must be monitored closely to obtain maximum production. Some well sites are many miles away from the closest monitoring facilities, making on-site data collection a costly and time-consuming operation. Regarding on-site monitoring, the system is able to proactively address potential problem situations, reduce downtime and minimize costly repairs. Because they are no longer required to spend so much time on the road, field personnel are able to plan their schedules more efficiently. (Patented)

Security

Today organizations are striving to improve their security to protect critical infrastructure at the well site. Especially for companies with foreign production operations, it has become the norm for many industries to heavily protect its assets and personnel from the risk of sabotage by keeping a constant eye on production facilities, especially if these facilities and personnel. Wireless tracking technology products with SWARM

Voice (440) 247.3434   PO Box 23054   Chagrin Falls, Ohio 44023   Fax (440).543.2955
innovation@bluetronix.net   www.bluetronix.net

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provide companies with solutions for remote surveillance of tracking personnel as well. The SWARM solutions allow an unlimited number of connections to be deployed quickly, easily and cost-effectively in a new or expanded security system. This system can deliver high-resolution real-time indoor tracking on a Smartphone, tablet or computer screen.

Safety

Safety is another major consideration for real-time surveillance transmissions and indoor tracking personnel ensure that you can quickly deliver aid to an injured worker or find certain area related safety issues or set a parameter on unsafe areas of the plant. There is countless ways safety can be enhanced and improved when a system like this is installed.

Proposed Integration with Rockwell FactoryTalk® AssetCentre

After meetings with many knowledgeable Rockwell personnel over the last six months it was suggested to integrate with these SW tools. Specifically, FactoryTalk® AssetCentre that provides tool for securing, managing, versioning, tracking and reporting automation related asset information that can automatically, with very limited oversight or work from employees impact uptime, productivity, quality, employee safety or regulatory compliance. This fits very well with Bluetronix Indoor Tracking and will be integrated.

This Rockwell SW enables the following:

- Secure access to the system
- Track detailed users' actions
- Manage historical versioning of any electronic file
- Provide automatic backup and compare operations on supported devices
- Add plug-ins for 3rd party vendor devices that are not natively supported
- Configure process instrumentation
- Manage instrumentation calibration schedules and certificates

Basically the SWARM SW/HW is an <u>enabling intelligent tracking system to operate over a wireless system such as Smartphone and designated collection point.</u> The FactoryTalk provides the Human Machine Interface **(HMI)** Human Machine Interface solution capable of scaling from design, to machine to enterprise, along with mobile solutions. Any information is accessible through Smartphone, tablet, or collections points. Real-time tracking of assets or personnel is within seconds when queried.

Typical HMI Screen with FactoryTalk® AssetCentre

Compliments of RW Software

FactoryTalk software provides a comprehensive and accurate picture of operations via integration to your Logix control platform and FactoryTalk information systems. (Rockwell Brochure).

Conclusion

Why SWARM?

What makes a system like this very different is it's *always learning*, *totally ad hoc wirelessly connected*, able to work without GPS indoors and the system can be integrated with other SW like Factory Talk.. An HMI is easily added or integrated as well. Also indoor tracking with SWARM using triangulation is unique because all nodes (workers or assets) learn from each other and their whereabouts and intercommunicate with each other to find each one's location as it changes in real-time in a mobile indoor environment.

For each node/worker in the network a location table is cross-shared based on need specifying that node's/ worker's geographical location and maximum broadcasting range to triangulate from back and forth. The location may be specified using any coordinated system, provided all nodes use the same system. The units used to specify the broadcasting range are updated continually, but look to be consistent. In addition, each line may contain an entry indicating the type of node/worker described by the line: stationary, somewhat mobile, or highly mobile. (Patented). Every node/worker maintains a table containing an entry for each location and each node is aware of a *"score,"—a claim in the patent--* or *pheromones,* indicating the *"goodness"*, with a timestamp used in the pheromone process for the scores. (Patented)

This enables the system to be used indoors to track personnel (nodes), assets (nodes) and for that matter track anything. All this is being constantly updated and logged in a learning mobile ad hoc tracking system. The HW is a sensor/radio the size of nickel (see page 3) with a Bluetooth 4.0 radio chip.

Bluetronix Inc. looks to work with <u>Kent St. College of Applied Engineering, Sustainability and Technology in this project if moved forward.</u> A specific SOW and firm schedule would be forthcoming to build a beta site and investigate custom attributes for Rockwell to the current system and integrations. This would be Phase 1 and then Phase 2 work efforts lower in costs actually to SBIR finding levels.

XXXXXXXXXXXXXXXX
 (Highly experienced with industry & PLCs)
Coordinator, Applied Engineering and Technology Program Area
College of Applied Engineering, Sustainability and Technology
Kent State University

Voice (440) 247.3434   PO Box 23054   Chagrin Falls, Ohio 44023   Fax (440).543.2955
innovation@bluetronix.net   www.bluetronix.net

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Proposed Effort:

Phase 1----Capture Requirements, Take worker studies, Integrate with Rockwell SW Factory Talk, Beta site design, Final report-Phase 2 Costs & proposal (90 days)

Phase 2----Beta-site Implementation, HMI design, System adjustments, Production system completed, User manual and data sheets completed, Final Report (90-120 days)

Of course a data analytics and other items can be accessed monthly for customer's usage and can be a valuable benefit.

If we receive the green light to proceed we will give formal quote for Phase 1 and a start date within fourteen days. XXX, thank you very much for your assistance and valuable insight to date and your sharing of extensive knowledge.

Mark Hunter j Heiferling
CEO/Bluetronix Inc.

Appendix

(1)   U.S. Patent (SARA) SWARM Mobile Ad Hoc Communications   US Patent # 7,957,355

US007957355B1

(12) **United States Patent**
Heiferling et al.

(10) **Patent No.:**   **US 7,957,355 B1**
(45) **Date of Patent:**   **Jun. 7, 2011**

(54) **SWARM AUTONOMOUS ROUTING ALGORITHM FOR MOBILE AD HOC NETWORK COMMUNICATIONS**

(76) Inventors: **Mark J. Heiferling**, Burton, OH (US); **Jonathon C. Kelm**, Shaker Heights, OH (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1077 days.

(21) Appl. No.: **11/421,067**

(22) Filed: **May 30, 2006**

Related U.S. Application Data

(60) Provisional application No. 60/685,504, filed on May 27, 2005.

(51) **Int. Cl.**
H04W 4/00   (2009.01)
(52) **U.S. Cl.** **370/338**; 370/351; 370/392; 370/395.31
(58) **Field of Classification Search** 370/338, 370/328, 351, 392, 395.31
See application file for complete search history.

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Primary Examiner — Wayne Cai
(74) *Attorney, Agent, or Firm* — D.A. Stauffer Patent Services, LLC

(57)   **ABSTRACT**

A Swarm Autonomous Routing Algorithm (SARA) is performed by simple communication node devices for node to node communications in a network, especially a Mobile Ad hoc NETwork (MANET). Each node maintains a table of pheromone values for known neighbor nodes. Pheromone values are dynamic for adapting to a dynamic arrangement of nodes, and are updated either passively or actively. Routing tables are not used. When a node receives a packet, it uses the pheromone table to simply determine whether or not to forward (rebroadcast) the packet to a neighbor node, and if possible, determines and indicates the best neighbor node for next forwarding the packet. Destination Zone Routing (DZR) and Swarm Location Service (SLS) are alternative enhancements of SARA that can be used for more efficient routing when nodes are location aware/knowledgeable. SLS may also be used to improve routing algorithms other than SARA.

15 Claims, 24 Drawing Sheets

Voice (440) 247.3434   PO Box 23054   Chagrin Falls, Ohio 44023   Fax (440).543.2955
innovation@bluetronix.net   www.bluetronix.net

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**(2)   U.S. Patent SWARM Location Service (SLS)
US Patent # 7,813,326**

US007813326B1

(12) **United States Patent**
Kelm et al.

(10) **Patent No.:** US 7,813,326 B1
(45) **Date of Patent:** Oct. 12, 2010

(54) **SWARM LOCATION SERVICE FOR MOBILE AD HOC NETWORK COMMUNICATIONS**

(75) Inventors: **Jonathon C. Kelm**, Shaker Hts, OH (US); **Mark J. Heiferling**, Burton, OH (US)

(73) Assignee: **Bluetronix Inc.**, Chagrin Falls, OH (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 855 days.

(21) Appl. No.: **11/561,634**

(22) Filed: **Nov. 20, 2006**

Related U.S. Application Data

(63) Continuation of application No. 11/421,067, filed on May 30, 2006.

(60) Provisional application No. 60/685,504, filed on May 27, 2005.

(51) **Int. Cl.**
H04W 4/00 (2009.01)

(52) **U.S. Cl.** **370/338**; 370/238; 370/395.31; 455/428

(58) **Field of Classification Search** 370/338
See application file for complete search history.

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Primary Examiner—Patrick N Edouard
Assistant Examiner—Jalaleddin Amirmokri
(74) *Attorney, Agent, or Firm*—D. A. Stauffer, Reg. Pat Agent

(57)   **ABSTRACT**

A Swarm Autonomous Routing Algorithm (SARA) is performed by simple communication node devices for node to node communications in a network, especially a Mobile Ad hoc NETwork (MANET). Each node maintains a table of pheromone values for known neighbor nodes. Pheromone values are dynamic for adapting to a dynamic arrangement of nodes, and are updated either passively or actively. Routing tables are not used. When a node receives a packet, it uses the pheromone table to simply determine whether or not to forward (rebroadcast) the packet to a neighbor node, and if possible, determines and indicates the best neighbor node for next forwarding the packet. Destination Zone Routing (DZR) and Swarm Location Service (SLS) are alternative enhancements of SARA that can be used for more efficient routing when nodes are location aware/knowledgeable. SLS may also be used to improve routing algorithms other than SARA.

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