INTEGRATION OF HEALTH AND POSITION TRACKING SYSTEM FOR EXTREME ENVIRONMENTS IN MINING AND MOUNTAIN CLIMBING

Abstract

The well-being checking and efficient monitoring for mountain climber is gaining its importance nowadays. Several precautions must be taken regarding the safety of climbers. In order to track the wellness of the climbers they must carry pulse rate sensors suitable communication devices to connect with the control rooms. At worst heath conditions, it turns out to be incompetent for the mountain climbers to utilize it and communication issues increases inefficiency after a particular altitude. The health and position tracking system with Global Positioning System (GPS) to detect the live location and furthermore measuring the temperature and heartbeat of the climber is proposed in the work which overcomes the shortcomings of the techniques used by the mountain climbers. providing them instant help.Mountaineering includes activities such asskiing, hiking, hill climbing and more. But, it becomes dangerous and involves high risks. Common accidents include altitude sickness, missing persons and accidental falling. Due to mountaineering activities lots of cases with heavy injuries and deaths are reported. There is a need for monitoring the mountaineer accidents and providing a rescue system. This issue is addressed and Wireless Sensor Networks along with Telehealth is seen as a promising solution. It can cut cost in power and wiring. Devices which is low poweris needed to transmit the data over very long distances were there are no network coverages. So Wireless technologies like Long Range (LoRa) which is a network being able to transmit over long distances without high power consumptions can be used under these conditions. A monitoring device is implemented which is used for monitoring the person for safety via LoRa technology. A cloud server is set up by using LoRa gateway combined with Internet of Things (IoT). This system provides anarchitecture system for monitoring, tracking and early rescue

1. Introduction

Mountain climbing or trekking count is increasing currently owing to their interest in improving their health, balancing mental and physical health. It also viewed in the point of body weight exercise, better flexibility and blood circulation. Both mountain climbing and trekking are comprehensive sports. This mountain climbing is fast growing recreation sport. Encouragement and sponsors from the various agencies motivates more persons to involve in mountaineering and as sport people aim to create new records by beating up the previous records. Especially these passionate climbers undergo several risks during their climbing activity. So, it is necessary to beware of the risks of accidents in climbing process High altitude mountain climbing exposed to low oxygen levels, low temperatures, wind, physical and mental stress, and dietary deficiencies. This sudden variation causes abnormal variation blood pressure and heart rates . The major risk incudes of shortness of breath due to insufficient oxygen at high attitudes and climbing in extreme warm and cold environment involves in getting the risk of injuries, hypothermia and heat stroke. In additional to the climatic conditions, getting contact with the insects and poisonous plants cause's allergies and variation in blood pressure needs medical attention. The leaders who lack in mountain medicine is failed to handle the situation when person get ill. Many trekkers do not know how to access the medical equipment and this leads to several issues. At this situation, immediate contact of rescue team by the person affected is difficult and this time lagging in identifying the affected climbers leads to severe illness. The tracing of mountain climber's location with suitable communication technologies is required for the team. The automatic tracking of mountain climber's location and reaching the spot by the rescue is needed [3-5]. Mountain climbers can communicate with their team or if emergency they contact the rescue team or medical team with the communication

medium, but the range of signal availability after a particular altitude is difficult. Mountain climbers often face unexpected situation with power and signal issuesLoRa (Long Range) is a wireless radio frequency technology that has been gaining high popularity for integration with Internet of things (IoT) networks worldwide. LoRa along with IoT has been used to solve some of the biggest challenges facing us such as the reduction in the natural resources used, infrastructure efficiency, pollution control and even energy management. Some applications where LoRa is used are Smart agriculture [4], Smart Diagnosis and Logistics [6], Smart homes and buildings [7] and even for monitoring a disable patient [8].The Long Range provided by the LoRa is key feature as it can reach up to 10Km in rural areas by using proper directional antennas. It also penetrates to a higher extent in urban conditions compared with other wireless technologies. LoRa is a low cost and low power replacement since it reduces the infrastructure costs to a large portion and provides negligible operating costs. The high battery life ensures that replacement is done after very long time. Thus, the LoRa is a combination of both Wi-Fi and Cellularnetworks making it an efficient, inexpensive and flexible alternative for other wireless technologies.Telehealth is a way of transmitting medical information and data over long distances using telecommunication systems which provide with the adequate medical care or diagnosis. It is needed to overcome the challenge of distance when there is no access to the medical services nearby. The Telehealth can be used to monitor the people remotely for the mountaineers, diagnose the issues and provide rescue.

2. LITERATURE REVIEW

Mountain Climber Monitoring system

Asarla Anusha, Kotha Ravi Teja, Suragani Srikanth, Muthyala.V. V Satya Chowdary

Mountains have attracted many enthusiasts and trekkers for a long time to conquer high peaks or explore picturesque terrain. A team of mountaineers carries the necessary equipment for climbing steep slopes and steering through rugged terrain. The movements are monitored through the main control centres. The reporting mechanism is periodic on a need basis or at the end of the day's summary reporting. The team members are travelling under the threat of avalanches and victims get buried inside the snow-mass in the event of accidents. In such accidents, 65% of fatalities happen due to asphyxia, 29% due to trauma, and balance due to hypothermia, drowning and primary cardiac arrest. Commercially available gadgets and previously developed electronic systems are designed for normal habitation. They use WiFi services to transmit health parameters on IoT platforms. Users should be conscious and self-aware to monitor and communicate health parameters, whereas the buried victims suffer from trauma and remain immobile/ unconscious. The present paper aims at addressing the healthcare issues of mountaineers while trekking in normal conditions as well as in a buried scenario without the need for WiFi connectivity. The proposed electronic system uses low power consuming chips that sustain low temperatures up to -40 °C. The system monitors oxygen level, heart rate, body temperature, etc., and disseminates the compiled data to a central control station by employing technological advancements in Wireless Sensor Networks, LoRa, and satellite modems. In the event of accidental burial of victims, the electronic system is equipped with a special feature to automatically activate Op-Mode-5 and transmit data at optimum power to the master node. The system helps in the

regular assessment of the health conditions of mountaineers so that search and rescue operations can be carried out in time for saving precious lives.

WSN BASED MOUNTAIN CLIMBER HEALTH

& GPS TRACKER

Mrs. P. Alekya1, K. Mounika2, R.Rekha3,Thambu Nagarjuna4,

Konda Prashanth5,Billuri malleswari6

Mountaineering has always been a very adventurist & enthusiastic activity. But with adventure comes risk. Mountain climbers are always under risk of accidents. When any such accident occurs at high altitudes or remote locations, search and rescue operations are not always successful. Because the news of accident takes hours or even days of reach search & rescue team. Search and rescue team doesn't know the location of the accident. Search & rescue team doesn't know if the person is alive or not, and if alive what is his condition. The smart mountain climber allows for teams to track vitals of climbers in real time as well as monitor their location over IOT.

Existing system

In the real time emergency rescue system [5], a heartbeat monitor

is used to remind the user of altitude sickness and inertia sensor to detect falling, the monitoring is done using the Bluetooth available in a smart phone and the data is transmitted using cellular networks to the rescuers by using an application on the mobile device to facilitate the transfer of data. In case of emergencies the wearer can use the application to transmit the geographical data and request for rescue. The WE-Safe [3] is device aimed at monitoring dangerous and hazardous environments. Multiple low-power environmental sensors nodes are used to transmit to a LoRa Gateway. By monitoring the carbon dioxide, ultraviolet leveland other environmental parameters, individuals were warned of unsafe work

environments. The LoRa Gateway is used to connect to the internet using a cloud server. A mobile application will provide with alerts when the environment reaches unsafe conditions.In the irrigation system [10], the LoRa is used to perform precision agriculture. A system that consists of soil moisture, temperature and humidity sensors were used by the nodes. The data was then transmitted to a

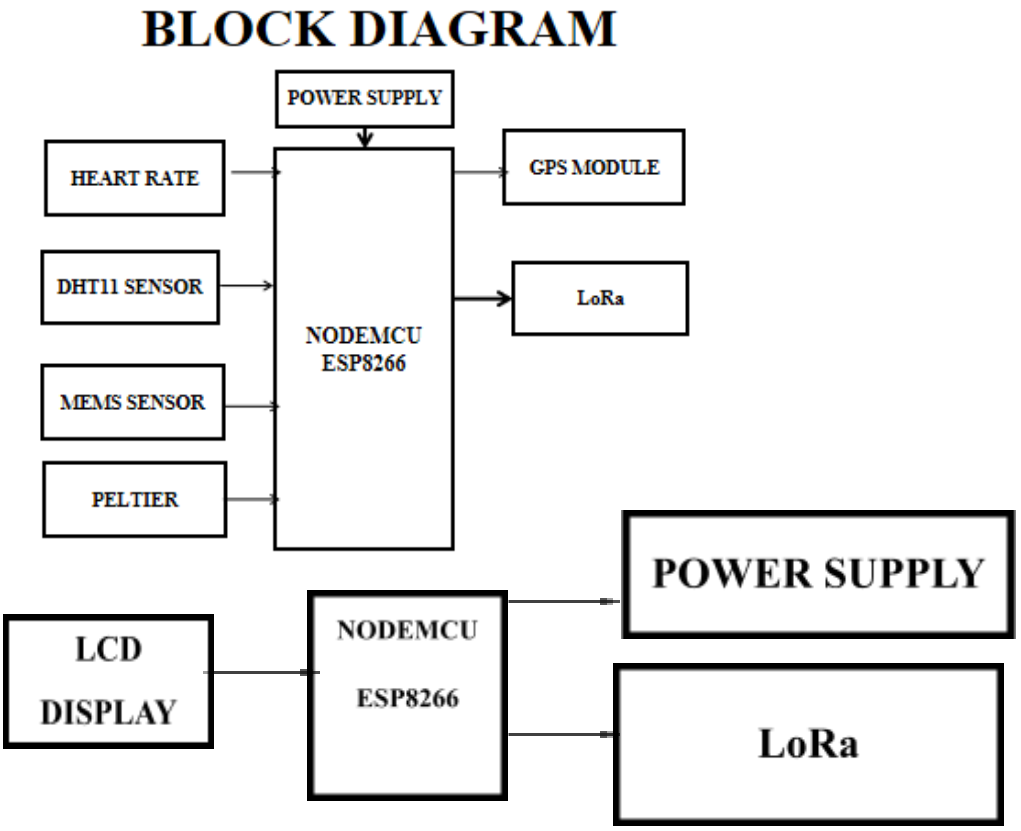
receiver called the Concentrator, which controls the irrigation process. Based on the soil's needs the irrigation was done instead of being set on a timer. The Concentrator allows the users to configure the irrigation system , monitor data and also manage crops remotely using a Computer and also Web interface for ease of access. A bus tracking system was implemented in [11]. It was mainly implemented to eliminate user's concern about the unreliability of the bus timing. A LoRa based tacking system was implemented which reduced the number of repeaters need by 75% or more compared with Wi-SUN based systems used previously which decreases the installation cost by a very large portion. The tracking was transmitted to an information terminal bus stop that the users were able to use.

In the wake of thinking about the above innovation, the checking of a route of mountain climbers, for example, understanding their speed, separation, not wellbeing of them during the climbing, which empowers the individual climbers to achieve the target as soon as possible and also getting the connect with the rescue team for help. The base station gets an area of a climber from GPS. The base station can get admission to the forefront status of the climber that is shown on the communication device with the assistance of GSM and subsequently reasonable activities. With the help of display, the climber can view the message from the control room such as Alert…! Heartbeat: (heart beat value)/M Temperature: (temperature value) C GPS Location:

3. PROPOSED SOLUTIONS

The main aim of our project is to monitoring the health of mountain climber and tracking of the climber location. The health monitoring can be done using the pulse sensor and temperature sensor. Pulse sensor give the heart rate, when the heart rate crosses the limit given by the user it will alerts.Temperature sensor will give the temperature of the climber on the LCD screen. In stage two through GPS location of the climber can be detected, and automatically information is sent to the higher authorities or rescue team. through blynk app the temperature, pressure, altitude, longitude, latitude, Pulse rate can be seenIn the LoRa based review system, a model is proposed where, a monitoring and emergency rescue systemusing LoRa is implemented. Mountaineering is activity performed by thousands on various hills, Alps,

mountains and more. Not all the mountaineering activities are successful and many also results in accidents.So an effective and reliable telehealth monitoring is required so that people experiencing medical emergencies and situational emergencies can properly send their geolocation to rescuers



5.MATERIALS REQUIREMENT

EMBEDDED SYSTEM:

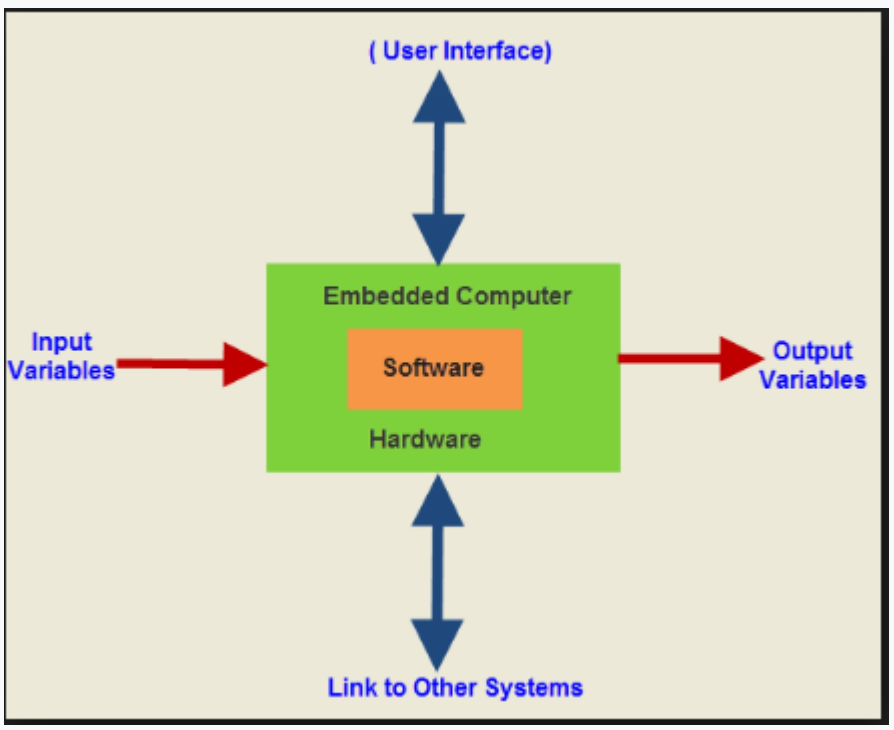
An embedded system is a controller programmed and controlled by a real-time operating system (RTOS) with a dedicated function within a larger mechanical or electrical system, often with real-time consumption of embedded systems computing constraints.

It is embedded as part of a complete device often including hardware and mechanical parts. Embedded systems control many devices in common use today. Ninety-eight percent of all microprocessors are manufactured to serve as embedded system component.

Examples of properties of typical embedded computers when compared with general-purpose counterparts are low power consumption, small size, rugged operating ranges, and low per-unit cost. This comes at the price of limited processing resources, which make them significantly more difficult to program and to interact with.

However, by building intelligence mechanisms on top of the hardware, taking advantage of possible existing sensors and the existence of a network of embedded units, one can both optimally manage available resources at the

unit and network levels as well as provide augmented functions, well beyond those available. For example, intelligent techniques can be designed to manage power.



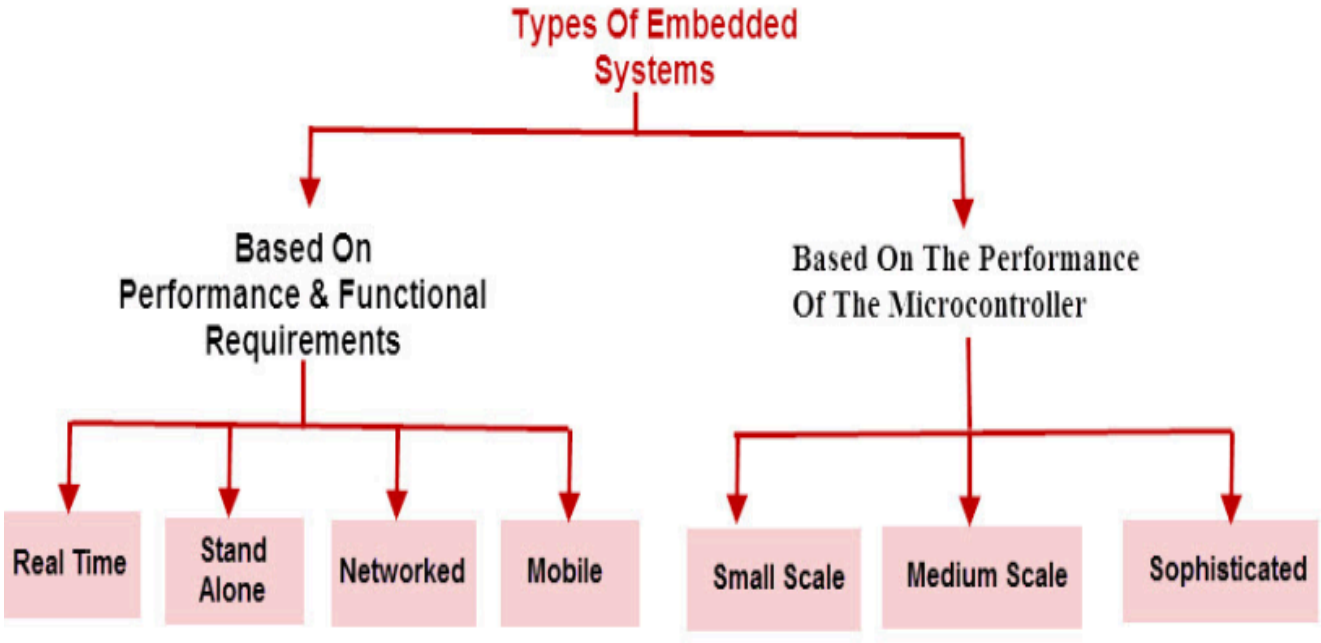
Embedded Computer Sub-Assembly for Electronic Voting Machine

Embedded systems are commonly found in consumer, industrial, automotive, medical, commercial and military applications.

Telecommunications systems employ numerous embedded systems from telephone switches for the network to cell phones at the end user. Computer networking uses dedicated routers and network bridges to route data.

Consumer electronics include MP3 players, mobile phones, video game consoles, digital cameras, GPS receivers, and printers. Household appliances, such as microwave ovens, washing machines and dishwashers, include embedded systems to provide flexibility, efficiency and features.

CLASSIFICATIONS OF EMBEDDED SYSTEMS:

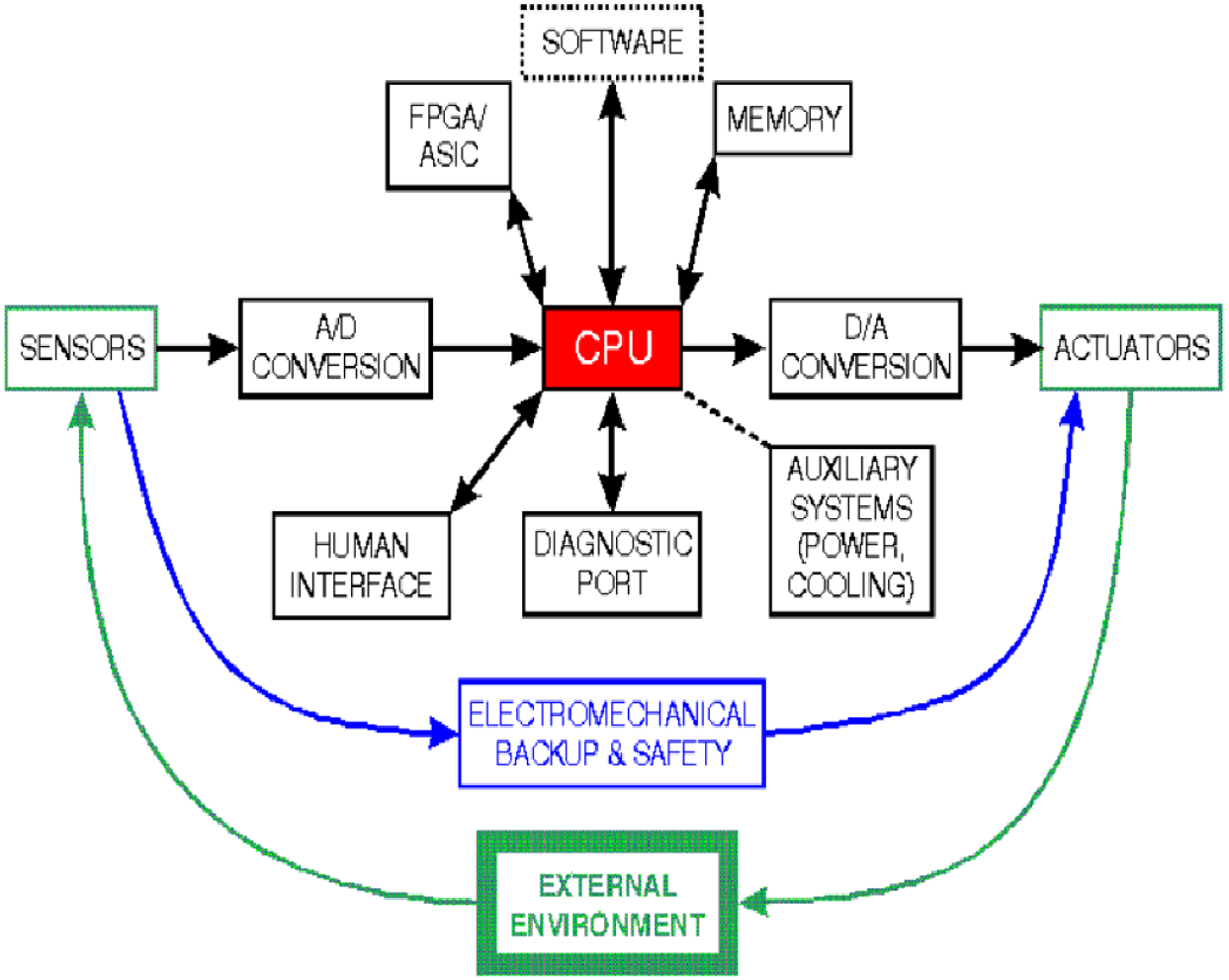


Advanced HVAC systems use networked thermostats to more accurately and efficiently control temperature that can change by time of day and season. Home automation uses wired- and wireless-networking that can be used to control lights, climate, security, audio/visual, surveillance, etc., all of which use embedded devices for sensing and controlling.

Like traffic lights, factory controllers, and largely complex systems like hybrid vehicles, MRI, and avionics Embedded systems range from portable devices such as digital watches and MP3 players, to large stationary installations. Complexity varies from low, with a single microcontroller

Block diagram of an embedded system:

An embedded system usually contains an embedded processor. Many appliances that have a digital interface microwaves, VCRs, cars utilize embedded systems. Some embedded systems include an operating system. Others are very specialized resulting in the entire logic being implemented as a single program. These systems are embedded into some device for some specific purpose other than to provide general purpose computing.



Block diagram of a typical embedded system

EMBEDDED SYSTEMS APPLICATIONS:

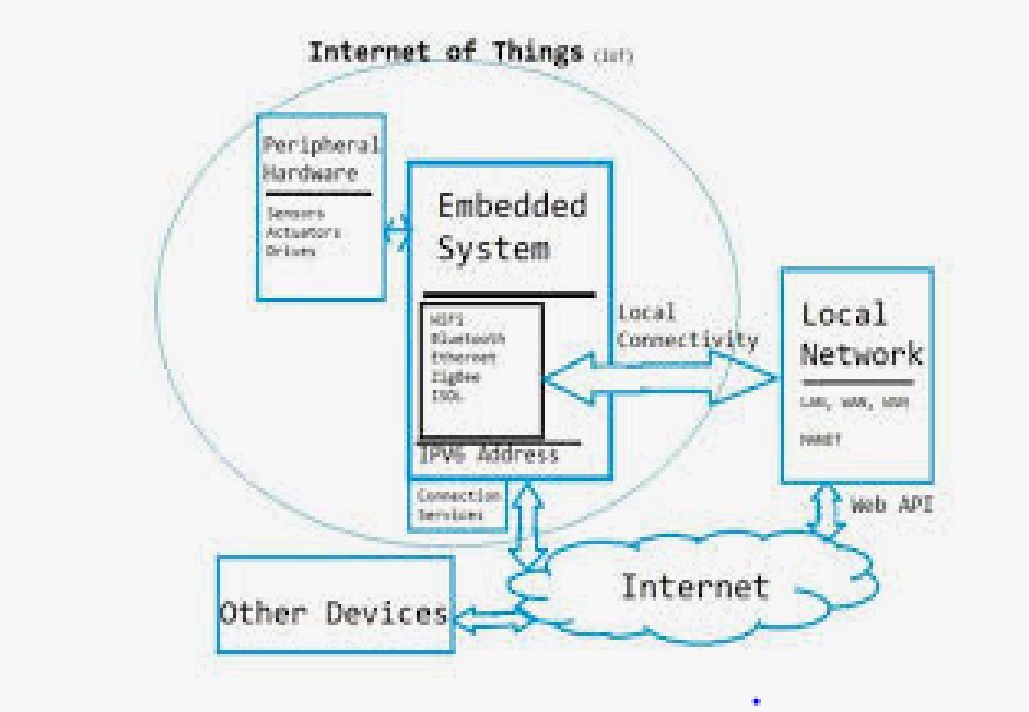
Embedded systems in automobiles include motor control, cruise control, body safety, engine safety, robotics in an assembly line, car multimedia, car entertainment, E-com access, mobiles etc.

- Embedded systems in telecommunications include networking, mobile computing, and wireless communications, etc.
- Embedded systems in smart cards include banking, telephone and security systems.
- Embedded Systems in satellites and missiles include defense, communication, and aerospace

- Embedded systems in computer networking & peripherals include image processing, networking systems, printers, network cards, monitors and displays
- Embedded Systems in digital consumer electronics include set-top boxes, DVDs, high definition TVs and digital cameras

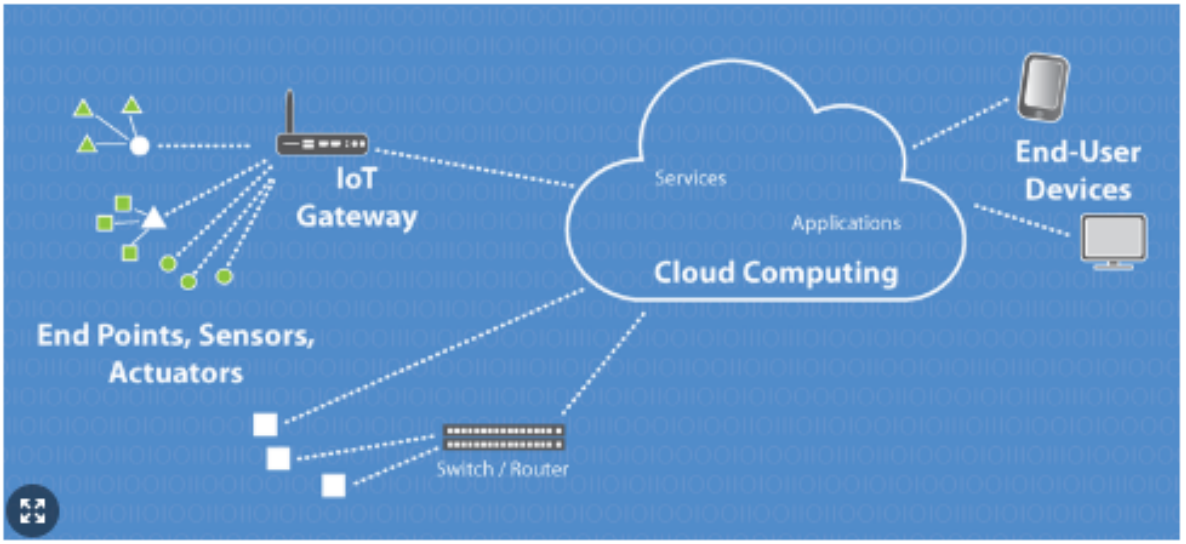
INTERNET OF THINGS:

- The term Internet of Things generally refers to scenarios where network connectivity and computing capability extends to objects, sensors and everyday items not normally considered computers, allowing these devices to generate, exchange and consume data with minimal human intervention. There is, however, no single, universal definition.
- Enabling Technologies: The concept of combining computers, sensors, and networks to monitor and control devices has existed for decades. The recent confluence of several technology market trends, however, is bringing the Internet of Things closer to widespread reality. These include Ubiquitous Connectivity, Widespread Adoption of IP-based Networking, Computing Economics, Miniaturization, Advances in Data.
- Connectivity Models: IoT implementations use different technical communications models, each with its own characteristics. Four common communications models described by the Internet Architecture Board include: Device-to-Device, Device-to-Cloud, Device-to-Gateway, and Back-End Data-Sharing. These models highlight the flexibility in the ways that IoT devices can connect and provide value to the user.



IoT devices are implemented using both hardware and software components. Dedicated hardware components are used to implement the interface with the physical world, and to perform tasks which are more computationally complex. Microcontrollers are used to execute software that interprets inputs and controls the system. This module discusses the roles of both the hardware and software components in the system. The functions of common hardware components are described and the interface between the software and hardware through the microcontroller is explained. IoT devices often use an operating system to support the interaction between the software and the microcontroller. We will define

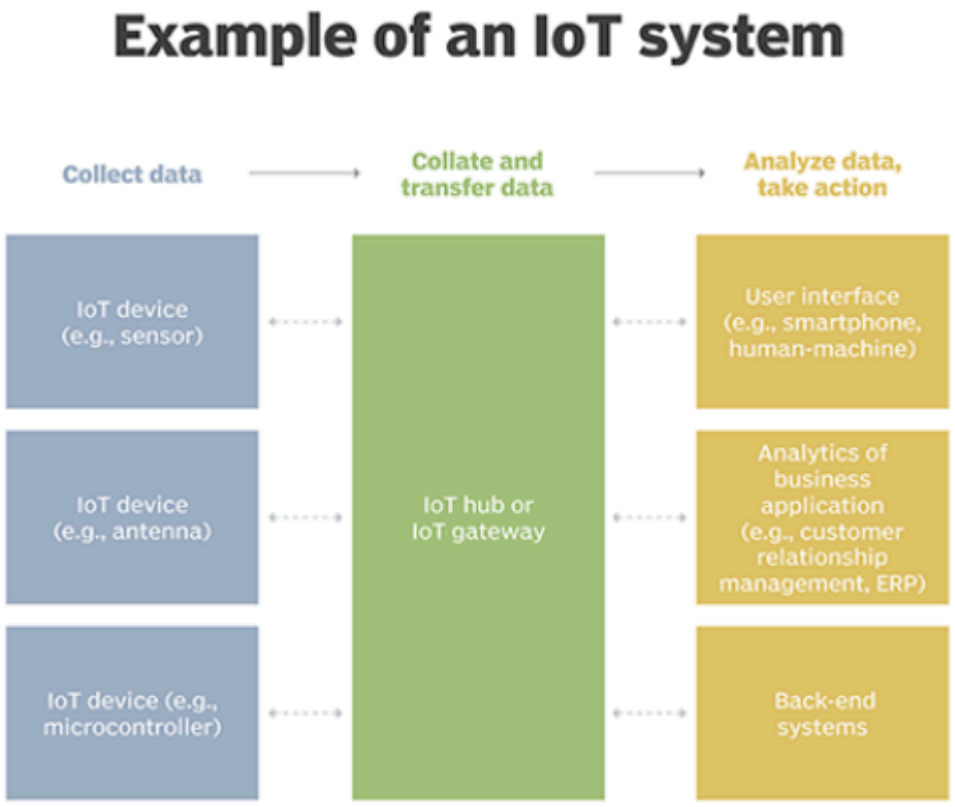
the role of an operating system in an IoT device and how an IoT operating system differs from a standard one.



How IoT works

An IoT ecosystem consists of web-enabled smart devices that use embedded processors, sensors and communication hardware to collect, send and act on data they acquire from their environments. IoT devices share the sensor data they collect by connecting to an IoT gateway or other edge device where data is either sent to the cloud to be analyzed or analyzed locally. Sometimes, these devices communicate with other related devices and act on the information they get from one another. The devices do most of the work without human intervention, although people can interact with the devices -- for instance, to set them up, give them instructions or access the data.

The connectivity, networking and communication protocols used with these web-enabled devices largely depend on the specific IoT applications deployed.



Benefits of IoT

The internet of things offers a number of benefits to organizations, enabling them to:

- monitor their overall business processes;
- improve the customer experience;
- save time and money;
- enhance employee productivity;
- integrate and adapt business models;
- make better business decisions; and
- generate more revenue.

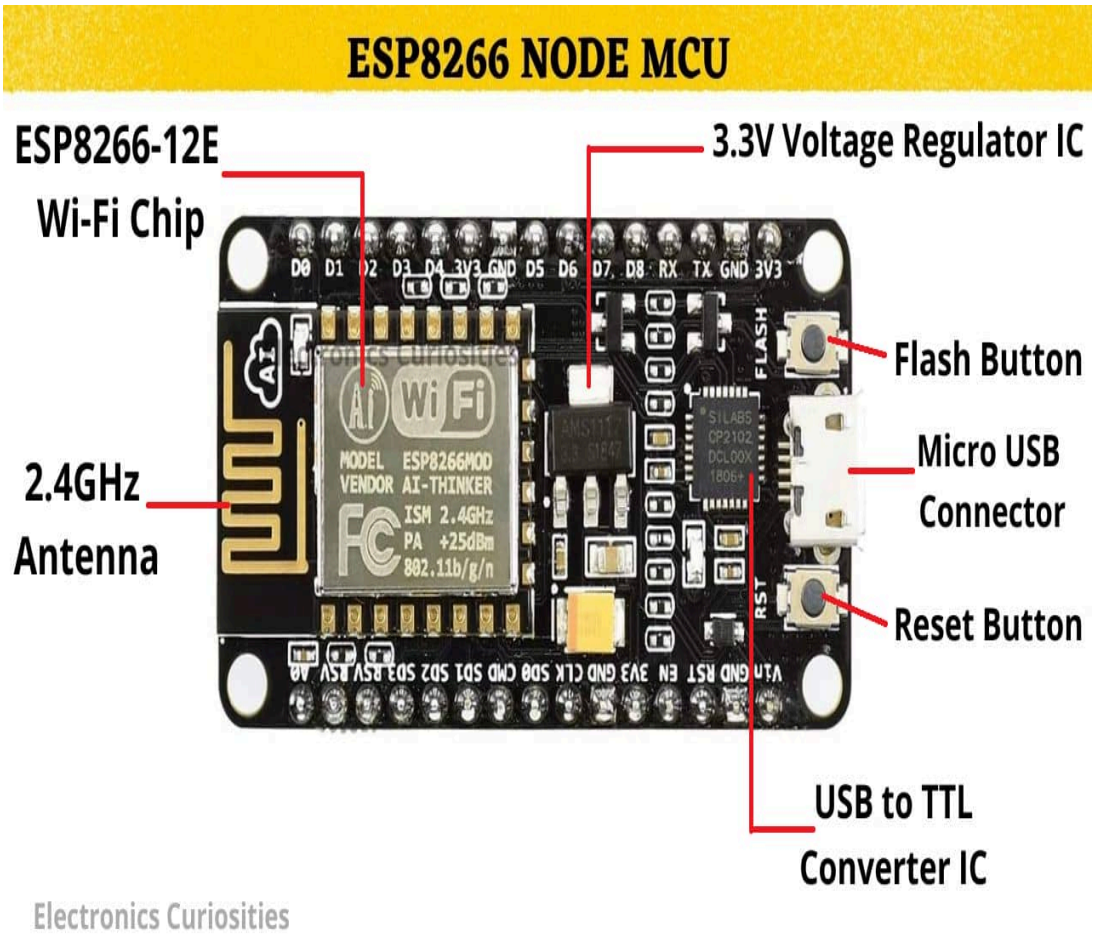
IoT encourages companies to rethink the ways they approach their businesses, industries and markets and gives them the tools to improve their business strategies.

Consumer and enterprise IoT applications

There are numerous real-world applications of the internet of things, ranging from consumer IoT and enterprise IoT to manufacturing and industrial IoT (IoT). IoT applications span numerous verticals, including automotive, telco, energy and more.

In the consumer segment, for example, smart homes that are equipped with smart thermostats, smart appliances and connected heating, lighting and electronic devices can be controlled remotely via computers, smartphones or other mobile devices.

Wearable devices with sensors and software can collect and analyze user data, sending messages to other technologies about the users with the aim of making users' lives easier and more comfortable. Wearable devices are also used for public safety -- for example, improving first responders' response times during emergencies by providing optimized routes to a location or by tracking construction workers' or firefighters' vital signs at life-threatening sites.



ESP8266 MODULE:

The **ESP8266** is a low-cost Wi-Fi microchip with full TCP/IP stack and microcontroller capability produced by manufacturer Espressif Systems in Shanghai, China.

The chip first came to the attention of western makers in August 2014 with the **ESP-01** module, made by a third-party manufacturer Ai-Thinker. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands. However, at first there was almost no English-language documentation on the chip and the commands it accepted.[2] The very low price and the fact that there were very few external components on the module, which suggested that it could eventually be very inexpensive in volume, attracted many hackers to explore the module, chip, and the software on it, as well as to translate the Chinese documentation

FEATURE:

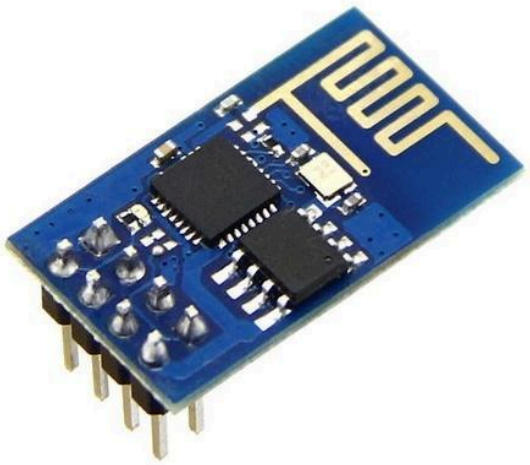
- Memory:
  - 32 KB instruction RAM
  - 32 KB instruction cache RAM
  - 80 KB user-data RAM
  - 16 KB ETS system-data RAM
- External QSPI flash: up to 16 MB is supported (512 KB to 4 MB typically included)
- IEEE 802.11 b/g/n Wi-Fi

  Integrated TR switch, balun, LNA, power amplifier and matching network

- WEP or WPA/WPA2 authentication, or open networks

- 16 GPIO pins
- SPI
- I^2C (software implementation)[6]
- I^2S interfaces with DMA (sharing pins with GPIO)
- UART on dedicated pins, plus a transmit-only UART can be enabled on GPIO2
- 10-bit ADC (successive approximation ADC)

ESP8266 is Wi-Fi enabled system on chip (SoC) module developed by Espress if system. It is mostly used for development of IoT (Internet of Things) embedded applications.



ESP8266-01 WIFI Module

ESP8266 comes with capabilities of

- 2.4 GHz Wi-Fi (802.11 b/g/n, supporting WPA/WPA2),
- general-purpose input/output (16 GPIO),
- Inter-Integrated Circuit (I^2C) serial communication protocol,
- analog-to-digital conversion (10-bit ADC)
- Serial Peripheral Interface (SPI) serial communication protocol,
- I^2S (Inter-IC Sound) interfaces with DMA (Direct Memory Access) (sharing pins with GPIO),
- UART (on dedicated pins, plus a transmit-only UART can be enabled on GPIO2), and
- pulse-width modulation (PWM).

It employs a 32-bit RISC CPU based on the Tensilica Xtensa L106 running at 80 MHz (or overclocked to 160 MHz). It has a 64 KB boot ROM, 64 KB instruction RAM and 96 KB data RAM. External flash memory can be accessed through SPI.

ESP8266 module is low-cost standalone wireless transceiver that can be used for end-point IoT developments.

To communicate with the ESP8266 module, microcontroller needs to use set of AT commands. Microcontroller communicates with ESP8266-01 module using UART having specified Baud rate.

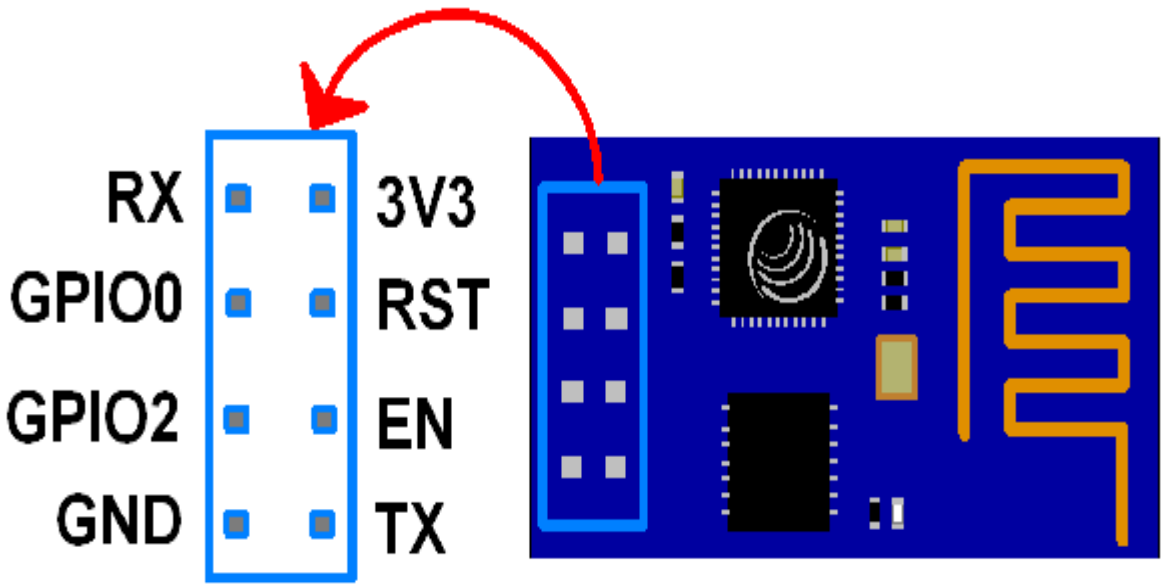
There are many third-party manufacturers that produce different modules based on this chip. So, the module comes with different pin availability options like,

- ESP-01 comes with 8 pins (2 GPIO pins) – PCB trace antenna. (shown in above figure)
- ESP-02 comes with 8 pins, (3 GPIO pins) – U-FL antenna connector.
- ESP-03 comes with 14 pins, (7 GPIO pins) – Ceramic antenna.
- ESP-04 comes with 14 pins, (7 GPIO pins) – No ant.

etc.

For example, below figure shows ESP-01 module pins

ESP8266-01 Module Pin Description



ESP8266-01 Module Pins

3V3: - 3.3 V Power Pin.

GND: - Ground Pin.

RST: - Active Low Reset Pin.

EN: - Active High Enable Pin.

TX: - Serial Transmit Pin of UART.

RX: - Serial Receive Pin of UART.

GPIO0 & GPIO2: - General Purpose I/O Pins. These pins decide what mode (boot or normal) the module starts up in. It also decides whether the TX/RX pins are used for Programming the module or for serial I/O purpose.

To program the module using UART, Connect GPIO0 to ground and GPIO2 to VCC or leave it open. To use UART for normal Serial I/O leave both the pins open (neither VCC nor Ground).

NPN silicon photo transistor. Due to its black epoxy, the sensor is sensitive to infrared radiation.

The sensor can be a great addition in a firefighting robot, it can be used as a robot eyes to find the fire source. When the sensor detects flame the Signal LED will light up and the D0 pin goes LOW.

The module has 2 outputs: Analogue, which gives a real-time voltage output signal on thermal resistance, and digital which allows temperature thresholds to be set via a potentiometer.

Features :

- High Photo Sensitivity
- Fast Response Time
- Sensitivity adjustable
- Detects a flame or a light source of a wavelength in the range of 760nm-1100 nm.
- Detection range: up to 100 cm.
- Adjustable detection range.
- Detection angle about 60 degrees, it is sensitive to the flame spectrum.
- Comparator chip LM393 makes module readings stable.
- Operating voltage 3.3V-5V.
- Digital and Analog Output.
- Power indicator and digital switch output indicator.

Specifications:

Operating Voltage(VDC)	3.3 to 5
Spectrum range	760nm ~ 1100nm
Detection Angle(°)	0 to 60
Operating Temperature (°C)	-25 to +85
Length (mm)	35.5
Width (mm)	15.2
Height (mm)	14
Weight (gm)	3

Package Includes :

- 1 x Flame Sensor Infrared Receiver/Ignition Source Detection Module

Dht11 SENSOR

DHT11 is a low-cost digital sensor for sensing temperature and humidity. This sensor can be easily interfaced with any micro-controller such as Arduino, Raspberry Pi etc… to measure humidity and temperature instantaneously.

DHT11 humidity and temperature sensor is available as a sensor and as a module. The difference between this sensor and module is the pull-up resistor and a power-on LED. DHT11 is a relative humidity sensor. To measure the surrounding air this sensor uses a thermistor and a capacitive humidity sensor.

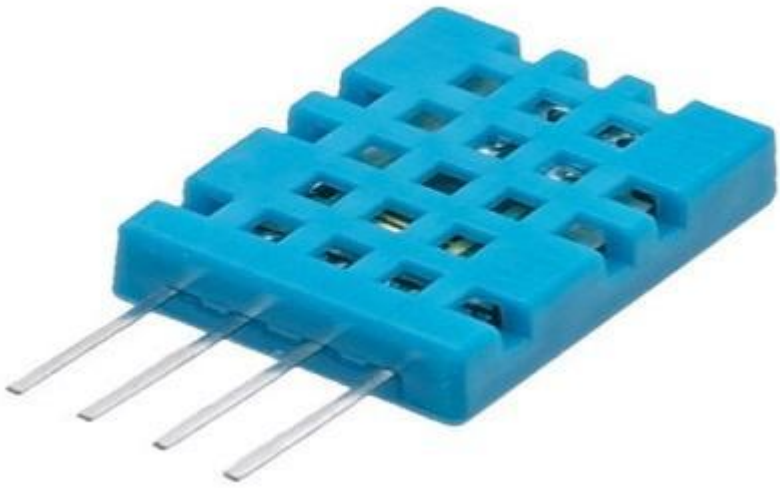
Working Principle of DHT11 Sensor

DHT11 sensor consists of a capacitive humidity sensing element and a thermistor for sensing temperature. The humidity sensing capacitor has two electrodes with a moisture holding substrate as a dielectric between them. Change in the capacitance value occurs with the change in humidity levels.

The IC measure, process this changed resistance values and change them into digital form.

For measuring temperature this sensor uses a Negative Temperature coefficient thermistor, which causes a decrease in its resistance value with increase in temperature. To get larger resistance value even for the smallest change in temperature, this sensor is usually made up of semiconductor ceramics or polymers.

The temperature range of DHT11 is from 0 to 50 degree Celsius with a 2-degree accuracy. Humidity range of this sensor is from 20 to 80% with 5% accuracy. The sampling rate of this sensor is 1Hz .i.e. it gives one reading for every second. DHT11 is small in size with operating voltage from 3 to 5 volts. The maximum current used while measuring is 2.5mA.



DHT11 Sensor

DHT11 sensor has four pins- VCC, GND, Data Pin and a not connected pin. A pull-up resistor of 5k to 10k ohms is provided for communication between sensor and micro-controller.

Applications

This sensor is used in various applications such as measuring humidity and temperature values in heating, ventilation and air conditioning systems. Weather stations also use these sensors to predict weather conditions. The humidity sensor is used as a preventive measure in homes where people are affected by humidity. Offices, cars, museums, greenhouses and industries use this sensor for measuring humidity values and as a safety measure.

It’s compact size and sampling rate made this sensor popular among hobbyists. Some of the sensors which can be used as an alternative to DHT11 sensor are DHT22, AM2302, SHT71.

HEART BEAT SENSOR

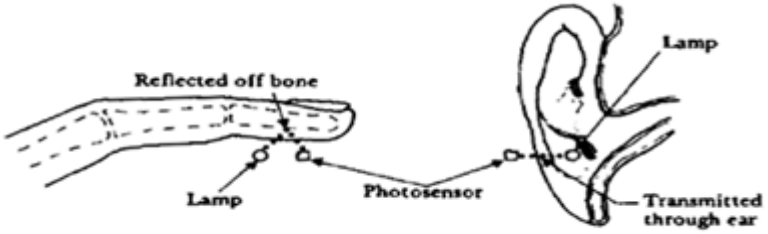
Principle of Heartbeat Sensor

The heartbeat sensor is based on the principle of photoplethysmography. It measures the change in volume of blood through any organ of the body which causes a change in the light intensity through that organ (avascular region). In the case of applications where the heart pulse rate is to be monitored, the timing of the pulses is more important. The flow of blood volume is decided by the rate of heart pulses and since light is absorbed by the blood, the signal pulses are equivalent to the heartbeat pulses.

There are two types of photoplethysmography:

Transmission: Light emitted from the light-emitting device is transmitted through any vascular region of the body like earlobe and received by the detector.

Reflection: Light emitted from the light-emitting device is reflected by the regions.



Working of a Heartbeat Sensor

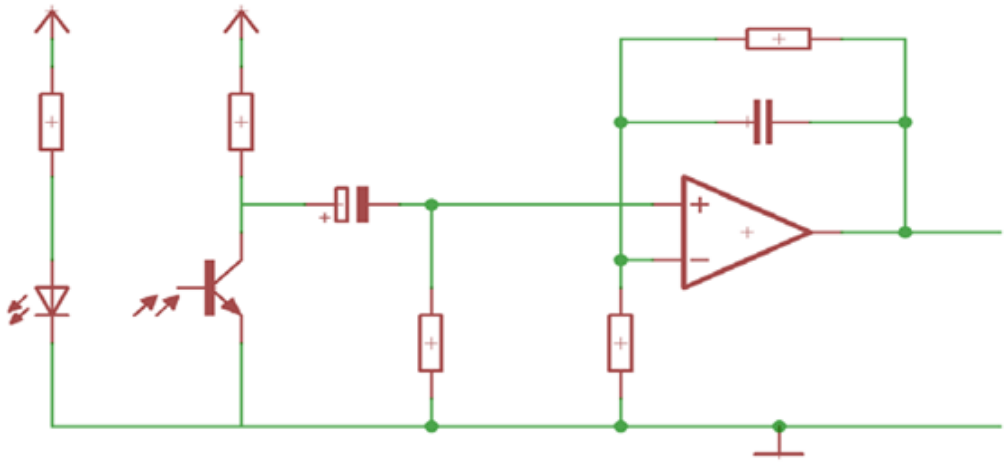
The basic heartbeat sensor consists of a light-emitting diode and a detector like a light detecting resistor or a photodiode. The heartbeat pulses cause a variation in the flow of blood to different regions of the body. When tissue is illuminated with the light source, i.e. light emitted by the led, it either reflects (a finger tissue) or transmits the light (earlobe). Some of the light is absorbed by the blood and the transmitted or the reflected light is received by the light detector. The amount of light absorbed depends on the blood volume in that tissue. The detector output is in the form of the electrical signal and is proportional to the heartbeat rate.

This signal is a DC signal relating to the tissues and the blood volume and the AC component synchronous with the heartbeat and caused by pulsatile changes in arterial blood volume is superimposed on the DC signal. Thus the major requirement is to isolate that AC component as it is of prime importance.

To achieve the task of getting the AC signal, the output from the detector is first filtered using a 2 stage HP-LP circuit and is then converted to digital pulses using a comparator circuit or using simple ADC.

The digital pulses are given to a microcontroller for calculating the heartbeat rate, given by the formula-BPM(Beats per minute) = 60*f

Where f is the pulse frequency



Liquid-crystal display

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals combined with polarizers. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome.

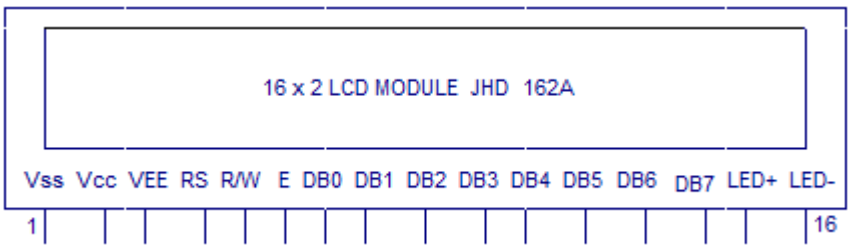
LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden. For instance: preset words, digits, and seven-segment displays, as in a digital clock, are all good examples of devices with these displays. They use the same basic technology, except that arbitrary images are made from a matrix of small pixels, while other displays have larger elements. LCDs can either be normally on (positive) or off (negative), depending on the polarizer arrangement.

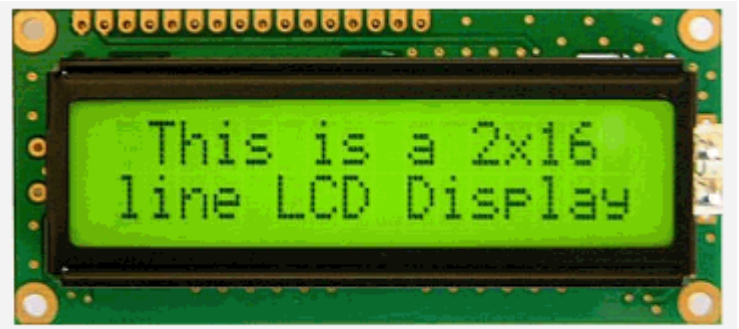
For example, a character positive LCD with a backlight will have black lettering on a background that is the color of the backlight, and a character negative LCD will have a black background with the letters being of the same color as the backlight. Optical filters are added to white on blue LCDs to give them their characteristic appearance.

Each pixel of an LCD typically consists of a layer of molecules aligned between two transparent electrodes, often made of Indium-Tin oxide (ITO) and two polarizing filters (parallel and perpendicular polarizers), the axes of transmission of which are (in most of the cases) perpendicular to each other. Without the liquid crystal between the polarizing filters, light passing through the first filter would be blocked by the second (crossed) polarizer. Before an electric field is applied, the orientation of the liquid-crystal molecules is determined by the alignment at the surfaces of electrodes. In a twisted nematic (TN) device, the surface alignment directions at the two electrodes are perpendicular to each other, and so the molecules arrange themselves in a helical structure, or twist. This induces the rotation of the polarization of the incident light, and the device appears gray. If the applied voltage is large enough, the liquid crystal molecules in the center of the layer are almost completely untwisted and the polarization of the incident light is not rotated as it passes through the liquid crystal layer. This light will then be mainly

polarized perpendicular to the second filter, and thus be blocked and the pixel will appear black.

By controlling the voltage applied across the liquid crystal layer in each pixel, light can be allowed to pass through in varying amounts thus constituting different levels of gray.





JHD 162A Character LCD

1. DISPLAYCONTENT : 16 CHAR x 2ROW

2. CHAR.DOTS : 5 x 8

3. DRIVING MODE : 1/16D

4. Backlight : LED(B/5.0V)

5. Number of data line : 8-bit parallel

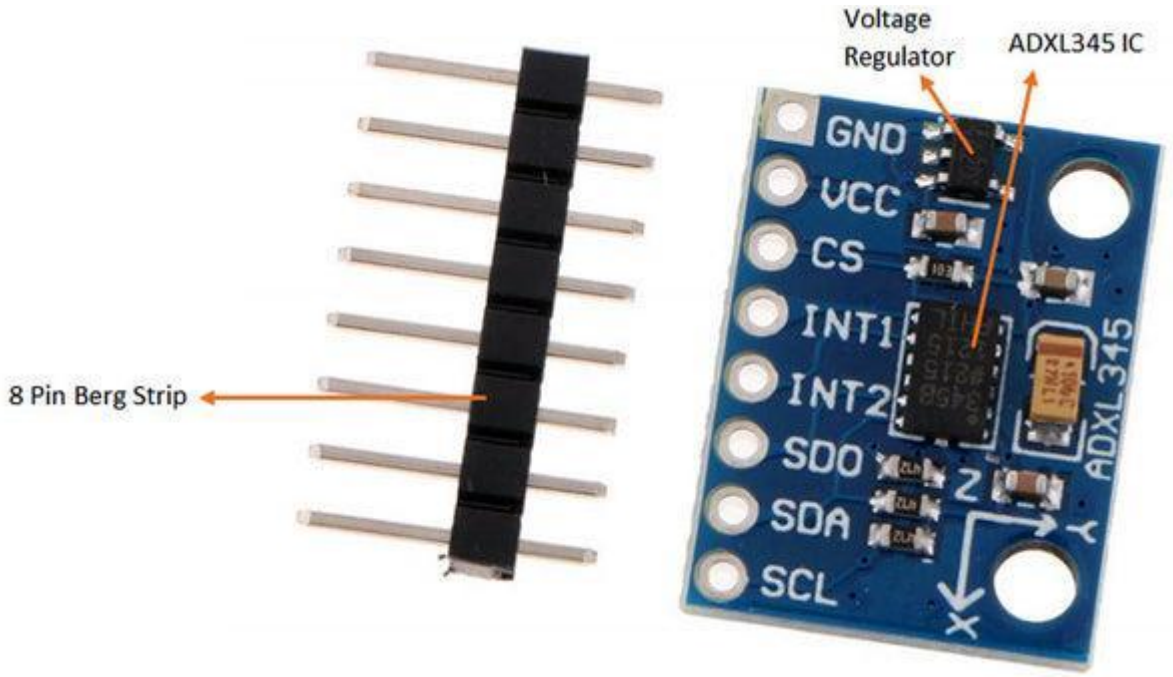
ADXL345 3-Axis Digital Accelerometer Sensor

Accelerometer is used to measure both static acceleration i.e. gravitational and dynamic acceleration i.e. motion or shock. In most of the robotics applications, it is used to measure the tilt of the object. The **ADXL345** is a low power, MEMS, three-axis accelerometer module with both SPI and I2C interfaces to communicate with your controller like Arduino, Raspberry Pi, PIC, etc. It also has user-selectable sensitivity and 10-13bit of resolution. This **Digital Accelerometer** has a voltage regulator on board hence can be connected to both 5V and 3.3V powered controllers. Its high-resolution 4mg/LSB also enables it to measure less than 1° change in the orientation of the object. The **ADXL**

Sensor can be used in Robotics applications, measuring vibration in a machine, in the data acquisition system of a vehicle, measuring the motions of a bridge, etc. It can also be used to detect taps on an object.

SPECIFICATIONS

- 3V-6V DC Supply Voltage
- Measuring range ±16g
- Onboard LDO Voltage regulator
- Built-in Voltage level convertor (MOSFET based)
- Can be interface with 3V3 or 5V Microcontroller.
- All necessary Components are populated.
- Ultra-Low Power Consumption: 40uA in measurement mode, 0.1uA in standby@ 2.5V
- Free-Fall Detection
- Digital Output with SPI and I2C interfaces



LoRa

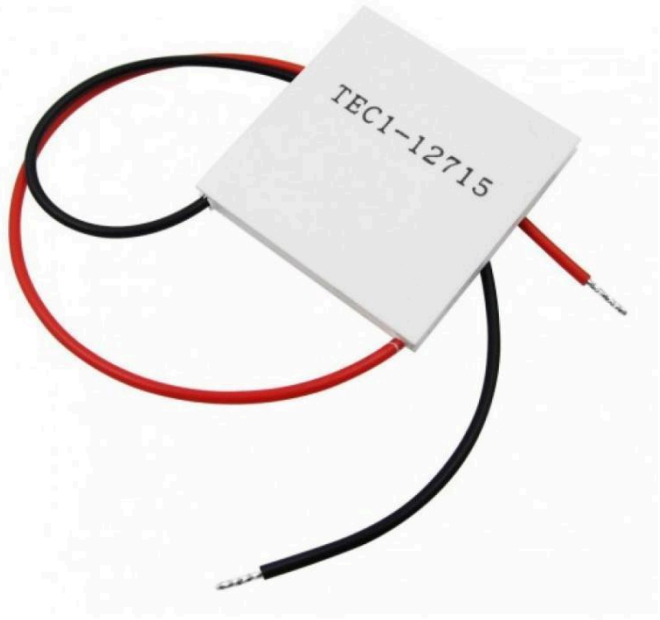
LoRa is a radio modulation technique that is essentially a way of manipulating radio waves to encode information using a chirped (chirp spread spectrum technology), multi-symbol format. LoRa as a term can also refer to the systems that support this modulation technique or the communication network that IoT applications use.

The main advantages of LoRa are its long-range capability and its affordability. A typical use case for LoRa is in smart cities, where low-powered and inexpensive internet of things devices (typically sensors or monitors) spread across a large area send small packets of data sporadically to a central administrator.

Peltier

Thermoelectric cooling uses the Peltier effect to create a heat flux at the junction of two different types of materials. A Peltier cooler, heater, or thermoelectric heat pump is a solid-state active heat pump which transfers heat from one side of the device to the other, with consumption of electrical energy, depending on the direction of the current. Such an instrument is also called a Peltier device, Peltier heat pump, solid state refrigerator, or thermoelectric cooler (TEC) and occasionally a thermoelectric battery. It can be used either for heating or for cooling,[1] although in practice the main

application is cooling. It can also be used as a temperature controller that either heats or cools.



ARDUINO IDE

A program for Arduino hardware may be written in any programming language with compilers that produce binary machine code for the target processor. Atmel provides a development environment for their 8-bit AVR and 32-bit ARM Cortex-M based microcontrollers: AVR Studio (older) and Atmel Studio (newer).

The Arduino integrated development environment (IDE) is a cross-platform application (for Microsoft Windows, macOS, and Linux) that

is written in the Java programming language. It originated from the IDE for the languages *Processing* and *Wiring*.

It includes a code editor with features such as text cutting and pasting, searching and replacing text, automatic indenting, brace matching, and syntax highlighting, and provides simple one-click mechanisms to compile and upload programs to an Arduino board.

It also contains a message area, a text console, a toolbar with buttons for common functions and a hierarchy of operation menus. The source code for the IDE is released under the GNU General Public License, version 2

The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures.

User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. The Arduino IDE employs the program avrdude to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

Sketch

A *sketch* is a program written with the Arduino IDE. Sketches are saved on the development computer as text files with the file extension **.ino**. Arduino Software (IDE) pre-1.0 saved sketches with the extension **.pde**.

A minimal Arduino C/C++ program consists of only two functions

- setup(): This function is called once when a sketch starts after power-up or reset. It is used to initialize variables, input and output pin modes, and other libraries needed in the sketch. It is analogous to the function main().
- loop(): After setup() function exits (ends), the loop() function is executed repeatedly in the main program. It controls the board until the board is powered off or is reset. It is analogous to the function while(1).

Libraries

The open-source nature of the Arduino project has facilitated the publication of many free software libraries that other developers use to augment their projects.

Operating systems/threading

There is a Xinu OS port for the atmega328p (Arduino Uno and others with the same chip), which includes most of the basic features. The source code of this version is freely available.

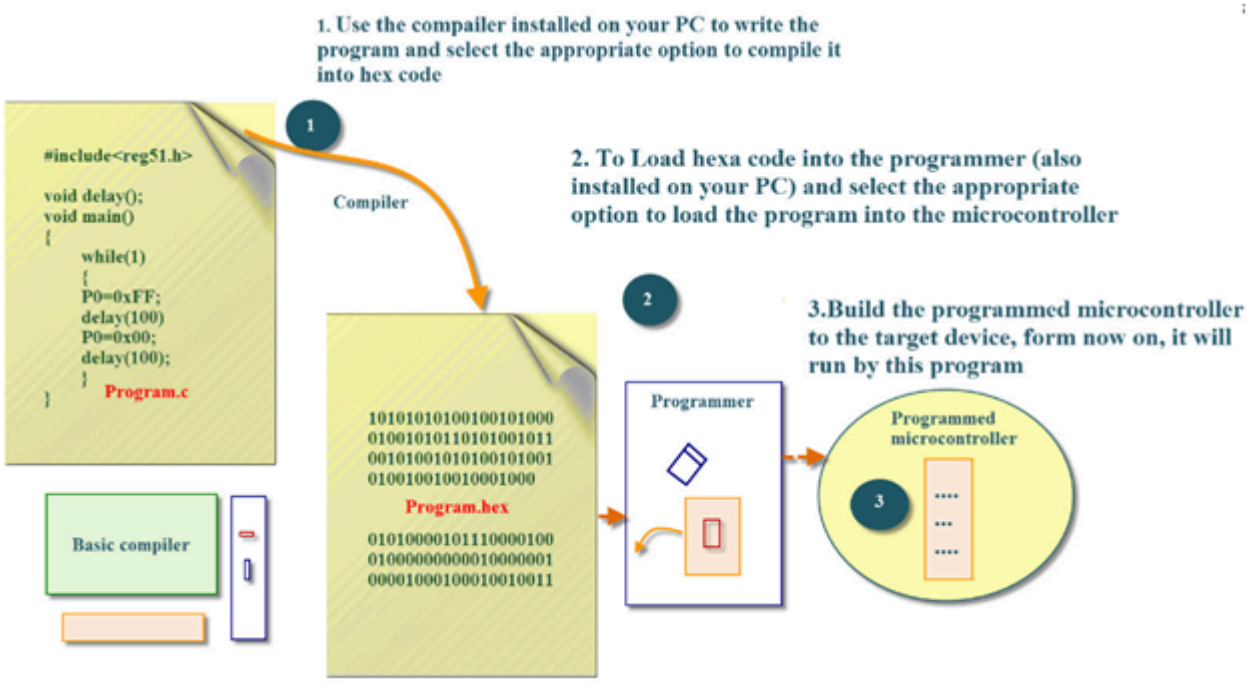
There is also a threading tool, named Protothreads. Protothreads are described as "extremely lightweight stackless threads designed for severely memory constrained systems, such as small embedded systems or wireless sensor network nodes.

Embedded C Programming

Embedded C is most popular programming language in software field for developing electronic gadgets. Each processor used in electronic system is associated with embedded software.

Embedded C programming plays a key role in performing specific function by the processor. In day-to-day life we used many electronic devices such as mobile phone, washing machine, digital camera, etc. These all device working is based on microcontroller that are programmed by embedded C.

Let's see the block diagram representation of embedded system programming:



Easy to understand In embedded system programming C code is preferred over other language. Due to the following reasons:

- High Reliability
- Portability
- Scalability

Function is a collection of statements that is used for performing a specific task and a collection of one or more functions is called a programming language. Every language is consisting of basic elements and grammatical rules. The C language programming is designed for function with variables, character set, data types, keywords, expression and so on are used for writing a C program.

The extension in C language is known as embedded C programming language. As compared to above the embedded programming in C is also have some additional features like data types, keywords and header file etc is represented by

include<**microcontroller** name.h>

ATmega32-8 Bit AVR MicroController

The AVR microController is based on the advanced Reduced Instruction Set Computer (RISC) architecture. ATmega32 microController is a low power CMOS technology based controller. Due to RISC architecture AVR microcontroller can execute 1 million of instructions per second if cycle frequency is 1 MHz provided by crystal oscillator.

40 pin DIP Photograph of ATmega32

Key Features:

Consider some general features of ATmega32 microcontroller is

- 2 Kilo bytes of internal Static RAM
- 32 X 8 general working purpose registers
- 32 Kilo bytes of in system self programmable flash program memory.
- 1024 bytes EEPROM
- Programmable serial USART
- 8 Channel, 10 bit ADC
- One 16-bit timer/counter with separate prescaler, compare mode and capture mode.
- Available in 40 pin DIP, 44-pad QFN/MLF and 44-lead QTFP
- Two 8-bit timers/counters with separate prescalers and compare modes
- 32 programmable I/O lines
- In system programming by on-chip boot program
- Master/slave SPI serial interface
- 4 PWM channels
- Programmable watch dog timer with separate on-chip oscillator

Special Microcontroller Features:

- External and internal interrupt sources

- Six sleep modes: Idle, ADC noise reduction, power-save, power-down, standby and extended standby.
- Power on reset and programmable brown-out detection.
- Internal calibrated RC oscillator

CONCLUSION

The V2I has been proposed in this paper to allow ambulance-to-traffic light controller communications, namely A2T. Based on the application of A2T in a use case of Thailand, ambulances benefit in terms of faster and safer casualty transfers by getting rid of stops at the intersections. Our performance evaluation shows that A2T accomplishes 100 percent stop removal for the ambulances at the intersection. Other vehicles on the rescue road also benefit from A2T by experiencing a 13.10 percent improvement in terms of AAWT. Other vehicles on the crossing road, in contrast, experience only a 2.48 percent increase of AAWT. Therefore, A2T is positioned as a promising approach to enhance rescue operations in the near future.

ADVANTAGES

1. Provide free way to ambulance
2. Tackle the emergency conditions
3. Track real time location of ambulance
4. Suggest the nearest hospital and optimum route
5. Storage of medical data of user

FUTURE SCOPE

The system proposed merely focuses on developing a way to let the ambulances pass traffic signals with minimum delay. As a result, many more areas can be explored to provide patients with high-quality ambulance service. The ambulance also can be equipped with a

microcontroller that can monitor patients on a real-time basis and send the data to the destined hospital. This can assist the hospital to get prepared in the best possible way for when the patient arrives. The inclusion of microcontrollers in ambulances also opens doors to enable double authentication of ambulances at traffic signals. While the system proposed here merely focuses on providing traffic service only to ambulances, the system can be modified to provide similar assistance to other emergency vehicles like fire engines, rescue vehicles, etc. The scope of improvement is just limited to the imagination of the human mind.

REFERENCES

1. Road traffic death; available: http://www.who.int/gho/road_safety/mortality/en, accessed .
2. Road Safety in The South-East Asia Region 2015; available: http://www.who.int/violence_injury_prevention/road_safety_status/2015/Road_Safety_SEAR_3_for_web.pdf, accessed .
3. The Economic and Societal Impact of Motor Vehicle Crashes, 2010;available:https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812013, accessed on .Statistics on Emergency Vehicle Accidents in the U.S.; available: http://www.arnolditkin.com/Personal-Inju_x0002_ry-Blog//November/Sta

tistics-on-Emergency-Vehi_x0002_cle-Accidents-in-the.aspx, accessed on 14 December.

4. S. A. Korkmaz and M. Poyraz, “Path Planning for Rescue Vehicles via Segmented Satellite Disaster Images and GPS Road Map,” Proc. 2016 9th Int’l. Congress Image and Signal Processing, BioMedical Engineering and Informatics (CISP_x0002_BMEI), Datong, 2016, pp. 145–50.

5. M. Poulton and G. Roussos, “Towards Smarter Metropolitan Emergency Response,” Proc. 2013 IEEE 24th Annual Int’l. Symposium on Personal, Indoor, and Mobile Radio Commu_x0002_nications (PIMRC), London, 2013, pp. 2576–80.

6. Accidents in the U.S.; available: http://www.arnolditkin.com/Personal-Inju_x0002_ry-Blog//November/Statistics-on-Emergency-Vehi_x0002_cle-Accidents-in-the.aspx, accessed on 14 December.

7. S. A. Korkmaz and M. Poyraz, “Path Planning for Rescue Vehicles via Segmented Satellite Disaster Images and GPS Road Map,” Proc. 2016 9th Int’l. Congress Image and Signal Processing, BioMedical Engineering and Informatics (CISP_x0002_BMEI), Datong, 2016, pp. 145–50.

8. M. Poulton and G. Roussos, “Towards Smarter Metropolitan Emergency Response,” Proc. 2013 IEEE 24th Annual Int’l. Symposium on Personal, Indoor, and Mobile Radio Commu_x0002_nications (PIMRC), London, 2013, pp. 2576–80.