

# Home Medical Devices Using Wireless Communication System

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**ABSTRACT:** Electricity-operated durable medical equipment (DME), such as ventilators, dialysis machines, and patient monitoring devices, are life-supporting machines used extensively by patients at home. While convenient and economical, at-home use of DME is susceptible to power outages, especially the ones caused by natural disasters that often occur in large area and for a long duration. The Base Station and User Nodes is each built with a Teensy microcontroller, a GPS receiver module, and an Xbee radio implementing the Zigbee protocol. Additionally, each User Node contains a status LED and an internal lithium-ion battery connected by a charge controller. User Nodes are programmed to obtain the GPS location of the patient, monitor the DME status, communicate with nearby nodes, transmit the data and relay information to the Base Station through the radio ad hoc network the nodes form in the case of a power outage. The Base Station device is programmed to receive and convey the information transmitted from the User Nodes to a nearby hospital's patient monitoring computer through a USB connection. This system works without relying on the infrastructure, and allows hospital staff to know the information and locations of DME and their users and provide help needed during power outages.

**INDEX TERMS:** GPS, LED, Xbee, DME

## I. INTRODUCTION

Zig-bee is a specification for a suite of high level communication protocols using small, low-power digital radios based on the IEEE 802.15.4, 2006 standard for wireless personal area networks (WPANs), such as wireless headphones connecting with cell phones via short-range radio. The technology defined by the Zig-bee specification is intended to be simpler and less expensive than other WPANs, such as Bluetooth. Zig-bee is targeted at radio-frequency (RF) applications that require a low data rate, long battery life, and secure networking

Zig-bee is a low data rate, two-way standard for home automation and data networks. The standard specification for up to 254 nodes including one master, managed from a single remote control. Real usage examples of Zig-bee includes home automation tasks such as turning lights on, setting the home security system, or starting the VCR. With Zig-bee all these tasks can be done from anywhere in the home at the touch of a button. Zig-bee also allows for dial-in access via the Internet for automation control.

Zig-bee protocol is optimized for very long battery life measured in months to years from inexpensive, off-the-shelf non-rechargeable batteries, and can control lighting, air conditioning and heating, smoke and fire alarms, and other security devices. The standard supports 2.4 GHz (worldwide), 868 MHz (Europe) and 915 MHz (Americas) unlicensed radio bands with range up to 100 meters.

## IEEE 802.15.4

IEEE 802.15.4 is a standard which specifies the physical layer and medium access control for low-rate wireless personal area networks (LR-WPAN's). This standard was chartered to investigate a low data rate solution with multi-month to multi-year battery life and very low complexity. It is operating in an unlicensed, international frequency band. Potential applications are sensors, interactive toys, smart badges, remote controls, and home automation.

802.15.4 Is part of the 802.15 wireless personal-area network efforts at the IEEE? It is a simple packet-based radio protocol aimed at very low-cost, battery-operated widgets and sensors (whose batteries last years, not hours) that can intercommunicate and send low-bandwidth data to a centralized device. It is the basis for the Zig-bee specification, which further attempts to offer a complete networking solution by developing the upper layers which are not covered by the standard.

## II PROPOSED SYSTEM

Today's GPS receivers are extremely accurate, thanks to their parallel multi-channel design. Garmin's 12 parallel channel receivers are quick to lock onto satellites when first turned on and they maintain strong locks, even in dense foliage or urban settings with tall buildings. Certain atmospheric factors and other sources of error can affect the accuracy of GPS receivers. Garmin® GPS receivers are accurate to within 15 meters on average.

Newer Garmin GPS receivers with WAAS (Wide Area Augmentation System) capability can improve accuracy to less than three meters on average. No additional equipment or fees are required to take advantage of WAAS. Users can also get better accuracy with Differential GPS (DGPS), which corrects GPS signals to within an average of three to five meters. The U.S. Coast Guard operates the most common DGPS correction service. This system consists of a network of towers that receive GPS signals and transmit a corrected signal by beacon transmitters. In order to get the corrected signal, users must have a differential beacon receiver and beacon antenna in addition to their GPS.

Our ancestors had to go to pretty extreme measures to keep from getting lost. They erected monumental landmarks, laboriously drafted detailed maps and learned to read the stars in the night sky.

The user segment is composed of hundreds of thousands of U.S. and allied military users of secure GPS Precise

Positioning Service, and tens of millions of civil, commercial and scientific users of the Standard Positioning Service. In general, GPS receivers are composed of an antenna, tuned to the frequencies transmitted by the satellites, receiver-processors, and a highly stable clock (often a crystal oscillator). They may also include a display for providing location and speed information to the user. A receiver is often described by its number of channels: this signifies how many satellites it can monitor simultaneously. Originally limited to four or five, this has progressively increased over the years so that, as of 2007, receivers typically have between 12 and 20 channels.

The Global Positioning System is vast, expensive and involves a lot of technical ingenuity, but the fundamental concepts at work are quite simple and intuitive.

**Applications Of GPS**

- a) GPS has become a mainstay of transportation systems worldwide,
- b) Providing navigation for aviation, ground, and maritime operations.
- c) Disaster relief and emergency services depend upon GPS for location and timing capabilities in their life-saving missions.
- d) Everyday activities such as banking.
- e) Mobile phone operations.
- f) The control of power grids, are facilitated by the accurate timing provided by GPS.
- g) Farmers, surveyors, geologists and countless others perform their work more efficiently, safely, economically, and accurately using the free and open GPS signals.

**TEMPERATURE SENSOR (LM35)**

The LM35 sensor series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature.

**LM35 Sensor Specification**

The LM35 series are precision integrated-circuit LM35 temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 sensor thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 sensor does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C over a full -55 to +150°C temperature range. Low cost is assured by trimming and calibration at the wafer level.

The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies. As it draws only 60 µA from its supply, it has

very low self-heating, less than 0.1°C in still air. The LM35 is rated to operate over a -55° to +150°C temperature range, while the LM35C sensor is rated for a -40° to +110°C range (-10° with improved accuracy). The LM35 series is available packaged in hermetic TO-46 transistor packages, while the LM35C, LM35CA, and LM35D are also available in the plastic TO-92 transistor package. The LM35D sensor is also available in an 8-lead surface mount small outline package and a plastic TO-220 package.

**LM35 Sensor Circuit Schematic**

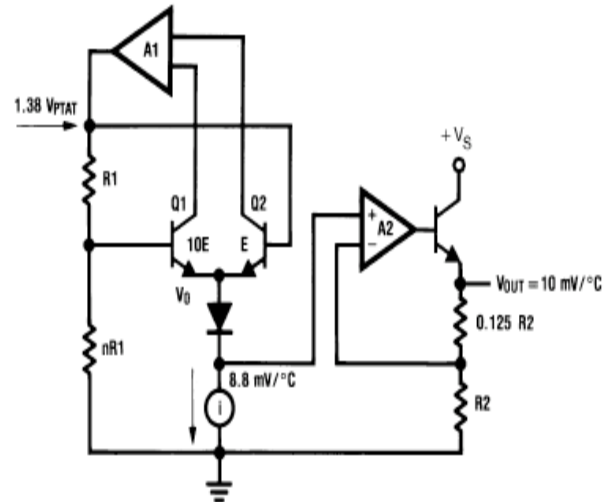
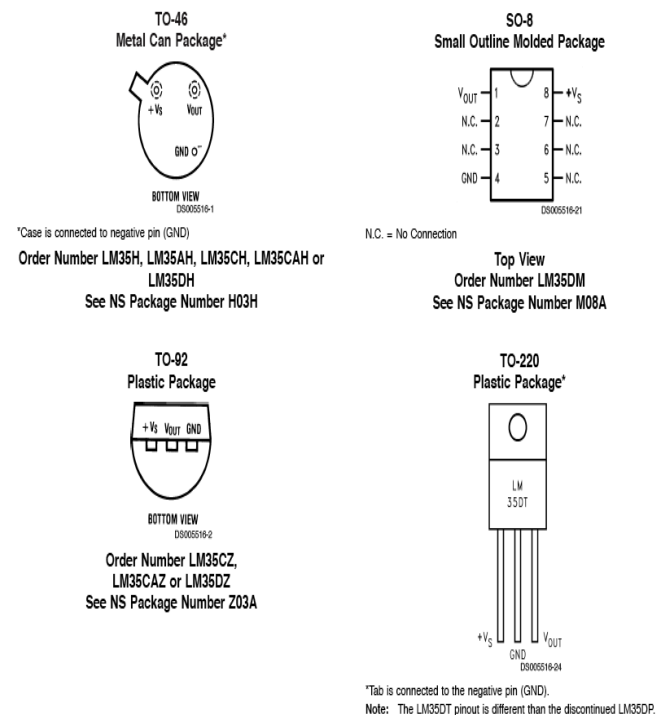


Fig-2.1 LM35 Sensor Circuit

**LM35 Sensor Pinouts and Packaging**



**LM35 Sensor Sources**

There are several manufacturers of this popular part and each has LM35 sensor specs, datasheets and other free LM35 downloads. This amplifier is available from the following manufacturers.

### III RESULTS

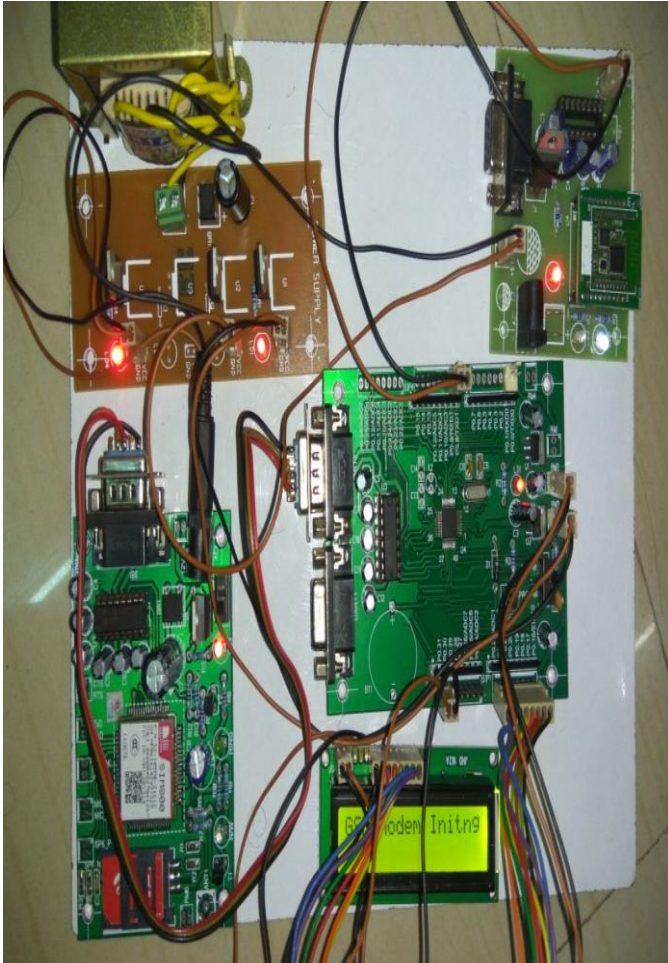


Fig3.1: Result Photocopy

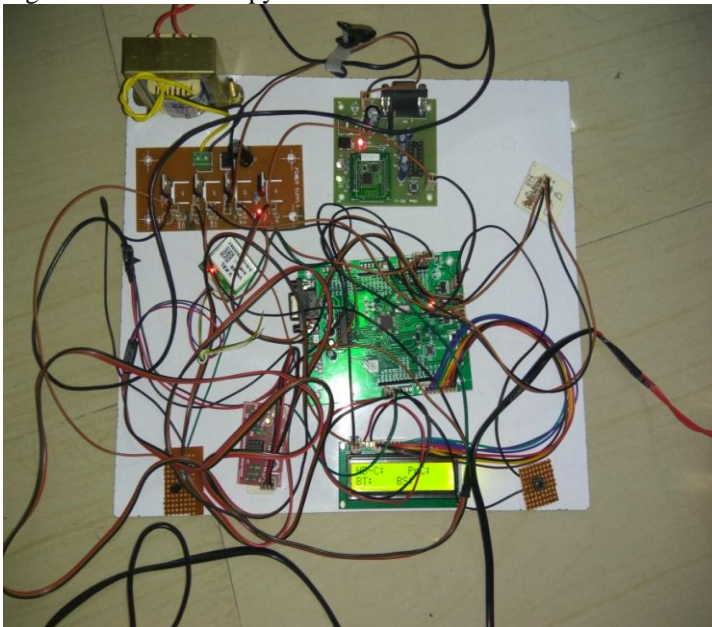


Fig 3.2: Result Photocopy

### IV CONCLUSION

Advantages, to reduce the man power, autonomously transfer between different locations, continuous monitoring system, applications, hospitals, nursing homes, children's hospital .

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