**Chapter II**

**REVIEW OF RELATED LITERATURE**

**2.1 Data logger**

Technically speaking, a data logger is any device that can be used to store data. This includes many data acquisition devices such as plug-in boards or serial communication systems which use a computer as a real time data recording system. However, most instrument manufacturers consider a data logger as a stand-alone device that can read various types of electrical signals and store the data in internal memory for later download to a computer.

The advantage of data loggers is that they can operate independently of a computer, unlike many other types of data acquisition devices. Data loggers are available in various shapes and sizes. The range includes simple economical single channel fixed function loggers to more powerful programmable devices capable of handling hundreds of inputs.

**2.2 Wireless Temperature Data Logger Implemented In a Two Point-to- Single Point Topology Utilizing Zigbee Protocol Through Xbee Radio Frequency Transceiver Modules**

Data Logging is the process of collecting data through sensors. Data logging is usually used in system monitoring and gathering of relevant information at a faster and efficient way than of a human being can. Data logging system are commonly used in gathering information such as environmental data like temperature, sound frequencies, vibrations, light intensities, electrical currents and pressure. Also, data logging systems are now commonly used in monitoring information in the medical field.

This project is a low-cost data logging system used to measure temperature with the use of LM35DZ (Precision Centigrade Temperature Sensor). The temperature sensor is connected to a microcontroller which gathers the data needed and transmit it wirelessly into the receiver device through the use of Xbee RF module. The module will do the A/D conversion and send data wirelessly to the receiver device. This receiver device is connected to a computer via serial port in which the data gathered is displayed and stored. The system’s readings show that the system 97-99 % accurate with the readings in the mercury thermometer as the standard of comparison.

With the Xbee RF module’s physical limitation, the said system has a reliable distance of separation between the transmitting device and the receiver device up to 70 meters.

**2.3 Pulsar - Bluetooth Wireless Heart Rate Monitor**

Pulsar is a Bluetooth wireless electronic device intended to monitor and chart the pulse rate of a person over time. With it continuously monitoring the pulse rate, an application program is available for the end user to view the chart of the pulse rate chart which is available for an iPhone or an Android mobile phone. Physically, Pulsar can monitor the pulse rate of the user without a need of a chest strap unlike the conventional pulse rate monitor locally available. (pulsarbt.blogspot.com, 2013)

**2.4 EL-WiFi-TH Wireless Data Logger**

The model EL-WiFi-TH and its newer version EL-WiFi-TH+ are WiFi-based data loggers intended to gather temperature and humidity of certain vicinity. The gathered data comes with a time and date stamp. Adhering to the 802.11b standards, these data loggers are capable to connect with a new or an existing network. These data loggers are mobile stand-alone devices with a built-in rechargeable battery encapsulated with a small IP55 rated enclosure isolating it from dust and other matter from the external environment. These loggers are fully programmable. Initially theses loggers can be programmed via an embedded USB interface and thereafter wirelessly via the WiFi link using and included software running in a Windows operating system. Programmable parameters include a unique logger name, Fahrenheit or a Celsius temperature units, data logging rate, data report rate, as well as temperature and humidity alarms. The same software acts as a database pool for temperature and humidity data, which the data logger uploads at programmable periodic intervals set.

However, built-in memory seamlessly buffers over 57 days of readings when contact is lost with the WiFi network, the software, or the PC on to which the software is running. Upon the reestablishment of the WiFi connection, the data logger simultaneously uploads its stored contents in the memory to the PC while it’s still logging data. Data is stored on the host PC in comma-separated value (CSV) format, and the host program allows the graphical review of acquired temperature and humidity data along with a dew-point calculation and time and date of acquisition, and seamless data export to Microsoft Excel. (EL-WiFi-TH and EL-WiFi-TH+ Wireless Data Loggers, 2014)

**2.5 ThermaData Wireless Temperature & Data Loggers**

ThermaData Wireless RF Loggers can monitor temperature data remotely from a single logger with a maximum of sixteen (16) loggers to a single base. Data is transmitted wirelessly so loggers can remain in place while data is captured and archived.

These loggers are capable of communicating at a maximum line of site range of 300 feet and transmit to a USB wireless base station of a PC. The system also comes with a security measure in a form of an alarm system and an automatic text message when the alarm conditions have been breached.

Each end device or an RF logger is enclosed in a waterproof (IP66/67) enclosure and o-ring sealed intended to withstand harsh environments. Models exist for ambient recording or product monitoring with fixed or interchangeable probes with a maximum range up to 257°F (125°C). Built-in front panel LED indicators alert you in the field when a reading is outside of safe limits.

Data is collected in ThermaData Studio Software and monitored in real-time. One software system manages the setup, download, archiving, and analyzing of your temperature data. Floor maps or facility photos can be imported onto a dashboard display for convenience in real-time monitoring and locating problem areas quickly. (ThermaData Wireless Loggers, 2014)

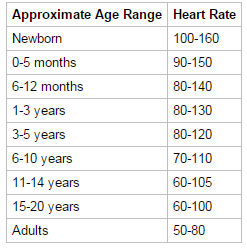
**2.6 Vital Signs**

­­­­­The vital signs is an objective measurement of physiological function in which it is used to monitor a patient’s status prior to or during patient care. Vital signs composed of heart/pulse rate, blood pressure, respiration rate, temperature.

**2.6.1 Pulse Rate**

Pulse rate is the number of times the heart beats per minute. Pulse is the beat of the heart felt by every artery such that arteries carry blood from the heart to the other parts of the human body. One can feel a pulse most plainly over these arteries: Carotid – on each side of the neck, Apical – over heart with the use of a stethoscope and the most common, the radial – located in the wrist. Note that; never use the thumb because there is also a pulse in it. (Dr. Richard Draper, et.al., 2015)

Shown in figure 2.1 is the normal reading for a person. However, recent studies show that, pulse rate readings coming from the ear is more efficient source than the wrist because it an area where blood flows neatly in and out. It provides a much stronger signal and less noise. (Metz, 2014)



**Table 2.1 Pulse Rate normal readings** (Charbek & Christensen, 2015)

**2.6.2 Temperature**

The human body temperature reflects the balance between the heat produced and the heat lost from the body. It is usually measured either in degrees Celsius or degrees Fahrenheit. Normal body temperature of a human body is 37 °C or 98.6°F. There are two kinds of body temperature: Core temperature is the temperature of the deep tissues of the body such as abdominal cavity and pelvic cavity; it remains relatively constant. The surface temperature is the temperature of the skin, the subcutaneous tissue, and fat. It rises and falls in response to the environment. When the amount of heat produced by the body equals the amount of heat loss, the person is in heat balance. (Sircus, 2015)