RADIO PILL

Radio pill is an instrument that transmit measurement by radio impulses from within the body. The block diagram of radio pill is given below,

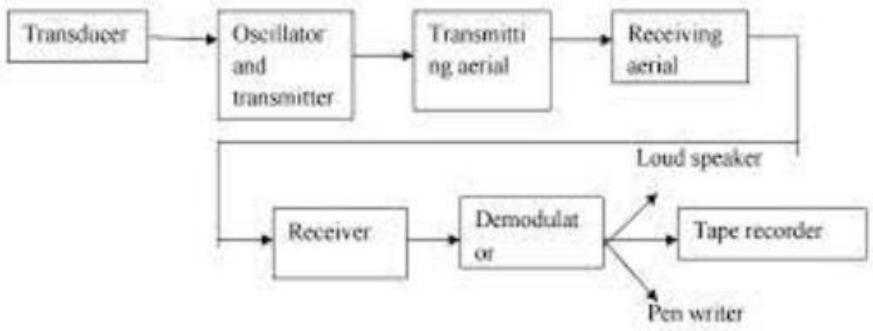

Fig: Block diagram of radio pill

A capsule containing miniature radio transmitter that can be swallowed by a patient. During its passage through the digestive track a radiopill transmits information about internal condition. It consists of transducer sensitive to pH, temperature and pressure. It is used for telemetering continuous, information about one or various variables from human of the gut. Temperature sensitive pills are designed by the medical research council's bio-engineering lab.

The radio pill is a small capsule shaped electronics pill that can be comfortably swallowed by any normal patient. It consists of lens, antenna, transmitters, camera or sensors, battery. It can reach regions such as small intestine and provides the video wirelessly to the receiving device connected to the monitoring system outside the human body and kept at distance of 1 meter.

The transmission of data takes place through the radio communication between electronic pill transmitter and external receiver. Parameters such as temperature, pH and pressure of gastrointestinal tract can be measured, for the detection of diseases and disturbance in gastrointestinal system which prevents the entry of conventional endoscopic tube, a micro pill with single channel radio telemetric function is preferred.

The invention of semiconductors provides ease in development of concise electronic pill capable to carry and transmit huge amount of data at a time without affecting the human body. The diagram below represents the wireless video transmission between transmitter and receiver.

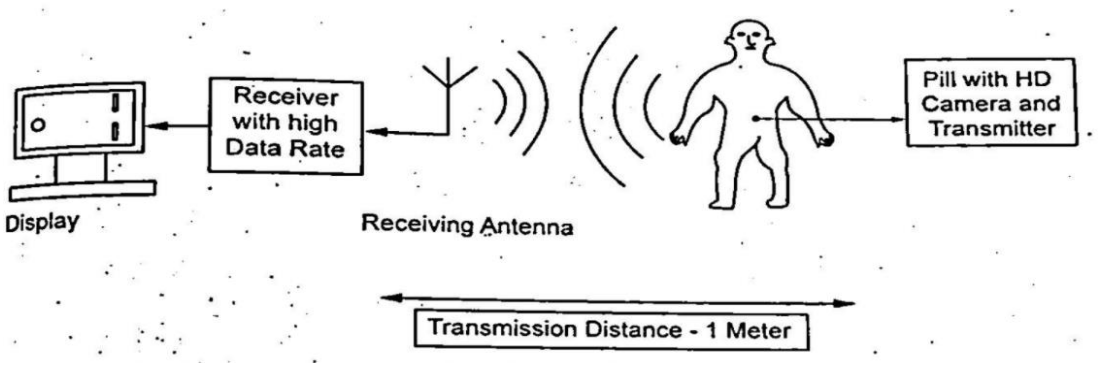

Fig: Wireless video transmission between transmitter and receiver

A radio pill construction requires narrow band transmission and has limited camera pixels. One of the commercially available endoscopic devices designed by the company "Given Imaging" uses radio frequency chip for wireless communication for real time video transmission based on the medical implant communication service band.

The channel bandwidth allowable for this band is limited to 300kHz, the low frequency application provides high transmission efficiency through layers of skin. The fabrication of sensors of electronic pill are done on two silicon chips which is generally kept at the top of the capsule and the first chip encompasses diode, the pH ISFET sensor, temperature sensor and conductivity sensor with two sensors.

The chip has thermometer and oxygen sensor. The method which provides the baud rate of 100Mbps is wideband technology. This technology is currently used in radar, Image processing and In-door entertainment. But the major problem in high frequency is the major loss in body tissue.

Block Diagram

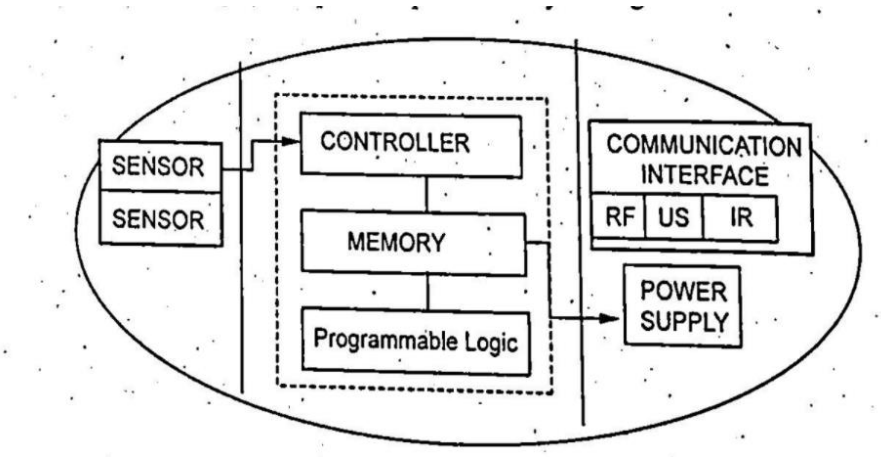

Fig: Schematic diagram of radio pill

All radio pill is powered by a battery, in order to utilize the device in internal remote locations. There is scanning receiver which captures the wireless radio signal from pill through a coil antenna. A computer system is required for the control of data acquisition unit which acquires data in analog form from the scanning receiver. It provides recording of data on the computer. Stable transmission frequency must be constantly maintained.

The transmission frequency is measured with the help of change in temperature. The change in frequency is measured with the help of scanning receiver, and the result obtained is used to evaluate the advantage of crystal stabilized unit. The power consumption of microelectronic including transmitter and sensors connected is calculated to 12.1 milli watt with current rating 3.9mill ampere at 3.1-volt voltage supply, whereas free running radio transmitter consumes 6.8milliwatt.

The temperature measurement is done from $0^{o}C$ to $70^{o}C$. The pH ISEFT sensor operated in constant current mode, with the drain voltage connected to the positive supply and the source voltage changes as per gate potential is grounded. In control chip, the noise from application specific integrated circuit provides a constant level of 3mega volt peak to peak, which provides single least significant bit of analog to digital convertor, the second least significant bit is used to provide an adequate noise margin, and here to have an effective resolution of 8 bits the 10-bit analog to digital converter is used.

The components of capsule must be capable to protect itself from corrosive environment in gastrointestinal tract and it must be nontoxic to the human being but as the battery electrodes are toxic in nature, so care must be taken to prevent leakage of toxic fluids into the digestive system.