

# Wireless and Ubiquity Communication to Bridge the Gap of Space and Time between Patient and Medical Service Provider

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**Abstract** - There is a rise in the record of frequent and premature death lately as a result of heart failure. Situation that could have been rescued but for the time and space divide between the health giver and the victim. An instant help can be offered to such person through wireless monitoring of the health condition, and quick attention be rendered. A portable, light weight, low power consumption mobile wireless monitoring device is designed for outpatients to constantly keep an eye on the state of their health characterized by three physiological vital signs: Heartbeat; Temperature and Blood Pressure. This work takes the advantage of advance semiconductor technology, wireless and ubiquity communication system to design a wireless monitoring device for BP, HBR and Temperature of dwellers in a remote areas. This will afford real time remote monitoring of the vital life signs of the people and seek immediate medical attention as the need arises. Different classes of people can use this device but the target audience for this work are the rural dwellers. Some of the conventional device for this purpose are bulky, expensive and immobile, while some lately designed by other researches require subscription fees by the user. This work has put into consideration the economic aspect to make it affordable for the low income earners.

**Key Words:** Heartbeat, Blood pressure, temperature, semiconductor, ubiquity

## 1. INTRODUCTION

It is obvious that the geometric increase in the population of our dear country will require a great number of health care givers for their wellbeing from time to time and during crisis which will necessitate their visits in the hospital. The record shows that out of about 72,000 medical doctors registered with the Medical and Dental Council of Nigeria, only approximately 50% of them practicing in Nigeria. This few numbers are expected to provide health services for current population of about 182 million in the Country. While the recommendation ratio of doctor to patient by the World Health Organization (WHO) is 1:600, the dearth and shortage of qualified personnel has increased this to 1:3500. This will in no small measure affect the effectiveness and productivity of the sector as a whole, while the poor people especially the rural dwellers will bear this brunt at the expense of their lives [1,2]. Again, the economy recession starting at the developing countries lately has imparted negatively on the standard of living of the citizenry, hence unhealthy life styles have characterized the standards

of living of its majority population. This has in no small way increase the rise in health problem and may continue to increase in years to come if adequate health services with ease is not put in place [2].

Health is wealth, therefore for any citizen to contribute positively to the economy drive of the nation, such individual must be in good frame of mind. Therefore proper routine checks on the physiological vital signals of a person is not negotiable. It is unfortunate that there is a short fall in the required number of qualified medical practitioners to cater for the huge number of Nigeria citizenry. The few qualified ones must be preserved from brain drain and over working, which will be detrimental to their health and reduce their efficiency and productivity. The concern for the well-being of the rural dwellers that work hard in their farms to feed the nation must be paramount to the stakeholders.

The aim of this work is to engage wireless and ubiquity communication for remote telemedicine. A wireless remote monitoring device is designed and implemented to bridge the time and space divide between the medical services and the end users. The heartbeat, body temperature and the blood pressure are the physiological vital signs a doctor looks out for during consultation by any patient. Diagnosis and subsequent counsel starts from this point. The monitoring of these is imperative being indicators of the state of the body wellness of an individual.

A heart beat rate machine is a device that measures the rate of heart beat, computes the beat per minutes for the purpose of tracking the state of heart of a person. The heartbeat of a healthy adult ranges from 70 to 75 bpm for adult. Body temperature measurement device: the body temperature from one person to the other differs and is dynamic throughout the day from highest in the morning time and lowest at night. The normal body temperature of a healthy person ranges between 36.1-37 ° C or 97-100 ° F. Blood Pressure: The walls of the blood vessels constantly experiencing pressure during circulation. The severity of this depend on the healthy state of the heart. The level of this parameter must be under control to avoid damage to the heart and eventual heart attack and death [3].

Sometimes, spontaneous and critical decision will be required to save a live and administer appropriate medical services needed by an ill person. Statistics show that one human life is lost every minute across the globe most time, the cause of such frequent death is as a result of heart failure

called cardiac arrest and late response by medical work force due to time and space barrier.

Therefore research into and development of this device becomes handy and timely to arrest such unpleasant experiences of life. This device is reliable, energy efficient and capable of real time application of consultation between a patient and his medical giver.

This device is targeted at the rural dwellers especially the feeders of the nation through their tireless hard work in the farm settlements where access to quality health services is hard to lay hold on in time. Distances of kilometres may be covered before they can enjoy such facility. The category of people in mind are in their late forties, this people in this stage are highly prone to diverse ill health conditions.

## 2. REVIEW OF PREVIOUS WORK

The increase in ill health around the world as a result of unmanaged lifestyle and change in weather and the decline in the number of qualified health givers in the health sector propels the research industry for a help through the semiconductor technology advancement. The widely acceptance of wireless technology in the recent times can be explore to lend a helping hand to the health care sector to bridge the gap of time and space in delivery of initial health services.

Some works exist on wireless innovations ranging from different frequency of operation to achieve a remote telemedicine. [4] in their work did an extensive work on the

working principle of a Heartbeat and Temperature Monitoring System for Remote Patients using Arduino. While [5,7] in their works made use of ZigBee wireless technology to monitor heartbeat of adult as well as fetal. This technology is characterized by short range communication, low power consumption and low cost. It affords easy communication without wires and cables around the home, factories and hospitals. Another author [6] designed wireless monitoring device for CO<sub>2</sub>, temp, BP and HB using ZigBee wireless technology. This author also used a ZigBee technology for the development of wireless monitoring system [7].

This work engages wireless technology at radio frequency range as a distinction from previous works by other researchers, also an additional physiology vital signal called blood pressure is included for monitoring with our wireless remote monitoring device. The operating frequency of this device is 450MHz, the potential of this frequency for wider coverage will be exploited. This device and its techniques offer a relief to health worker and saves the patient the stress of travelling to hospitals.

## 3. OPERATIONAL METHODOLOGY

This paper intends to see to how the proliferation of wireless communication can be engaged to alleviate the stress of over burden on part of medical practitioners while easy access to real time health care is guaranteed for the rural dwellers through remote telemedicine facility. According to [6,8,9, 10], An adapted typical block diagram of the device circuit for transmission and reception link is presented in Fig 1 and 2.

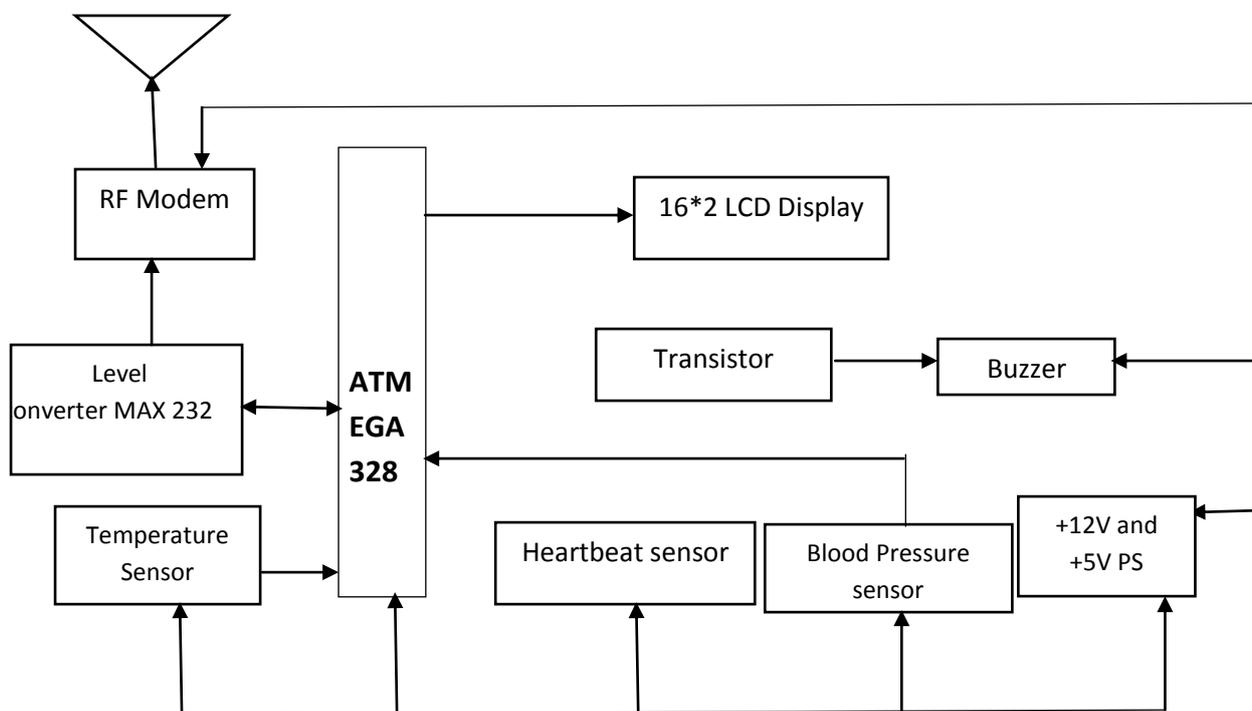


Fig 1: Block diagram of wireless remote monitoring device transmitter

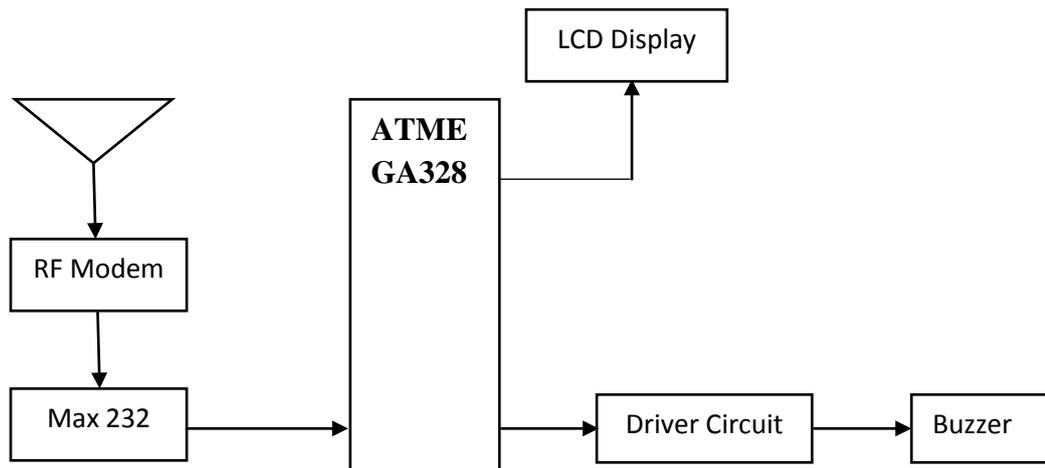


Fig 2: Block diagram of wireless remote monitoring device Receiver

### 3.1 Operation of the device

The system consists of an infrared LED that transmits an rf signal through the wrist of the subject. Three sensors are contained in data sensing module such as temperature sensor, heart rate sensor, and blood pressure. Temperature sensor is used to measure the body temperature. Heartbeat sensor is used to measure the function of heart by blood flow through wrist. The output of each sensor is interfaced with Analog to Digital circuit (ADC) pins of microcontroller. LCD is used as a display unit in connection with microcontroller for displaying the current details of physiological parameter with buzzer for the alert. The microcontroller: ATMEGA328 used in this work operates in the frequency range of 415 MHz per second used for data transmission, which can easily penetrate beyond three floors of a building and go over 30 feet's in open space. It uses temperature sensor, heartbeat sensor, power supply, The signals from the three sources are sent to the health giver wirelessly through rf wave at 450MHz while the receiver end see a display of the measured data for necessary action. The temperature signal is in form of electrical voltage, therefore an ADC is required for proper interpretation in digital form. The output of the ADC is sent to port A of the MCU for process and finally display it on the LCD and also send it wirelessly to the end users.

### 4. DISCUSSION

The work focuses on the design and implementation of an inexpensive wireless remote monitoring device capable of measuring heart beat rate, body temperature and the body blood pressure of individual or patient and wireless transmission of same to medical assistance giver where the data are displayed on the LCD for consumption of the receiver for adequate diagnosis and quick response of attention. This system will facilitate rapid response in emergency thereby save the life of the person involved, and saves time of both party. The Tx/RX pair used in this work

operates at frequency spectrum of 450MHz with coverage area up to 100m and the data speed of 1-10kbps [6]. This development becomes very imperative considering the highly busy schedule and lifestyle people engage in today. Wireless monitoring system offers real time medical attention regardless of the time and space divide. Through the remotely wireless communication, patients get in touch with medical service provider for timely and appropriate advice. In case of critical condition by the indication of the LCD display, a signal through the buzzer is sent to the appropriate personnel for immediate help.



Fig 3 : The complete wireless remote monitoring device with LCD

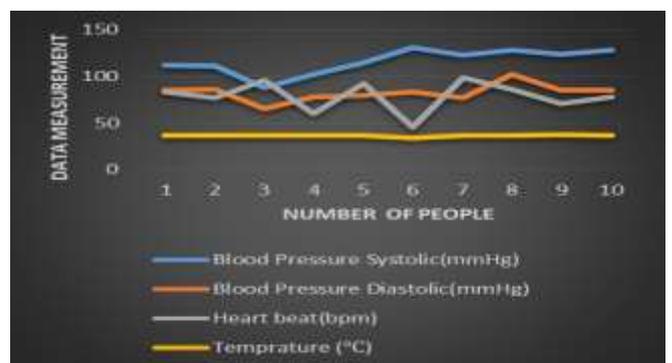


Chart 1 : Data Measurement for 10 People with the Device (Day1)

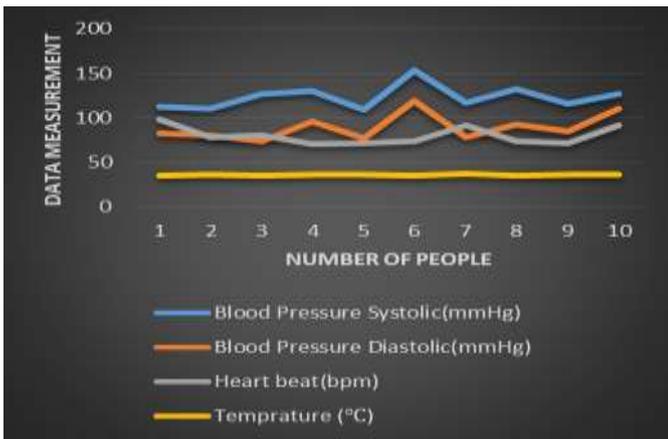


Chart 2 : Data Measurement for 10 People with the Device (Day2)

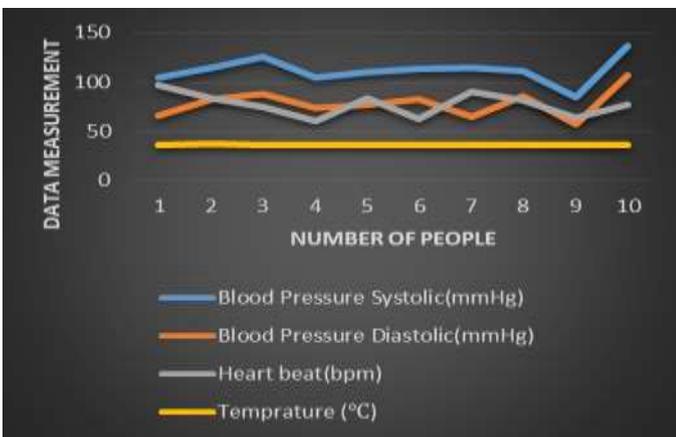


Chart 3: Data Measurement for 10 People with the Device (Day3)

Charts 1-3 are the results of measurement HBR, BP and Temperatures of ten selected people for three days. Figs 3-6 are the diagrams of the different parts of the constructed wireless heart beat rate, blood pressure and temperature monitoring device. The practical demonstration of the device for taken measurement of a person is also shown in Fig 7.



Fig 4 : The Complete Wireless Monitoring Device



Fig 5 : The Wireless Monitoring Device Receiver



Fig 6 : The Wireless Monitoring Device wrist Wear



Fig 7 : HBR, BP and Temp Measurement with the Constructed Wireless Monitoring Device.

## 5. CONCLUSION

It is an established fact and experience that physical contact between the doctor and a sick person in the hospital demands a great deal of stress and time consuming, whereas this hassle can be avoided using this device and telemedicine services. The weariness induced on the part of the doctor who has a long queue of patient waiting for consultation everyday will be taken out of the way and this precious time will be devoted for better things that will enhance better efficiency and productivity of the same. A health worker can remotely monitor the vital health parameters of the person of interest. In the recent times, health failure problem has been on the increase rise and has been noted to be the cause of sudden and untimely death across all age groups. This is due to stress filled lifestyle people engage in all over the globe in pursuant of basics things of life. The society at large will embrace the idea to have a system handy with which they can abreast of the state of their help on the go as well as receive appropriate medical attention without delay.

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