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DESIGN AND DEVELOPMENT OF ULTRA LOW POWER WIRELESS PROGRAMMABLE COMPACT DEVICE

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ABSTRACT

This project is about to design and development of ultra- low power wireless device. Which is used for wireless devices and wireless applications. Requirements the design of microelectronic circuits with the low power blow out. Additionally, the size and complexity of the chip are parallel increases with the demands. In order to extend the life span of battery powered wireless sensor network lumps. This move on from the power module, nRF24L01 and Atmega328 to design ultra- low power wireless module. The lumps increase the power module's ability maximally. At the same time, it makes use of ultra- low power data processing module. The energy consumption of wireless device which has the practical importance of expanding the application and its effects ona wireless device.

KEYWORDS: *At Mega 328, nRF24L01, Arduino, Basics of Power, Transistor as Switch, Power Filter, Noise Rejection*

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1. INTRODUCTION

In the same way that fuel consumption is important in everything from scooters & oil tankers, power consumption is a main parameter in electronics applications. The obvious applications to which power consumption is critical, battery-powered applications, like that home thermostats & security systems. Low power also leads to low power supplies, low coast batteries, enables products to be powered by signal lines. Less the cost of the end-product. As a result, low power consumption become a main parameter of microcontroller designs.

Generally, power consumption is the product of operating voltage (Vcc) multiplied by the current consumption (Icc), current consumption is usually the one measure considered when describing the power characteristics of the chip. This is a mistake cause of declining the operating voltage directly down the current consumption and the overall power drain. [1]. Current consumption up directly with the system clock frequency so getting the system clock as low as possible is critical to keeping power consumption decreases.

The clock frequency is affected by factors that include the microcontroller's surroundings and peripheral, the architecture, & the instruction set. RISC microcontrollers open in a single clock cycle, but architectures divide the clock low in the same way as CISC architectures do before feeding into the CPU. This situation comes first to confusion about what clock frequency is really required to open the target application.

Designer's attention to the Instruction set architecture when reading the current consumption numbers in a microcontroller's datasheet.

Generally, all datasheets provide power consumption numbers for the microcontroller with no peripherals running. The external current shown by the peripherals should be taken into account all MCUs have peripherals and their contribution to power drain may be significant. Temperature is one of the factors. Higher temperatures give to high power consumption.

The equation for energy is given by,

$$w = p * \Delta T$$

Such that P is the average computational power, and ΔT is the time per operation. In computing, we can reduce energy per operation either lowering the power consumed in the computation logic or by declining the amount of time required per operation. Sometimes going up power shall be traded for a significant declining at opening time such that there is more benefit in energy conservation.

The new type of energy consumption is switching power, shown by the given formula.

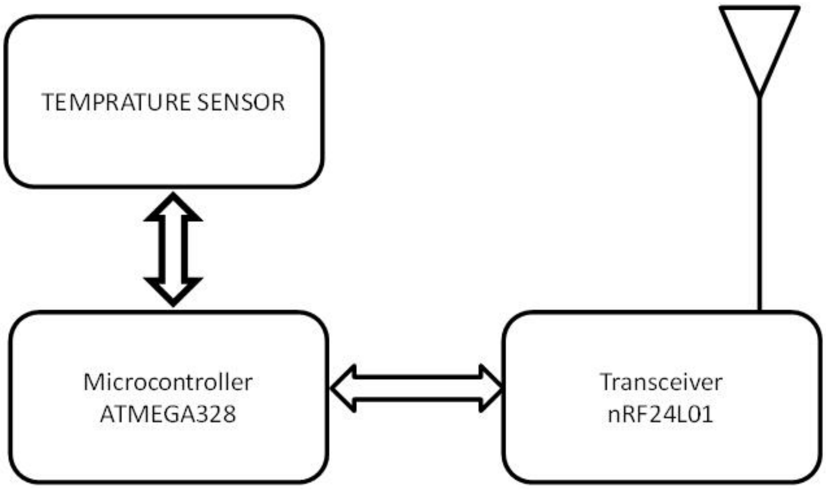
$$P = \left({}^{1}\!/_{2}\right) * C_{LOAD} * f * (V)^2$$

C_{LOAD} is the capacitance the transistors should drive which is made up of wire and gate capacitance. The frequency, f is the rate at which the transistor switches and depends on switching activity information [2].

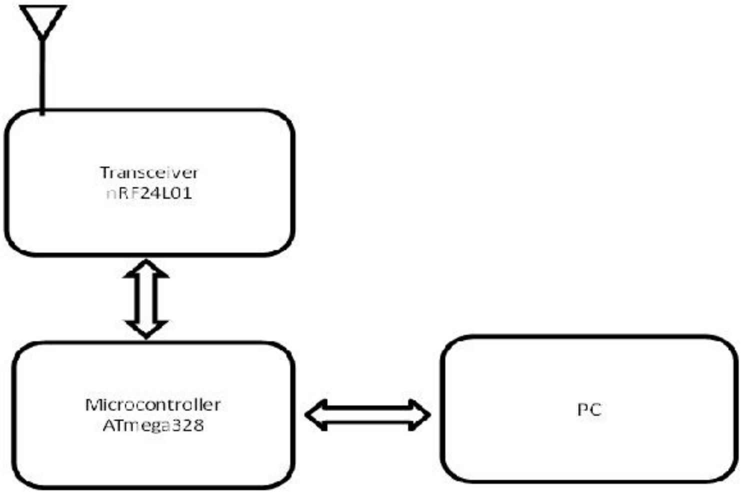
Microcontroller and radio receiver, transceiver through circuit design and its work results is better getting [3]. In this paper section, II is about the methodology, section III is demonstrates the testing and resulst and lastly, section IV gives a conclusion about the presented work.

2. METHODOLOGY

2.1. System Architecture



(a)



(b)

Figure 1: (a) Transmitter Module (b) Receiver Module

Figure (1) shows the total design of the wireless sensor network. The RF transceiver is connected to the microcontroller via SPI. It is also connected to the temperature sensor. Which is since the temperature of any room, heat, etc. Receiving side, alike architecture is used. A microcontroller accesses the transmitter and receiver through SPI and sends data to a computer application via UART.

2.2. System Diagram Circuit

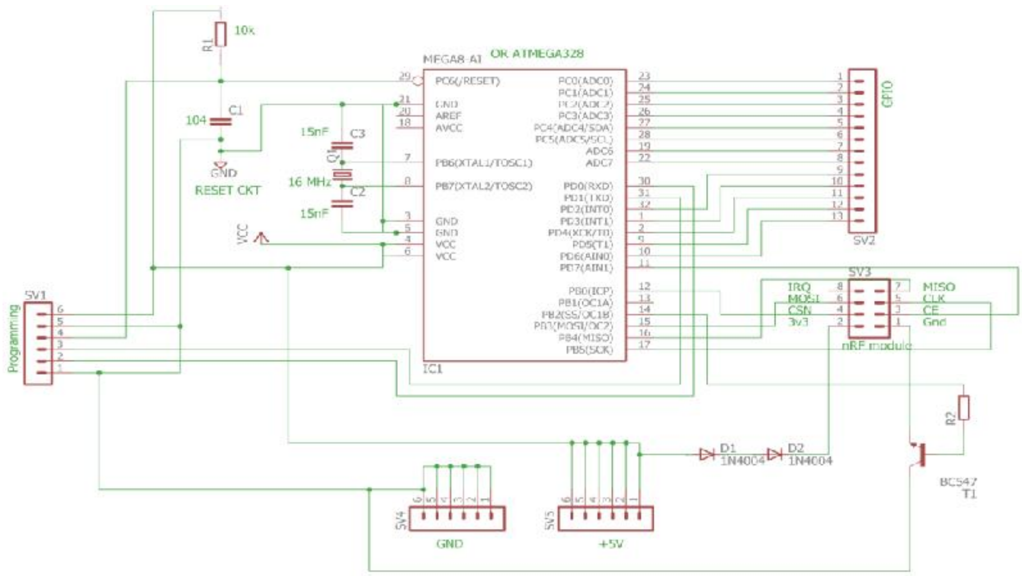


Figure 2: Circuit Diagram of System

It is based on atmega328 and Nrf24L01.its communication range up to329feet in ideal condition.

A host microcontroller can communicate and configure the Nrf24L01 over a 4 pin serial peripheral interface. The configuration register is accessible through the serial peripheral interface connected.

The chip voltage regulator accepts supply voltage to 1.9 to 3.6 v. When using the nRF24L01 with an MCU, sure to use the 3.3v output pin from the MCU to power the nRF24L01 module.

The nRF24L01 module having 5v tolerant i/p, which allows for direct connection of SPI pins to the MCU.

The wireless transceiver module includes an interrupt request pin which can be used to wake the host microcontroller from sleep when the module receives a transmission providing great power conservation in devices.

2.3. System Flow Chart

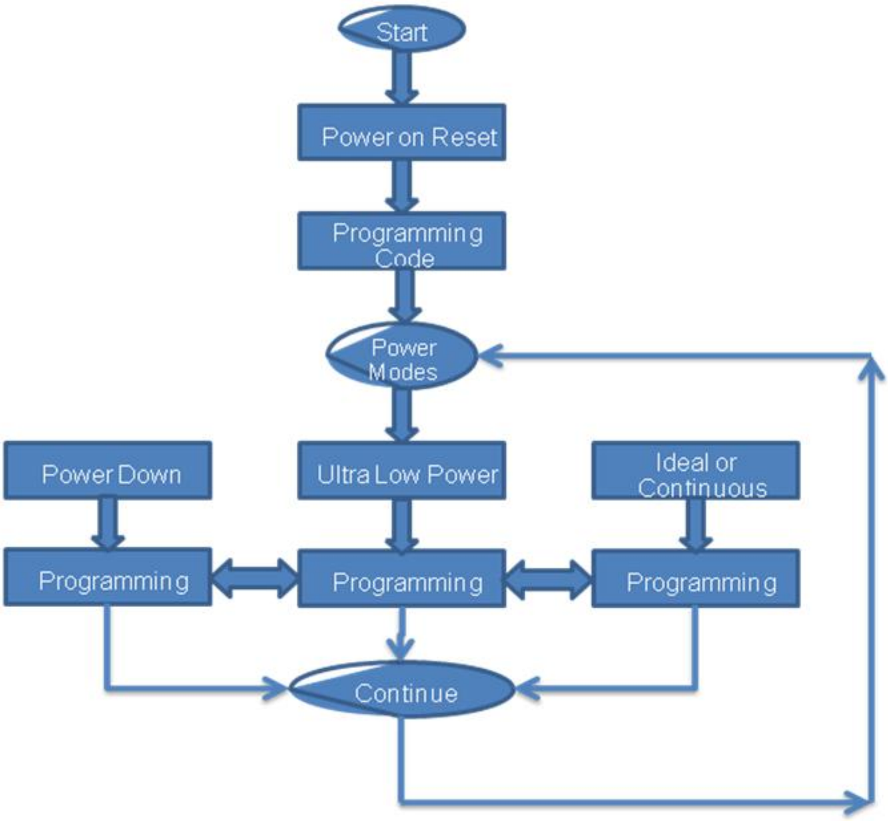


Figure 3: Flow Chart of System

When the circuit power ON the capacitor at Reset pin will short to ground at T=0 times and when the capacitor will charge at T=T time, then the reset pin will open with ground thus the auto reset the MCU when it power up.

Then the MCU will jump to the coding there are three power modes.

- Power down mode
- Ultra low power mode
- Ideal or continuous mode

In the power down mode MCU will turn off the RF and other peripheral internally in MCU and when it will be called by any external interrupt then it will choose ideal or ultra low power mode.

In ultra low power mode the program will turn off the unused peripheral internally in MCU meanwhile the RF module is turned on.

In ideal or continuous mode the user can use the MCU in a normal way of programming .when user need higher performance the user need to choose this mode but the major drawback is in this mode the MCU and the RF will consume the large power from the power source.

3. SYSTEM TESTING RESULTS

Table 1: System Output Current for Different Modes

Sr. Number	Different Mode	Output Current
1	Baseline code	17.660mA
2	1+ Open drain mode	13.119mA
3	1+2+Power down mode	0.381mA
4	1+2+3+Disable ADC	0.058mA
5	1+2+3+4+Disable BODR	0.000328mA

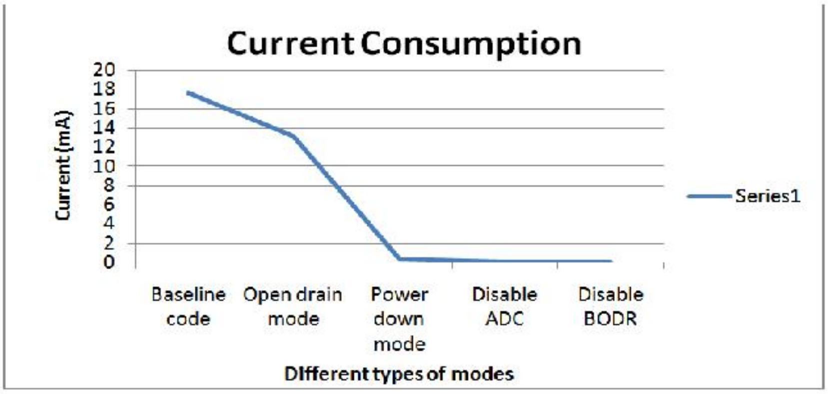


Figure 4: Current Consumption Chart for Different Modes

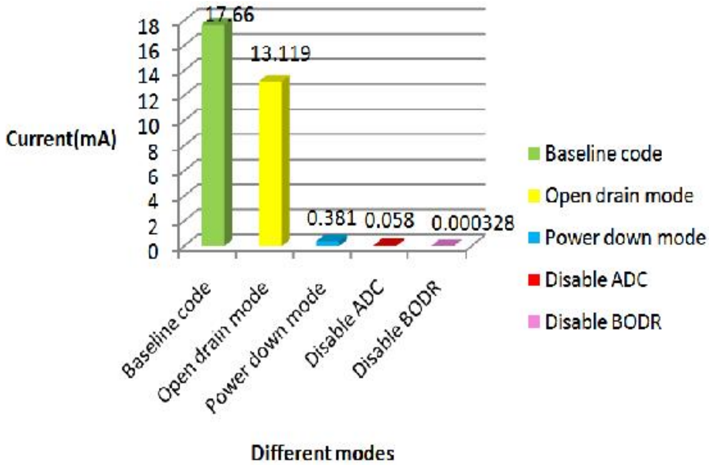


Figure 5: Current Consumption Different Plots

Above shows graphs are defining that different node and junction having a different result of current. so from that at the baseline code the outcomes of that is 17.66mA. Another one is open drain mode on that result is 13.119mA displayed. At the mode of power down at that time cycle is working in a very deep mode so from that output is 0.381mA get. Obtaining 0.058mA value on the point of disable ADC. Lastly, final value, 0.00032 mA acquired which is very down value in the current so from that we shows that power consumption is very low and battery and any cell life is going very long.

CONCLUSIONS

The project is about to development of ultra -low power general purpose device that can be used in any wireless application. As well as it is a connection to any electronic device wirelessly and .it's through consume of current down to microampere. So we can save energy and money from that. Future work in that we can get consumed in microampere but if anybody work on that and power ratio change, some parameters and technology make used different than maybe get output in neon ampere also. It could be compatible with any wireless ultra -low power communication application like water level monitoring, wireless parking sensor, shopping malls, toys, any medical and biomedical applications, and industrial and commercial applications.

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