Dhirubhai Ambani Institute of Information and Communication Technology

April 13, 2019

Analog Circuits
EL 213

"Detect whether person is dead or alive using Arduino UNO and Pulse sensor(SEN 11574). Transmit message using Xbee module."

Assigned by : Prof. Rutu Parekh

Student Name	ID
Harsh Patel	201701251
Viraj Patel	201701251
Kushal Shah	201701251
Rudra Patel	201701033
Karan Jhaveri	201701154
Tathagat Shah	201701053
Karan Pawar	201701132
Raj Vaniya	201701097
Jay Dev	201701425
Sanket Chaudhari	201701247
Ronak Jain	201701419

ABSTRACT

This project demonstrate the working of XBee modules and SEN 11574 sensor to detect whether a person is dead or alive. The idea is to use SEN 11574 as a heart rate monitor and the data received from the SEN 11574 sensor will then be transmitted through XBee modules which we will be using to detect whether the person is alive or dead through the code written in arduino.This device is especially important for people who need to monitor these parameters due to certain health conditions, such as asthma or congestive heart failure.

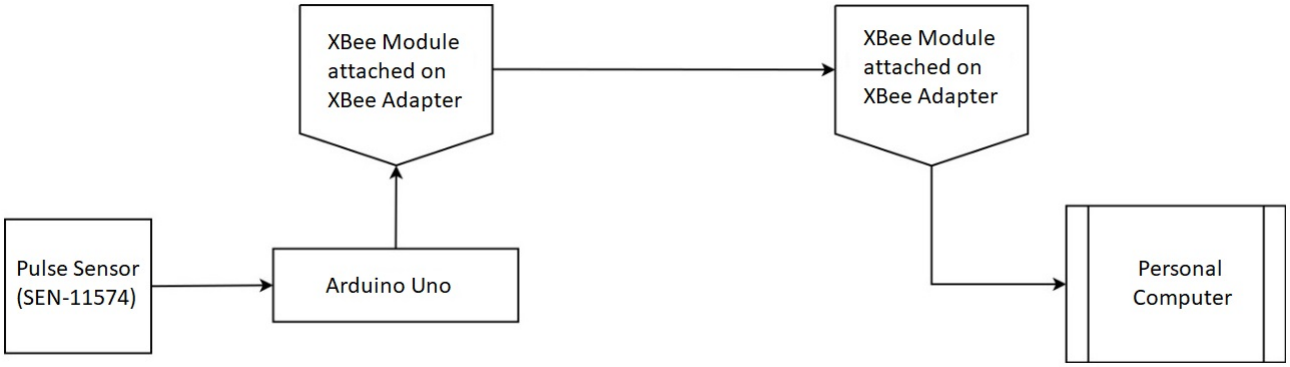
Contents

1 OBJECTIVE

The objective of this project is to create a working model for calculating Pulse rates of a person so it can be used along with many other devices using different sensors to monitor overall health of a person. Alone, this model can only calculate Pulse Rates in blood with the help of a arduino and XBees(for transmission of information) but with the help of many other models it can keep a check on person's health by calculating various parameters.

2 BLOCK DIAGRAM

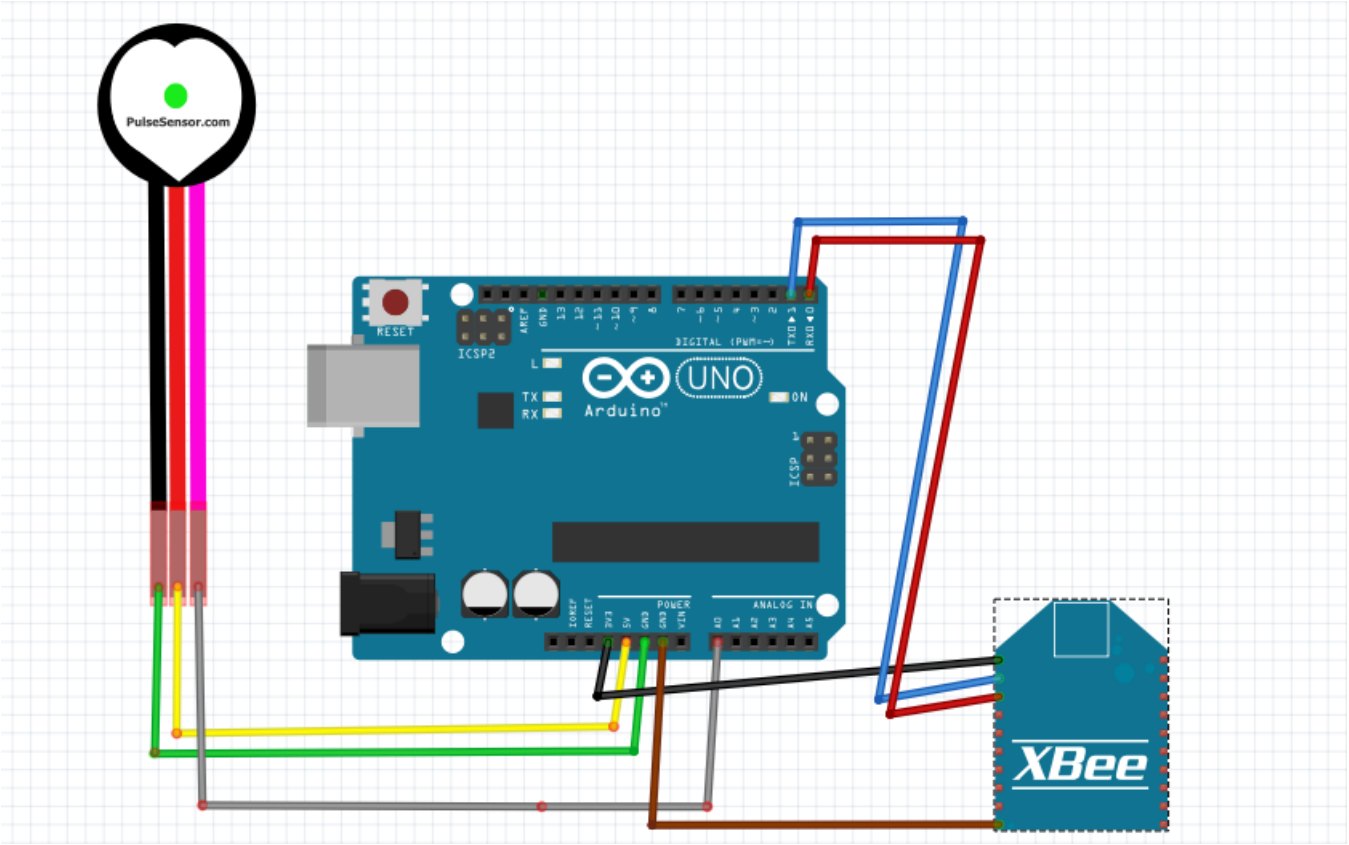
Following is the block diagram for calculating pulse rates in blood and displaying on screen.



Pulse sensor detects whether a person is alive or dead and then the data of dead or alive is transmitted wirelessly through two Xbees and then displayed on Personal Computer.

3 CIRCUIT DIAGRAM

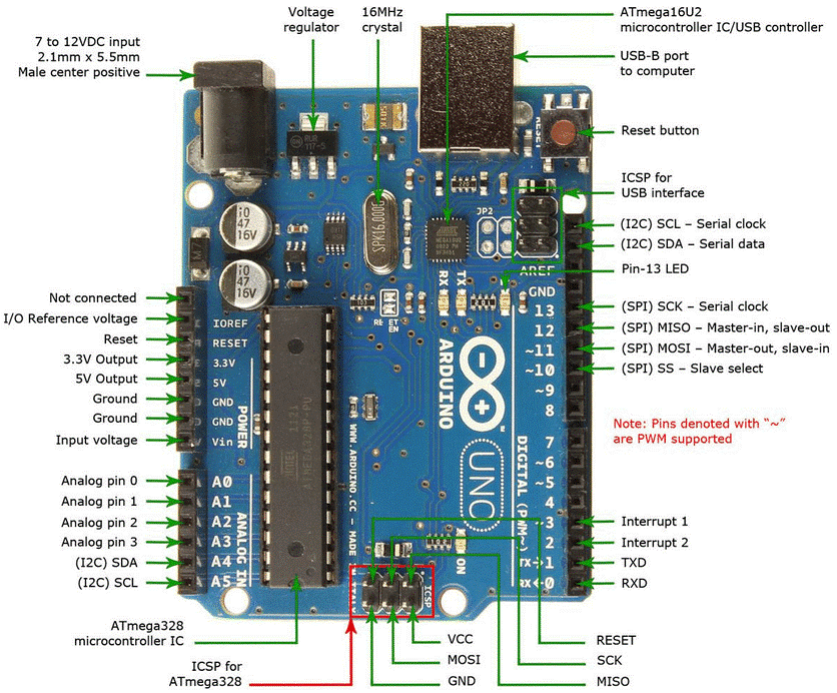
Following is the circuit diagram for calculating pulse rates in blood created using Fritzing Software.



Above figure shows the circuit diagram for pulse sensor Arduino and Xbee connected together.It shows all the connections between the Arduino pins and Xbee pins. Xbee shown is the transmitted Xbee, the receiver Xbee will be connected to the Computer Screen or any screen for showing the heart rate. Data from transmitter Xbee to the Receiver Xbee is transmitted wirelessly.

4 TOOL'S DESCRIPTION

4.1 Arduino UNO



The Arduino Uno is a microcontroller board based on the ATmega328. It has total 20 pins out of which 6 pins are analog pins and 14 are digital pins.
The Analog PINs are numbered from A0 to A5 with 10 bits of resolution (1024 bits).

1. LED: There is a built-in LED which is digital pin 13. The LED is on when the PIN value is high and LED is off when the PIN value is low.
2. Input voltage (Vin): This PIN is used as an input voltage when using an external power source.
3. 5 Volt Pin: This PIN outputs a regulated 5V.
4. 3V3 Pin: This PIN outputs a regulated 3.3V. Maximum current drawn is 50 mA.
5. GND: Ground Pins.
6. IOREF: This PIN provides the voltage reference with which the microcontrollers work.
7. RESET: To reset Arduino.

PIN NUMBERS AND THEIR FUNCTIONS

1. Serial/UART

   a)Pin 0: RX (Receiver PIN)

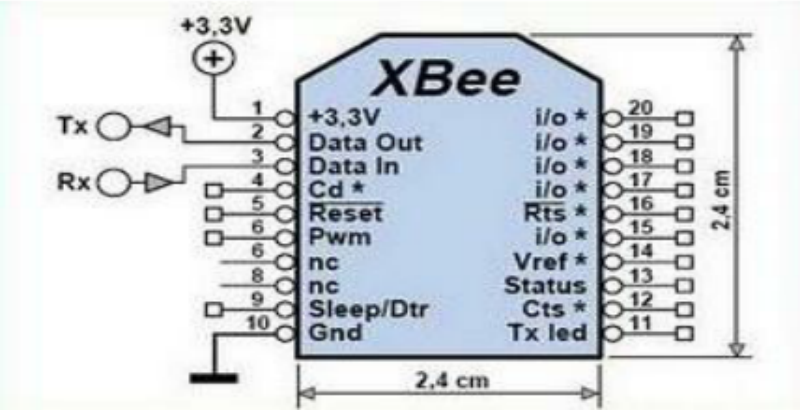
   b)Pin 1: TX (Transmitter PIN)

   These PINs are used to transmit and receive data.

2. External Interrupts: PIN 2 and PIN 3
3. Pulse Width Modulation (PWM): Pin 3,5,6,9,10,11 These PINs can provide 8-bit PWM output.
4. SPI(Serial Peripheral Interface): These pins support SPI communication using the SPI library.
5. TWI (Two Wire Interface): A4 or SDA pin and A5 or SCL pin. These PINs support TWI communication using the Wire library.
6. AREF (Analog Reference): This provides reference voltage for the analog inputs.

4.2 XBee and XBee Board

XBee devices communicate with each other over the air, sending and receiving wireless messages. The devices only transfer those wireless messages; the major shortcoming of the devices is that they cannot manage the received or sent data.
However, the limitation is later removed as they can communicate with intelligent devices via the serial interface.
XBee devices transmit data coming from the serial input over the air - wireless medium, and they send anything received wirelessly to the serial output. A combination of both processes receiving and sending makes XBee communication possible. In this way, microcontrollers or PCs can control what the XBee device sends and manage incoming wireless messages.



One can identify the two types of wireless data transmission in an XBee communication process:

1. Wireless communication: This communication takes place between XBee modules. Modules that are supposed to work together need to be part of the same network and they must use the same radio frequency. All modules that meet these requirements can communicate wirelessly with each other.

2. Serial communication: This communication takes place between the XBee module and the intelligent device connected to it through the serial interface.

ZigBee defines three different device types: coordinator, router, and end device.

Coordinator :

1. ZigBee networks always have a single coordinator device. This device Starts the network, selecting the channel and PAN ID. Distributes addresses, allowing routers and end devices to join the network. Buffers wireless data packets for sleeping end device children.
2. The coordinator manages the other functions that define the network, secure it, and keep it healthy. This device cannot sleep and must be powered on at all times.

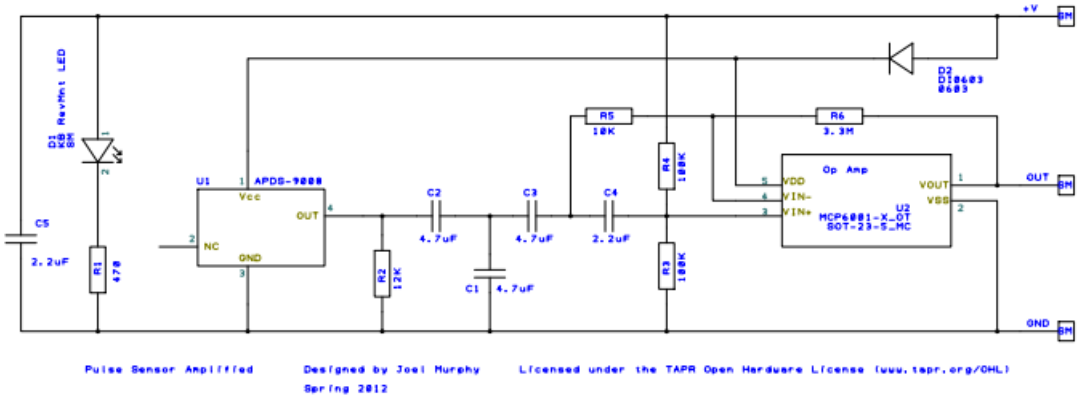
Router :

1. A router is a full-featured ZigBee mode. This device can join existing networks and send, receive, and route information. Routing involves acting as a mes-

senger for communications between other devices that are far apart to convey information on their own.

2. Can buffer wireless data packets for sleeping end device children. Can allow other routers and end devices to join the network. Cannot sleep and must be powered on at all times. May have multiple router devices in a network

4.3 SEN 11574(Pulse sensor)



Heart rate data can be really useful whether you're designing an exercise routine, studying your activity or anxiety levels or just want your shirt to blink with your heart beat. The problem is that heart rate can be difficult to measure. Luckily, the Pulse Sensor Amped can solve that problem!

The Pulse Sensor Amped is a plug-and-play heart-rate sensor for Arduino. It can be used by students, artists, athletes, makers, and game mobile developers who want to easily incorporate live heart-rate data into their projects. It essentially combines

a simple optical heart rate sensor with amplification and noise cancellation circuitry making it fast and easy to get reliable pulse readings. Also, it sips power with just 4mA current draw at 5V so it's great for mobile applications.

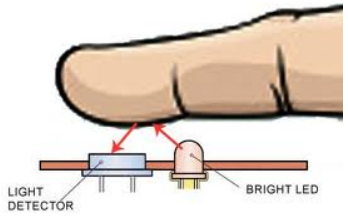
Simply cliping the Pulse Sensor to earlobe or finger tip and pluging it into 3 or 5 Volt Arduino it is ready to read heart rate! The 24" cable on the Pulse Sensor is terminated with standard male headers so there's no soldering required.

4.3.1 Features

1. Includes Kit accessories for high-quality sensor readings
2. Designed for Plug and Play
3. Small size and embeddable into wearables
4. Works with any MCU with an ADC
5. Works with 3 Volts or 5 Volts
6. Well-documented Arduino library

4.3.2 How it Works!

Heart beat sensor works on a very basic principle of optoelectronics. All it takes to measure you heart rate is a pair of LED and LDR and a microcontroller.



What we do to measure the heart rate is, first we will detect the heart beat/pulse and count the pulses for one minute to get the beats per minute. So in order to detect the pulse we will pass light (using an LED) from one side of the finger and measure the intensity of light received on the other side (using an LDR). Whenever the heart pumps blood more light is absorbed by increased blood cells and we will

observe a decrease in the intensity of light received on the LDR. As a result the resistance value of the LDR increases. This variation in resistance is converted into voltage variation using a signal conditioning circuit usually an OP-AMP. The signal is amplified enough to be detectable by the microcontroller inputs. The signal given to the microcontroller input will look somewhat like shown in the image above in a oscilloscope. The microcontroller can be programmed to receive an interrupt for every pulse detected and count the number of interrupts or pulses in a minute. The count value of pulses per minute will give you the Heart rate in bpm (Beats Per Minute).

4.4 Jumper Wires

A jump wire (also known as jumper wire, or jumper) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.

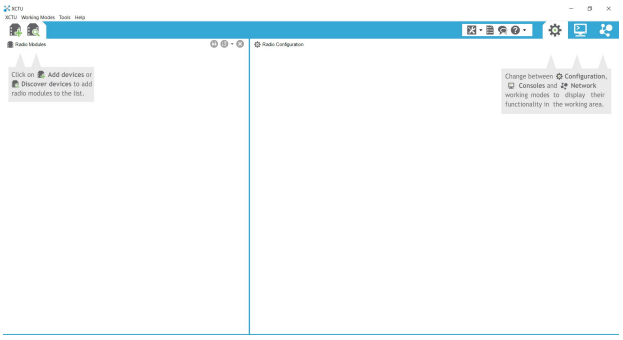
5 USED SOFTWARE

5.1 Arduino Software

The open-source Arduino Software (IDE) makes it easy to write code to program arduino of different kind and upload it to the board. It is user friendly software to work with arduino. Different libraries for different sensors can be installed in this software.

5.2 XCTU Software

This is the XBee Configuration and Test Utility Software. First of all, it is used to configure both ZigBee transmitters and receivers i.e. to set the common IDs (PAN ID) in both transmitter and receiver so that ZigBee modules can form a network and the data can be received wirelessly.



6 DESCRIPTION AND WORKING

6.1 Description

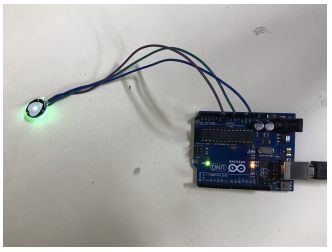
Our project's Aim is to determine whether a person is dead or alive using sensors.

The sensor that we have used in the project is PULSE sensor(Sen - 11574). This sensor determines HBM(Heart-beats per minute).

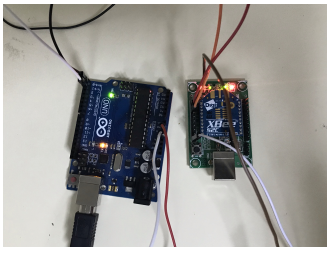
In addition to this we have made a system, which will alert people and send a SOS on sudden changes in heart beats. Sudden increase/decrease in heart beats would also send alerts, which would provide medical health to the user.

6.2 Working

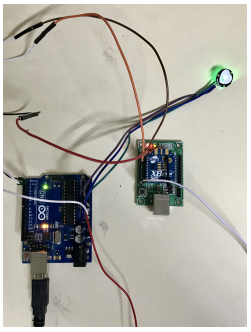
6.2.1 Connections



The above figure shows the connections of the pulse sensor(SEN 11574) and Arduino UNO. More information reagarding the pins of Arduino UNO and the sensor is given in the TOOL's DESCRIPTION section.

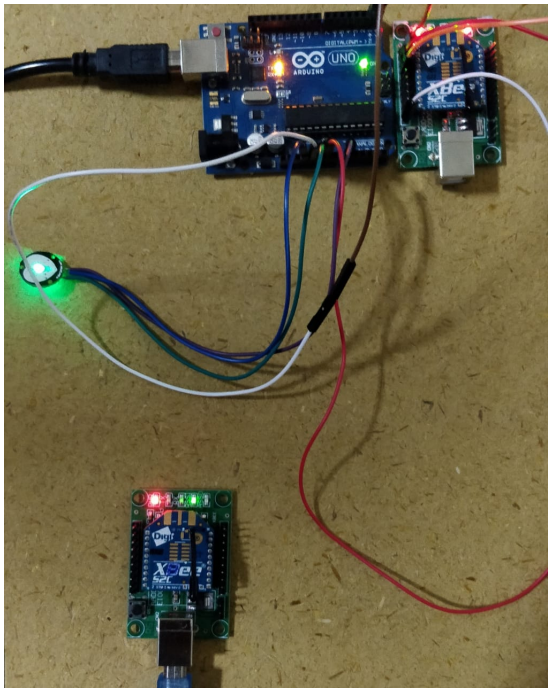


The above figure shows the connections of Xbee and Arduino UNO. More information reagarding the pins of Arduino UNO and Xbee is given in the TOOL's DESCRIPTION section.



The above figure shows the connections of the pulse sensor(SEN 11574), Arduino UNO and XBEE. More information reagarding the pins of Arduino UNO, pulse sensor and Xbee is given in the TOOL's DESCRIPTION section.

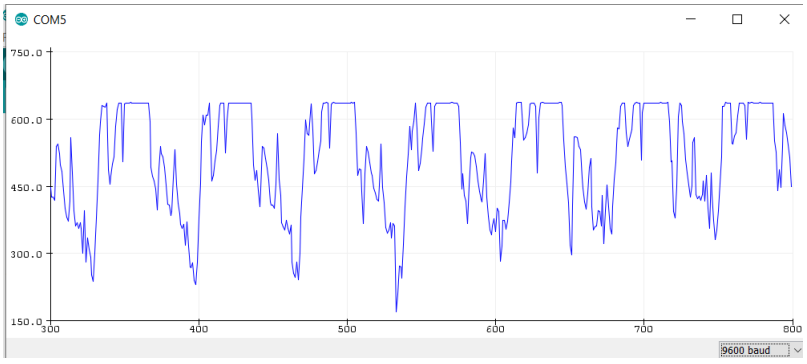
6.2.2 Demostration



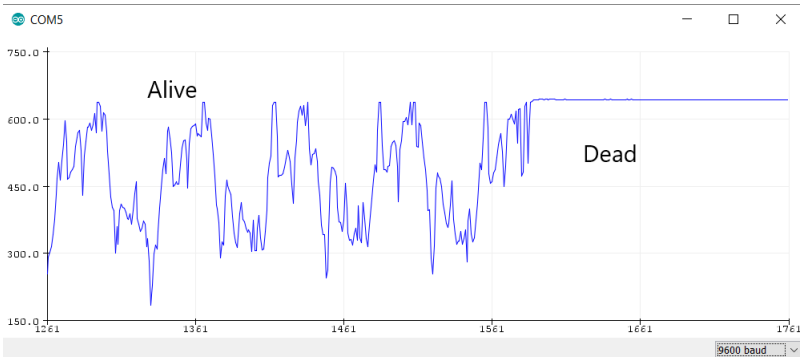
As shown in the figure above, the pulse sensor(SEN 11574) is connected to the arduino which is connected to the Xbee using Tx and Rx pins. When we put our finger on the pulse sensor, then according to the property of sensor the intensity of light detected by LDR decreases. This decrease in intensity is due to the more absorption of the light by the increased number of blood cells pumped by the heart. So, with the values of intensity of light, it is calculated that whether the person is

dead or alive. This calculated data is transmitted to the the other Xbee wirelessly. Then the other Xbee displays the data on the screen. The connections are explained above int the description part.

7 RESULTS



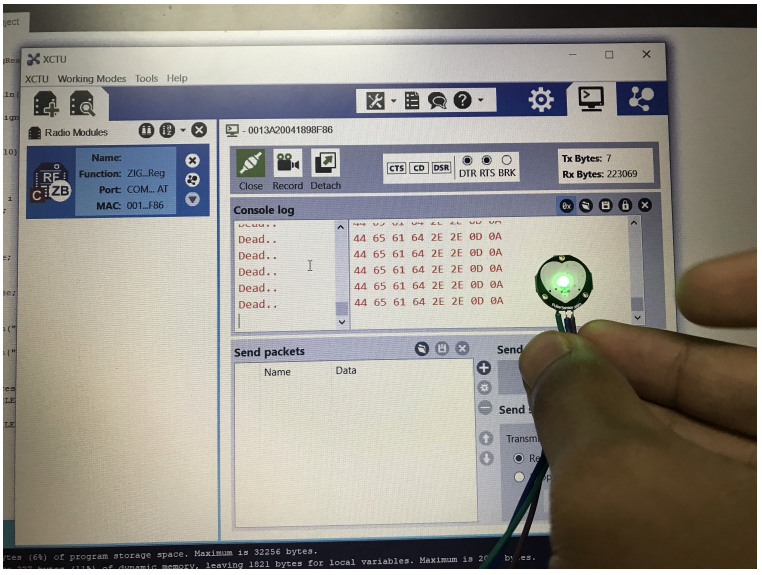
Above graph shows the variation of intensity of light w.r.t Time for an alive person. When the heart pumps blood, due to increase and decrease of blood cells in the alive person there is variation of intensity of light and due to this there are maximas and minimas in the curve. The curve traces similar path because the heart continuously pumps blood due to which there will be continuous change in the intensity of light(overall decrease in intensity due to absorption by blood cells). From this continuous variation of intensity of light, we can conclude that the person's heart is pumping and he is alive.



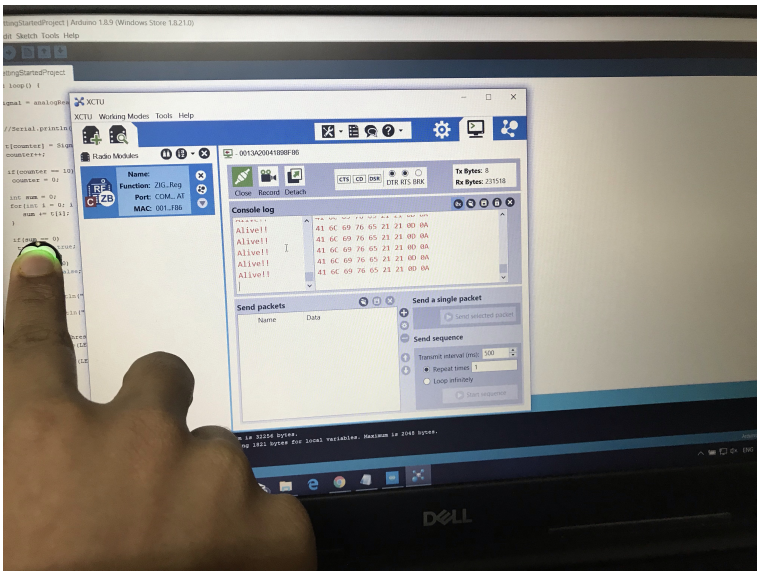
Above graph shows the variation of intensity of light w.r.t Time when the finger of an alive person is taken from the sensor after putting it. So, in the "Alive" part of the graph, there is variation in the intensity of light and in the "Dead" part of the graph there is a straight line which is at the maxima for the alive person. When the person is dead, heart will not pump blood due to which there will be no variation in intensity of light and a straight line will be obtained.

For a non living object, there will not be any absorption of light and so a straight line at maxima is obtained. But for a dead person this straight line will be below the maxima as blood cells will absorb the light but intensity if light will be static as there is no pumping of heart.

When non living object is placed on the pulse sensor , pulse is not detected and so "dead" message is transmitted through Xbee and is displayed on the console.



When no object is placed on the pulse sensor , pulse is not detected and so "dead" message is transmitted through Xbee and is displayed on the console.



When living object is placed on the pulse sensor , pulse is not detected and so "alive" message is transmitted through Xbee and is displayed on the console.

8 FUTURE SCOPE

We plan to attach this with any wearable like watches, ring or etc. This sensor would then transmit heart beats per minute, and on any significant/sudden change in heart beats, or on sudden high/low beats, it would send a SOS accordingly, which would further help the person. We also plan to make a combination of such devices, which would monitor overall health, and it would be combined with day to day usage products like jewellery, watches and etc This data would be transmitted to various locations/persons, through mesh networking

9 CONCLUSION

From this project we came to know about how the pulse detector sensor is used to detect the pulse based on the absorption of light on the sensor. If the blood flows in, then the blood cells absorbs more light hence the intensity of light detected by the sensor decreases. When the blood flow is absent i.e human body is dead then the intensity of light detected by the sensor is equal to intensity of the light send by the sensor. Hence, using this principle we can make a device that can detect whether the person is dead or alive. Also, we learn about how the Xbee is used in the wireless communication of signals over the range of few hundred meters. We also learn about arduino software where we can make a system work according to our requirement by writing the code in the software and also using different libraries of different sensors.
Hence, using different types of sensors, Arduino and wireless communication devices like Xbee we can make a model which can moniter the overall health of a person.

10 BIBLIOGRAPHY

1. https://www.raviyp.com/embedded/140-learn-how-a-heart-beat-sensor-works
2. https://learn.sparkfun.com/tutorials/i2c/all
3. https://www.corelis.com/education/tutorials/spi-tutorial/
4. https://pulsesensor.com/
5. https://www.generationrobots.com/media/DetecteurDePoulsAmplifie/PulseSensorAmpedGetti
6. https://www.farnell.com/datasheets/1682209.pdf
7. https://www.sparkfun.com/datasheets/Wireless/Zigbee/XBee-Datasheet.pdf
8. https://youtu.be/odekkumB3WQ
9. https://youtu.be/mPx3TjzvE9U
10. https://youtu.be/uBkQUph9EKM