SMART HEALTH MONITORING SYSTEM

A Project Report

Submitted in partial fulfilment of the
requirements for the award of the Degree of

BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)

By

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CERTIFICATE

This is to certify that the project entitled, **"Smart Health Monitoring System"** is bonafide work of Rohit Mahadik bearing Seat No: 18302E006 submitted in partial fulfilment of the requirements for the award of degree of BACHELOR OF SCIENCE in INFORMATION TECHNOLOGY from University of Mumbai.

Internal Guide **Coordinator**

Internal Examiner **External Examiner**

Date:

College Seal **Principal**

ACKNOWLEDGEMENT

We would like to express our special thanks and gratitude to ur project guide **Ms.Maitreyi Joglekar** for guiding us to do the project work on time and giving us all support and guidance, which made complete our project duly. We are extremely thankful to her for providing such nice support and guidance.

We are also thankful for and fortunate enough to get constant encouragement, support and guidance from the teachers of information Technology who helped us in successfully completing our project work.

DECLARATION

I hereby declare that the project entitled, "**Smart Health Monitoring System**" done at Vidyalankar School of Information Technology, has not been in any case duplicated to submit to any other universities for the award of any degree. To the best of my knowledge other than me, no one has submitted to any other university.

The project is done in partial fulfillment of the requirements for the award of degree of **BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)** to be submitted as final semester project as part of our curriculum.

Name and Signature of the Student

INDEXES

1. INTRODUCTION

1.1 BACKGROUND

In Smart health monitoring system latest trends of IOT is used. IOT software helps patients to reduce health-related threats and hospital expenses by gathering patient information and processing data using cloud services to exchange data sources. This system offers a cloud-based solution to a diagnostic framework for automatic cardiac disease that utilizes sensors to monitor specific patient parameters such as blood pressure, heart beat rate, respiration and temperature. Here, hither project to predict cardiac attack by collecting sensor data and submitting the data to the doctor via cloud. Using this plan will save both specialist and patient time and easily make recommendations about follow up medical care and to receive it at anytime and anywhere they need it. Through gathering data, the patient may receive appropriate and secure medical attention through tracking the current state of the patient displayed in LCD

This project will measure Percentage of oxygen, heart rate and body temperature without even visiting a doctor. The best part of this project is that it will save all the readings automatically in text file using a smart phone connected via Bluetooth. Components required are Max30100 sensor, Max30205, Arduino Uno-Board, oLED display Bluetooth HC 05 and some small connection wires.

Max30100 sensor will measure heart rate.
Max30100 will measure the body temperature.
Using Arduino IDE we will program Libraries like Addafruit GFX, Oak oLED, Max30100 and Max30205 into Arduino Uno board.
We will write different codes for installing these libraries, the bitmap code and also to check the availability of sensor status.
Also the code for displaying the sensor data on the oLED screen.
To make the app for storing sensor measurements we will be using MIT inventor app.
In this way, we can send the data read from the device to another device or to the Internet.

The early identification of any health problem can help the patient to take necessary emergency measures, which can potentially save the patient’s life.

1.2 OBJECTIVES

- In this project, we will make a device that can measure Blood Oxygen Concentration & Heart Rate using MAX30100 pulse oximeter & Arduino.
- The blood oxygen concentration termed as SpO2 is measured in percentage and the Heart Beat/Pulse Rate is measured in bpm (beats per minute).
- The MAX30100 is a pulse oximeter and heart rate monitor sensor solution.
- Oximeter is a measuring device made for measuring oxygen saturation in blood and is usually expressed as a percentage (a normal reading is typically 97 percent or higher).
- A pulse oximeter is a non-invasive device that measures the oxygen saturation of a person's blood as well as their heart rate.
- We will display the SpO2 and BPM value in 0.96" OLED Display.
- With each beat, the display value is changed in the OLED screen. By using Bluetooth module HC-05/HC-06 (operating in a slave mode), we can send data to the android app wirelessly and monitor the data on the app as well as keep a track record of the data in text format.
- In this way, we can send the data read from the device to another device or to the Internet.
- This wearable device can be used by athletes to monitor their heart rate and blood oxygen levels during a workout.
- The pulse oximeter available in the market is very expensive, but with this simple & low-cost pulse oximeter module we can make our own device.
- It features a MAX30100 pulse oximeter and heart rate monitor module, as well as a MAX30205 biometric sensor hub that can supply raw or calculated data to another device via I2C.
- These data results can be stored in data base centre which can be invoked from remote location at any time in an emergency case of patient without delaying the time. This project may play vital role in saving the patient life at emergency time since "Time is life"

1.3 SYSTEM FEATURES

This system has following features:

1. Low Cost :
   The cost required for this system is very low.
2. Very short response time :
   It hardly takes several seconds for this project to display the measured values and stores permanently into the app cloud.
3. Non-complex interface :
   When compared to the systems used for measuring these values on professional scales, this project is highly user friendly and easy to use.
4. High Accuracy :
   If properly working sensors are used, then this system can deliver high end accuracy values.
5. Small sized :
   This project is small in sized and can be taken anywhere while travelling.
6. Applicability :
   Every individual in a family can use this device and each can store their readings differently.
7. Reliable :
   This system can be relied upon when it comes to health related cases.

1.4 PURPOSE

- Pulse oximetry is a test used to measure the oxygen level (oxygen saturation) of the blood.
- It is an easy, painless measure of how well oxygen is being sent to parts of your body furthest from your heart, such as the arms and legs.
- People with respiratory or cardiovascular conditions, very young infants, and individuals with some infections may benefit from pulse oximetry.
- Normal oxygen saturation levels are between 95 and 100 percent. Oxygen saturation levels below 90 percent are considered abnormally low and can be a clinical emergency.

1.5 SCOPE

- The pulse oximeter has already found a number of clinical applications outside of the operating room, such as monitoring during patient transport, respiratory monitoring during narcotic administration, and evaluation of home-oxygen therapy.
- Smart Health Detector is used to assess arterial blood oxygenation for many diverse patient groups with suspected cardiopulmonary disorders or in ordinary people during heavy exercise or exposure to low partial pressures of oxygen.
- It has its broadest application as a method for continuously monitoring arterial blood oxygenation under a variety of conditions and circumstances.

1.6 APPLICABILITY

- Every individual in a family can use this device and each can store their readings differently.
- This system has its broadest application as a method for continuously monitoring arterial blood oxygenation under a variety of conditions and circumstances.

1.7 WORKING

A pulse oximeter measures the amount of oxygen in a patient's blood by sensing the amount of light absorbed by the blood in capillaries under the skin. In a typical device, a sensing probe is attached to the patient's finger with a spring-loaded clip or an adhesive band. On one side of the probe is a pair of Light- Emitting Diodes (LEDs), and on the other side is a photodiode. One of the LEDs produces red light, and the other produces infrared light. Pulse oximetry depends on the optical characteristics of hemoglobin, the blood protein that carries oxygen. When hemoglobin is more highly oxygenated, it becomes more transmissive to red light and more absorptive to infrared light. When hemoglobin contains little oxygen, it becomes relatively more transmissive to infrared, and more absorptive to red light. This property means that by measuring the ratio of red light to infrared light passing through the patient's finger, the probe can produce a signal proportional to the amount of oxygen in the blood. In addition, the surge of blood on each heartbeat generates a signal representative of the patient's pulse rate (Dwivedi 2014). Since the output of the photodiode is low amplitude current, some signal conditioning must be applied before it can be used. Operational amplifier is an ideal choice for use in a resistor-feedback transimpedance amplifier configuration. This configuration is also used in other bioelectric sensing applications. The resulting output voltage is read by an analog-to-digital converter on a microcontroller micro-controller calculates the ratio of red light to infrared light, and determines the corresponding oxygen saturation level using a lookup table. This value is then sent via serial communications link to a data acquisition system, or, in the care of a stand-alone pulse oximeter, displayed for the user. In this project we show that how we monitor the heart beat by pulse oximetry technique. In this project we use innovative technique to measure the heart beat measurement. This is achieved by pulse oximetry logic. We use this technique to get the pulse from body and to amplify the signal and display this data on the LCD. We use this technique n the exercise machines, where measurement of the heartbeat is very much important for controlling the speed of treadmill automatically. A pulse oximeter is a particularly convenient noninvasive measurement instrument. Typically it has a pair of small light-emitting diodes (LEDs) facing a photodiode through a translucent part of the patient's body, usually a fingertip or an earlobe. One LED is red, with wavelength of 660 nm, and the other is infrared, 905, 910, or 940 nm. Absorption at these wavelengths differs significantly between oxyhemoglobin and its deoxygenated form; therefore, the oxy/deoxyhemoglobin ratio can be calculated from the ratio of the absorption of the red and infrared light. The absorbance of oxyhemoglobin and deoxyhemoglobin is the same (isosbestic point) for the wavelengths of 590 and 805 nm; earlier oximeters used these wavelengths for correction for hemoglobin concentration. The monitored signal bounces in time with the heart beat because the arterial blood vessels expand and contract with each heartbeat. By examining only the varying part of the absorption spectrum (essentially, subtracting minimum absorption from peak absorption), a monitor can ignore other tissues or nail polish and discern only the absorption caused by arterial blood. By examining only the varying part of the absorption spectrum (essentially, subtracting minimum absorption from peak absorption), a monitor can ignore other tissues or nail polish and discern only the absorption caused by arterial blood. As we insert the finger in the tube, then light is crossed through the finger and focus on the photodiode. Photodiode resistance is to change as per the light on the photodiode is to be change. Photodiode is connected to the op-amp amplifier. Here we use LM324 amplifier IC. Here op-amp works as an amplifier circuit.The light emitted from the LEDs were transmitted through the skin and detected by photodiodes. An infrared rejection filter photodiode was then placed across from the red LED in order to detect transmitted red light and prevent infrared light interference. Photodiodes were then connected to a transimpedance amplification circuit that converted the current to an appropriately-enhanced voltage signal. The LM324 series consists of four independent, high gains; internally frequency compensated operational amplifiers which were designed specifically to operate from a single power supply over a wide range of voltages. Operation from split power supplies is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage. Application areas include transducer amplifiers, DC gain blocks and the entire conventional op amp circuits which now can be more easily implemented in single power supply systems. For example, the LM124 series can be directly operated off of the standard a 5V power supply voltage which is used in digital systems and will easily provide the required interface electronics without requiring the additional g15V power supplies. Change of signal is further converted into pulse. We count the pulses with the help of the 89s51 controller, internal timer (counter). Count pulses within 60 second are further converted into ASCII code for LCD display. Here we use alphanumeric LCD to display the total pulse count. On this LCD we display the content of any value is only in ASCII code.

2. SURVEY OF TECHNOLOGIES

2.1 Feasibility Study:-

- **Features of MIT App inventor**
  Open source software
  Easy to implement
  More optimized on mobile-platform
- **Arduino IDE:**
  It is integrated development
  It supports only Arduinoide.
- **Documentation:**
  The easy-to-understand and detailed information about every topic.
- **Why not other Arduino?**
- Because our project is more compatible with the Arduino-Uno.
- Less expensive than other Arduino boards.
- **Why should we use MIT app inventor?**
- Open-Source
- Easy to implement
- **Why Arduino Uno?**
  - As our project is SMART HEALTH DETECTOR Arduino Uno is more compatible than Arduino Nano.
  - Its biggest advantage is that we connect the board to the computer via a USB cable which does a dual purpose of supplying power and acting as a Serial port to interface the Arduino and the computer.
  - It can also be powered by a 9V-12V AC to DC adapter

Software Implementation

This section discusses the methodology to interface the sensor and hardware module. The most significant part is to enable the analog sensor to send analog data to Arduino, and then to transfer data to the GUI.

Programming of Arduino

Programming of Arduino is the core of current research because Arduino controls all the data from sensors to the GUI and alarm system. Arduino programming language (based on Wiring), and the Arduino Software (IDE) "Integrated Development Environment", based on processing. Processing is an open source computer programming language and IDE.

2.2 Arduino History:-

Colombian student Hernando Barraging created the development platform wiring as his Master's thesis project in 2004 at the Interaction Design Institute Ivrea (IDII) in Ivrea, Italy. Massimo Banzi and Casey Reas (known for his work on Processing) were super goal was to create low cost, simple tools for non-platform consisted of a hardware PCB with an ATmega128 microcontroller, an IDE based on Processing and library functions to easily with David Mellis (then an IDII student) and David Cuartielles, added support for the cheaper ATmega8 microcontroller to Wiring. But instead of continuing the work on Wiring, they forked (or copied) the Wiring source code and started running it as a separate project, called Arduino. The Arduino's initial core team consisted of Massimo Banzi, David Cuartielles, Tom Igoe, Gianluca Martino, and David Mellis.

The name Arduino comes from a bar in Ivrea, where some of the founders of the project used to meet. The bar was named after Arduin of Ivrea, who was the margrave of the March of Ivrea and King of Italy from 1002 to 1014.Following the completion of the Wiring platform, its lighter, lower cost versions were created and made available to the open-source community. Associated researchers, including David Cuartielles, promoted the idea. The first prototype board, made in 2005, was a simple design, and it wasn’t called Arduino. Massimo Banzi would coin the name later that year.

TYPES OF ARDUINO

There are mainly four types of Arduino:-

Entry Level- Get started with Arduino using Entry Level products: easy to use and ready to power your first creative projects. These boards and modules are the best to start learning and tinkering with electronics and coding. The starter kit includes a book with 15 tutorials that will walk you through the basics up to complex projects.

Enhanced Features- Experience the excitement of more complex projects choosing one of the boards with advanced functionalities, or faster performances.

Internet of Things- Make connected devices easily with one of these IoT products and open your creativity with the opportunities of the World Wide Web.

Wearable- Add smartness to your soft projects and discover the magic of sewing the power of electronics directly to textiles.

Retired- Explore the history of Arduino with a journey through all the boards, accessories, shield, kits and documentation released since 2006.

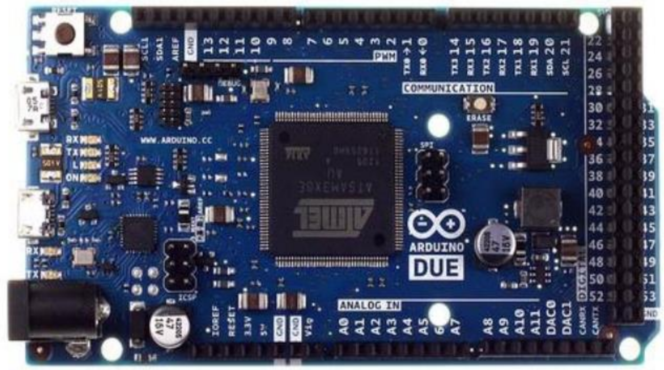
Features	Arduino Uno	Arduino Due	Arduino Mega	Arduino Leonardo
Processor	16Mhz ATmega328	84MHz AT91SAM3X8E	16MHz ATmega2560	16MHz ATmega32u4
Memory	2KB SRAM, 32KB flash	96KB SRAM, 512KB flash	8KB SRAM, 256KB flash	2.5KB SRAM, 32KB flash
Digital I/O	14	54	54	20
Analogue I/O	6input, 0 output	12input, 2output	16input, 0 output	12input, 0 output

1.The Arduino Uno

The Uno is the most common board and the one labeled as the classic Arduino. This board comes with everything new users need to learn about the electronics and programming requires starting this hobby. It is compatible with most available Arduino shields.

2. The Arduino Due

The Arduino Due is the second iteration of the classic Arduino and offers more features for advanced users. The Due's processor is faster, has more memory, and more I/O ports. It does not support many shields. Because of the faster CPU, the Arduino Due runs on a lower voltage: 3.3V over the Uno's 5V. This means it cannot always support the same devices



3.The Arduino Mega

The Arduino Mega comes in two types, the Mega 2560 and the MEGA ADK. The ADK is similar to the 2560; however, it also has a programmable USB host chip installed. It uses the same 5V power supply as the Uno, so many of the Arduino shields are also compatible with the Mega; however, because of the placement of some of the pins, not all of them are usable.

4. The Arduino Leonardo

The Leonardo is not a common board, but has similar features to the Uno, including the 5V power supply and the processing power. It is a good board for those who need more input and output ports than the Arduino Uno, but do not need the horsepower or size of the Due. It uses a micro-USB adapter instead of the Uno's full-size USB port.

Advantages of Using Arduino

Using an Arduino simplifies the amount of hardware and software development you need to do in order to get a system running. The Arduino hardware platform already has the power and reset circuitry setup as well as circuitry to program and communicate with the microcontroller over USB. In addition, the I/O pins of the microcontroller are typically already fed out to sockets/headers for easy access (This may vary a bit with the specific model).On the software side, Arduino provides a number of libraries to make programming the microcontroller easier. The simplest of these are functions to control and read the I/O pins rather than having to fiddle with the bus/bit masks normally used to interface with the Atmega I/O (This is a fairly minor inconvenience). More useful are things such as being able to set I/O pins to PWM at a certain duty cycle using a single command or doing Serial communication. On the other hand, if you want to measure the voltage using Arduino.

1. Ready to Use: The biggest advantage of Arduino is its ready to use structure. As Arduino comes in a complete package form which includes the 5V regulator, a burner, an oscillator, a micro-controller, serial communication interfaces LED and headers for the connections. You don't have to think about programmer connections for programming or any other interface. Just plug it into USB port of your computer and that's it. Your revolutionary idea is going to change the world after just few words of coding.

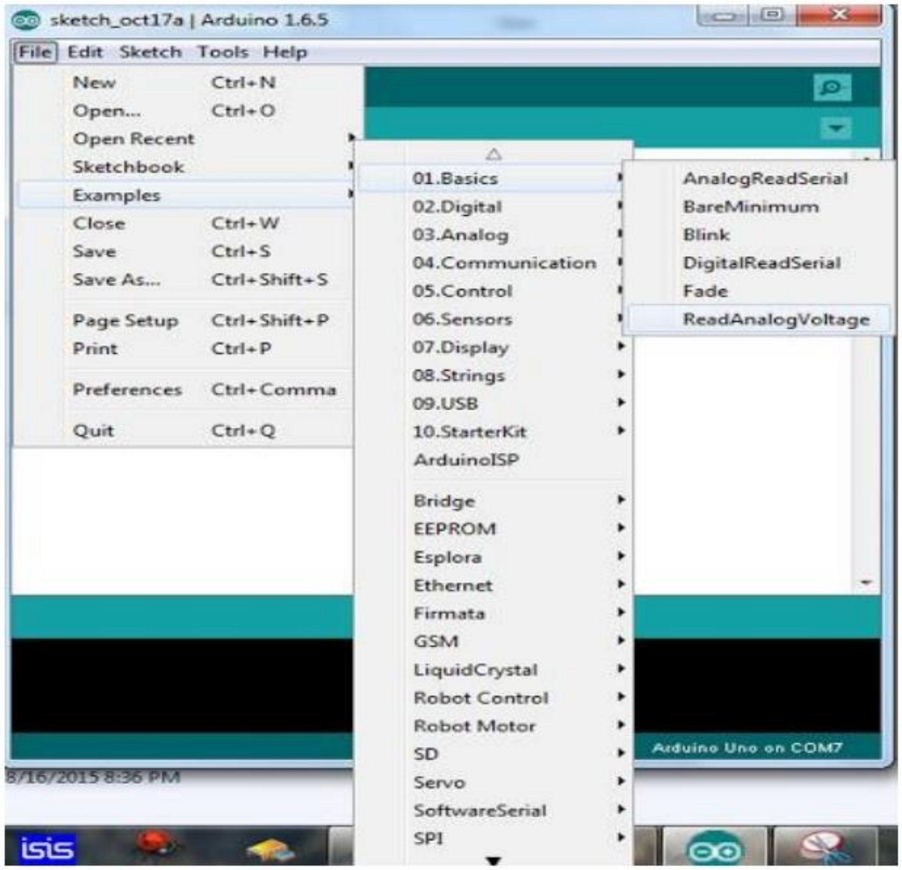
2. Examples of codes: Another big advantage of Arduino is its library of examples present inside the software of Arduino. I'll explain this advantage using an example of voltage measurement. For example if you want to measure voltage using ATmega8 micro-controller and want to display the output on computer screen then you have to go through the whole process. The process will start from learning the ADC's of micro-controller for measurement, went through the learning of serial communication for display and will end at USB - Serial converters. If you want to check this whole process click on the link below. DC voltage measurement using Atmel AVR micro-controller. On the other hand, if you want to measure the voltage using Arduino. Just plug in your Arduino and open the Read Analog Voltage example as shown in the below.

3- Effortless functions: During coding of Arduino, you will notice some functions which make the life so easy. Another advantage of Arduino is its automatic unit conversion capability. You can say that during debugging you don't have to worry about the units conversions. Just use your all force on the main parts of your projects. You don't have to worry about side problems.

4- Large community: There are many forums present on the internet in which people are talking about the

Arduino. Engineers, hobbyists and professionals are making their projects through Arduino. You can easily find help about everything. Moreover the Arduino website itself explains each and every functions of Arduino.

So, We should conclude the advantage of Arduino by saying that during working on different projects you just have to worry about your innovative idea. The remaining will handle by Arduino itself.



Name of the part	Arduino Nano	Arduino Uno
Microcontroller	ATmega328	ATmega328P
Operating Voltage	5V	5V
Input Voltage	7-12V	7-12V
Digital I/O Pins	20	20
PWM Digital I/O Pins	6	6
Analog I/O Pins	8	6
DC Current per I/O Pins	40mA	20mA
Clock Speed	16MHz	16MHz
Flash Memory	32 KB of which 2KB used by boot loader	32KB of which 0.5KB used by boot loader
SRAM	2KB	2KB
EEPROM	1KB	1KB
LED_Builtin	13	13
USB-to-serial-converter	FTDI 323	AT mega 16U2(AT mega 8UA up to 2 version)

- **Why Arduino Uno?**
  - As our project is SMART HEALTH DETECTOR Arduino Uno is more compatible than Arduino Nano.
  - Its biggest advantage is that we connect the board to the computer via a USB cable which does a dual purpose of supplying power and acting as a Serial port to interface the Arduino and the computer.
  - It can also be powered by a 9V-12V AC to DC adapter

2.3COMPONENTS USED (HIGHLIGHTS)

Arduino IDE:

The **Arduino Integrated Development Environment (IDE)** is a cross-platform application (for Windows, macOS, Linux) that is written in functions from C and C++ .
It is used to write and upload programs to Arduino compatible boards

Arduino UNO:

The **Arduino Uno** is an open-source microcontroller board based on the Microchip AT Mega 328P microcontroller and developed by Arduino.cc

BLUETOOTH HC – 05:

Serial Bluetooth module for Arduino & other micro-controllers.

MAX30100:

The MAX30100 sensor is an integrated pulse oximetry and heart-rate monitor sensor solution.

MAX30205:

The MAX30205 temperature sensor accurately measures temperature with 0.1°C accuracy.

OLED DISPLAY:

OLED (Organic Light-Emitting Diode) is a self light-emitting technology composed of a thin, multi-Layered organic film placed between an anode and cathode.

SMALL CONNECTION WIRES:

Connecting wires provide a medium to an electrical current so that they can travel from one point on a circuit to another.

3.1 PROBLEM DEFINITION

The pulse oximeter available in the market is very expensive, but with this simple & low-cost pulse oximeter module we can make our own device.
It features a MAX30100 pulse oximeter and heart rate monitor module, as well as a MAX30205 biometric sensor hub that can supply raw or calculated data to another device via I2C.
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In this way, we can send the data read from the device to another device or to the Internet.
This wearable device can be used by athletes to monitor their heart rate and blood oxygen levels during a workout.

3.2 REQUIREMENT SPECIFICATION

Arduino IDE:

The **Arduino Integrated Development Environment (IDE)** is a cross-platform application (for Windows, macOS, Linux) that is written in functions from C and C++ It is used to write and upload programs to Arduino compatible boards.
The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures.
User-written code only requires two basic functions, for starting the sketch and the main program loop.
The Arduino IDE supports the languages C and C++ using special rules of code structuring.
The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures.
User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub *main()* into an executable cyclic executive program with the GNU tool chain, also included with the IDE distribution.

Arduino UNO:

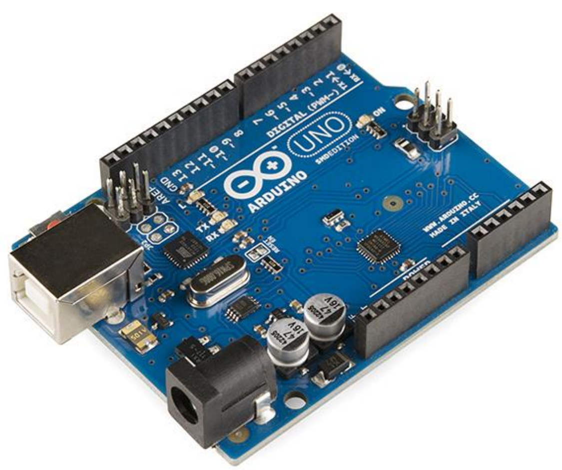
The **Arduino Uno** is an open-source micro-controller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc

The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits

The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment),

It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts.

The Uno board is the first in a series of USB-based Arduino boards and version 1.0 of the Arduino IDE were the reference versions of Arduino, which have now evolved to newer releases. The ATmega328 on the board comes pre-programmed with a boot-loader that allows uploading new code to it without the use of an external hardware programmer.



BLUETOOTH HC – 05:

Serial Bluetooth module for Arduino & other micro controllers.
Operating voltage: 4V to 6V (Typically +5V).
Operating current: 30mA.
Range : <100m
Can be easily interfaced with Laptop or Mobile phones with Bluetooth.
The HC-05 Bluetooth Module has 6pins.

MAX30100:

The MAX30100 is an integrated pulse oximetry and heart-rate monitor sensor solution. It combines two LEDs, a photo detector, optimized optics, and low-noise analog signal processing to detect pulse oximetry and heart-rate signals.

The MAX30100 operates from 1.8V and 3.3V power supplies and can be powered down through software with negligible standby current, permitting the power supply to remain connected at all times.

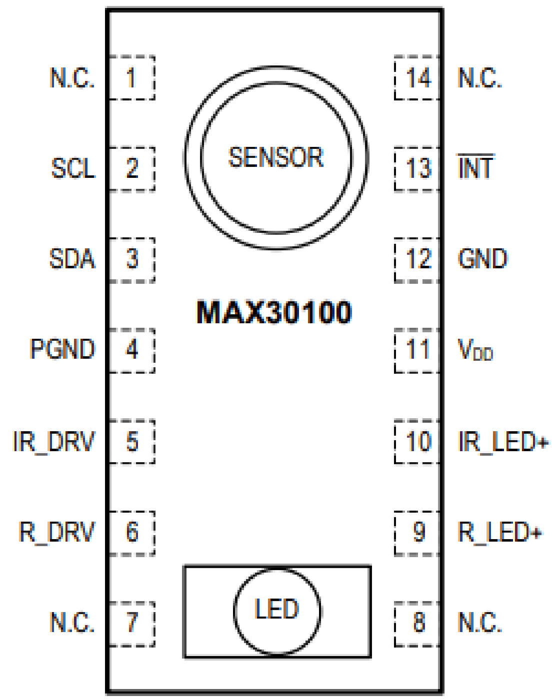
Operating voltage: 1.8V to 3.3V
Operating current: 0.7microampere
Fast data output capability.

<u>Benefits and Features:</u>

● Complete Pulse Oximeter and Heart-Rate Sensor Solution Simplifies Design
• Integrated LEDs, Photo Sensor, and High-Performance Analog Front -End
• Tiny 5.6mm x 2.8mm x 1.2mm 14-Pin Optically Enhanced System-in-Package
● Ultra-Low-Power Operation Increases Battery Life for Wearable Devices
• Programmable Sample Rate and LED Current for Power Savings

• Ultra-Low Shutdown Current (0.7μA, typ)
● Advanced Functionality Improves Measurement Performance
• High SNR Provides Robust Motion Artifact Resilience
• Integrated Ambient Light Cancellation
• High Sample Rate Capability
• Fast Data Output Capability

PIN CONFIGURATION



MAX30205:

Maxim Integrated MAX30205 Human Body Temperature Sensor accurately measures temperature and Provides over temperature alarm/interrupt/shutdown output.
The MAX30205 converts temperature measurements to digital form using a high-resolution, sigma-Delta, analog-to-digital converter (ADC).
One-Shot and Shutdown Modes helps to reduce power usage. Communication is through an I^2C-Compatible, 2-wire serial interface.
The I2C serial interface accepts standard write byte, read byte, send byte, and receive byte commands to

Read the temperature data and configure the behavior of the open-drain over temperature shutdown.

The MAX30205 features three address select lines with a total of 32 available addresses.

The sensor has a 2.7V to 3.3V supply voltage range, low 600μA supply current, and a lockup-protected

I2C-compatible I interface that make them ideal for wearable fitness and medical applications.

FEATURES

High Accuracy and Low-Voltage Operation Aids Designers in Meeting Error and Power Budgets

- 0.1°C Accuracy (37°C to 39°C)
- 16-Bit (0.00390625°C) Temperature Resolution
- 2.7V to 3.3V Supply Voltage Range

One-Shot and Shutdown Modes Help Reduce Power Usage

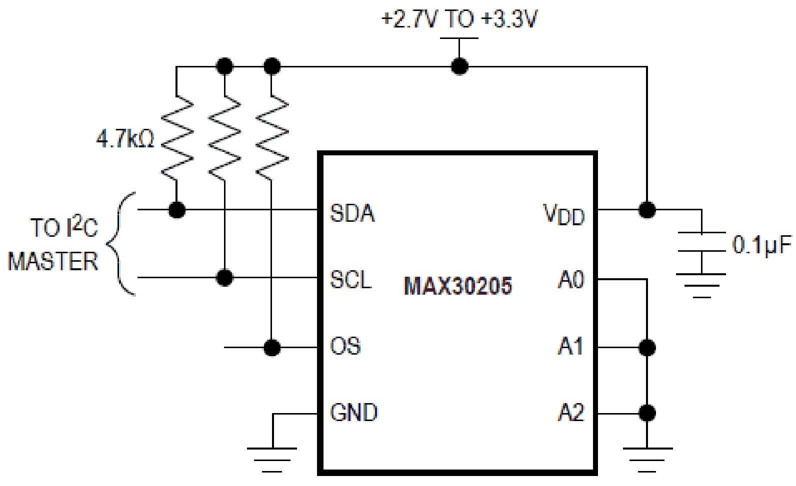
600μA (typ) Operating Supply Current

Digital Functions Make Integration Easier into Any System

Selectable Timeout Prevents Bus Lockup

Separate Open-Drain OS Output Operates as Interrupt or Comparator/Thermostat Output

PIN CONFIGURATION



O-LED DISPLAY:

An organic light-emitting diode (**OLED** or **organic LED**), also known as **organic electroluminescent** (**organic EL**) **diode**, is a light-emitting diode (LED) in which the emissive electroluminescent layer is a film of organic compound that emits light in response to an electric current. This organic layer is situated between two electrodes; typically, at least one of these electrodes is transparent. OLEDs are used to create digital displays in devices such as television screens; computer monitors portable systems such as smart phones, handheld game consoles and PDAs. A major area of research is the development of white OLED devices for use in solid-state lighting applications.

There are two main families of OLED: those based on small molecules and those employing polymers. Adding mobile ions to an OLED creates a light-emitting electrochemical cell (LEC) which has a slightly different mode of operation. An OLED display can be driven with a passive-matrix (PMOLED) or active-matrix (AMOLED) control scheme. In the PMOLED scheme, each row (and line) in the display is controlled sequentially, one by one, whereas AMOLED control uses a thin-film transistor backplane to directly access and switch each individual pixel on or off, allowing for higher resolution and larger display sizes.

An OLED display works without a backlight because it emits visible light. Thus, it can display deep black levels and can be thinner and lighter than a liquid crystal display (LCD). In low ambient light conditions (such as a dark room), an OLED screen can achieve a higher contrast ratio than an LCD, regardless of whether the LCD uses cold cathode fluorescent lamps or an LED backlight. OLED displays are made in the same way as LCDs, but after TFT (for active matrix displays), addressable grid (for passive matrix displays) or ITO segment (for segment displays) formation, the display is coated with hole injection, transport and blocking layers, as well with electroluminescent material after the 2 first layers, after which ITO or metal may be applied again as a cathode and later the entire stack of materials is encapsulated. The TFT layer, addressable grid or ITO segments serve as or are connected to the anode, which may be made of ITO or metal. OLEDs can be made flexible and transparent, with transparent displays being used in smart phones with optical fingerprint scanners and flexible displays being used in foldable smart phones.

How O-LED Display works?

OLEDs work in a similar way to conventional diodes and LEDs, but instead of using layers of n-type and p-type semiconductors, they use organic molecules to produce their electrons and holes. A simple OLED is made up of six different layers. On the top and bottom there are layers of protective glass or plastic. The top layer is called the seal and the bottom layer the substrate. In between those layers, there's a negative terminal (sometimes called the cathode) and a positive terminal (called the anode). Finally, in between the anode and cathode are two layers made from organic molecules called the emissive layer (where the light is produced, which is next to the cathode) and the conductive layer (next to the anode).

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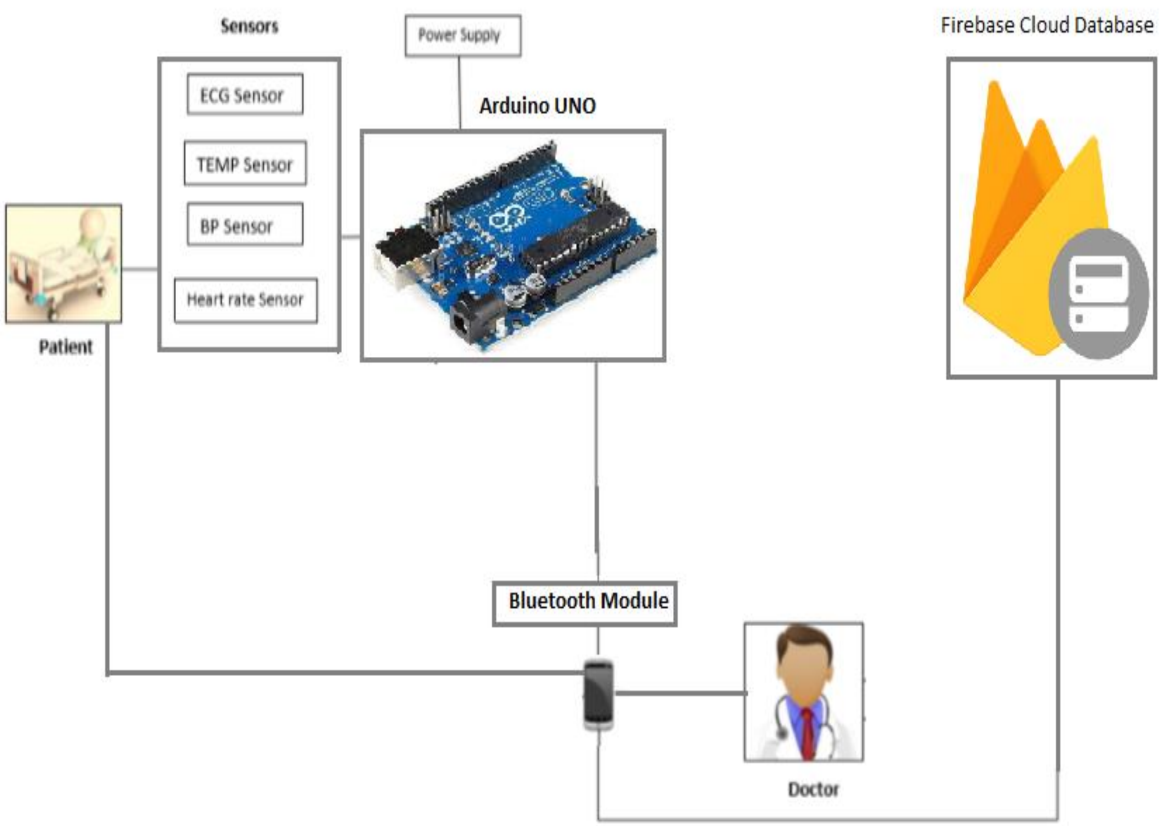
3.3 PLANNING AND SCHEDULING

		Semester V																								
	June		July				August			September			October		December		January					Feburary			March	
Activities	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12
Project Idea Finalization																										
Requirements																										
Survey of data/ need (Literature Review)																										
Feasibility and need validation																										
Scope Freezing																										
Requirements Detailing																										
Use Case Diagrams																										
Static User Interface Prototype																										
Design																										
Database Design/ Block Diagram (ER Diagram, Key Data Structures)																										
Other UML Diagrams (Sequence, Activity, Flow Chart etc.)																										
Class Diagrams																										
Hardware Design - [for embedded/ IoT projects]																										
Evaluate Technology options																										
Prototype																										
Key Technical issue defination																										
Build basic Working Prototype																										
Planning & Review																										
Overall Project Plan																										
Weekly Review/ Discussion with Guide																										

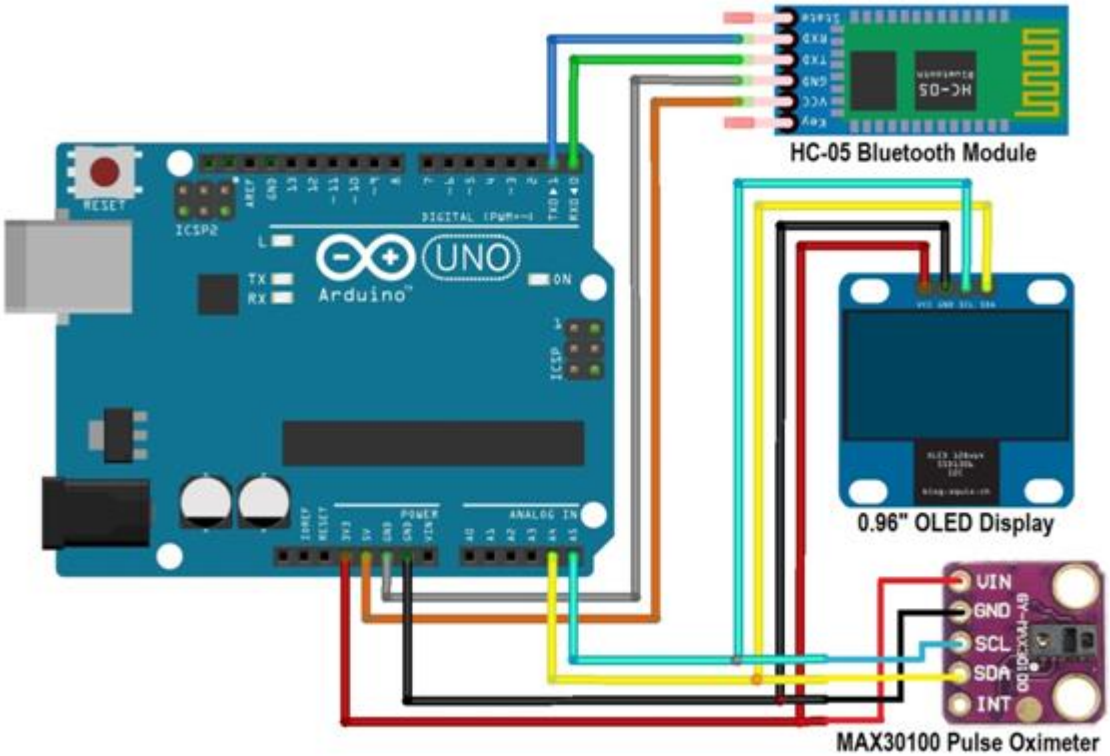
4. DATA DESIGN

4.1 BLOCK DIAGRAM

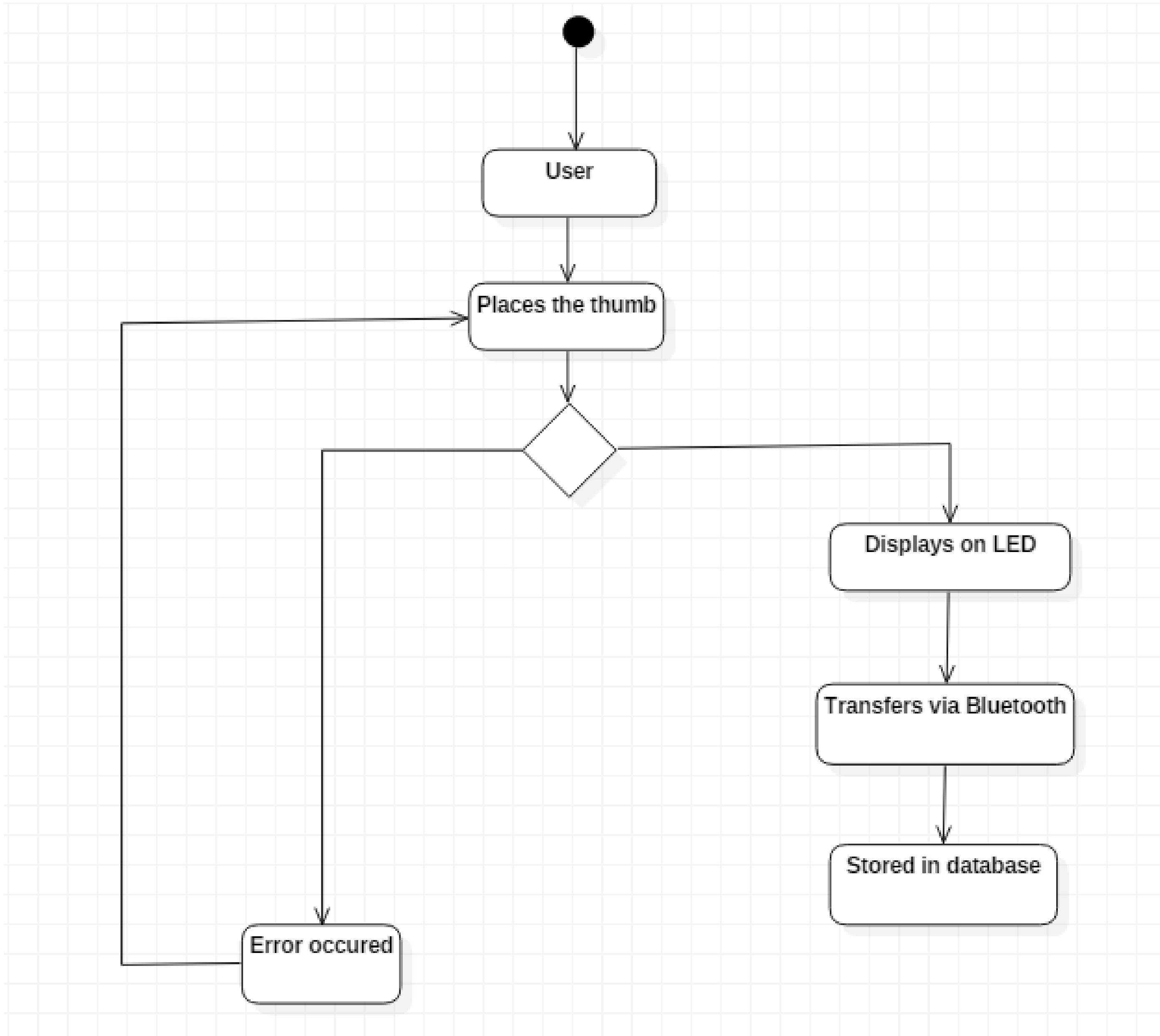
A block diagram is a diagram of a system in which the principal parts or functions are represented by blocks connected by lines that show the relationships of the blocks.



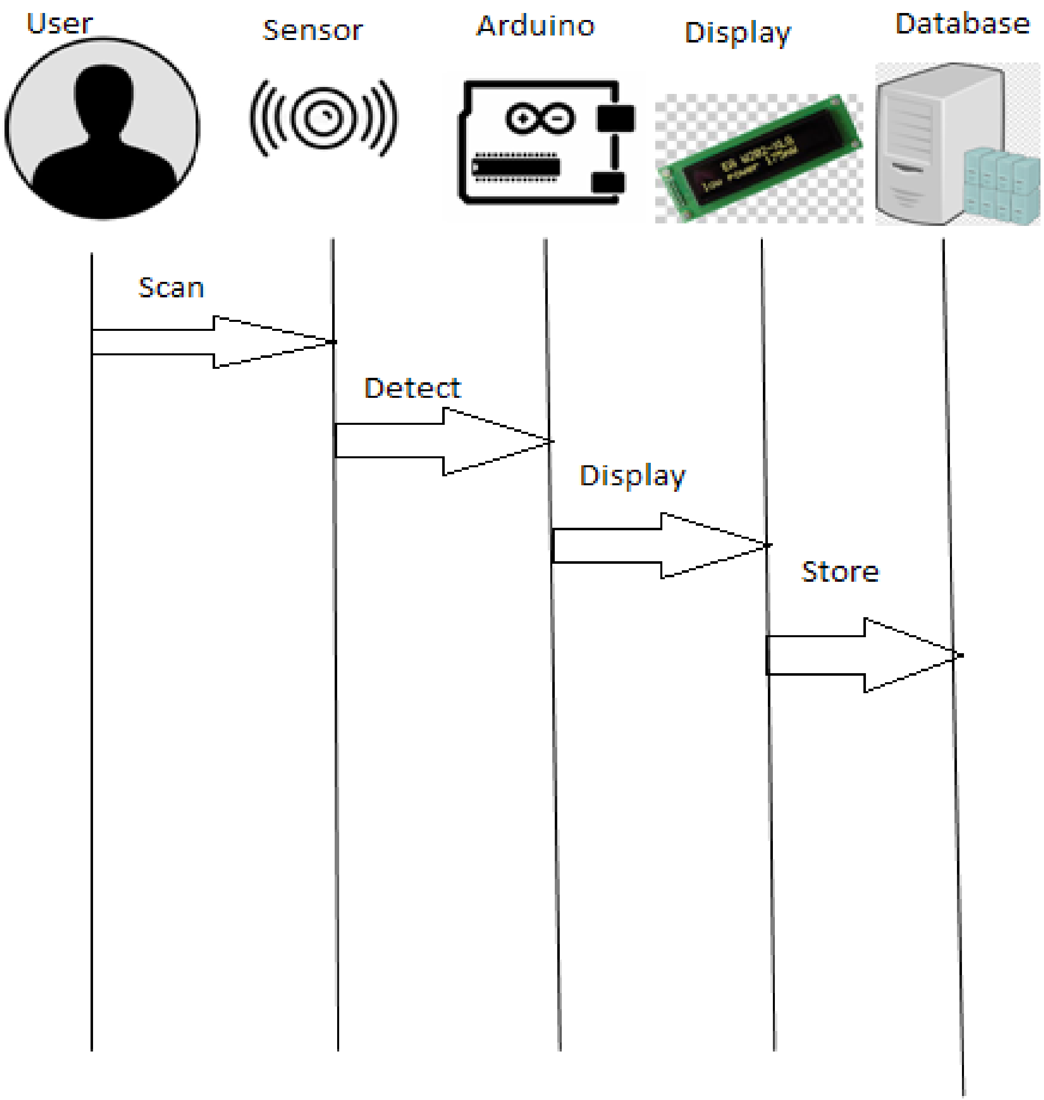
4.2 CIRCUIT DIAGRAM



4.3 ACTIVITY DIAGRAM



4.3 SEQUENCE DIAGRAM



6. REFERENCES

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