UTILITY OF CLOUD IN IOT

Project report submitted in fulfillment of the requirement for the degree of Bachelor of Technology

in

Computer Science and Engineering/Information Technology

By

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To

Department of Computer Science & Engineering and Information Technology

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CERTIFICATE

Candidate's Declaration

I hereby declare that the work presented in this report entitled **" Utility Of Cloud in IOT"** in fulfillment of the requirements for the award of the degree of **Bachelor of Technology** in **Computer Science and Engineering/Information Technology** submitted in the department of Computer Science & Engineering and Information Technology, Jaypee University of Information Technology Waknaghat is an authentic record of my own work carried out over a period from August 2017 to May 2018 under the supervision of **Dr.Vivek Sehgal** (Associate Professor ,Computer Science Department).
The matter embodied in the report has not been submitted for the award of any other degree or diploma.

Aarush Sharma
141279

This is to certify that the above statement made by the candidate is true to the best of my knowledge.

Dr. Vivek Sehgal
Associate Professor
Computer Science Department
Dated:

ACKNOWLEDGEMENT

I wish to express our deep gratitude to Dr. Vivek Sehgal(**Associate Professor,** Computer Science Department) for guiding us through our project and helping us with his invaluable support and encouragement that defines our determination which otherwise would have left us derailed.

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ABSTRACT

Internet of Things (IoT) is a concept that visualizes all the objects that surround us as part of the Internet. IoT coverage is very broad and includes a variety of objects such as smartphones, tablets, digital cameras, sensors, etc. Once all these devices are connected, they allow increasingly intelligent processes and services that satisfy our basic needs, our economies, the environment and health. Such a large number of devices connected to the Internet provide many types of services and produce a large amount of data and information. Cloud computing is a model of on-demand access to a shared set of configurable resources (for example, computing, networks, servers, storage, applications, services and software) that can be easily provisioned for infrastructure (IaaS), software and applications (SaaS). Cloud-based platforms help connect us to the things (IaaS) that surround us so we can access at any time, anywhere, in an easy-to-use way, using custom portals and integrated applications (SaaS). As a result, the cloud acts as an interface to access the Internet of things. Applications that interact with devices such as sensors have special requirements for mass storage to store large data, great computing power to allow real-time data processing and a high-speed network to transmit audio or video content. In our project, we describe how the Internet of things and Cloud Computing can work together. We aim create a prototype model to provide a cloud-based detection service to constantly monitor the pulse.

CHAPTER-1
INTRODUCTION

1.1 INTRODUCTION

Internet of Things is a new paradigm of the modern era in the field of information technology. The term "Internet of Things" which is also known as the IOT is forged from two words where the first word is "Internet" and the second word being "Things". "The Internet is worldwide systems of computers connected together and communicate with each other using the typical Internet protocols to serve users throughout the world." It is a network of networks consisting of millions of private networks. , public, academic, commercial and governmental, from local to global, connected by a wide range of electronic, wireless and optical network technologies.

Cloud computing and the Internet of Things are two of the trending technologies in this modern era. These technologies have been welcomed very well in our day to day life and are bound to increase in the near future, making them important elements of the future of the Internet.

Though cloud and IoT may seem to be very different concepts when it comes to an average man, however these two are very closely linked to each other.

IoT is characterized as a system of small things which have very limited storage and processing capability and low security.

Complementing to that, cloud computing is capable of providing virtually infinite storage along with much more processing power, security and privacy. Figure 1.1 elaborates the architectural views of IoT and Cloud computing combined together where the application/user layer can even run on portable gadgets like mobile phones or tablet PC’s.

Cloud structures include huge amounts of storage capabilities, powerful processing for data analysis that comes as a great help for IoT devices. The structure of the cloud is linked bidirectionally to the IoT systems via the internet which may be wired or wireless.

The endpoints of the IoT have a detection system which is used to collect data from the environment.

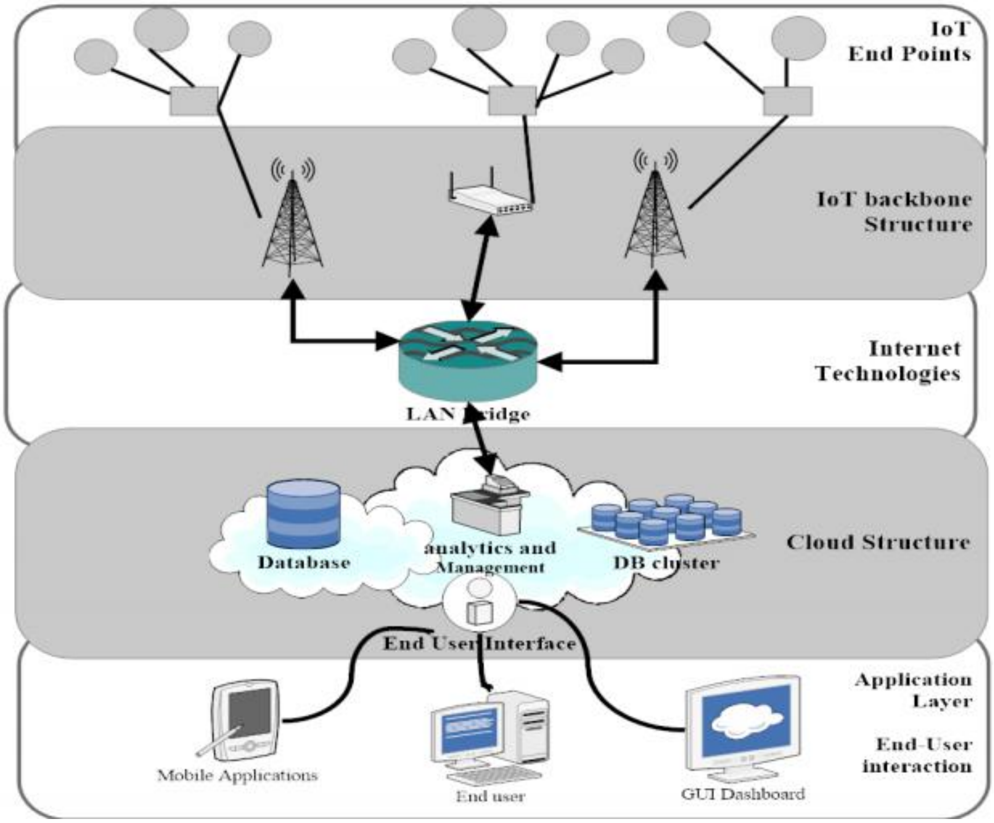


Figure 1.1

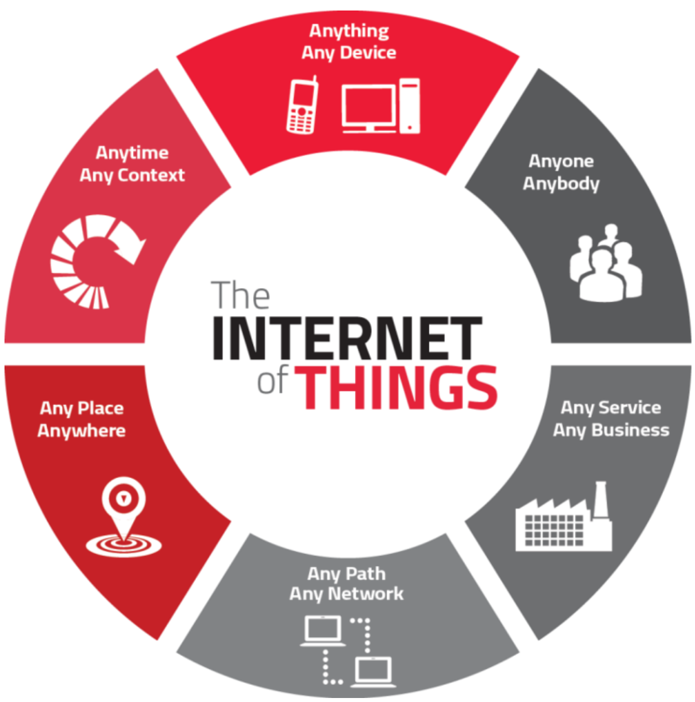


Figure 1.2

1.2 PROBLEM STATEMENT

Generally, regular electrocardiograms (ECGs or EKGs) help a doctor check on a patient's heart's activity only at one point in time which is during an ECG test. However, abnormal heart rhythms and cardiac symptoms may happen at any time of the day. So, the doctors may want to evaluate your heartbeat over time while you go about your normal activities. One may be asked to wear a Holter monitor if he has fast, slow or irregular heartbeats known as arrhythmias.

However the Holter monitors store the data inside a disk which the doctor evaluates after a certain time. So the entire system should be physically given to the doctor for further analysis. This becomes a tedious task for the patient to visit the doctor.

Also the data is continuously at risk because there is only one copy of the data present inside the disk.

Hence, we aim to build a continuous pulse monitoring system which would take your pulses and store the data onto the cloud. In case of sudden fluctuations when the pulse rate falls below or above the normal readings, it could inform your doctor of the change.

1.3 OBJECTIVES

The objective of the project is to provide clinical alerts in case of any distortion of the pulse recorded to the doctor. And to assist the patient and the medical staff in making better informed decisions and draft a care plan with the information needed.

We also aim to measure the severity of the illness by regularly monitoring the pulse of a patient. Since, our sensor captures raw physiological data, transmits it and then communicates it for action; we hope to reduce the work load that is needed otherwise in the Holter monitoring.

1.4 METHODOLOGY

a. Raspberry Pi : The Raspberry Pi is a budget-friendly, pocket sized computer which can simply be connected to a computer monitor or TV along with standard keyboard and mouse. It is a small yet powerful device that allows people of all ages to explore computing and learn programming in languages such as Scratch and Python. You can do everything you want from a desktop computer which includes surfing the web, playing high definition videos, creating spreadsheets, word processing and even playing games.
   In addition, Raspberry Pi can communicate with the sorroundings and hence is used in a wide range of digital projects, from music machines and portable CCTV to even weather stations.

b. ArduinoUno :It is a microcontroller based on a detachable, dual-inline-package (DIP) ATmega328 AVR microcontroller. It has 20 digital I/O pin . Programs can be uploaded on to the board from the easy-to-use Arduino computer IDE. The Arduino has an active and a widespread support community, which makes it a very easy way to get started working with embedded electronics. The language used to code in this project is embeddedC.

c. Pulse Sensor :Pulse Sensor Amped is a non-invasive heart-rate sensor which uses photoplethysmography and is compatible with Arduino Uno and some other boards of the Arduino family. Pulse Sensor posses added adcantage of signal amplification as well as noise cancellation. The pulse Sensor requires a 3V or 5V of power supply alongside the Arduino Uno.

d. Dropbox : Dropbox is a file hosting service operated by Dropbox, Inc, that offers cloud storage, file synchronization, personal cloud, and client software.

e. Microsoft Excel: Microsoft Excel is spreadsheet software which comes bundled with the Microsoft Office. Excel is available for wide number of operating systems ranging from Windows and MacOs to popular mobile platforms like Android and iOS.
   Excel has some basic features which include data organization, graph implementation to a macro programming language known as Visual Basic for Application.
   Programmers can simply write the code they wish to execute which can be either automated, or it can run on the click of a button. It acts as a great medium to fetch some raw data and present it formally.

CHAPTER-2
LITERATURE SURVEY

There is a radical change in the daily life of men and in the way in which organizations functions after the advent of IT and ITeS technologies. Now it has become a recognized concept all over the market, including the everyday life of a common man in society because it posses multiple applications. The development of Internet of Things [IoT] has been driven majorly by the needs of market giants that would greatly benefit from the predictability and predictability offered by the ability to track all objects across the product chains in which they are located. find integrated. The ability to track objects has allowed organizations to be more effective, faster processes, minimized errors, and prevention of theft and integrate complex systems through the IoT.. They will mark each object to identify, automate, control and control. [1] There is no single definition available for the Internet of Things that is acceptable to the global user community. In fact, there are many different groups, including academics, researchers, professionals, innovators, developers and entrepreneurs who have defined the term, although its initial application was credited to Kevin Ashton, an expert in this field. Even though there exist many definitions for IoT, each and every definition has one thing common that is the idea that the first version of the Internet was based on data created by people, while the next version is about data generated by things. The complete definition for the Internet of Things would be: "An open and complete network of intelligent objects that can self-organize, share valuable information, which include data and resources, respond to changing situations in the environment." The environment "Internet of Things is maturing and It is still the last publicized concept in the IT world During the last decade, the term Internet of Things (IoT) has attracted attention when projecting the vision of a global infrastructure of physical objects in a network, allowing connectivity in any time and place for any purpose, it does not matter to anyone. [2] Cloud computing and the Internet of Things (IoT) are two very different technologies that are already part of our lives. Their adoption and use should be increasingly ubiquitous, making them important elements of the future of the Internet. A new paradigm in which the cloud and IOT merge is intended to be a disruptive and enabler of a large number of application scenarios.

[5] Numerous works in the literature have separately studied Cloud and IoT and, more specifically, its main properties, characteristics, underlying technologies and pending problems. However, as far as we know, this work lacks a detailed analysis of the new paradigm of the cloud and the IoT, which implies completely new applications, challenges and research problems. The difference between Cloud and IoT as in Table 2.1 and removal of problems when it comes to terms processing power, storage as well as privacy concerns. The distinctive character of IoT and Cloud from different patterns that displace the IoT paradigm of the cloud is shown in TABLE 2.1. [3]

IoT	Cloud Computing
Pervasive	Ubiquitous
Real world	Virtual resources
Limited computational	Unlimited computational
Limited storage	Unlimited storage
Point of convergence	Service delivery
Big data source	Means to manage big data

Table 2.1

Together, Cloud Computing and IoT can perform detection of the environment and simultaneously process sensor data, which the "things" would fail to do so individually, inspiring innovation in both areas. For example, cloud platforms can intelligently store and use detection data for intelligent monitoring and smart device performance. Machine learning as well as artificial intelligence can be used to completely automatized to take smart decisions, all credits to the high processing power in cloud services. This can lead to development of smart cities, networks as well as transport system. Though it may sound easy to implement, there are a lot of concerns like high performance network which is the basic requirement for using cloud services.

Also integrating large amounts of data continuously could compromise Quality of Service, Quality of Experience, as well as data security, confidentiality and reliability, are fundamental concerns.

REVIEWS ON RESEARCH PAPER BASED ON CLOUD COMPUTING AND THE INTERNET OF THINGS

A. The integration of Cloud and IoT and the problems of Mohammad Aazam et al, [6] propose an integration of IoT and Cloud Computing as “Cloud of Things (CoT)”. Provide improved service provision more useful to the user and efficient use of resources.

   The integration of the technologies i.e. “The Cloud of Things” has a lot of challenges.

   There are cases when the sensor data during some initial duration is not really useful , but the data might still get uploaded to the cloud platform. In that case, either the sensor should pause parsing the data, or the device should be capable of recognizing the waste data before uploading it to the cloud in order to minimize network consumption as well as the storage. For this purpose, the device uploading the data should be able to perform some processing before sending it to the cloud. Also the device should be capable enough to run tasks on a schedule and also collect feedback from the applications.

B. A common design for combining the Internet of things in cloud computing Jiehan Zhou et al [7] is by focusing on a general advancement in integrating the Internet of Things and Cloud Computing as “Cloud Things Architecture”. The “Cloud Things architecture”,

   A cloud-IoT platform that supports Platform as a service, Infrastructure as a service and Software as a service (PaaS, Iaas and Saas) to manage the data as well as process it.

   Another challenge which exists is how to use the various models of cloud computing in order to generate optimum efficiency. Figure 2.1 defines that “Cloud Things Architecture” allows systems to take complete advantage of the infrastructure to develop and build applications and services.

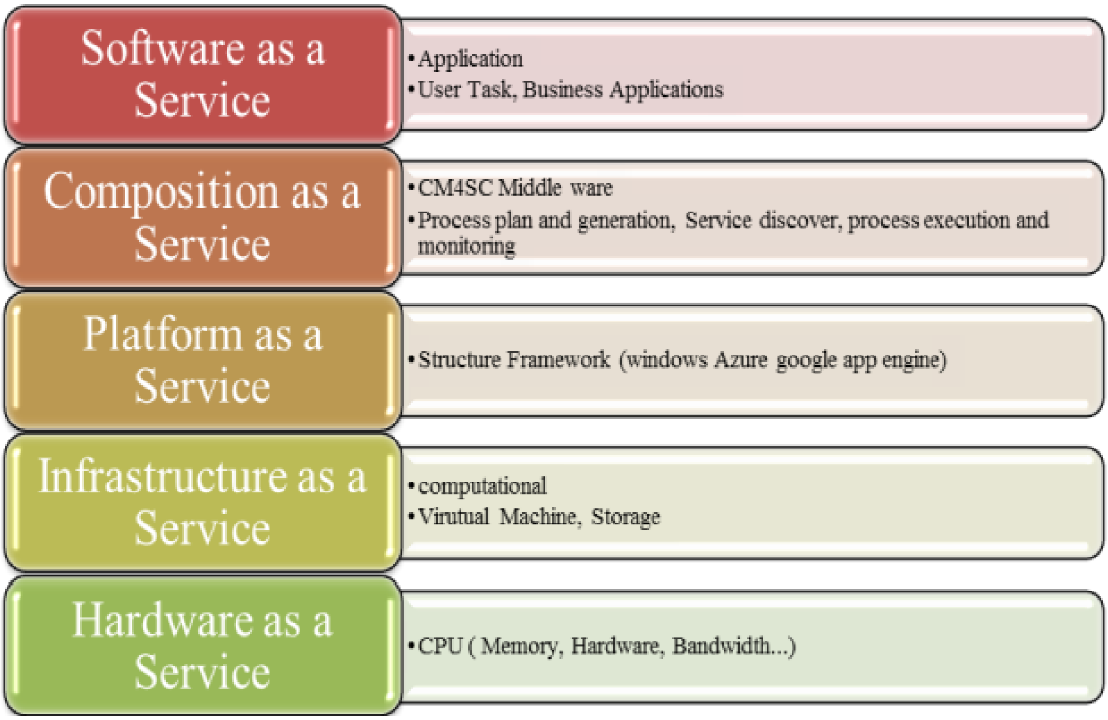


Figure 2.1

C. “ On the integration of Cloud Computing and Internet of Things Alessio Botta, Walter de Donato et al. [9]” the authors suggested to analyze and discuss the need for this combination .

1) Storage: IoT generates huge amounts of data, which is usually unstructured or semi-structured data, along with a lot of variety (data types) as well as different data generation speeds. This involves gathering and processing huge amounts of data. By the vast amounts of storage capabilities of the cloud at a comparatively low cost, cloud computing is the cheapest way to process and preserve the data generated by IoT.

2) Computational power: The IoT devices posses very limited processing power and hence it is very difficult to analyze such data on the spot.Thus, the data needs to be sent to powerful computers where the data can be processed. The high processing capabilities along with on demand services make cloud computing an optimal solution to avoid the problem. Other perspectives include real-time processing,

scalable, collaborative, sensor-centric applications, real-time management of complex events, and the implementation of task downloads to save energy.

3) New capabilities: IoT is characterized by a wide range of devices, technologies, and protocols. Therefore the major concerns of scalability, availability, efficiency, interoperability, and security can be tedious to achieve. The addition of cloud solves most of mentioned problems as well as provides certain additional features such as ease of-use and reduced deployment costs. Extension of cloud through the things as mentioned in the following TABLE.

Table III. Extension of Cloud through the Things

SaaS	Sensing as a Service	Providing ubiquitous access to sensor data.
SAaaS	Sensig and Actuation as a Service	Enabling automatic control logics implemented in the cloud.
SEaaS	Sensor Event as a Service	Dispatching messaging services triggered by sensor events.
SenaaS	Sensor as a Service	Enabling ubiquitous management of remote sensors.
DBaaS	DataBase as a Service	Enabling ubiquitous database management.
DaaS	Data as a Service	Providing ubiquitous access to any kind of data.
EaaS	Ethernet as a Service	Providing ubiquitous layer-2 connectivity to remote devices.
IPMaas	Identity and Policy Management as a Service	Enabling ubiquitous access to policy and identity management functionalities.
VSaaS	Video Surveillance as a Service	Providing ubiquitous access to recorded video and implementing complex analyses in the cloud.

Table 2.2

CHAPTER-3
SYSTEM DEVELOPMENT

Hardware Components Used

- Raspberry Pi 3: The Pi 3 Model is even more powerful than its predecessor owing to a quad-core processor and 1 GB of RAM .

- Power Supply: A 5V power source is required in order to power up the setup.

- micro SD Card: A micro SD card is required in order to install the operating system for raspberry pi

- Pulse Sensor: The pusle sensor whose data would be syncchronized.

- Arduino Uno:The UNO is the most used and documented board of the whole Arduino family.

- microSD card reader: A microSD card reader is required in order to connect it to the PC from where the OS is copied to it for further installation. Adafruit is a readily available SD card which already has the Rapsbian OS mounted on it.

- A monitor that supports HDMI — One can use an older composite video display, but HDMI is much more advanced in terms of speed and quality.

- USB mouse

- USB keyboard

RAPSBERRY PI 3

Figure 3.1

The specifications of the latest version of raspberry pi are as follows:

	Model A	Model B
Target Price	20,00 €	28,00 €
SoC	Broadcom BCM2835 (CPU + GPU + DSP + SDRAM)	
CPU	700 Mhz ARM1176JZF-S core	
GPU	VideoCore IV, OpenGL ES 2,0, 1080p30 Full HD HP H.264	
Memory	128 MiB SDRAM	256 MiB SDRAM
USB 2.0 ports	1	2 (via integrated USB hub)
Video outputs	Composite RCA, HDMI	
Audio outputs	3.5 mm jack, HDMI	
Onboard storage	SD / MMC / SDIO card slot	
Low-level peripherals	GPIO pins, SPI, I^2C, UART	
Onboard network	none	10/100 wired Ethernet (RJ45)
Real-time clock	No clock or battery	
Power ratings	500 mA (2.5 Watt)	700 mA (3.5 Watt)
Power source	5 Volt via MicroUSB or GPIO header	
Size	85.60mm x 53.98mm	
Supported OS'es	Debian GNU/Linux, Fedora, Arch Linux	

Table 3.1

GPIO IN RASPBERRY PI

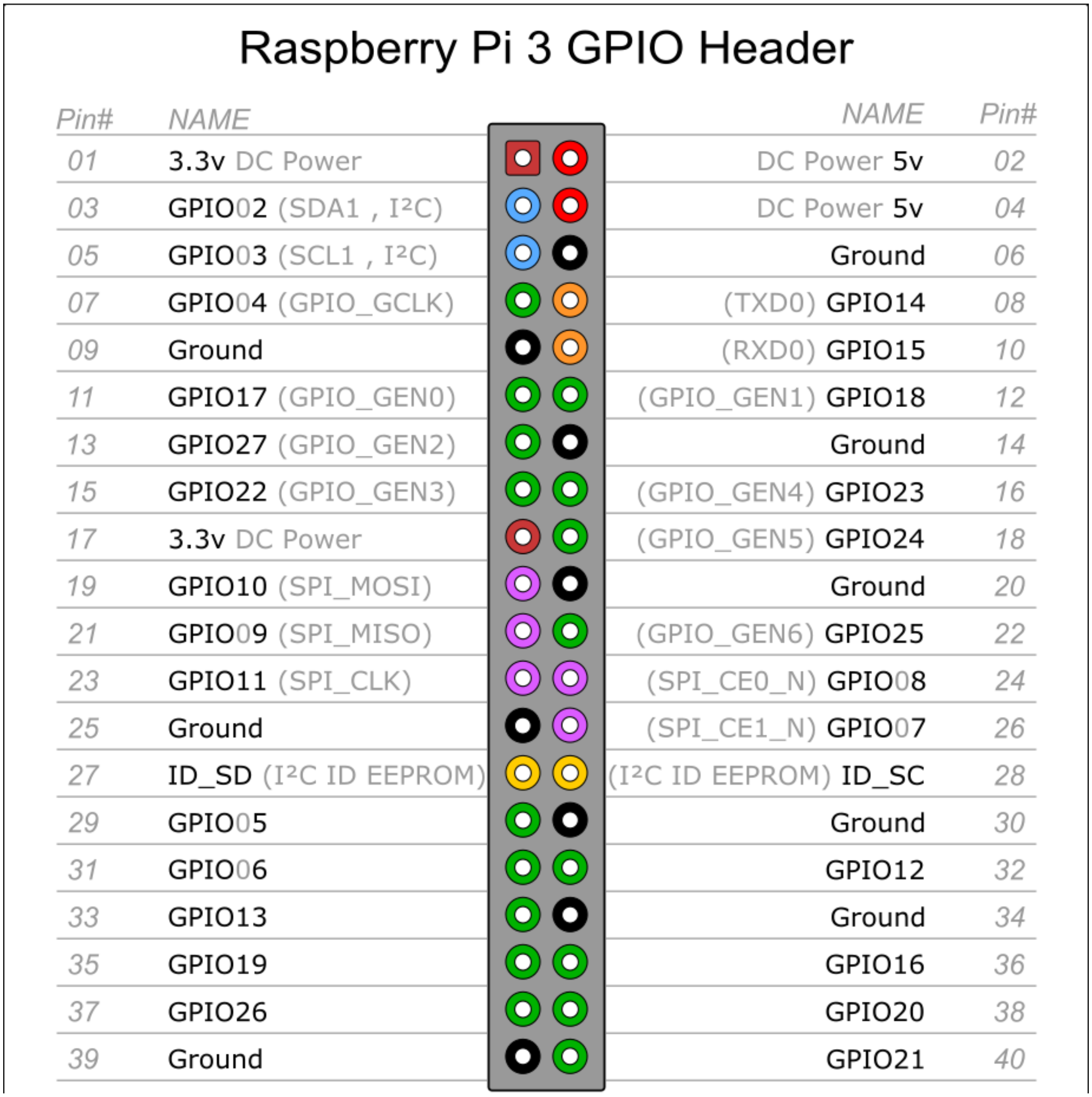


Figure 3.2

ARDUINO UNO

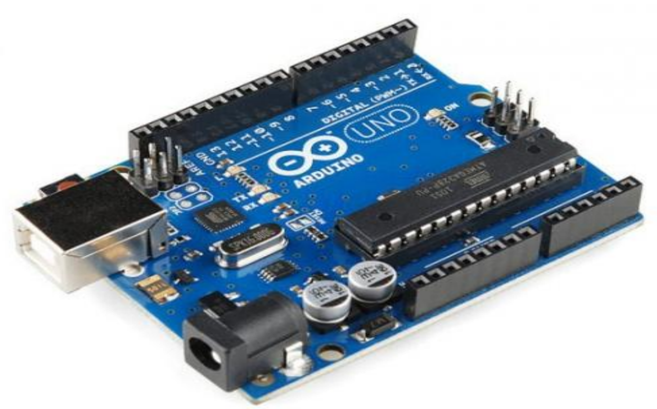


Figure 3.3

Arduino Uno is a multi-utility board based on the ATmega328P microcontroller . It is equipped with 14 digital input/output pins, 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply attach it to a PC via a USB cable or power it through an AC-to-DC adapter or battery to run the microcontroller.

Microcontroller	ATmega328P
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limit)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	6
Analog Input Pins	6
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328P)
SRAM	2 KB (ATmega328P)
EEPROM	1 KB (ATmega328P)
Clock Speed	16 MHz
LED_BUILTIN	13
Length	68.6 mm
Width	53.4 mm
Weight	25 g

Table 3.2

GPIO IN ARDUINO UNO

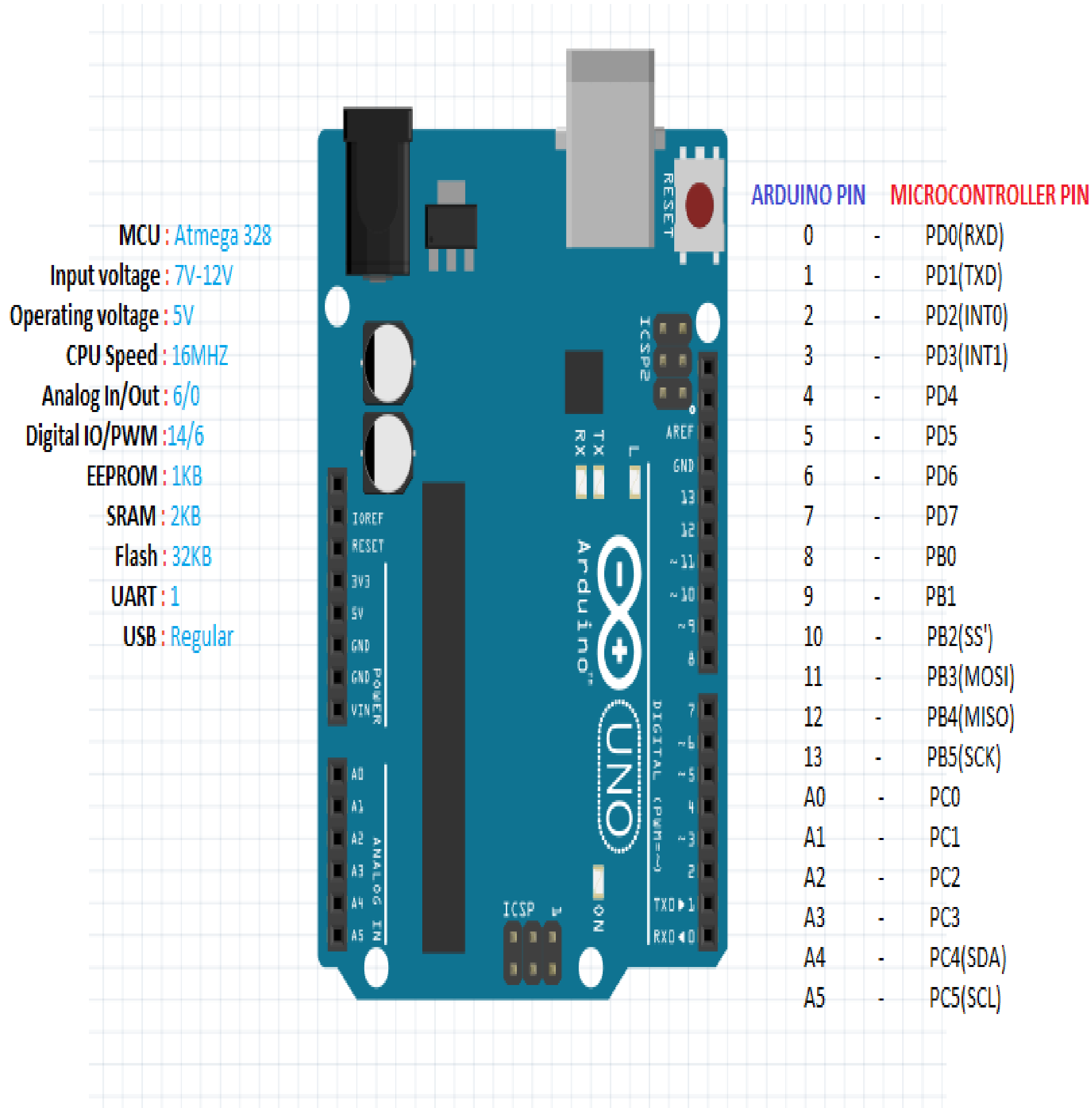


Figure 3.4

PUSLE SENSOR:

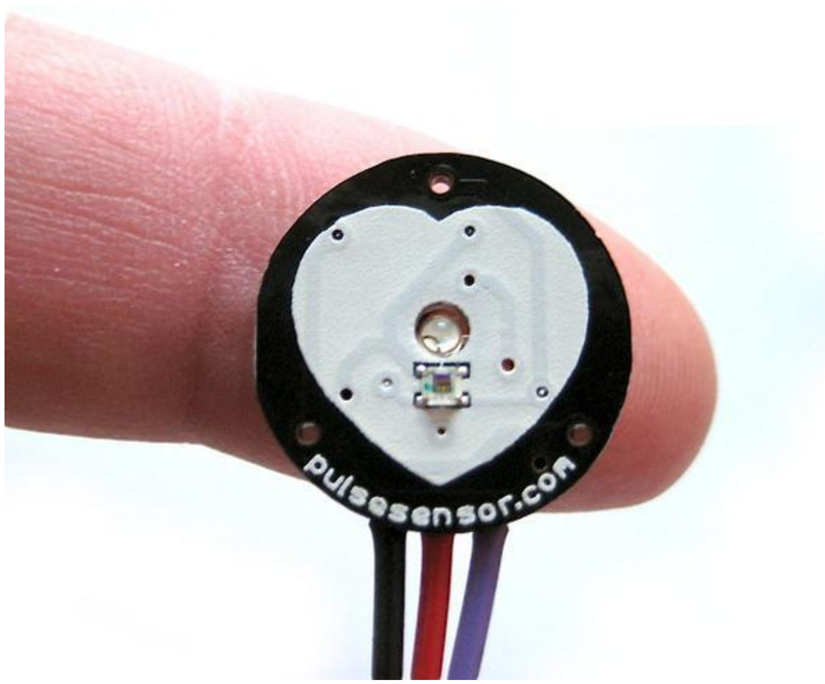


Figure 3.5

The Pulse Sensor that is being used uses a technique known as photoplethysmography, which is a well known medical device used for non-invasive heart rate monitoring. At times, photoplethysmographs measure oxygen levels within the blood (SpO2), sometimes they don't. The output from the photoplethysmograph is an analog fluctuation in voltage, and it has a predictable wave shape as shown in the figure on the next page. The depiction of the pulse wave is called a photoplethysmogram, or PPG. This piece of hardware amplifies the raw signal of the previous Pulse Sensor, and normalizes the pulse wave around V/2 (midpoint in voltage). Pulse Sensor Amped responds to relative changes in the intensity of light that is received .If the amount of light incident on the sensor remains constant, the signal value will remain at (or close to) 512 (midpoint of ADC range). More light and the signal goes up. Less light, the opposite .Light from the green LED that is reflected back to the sensor changes during each pulse.

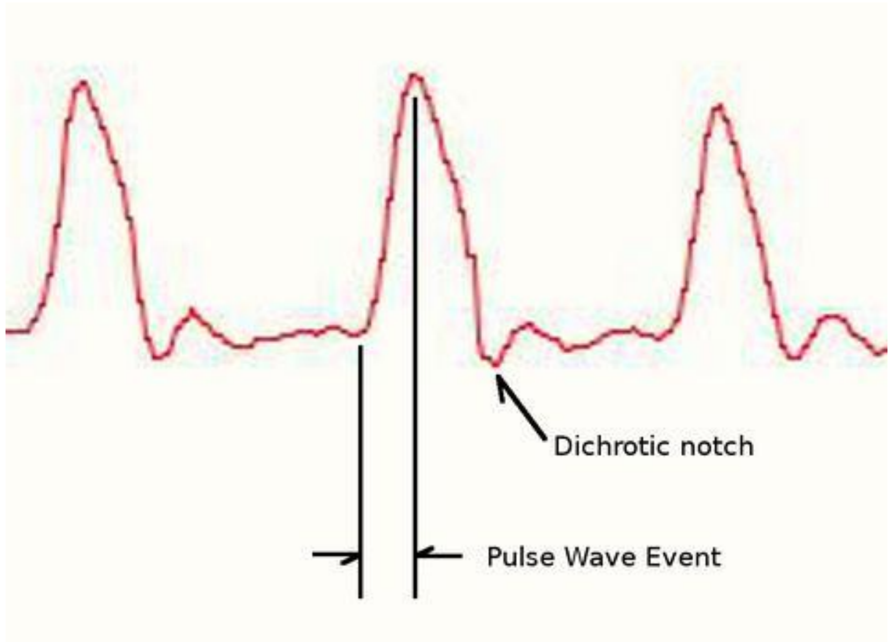


Figure 3.6

PULSE SENSOR INTERFACING

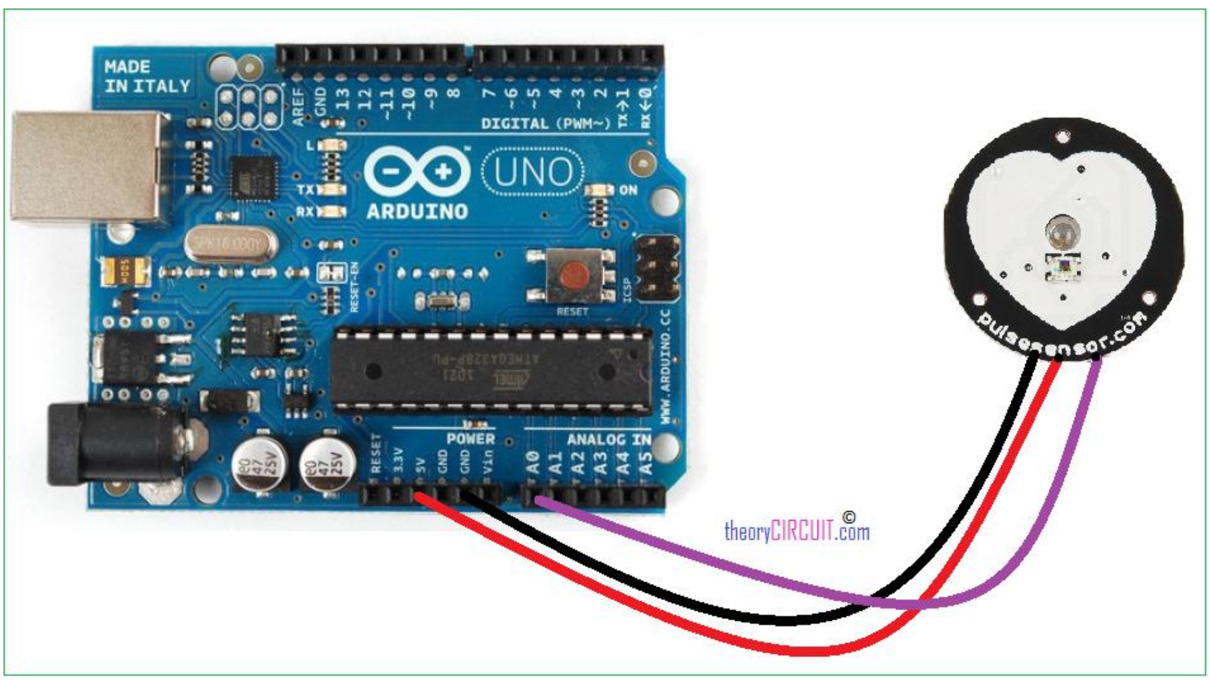


Figure 3.7

Once the pulse sensor is connected to the board properly , we supply power to the board and begin the coding for the output.The coding part for board is done on an open source program called the Arduino IDE.

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board.

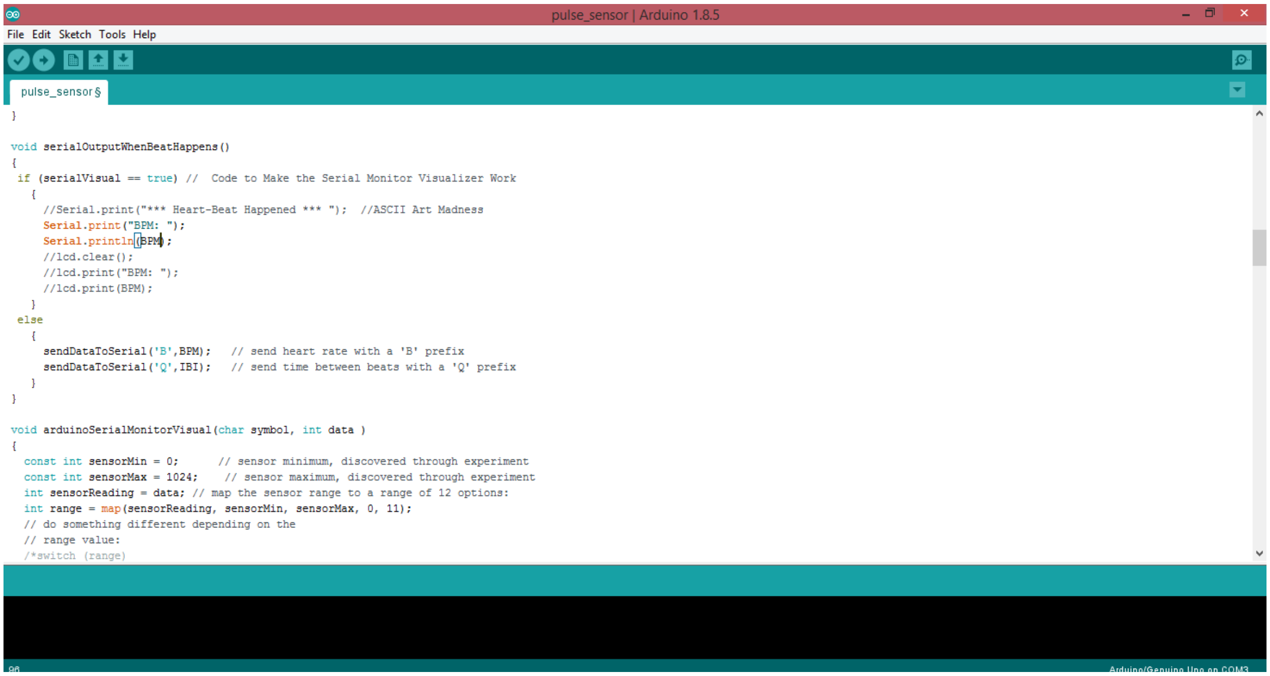


Figure 3.8

FILE I/O

The Serial Monitor is a separate pop-up window that acts as a separate terminal that communicates by receiving and sending Serial Data. However, a proper file format is required to store and further analyze the data.

Thus a program is required to fetch the data. The program used to save the data is a python program by the name ‘grabserial’.

In order to save the data into a csv file with a timestamp file the following command is used.

```
Python grabserial –T –o data.csv
```

DATA FLOW

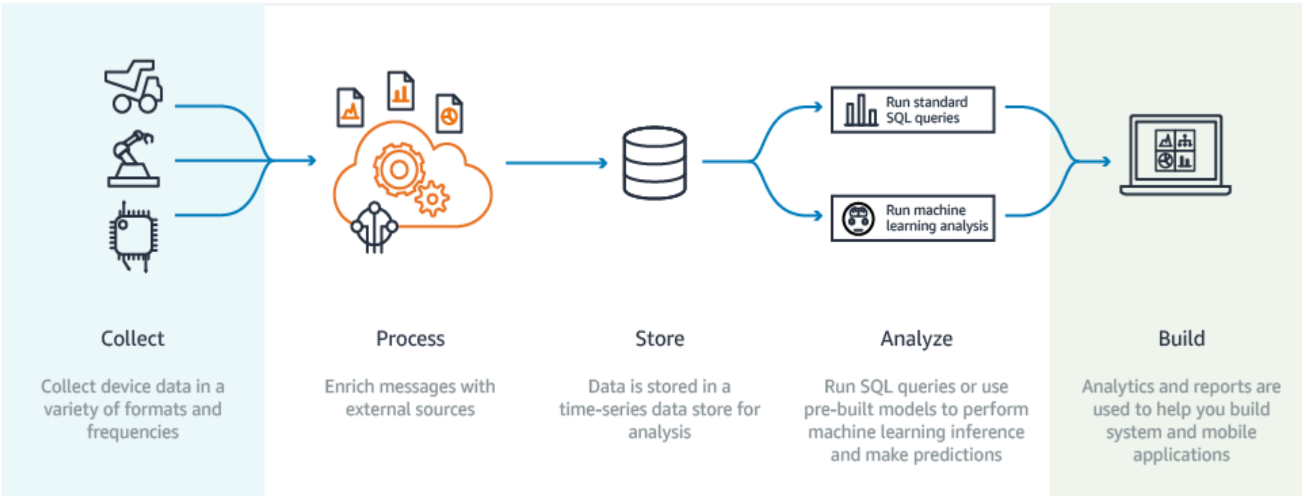


Figure3.9

CLOUD SYNCHRONIZATION

IoT data are completely incomprehensible, which makes it difficult to analyze with traditional analysis tools and intelligence tools to process structured data. IoT data comes from devices that often register very noisy processes (temperature, motion or noise). Therefore, data from these devices can often have significant gaps, erroneous messages and misleading data that must be cleared before the operation. In addition, IoT data is often only useful along with other data from external sources as it is anetwork of sensors working together.

DROPBOX

Dropbox is a global collaboration platform where files, folders, and docs are created, accessed, and shared.. It has more than 500 million registered users spread worldwide.
Dropbox is available online at dropbox.com and for Windows, Mac, or Linux computers, as well as Android and iOS phones and tablets.

However, the official application designed by Dropbox only supports x86based computers and fails to provide an application for ARM based devices, such as the Raspberry Pi.

Hence in order to sync the data to cloud, a different approach is needed to continuously synchronize data from the sensors into the cloud platform.

RCLONE

Rclone is an open source command line project to synchronize files and directories to and from various cloud services.
It acts as a great tool to upload the data into cloud servers by using the respective API for particular service.
Currently supported services through rclone include:

- Amazon S3
- Dropbox
- Google Cloud Storage
- Google Drive
- Memset Memstore
- Microsoft Azure Blob Storage
- Rackspace Cloud Files
- SFTP
- The local filesystem

Rclone needs to be extracted and configured properly before use:

In order to upload a particular file to the cloud:

```
Rclone copy /home/pi/test2.csv remote:/data/
```

CRON

Raspberry Pi Cron Jobs can be used for a number of things. They can be configured so as to run programs/scripts at a defined system time.
A few examples include performing data analytics on a scheduled time, uploading files into the cloud or even creating data backups.

```
# * * * * *  linux command which is to be executed
# ┬ ┬ ┬ ┬ ┬
# │ │ │ │ │
# │ │ │ │ │
# │ │ │ │ └───── day of week (0 - 7) (0 to 6 are Sunday to Saturday, or
use names; 7 is Sunday, the same as 0)
# │ │ │ └────────── month (1 - 12)
# │ │ └─────────────── day of month (1 - 31)
# │ └──────────────────── hour (0 - 23)
# └───────────────────────── minutes (0 - 59)
```

Cron job plays a crucial role when it comes to synchronizing the data. Proper scheduling can be done with the help of crontab so the exact time for uploading the data can be decided.

In order to run upload data every minute the crontab needs to be configured as:

```
* * * * *  Rclone copy /home/pi/test2.csv remote:/data/
```

DATA ANALYSIS

The raw data generated from the sensors needs to be further analyzed to analyzed.
The tool to be used for this purpose is Microsoft Excel.

EXCEL MACROS

An Excel macro is a set of instructions coded in VBA that can be used to abolish the need to repeat the steps of commonly performed tasks over and over again.

VBA code can also be used to filter out required data and hence acts as a great tool for data mining of the sensor data.

CHAPTER-4
PERFORMANCE ANALYSIS

TESTING METHODS

SOFTWARE TESTING:
Software testing is done in order to ensure that the program made or the application (running) to works as planned and no error is generated when the desired input is given. The different levels of testing are:

I. **Unit Testing:**
Unit testing is done in order to ensure that a complete module is working independently and properly without generating any errors.

II. **Integration Testing:**
Integration testing is done in order to check when two or more modules, which have gone under the unit testing phase, are working properly together without generating errors.

III. **System Testing:**
System testing is done to ensure that the entire system is working perfectly without any bugs and errors.

IV. **Acceptance Testing:**
Acceptance testing is done to decide whether the application/system is doing exactly what it was designed for or not.

UNIT TESTING:

In order to check that the each module is working as it is supposed to work,
unit testing was performed.
The unit tests were conducted on the Arduino IDE and the results were generated on the serial monitor.

TEST SUBJECT 1:

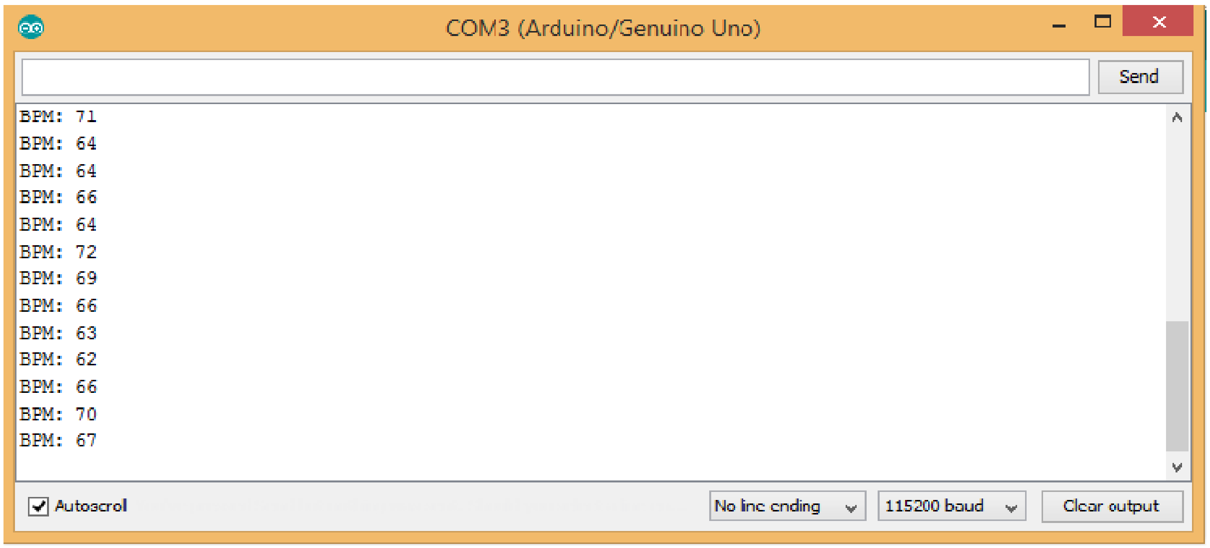


Figure 4.1

TEST SUBJECT 2:

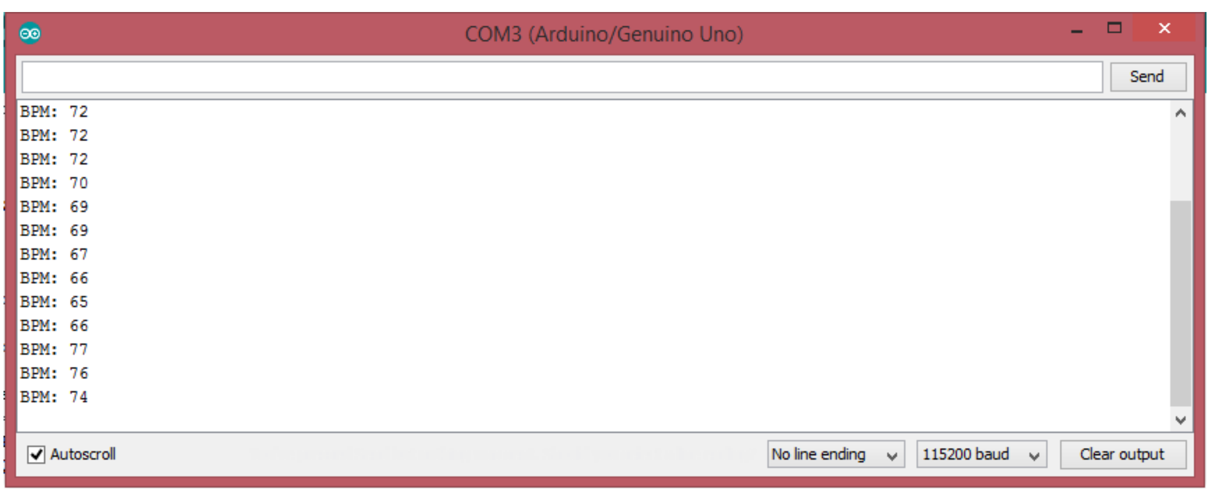
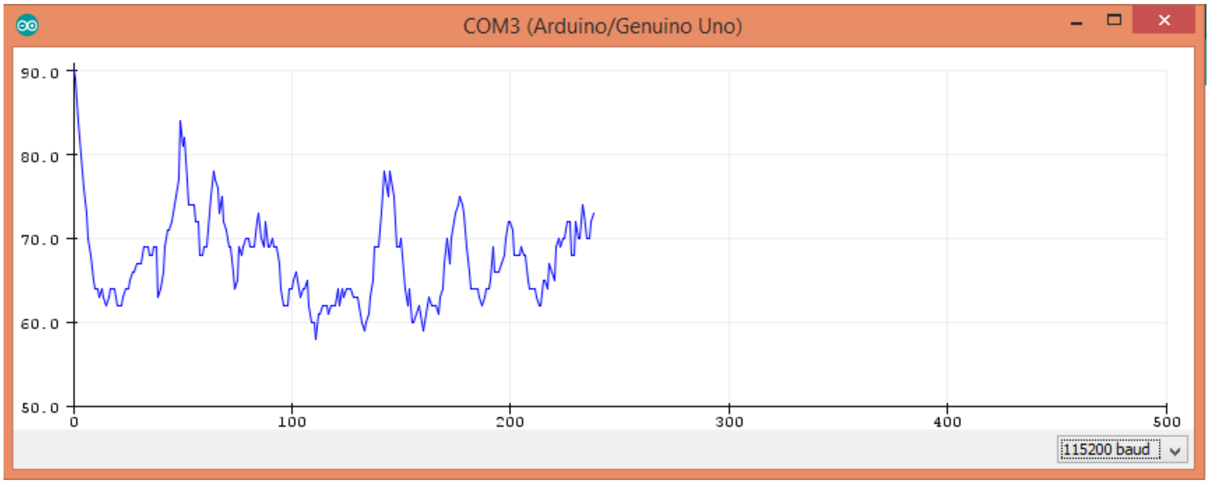


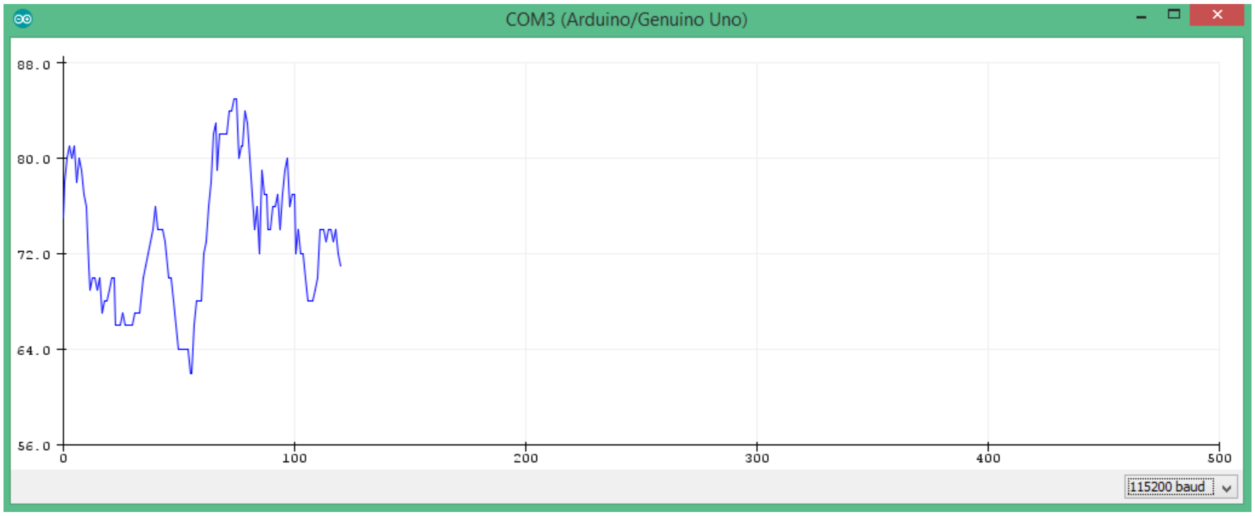
Figure 4.2

GRAPHS**:**

Pulse of various test subjects were monitored and plotted on a graph over a small period of time



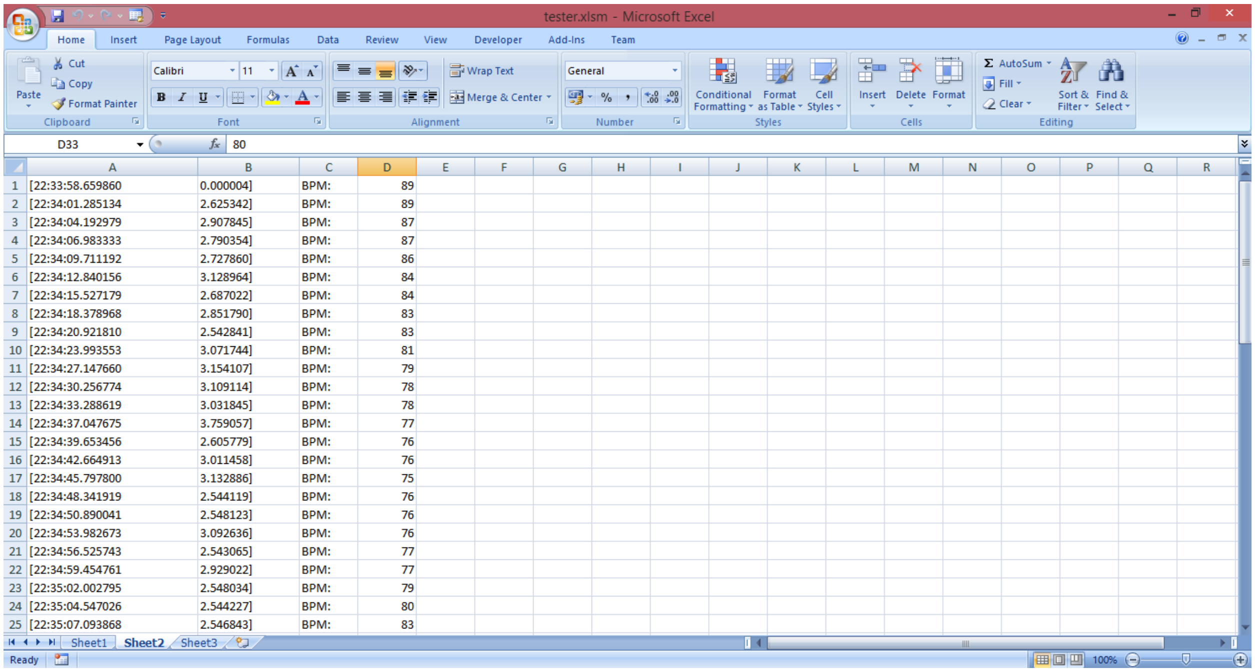
Graph 1



Graph 2

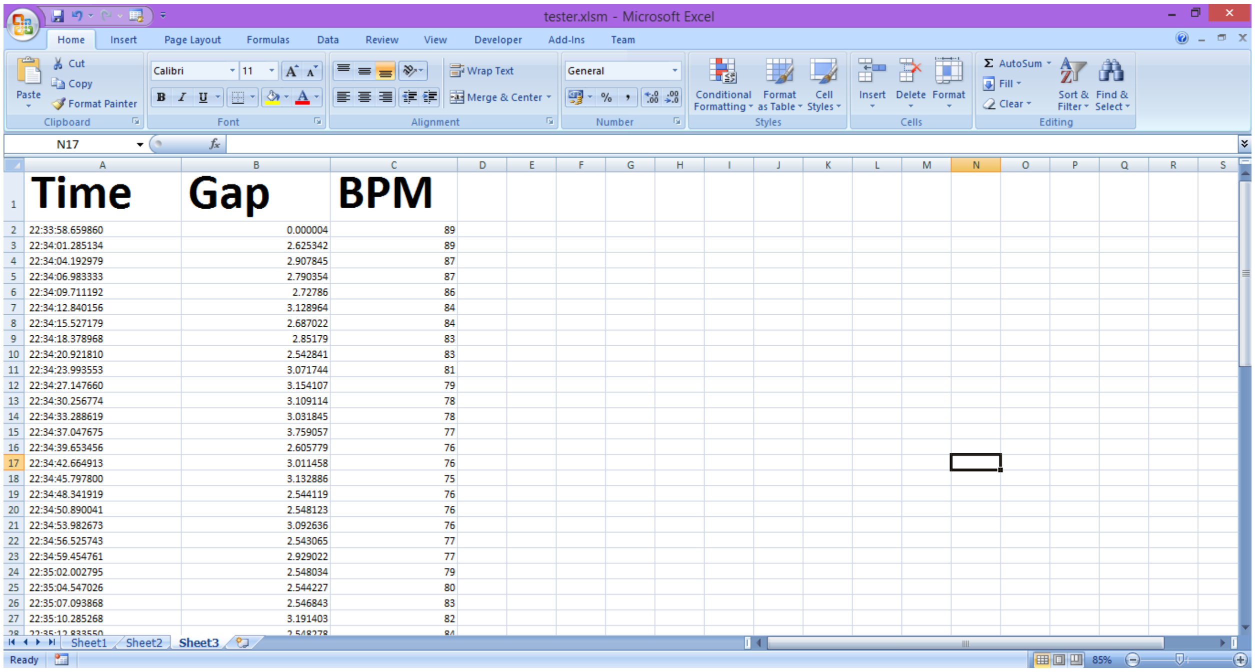
INTEGRATION TESTING

Once unit testing gets completed, integration testing is the next phase in the testing process. We need to assure that two individual modules can function together without generating errors.



	A	B	C	D
1	[22:33:58.659860	0.000004]	BPM:	89
2	[22:34:01.285134	2.625342]	BPM:	89
3	[22:34:04.192979	2.907845]	BPM:	87
4	[22:34:06.983333	2.790354]	BPM:	87
5	[22:34:09.711192	2.727860]	BPM:	86
6	[22:34:12.840156	3.128964]	BPM:	84
7	[22:34:15.527179	2.687022]	BPM:	84
8	[22:34:18.378968	2.851790]	BPM:	83
9	[22:34:20.921810	2.542841]	BPM:	83
10	[22:34:23.993553	3.071744]	BPM:	81
11	[22:34:27.147660	3.154107]	BPM:	79
12	[22:34:30.256774	3.109114]	BPM:	78
13	[22:34:33.288619	3.031845]	BPM:	78
14	[22:34:37.047675	3.759057]	BPM:	77
15	[22:34:39.653456	2.605779]	BPM:	76
16	[22:34:42.664913	3.011458]	BPM:	76
17	[22:34:45.797800	3.132886]	BPM:	75
18	[22:34:48.341919	2.544119]	BPM:	76
19	[22:34:50.890041	2.548123]	BPM:	76
20	[22:34:53.982673	3.092636]	BPM:	76
21	[22:34:56.525743	2.543065]	BPM:	77
22	[22:34:59.454761	2.929022]	BPM:	77
23	[22:35:02.002795	2.548034]	BPM:	79
24	[22:35:04.547026	2.544227]	BPM:	80
25	[22:35:07.093868	2.546843]	BPM:	83

Figure 4.3



	A	B	C
1	Time	Gap	BPM
2	22:33:58.659860	0.000004	89
3	22:34:01.285134	2.625342	89
4	22:34:04.192979	2.907845	87
5	22:34:06.983333	2.790354	87
6	22:34:09.711192	2.72786	86
7	22:34:12.840156	3.128964	84
8	22:34:15.527179	2.687022	84
9	22:34:18.378968	2.85179	83
10	22:34:20.921810	2.542841	83
11	22:34:23.993553	3.071744	81
12	22:34:27.147660	3.154107	79
13	22:34:30.256774	3.109114	78
14	22:34:33.288619	3.031845	78
15	22:34:37.047675	3.759057	77
16	22:34:39.653456	2.605779	76
17	22:34:42.664913	3.011458	76
18	22:34:45.797800	3.132886	75
19	22:34:48.341919	2.544119	76
20	22:34:50.890041	2.548123	76
21	22:34:53.982673	3.092636	76
22	22:34:56.525743	2.543065	77
23	22:34:59.454761	2.929022	77
24	22:35:02.002795	2.548034	79
25	22:35:04.547026	2.544227	80
26	22:35:07.093868	2.546843	83
27	22:35:10.285268	3.191403	82

Figure 4.4

CHAPTER-5
CONCLUSIONS

CONCLUSIONS

The IoT and cloud customizations are reasonable: on the one hand, IoT provides a new data environment and a large amount of new data from multiple sources, while on the other hand, the cloud provides a fast and flexible way to take on responsibilities.

Utilities can use IoT technologies and consumer technologies to support strategic interactions with peripherals, both to monitor and manage asset assets and to optimize the distribution network. In addition, utilities can support consumer energy technology as network resources to obtain competitive costs with alternative resources.

5.1 The Future Utility

The addition of distributed energy resources to the distribution network is also a new frontier for the industry. Sensor data will continue to play a key role in ensuring end-to-end exposure, as well as modeling, managing, analyzing, controlling and optimizing DER. The Internet is the link that connects all parts of the new distribution platform, and the cloud provides an environment in which you can do it quickly, with reduced risk and lower costs.

But traditional supplies also benefit. Millions of field devices that can connect to the network through a communications network and produce continuous data are analyzed regularly, which changes the industry. The ability to store all data in the cloud and analyze where it can be available 24 hours a day, 7 days a week, no matter where they come from, whether in the office or in the field, is a radical change.

The combination of IoT and Cloud technologies gives network operators the flexibility and flexibility to allow operators to efficiently and effectively manage data from multiple devices and large networks in a safe and proactive environment.

5.2 Contribution

- Implement large amounts of sensor-based information faster and better..
- Secure device connection, real-time data analysis and historical data, and integration with back-end applications.
- Allow the organization to deliver new and innovative services more quickly and with less risk..
- Track personnel locations and inventory of remote parts so that technicians enter the field more efficiently.
- Personalize, update and repair smart devices in the network and IoT as needed.
- Identify the risk of device failure faster by increasing the age and reliability of each device.

By leveraging a scalable cloud IoT platform, departments can also take advantage of the latest IT infrastructure as a service, making it easier to maintain and maintain legacy systems in large volumes of data.

5.3 OTHER APPLICATIONS

- **IoT Home Security Model**: A smart home security system can be implemented with the help of smart sensors which could inform the owner of any mis-happenings in the home. The data from the sensor would be stored in the cloud, so that there is no need to clear the memory of the data collected.

- **Smart e-Health Gateway: Bringing Intelligence to Internet-of-Things Based Ubiquitous Healthcare Systems**: A smart e-Health gateway can be implemented here which could acts as a bridge for medical sensors and hospital automation systems to internet and cloud computing platforms. Such gateways can be used in energy efficiency, reliability and interoperability of the health care systems.

- **Windows IoT Core Breathalyzer**: An internet connected alcohol analyzer with cloud synchronization to find out repeated violators.

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