

Lect-1

IOT

31/1/2022

Subject : IOT

INTERNET OF THINGS

hot technology of current world.

IOT involved in different aspects of research.
implementation

IOT cuts across different application domain like

Agriculture

Space

Healthcare

Manufacturing

CONCEPT OF

Smart
City

IOT based applications

→ innovative Shopping System

→ infrastructure management in both urban and rural

areas.

→ Remote health monitoring

→ Emergency notification system.

→ transportation Routing System.

We'll learn Some fundamental Concept & will try to understand them?

Understand the Concept of IOT

Understand what Constituents an IoT design Solution

Identify the sensors and other devices needed for different IOT solution

Understand the Component parts of an IOT network & its connections.

Ch1: Introduction to IOT

Ch2: IOT Devices

Ch3: IOT Networks

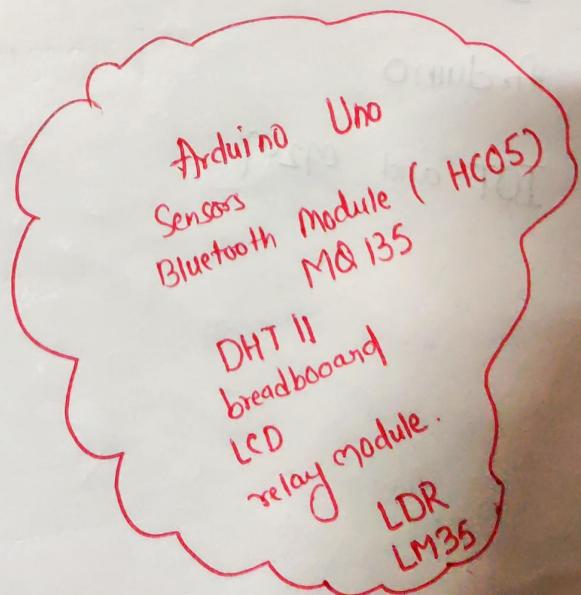
Ch4: Arduino

Ch5: IOT and MQTT

ch 1

Introduction to IoT

- 1 Introduction to IoT.
- 2 Defining IoT.
- 3 Characteristics of IoT.
- 4 Physical Design of IoT.
- 5 Logical Design of IoT
- 6 Fundamental Blocks of IoT
- 7 IoT Protocols
- 8 IoT communication Models
- 9 IoT communication APIs
10. IoT enabling Technologies.



Ch² IoT Devices

Topic 1. How Electronic Devices fit with IoT and why they are important.

2. Electronic Components:
- ✓ BreadBoard and its internal connections.
 - ✓ Seven Segment Display on bread board.
 - ✓ LED & its Connections
 - ✓ Tri Color LED
 - ✓ Resistor

3. Introduction to many end devices,

4. Sensors.

5. Actuators.

6. Differentiate between diff Sensor types.

③ IoT Networks :

- ✓ Introduction to the components of basic IoT Networks
- ✓ the types of the n/w Connections and how data travels through them
- ✓ Role of Internet Protocols
- ✓ Basic Understanding of Microcontrollers / Arduino
- 4 ✓ Communication Protocols

④ Arduino

- Arduino device Introduction
- feature of Arduino Device
- Components of Arduino Device/ board.

Basic Arduino IDE

A Pro. Language [C language]

Variables

Data type

loops

control Statement

function

⑤ IoT & M2M

- Introduction
- M2M
- Difference b/w M2M & IoT
- SDN
- NFV
 - Software defined Networking
 - Network function Virtualization
- IoT & WoT

5 DISRUPTIVE TECHNOLOGIES

- for the next 5-10 years, the most relevant techs that will undergo deep impact on us
- It will create world which will substantially change the world.

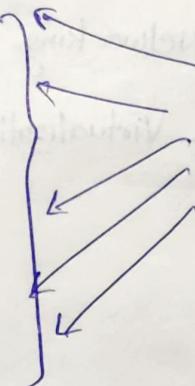
DISRUPTION

- old system collapse
- New things arrive

AIM: we try to teach S/w the way human beings think.

- AI (एमी एसीट) → ML → DL
- 5G (telecom)
- Gene Drive
- DNA Storage
- Block Chain

IoT



All these are developed in parallel

process of brain
linear | Non-linear

→ Computer are dumb, they do not respond to env. autonomy.

Applications (AI)

→ Processes in company like Repetitive task in company, they will get with help of AI / ML Engine.

Automation

(AI)

must not
have

Singular
Consciousness

must not
have

Kill Switch

Humans must have Kill Switch
to prevent Consciousness

(5G)

people think 5G is extension of 4G

Comparision of higher Data Capacity

if it do - 30sec — to — 3sec

it does not mean to
have use case then

→ 5G is just not about Data Capacity.

→ 5G is all about Application,

5G will be data Rich (enough) in data Carrying
capacity of bandwidth both sides (up/down link)

qf can create 3D env to surroundings.

Ex: 3D Class

3D offc.

3D Tax.

3D car destination routing) ^{sense of} autonomous car
driving.

5G is going to transform because of the shear Data Capacity

— enormous applications are there

Gene Drive

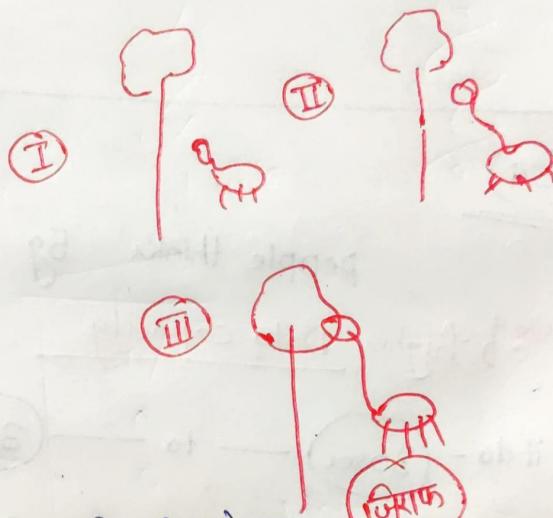
Gene drive is giving molecular level power to Human beings to completely change the laws of inheritance

change the laws of inheritance

Darwin — Natural Evolution

अंतरिकी के नियम

Mendal — How genes pass on to next generation



→ अंतरिकी के नियमों को bypass करके मिलने का
shortcut तरीका Gene drive है।

Preferred characteristics

Non-Preferred characteristics

की widespread

CRISPR Cas 9
tech

Genes Modification

Both chromosome will spread

50% 50%
offspring

XX XY

Cas9 enzyme → Cell repair酶

After 5-10 interation of Generations

They will be modified genes.

Modified gene

CRISPR
Cas9

mosquito

Reproduction power lock (?) X

मादरों की आवादी रक्तम्

gt will wipe out the whole generation of mosquito.

what will be
Evo. effect



But Is it fruitfull?

You don't know
what are the 10 domino effect qt can create

In Nature No species is Useless

Cas9 enzyme → Cell repair Mechanism

After 5-10 interation of Generations

They will be modified genes.

Modified gene

CRISPR
Cas9

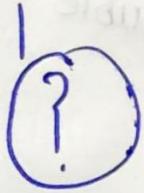
mosquito

Reproduction power (?) X
lock

मच्छरों की आबादी स्तरम्

gt will wipe out the whole generation of mosquito.

what will be
Evn. effect



But Is it fruitfull?



You don't know
what are the 10 domino effect gt can create

In Nature No species is Useless

④ →

DNA STORAGE

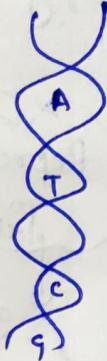
Electronic Storage

CODE
DNA

Modified info.

- 1 > A
- 2 > B
- 3 > C
- 4 > D
- 5 > X
- 6 >

double



A
D/T
C
G

4 compound structure

Compressed information

Storage

→ Nature evolved
↳ near perfect.

Tech.
It is proven
But
Not Scalable

1mm × 1mm × 1m

1 Exa Byte Data

Data coding → Synthetic DNA

device that
decode DNA
information

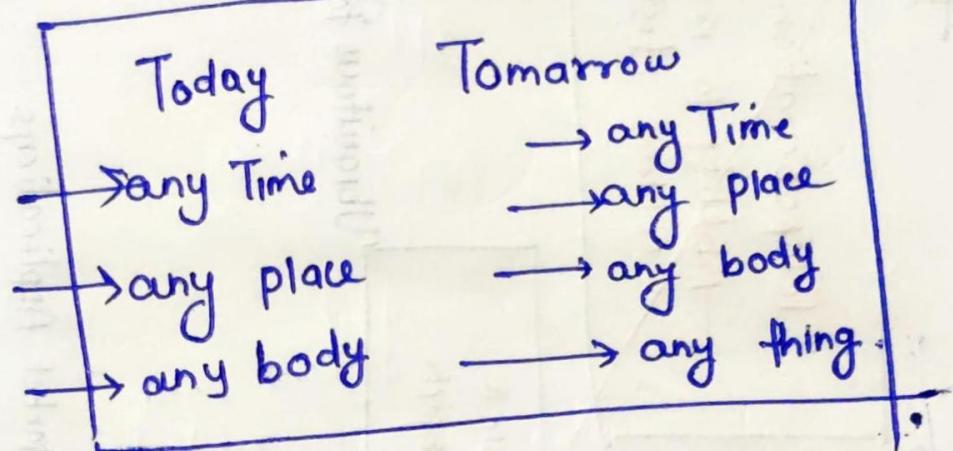
Intro to IoT.

वस्तुओं का Internet

1. Nature of IoT.
2. Features of IoT
3. Benefits of IoT
4. Applications
5. Challenges in IoT

progenitor of IoT

Kevin Ashton
— 1999



bits
32
IPv4
IPv6

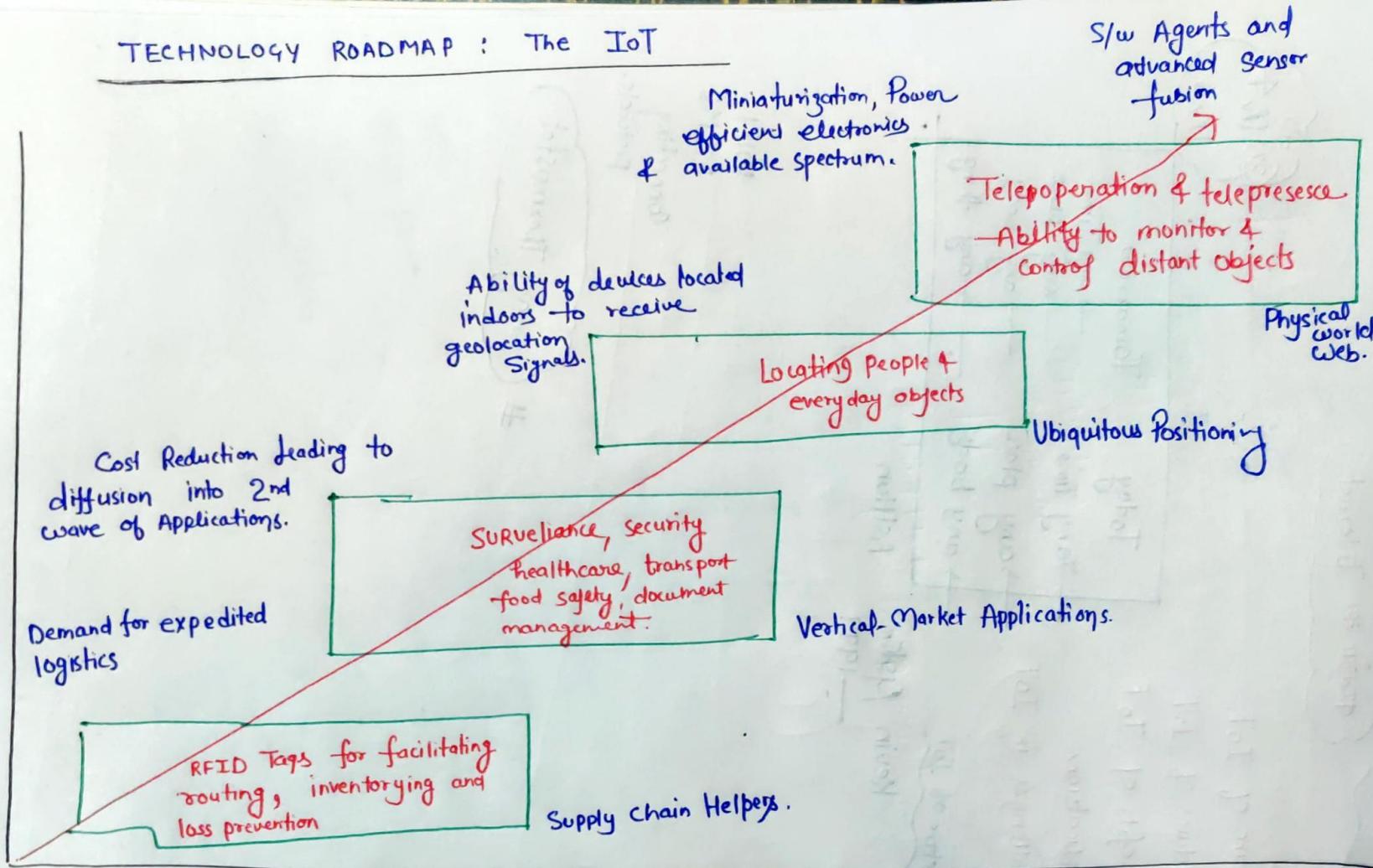
WIFI
MEMS

Connecting
protocols.

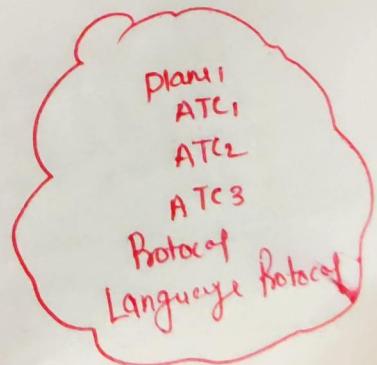
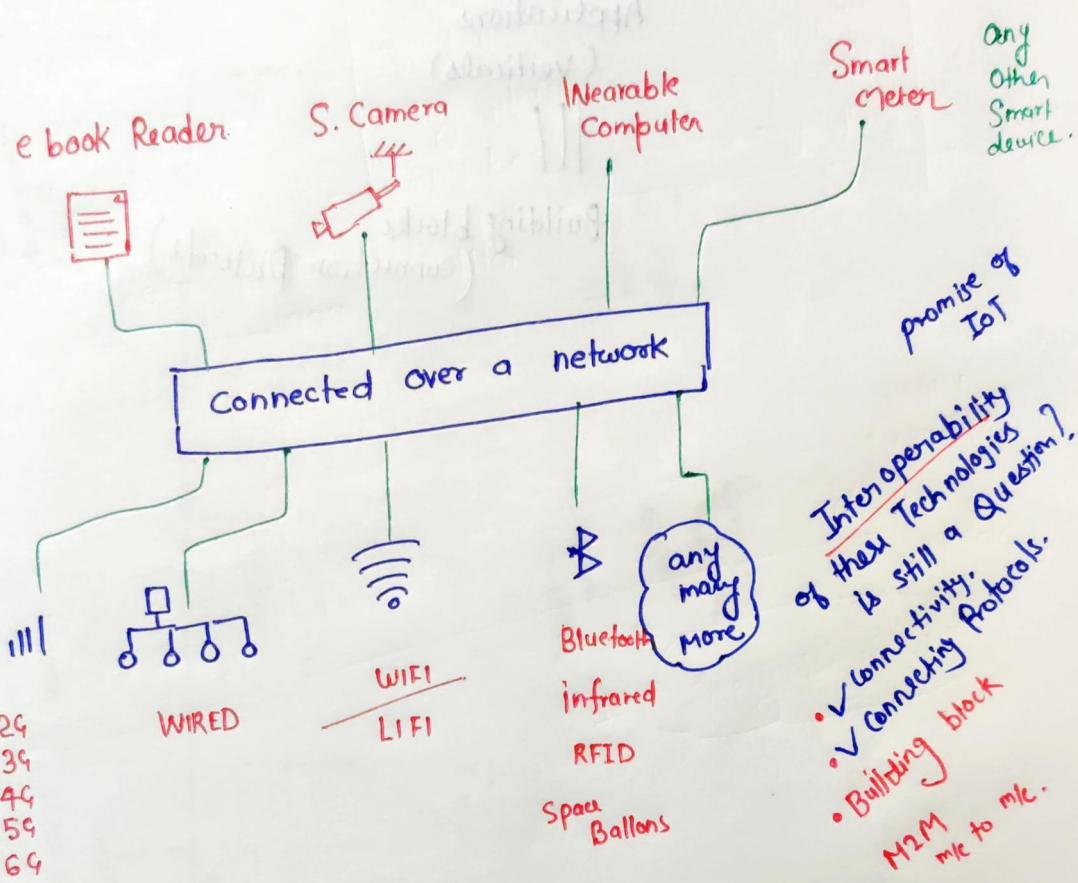
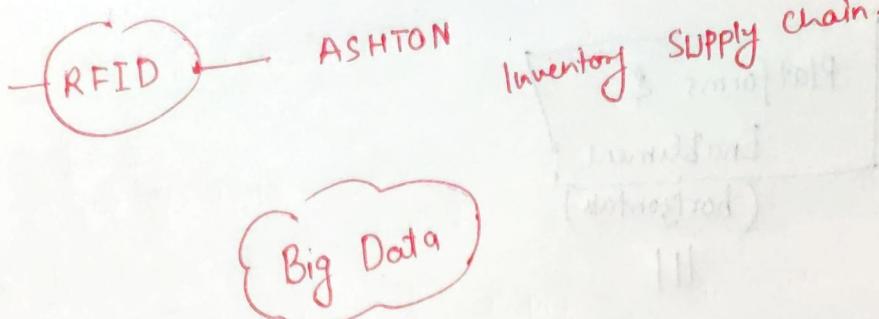
Smart Thermostat

TECHNOLOGY ROADMAP : The IoT

Technology
Reach.



Time



Platforms &
Enablers
(horizontal)

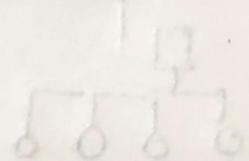
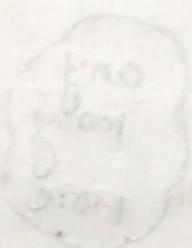
|||

Applications
(verticals)

|||

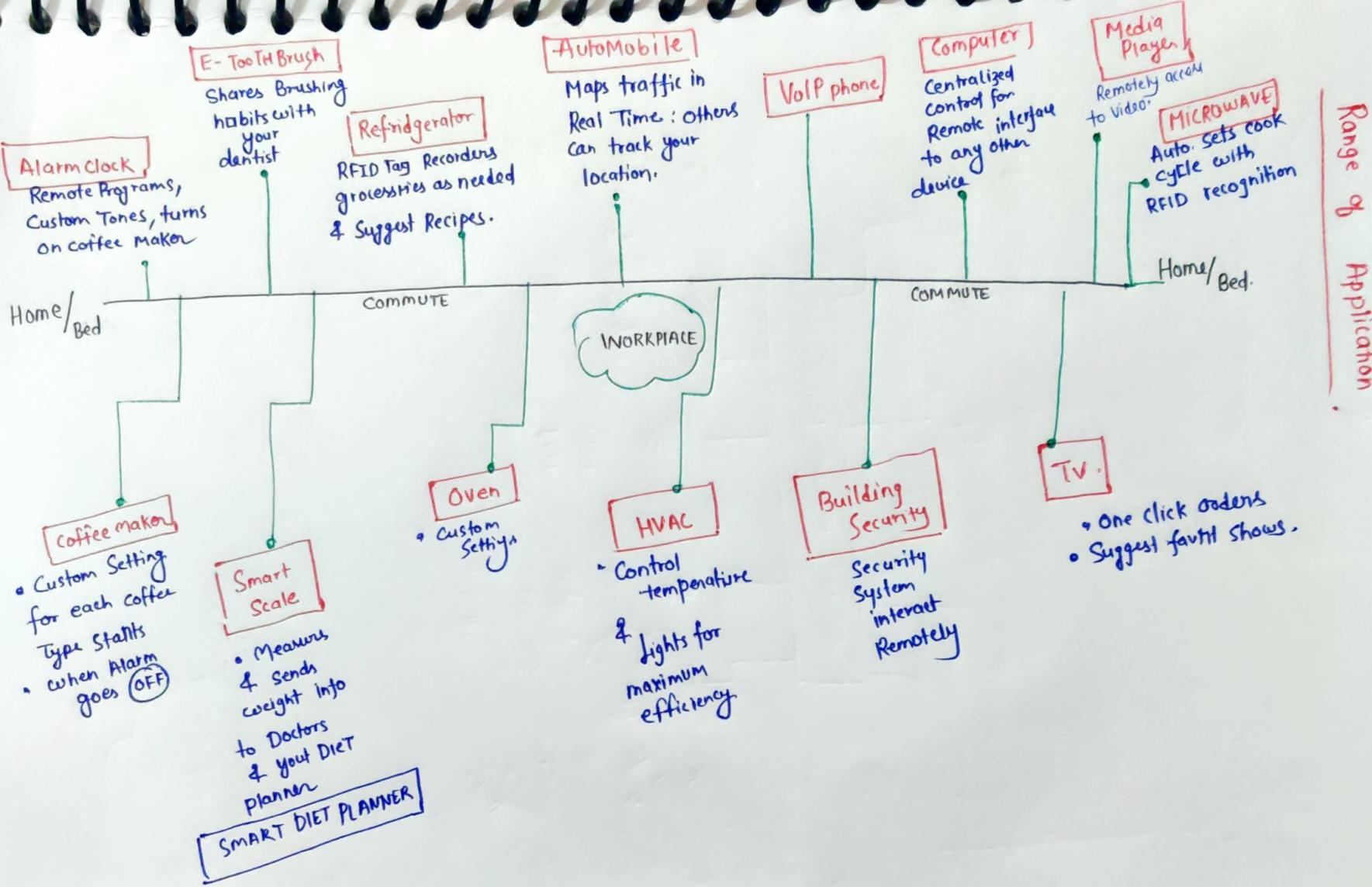
Building blocks
(connection protocols)

Components of a network



|||

27
28
29
30



tion of challenges. Figure 1.4 shows a list of some of its main problems:

Security: IoT generates an environmental scheme for frequently linked nodes contacting networks. Furthermore, the scheme provides minimal regulation despite safety measurements. It protects consumers from different types of hackers [1].

Privacy: IoT expertise presents private information with complete information, not including the involvement of the consumer.

Flexibility: Consumers are worried regarding the elasticity of the IoT scheme for easy integration. The anxiety is about discovering themselves with too many contradictory or protected source codes.

Compliance: IoT, similar to all other technologies in the trade sector, should obey the rules. Its difficulty creates the problem of compatibility seeming like a daunting challenge when many think that typical software compatibility is at war.

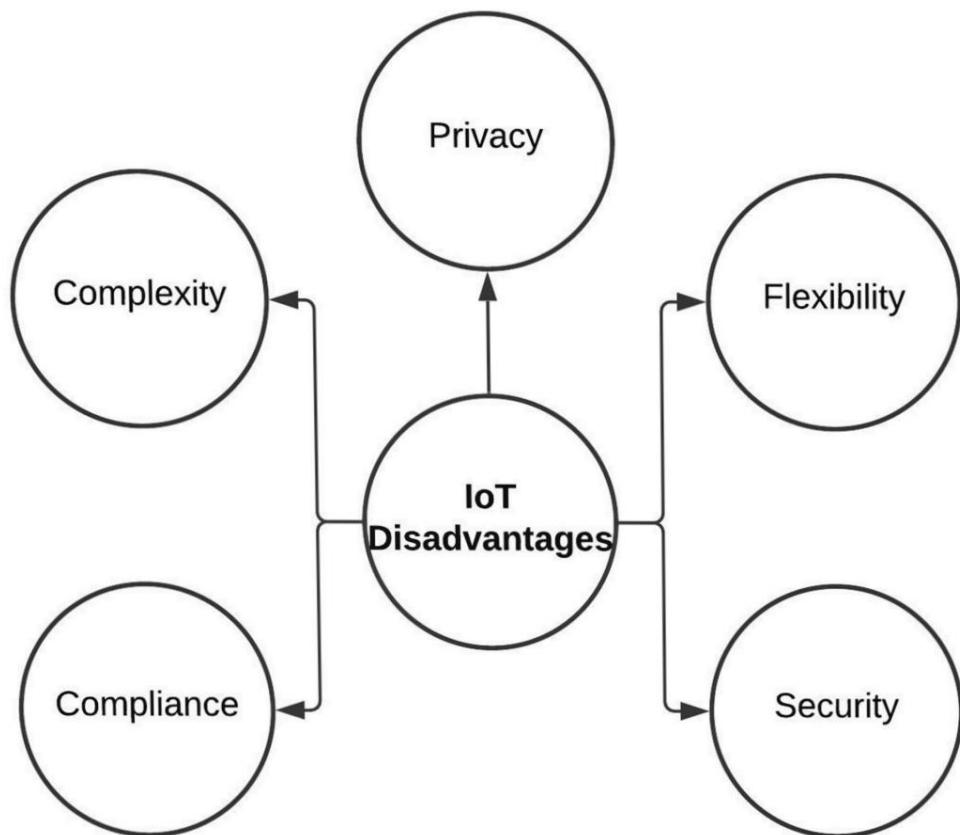
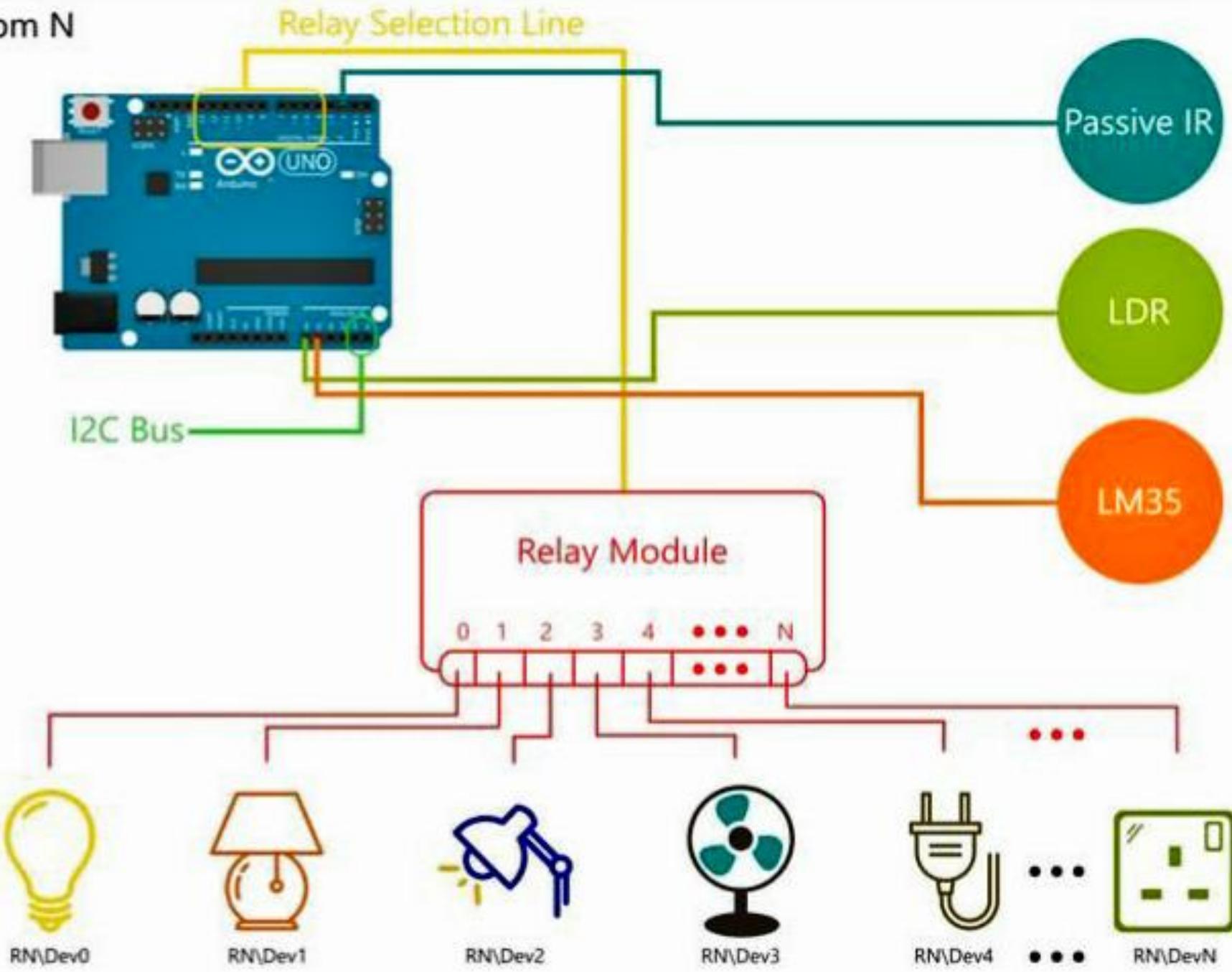


Figure 1.4. Disadvantages of IoT.

SMART HOME



Room N



What Are The Top 10 IoT Trends For The Next 5 Years



- 01 Artificial Intelligence (AI)
- 02 Sensor Innovation
- 03 Social, Legal and Ethical IoT
- 04 Trusted Hardware and Operating System
- 05 Infonomics and Data Broking
- 06 Novel IoT User Experiences
- 07 The Shift from Intelligent Edge to Intelligent Mesh
- 08 Silicon Chip Innovation
- 09 IoT Governance
- 10 New Wireless Networking Technologies for IoT

The Rise of Industrial IoT

82% of respondents have either implemented IoT, are running a pilot program, or are considering it.



79% of respondents currently use or plan to use IoT for predictive maintenance

40% of respondents are not implementing any IoT system (further or otherwise) because they lack the in-house skills to implement and maintain.

What, if any, measures are taken to secure your company's IoT devices?



20% Other

26% Features in existing ERP or other enterprise system

54% Separate monitoring/security solution

What area(s) of your company use data collected from IoT devices?



What data is your company collecting with IoT devices?



51%

Equipment status
(wear-and-tear,
vibrations, etc.)



45%

Energy usage



32%

Telemetrics



28%

GPS



28%

Other



17%

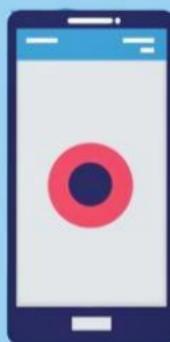
Weather/Climate

All data based on a survey of 139 respondents conducted in January 2019.

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Top sensor types in IoT





EVERYTHING YOU NEED TO KNOW ABOUT THE INTERNET OF THINGS

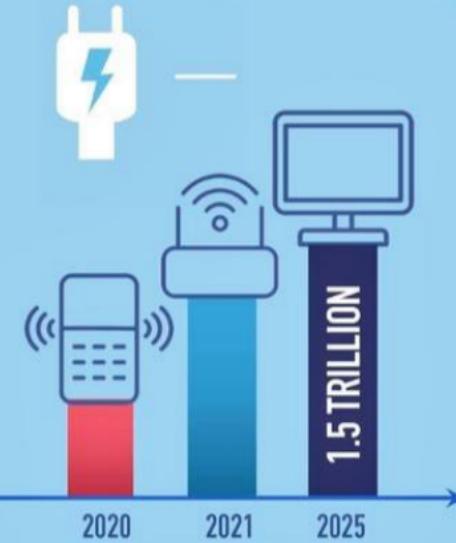
WHAT IS THE

INTERNET OF THINGS (IOT)?

The Internet of Things is a system made up of physical devices connected by the internet and capable of accumulating and sharing data across a network. While the platforms used to develop IoT devices can differ, they all have the same core components in common when it comes to their architecture.

IOT EXAMPLES

If you purchased an Apple watch or Google Home device in recent years, you became part of the IoT revolution. Other Internet of Things applications include Alexa, Ring, and the Amazon dash button that lets you reorder your favorite candy bars when you are running low.



IOT GROWTH

In 2015, small business and mid-sized companies did not have IoT technology as a priority. Fast-forward to today, and many of them now rely on devices for handling day-to-day business.

Seven billion devices were connecting to the internet in 2018, with that number expected to reach anywhere from 10 to 14 billion by 2020.

Researchers estimate that the average person will have at least four connected devices by 2021.

Experts also expect the value of the IoT market to exceed 1.5 trillion by the year 2025.

NEED FOR SPEED

The variety of uses for IoT technology has spurred on its rapid growth in recent years. Consumers will need more bandwidth for their communication needs. Luckily, Phoenix Internet continuously upgrades its infrastructure to handle the needs of multiple IoT connections.



01

The data needs to be sent to cloud to be analyzed. But it needs a way to get there.

Data Ingestion

IoT devices/sensors collect data from the environment. The data can be as simple as temperature/humidity or it can be as complex as a full video feed.

"Almost 5 quintillion bytes of data produced every day by IoT devices."

**02**

To ensure the data security, protocols such as Bluetooth, Sig Fox, LoRa, NB-IoT, ZigBee, COAP, REST, DDS, MQTT, XMPP etc. are used.

Data Transmission

The data is transmitted to the cloud via Gateways (Telemetry Devices). The gateways use both the cellular as well as the satellite communication to transmit the data.

03

Data Processing

Once the data gets to the cloud, IoT platform processes it. The processing can be as simple as checking if the temperature is within the acceptable range or it could be very complex, such as using computer vision on video to identify objects.

**04**

Data Visualization

The processed data (Information) is made useful to the end-user by providing alerts to the user (E-Mails, Text, Notification). The user might have an application (Interface) that allows him to proactively check-in to the system.

05

Data Analysis and prediction

To utilize the data collected over the time, data analytics makes use of the historical data to provide actionable insights. Insights helps in predicting the future events that may occur.

For example, by analyzing the data, we can predict the possible future malfunctioning of a machinery.

How IoT Works

KEY CONCEPTS OF IOT



Hardware

The heart of IoT is billions of interconnected devices with attached sensors and actuators that sense and control the physical world.



Embedded programming

IoT devices are embedded devices, and may be prototyped using commoditized micro-controller platforms, such as Arduino, with custom printed circuit boards (PCBs) developed at a later stage.



Security

Security is one of the most critical concerns in IoT, closely related to data ethics, privacy and liability. It must be built-in at every step of the design of the system.



Networking and cloud integration

Network design and management are essential within IoT, due to the sheer volume of connected devices and due to the impact that network design decisions can have at scale.



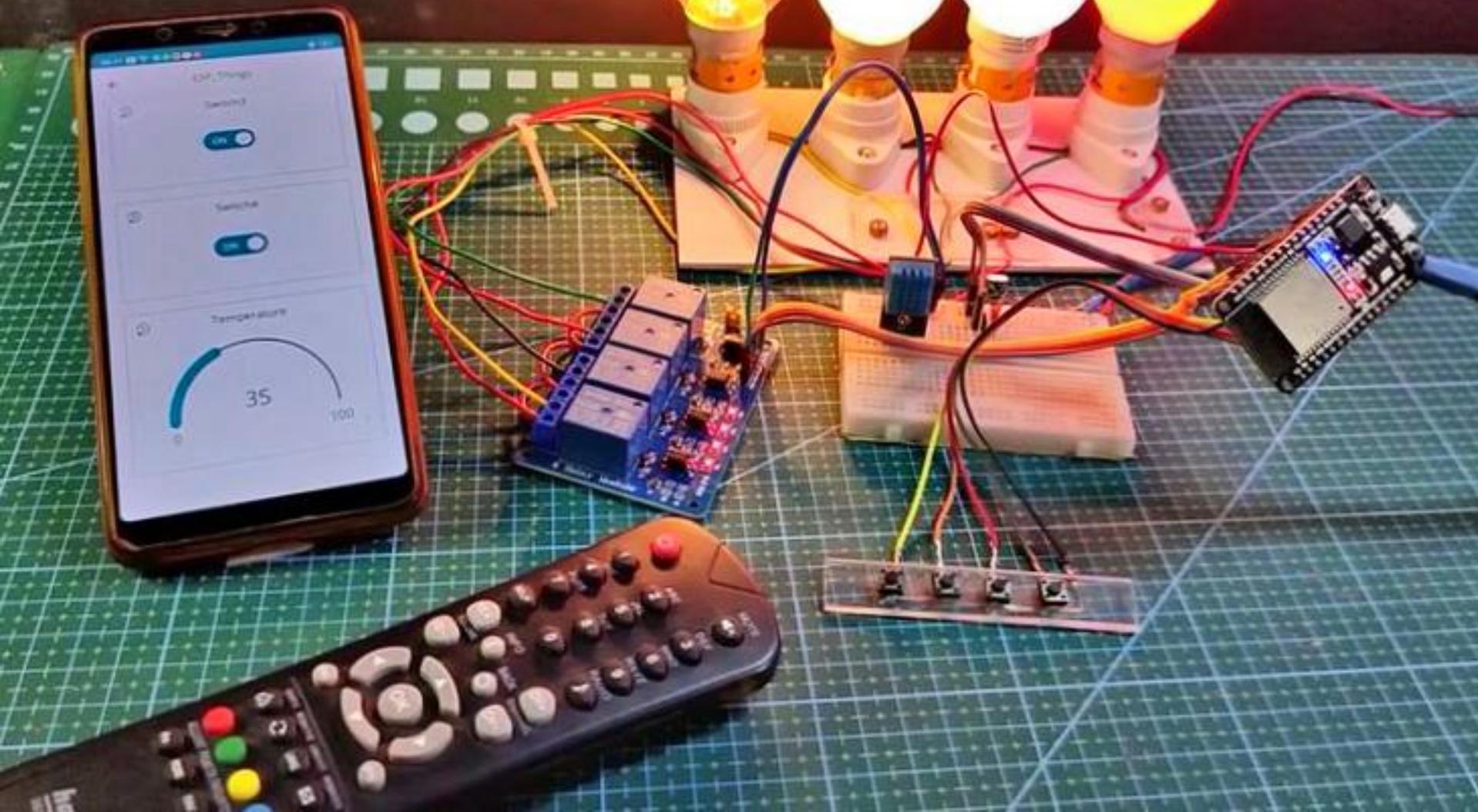
Data analytics and prediction

Developers will need securely and reliably ingest, store, and query the vast quantities of heterogeneous data originating from these devices.

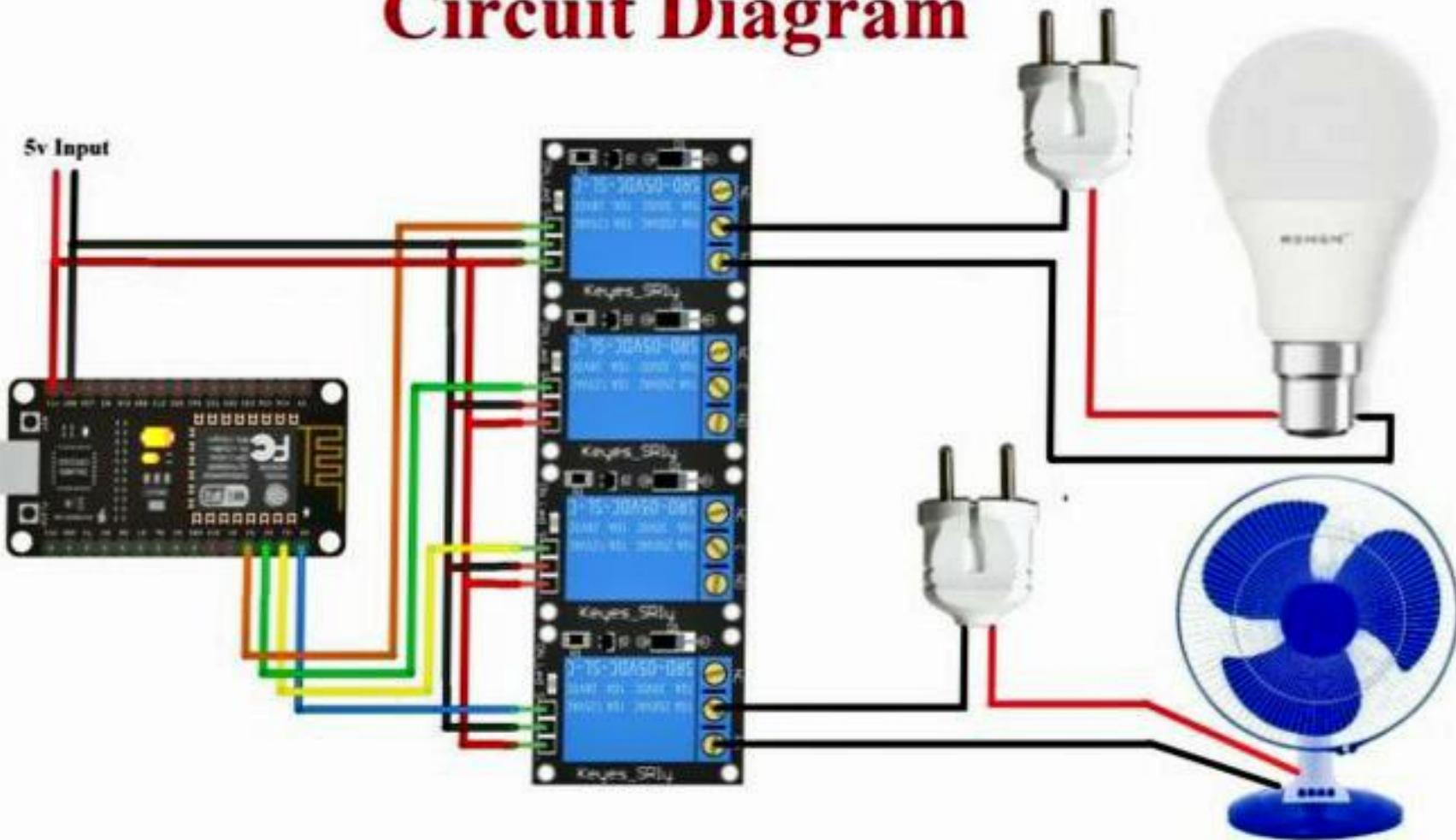


Machine Learning and AI

To be truly intelligent, big data analytics needs to apply cognitive computing techniques drawn from data mining, modeling, statistics, machine learning, and AI.



Circuit Diagram





Why You Should Learn IoT



BETTER SCOPE FOR FUTURE DATA SCIENTIST

One of the unavoidable parts of the web is the information science and examination.

BETTER LEARNING FOR CREATORS EACH DAY

For those who have been promoting IoT needs to understand that once they learn it, their journey does not stop here.

A USER-FRIENDLY PROGRAMMING LANGUAGE

When it comes to learning IoT students have to expect using different tools and programming language that can be used in near future.

BETTER ENCOURAGEMENT

In this competitive world, you might wonder if it is a right choice to be made in terms of career opportunity or not.



AFFORDABLE OPTION OF LEARNING

At a learning age, you need to think of choices that would offer more knowledge than the price.

BETTER CAREER OPPORTUNITIES

Internet has become the ultimate platform for any kind of business irrespective of location and industrial sector.



THE MOBILE ERA

There is no doubt that mobile era has turned out to be a point of change, development and growth for many.

A BETTER UNDERSTANDING OF BUSINESS STRATEGIES

For those students who look forward to come up with their own business shall certainly take a course in this topic.

SAFE AND SECURE LEARNING ENVIRONMENT

If you admit your child for learning IoT, it can be the bliss for them. Generally the course where such option is advised is well integrated with cameras, RFIDs, and better monitoring devices.

A BETTER WAY TO SURVIVE AND FLOURISH

By choosing the option of IoT, there are lot many options that are possible in terms of energy conservation, environmental solution and even the transport and traffic option.



HOW THE INTERNET OF THINGS is RAISING YOUR IQ

CONNECTED HOME

Overnight change in calendar automatically updates alarm clock and turns on coffee-machine timer

Lights & temperature power down as you leave home

Monitor & optimize energy consumption with smart meters & appliances

CONNECTED CITY

Optimize parking resources, reduce pollution & street congestion via connected parking & billing systems



CONNECTED CAR

Find an open parking spot or electric charging station using maps

Reserve a spot & pay with mobile wallet



Maximize resource utilization & plan for future parking locations with real-time analytics



There will be
24,000,000,000
connected devices by 2020

A connected world is enabled by convergence of Mobile, Big data and Cloud. A recent survey of 700+ IT decision makers in the US, UK, Germany, China, India and Brazil presents the following insights.

82%

Think Machine-to-Machine interaction enables businesses to respond to real-world events*

MOBILE BIG DATA CLOUD

Mobile devices will outnumber **HUMAN POPULATION** in 2013



66% think **BUSINESS & CONSUMER TECHNOLOGY** will converge in 3-5 years*



89% think availability of **LTE & 4G** will be instrumental in M2M growth*



65% think increased **WORKFORCE MOBILITY** is the #1 opportunity for M2M**



In 2013, **DATA VOLUME** will reach **4,000,000,000** terabytes

In 2013, **90%** of consumer-connected devices will have access to some **PERSONAL CLOUD**



65% think biggest challenge in M2M is managing & analyzing the resulting **REAL-TIME DATA****

75% think **EMPLOYEES'** personal use of mobile devices & apps influences business's use of cloud



By 2015, **35%** of mid-to-large organizations will adopt **IN-MEMORY computing**



Cloud provides scalability & standardized interfaces to **CONNECT DATA** from sensors & machines



85% think **M2M** is part of the natural evolution of the "**CONSUMERIZATION OF IT**" trend*

RUN CONNECTED

Where is the value potential of the Internet of Things?



Interoperability required to capture 40% of total value



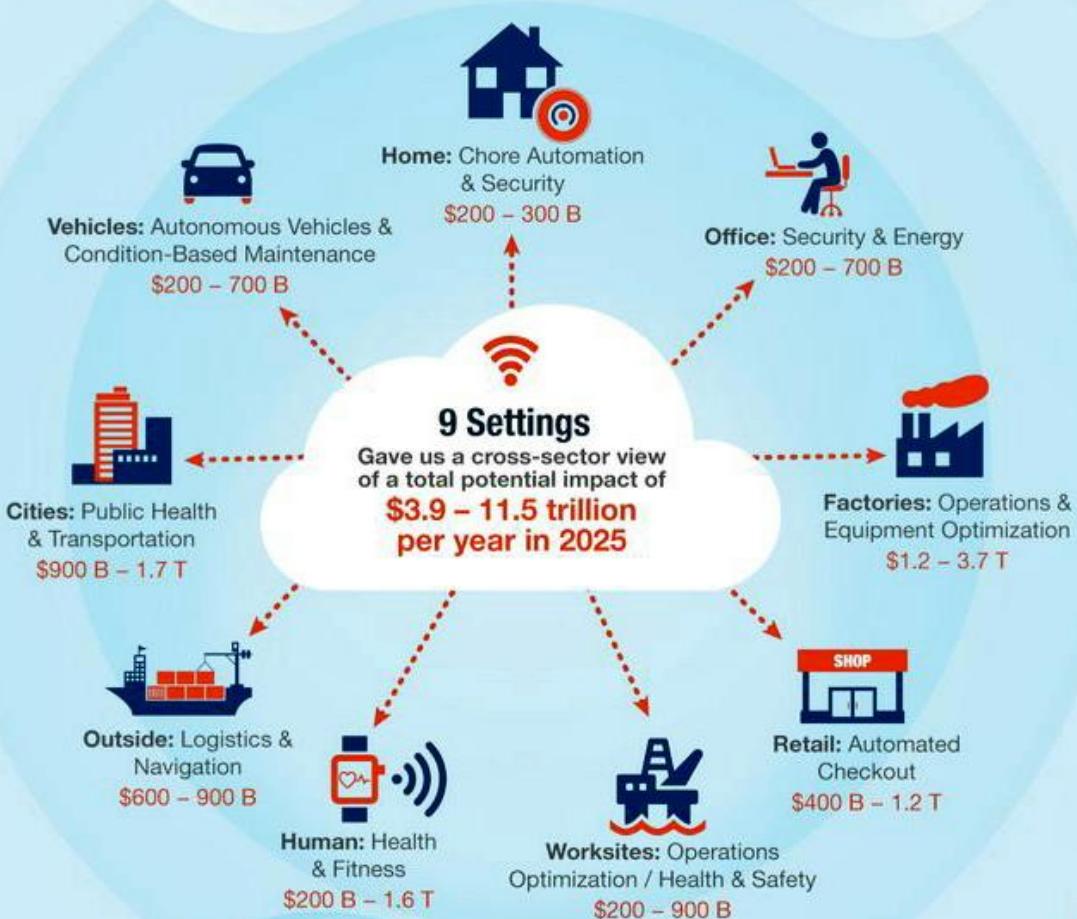
< 1% of data currently used, mostly for alarms or real-time control. More can be used for optimization & prediction.



2X more value from B2B applications than B2C



Developing: 40% / Developed: 60%



Types of Opportunities

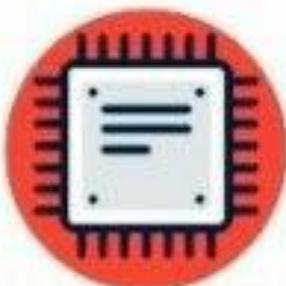
Transform business processes
Predictive maintenance, better asset utilization, higher productivity



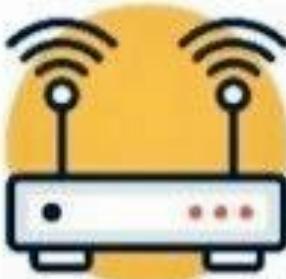
Enable new business models
E.g., remote monitoring enables anything-as-a-service

TOP IoT PROGRAMMING LANGUAGES

Devices



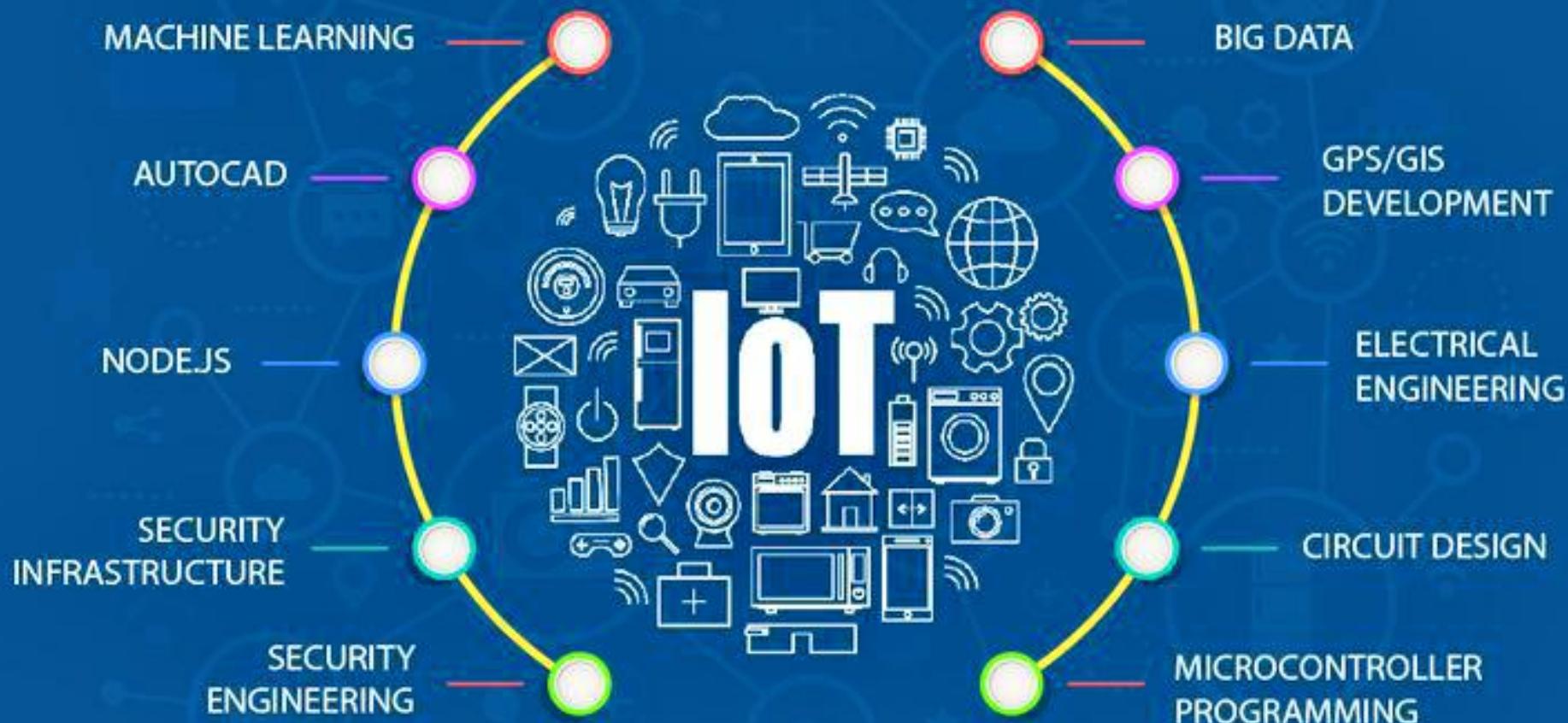
Gateways



Cloud



TOP 10 MOST WANTED IoT SKILLS



Wavelength

1 meter

1 micron

10 nm

0.1 nm

0.01 nm

Radio

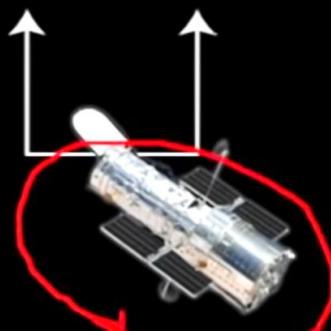
IR

UV

X-ray

Gamma

Nanometers (nm)



Visible



Infrared



In the visible-light image, the Lagoon Nebula is a nearly impenetrable cloud of gas and dust. Buried in its center is a hint of a monster-sized young star 200,000 times brighter than the Sun whose radiation is carving and shaping the nebula around it. Infrared light penetrates the nebula to unveil that blazing star, known as Herschel 36, as well as the myriad of background stars behind the nebula and many that were cloaked in its dust.