Implementation of Blockchain on IoT based System

Group Number - 23

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ABSTRACT

- **Blockchain**
  - Distributed and decentralized ledger
  - Maintains an immutable log of transactions
  - Tamperproof and secure environment for IoT systems
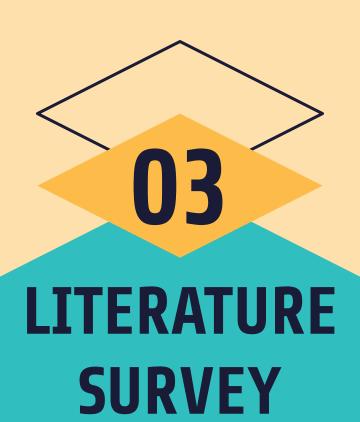
- **IoT**
  - Intelligent interaction between physical and virtual things
  - Machine-to-machine interaction
  - Challenged with security issues
  - Users' private data can be tampered

- **The system consists of:**

  - Smart Laboratory System implementing Blockchain as a security feature
  - Tracking of any changes happening in the environment
  - Record consumption patterns on a private Blockchain network

02

PROBLEM STATEMENT

1. Minimise the potential risks for security of the users' private data
2. Decrease the vulnerabilities in the automation system
3. Maintain privacy and anonymity
4. Minimise the power consumption of the laboratory.

03

LITERATURE SURVEY

Papers – Blockchain on IoT

- G. Papadodimas, G. Palaiokrasas, A. Litke, and T. Varvarigou. "**Implementation of smart contracts for blockchain based iot applications**". In 2018 9th International Conference on the Network of the Future (NOF), pages 60–67, 2018

- N. Fotiou and G. C. Polyzos. "**Smart contracts for the internet of things: Opportunities and challenges**". In 2018 European Conference on Networks and Communications (EuCNC), pages 256–260, 2018

- K. Christidis and M. Devetsikiotis. "**Blockchains and smart contracts for the internet of things**". IEEE Access, 4:2292–2303, 2016
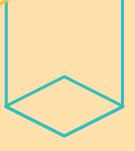
Papers – Smart Laboratory System

- Hu Yin. "**Smart Lab Technologies**", pages 999–1012. Springer Berlin Heidelberg, Berlin, Heidelberg, 2015

- Mary Cherian and Hitesh Kumar. "**Implementation of a secure and smart lab with wireless sensor network**". International Journal of Science and Research (IJSR), 3:964–967, 06 2014

- M. Poongothai, P. M. Subramanian, and A. Rajeswari. "**Design and implementation of iot based smart laboratory**". In 2018 5th International Conference on Industrial Engineering and Applications (ICIEA), pages 169–173, 2018

Papers – Study

- Satoshi Nakamoto. **"Bitcoin: A peer-to-peer electronic cash system"**, 2009

- S. Singh and N. Singh. **"Blockchain: Future of financial and cyber security"**. In 2016 2nd International Conference on Contemporary Computing and Informatics (IC3I), pages 463–467, 2016

- Nick Szabo. **"Smart contracts"**

- Patrick Guillemin Martin Serrano Mustapha Bouraoui Luis P´erez Freire Thomas Kallstenius Kit Lam Markus Eisenhauer Klaus Moessner Maurizio Spirito Elias Z. Tragos Harald Sundmaeker Pedro Malo Ovidiu Vermesan, Peter Friess and Arthur van der Wees. **"IoT Digital Value Chain Connecting Research, Innovation and Deployment"**.

04

TECHNOLOGY STACK

BLOCKCHAIN

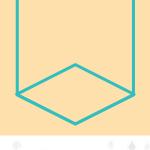Blockchain is a growing list of records, called blocks, that are linked using cryptography

SMART CONTRACT

Smart Contract is a contract that is automatically executed when the requirements are met without the need for a trusted third party

PROOF OF AUTHORITY

PoA is a consensus mechanism that gives a small and designated number of (trustworthy) blockchain actors the power to validate transactions and to update its registry

WEB3.PY

Web3.py is a collection of libraries which allow you to interact with a local or remote ethereum node, using a HTTP or IPC connection.
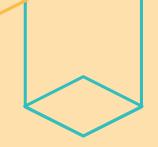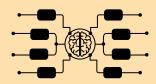

ETHEREUM

Ethereum is an open-source, blockchain-based, decentralized software. It enables Smart Contracts and Decentralized Applications (DApps) to be built and run without any downtime.

SOLIDITY

Solidity is a contract-oriented, high-level language for implementing smart contracts.
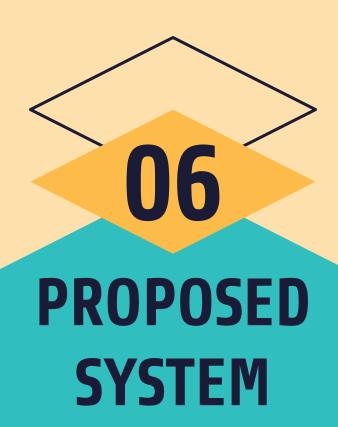
Internet of Things (IoT)

IoT is an environment of a diversity of things
having a wide
presence, which through wireless and wired
connections are able to interact
with each other and cooperate with other things.

05

EXISTING
SYSTEM

- **Design and implementation of IoT based Smart Laboratory**, shows a Smart Laboratory implementation which is built across IoT and Mobile communication technologies to supervise the overall activities of the laboratory. The system monitors the consumption pattern of the devices and uploads it to their server.

- **Smart Lab Technologies**, shows a Smart Laboratory implementation for management of subsystems of a university, including lighting conditions, AC, heating, audio/video, controlling switches and security.

- **Implementation of a secure and smart lab with wireless sensor network**, shows a Secure and Smart Laboratory implementation with Wireless Sensor Network (WSN), Ambient lighting module, Passive Infrared Sensor (PIR), and Environment Sensor (ES).

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PROPOSED SYSTEM

- Implement Blockchain technology on an IoT based system.

- IoT network set up in the college laboratory
  - laboratory will be a private Blockchain network
  - IoT devices will act as nodes on the Blockchain and maintain a private distributed ledger.
  - Every action taken by the system will be recorded as a transaction on the Blockchain using a Smart Contract.

- The Blockchain technology will prove as a security feature.

- Users' private and sensitive data will be secured and it will be ensured that no tampering can be done.
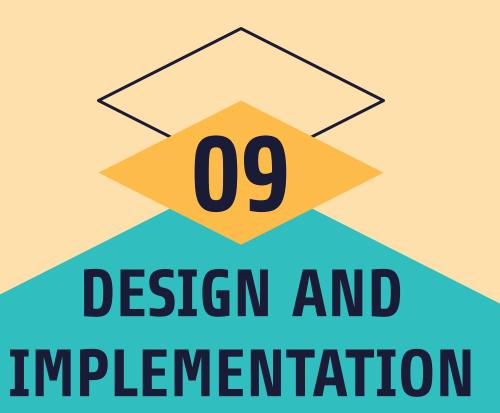
- The system will
  - sense its environment i.e. the laboratory for motion, temperature, humidity and luminosity values
  - Compare these values with the thresholds
  - Actions would be taken accordingly
  - These sensor values as well as actions will be recorded on the Blockchain network
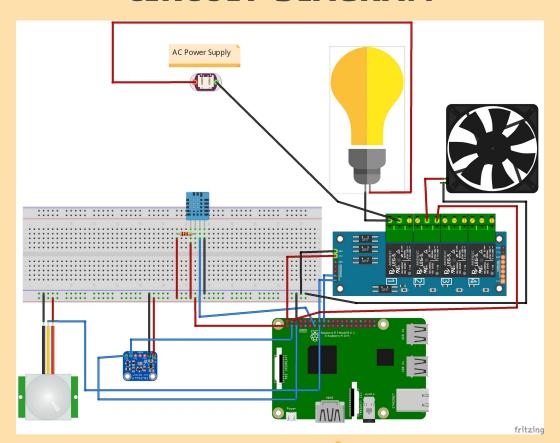
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HARDWARE REQUIREMENTS

- Microcontroller
  - Raspberry Pi version 3 B
- Sensors
  - Luminosity Sensor - TSL2561
  - Temperature and Humidity Sensor - DHT11
  - Passive Infrared Sensor (PIR) Motion Detector Sensor module
- 8 channel Relay board
- Appliances
  - LED Light bulb
  - DC Fan
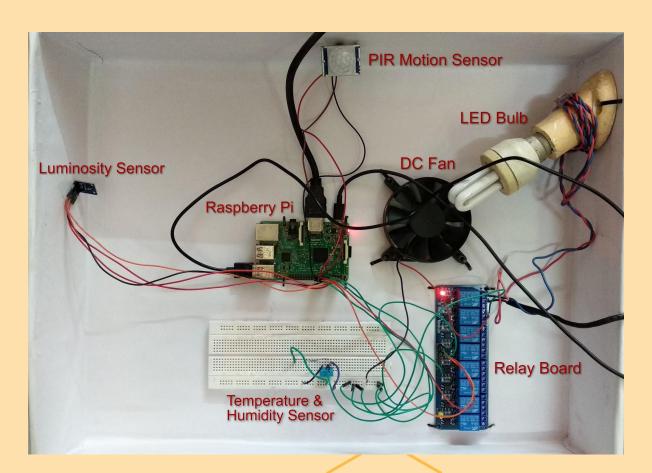- Jumper cables
- Resistors
- Breadboard

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SOFTWARE REQUIREMENTS

- Raspbian Operating System
- Python - 3.x
- Apache Web Server - 2.x
- PHP - 7.x / HTML5 / CSS
- Common Gateway Interface (CGI)
- Ethereum - Geth - 1.8.23
- Ethereum Wallet - 0.9.0
- Truffle - 5.1.17
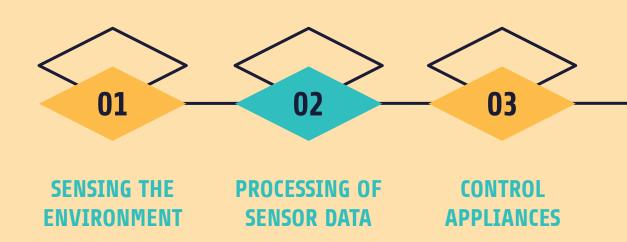- Solidity - 0.5.1
- Web3.py - 5.4.0

09
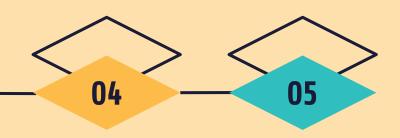
DESIGN AND IMPLEMENTATION

CIRCUIT DIAGRAM

AC Power Supply

fritzing

MODEL of the IoT SYSTEM

PIR Motion Sensor

LED Bulb

Luminosity Sensor

DC Fan

Raspberry Pi

Relay Board

Temperature & Humidity Sensor

IMPLEMENTATION OF THE SYSTEM

01

02

03

SENSING THE ENVIRONMENT

PROCESSING OF SENSOR DATA

CONTROL APPLIANCES

IMPLEMENTATION OF THE SYSTEM (contd.)

04

STORING IOT DATA
ON PRIVATE
BLOCKCHAIN
NETWORK

05

RETRIEVING
DATA FROM THE
BLOCKCHAIN

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CONCLUSION

- Tamper-proof storage of IoT data

- Scalable and decentralized environment to IoT devices system

- Reduction in the amount of power consumed throughout the day

- Help in managing energy efficiently, improved organization and reduced staff involvement in simple administration tasks

- By integrating Blockchain and IoT technology, we suggest Blockchain as a solution to insecure and vulnerable IoT ecosystems

- By implementing Blockchain on the IoT based system, the privacy and security of the IoT data is maintained

THANK YOU!