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Department of Electronics and Communication Engineering

Major Project On

Remote Monitoring of Radiation and Environmental Conditions with Telegram Responder Bot

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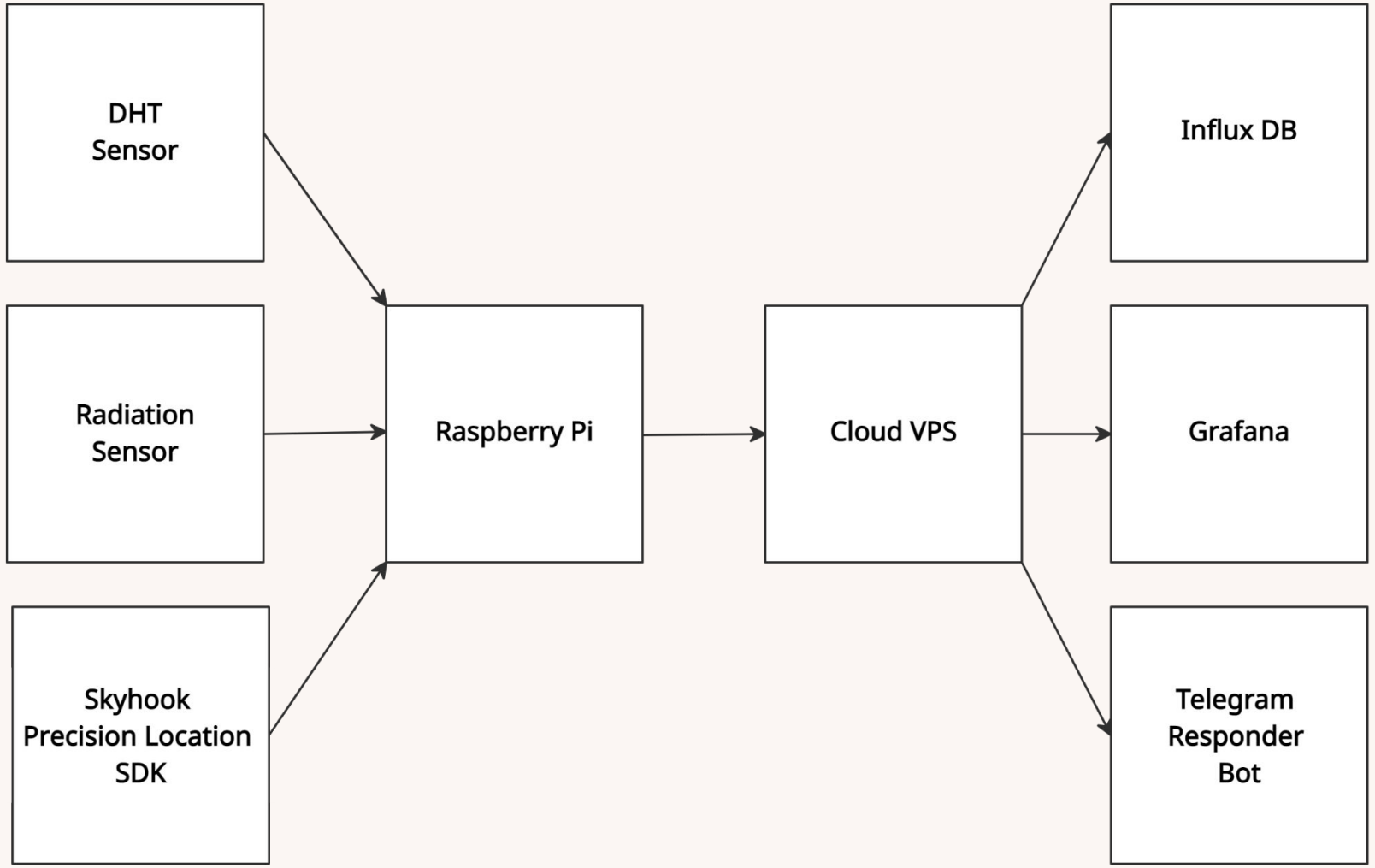
ABSTRACT

- These days, the need to use radioactive sources has been increasing in every country and the same has been observed in India as well.
- Research laboratories, personal radiation monitoring and field of radiation protection essentially need radiation detection instruments.
- This project proposes to use low-cost hardware to build a monitor that measures Radiation levels and Environmental conditions (temperature and humidity) and relays the measurement readings to an endpoint on the internet, which would enable concerned parties to remotely keep a check on the system.

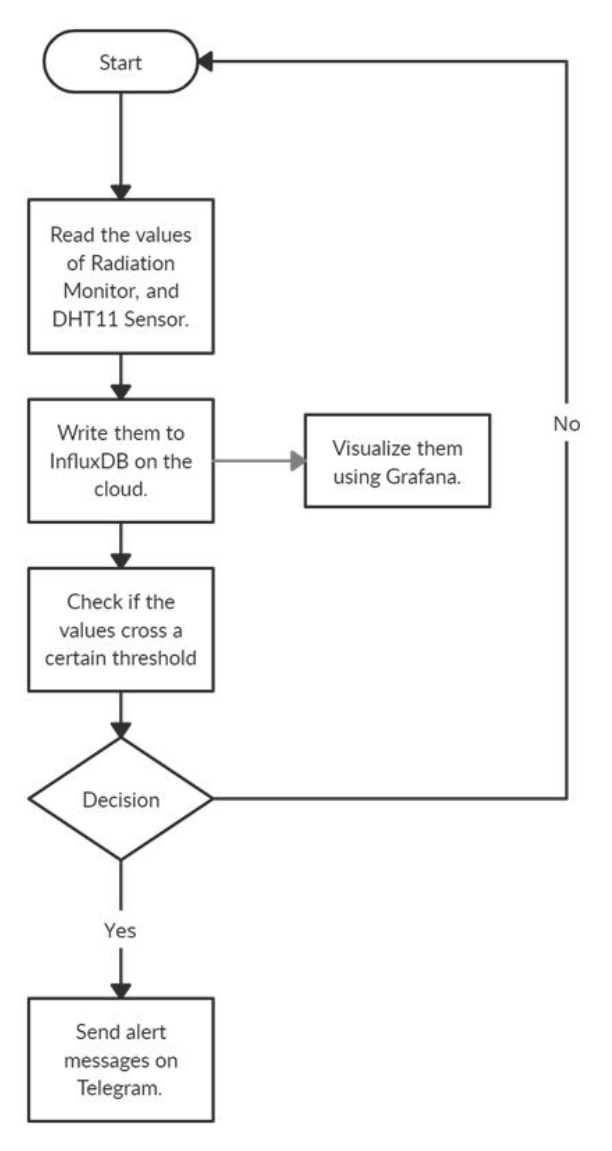
OBJECTIVE

- To monitor and measure the radiation levels and environmental conditions (temperature and humidity) and graphically represent the readings.
- To set up a Telegram Responder Bot for the authorities to interact with and to receive periodical updates about the radiation levels and environmental conditions and alert notifications if the readings cross predefined thresholds.
- To relay all the information (measurements) to an endpoint on the internet for remote monitoring and analysis.

BLOCK DIAGRAM



FLOW DIAGRAM

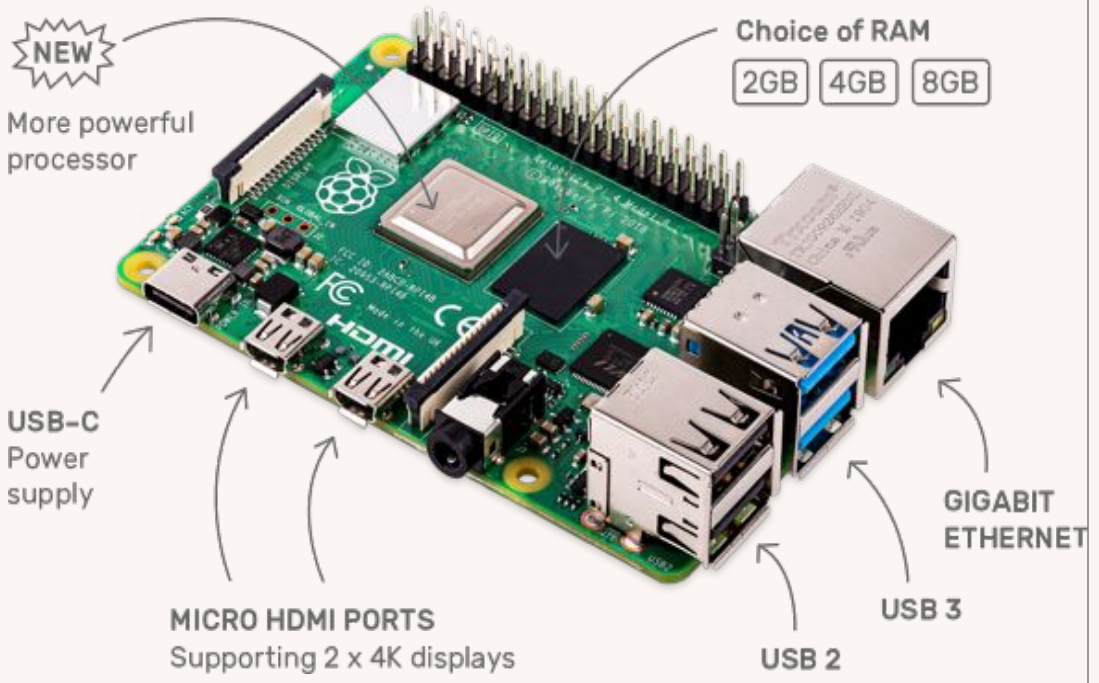


HARDWARE AND SOFTWARE REQUIREMENTS

Hardware Requirements:	Software Requirements:
• Raspberry Pi • Geiger-Müller Tube • High voltage DC-DC boost converter • DHT Sensor • microSD card - 4GB or higher	• Raspberry Pi OS on the Raspberry Pi • Ubuntu 18.04 as our OS on the Cloud VPS • InfluxDB as our Database • Grafana for Analytics and Visualization

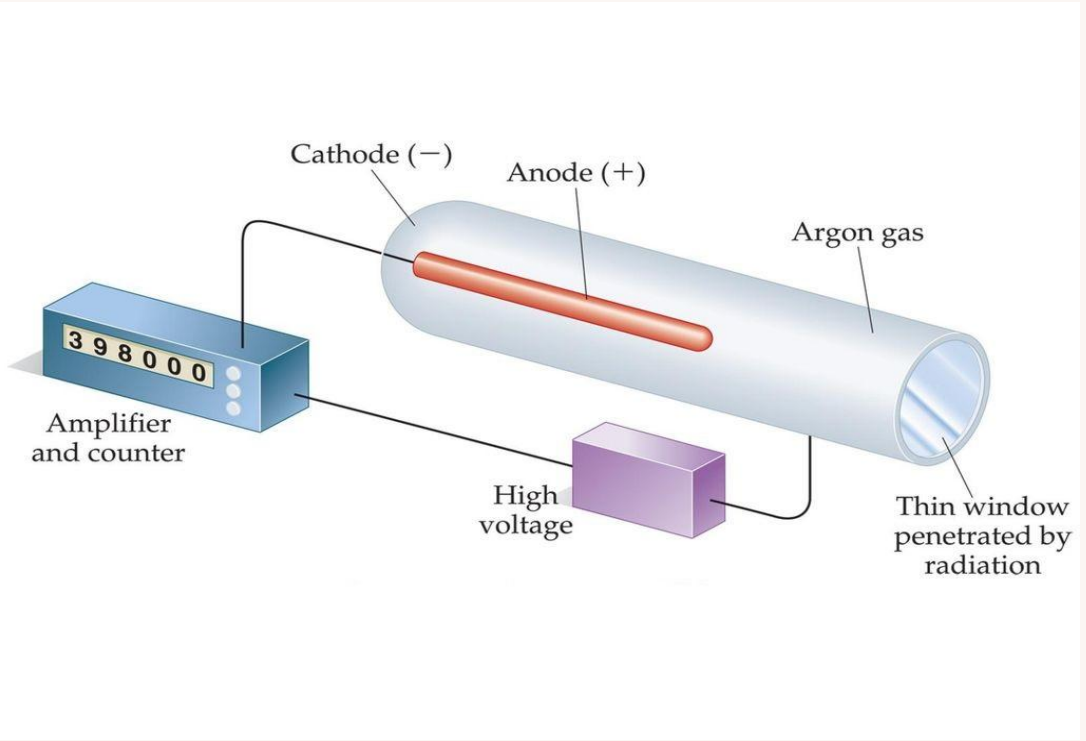
Raspberry Pi 4

- Single Board Computer
- Internet Access via Wi-Fi or Ethernet
- Bluetooth Connectivity
- Powerful Processor
- USB and HDMI ports
- Affordable



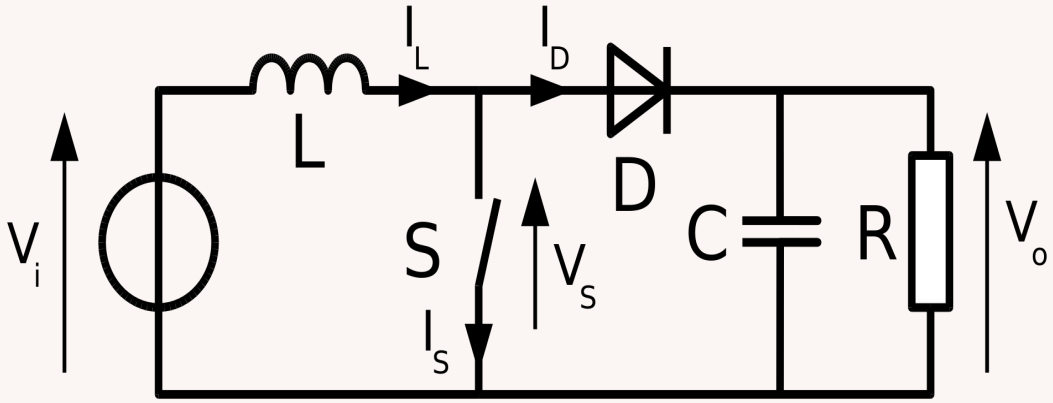
Geiger Müller Tube

- Radiation Sensing Element
- Contains mixture of noble gas and halogen gas inside it (Ne / Ar + Halogen)
- Operates at 450V-650V DC
- Conducts current when Radiation falls on the tube (alpha, beta and gamma radiations)



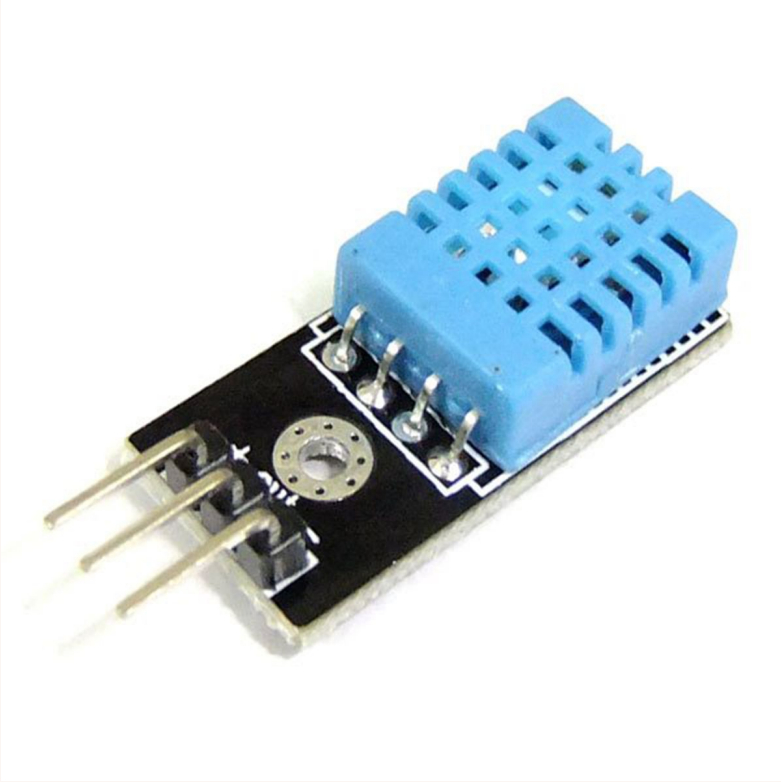
DC-DC Boost Converter

- Steps up voltage from input to output.
- Contains two semiconductors (a diode and a transistor) and one storage element (a capacitor or an inductor).
- Used in Battery Powered Systems, Photovoltaic cells etc.



DHT11 Sensor

- DHT sensors are made of two parts, a capacitive humidity sensor and a thermistor, and contains a basic ADC converter.
- Ultra low cost
- 3 to 5V power and I/O, 2.5mA max current use
- Humidity 20-80%, 5% accuracy
- Temperature 0-50°C, ±2°C accuracy
- 1 Hz sampling rate

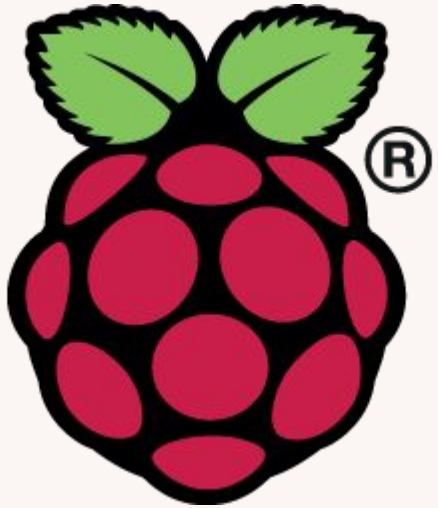


microSD card

- Has a small physical size and is therefore portable.
- Non-volatile memory.
- High storage capacities (upto 1TB)
- High compatibility - compatible with almost every SBC, Digital Cameras, and smartphones.
- Cost effective
- Low power consumption

Raspberry Pi OS

- Debian based operating system.
- Developed and Maintained by the Raspberry Pi Foundation.
- Highly optimized for all models of Raspberry Pi.
- Can be used to extensively control the Raspberry Pi (Serial Mode, I2C, etc.)
- APT is the package manager used to add/remove software.



Ubuntu Server

- Debian based operating system.
- Developed and Maintained by the Canonical Ltd.
- Most used Operating System on servers
- APT is the package manager used to add/remove software.
- Receives regular security updates.
- Low usage of system resources.

InfluxDB

- InfluxDB is a time series database designed to handle high write and query loads.
- Open source server agent to collect metrics from stacks, sensors and systems.
- Uses Flux for querying which is optimized for time series analysis.
- Provides client libraries in multiple programming languages.

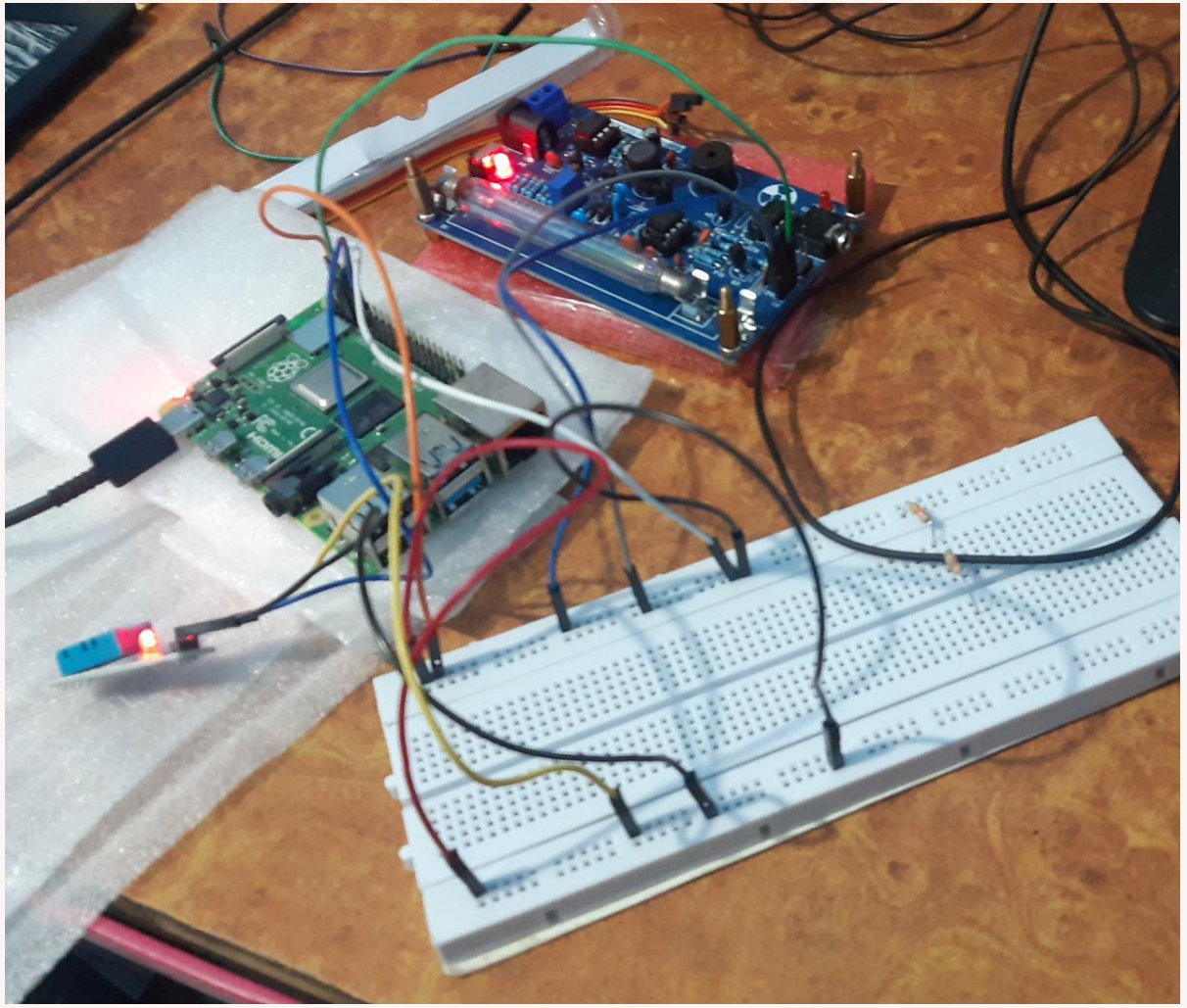
Grafana

- Grafana is an open source analytics & monitoring tool.
- Provides multiple visualizations such as Graphs, Heatmaps, Histograms, Geomaps etc.
- Allows transformation of data to summarize, combine and perform calculations across different queries and data sources.
- Has built-in alert mechanism.

PLAN OF ACTION

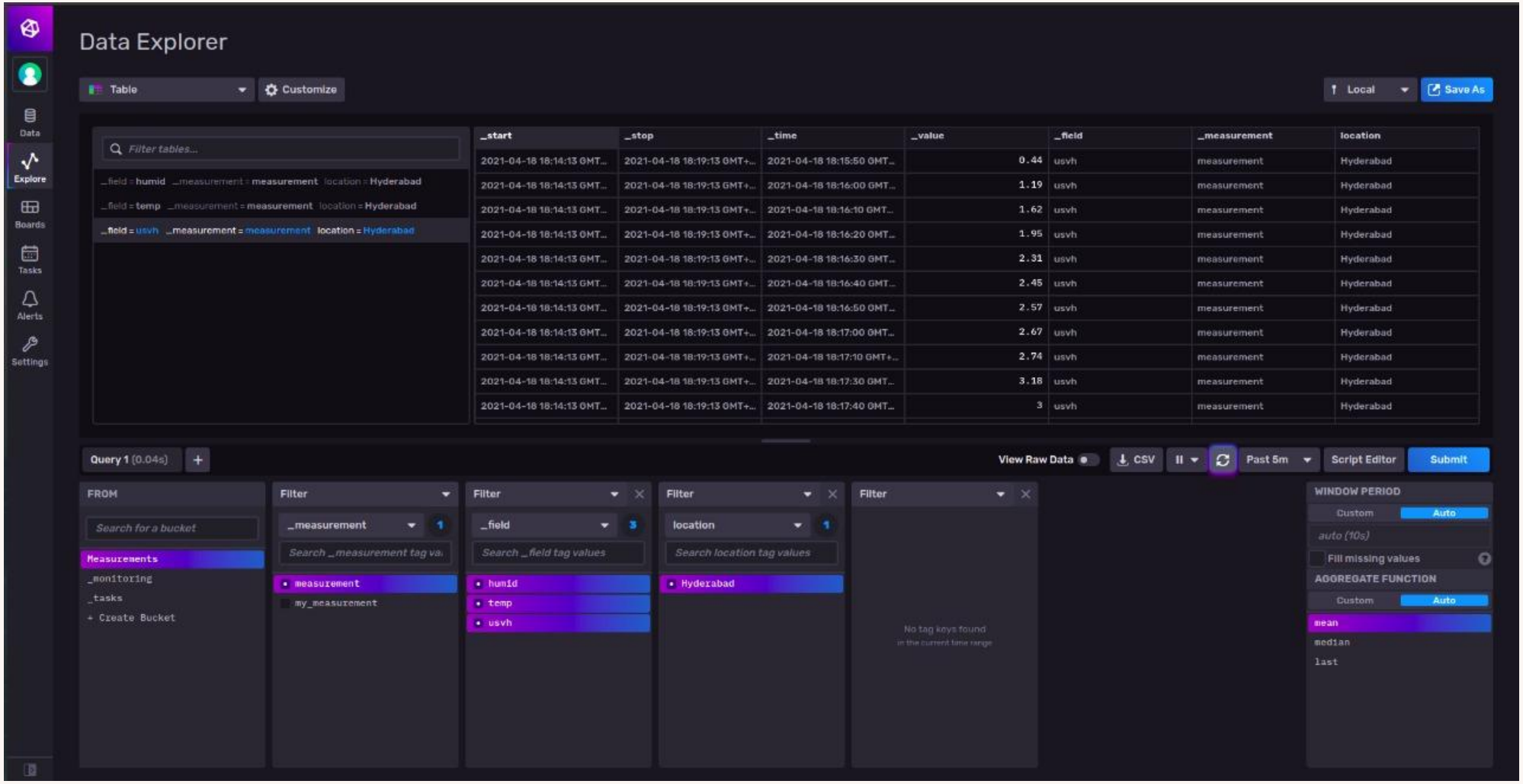
PRC	STATUS
PRC-1	Based on our domain, we obtained a scientific paper and we prepared our abstract accordingly.
PRC-2	Detection and measurement of radiation levels, climate conditions and geographical location, along with an Telegram Responder Bot system.
PRC-3	Relaying of the information to the cloud, and graphical representation of the information on the local and remote computers.

RESULTS



RESULTS

RESULTS


Data Explorer
Table
Customize
Local
Save As
Data
Explore
Boards
Tasks
Alerts
Settings
Filter tables...
_field = humid _measurement = measurement location = Hyderabad
_field = temp _measurement = measurement location = Hyderabad
_field = usvh _measurement = measurement location = Hyderabad
_start _stop _time _value _field _measurement location
2021-04-18 18:14:13 GMT... 2021-04-18 18:19:13 GMT+... 2021-04-18 18:15:50 GMT... 0.44 usvh measurement Hyderabad
2021-04-18 18:14:13 GMT... 2021-04-18 18:19:13 GMT+... 2021-04-18 18:16:00 GMT... 1.19 usvh measurement Hyderabad
2021-04-18 18:14:13 GMT... 2021-04-18 18:19:13 GMT+... 2021-04-18 18:16:10 GMT... 1.62 usvh measurement Hyderabad
2021-04-18 18:14:13 GMT... 2021-04-18 18:19:13 GMT+... 2021-04-18 18:16:20 GMT... 1.95 usvh measurement Hyderabad
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2021-04-18 18:14:13 GMT... 2021-04-18 18:19:13 GMT+... 2021-04-18 18:16:40 GMT... 2.45 usvh measurement Hyderabad
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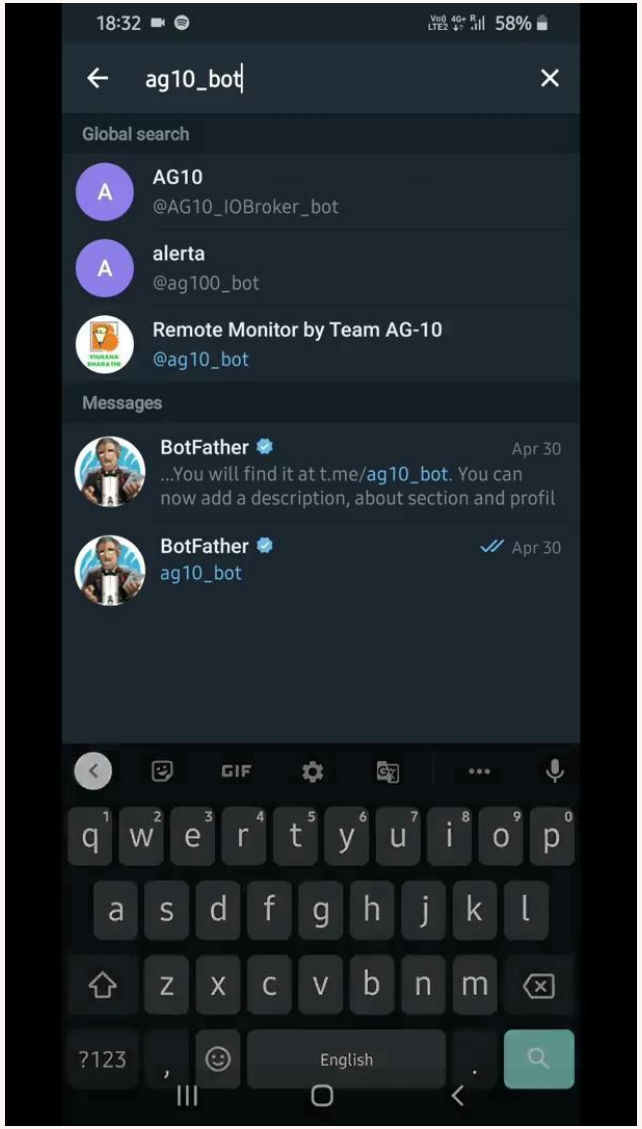
2021-04-18 18:14:13 GMT... 2021-04-18 18:19:13 GMT+... 2021-04-18 18:17:40 GMT... 3 usvh measurement Hyderabad
Query 1 (0.04s)
View Raw Data
CSV
Past 5m
Script Editor
Submit
FROM
Search for a bucket
Measurements
_monitoring
_tasks
+ Create Bucket
Filter
_measurement
Search _measurement tag va...
measurement
my_measurement
Filter
_field
Search _field tag values
humid
temp
usvh
Filter
location
Search location tag values
Hyderabad
Filter
No tag keys found
WINDOW PERIOD
Custom
Auto
auto (10s)
Fill missing values
AGGREGATE FUNCTION
Custom
Auto
mean
median
last

RESULTS


18:32
58%
ag10_bot
Global search
AG10
@AG10_IOBroker_bot
alerta
@ag100_bot
Remote Monitor by Team AG-10
@ag10_bot
Messages
BotFather
Apr 30
...You will find it at t.me/ag10_bot. You can now add a description, about section and profil
BotFather
Apr 30
ag10_bot
GIF
English

ADVANTAGES AND DISADVANTAGES

Advantages:

- A simple and a cost effective radiation and environmental conditions monitor.
- The Cloud platform allows authorities to remotely monitor areas of interest from anywhere in the world.
- Telegram Responder Bot alerts the authorities when the radiation/environmental condition levels cross the safety threshold levels and also sends periodical updates regarding the same.

Disadvantages:

- The Geiger-Müller tube is a delicate instrument, and should therefore be handled carefully.
- The power source for the apparatus (AA batteries) has to be replaced periodically.
- Has to be constantly connected to the internet for sending sensor readings to the cloud and therefore latency can be expected for the Telegram Responder bot.

APPLICATIONS

- It can be used in areas surrounding Nuclear power plants. An example would be to install our device near water-bodies to check radiation contamination levels.
- It can be used at mining sites to keep a check of radiation levels for the safety of the miners.
- To detect radioactive rocks and minerals in the course of mineral prospecting or as a mineral collector.
- Radiation detection in the scrap metal processing business, including oil field drill pipe that has been contaminated by Radium 226, an alpha emitter.
- In or near X-ray labs in a medical facility, to check for leaks or possible exposure.
- To check for irradiated gemstones in the jewelry trade.

REFERENCES

- Holovatyy, Andriy; Teslyuk, Vasyl; Kryvinska, Natalia; Kazarian, Artem. 2020. "Development of Microcontroller-Based System for Background Radiation Monitoring" Sensors 20, no. 24: 7322. https://doi.org/10.3390/s20247322

- Geiger Counter - Radiation Sensor Board for Arduino and Raspberry Pi Geiger Counter - Radiation Sensor Board for Arduino and Raspberry Pi

- Creating a Telegram Bot using Python https://www.youtube.com/watch?v=PTAkiukJK7E

THANK YOU