МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ

КРЕМЕНЧУЦЬКИЙ НАЦІОНАЛЬНИЙ УНІВЕРСИТЕТ ІМЕНІ МИХАЙЛА ОСТРОГРАДСЬКОГО

VII Міжнародна науково-практична конференція

«Напівпровідникові матеріали, інформаційні технології та фотовольтаїка»

ТЕЗИ ДОПОВІДЕЙ

14-16 травня 2022 р.

Кременчук −2022

VII Міжнародна науково-практична конференція «Напівпровідникові матеріали, інформаційні технології та фотовольтаїка»: Тези доповідей. − Кременчук: Кременчуцький національний університет імені Михайла Остроградського, 2022. 140 с.

ISSN 2222-4386

Посвідчення УкрІНТЕІ про реєстрацію конференції № 569 від 02.11.2015.

Друкується за рішенням Вченої ради Кременчуцького національного університету імені Михайла Остроградського (протокол № 6 від 14.05.2022 р.).

Збірник публікує тези доповідей, що містять нові теоретичні та практичні результати в галузі технічних наук.

Відповідальний за випуск: д.т.н., проф. Притчин С. Е.

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ISSN 2222-4386

UDC 629.4.053

USE OF MICROCONTROLLERS WITH CLOUD SERVICES FOR PRODUCTION NEEDS

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Introduction. Core areas of the Fourth Industrial Revolution include aspects such as cybersecurity, cloud computing, Internet of Things, Big Data/Analysys and M2M. Production, which is designed using such approaches, as a rule, is modular and fully programmatically controlled, which allows you to implement the adjustment of the environment, the collection and business analysis of data over long periods of time, as well as quick access to data from anywhere in the world [1]. Microcontrollers using the concept of IoT are connected to cloud services that collect data in real time and process it according to the needs of production. Therefore, when designing a production data pipeline, it is necessary to take into account the need for security for the infrastructure as well as develop an automatic datastream within the pipeline. Also, for data processing, you need to create a data visualization.

The purpose of the work is to develop a flowchart for the transmission, processing and visualization of data using during business analysys, as well as securing access using Amazon Web Services**.**

Flowchart development. At the first stage of developing a pipeline for business data analytics, an analysis of the available services of a cloud provider was carried out and the most suitable tools for this task were selected. Figure 1 shows a block diagram of the pipeline.

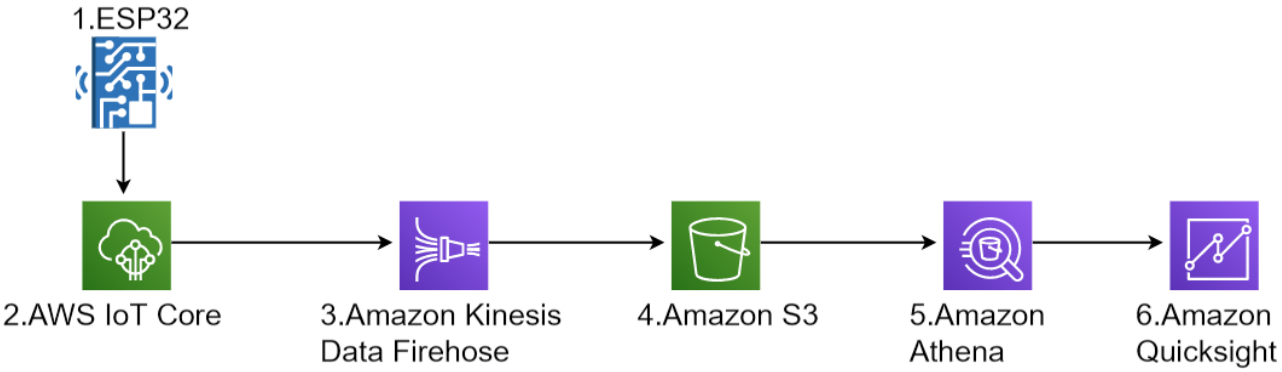

Figure 1 – Business data analysis pipeline

Which consists of: 1 – esp32 microcontroller; 2 – AWS IoT Core services; 3 – Amazon Kinesis Data Firehose; 4 – Amazon Simple Storage Service; 5 – Amazon Athena; 6 – Amazon Quicksight.

The selected elements allow you to easily and cheaply build a pipeline to collect and analyze the necessary data. ESP32 as end device to gather data is easy to use and cheap to buy. Also, it can be easely programmed with C/C++ to your needs and has a built-in wifi module from the factory, which allows us to use MQTT protocol to connect our device to AWS IoT Core services. AWS IoT Core services get a raw data stream that is collected by Amazon Kinesis Data Firehose and stored in Amazon Simple Storage Service sorted by selected parameter. Amazon Athena reorganizes this data by passing it to Amazon Quicksight which allows us to visualize based on our needs [2].

ESP32 is a best choice, because microcontrollers of this family can perform as a complete standalone system or as a slave device to a host MCU, reducing communication stack overhead on the main application processor. ESP32 can interface with other systems to provide Wi-Fi and

Bluetooth functionality through its SPI / SDIO or I2C / UART interfaces. Also, it's engineered for mobile devices, wearable electronics and IoT applications, ESP32 achieves ultra-low power consumption with a combination of several types of proprietary software. ESP32 also includes state-of-the-art features, such as fine-grained clock gating, various power modes and dynamic power scaling. It is capable of functioning reliably in industrial environments, with an operating temperature ranging from –40°C to +125°C. ESP32 is highly-integrated with in-built antenna switches, RF balun, power amplifier, low-noise receive amplifier, filters, and power management modules. ESP32 adds priceless functionality and versatility to your applications with minimal Printed Circuit Board (PCB) requirements [3].

Amazon Quicksight provide embed interactive visualizations and dashboards, sophisticated dashboard authoring, or natural language query capabilities in your applications to differentiate user experience and unlock new monetization opportunities. Also it allow to ask conversational questions of your data and use Q's ML-powered engine to receive relevant visualizations without the time consuming data preparation from authors and admins.

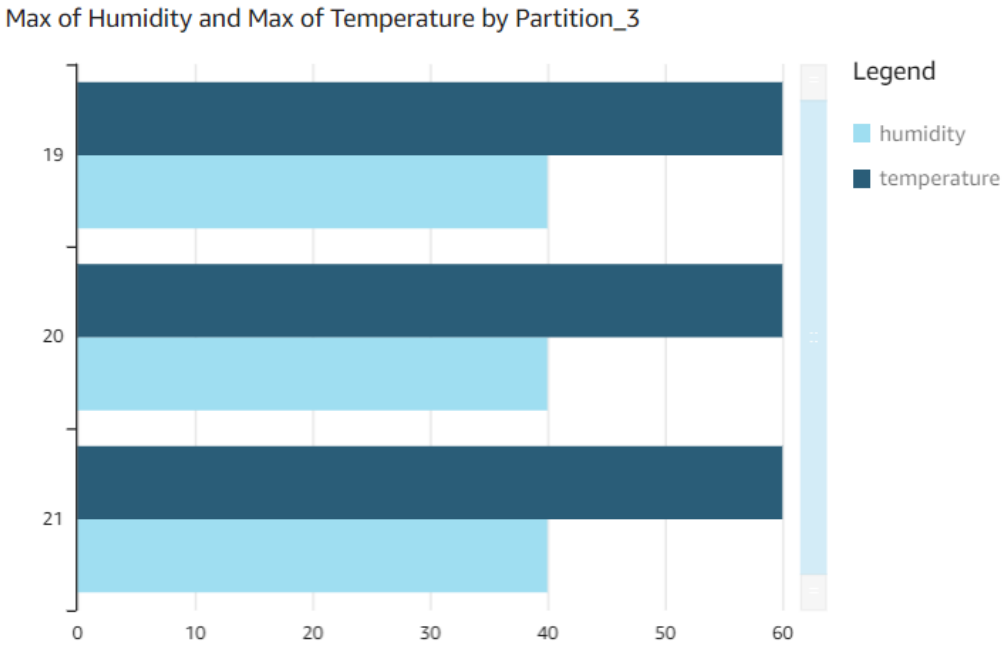

Figure 2 – Amazon Quicksight in action

Also we need to secure our infrastructure so we could use amazon IAM to process data and use secure Amazon Quicksight endpoint to visualize data only to authorized workers.

Conclusions. As a result of modeling the pipeline of data for business intelligence, the most suitable elements for this task were identified, and a block diagram of the pipeline was developed with secure connection and workers-only access.

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