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STRUCTURE OF INTERNET OF THINGS NETWORK FOR SOUND CONTROL IN UNIVERSITY STUDY PROCESS

The IoT system for processing sound information has been developed. The system consists of a Raspberry Pi 3 computer, a small microcomputer on one board, to which sound sensors are connected. Development of Raspberry Pi system is presented, hardware and software installation are shown. It can used in laboratory of Belarusian State University of Informatics and Radioelectronics for study course «Base of IoT».

Keywords: IoT network, sound information detecting, study process implemented.

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СТРУКТУРА ИНТЕРНЕТА ВЕЩЕЙ СЕТИ ДЛЯ КОНТРОЛЯ ЗВУКА В УЧЕБНОМ ПРОЦЕССЕ УНИВЕРСИТЕТА

Разработана система IoT для обработки звуковой информации. Система состоит из компьютера Raspberry Pi 3, небольшого микрокомпьютера на одной плате, к которой подключены звуковые датчики. Представлен процесс разработки системы Raspberry PI, установка оборудования и программного обеспечения. Система используется в лаборатории Белорусского государственного университета информатики и радиоэлектроники для учебного курса «Основы Интернет вещей».

Ключевые слова: сеть IOT, обнаружение звуковой информации, реализованный процесс изучения.

Introduction. The IoT allows objects to be sensed or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention. When IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical

systems, which also encompasses technologies such as smart grids, virtual power plants, smart homes, intelligent transportation and smart cities. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure. Examples also include smart cities, fitness and health monitoring, industrial automation for gathering of data [1]. In article [2] educational disciplines of IoT specialization are presented to improve the training of specialists.

IoT network structure. The IoT multi-agent system for monitoring sound information (MAIOT) in the environment is a set of agents for sound detection, classification, analyzing and transformation by the help of IoT. The objective of this report is to propose a methodology from the integration between IoT and multi-agent system for detecting sound from environment to classify and take a decision [3].

In order to do the classification of sounds type, the multi agent system will collect the sound and send it to the IoT, that will recognize and classify this type of sound. Then it will send information again to the multi agent system to take the appropriate action. MAIOT implements the functions to ensure the required class of protection of people (working or living) and allows implementing an environmental safety system.

The classification agent in MAIOT can handle noise levels in the urban space and help in learning noise pollution of various areas: inside the building, in a public park or around the entire area, increasing the protection of the space to the required level. A conceptual schema will be automatically enhanced in the transformation agent in order to help in decision making [4].

The multi-agent system for monitoring sound information using internet of things (MAIOT) is composed of two different agents that works together with the supervision of IoT. The process of MAIOT has several algorithms that can cover various needs at the same time we can modify this concept so it can be used is several domains and needs.

This system consist of a Raspberry Pi 3 computer and incredibly small microcomputer packed onto a single board [5]. For all that, the Raspberry Pi 3 is packed with enough power to handle demanding computer projects.

Raspberry Pi3 is a rewarding device that’s ideal for creating Internet of Things network, wearable, and embedded projects, to keep the size down. The Raspberry Pi 3 features a smaller-than-normal mini HDMI socket, and it offers a full computer experience. Raspberry Pi 3 will be connected to a solar power rechargeable battery, that provide it power 24/7, and on the other hand it will be connected to wireless to the internet using the Wi-Fi connection. A microphone is connected also to Raspberry Pi 3 to detect the sound from the environment, also Raspberry Pi 3 is connected to an Arduino Uno, that is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins, that may be interfaced to various expansion boards (shields) and other circuits.

From the side of power, the Arduino will be connected to the solar power rechargeable battery and a Global System for mobile communicate.

Sound sensor. The sound sensor module provides an easy way to detect sound and is generally used for detecting sound intensity. This module can be used for security, switch, and monitoring applications. Its accuracy can be easily adjusted for the convenience of usage. It uses a microphone which supplies the input to an amplifier, peak detector and buffer. When the sensor detects a sound, it processes an output signal voltage which is sent to a microcontroller then performs necessary processing. Sound sensor and its pin-out specification include: operating voltage 3.3V-5V; output model: digital switch outputs (0 and 1, high or low level); voltage gain 26dB; microphone impedance 2.2kΩ; microphone frequency 16.20 kHz.

Pin Configuration has: VCC: 3.3V-5V DC; GND: ground; DO: digital output; AO: analog output.

Raspberry Pi-operations systems. Operating System is regarded as the most crucial software for computer hardware to work and to provide interface between the computer hardware and programs running. Raspberry Pi has several operating systems which are based on Linux and are free and open source

Linus Torvalds, the man behind the development of Linux operating system, provided Linux as platform for community development. Raspberry Pi foundation decided to integrate official Linux distribution which is optimized for Raspberry Pi known as Raspbian Pi.

Operating system being represented as “Outer Body” of system, Kernel is regarded as “Brain” of the overall system. Kernel is basically a component of operating systems which functions with installed hardware devices. Kernel is also termed as “Firmware” because it is software that is semi-permanently written on Partition 1 of SD card. The Operating Systems can be divided into two Categories available for Raspberry Pi.

Communication The Arduino Uno has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The '16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, a .inf file is required. The Arduino software includes a serial monitor, which allows simple textual data to be sent to and from the Arduino board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial communication on pins 0 and 1).

A SoftwareSerial library allows for serial communication on any of the Uno's digital pins. The ATmega328 also supports I2C (TWI) and SPI communication. The Arduino software includes a wire library to simplify use of the I2C bus For SPI communication, is used the SPI library.

Conclusion. IoT and multi agent system for detection of audio data for safe environment is discussed. Developed the IoT system with the capability of sensing some types of domestic violence and recognizing with the help of IoT. Hardware and software installation of IoT are shown. This system can be used to detect and report the specific incidents with sounds and use in laboratory of Belarusian State University of Informatics and Radioelectronics for study course «Base of IoT».

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