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### **AN INTEGRATED APPROACH TO SCIENCE MODERNIZATION: METHODS, MODELS AND MULTIDISCIPLINARITY**

held on April 29<sup>th</sup>, 2022 by

NGO European Scientific Platform (Vinnytsia, Ukraine)  
LLC International Centre Corporate Management (Vienna, Austria)



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## ZOOMORPHIC MOBILE ROBOT DEVELOPMENT FOR VERTICAL MOVEMENT BASED ON ESP 32- CAM

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The research of the world's leading companies in the field of progressive robotics, such as Feso, Boston Dynamics, shows the perspective of using the biomechanics of living beings to create zoomorphic robots for solving complex problems [1-3]. In the work of H.Atttar, it was proposed the solution of the development of a zoomorphic robot for moving along vertical surfaces based on the borrowing the kinematics of Family Caterpillar's movement. Analyzing this publication, it can be seen, that the author uses the ESP 8266-12 as a mobile robot control board, and as a result, it is impossible to implement a computer vision and decision-making system for the developed mobile robot. Based on this, it is proposed to implement the improvement for a mobile robot on account of the ESP32-CAM module of Shenzhen AI-Thinker Co.Ltd [5]. The foundation for choosing this module is the existence of a slot for connecting cameras OV2640 and OV7670, which support resolutions up to UXGA (1622 × 1200 pixels) streaming video. Main technical characteristics of ESP32-CAM: clock frequency: up to 160 MHz; Memory: 520 KB SRAM, 4 MB PSRAM, SD card slot; Wi-Fi 802.11b/g/n, Bluetooth 4.2 with BLE; microcontroller processing power: up to 600 DMIPS; 9 GPIO pins with interface support: UART/SPI/I2C/PWM/ADC/DAC. Based on the above parameters of the ESP32-CAM module, it was developed the following architecture of a mobile robot for vertical movement, which is shown in Figure 1.

The proposed architecture of the mobile robot makes it possible to implement a control duplication system with built-in priorities and, in case of loss of communication, the possibility to duplicate the communication channels. This is possible to use IoT/Internet based wireless Wi-Fi module on the ESP32-CAM, which

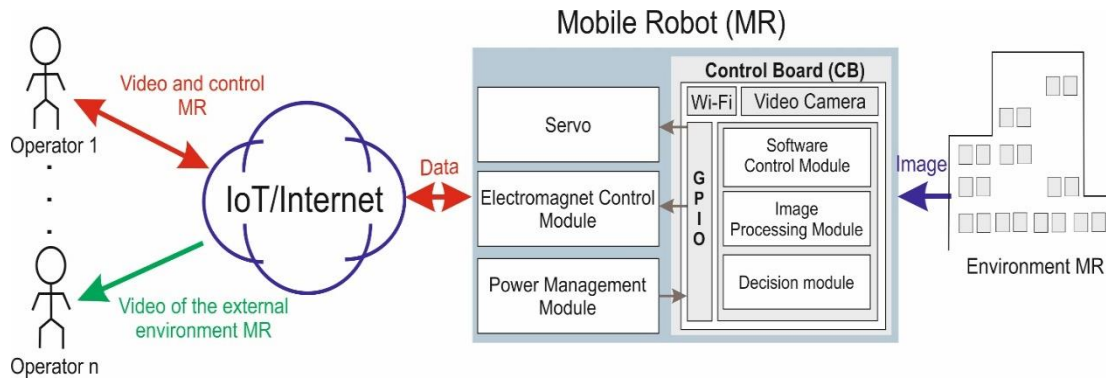


Fig. 1. Architecture of a mobile robot for vertical movement based on ESP32-CAM

can be as a secure access point. Mobile Robot (MR) consists of the following modules: Servo - it is a PZ-15320 micro-servomotor (14x6.2x17.9mm 1.7g) on which the OV2640 camera will be mounted, according to it will allow to implement the computer vision system and increase the viewing angle by turning camera operator; [6] Electromagnet Control Module - allows to control the on / off electromagnets ELE-P30/22 (10kg/100H, 12V); [7] Power Management Module - implements a power management system for a mobile robot (3 batteries 18650, min 2500mA).[8]

Control Board (ESP32-CAM) interacts with the above-mentioned modules using the general-purpose input / output (GPIO) bus, which makes the possibility to implement the following functions: software control of a mobile robot, a video information processing module for subsequent broadcast to the operator, and a decision-making module. The developed architecture of a mobile robot for vertical movement will allow to implement a system for recognizing and identifying objects that are in the workspace. This will expand the range of tasks which a mobile robot can solve.

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