

ABSTRACT

THE «MAGIC CHESS» HARDWARE AND SOFTWARE SYSTEM FOR TRAINING AND CONDUCTING CHESS TOURNAMENTS: diploma work / Harold F. B. Bankwe Tate. – Gomel: GSTU named after P.O. Sukhoi, 2026. – Diploma work: 100 pages, 91 figures, 17 tables, 22 sources, 4 appendices.

Keywords: CHESS AUTOMATION, COMPUTER VISION, YOLO11, FASTAPI, MECHATRONICS, DEEP LEARNING, OBJECT DETECTION, POSTGRESQL, STOCKFISH, G-CODE, ARDUINO, RASPBERRY PI.

Object of development: a hardware-software mechatronic platform for automated physical-to-digital chess state synchronization using zero-sensor computer vision architecture.

Purpose of the work: to design, develop, test, and deploy the «Magic Chess» system featuring vision-based piece tracking, rule validation, and real-time state transformation between digital chess logic and physical playing environments.

Method of research: systematic analysis of existing automated chess systems; design of a decoupled microservice-inspired architecture using YOLO11n neural network for object detection; planar homography for board state extraction; FastAPI asynchronous backend for logic orchestration; PostgreSQL for ACID-compliant persistence; Arduino-based Cartesian gantry for physical piece actuation.

Results obtained: a functional Dockerized cyber-physical system featuring a 60 FPS vision pipeline achieving 94.2 mAP50, sub-50 ms asynchronous logic execution, PostgreSQL persistence for tournament history, and Arduino-based kinematic actuation with positioning accuracy within ± 1.5 mm. Payback period of 1.68 years at commercial pricing of 450 BYN per license with 35 projected sales.

Scope of application: competitive sports clubs, regional chess federations, public and private educational institutions, and specialized remote training academies.

The author confirms that the diploma work was completed independently. The explanatory note was checked in the anti-plagiarism system. The percentage of originality is ____ %. All borrowed theoretical and methodological provisions and concepts are accompanied by references to the sources listed in the List of References.