

УДК 007.51

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Application for controlling industry robot via smartphone

This article was designed for exhibition purposes. The article describes part of the application namely created software applications for Android. It was designed in MIT App Inventor 2. This application use for monitoring two dice and sending commands to dual - arm robot.

Key words: Android application, dual-arm robot, bluetooth.

INTRODUCTION

Dice application is linkage control system of the robot with Android devices via computer and also uses the camera system. Android smartphone or tablet sends commands to dual – robot arm via Bluetooth connection. Computer is using for image processing from external camera and then send image of dice to android devices and show on screen score of dice. This game can play one or two players. Application is free download from Google play store – DuoRobotCubes.

MAIN FUNCTION OF APPLICATION

Multi devices application shown on figure 1. consists from dual-arm robot and its control system, computer linkage with arduinonano, camera and two bluetooth modules and Android devices [1].

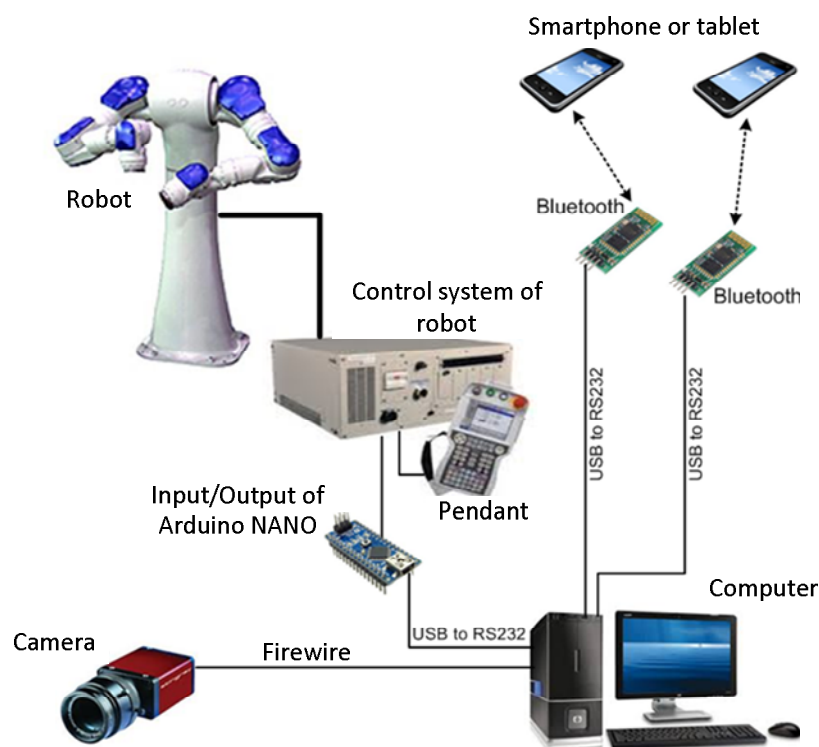


Fig. 1 Interconnection devices

Robot is mainly used for throw dice and collect dice. After the throw it sends result to Android device. User can read it and continue in the game by clicking the button on the Android device. Home screen looks like the figure 2. and allows select game only for one player or for two players. Next screen shown on figure 3. used for control game. Button “Click here” used for collect dice, when it is done, ball in the middle screen show movement of android device accelerometer and robot shaking with dice. Quick movement up or down with android

device means robot throw dice. Then followed scan dice with camera located on robot arm and send result to Android device.



Fig. 2 Home screen

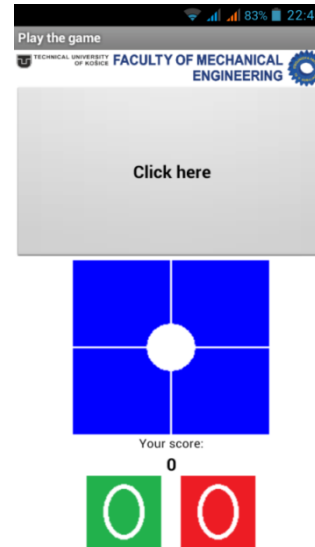


Fig. 3 Game screen

ALGORITHM OF ANDROID APPLICATION

Application will write “connection error” and switch off itself if Bluetooth will not find.

```

when clkInitBT.Timer
do
  set clkInitBT.TimerEnabled to false
  evaluate but ignore result call btc.Connect
  address "98:D3:31:B2:84:82"
  call btc.Send1ByteNumber
  number 11
  call canvas.DrawLine
  x1 100
  y1 0
  x2 100
  y2 200
  call canvas.DrawLine
  x1 0
  y1 100
  x2 200
  y2 100
  call canvas.DrawCircle
  x 100
  y 100
  r 25
  set btn.Enabled to true
  
```

Fig. 4 Algorithm for initialization screen

Bluetooth awaiting (Fig.6). There is number 192 as robot communication conformation. Robot it sends if it is at position for throw dice.

Algorithm that is running after start screen is shown on Figure 4. Algorithm is created in the MIT App Inventor 2.

Algorithm pairs Android device with robot. Than it paints all items and enables button “Click here”. Algorithm continues by clicking button (Fig. 5).

```

when btn.Click
do
  if not btc.IsConnected
  then close application
  set btn.Enabled to false
  call btc.Send1ByteNumber
  number 9
  set clkTaked.TimerEnabled to true
  
```

Fig. 5 Algorithm for event “button click”

Robot is receiving command for dice collecting. After that are data via

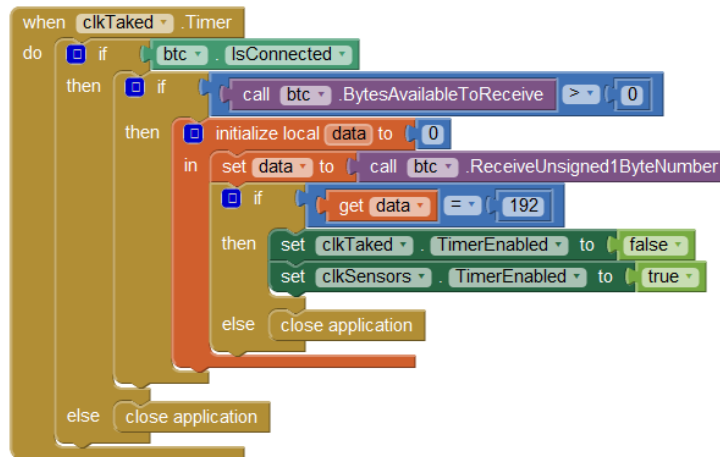


Fig. 6 Bluetooth data receiving algorithm

Robot movements for mixture dice are depend on accelerometer sensing (Fig.7). User shaking with Android device and robot shaking with dice, too.

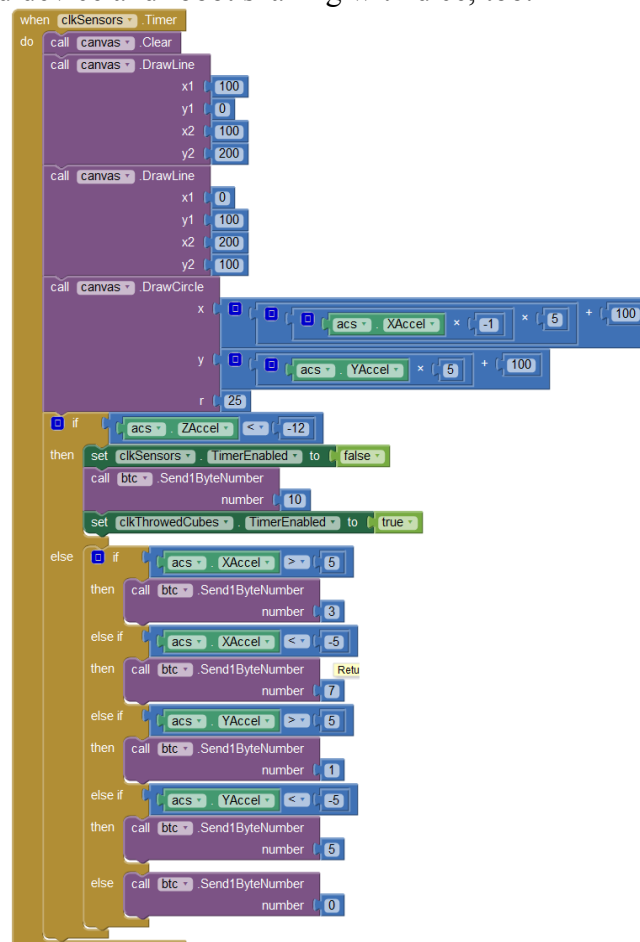


Fig. 7 Accelerometer service

CONCLUSION

The application between dual – arm robot, android devices, computer and camera is dependent on three main software applications:

- Program the robot's movement (in robot control system),
- Application on the computer (communication software modules and image processing),

- A mobile application running on the mobile handheld device with Bluetooth communication.

In the future, after removal of the fault condition could be to extend the application of multi-dice game where intervention would be needed to image processing module. Possibly could be revised effectors after adjusting communication between the computer and the robot through UDP protocol effectors active, able to collect blocks of seats for the camera. Another option would be to create multiple variations of dice games and store the results of the Internet server or. and the ability to play the long range through the internet.

The application as proposed offers many opportunities for improvement it need only devote time and resources.

List of sources used

[1] Sukop, D.: Interakcia robotického pracoviska s okolím pomocou kamerového systému. Diplomová práca, Košice, 2014. 58 s.

[2] Slamka, J., Jedinák, M., Tolnay, M., Bachratý, M., Staš, O.: Automatic manipulation of parts made from yielding material. In: Applied Mechanics and Materials Vol. 332 (2013) pp. 432- 430.

[3] Piotrowski A.: "The Spectacle of Architectural Discourses," at Architectural Theory Review, (13:2, Routledge, 2008): 130 -144.

[4] Zubrzycki J., Świć A., Taranenko V.: Mathematical model of the hole drilling process and typical automated process for designing hole drilling operations. Applied Mechanics and Materials Vol. 282 (2013), pp. 221-229.

[5] Świć A, Taranenko W, Szabelski J. Modelling dynamic systems of flow-rigid shaft grinding. Eksploatacja i Niezawodność – Maintenance and Reliability 2011, 2 (50): 13–24.

This contribution is the result of the project implementation: Aplikovaný výskum systémov inteligentnej manipulácie priemyselných robotov s neorientovanými 3D objektmi, (ITMS: 26220220164) supported by the Research & Development operational Program funded by the ERDF.