

## Deneyap Card

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### Introduction

Education systems are being developed by children who prepare applications with robotic coding at an early age (Goksoy & Yilmaz, 2018). Looking at the age of technology of the century, it has become very important to actively use the technological innovations required by the era in courses in order to ensure the permanence of Education. At the beginning of these technological innovations are the robotic and robotic coding concepts (Butuner, 2019). Currently, many microcontrollers use electronic cards to provide us with solutions to problems in everyday life. One of these cards is the Deneap card, which has just been produced by engineers working in Baykar Defense.

DENEYAP card has been developed using the original ESP32-WROVER-E module, with a versatile and powerful dual core Tensilica Xtensa LX6 microprocessor electronic structure. There are modules for internal wifi and bluetooth communication on the card. Thanks to these features, it helps to prepare internet of things and cloud-based applications. With the wifi feature, data can be exchanged between the installed system and the cloud-based application. A closed loop wireless communication network can be established by using the DENEYAP card as a server. There is a dual mode Bluetooth feature on the card. This feature allows data exchange with devices with both BLE and Bluetooth EDR infrastructure. There is a high-sensitivity LSM6DSM sensor on the DENEYAP card, which enables 3 axis acceleration and 3 axis rotation measurements and measures the temperature of the system. MP34DT05 microphone, built into the DENEYAP card, helps to prepare both the loudness of the surrounding sounds and the applications for voice and speech recognition depending on them. There are 24 pins on the card to be used for general purposes. Those that are used as digital inputs and outputs from these pins are protected by PTC fuses against overcurrents. It has a special lipo connection connector to help power the system safely. There is an FPC connector on the card that allows the camera to be connected directly. There are 2 buttons and 1 RGB LED internally on the card. DENEYAP card allows output with 3.3V and 5V voltages to be used in peripheral units with external connection continuously. DENEYAP card was developed based on USB 3.2 and designed in a way that is compatible with breadboard. The pins on the card are soldered to the breadboard for various applications and projects. DENEYAP Mini, on the other hand, is the reduced size of the DENEYAP card. In Figure 1, the drawing of the DENEYAP card and the explanations of its pins are given (Deneyap Card, 2021).

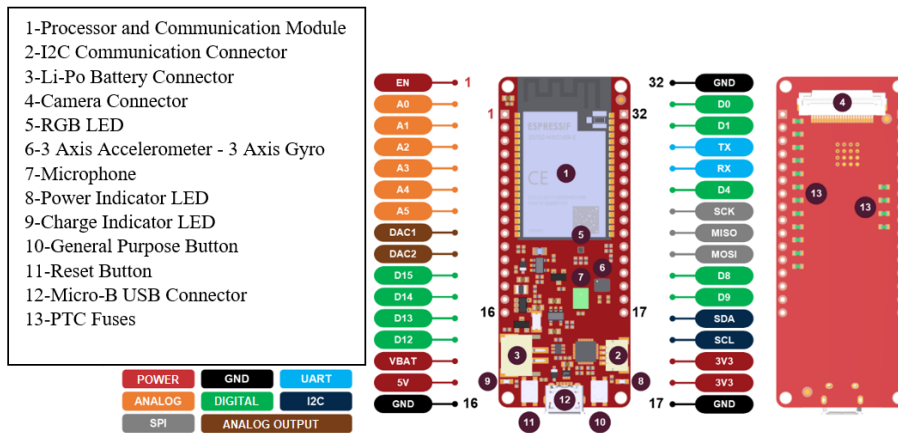


Figure 1. Pin Structure of DENEYAP Card(Deneyap Card, 2021)

## Pin Properties

### Power Pins

**5V:** This pin provides 5V voltage and 0.5A output. It can be used to feed peripherals to be connected externally to the card.

**3V3:** This pin provides 3V3 voltage and 1A output. Since some peripherals work with 3V3, voltage can be supplied from this pin.

**VBAT:** It gives the voltage of the externally connected Li-po battery as an output between 3.3V-4.2V. It can be used to feed external peripherals to be connected.

**EN:** For the ESP32 module to work, the pin value must be set to the logic “1” level. Logic “1” gives 3V3 voltage. The “RES” button is used to reset the system. When the button is pressed, the EN pin reaches the logical “0” level.

**GND:** It is the common ground to complete the circuit. Since it is designed as a card, it has more than one GND pin.

### Input/Output Pins

**D0-D15:** These pins are digital input/output pins. It is used to give 3V3 or 0V according to the software in the card or to detect that these voltages are given from the outside. Short circuit protection is provided by PTC fuses.

### Analog Pins

**A0-A5:** These pins are analog input pins. There are 6 pins on the card. It means that it is divided into 1024 parts with the applied voltage between 0-3V3 and that the voltage value can be read with this precision ( $3V3/1024$ ). A0-A3 pins are only used as input pins, while A4 and A5 pins can be used as digital input/output.

**DAC1-DAC2:** These pins are used to provide analog output with voltage between 0-3V3. It also allows it to be used as a digital input/output pin.

### Communication Pins

**TX-RX:** These are called serial communication pins. Uploading the code and communicating with the terminal is done through these pins. RX is the input pin and TX is the output pin. It is connected to the D2 and D3 pins. It is used as a digital input/output pin.

**I2C:** For serial communication, it is an example of synchronous communication. Apart from the ground line, two lines, SCL and SDA, are needed to ensure communication. SDA is both input and output data line, and SCL is time synchronization pin as output. Besides I2C communication feature, it can also be used as a digital input/output pin and is connected to D10 and D11 pins.

**SPI:** Thanks to MOSI, MISO and SCK pins, any sensor or actuator can be controlled. It is the MOSI output and MISO input data line. SCK is the time synchronization pin as output. It can also be used as a digital input/output pin with SPI communication. SPI pins are connected to D5, D6 and D7 pins.

### PWM Pins

**PWM0 – PWM1:** It is called square wave output pin. These pins are connected to the D0 and D1 pins. It can be used as a digital input/output pin. All digital pins D0-D15 can be used as PWM pins.

### Camera Pins

**CAMD2-CAMD9:** These are the pins where image data is transferred and used as output. These are pins D0, D1, D4, D5, D6, DAC2, A2 and A3.

**CAMSD-CAMSC:** CAMSD bidirectional data transfer is used as serial communication pins, and CAMSC is used as time synchronization. These pins are connected to A5 and DAC1.

**CAMXC:** It is the basic timing signal source required for the operation of the camera sensor from the peripherals. It is used as an input and is connected to the A4 pin. It allows it to be used as a digital input-output.

**CAMPC:** It is the timing mark included in the image data derived from the camera sensor. It is used as an output and is connected to pin D7. It can also be used as a digital input/output.

**CAMV:** Output pin indicating that the image data is available. It is connected to the A0 pin and is used only as a digital input.

**CAMH:** It is the output pin that indicates the image data is available. It is also connected to the A1 pin and is used only as a digital input.

### Internal Sensor Pins

**6-Axis Inertial Measurement Unit:** It contains IMUSD and IMUSC pins, and IMUSD is used as bidirectional data transfer and IMUSC as input for time synchronization. These pins are also connected to the common SDA and SCL lines.

**Microphone:** Contains MICD and MICC pins and MICD is used as bidirectional data transfer and MICC as input for time synchronization.

### Capacitive Sensor Pins

**T0-T5:** It is the input pin used for capacitive sensing and is connected to A4, A5, D15, D14, D13 and D12 pins respectively. These pins can be used as digital inputs/outputs.

### RGB Pins

**LEDR:** Internally, it is the pin that the red led is connected to and is connected to the RX line. It is also used as a status led during serial port data communication.

**LEDG:** Internally, it is the pin that the green led is connected to and is connected to the TX line. It is also used as a status led during serial port data communication.

**LEDB:** Internally, it is the pin to which the blue led is connected and it is connected to the SDA line. It is also used as a status led during I2C data communication.

### Button Pin

**GPKEY:** It is used for general purpose. It is the pin to which the internal button is connected. It is also used to put the system into manual install mode. It is connected to the D8 pin and can also be used as a digital input and output.

## Programming with Arduino IDE

### Arduino IDE Editor Download and Installation

It is compatible with Arduino IDE in order to upload a program to the DENEYAP Card. The version suitable for your operating system must be downloaded from Arduino Ide's own page (<https://www.arduino.cc/en/software>). The Arduino ide download screen is given in Figure 2. On the page that opens, your operating system is selected from the

Download Option tab, and then the installation file is downloaded by clicking the just download button.

## Downloads

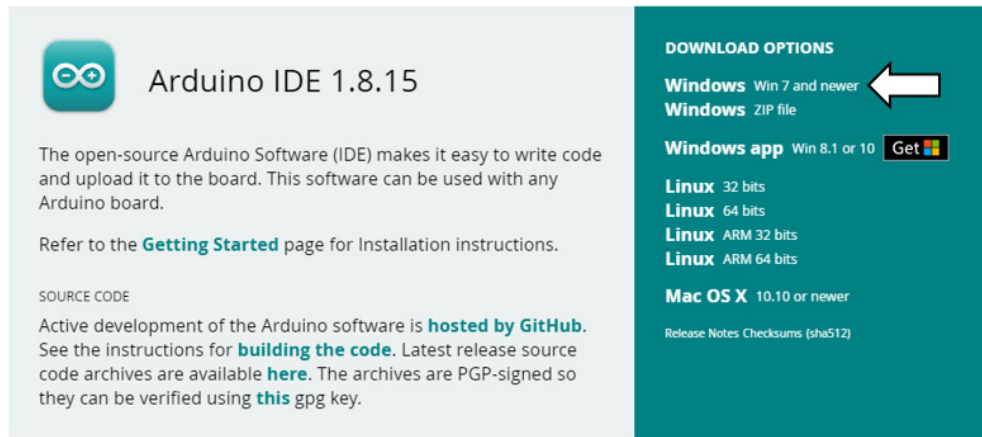


Figure 2. Arduino Ide Editor Download Screen

## Adding DENEYAP Card to Arduino IDE

It must be added to the Arduino IDE before the program can be uploaded to the DENEYAP Card. For this, the window is opened by following the File-Preferences step in the Arduino IDE. In this window, the address of the JSON file should be copied to the Additional Circuit Cards Manager URLs section ([https://raw.githubusercontent.com/deneyapkart/deneyapkart-arduino-core/master/package\\_deneyapkart\\_index.json](https://raw.githubusercontent.com/deneyapkart/deneyapkart-arduino-core/master/package_deneyapkart_index.json)) in the Settings tab. Figure 3 shows the preferences screen.

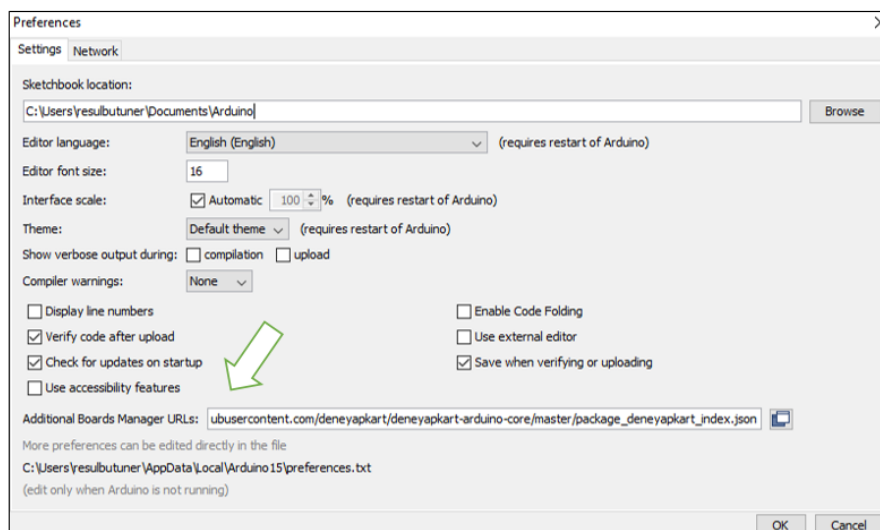


Figure 3. Arduino IDE Preferences Screen

Then, “DENEYAP Development Cards” is written in the search line on the screen that appears by following the steps of Tools-Card-Card Manager. The latest version is the default on the new screen. Clicking on the Install button will perform the installation.

The Card Manager screen is given in Figure 4.

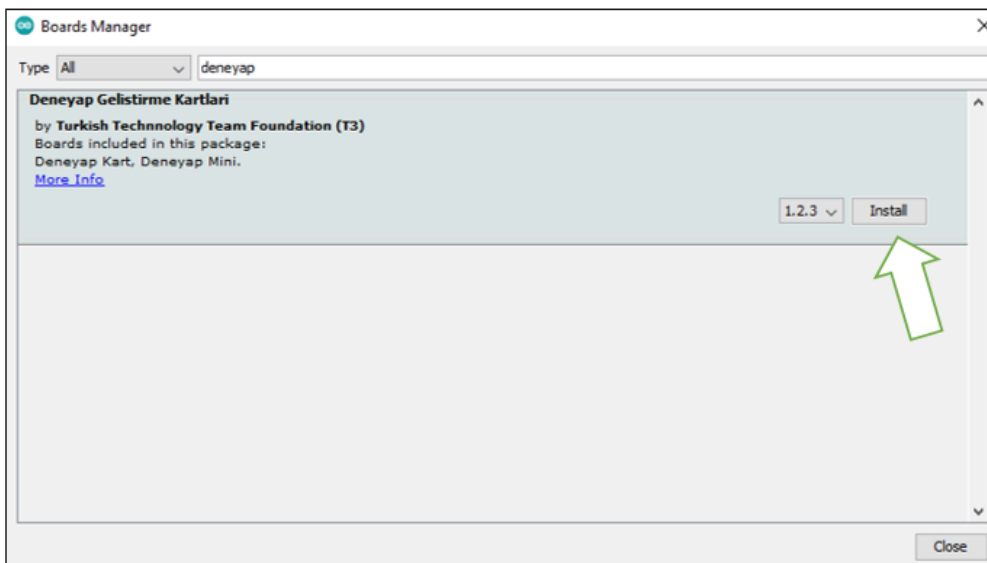


Figure 4. Arduino IDE Card Manager screen

Finally, the coding area is entered by selecting the Tools-Kart, then “DENEYAP Card” and the Port to which the card is connected. Figure 5 shows the screen for selecting DENEYAP Card and related port.

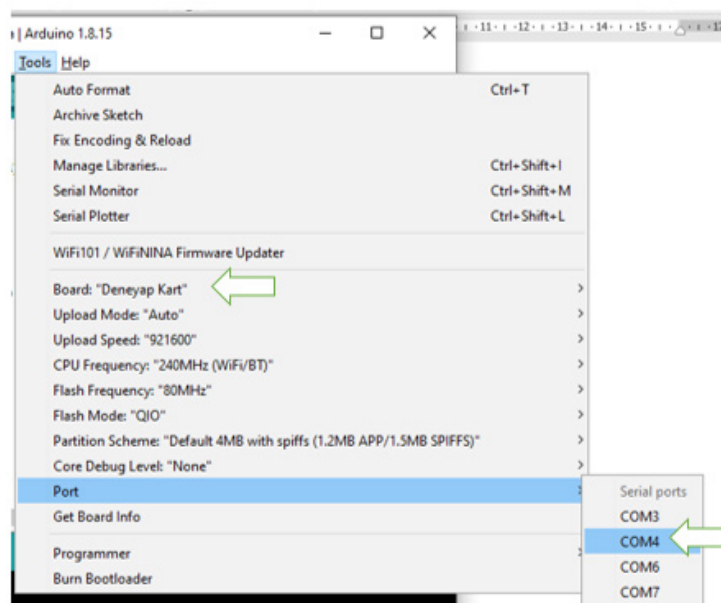


Figure 5. Arduino IDE Card and Port setting

“File-Examples- Examples for DENEYAP Card” is selected to access the sample codes made with the DENEYAP Card. Here, related applications using various sensors can be examined. In Figure 6, the screen is given to access the examples made with the DENEYAP Card.

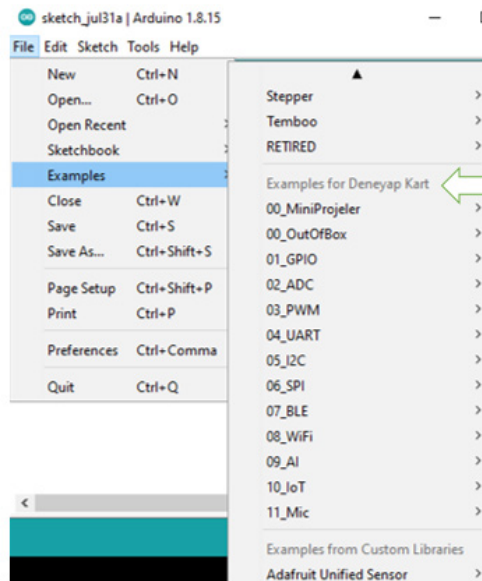


Figure 6. Examples of DENEYAP Card

## USB Driver

If the drivers are not automatically installed when you insert the Test Card to your computer (<https://www.silabs.com/developers/usb-to-uart-bridge-vcp-drivers>) the Downloads tab is selected from the address link and the driver suitable for the operating system is downloaded and installed. The download screen is given in Figure 7.

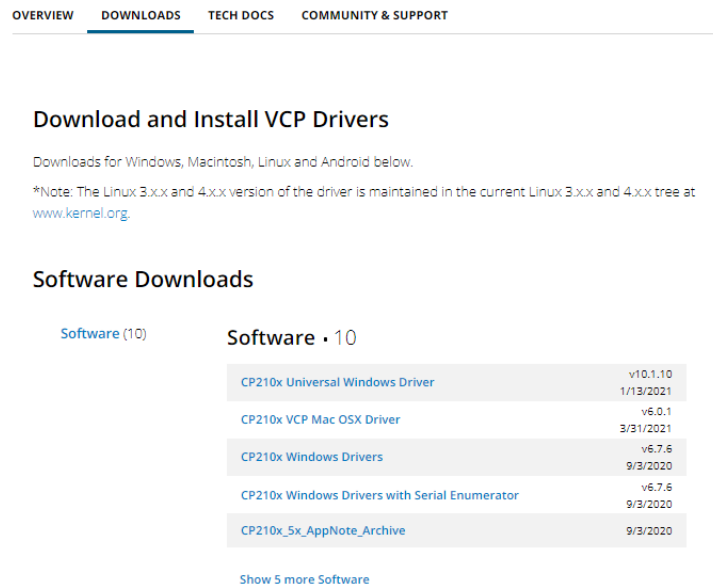


Figure 7. USB Driver File Download Screen

## Programming with MicroPython

### Download and Installation

DENEYAP Card works in harmony with MicroPython. First of all, Visual Studio Code (<https://code.visualstudio.com/Download>) must be downloaded and installed by clicking the appropriate tab for the operating system from the download link. Next, the Pymakr plugin needs to be installed via the Visual Studio Code editor. After the installation is complete, the Visual Studio Code should be opened, the “Pymakr” plugin should be searched and installed from the “Extensions” tab. In Figure 8, the installation order of the “Pymakr” plugin is given (Deneyap Card, 2021).

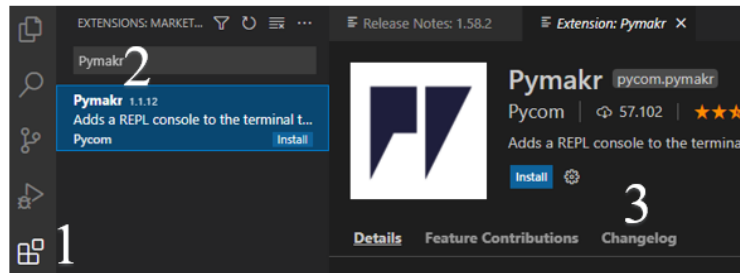


Figure 8. “Pymakr” Plugin Installation Sequence

### Programming with DENEYAP Block

It offers the opportunity to program the DENEYAP Card on a block-based basis. For this, a program can be prepared with application-oriented blocks by clicking on the (<https://deneyapkart.org/deneyapkart/deneyapblok/>) address. DENEYAP Card Block screen is given in Figure 9. Block or text-based programs created on the block page are uploaded to the DENEYAP Card through another editor such as Arduino IDE.

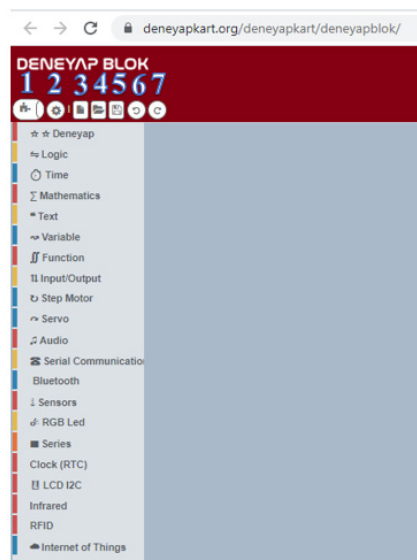


Figure 9. DENEYAP Block screen

Looking at the page, respectively;

1: It allows switching between block or text-based editors.



- 2: This section with settings on the block screen, which blocks to show or not, etc.
- 3: It is used for a new worksheet.
- 4: It is used to open the previously saved file.
- 5: It is used to save the file with the bloc extension.
- 6: It is used to undo the action.
- 7: It is used to redo the undo action.

### DENEYAP Camera

DENEYAP Camera has an infrared filter lens, 2 Megapixels and OV2640 sensor. Compatible with DENEYAP Card and connected to the card with a 24-pin Flat Flexible Cable. Video shooting is done with 15 FPS image transfer rate and 1600x1200 pixel resolution. Likewise, it is possible to take photos with a resolution of 1600x1200 pixels. Using DENEYAP Camera, face detection, image classification, object recognition, motion detector, etc. artificial intelligence applications can be made. DENEYAP Camera image is shown in Figure 9.

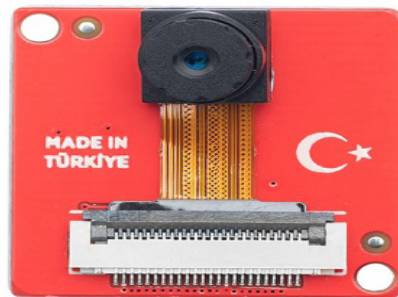


Figure 9. DENEYAP Camera

### References

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