

## Programmable Microcontrollers: Potential for Illicit Use

Microcontrollers<sup>1</sup> are readily available, inexpensive, and a developing commercial technology that may become a threat to public safety. They are designed for legitimate purposes, but have been used in the construction of IEDs, unmanned aircraft systems (UAS), and unmanned surface vessels (USVs). Some microcontrollers use an open-source programming platform for building devices that interact with a wide variety of electronic components that can be stacked, or linked together, to incorporate multiple functions into a single device. This feature enables the microcontroller to be used for a variety of functions, including malign purposes. In addition, construction and programming assistance is widely available through online forums, publications, and videos.

**SCOPE:** The purpose of this product is to enhance awareness of emerging lawful technologies that may be used illicitly. Recognition, reporting, and vetting of suspicious activity with electronics in combination with precursor chemicals for homemade explosives or illicit UAS modifications—without a reasonable explanation—are critical to public safety.

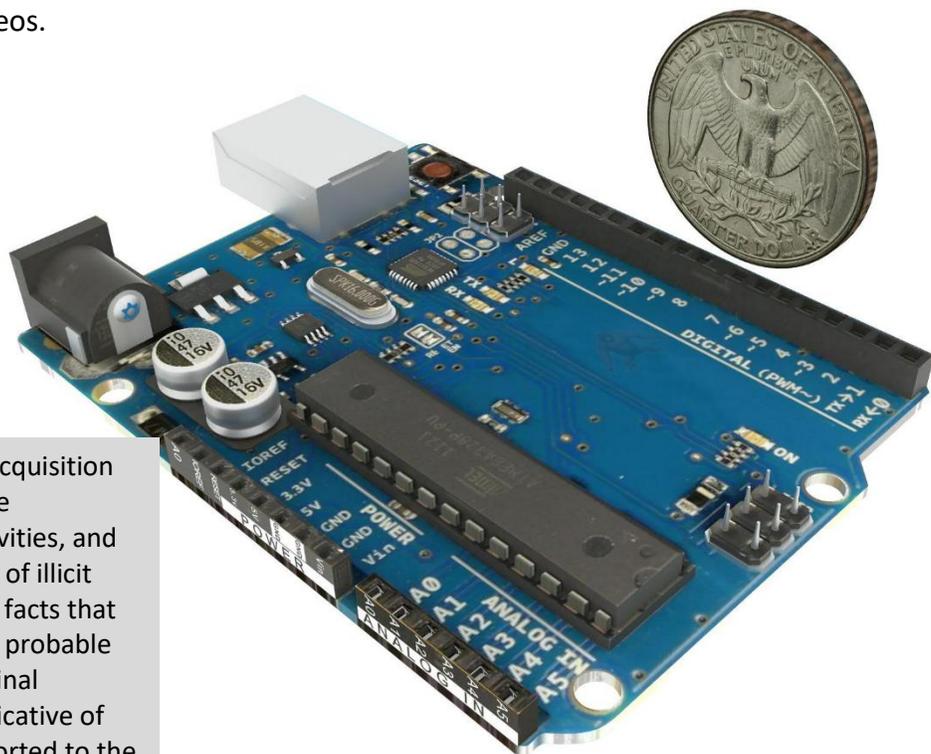


Image of microcontroller; US Quarter for perspective

**WARNING:** The indicators of acquisition and use of microcontrollers are constitutionally protected activities, and their use in any determination of illicit intent should be supported by facts that justify reasonable suspicion or probable cause. Activity that is not criminal behavior but is reasonably indicative of suspicious activity may be reported to the local fusion center or FBI field office.

<sup>1</sup>An integrated circuit (IC) is a small, low-cost, self-contained computer designed to handle a specific task in embedded systems.



10 DECEMBER 2020  
 AUTHORED BY NCTC, DHS, FBI

**NOTICE:** This is a Joint Counterterrorism Assessment Team (JCAT) publication. JCAT is a collaboration by the NCTC, DHS and FBI to improve information sharing among federal, state, local, tribal, territorial governments and private sector partners, in the interest of enhancing public safety. This product is **NOT** in response to a specific threat against the United States. It provides general awareness of, considerations for, and additional resources related to terrorist tactics, techniques and procedures, whether domestic or overseas. Consider the enclosed information within existing laws, regulations, authorities, agreements, policies or procedures. For additional information, contact us at [JCAT@NCTC.GOV](mailto:JCAT@NCTC.GOV).

**CHARACTERISTICS:** Malign actors can abuse and manipulate many brands of microcontrollers. These devices provide a low-cost, easy way for novices and professionals to create devices that interact with motors, light emitting diodes (LEDs), infra-red (IR), and sensors measuring light, temperature, pressure, proximity, acceleration, carbon monoxide, radioactivity, humidity, and barometric pressure. The Arduino platform stands out from other microcontroller platforms because it offers easy-to-use programming capabilities used by other platforms.

- In 2005 the Arduino<sup>2</sup> microcontroller platform was developed along with an open-source platform used for building electronics projects. The platform employs a user-friendly basic code making it easy for anyone to program.
- Arduino microcontrollers can be combined with prebuilt circuit boards, known as “shields,” which offer additional capabilities, such as operating motors, Internet connectivity, cellular or other wireless communication capability, or the ability to control an liquid crystal display (LCD) screen.
- As the technology continues to evolve, newer and better capabilities will be available to anyone through online libraries, preassembled components, and do-it-yourself (DIY) kits.
- “Maker Space” online instructions and code libraries—and similar platforms offered by other companies—can further expand the use of microcontrollers.
- Imitation or “knockoff” boards—identified by missing logos, different board colors, or sold at a much lower cost—often work with Arduino coding and can use genuine and “knockoff” shields. Headers, universal serial bus (USB) connectors and power connectors are common among boards. These boards are also susceptible to abuse and malign use.

**CONSIDERATIONS:** Information sharing among federal, state, and local intelligence liaisons, first responders, and private sector security professionals will enhance understanding of evolving lawful technologies that terrorists have subverted for weapon development. Cooperation will promote a common understanding of the threat environment and increase recognition of dual-use components that may enhance suspicious activity reporting and investigations.

- Partnerships with explosive ordnance disposal (EOD) and public safety bomb squads can increase personnel safety by highlighting explosive precursor chemicals and materials of concern.
- Partnerships with hobby shops, online vendors, and enthusiasts may enhance the identification of activities or behaviors indicative of illicit microcontroller use.
- Commercial components sales may not be subject to government export licenses and are far less scrutinized or regulated than weapons sales.
- Companies that develop, manufacture, and sell related components may be unaware of their use in the development of illicit weapons. Establishing a relationship with business owners and operators may encourage them to report suspicious purchases for further investigation.

**RESOURCES:**

- **ARDUINO – INTRODUCTION:** <https://www.arduino.cc/en/guide/introduction>
- **BOMBMAKING MATERIALS AWARENESS PROGRAM (BMAP):** <https://www.cisa.gov/bmap>

---

<sup>2</sup>An open-source hardware and software company, project, and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices.





## PRODUCT FEEDBACK FORM

(U) JCAT MISSION: To improve information sharing and enhance public safety. In coordination with the FBI and DHS, collaborate with other members of the IC to research, produce, and disseminate counterterrorism (CT) intelligence products for federal, state, local, tribal and territorial government agencies and the private sector. Advocate for the CT intelligence requirements and needs of these partners throughout the IC.

NAME and ORG:

DISCIPLINE:    LE    FIRE    EMS    HEALTH    ANALYSIS    PRIVATE SECTOR    DATE:

PRODUCT TITLE:



ADDITIONAL COMMENTS, SUGGESTIONS, OR QUESTIONS.

WHAT TOPICS DO YOU RECOMMEND?

