Shopping List

If you want to take part in the pilot of this study, it does require an investment on the part of the university or the students. If the department purchases the supplies for the students, here is the cost breakdown. I have listed required items and optional items as well as a link for purchase through Amazon.

I have included the cost for each. Most students will typically need one of each type of thing. Buying the LEDs in bulk dramatically lowers the costs for the students. They won't use all of them. Check the total count for each item and determine if it is enough for your class. I bought one of most of the packs below and it was enough for my 16 students, but they worked in pairs. I probably would have had enough of the bulbs and resistors if they would've worked individually, but not enough breadboards.

Materials and Cost:

Item	Cost per	Total
Arduino Nanos	$4 /student	
Breadboards	$18 / 10 students	
IR emitter/receiver	$6 / 10 students	
Total *depends on # of students	**(example of 10 students)**	**$64**
Resistors	$11 / class	$11
op-amps	$7 / class	$7
LEDs	$9 / class	$9
Photoresistors	$8 / class	$8
Bumpers (optional)	$4 / class	$4
Wires	$15 / class	$15
Push buttons	$7 / class	$7
Total		**$61**

1. Arduino is the name brand, with Elegoo the most popular "off-brand" that is still quality. For spring 2020, my department purchased students pairs the Elegoo Uno R3 ($13 each, https://www.amazon.com/gp/product/B01EWOE0UU/ref=ppx_yo_dt_b_search_asin_title?ie=UTF8&psc=1). The Arduino Unos are closer to $24 each. I think I will go with the nano next time as it is cheaper ($4 each). I ordered the kind that is pre-soldered, and I am glad I did. They worked like a charm and it would be time consuming and with errors to solder them when they arrive. All three of mine worked, but only 2/3 cables worked. (https://www.amazon.com/Hosyond-ATmega328P-Controller-Compatible-Arduino/dp/B08915GQ89?pd_rd_w=Im1Uv&pf_rd_p=5b0ba21b-1e5a-4af0-96e7-63e47d7517e6&pf_rd_r=G3WV1NSHQY05QXPDEP65&pd_rd_r=d5e6c05a-138c-4d7f-b26a-91740c6ace19&pd_rd_wg=Il6I7&pd_rd_i=B08915GQ89&psc=1&ref_=pd_bap_d_rp_1_dv_vtp_2_t) We can probably buy in bulk cheaper somewhere. The USB cable your students probably have around their house somewhere.
2. Breadboards. Each student needs a breadboard. I purchased each ten pack for $18, but you can probably find these cheaper or you might have some around your departments. https://www.amazon.com/gp/product/B07H9X7XVN/ref=ppx_yo_dt_b_search_asin_title?ie=UTF8&psc=1
3. Pack of IR emitter/receivers. Need one pack for every 10 students for $6/pack. https://www.amazon.com/gp/product/B01HGIQ8NG/ref=ppx_yo_dt_b_search_asin_title?ie=UTF8&psc=1
4. A pack of various resistors. I found this one for $11 and is enough for a very large class. https://www.amazon.com/gp/product/B072BL2VX1/ref=ppx_yo_dt_b_search_asin_title?ie=UTF8&psc=1
5. A large pack of LEDs. I liked this pack as there was plenty of each student have various colors and types of bulbs for $9. It does only come with 10 of the RGB bulbs, so you might have to buy extra of these for a class. https://www.amazon.com/gp/product/B0739VKXYG/ref=ppx_yo_dt_b_search_asin_title?ie=UTF8&psc=1

6. Photoresistors for them to build their own spectrophotometers. I bought this pack that has different resistances for $8 and is plenty for a very large class. https://www.amazon.com/gp/product/B07M9P6357/ref=ppx_yo_dt_b_search_asin_title?ie=UTF8&psc=1
7. A pack of op-amps, 50 of them for $7. https://www.amazon.com/gp/product/B077BR9KT2/ref=ppx_yo_dt_b_search_asin_title?ie=UTF8&psc=1
8. Bumpers for the microprocessors. These aren't needed, but they kept the Arduino Unos from scratching the work stations. $4 for up to 25 Unos. You don't need these if you go with the nanos. https://www.amazon.com/gp/product/B07G8926LH/ref=ppx_yo_dt_b_asin_title_o06_s00?ie=UTF8&psc=1
9. Wires. You will need lots of wires. You can either buy spools and have the students cut and strip the wires, or you can buy male to male connector wires specific for Arduino. $15 for this pack. https://www.amazon.com/gp/product/B07TX6BX47/ref=ppx_yo_dt_b_asin_title_o06_s00?ie=UTF8&psc=1 or https://www.amazon.com/XLX-Breadboard-Soldering-Brushless-Double-end/dp/B07S743PLP/ref=sr_1_7?dchild=1&keywords=arduino%2Bjumper%2Bwires&qid=1607720781&s=hi&sr=1-7&th=1
10. Push buttons. Pack of 100 for $7. https://smile.amazon.com/CO-RODE-Tact-Button-Switch-6x6x5mm/dp/B00W0YUV1W/ref=sr_1_21?dchild=1&keywords=arduino+button&qid=1605282758&sr=8-21