INDEX

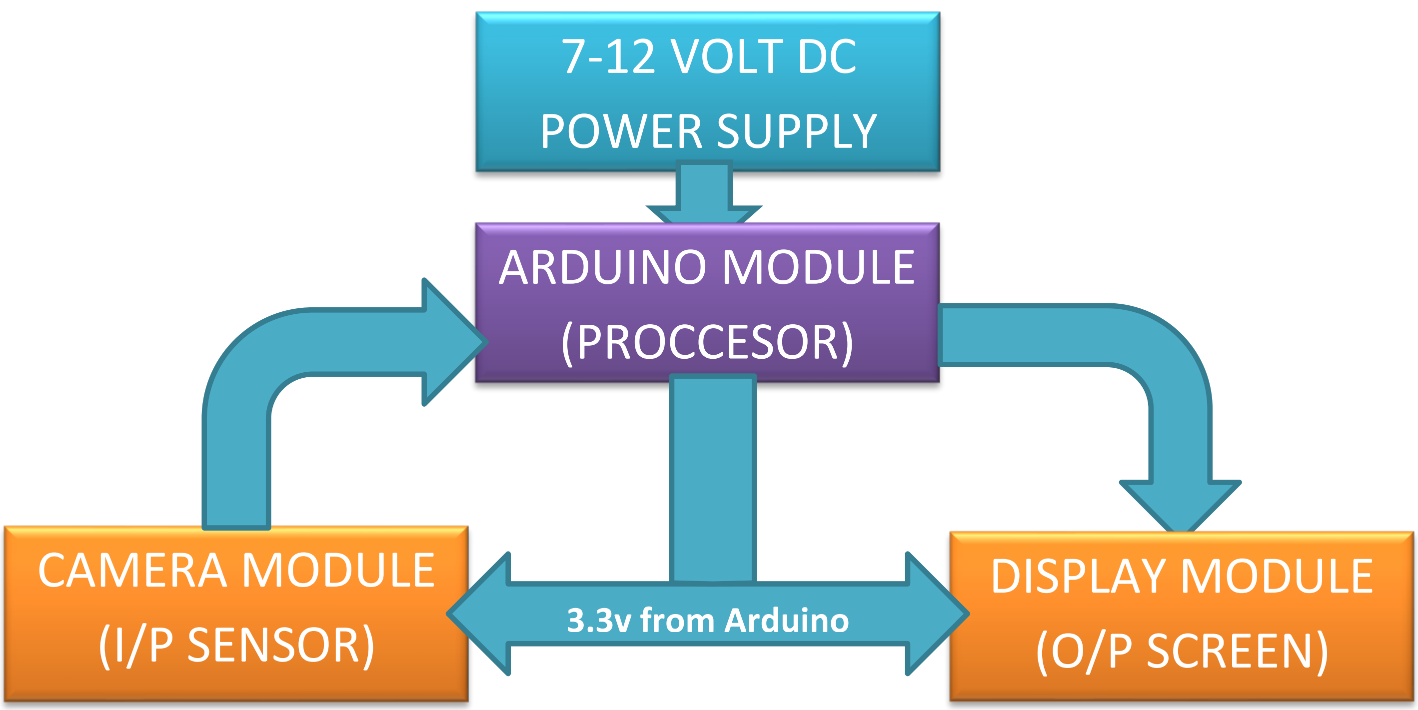
INTRODUCTION OF PROJECT

This is the project on the 'DEFENSOFFENSSIVE EQUIPMENT' for the soldiers which mounted on the 'Assault Rifles'. We hear such news there are several injuries in the combat operation, like soldier get shot by enemy in actions. There is some condition when soldier need to go out of cover area and had to fire on the enemy. At that time soldier can be easily get targeted. So I decided to make equipment which can mount on the rifle and helps soldier to see into infiltrated area. Not only soldier can see but also easily aim and take shot within the cover.

COVER PROTECT & AIMER

Helmet Mounted Screen & Rifle Mounted Camera

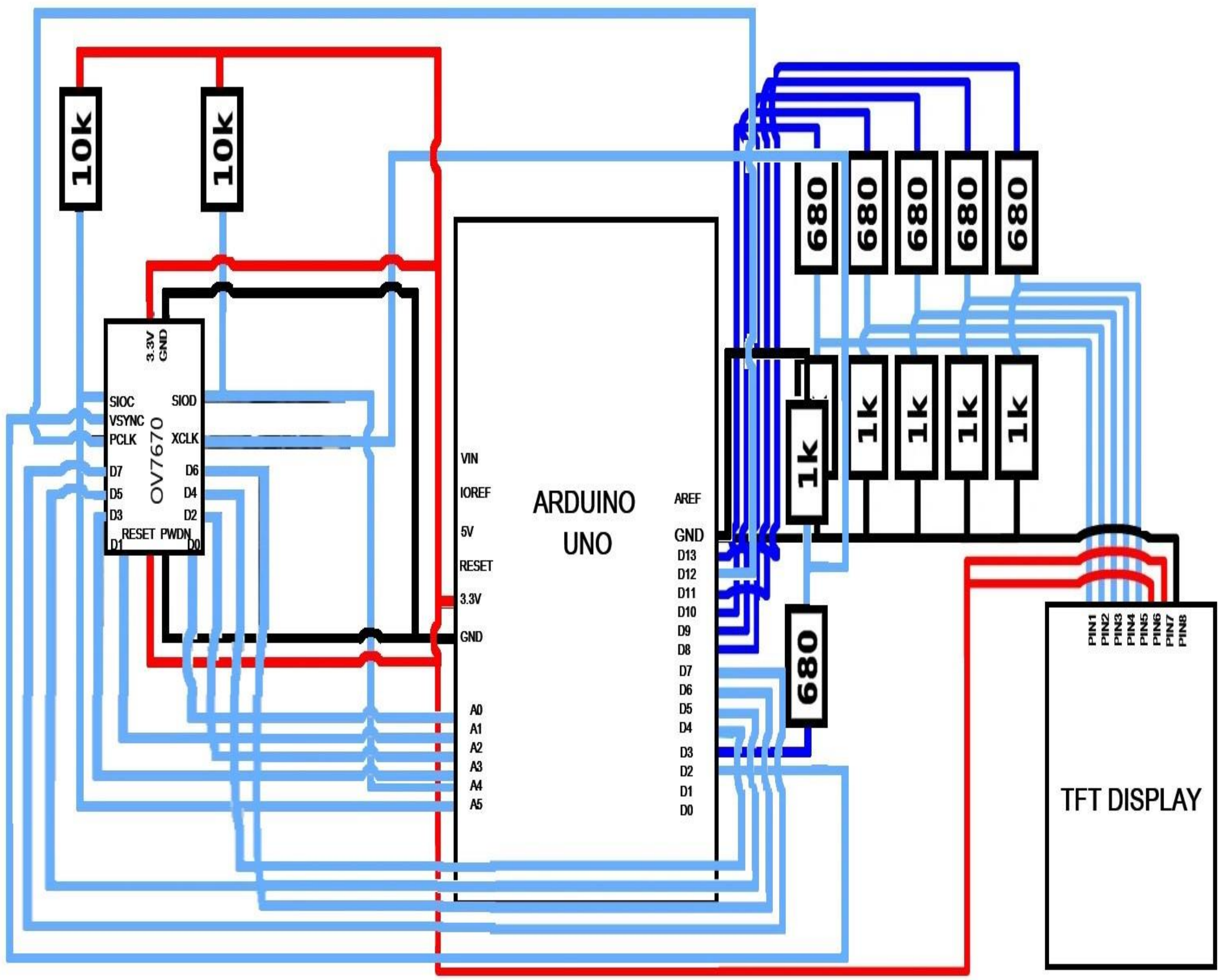
Block Diagram: -



Components

COMPONENTS	QUANTITY
ARDIUNO UNO	1
OV76701 (CAMERA MODULE)	1
TFT DISPLAY	1
RESISTORS (10K Ω)	2
POWER SUPPLY	7-12V
CONNECTING WIRES	26
RESISTORS (1K Ω & 650 Ω)	6

Circuit Diagram



Connection

Connection Between the OV7670 & Arduino UNO

OV7670	Arduino UNO
VSYNC	PIN D2
XCLCK	(Between the Voltage Divider of GND & D3)
PCLCK	PIN D12
SIOD	A4(With 10K Pull up Resistors to 3.3V)
SIOC	A5(With 10K Pull up Resistors to 3.3V)
D0 D3	A0…A3(pixel data bits 0…3)
D4 D7	PIN 4…PIN 7(pixel data bits 4…7)
3.3v	3.3v
RESET	3.3v
GND	GND
PWDN	GND

Connection Between the TFT Display & Arduino UNO

TFT Display	Arduino UNO
PIN 3 (D/C)	PIN D8 (With Voltage Divider)
PIN 2 (CS)	PIN D9 (With Voltage Divider)
PIN 1 (RESET)	PIN D10(With Voltage Divider)
PIN 4 (DIN)	PIN D11(With Voltage Divider)
PIN 5 (CLK)	PIN D13(With Voltage Divider)
VCC	3.3V
BL	3.3V
PIN 8 (GND)	GND

CONNECTION DISCRIPTION

1. Preparing the Screen

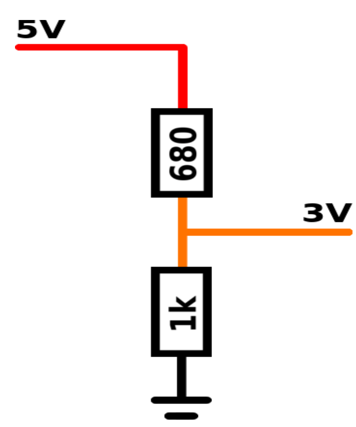
Shorted the J1 connector on the back of the screen. Then the VCC pin of the display connected to the 3.3V pin of the Arduino board.

Faint vertical stripes going across the screen. By default, the screen is configured to be powered by 5V, but internally it operates at 3.3V levels. I was able to get rid of those ghosting lines by using 3.3V data signals (with voltage dividers) and switching the power input over to 3.3V.

2. Connecting the 1.8 Inch TFT to Arduino

The input pins of the 1.8-inch TFT screen are not 5V tolerant. I have to convert the Arduino 5V signals to 3V. The easiest way to achieve that is to put voltage dividers on the signal wires.

<u>Added a Voltage divider network to every connection made in steps 1 to 5.</u>



Step 1. Connected the screen pin 1 (RST) to the Arduino pin 10.

This is the reset pin. It is used by the Adafruit library when initializing the screen.

Step 2. Connected the screen pin 2 (CS) to the Arduino pin 9.

Chip select pin. Signal LOW – the screen is active and listening to the SPI port. Signal HIGH – the screen ignores all the data on the SPI wire.

Step 3. Connected the screen pin 3 (D/C) to the Arduino pin 8.

Data/Configuration pin. Send either pixel data (image to be displayed) or configuration data (color format, screen orientation, etc.). Input HIGH is for sending pixel data and LOW for sending configuration.

Step 4. Connected the screen pin 4 (DIN) to the Arduino pin 11.

SPI data input pin. The screen is listening to the SPI port if the CS pin is LOW.

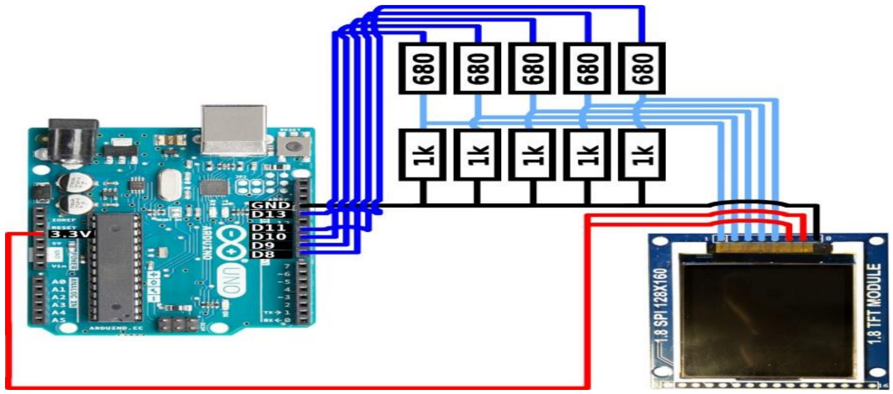
Step 5. Connected the screen pin 5 (CLK) to the Arduino pin 13.

SPI clock pin. The screen is listening to the SPI port if the CS pin is LOW.

Step 6. Connected the screen power pins. The pins 6 (VCC) and 7 (BL) to the Arduino 3.3V pin. The screen pin 8 (GND) to the Arduino GND pin.

Pin 7 is the signal to activate the backlight. I connected it to the 3.3V, so the display is always lit. The Arduino could control it, but in this project, we need all the other Arduino pins for the camera connections.

Pins 6 and 8 are power pins for the screen. Since we shorted the J1 connector, we need to use 3.3V input for the VCC.



3. First Part of the Camera Connections – Power It Up

The camera wiring in two phases. I'm going to make all the necessary connections to get the camera running and configured by the Arduino.

Step 1. A voltage divider from the Arduino pin 3 to the XCLK pin of the camera.

Similarly, to the screen, the camera module is not 5V tolerant. This is the only connection that needs a voltage divider on the camera side. It's the single digital output signal from Arduino to the OV7670 module (all the other ones are inputs for the Arduino).

XCLK is the input clock that makes the camera run. The maximum frequency that Arduino can put out is 8Mhz. For full speed, the camera module needs 30Mhz, but eight is enough to display ten frames per second image.

Step 2. The I^{2}C connections. Arduino pin A5 to SIOC and Arduino pin A4 to SIOD. Then add a 10k pull-up resistors to 3.3V to both of the wires (A5 to 10k to 3.3V, A4 to 10k to 3.3V).

I^{2}C is necessary for sending configuration data to the camera (resolution, pixel format, etc.).

Step 3. VSYNC to Arduino pin 2.

It's a 3.3V signal from the camera to the Arduino. This connection can be made directly without a voltage divider.

I need vertical sync to know when a new frame begins. Otherwise, it looks to Arduino like a constant pixel stream with no start or end.

Step 4. PCLK to Arduino pin 12.

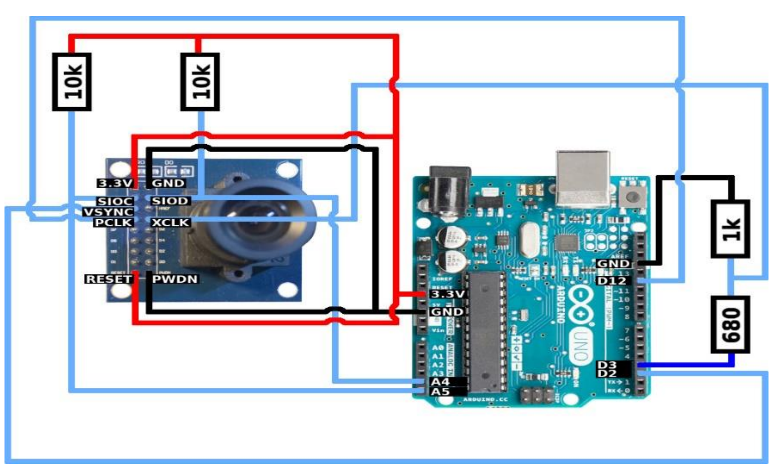
This is also a 3.3V signal from the camera to the Arduino and can be connected directly.

Pixel cock is necessary for knowing the exact time when to read pixel data.

Step 5. Connected power to the camera. From Arduino 3.3V pin to the camera's 3.3V input and from Arduino GND pin to the camera's GND.

Step 6. Connected the camera's RESET pin to 3.3V and PWDN to GND.

Reset pin could be used to reset the camera module and power down to turn it off. But since I don't have any left-over pins, I let it run all the time.



4. Validated That the Camera is Running

This is the second test before I get to the actual images from the camera.

When I start the Arduino again, then it should flash a green screen. This means that the LiveOV7670 library was able to detect and configure the camera successfully

I can't see any images yet since the pixel data pins are not connected.

If I still see the red screen, then check the wiring. Make sure that the XCLK wire isn't too long. The square wave of the input clock signal to the camera may become too deformed for it to operate correctly.

5. Second Part of the Camera Connections – Pixel Data Pins

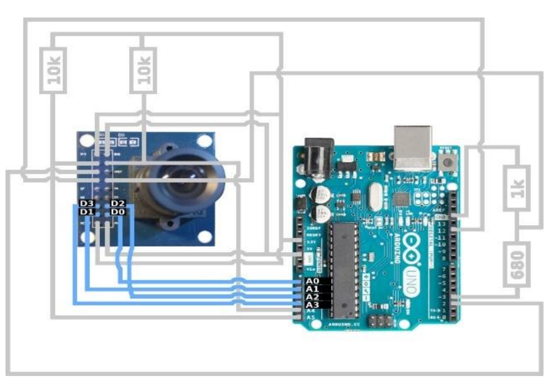
Now I can finish the camera wiring by connecting pixel data inputs. Pixels are streamed from the camera one byte at the time. Each pixel consists of two bytes that are read sequentially.

Step 1. Connected Camera's D0 to D3 to the Arduino pins A0 to A3.

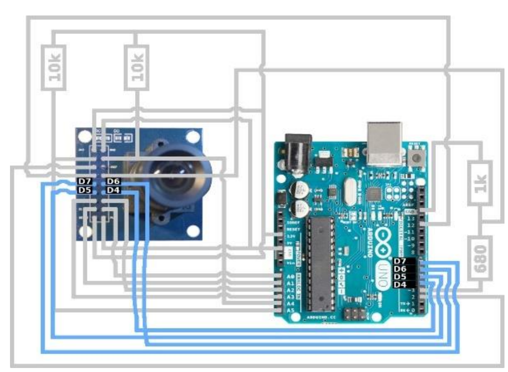
These are the lower four bits of a pixel byte.

Step 2. Connected Camera's D4 to D7 to Arduino pins 4 to 7.

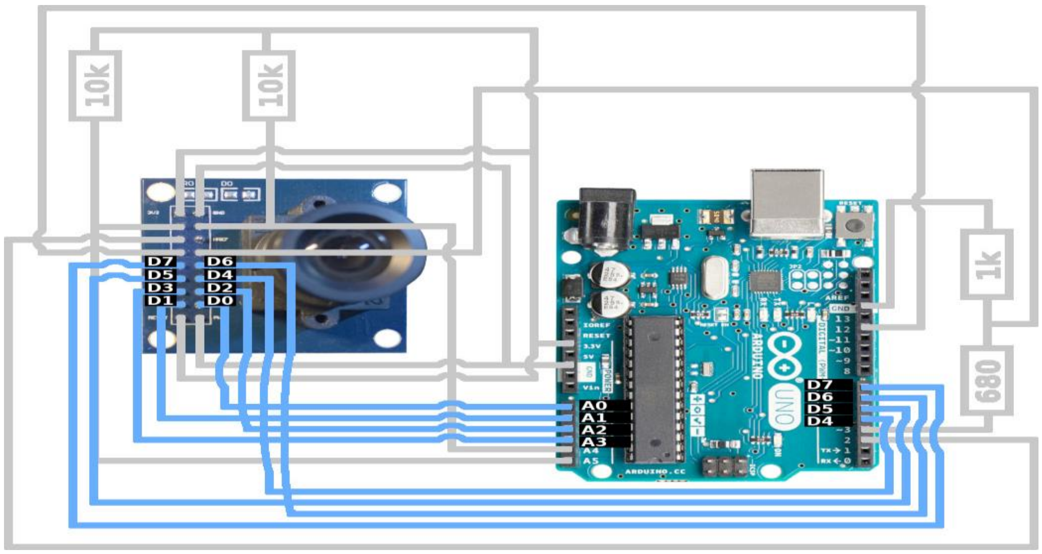
These are the higher four bits of a pixel byte.



STEP-1



STEP-2



6. CODEED SCRIPT INSTALLATION

I downloaded the coded script from this link
https://github.com/indrekluuk/LiveOV7670.git

And installed it in the Arduino UNO.

7. NOW I CAN SEE THE VIDEO STREAMING ON DISPLAY.

Working

When we power up the power supply at that time the port of Arduino 3.3v get powered up and turned on the OV7670 CAM with the power port 3.3v & also powers the TFT display with the PIN6,7. Camera is not 5v tolerant so we divide voltage from the Arduino pin 3 to the XCLK pin. XCLK is a system clock start frames generating at that time VSYNC is low during frame HREF high during active pixels of row. PCLK give signal to Arduino PORT D12 gives exact time when to read pixel data. PORT D0-D7 is RGB (Red, Green, Blue) video component digital output give signal directly to the Arduino's port A0...A5 & D3...D7. Arduino pin A5 to SIOC and Arduino pin A4 to SIOD it sends configuration data to camera like (resolution, pixel format, etc.). VSYNC (vertical sync) give signal to Arduino PORT D2 to know when a new frame begins.

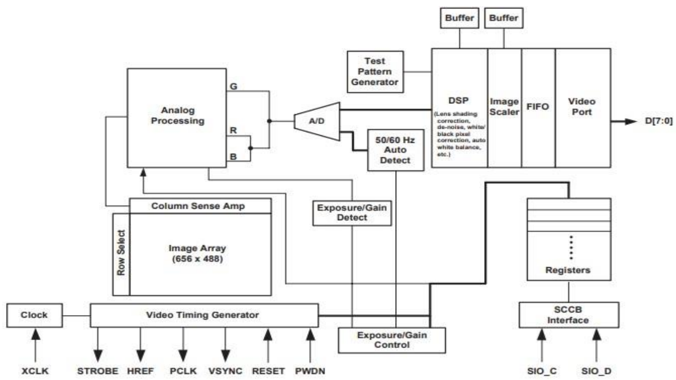
After that these all signal received from the camera is integrated in the microcontroller and program distribute this signal in digital format. After the output signal is send towards the PORT D8...D13. Display is not 5v tolerant so voltage divider network is added. 1k resistors are connected to GND and 680-ohm resistor connected to output of Arduino. The two resistors are connected Between that the TFT Display PORT1 to PORT5. That gives the signal to the display and display shows correct output which is in the video format of 10fps.

COMPONENTS DISCRIPTION

CAMERA MODULE: - An image sensor or imager is a sensor that detects and conveys information used to make an image. It does so by converting the variable attenuation of light waves (as they pass through or reflect off objects) into signals, small bursts of current that convey the information. The waves can be light or other electromagnetic radiation.

The two main types of electronic image sensors are the charge-coupled device (CCD) and the active-pixel sensor (CMOS sensor). Both CCD and CMOS sensors are based on metal–oxide–semiconductor (MOS) technology, with CCDs based on MOS capacitors and CMOS sensors based on MOSFET (MOS field-effect transistor) amplifiers. Analog sensors for invisible radiation tend to involve vacuum tubes of various kinds, while digital sensors include flat-panel detectors. Image sensors with built-in processing units for machine vision are known as smart image sensors or intelligent image sensors.

The OV7670/OV7171 CAMERACHIPTM is a low voltage CMOS image sensor that provides the full functionality of a single-chip VGA camera and image processor in a small footprint package. The OV7670/OV7171 provides full-frame, sub-sampled or windowed 8-bit images in a wide range of formats, controlled through the Serial Camera Control Bus (SCCB) interface. This product has an image array capable of operating at up to 30 frames per second (fps) in VGA with complete user control over image quality, formatting and output data transfer. All required image processing functions, including exposure control, gamma, white balance, color saturation, hue control and more, are also programmable through the SCCB interface. In addition, OmniVision CAMERACHIPs use proprietary sensor technology to improve image quality by reducing or eliminating common lighting/electrical sources of image contamination, such as fixed pattern noise (FPN), smearing, blooming, etc., to produce a clean, fully stable color image.

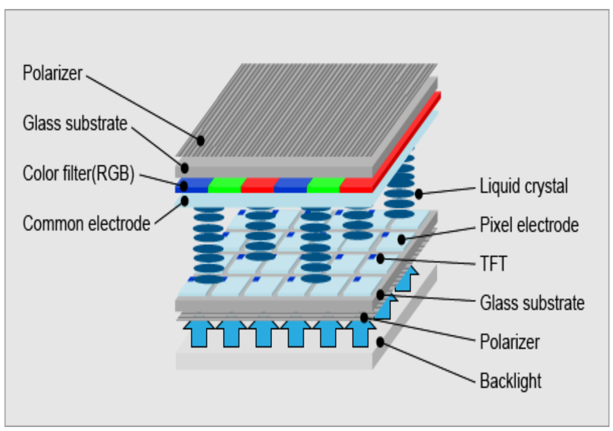


OV7670 SENSOR DIAGRAM

ARDUINO: - Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.

Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. A worldwide community of makers - students, hobbyists, artists, programmers, and professionals - has gathered around this open-source platform, their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts alike.

TFT DISPLAY: -An LCD consists of many pixels. A pixel consists of three sub-pixels (Red/Green/Blue, RGB). In the case of Full-HD resolution, which is widely used for smartphones, there are more than six million (1,080 x 1,920 x 3 = 6,220,800) sub-pixels. To activate these millions of sub-pixels a TFT is required in each sub-pixel. TFT is an abbreviation for "Thin Film Transistor". A TFT is a kind of semiconductor device. It serves as a control valve to provide an appropriate voltage onto liquid crystals for individual sub-pixels. A TFT LCD has a liquid crystal layer between a glass substrate formed with TFTs and transparent pixel electrodes and another glass substrate with a color filter (RGB) and transparent counter electrodes. In addition, polarizers are placed on the outer side of each glass substrate and a backlight source on the back side. A change in voltage applied to liquid crystals changes the transmittance of the panel including the two polarizing plates, and thus changes the quantity of light that passes from the backlight to the front surface of the display. This principle allows the TFT LCD to produce full-color images.



TFT LCD DISPLAY BASIC Principle DIAGRAM

FUTURE SCOPE OF THE PROJECT

In this project we can use different types of cameras for different places or different geographical condition as per the situation & requirement of military troops.

For example: -

1. 360 cameras
2. Night vision cameras
3. Thermal imaging cameras
4. Optical zoom cameras
5. Wide angle cameras
6. Depth sensing cameras
7. Invisible lasers aiming
8. Tactical flashlight
9. Grenade launcher Assistance, etc.
10. Using this equipment, we can make combat helmets which can achieve up to 100% bulletproof safety, covering face of soldiers. And protect them from direct head injuries.

Disadvantages of similar system

There are few guns which can take shot from corner like Israel made corner-shot & DRDO also develops gun which can take shot on corner, china, Iran, S. Korea had also similar system weapons but they have various limitation.

Corner shot by Israel

Corner shot by DRDO

1. Barrel of gun is folded because of short barrel,
2. Range is short compared to Assault Rifle & Carbines
3. Folded mechanism increases weight & maintenance of gun
4. Durability of gun is decreases
5. We cannot mount this system to any other hand fire weapon
6. It cost in lakhs of rupees

These are some factors which affect in the combat role.

Pros & Cons with Applications

1. User friendly
2. Can mount on any weapon
3. It does not affect to range of any weapon
4. Accuracy is same as before mounting
5. Soldier can shoot within the cover
6. It is very cheap at pricing compared to corner shot gun
7. Useful in Antiterror operations
8. Saves injuries of soldier
9. Light weight
10. Portable
11. System can easily modify & can connect other accessories.

Disadvantages: - This project is made for overcome the problems in other system so we fix most issues and now there is no disadvantages**.**

Thank you.
