BIOMETRIC VOTING SYSTEM

1. 4X3 KEYPAD:

1.1 WORING OF KEYPAD:

The matrix keypad consists of pushbutton contacts that are connected to the row and column lines. There is one pin for each column and one pin for each row. So the 4×4 keypad has 4 + 4 = 8 pins, while the 4×3 keypad has 4 + 3 = 7 pins.

This illustration of a basic 4×3 keypad arrangement demonstrates how the internal conductors connect the rows and columns.

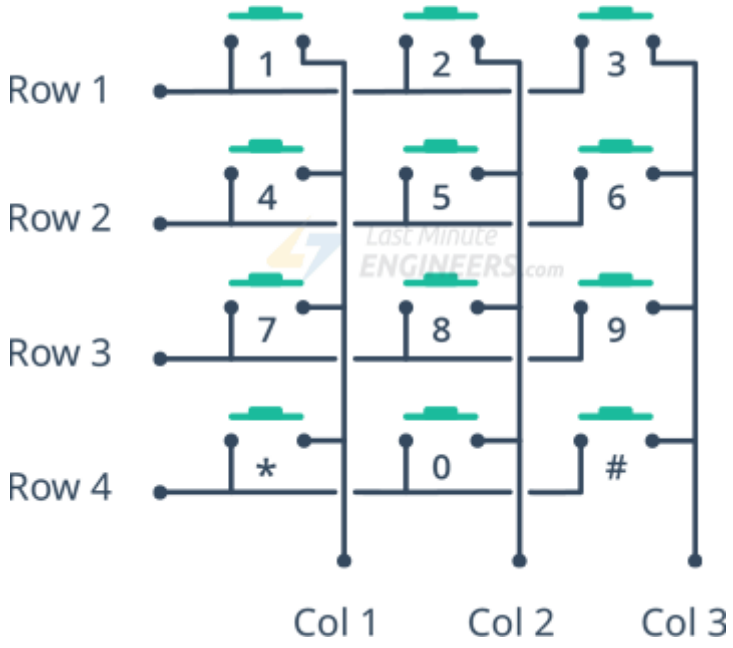

Fig 1.0 Switch configuration

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This illustration of a basic 4×3 keypad arrangement demonstrates how the internal conductors connect the rows and columns.

When the button is pressed, one of the rows is connected to one of the columns, allowing current to flow between them. When the key '4' is pressed, for instance, column 1 and row 2 are connected.

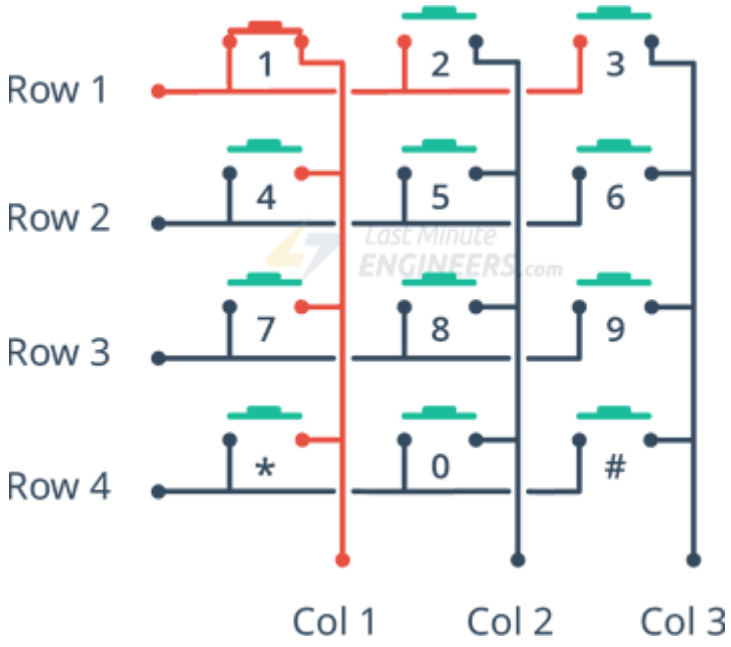

Fig 1.1 Switch configuration

By identifying which column and row are connected, we can determine which button has been pressed.

1.2 KEYPAD SCANNING:

Here is how a microcontroller scans rows and columns to identify which button has been pressed.

1. Each row is connected to an input pin, and each column is connected to an output pin.
2. Input pins are pulled HIGH by enabling internal pull-up resistors.
3. The microcontroller then sequentially sets the pin for each column LOW and then checks to see if any of the row pins are LOW. Because pull-up resistors are used, the rows will be high unless a button is pressed.
4. If a row pin is LOW, it indicates that the button for that row and column is pressed.

5. The microcontroller then waits for the switch to be released. It then searches the keymap array for the character that corresponds to that button.

2.0 What Are Fingerprint Biometrics?

Fingerprint biometrics is the systematic study and application of unique physical attributes inherent in an individual's fingerprints. Representing a more dependable identification method than traditional passwords or identity cards, fingerprint biometrics eliminates the issues of misplacement, forgetfulness, or theft. The distinctive nature of each person's fingerprint ensures a robust barrier against unauthorized access to secure data.

2.1 Genetics and Environmental Factors: The Roots of Fingerprint Uniqueness:

Fingerprints are nature's signature of a person's identity. Using fingerprints as a biometric identification tool dates back to ancient Babylon and has roots in our evolutionary biology. The friction ridges on our fingertips that comprise these prints have been crucial to human survival, helping us grip and touch objects.

Fingerprints are formed during the embryonic stage and remain unaltered throughout an individual's life. No two individuals, not even identical twins, share the same fingerprint. The basis for this uniqueness can be traced back to the genetic and environmental factors that influence the development of fingerprints.

Aspects of fingerprints that are analyzed include:

- **Patterns:** The general pattern or type of fingerprint (arch, loop, or whorl) is inherited through genetics.
- **Minutiae:** The precise details of the ridges, known as minutiae, are influenced by random and unpredictable factors such as pressure, blood flow, and position in the womb during development.
- **Ridges:** Each ridge in a fingerprint contains several minutiae points, which can be bifurcations (where one ridge splits into two) or ridge endings.

The distribution and layout of minutiae points vary in every individual, contributing to the specific characteristics of each fingerprint. It is these characteristics that biometric systems analyze when comparing and matching fingerprints.

2.2 GT-521F32 FINGER PRINT MODULE:

The GT521F32 Optical Fingerprint Scanner Module with JST SH Connector is a highperformance fingerprint scanner. Which is useful for to access control, security, identification, and convenience. This optical sensor module is designed for easy integration into applications with serial interface (UART). We need two wires are for TX and RX and two wires for power supply (5V). The GT521F32 Fingerprint Scanner Module is an optical scanner module. This optical scanner takes a visual image using a digital camera. The idle module is woken by a finger touching the metal frame of the sensor.The pictures of the fingerprints are processed on-board by the fingerprint algorithm (low power 32- bit ARM Cortex-M3 processor) and convert it into strings of data. These so-called ‘templates’ are residing on the module configured as a USB mass storage device. They can store and share through a database with other modules in a network, allowing easy enrollment of many users.

Fig 2.2 GT-521F32 Finger Print

2.3 Features of GT-521F32 Finger Print:

- Ultra-thin Optical Sensor.
- High-accuracy & high-speed fingerprint identification technology.
- Works well with dry, moist or rough fingerprints.
- 200 fingerprints storage.

- Wake up on Finger Function.
- Easy one-touch enrollment.
- 1: 1 verification, 1: N identification.
- Simple UART & USB communication protocol.
- External UART-to-USB converter required (TX & RX levels: 3.3V).
- Complies with USB 2.0 full-speed (12 Mbps) specifications.
- Reading & writing fingerprint template(s) (i.e. processed data) from/to the device.
- Downloading the raw bitmap image from the device (catalog fingerprints).
- Anti-Scratch with surface high hardness ≧ 5H.

2.4 Specifications of GT-521F32 Finger Print:

- CPU: ARM Cortex M4 Core MCU)
- Sensor: Optical Sensor
- Window (mm): 16.9 x 12.9
- Effective area of the Sensor (mm) : 14 x 12.5
- Image Size: 258 x 202 Pixels
- Matching Mode: 1 : 1 ； 1 : N
- Resolution: 450 dpi
- The size of template: 496 Bytes (template) + 2 Bytes (checksum)
- Communication Interface: UART, default baud rate = 9600bps after power on
- False Acceptance Rate (FAR): < 0.001%
- False Rejection Rate(FRR): < 0.1%
- Enrollment Time: < 3 sec (3 fingerprints)
- Identification Time: < 1.5 sec
- Operating Voltage (V): Power pin: 3.3V~6V, Tx/Rx pins:3.3V
- Operating Current (mA): < 130
- Touch: Operating Voltage: DC 3.3 V

2.5 Working of GT-521F32 Finger Print:

A Fingerprint sensor is an optical sensor. It works by flashing a bright light over your finger and capture a digital picture of your fingerprint. The light-sensitive microchip converts the

digital image into a series of 0's and 1's by checking the ridges(peaks) and valleys(gaps) of the fingerprint. The series of 1's and 0's generated is individual to every person which creates a unique ID for every fingerprint.

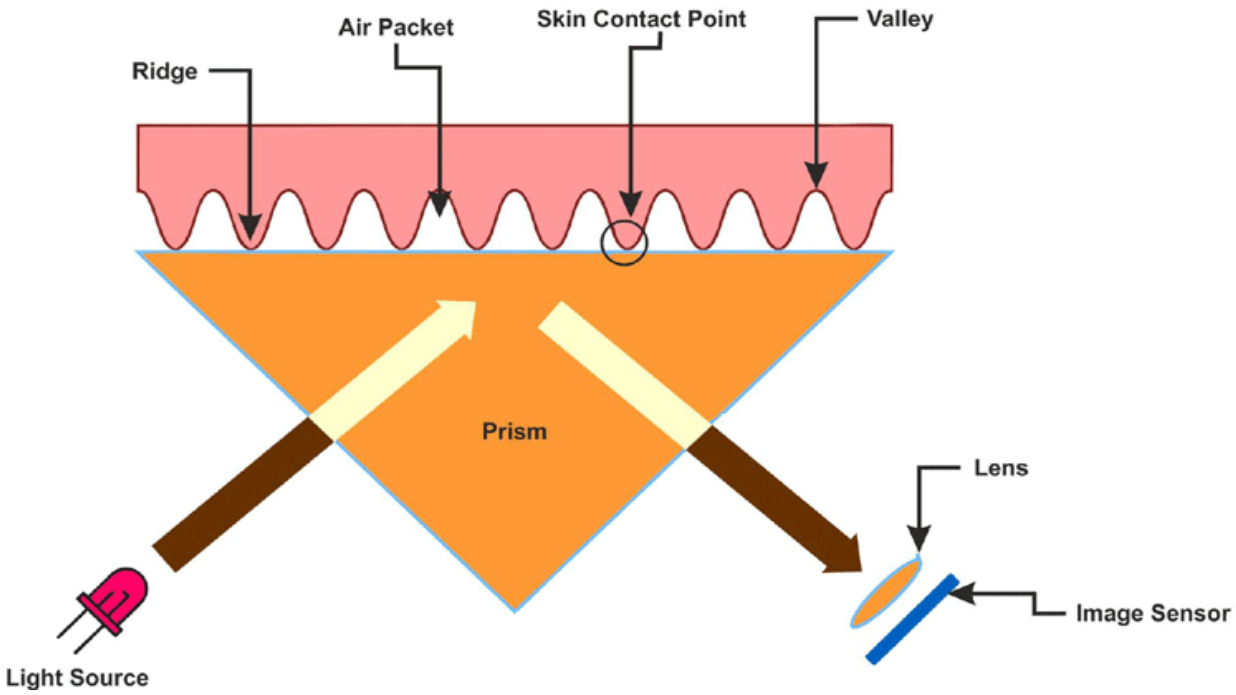

Fig 2.5 Working of GT-521F32 Finger Print

2.6 Applications of GT-521F32 Finger Print:

Here are some of the application where the GT-521F32 sensor can be used:

- Security systems
- School Attendance system
- Home/Office Locks
- Biometrics
- Smartphone unlocking