

## Prepared by



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## Introduction

“Administration Device” is an application running on a development board, based on [AT90USB162 Microcontroller](#).

There could be two different introductions here - one about the “Administration Device” as an application, the other one about the Development Board itself. For simplicity sake, they will go hand in hand, for some time and will bifurcate at some appropriate time.

AT90USB162 Microcontroller (MCU) has been used at the core of this board. The board hosts communication channels and peripherals that will help build applications, including Administration Device, and such as Data Loggers, Automation Controllers etc.

The application named as “Administration Device” is meant to be used in schools (or for that matter organisations where people management is crucial) to log in data, related to the administration activities, such as Attendance processing and storage, Mark-sheet storage and so on.

What follows is a primary document, that a user can go through to understand the usage as well as the design of this device. However, it is not currently a complete design document.

## Scope of this document

Presented here is a primary document. It intends to introduce the device (Hardware, Firmware) at a primary level.

A user willing to use the device, will find minimum required information, in order to operate the device.

For a developer willing to understand the design and architecture a primary level of description has been provided in this document. This is neither a detailed description of design nor a user manual.

Following aspects have *not* been covered in this document. Those will be crucial to be made available in detail, if a person wishes to understand the underlying design of firmware and hardware.

- Detailed designs of each block
- Flowchart of the firmware
- Calculation details w.r.t. the Administration Device Application
- Information on Peripheral implementation

## Block level design

The Administration Device, as an application, has been divided in two boards.

1. Main Board (also called as Development Board)
2. Keypad Board

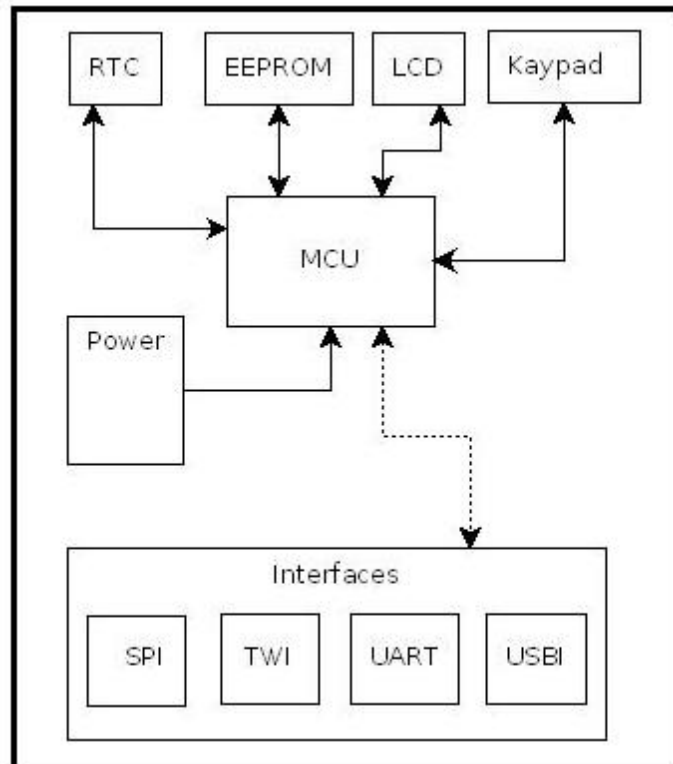


Fig 1 – Main Board Block Diagram

## Peripherals and Interfaces

Fig. 1 above depicts the overall design of Main Board, at a block level. The MCU (At90USB162) interfaces with various peripherals namely -

1. RTC (Real Time Clock)
2. EEPROM (Electrically Erasable Programmable Memory)
3. LCD (Liquid Crystal Display)
4. Keypad

over specific interface protocols.

Following are the protocols that the board is equipped with. Some of them are also used to communicate with peripherals enlisted above.

1. SPI (Serial Peripheral Interface)
2. TWI (Tow Wire Interface, also know as [I2C](#))
3. UART (Universal Asynchronous Receiver Transmitter)
4. USB 2.0 (Universal Serial Bus)

Following Table depicts the MCU and peripheral interface names -

Index	Peripheral	Device	Interface	Notes
1	RTC	DS1307	TWI	100KHz
2	EEPROM	24C512	TWI	100KHz
3	LCD	LCM 1602	Custom	-
4	Keypad	-	UART	9600

Table 1 – MCU-Peripheral Interface

## Keypad Interface

The keypad is a special peripheral here. While RTC, EERPOM and LCD, as peripherals, are mounted on the Main Board, the Keypad is an independent module. Keypad constitutes a separate PCB that can be plugged-in to the Main Board and played.

As already shown in Table 1, Keypad module (as a PCB) connects with the Main Board over UART. Both boards are set at 9600 baud rate and hence, communicate with each other.

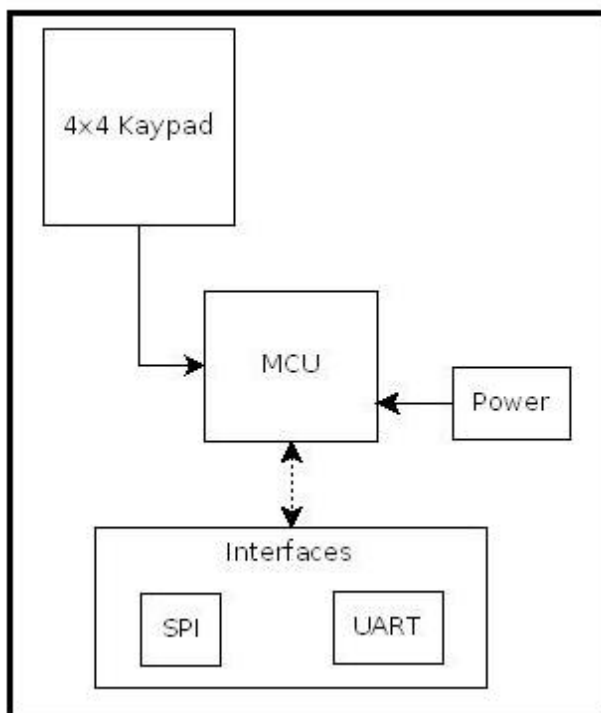


Fig 2 – Keypad Block Diagram

Keypad module is supposed to be a secondary controller and is being handled by Main Board. However, it is the Keypad module that sends user-choices to the Main Board and Main Board decides whether to deal with the received key or not.

ATTiny2313 MCU forms the core of Keypad module. A 4x4 keypad is available to the user to enter her/his choices according to the application.



## Event Tree

What follows is specific to the application - "Administration Device". Following is Event Tree that a user is available with, through this particular application. Once the device is turned ON, following events are shown one by one and user can browse or work through them, as depicted in the table.

Choice No.	Event	Sub event	User Activity	Details
1	Attendance	-	To select Attendance - - press 1 - press 'O' (O as in OK)	- "Class" and corresponding Number Of Students ("Total") will be displayed - One by one, for each Roll Number user will be asked to enter "Y" or "N" - After the last Roll Number is taken care of, system will record the Attendance Status in External Memory and "Recorded" will be displayed - At last "Presence: <->" will be displayed depicting the Present Number of Students - System will go to home Showing Event - 1 again.
2	Backup	-	To select Backup - - press 2 - press 'O' (O as in OK)	- Not implemented yet
3	Settings		To select Settings - - press 3 - press 'O' (O as in OK)	"Settings" has 4 sub-events. Under these, user can see the existing value and also choose to set to a new one or leave it as it is.
	1	Class	To select Class - - press 1 - press 'O' (O as in OK)	- "Class:" will be displayed on the first line - Second line will show existing Class (e.g. 2A) - A blinking cursor will indicate the user to change the class if required - In that case pressing 'O' will change this setting in internal EEPROM. A tick will be shown. - Pressing 'N' will leave the previous setting intact, whether user types a new class or not. A cross will be shown.
	2	Total	To select Total - - press 2 - press 'O' (O as in OK)	- "Total:" will be displayed on the first line - Second line will show existing Number of students (50) - A blinking cursor will indicate the user to change the class if required - In that case pressing 'O' will change this setting in internal EEPROM. A tick will be shown. - Pressing 'N' will leave the previous setting intact, whether user types a number or not. A cross will be shown.
	3	Date	To select Date - - press 3 - press 'O' (O as in OK)	- "Date:" will be displayed on the first line - Second line will show "- Demo -" This is only a sample sub-event and does not work for now.
	4	Time	To select Time - - press 4 - press 'O' (O as in OK)	- "Time:" will be displayed on the first line - Second line will show current time in hh:mm:ss format. - A blinking cursor will indicate the user to change the class if required - In that case pressing 'O' will change this setting in RTC. A tick will be shown. - Pressing 'N' will leave the previous setting intact, whether user types a number or not. A cross will be shown.
4	Exit		To select Exit - - press 1 - press 'O' (O as in OK)	- System will end current run and reset to the first screen of main events

Table 2 – User – Event Tree

In the same reference, let us look at how the mechanical 4x4 keypad looks like

Keypad				
	C1	C2	C3	C4
R1	1	2	3	Y
R2	4	5	6	N
R3	7	8	9	*
R4	<	0	>	O

Table 3 – 4x4 keypad arrangement

Legends are as follows -

<b>Legends (Key Map)</b>			
Col-Row	Key	Meaning	Notes
C1-R1	1	Number – 1	
C1-R2	2	Number – 2	
C1-R3	3	Number – 3	
C1-R4	Y	YES	Used in Attendance Process to confirm presence.
C2-R1	4	Number – 4	
C2-R2	5	Number – 5	
C2-R3	6	Number – 6	
C2-R4	N	NO	- Used in Attendance Process to confirm absence - Used to exit an event without changing any settings
C3-R1	7	Number – 7	
C3-R2	8	Number – 8	
C3-R3	9	Number – 9	
C3-R4	*	*	- Not implemented yet - Will turn on alternative keypad
C4-R1	<	Left	- Used to move to left, one step each press
C4-R2	0	Number – 0	
C4-R3	>	Right	- Used to move to right, one step each press
C4-R4	O	OK	- Used to confirm an entry and save

Table 4 – Key Map (Legends)

## Enclosure

[Inkscape](#) has been used to design the Enclosure for the proposed device.

For the first time at Vigyan Ashram, a press-fit (also known as [Interference fit and friction fit](#)) design has been tried upon and made *almost* successfully – meaning – walls do fit in with each other and no glue is desired to be used, however, some improvements can still be done in order to precisely match the fit-points.

Following is a cropped version of actual design.

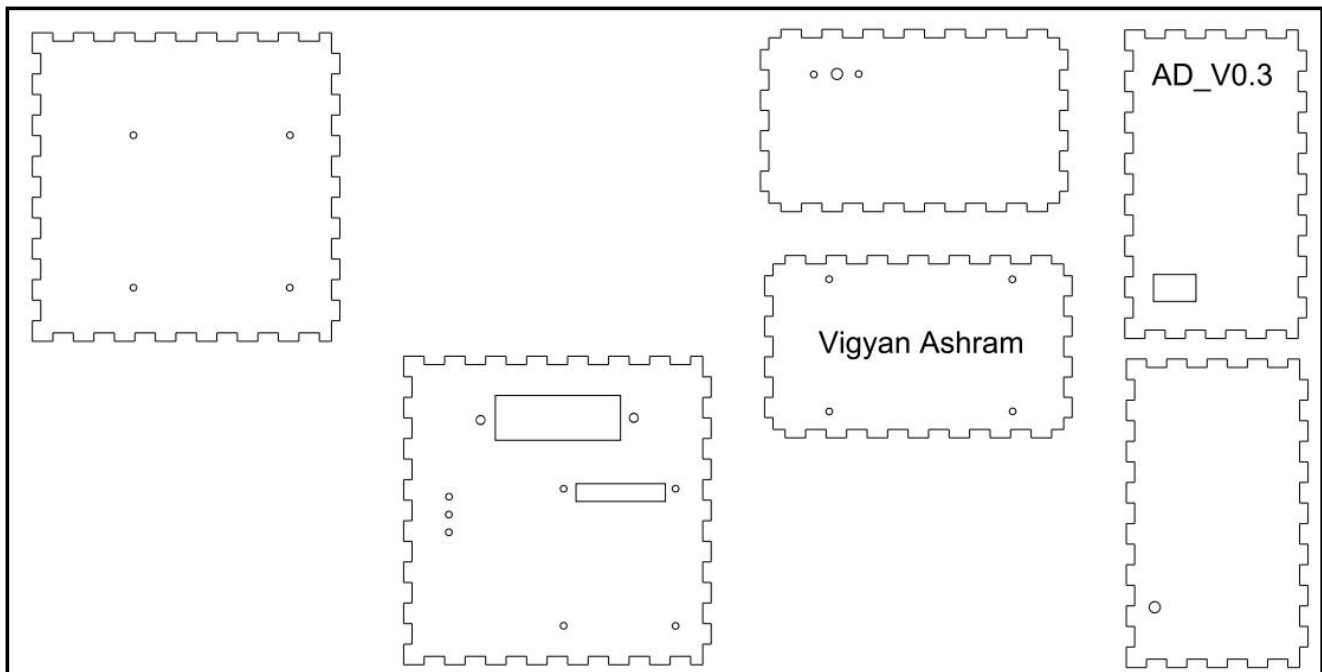


Fig. 3 – Press – Fit Enclosure Design

## Notes on Enclosure

1. The design proposed here involves both cutting and engraving.
2. Various sizes of the blocks cut are function of the devices to be fit-in there.
3. One of the walls (engraved with 'Vigyan Ashram') hosts the keypad board

## A few images of the enclosure



Fig. 4 – Top View

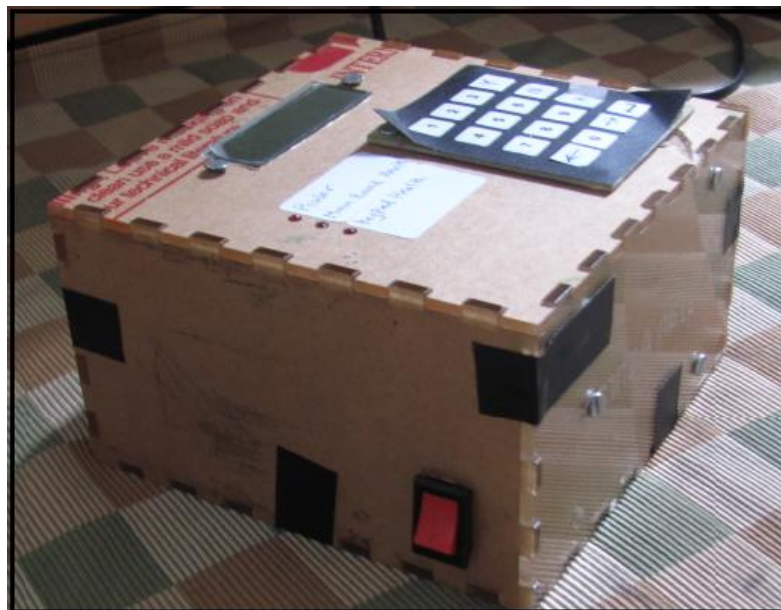


Fig. 5 – View 2

## Closing notes

As stated earlier application “Administration Device” I simply one of the possibilities and needs to be looked upon like an example of what can be done with this Development Board. Following is to explore possibilities with this board -

### 1. Probable Applications

- The PCB is a development kit, developed at Vigyan Ashram. The same has been used in Administration Device.
- Specific Examples
  - Learning kit for Students exploring electronics
  - Data Loggers
  - Sensory Systems
  - Motor or other mechanical automations, including robotics

2. Future projects that rely upon MCU, Algorithms and overall automation (e.g. automated movements, motor based applications, applications such as LWDSS, hearing aid etc) this kit provides a base to start with.

3. With this PCB available at Vigyan Ashram, a new project that depends upon MCU, need not be started with PCB Designing. A developer can start developing desired software implementation, saving lot of time.

4. Ofcourse, some specifics w.r.t. projects will change and this kit may or may not be sufficient. Then we will modify as per needs.

## Source Files

Links for Admin Enclosure :-

<http://www.scribd.com/doc/161107256/VA-AD-Enclosure-V0-3>

Link for board file and block Dig.

:- <http://www.scribd.com/doc/161115060/Admin-Board-and-Block-Dig>