# Introduction:

If two clocks have same phase and frequency may or may not be same then they are called synchronized clocks. Synchronization doesn't depend on frequency (only speed depends on frequency), it only depends on the phase.For maintaining the same phase. The source of two clock has to be same, otherwise it may be asynchronous. We have two approach for maintaining the same source.

1. We can connect two or more clocks in a ring structure. Each will pass their current phase to their neighbor clock. Clocks will set themselves according to the received signal and become synchronized.

2. We can create a master clock; other slave clocks will get the time and phase from the master through signal. All the slaves and master clock will be connected through a network. Signals will be passed through that network.

3. We will host a server and fetch time from that. All clocks will be connected to that server and take the time from that individually. None of the clocks are connected to each other. They are just connected to the server and fetching time from that.

For the **first solution**, when we try to connect two devices with signal, there comes the issue of noise. Another point is that, passing one signal to another takes time. So, the synchronization required will not be achieved.
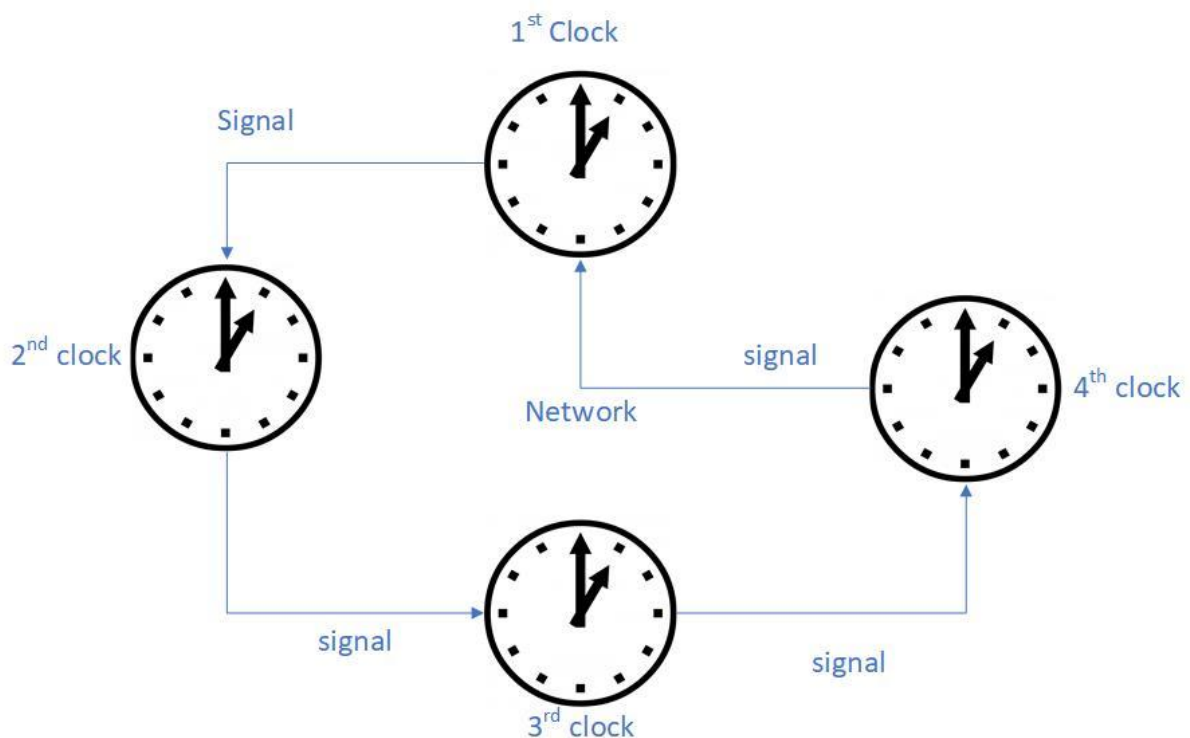
For the **second solution**, there comes the point of distance. If the slave clocks are distant from the master clock, signal passed from the master will become weaker and weaker. We need an amplifier or other additional devices for this. Which is not cost effective and not even realistic.

Master clock

Signal

signal

signal

Slave clock

Slave clock

Slave clock
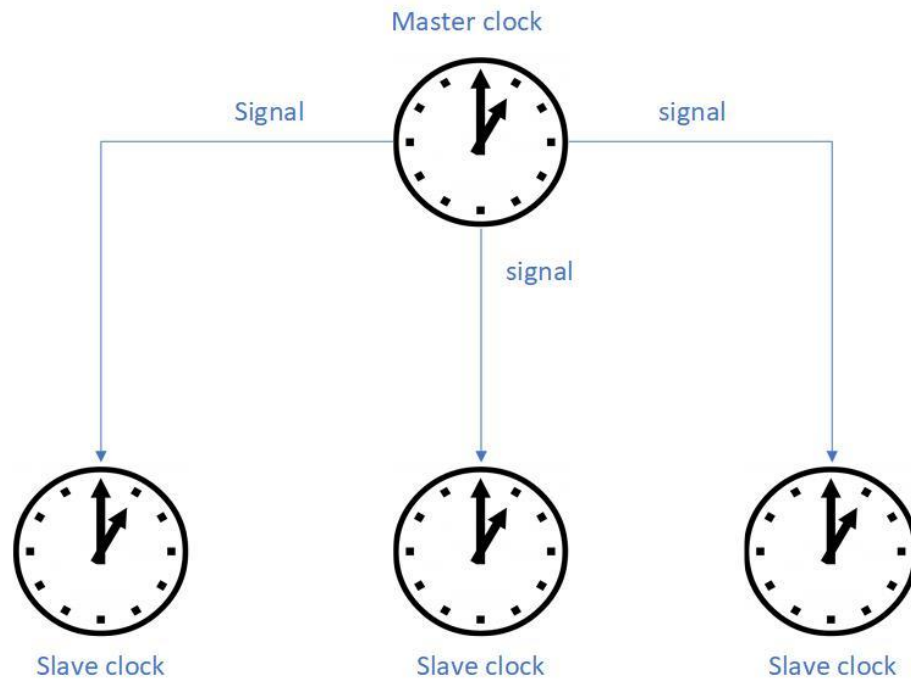
The last solution removes the problem of distance, noise and time. Here the server works as the master clock but connected with the server clock through wireless network. The solution will be described in detail in the next sections.

SERVER

MICROPROCESSOR

MICROPROCESSOR

MICROPROCESSOR

1st clock

2nd clock

3rd clock
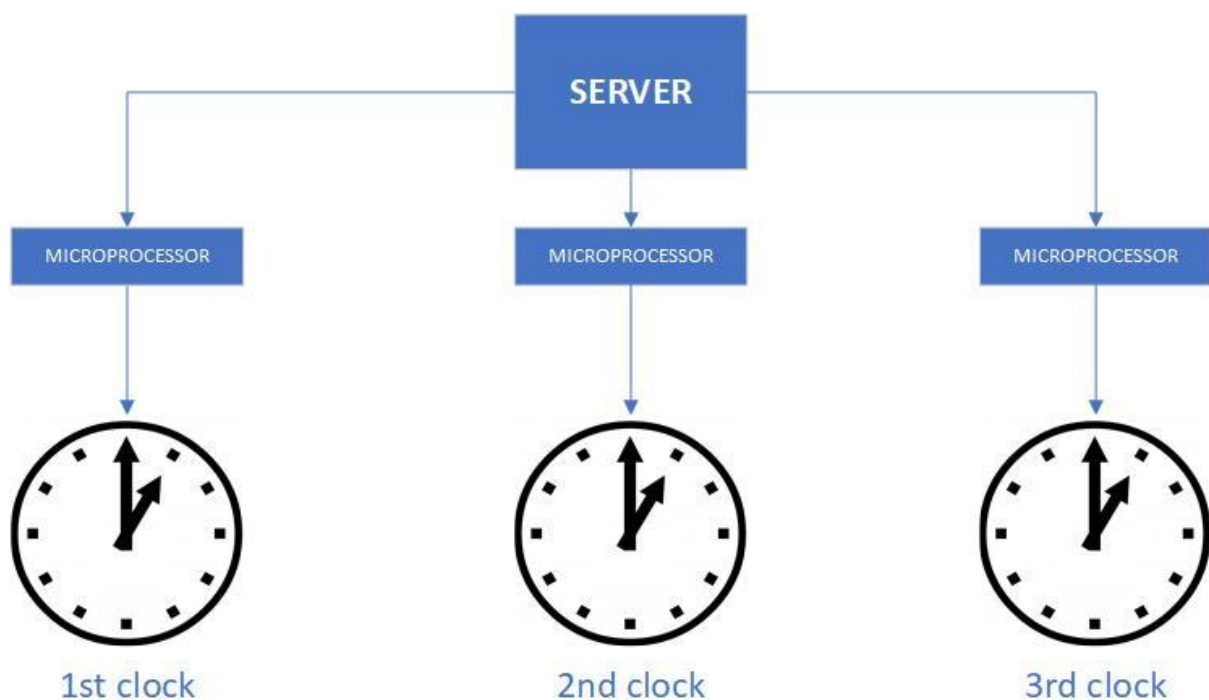
Aim of Our Project:

Synchronization of two or more clocks is a very common concept but yet not generally used. So, we are trying to find a feasible solution for synchronizing all the clocks of an institution for example it may be an office or a school college or university, where maintaining time among the participants of that institution is crucial. Our main objectives are:

1.   Creating a synchronized clock system for an institution where each and every clock will be maintaining the same time

2.   Implementing a clock system where distance between the clocks will not matter to implement synchronization among them.

3.   Using a very common and cost-effective network base- WiFi for synchronization

4.   Synchronizing the time of the clock with the real time of the world.

5.   Running an automated time setting system where there will be no need to set the time manually. Whenever the device is on, It will be set automatically in local time according to the world clock.
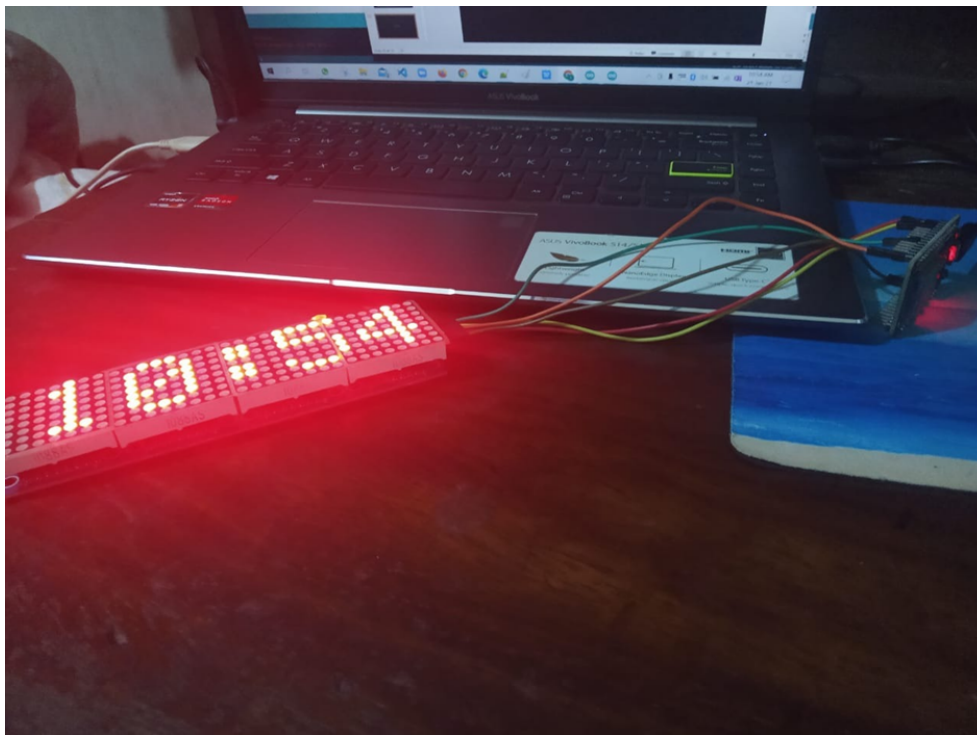
Hardware Implementation:

Component List:

1) ESP32 Module
2) 4*8*8 Dot Matrix
3) Jumper Wire Female to Female
4) 5V Battery

Connection Diagram:

CLK
CS
DIN
GND
VCC

4 x 8 x 8 Dot Matrix

GPIO18   GPIO15

GPIO23

GND

3.3V
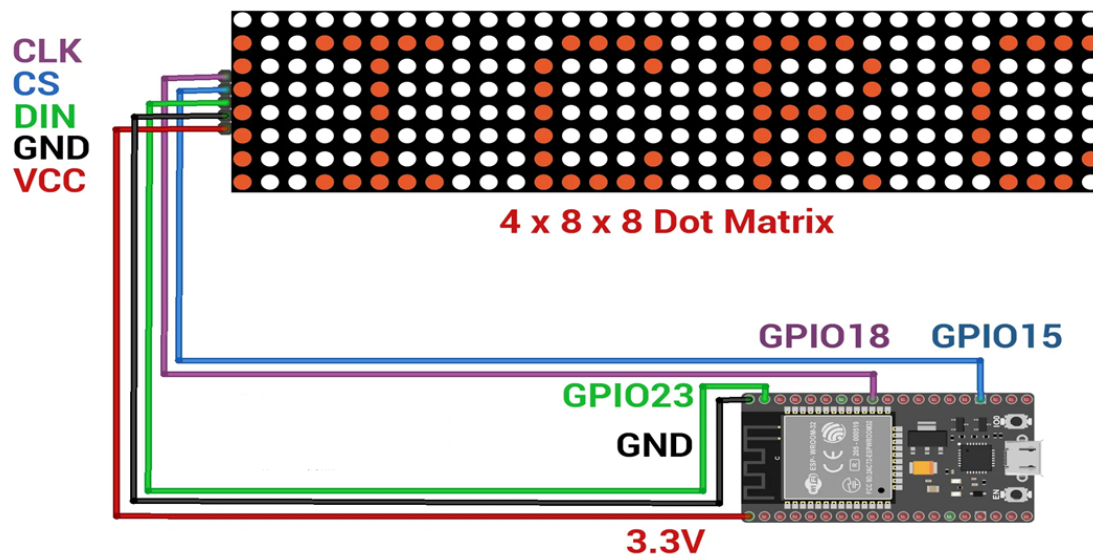
Co-ordination of Components:

We give connection Dot matrix with ESP32 module according to the connection diagram.ESP32 fetch the time from website using wifi internet and display the time in Dot Matrix.

Result and Analysis:

As we wanted to create clocks that will have the same time anywhere in Bangladesh. So no matter how many clocks we have all will show the exact time everywhere. The server time will be same all over Bangladesh so our clock will show same time and the exact correct time anywhere in Bangladesh.

Limitation and Future Scope:

There are few limitations that can be implemented in future:

1.   The screen can be bigger or smaller depending on the user preference

2.   Here only the hour and minute are shown, if anyone wants, second can be shown as well because the server also sends the second with the time

3.   Many other features can be added in our clock. Alarm system can be added.

4.   Some other features can be added as well. The clock can be used for punctuality such as bell system to remind people the start and end time of any event according to institutions need.

5.   Clock can be used as picture slide for decoration purpose which will show time as well.

6.   Can be used as reminder. Also can show the global time.

7.   Location and weather update can be added.

8.   We can use this clock anywhere in this world by changing the time zone of that particular location.

Working Procedure:

Connecting clocks by ring structure or by synchronizing clocks in a master slave structure introduce problems like noise effect and weak signal passing.

So the best solution is to host a server and fetch the server time in all the clocks.

The first step of our working procedure was to host the website in a public server so that we can fetch the server time through the website in our ESP32 module. we used   00webhost server (https://www.000webhost.com/) to host our website as it is totally free of cost.

The second step was to write the time showing code in website. We used php code to fetch the the current time using date() function and we used timezone as Asia , Dhaka using date_default_timezone_set() function.Then we publish the website in the server.

Third step was to fetch the server time in our ESP32 module.For this we used arduino BasicHttpClient code.In arduino we firstly make connection our esp32 with wifi using wifiMulti.addAP("WIFI name","Wifi Password") .Then we make connection to our website and ESP32 using http.begin("Our Website's URL").Our websites URL is https://ifath.000webhostapp.com/index.php . Then we fetched the website time using http.getString() function .We used a substring function because when we fetched the whole website string it returns html code too but as we need only the time so we took only the time showing part using substring.

In the final step we show the fetched time which come in ESP32 as a string in the Dot Matrix.As our display is small for showing the whole Day Month Year and Time at a time so we make the Day Month and Year scrolling after some time (50 msec) and the time is fixed.

Conclusion:

 All clocks are connected to the hosted server and each clock take the time from that individually. As none of the clocks have to be connected to each other directly , this is a very useful and convenient method to synchronize all the clocks.By this solution the clocks can't differ in time with each other .So,thus all the clocks are synchronized regardless of their internel distance.