IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 3, May 2022
Impact Factor: 6.252

Smart Watch using ESP-32 WROOM

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Abstract: *A smart watch is a wearable computing device that closely resembles a wristwatch or other time-keeping device. Smart watch has slowly become the mainstream gadgets. In day-to-day life smart watches is one of the imminent launches on people's mind. In addition to telling time, many smart watches are Bluetooth-wi-fi capable. The watch shows time, day and date by accessing Internet API. The smart watch has a sensor which enables user to check his/ her heart rate and SPo2 in real time. Increasing demand for wireless sports and fitness devices is driving the market. Currently, the use of smart watches among cyclers, runners, gym-goers, swimmers, and athletes is increasing rapidly, owing to their wide range of monitoring capabilities.*

Keywords: ESP 32Wroom, Smart watch, Heart-rate, SPo2, Wi-fi.

I. Introduction

The goal of this project is to create a smartwatch that is easy to reprogram. Serial communication and charging are handled on-board through a single micro-usb connector without any external clock. The watch is built around the ESP-32 WROOM module and is programmable using the espress-if or Arduino IDE. Using the ESP32 allows for the user to develop their software while leveraging the open-source libraries and examples that are available online for quick development. This project involves hardware and software with a little bit of 3D printing thrown in. By using MAX30100 sensor we are able to check our heart rate and SPo2 in real-time. It fetches the time and date from NTP client. As this smartwatch comes with ESP-32 Wi-Fi and Bluetooth it can be developed in future for various other advanced features.

II. Scope Of Project

Increase in health awareness among the consumer is driving the market. Consumers across the world are spending a lot on health monitoring gadgets. Using smartwatch, a user can take the required precautions in advance by consulting doctors. According to the survey from Rock Health on digital health adoption, in 2018, wearable adoption increased rapidly from 24% in 2017 to 33% in 2018. More consumers are leveraging such devices to address critical health needs rather than just fitness tracking.

Moreover, the ongoing technological advancements by market players are also stimulating the growth of smartwatches, as they are technical products that require constant R&D for different features. This product is ideal for all health and activity enthusiasts. One of the major reasons for consumers not opting for smartwatches is the lack of awareness about its utility. The technology used in smartwatches and the complexity of the devices are major key restraints for the market..

III. Working

Our Smartwatch has mainly five sections Battery and power management system, ESP32 section, OLED Display section, MAX 30100 Sensor, Pull down and button section.

So in the battery and power management system gives regulated power output to the IC and prevents it from overcharging and over-discharging.

Then, in the ESP32 section it contains the esp32 MCU module which contains the Wi-Fi module which is responsible for Different IOT applications.

The MAX30100 sensor has two LEDs, one emitting red light, another emitting infrared light. For pulse rate, only infrared light is needed. Both red light and infrared light are used to measure oxygen levels in the blood.

When the heart pumps blood, there is an increase in oxygenated blood as a result of having more blood. As the heart relaxes, the volume of oxygenated blood also decreases. By knowing the time between the increase and decrease of oxygenated blood, the pulse rate is determined.

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It turns out, oxygenated blood absorbs more infrared light and passes more red light while deoxygenated blood absorbs red light and passes more infrared light. This is the main function of the MAX30100: it reads the absorption levels for both light sources and stores them in a buffer that can be read via I2C communication protocol.

This completes the working of pulse & oximeter, now we go for the Internet clock working:

Before go for the working let us understand what is Network Time Protocol (NTP) , is a networking protocol used for synchronization of time between systems and Data networks. The NTP framework depends on Internet Time servers. NTP has algorithms to precisely adjust the time of day. NTP servers have software which send the clock's time of day to client computers using UDP port 123. So here in this project, we are getting time from NTP server using ESP32 and showing it on OLED display.

First of all, we need to connect our board to Wi-Fi to access the Internet. So, we have used Wi-Fi Manager library to set our ESP as an Access Point (AP) then we connect our mobile to this AP and configure it's Wi- Fi settings and connect it to our desired Network.

Here NTPClient.h library is used to connect with the time server. It takes time from a NTP server and keep it in sync. And Here WiFiUdp.h library is used to send and receive UDP messages. UDP is a protocol which sends and receive short messages from our system to NTP server.

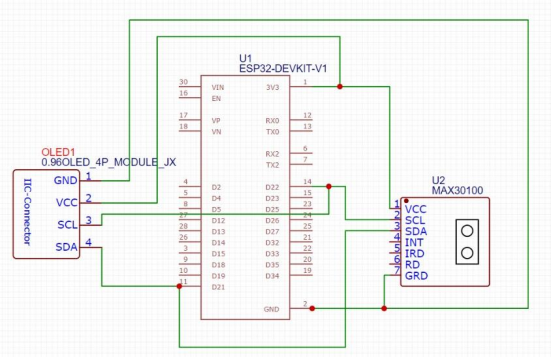
So to get the time from Internet, we have to define three variables in our program for NTP.

NTP_OFFSET which is the time zone of your country i.e. for India it is +5:30 hour. So it is 19800 in seconds.

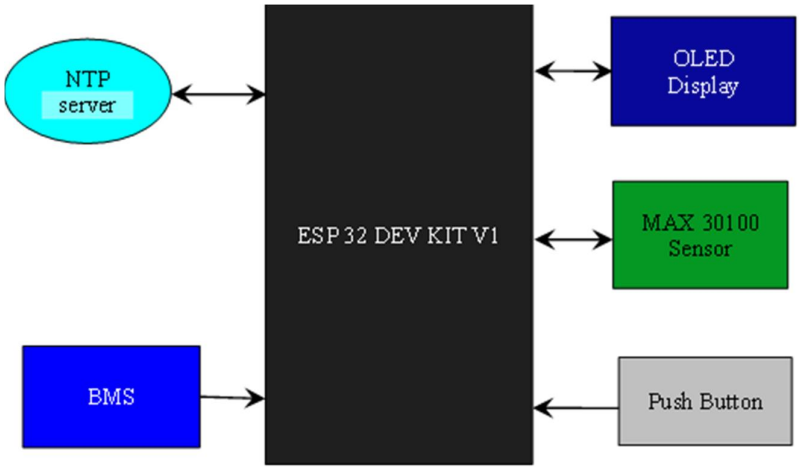
NTP_INTERVAL which is time interval taken by NTP to update time. It is 60-64 seconds.

NTP_ADDRESS is the NTP server of our country. For India you can use "in.pool.ntp.org".

IV. SCHEMATIC DIAGRAM



V. BLOCK DIAGRAM



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The above figure is a simple block diagram that explains the Smartwatch using ESP 32. MAX 30100 Sensor measure BPM & SPO2. The ESP 32 DEV KIT processes the code and displays it to 128 x 64 OLED Display. ESP32 connects to Wi-Fi and fetches the data for clock. Battery Management System (BMS) it supplies power to the ESP and MAX30100. Push button is for switching between clock and bpm monitoring.

VI. ALGORITHM

1. Switch on the Power.
2. Set the ESP as Wi-Fi Station.
3. Configure it and connect to desired Network.
4. Check if the button state is HIGH.
5. If its high then initialize pulse oximeter and fetch readings from the buffer and display it on OLED.
6. Else initialize NTP client and fetch data from its server and display day,time and Date.
7. Do this repeatedly.

VII. RESULT

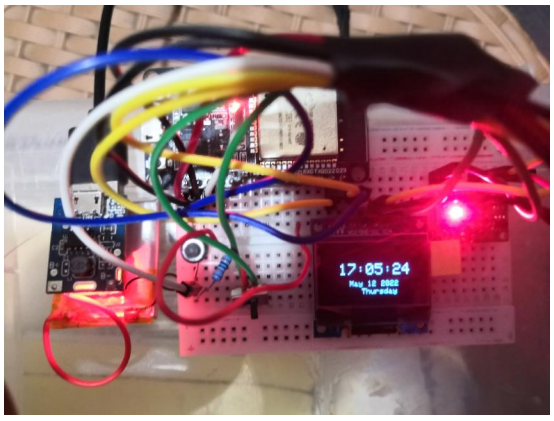

Fig 3.1: When button is not pressed

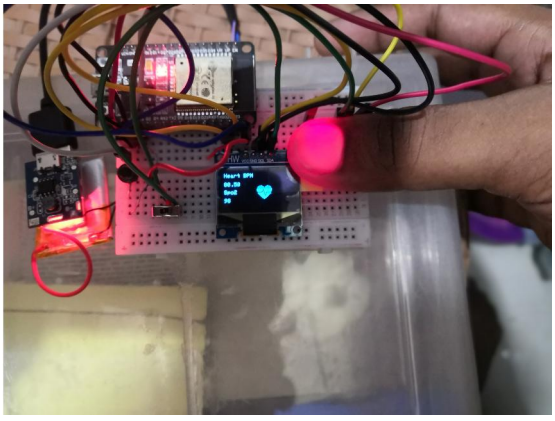

Fig 3.2: When button is pressed and holded

Normally it shows time and when we press and hold the button it switches to heart rate monitoring. The smartwatch collects data of heart rate and Spo2 through MAX30100 sensor and displays it on OLED

VIII. CONCLUSION

All the above chapter gives the complete idea of motivation, implementation and application of this project. This chapter gives the overall summery of the project. This project elaborates the design and development of the Smart Watch Using ESP 32 WROOM with MAX30100 Sensor.

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