IOT – BASED MILITARY HEALTH SERVICE IN BATTLE FIELD AND GPS TRACKING

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ABSTRACT

An Internet of Things-based system for tracking a soldier's position and health during combat operations is one technological advancement that makes it possible to monitor a soldier's whereabouts and health in real time. The system goals are to protect soldiers and improve their effectiveness in combat. The system utilizes various sensors and devices such as heart rate monitors, temperature sensors, GPS, and accelerometers to gather data on the soldier's vital signs and movements. This data is then transmitted wirelessly to a central monitoring system, which analyzes it and provides real-time feedback to the commanding officers. By monitoring soldier's vital signs, the system can quickly identify any health issues that may arise, such as fatigue or dehydration, and alert the appropriate medical personnel. The system also tracks soldier's positions and movements, allowing commanders to make informed decisions about deployment and resource allocation. All things considered, a position

tracking and health monitoring system for soldiers based on the Internet of Things is a useful instrument for ensuring their safety and wellbeing in combat.

CHAPTER 1

INTRODCTION

In the modern era of warfare and military operations, ensuring the safety, well-being, and effectiveness of soldiers is paramount. To address this need, the integration of cutting-edge technology has led to the development of Soldier Tracking and Health Monitoring Systems. These systems represent a significant leap forward in enhancing the capabilities of military units by providing real-time insights into the location, physiological condition, and environmental factors affecting each soldier. This project aims to delve into the intricacies of these advanced systems, their components, functionalities, and the invaluable benefits they bring to military operations.

The primary objective of this project is to explore the various components and functionalities of Soldier Tracking and Health Monitoring Systems. By examining the role of each technology, from biometric sensors that monitor heart rate and body temperature to GPS tracking that provides precise location data, we aim to highlight the holistic approach these systems take toward soldier safety. Additionally, we will delve into the data analysis and visualization techniques that enable medical personnel and commanders to interpret the collected data effectively. The implementation of Soldier Tracking and Health Monitoring Systems holds immense promise for revolutionizing military operations. This project will shed light on the advantages these systems offer, including improved situational awareness, rapid response to medical emergencies, enhanced strategic decision-making, and reduced risks to soldiers' lives. Moreover, the project will touch on the ethical considerations associated

with data collection and privacy in military contexts, as the deployment of such technology necessitates careful balancing of security and individual rights.

In modern military operations, ensuring the well-being and safety of soldiers in the field is of paramount importance] Soldiers are frequently exposed to physically demanding environments, potentially hostile situations, and remote locations, making real-time health monitoring and tracking a critical requirement. The challenge is to develop an integrated system leveraging Internet of Things (IoT) technologies that can continuously monitor the health status of soldiers, track their locations, and relay this vital information to commanders and medical personnel, thereby enhancing situational awareness and the ability to respond promptly to emergencies. The heart of the Soldier Health and Position Tracking System is a sophisticated network of interconnected devices, sensors, and communication systems, all powered by IoT technology. Wearable devices equipped with sensors constantly collect data on soldiers' vital signs, including heart rate, body temperature, blood pressure, and even stress levels. These devices are designed to withstand harsh environmental conditions, ensuring that data remains reliable even in extreme circumstances. Additionally, GPS technology provides real-time geographic positioning data, allowing commanders to monitor the precise location of each soldier.

CHAPTER 2

LITERAURE REVIEW

1. SOLDIER HEALTH MONITORING AND TRACKING SYSTEM USING IOT

Nowadays, the security system of the nation depending upon the enemy’s war and so the security of the soldiers is considered as an important role in it. Concerning the safety of the soldiers, there are numerous tools to

observe the health condition of the soldiers. The proposed system uses GPS to track the direction of the soldier in the form of latitude and longitude values. So that direction can be found easily. The proposed system can be mounted on the soldier's body to track their health status and current location using GPS. This information will be transmitted to the control room through IoT. The proposed system comprises of tiny wearable physiological equipment's, sensors, transmission modules. Hence, with the use of the proposed equipment, it is possible to implement a low cost mechanism to protect the valuable human life on the battlefield. Designing of this system using GPS and GSM gives a wireless system for tracking the location of the soldier and observing the heart beat rate and body temperature of the soldier.

2. SOLDIER TRACKING AND HEALTH MONITORING SYSTEMS

In today's era enemy warfare is an important factor in any nation's security. The national security mainly depends on army (ground), navy (sea), air-force (air). The important and vital role is played by the soldiers. There are many concerns regarding the safety of these soldiers. The defense department of country must be effective for the security of that country. This system will be useful for soldiers, who involve in missions or in special operations. This system enables GPS (Global positioning systems) tracking of these soldiers. It is possible by M-Health. The M-health can be defined as mobile computing, medical sensors and communication technologies for health care. In this system, smart sensors are attached to the body of soldiers. This is implemented with a personal server for complete mobility. This personal server will

provide the connectivity to the server at the base station using a wireless connection. Each soldier also has a GSM (Global system for Mobile communication) module which enables the communication with the base station in case of injuries. As soon as any other soldier enters the enemy lines it is very difficult for the army base station to know about the location as well as the health status of all soldiers. In our project we have come up with an idea of tracking soldier as well as to give status of the soldier during the war

3. SOLDIER HEALTH AND POSITION TRACKING SYSTEM

Soldier's tracking is done using GPS and GSM is used to provide wireless communication system. For monitoring the health parameters of soldier we are using bio medical sensors such as temperature sensor and heart beat sensor. An oxygen level sensor is used to monitor atmospheric oxygen so if there are any climatic changes the soldiers will be equipped accordingly. This system uses GPS module and wireless body area sensor network to record all parameters in real time and send it to the base station. The different types of sensors used in this system are the humidity sensor, temperature sensor and pulse sensor which help in deciding the health status of that particular army official. This is a wearable technology which is the most important factor of this project

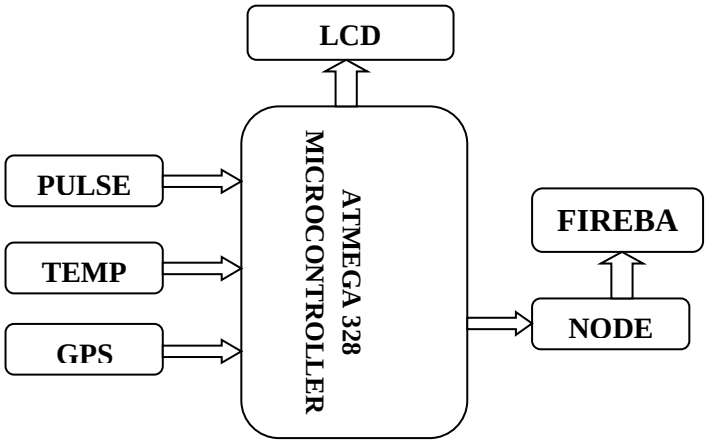
4. GPS BASED SOLDIER TRACKING AND HEALTH INDICATION SYSTEM

In this paper we focus on tracking the location of soldier from GPS, which is useful for control room station to know the exact location of soldier and accordingly they will guide them. Also Highspeed, shortrange, soldier-to-soldier wireless communications to relay information on situational awareness, GPS navigation, Bio-medical

sensors, Wireless communication. The paper reports an Internet of Thing (IoT) based health monitoring and tracking system for soldiers. The proposed system can be mounted on the soldier's body to track their health status and current location using GPS. This information will be transmitted to the control room through IoT. The proposed system comprises of tiny wearable physiological equipment's, sensors, transmission modules. Hence, with the use of the proposed equipment, it is possible to implement a low cost mechanism to protect the valuable human life on the battlefield.

CHAPTER 3

BLOCK DIAGRAM



CHAPTER 4

.EXISTING SYSTEM

There are many shortcomings are present in these existing systems. Some of these existing systems use GSM technology to transmit data wirelessly. The use of GSM technology is restricted in battlefield. Since, GSM protocol stack can be hacked easily by any professional hacker. So, it becomes very easy for enemies to take out the information which will be communicating through GSM module. Therefore, for nation's security purpose, we have to keep our army control room's communications and information confidential, private and safe from enemies and hackers. And to achieve this, Network Jammers (CDMA, GSM AND GPRS Jammers) are used in the battlefields. When military war held in hilly area, or in mountain region or in desserts, then usually GSM technology have no network access and it became useless for data transmission, which is a very serious drawback of GSM technology.

CHAPTER 5

PROPOSED SYSTEM

Soldiers may be tracked in real time due to military health monitoring and position tracking devices. This suggested device also tracks the soldier's condition, including heartbeat movements. In this system, we also monitor the soldier's pulse sensor, oxygen level, and normal body temperature. The plan is divided into two sections: Soldier Unit and Control Unit. The sensor network used to monitor health and the environment was lowered by the military unit. To transport data, we used a Wi-Fi module. Our technology is extremely useful in determining soldiers' health status and delivering health treatment to them. The data is received by the Trans receiver, which stores and checks it on the cloud platform, while the control room gets data on the soldier's location. The

hardware specifications include Arduino UNO, Temperature Sensor LM35, Pulse Sensor, GPS Module Neo-6M, and WIFI-module ESP8266.

CHAPTER 6

COMPONENT USED

ARDUINO UNO

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 onWiring), 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.

Arduino was born at the Ivrea Interaction Design Institute as an easy tool for fast prototyping, aimed at students without a background in electronics and programming. As soon as it reached a wider community, the Arduino board started changing to adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for IoT applications, wearable, 3D printing, and embedded environments. All Arduino boards are completely open-source, empowering users to build them independently and eventually adapt

them to their particular needs. The software, too, is open-source, and it is growing through the contributions of users worldwide.

Why Arduino?

Thanks to its simple and accessible user experience, Arduino has been used in thousands of different projects and applications. The Arduino software is easy-to-use for beginners, yet flexible enough for advanced users. It runs on Mac, Windows, and Linux. Teachers and students use it to build low cost scientific instruments, to prove chemistry and physics principles, or to get started with programming and robotics. Designers and architects build interactive prototypes, musicians and artists use it for installations and to experiment with new musical instruments. Makers, of course, use it to build many of the projects exhibited at the Maker Faire, for example. Arduino is a key tool to learn new things. Anyone - children, hobbyists, artists, programmers - can start tinkering just following the step by step instructions of a kit, or sharing ideas online with other members of the Arduino community.

There are many other microcontrollers and microcontroller platforms available for physical computing. Parallax Basic Stamp, Netmedia's BX-24, Phidgets, MIT's Handyboard, and many others offer similar functionality. All of these tools take the messy details of microcontroller programming and wrap it up in an easy-to-use package. Arduino also simplifies the process of working with microcontrollers, but it offers some advantage for teachers, students, and interested amateurs over other systems:

- Inexpensive - Arduino boards are relatively inexpensive compared to other microcontroller platforms. The least expensive version of the Arduino module can be assembled by hand, and even the pre-assembled Arduino modules cost less than $50

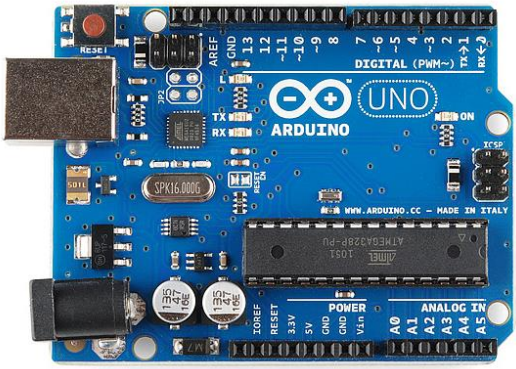
- Cross-platform - The Arduino Software (IDE) runs on Windows, Macintosh OSX, and Linux operating systems. Most microcontroller systems are limited to Windows.
- Simple, clear programming environment - The Arduino Software (IDE) is easy-to-use for beginners, yet flexible enough for advanced users to take advantage of as well. For teachers, it's conveniently based on the Processing programming environment, so students learning to program in that environment will be familiar with how the Arduino IDE works.
- Open source and extensible software - The Arduino software is published as open source tools, available for extension by experienced programmers. The language can be expanded through C++ libraries, and people wanting to understand the technical details can make the leap from Arduino to the AVR C programming language on which it's based. Similarly, you can add AVR-C code directly into your Arduino programs if you want to.
- Open source and extensible hardware - The plans of the Arduino boards are published under a Creative Commons license, so experienced circuit designers can make their own version of the module, extending it and improving it. Even relatively inexperienced users can build the breadboard version of the module in order to understand how it works and save money.

How do I use Arduino?

See the getting started guide. If you are looking for inspiration you can find a great variety of Tutorials on Arduino Project Hub.

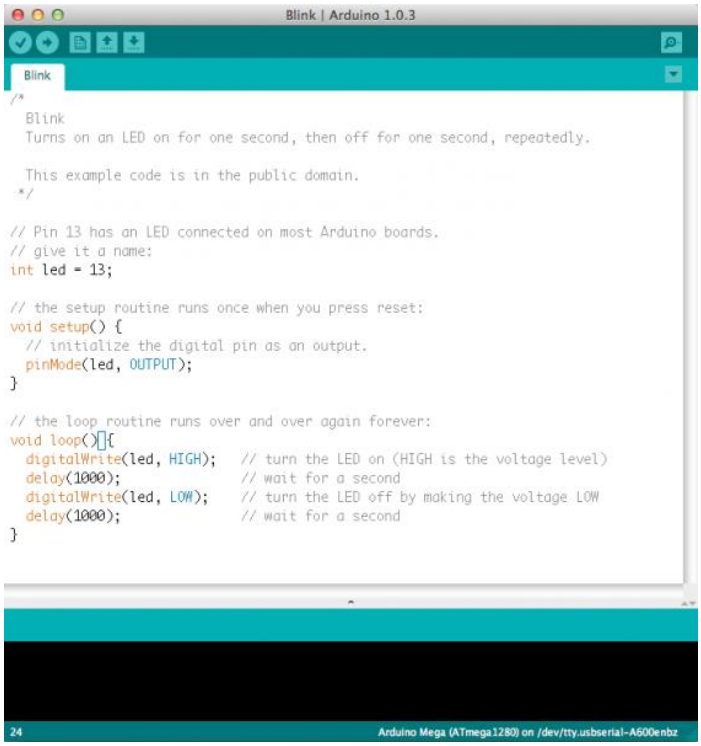
Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

The Arduino platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board – you can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible package.



This is an Arduino Uno

The Uno is one of the more popular boards in the Arduino family and a great choice for beginners. We'll talk about what's on it and what it can do later in the tutorial.



This is a screenshot of the Arduino IDE.

Believe it or not, those 10 lines of code are all you need to blink the on-board LED on your Arduino. The code might not make perfect sense right now, but, after reading this tutorial and the many more Arduino tutorials waiting for you on our site, we'll get you up to speed in no time!

Arduino is a great tool for people of all skill levels. However, you will have a much better time learning along side your Arduino if you understand some basic fundamental electronics beforehand. We recommend that you have at least a decent understanding of these concepts before you dive in to the wonderful world of Arduino.

What Does it Do?

The Arduino hardware and software was designed for artists, designers, hobbyists, hackers, newbies, and anyone interested in creating interactive objects or environments. Arduino can interact with buttons, LEDs, motors, speakers, GPS units, cameras, the internet, and even your smart-phone or your

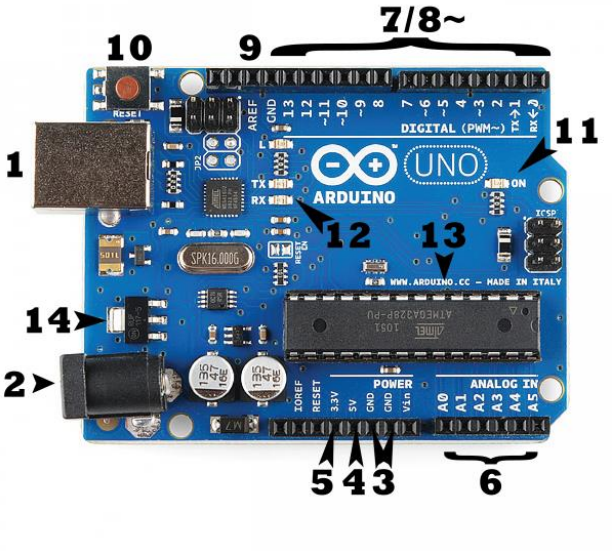
TV! This flexibility combined with the fact that the Arduino software is free, the hardware boards are pretty cheap, and both the software and hardware are easy to learn has led to a large community of users who have contributed code and released instructions for a **huge** variety of Arduino-based projects.

For everything from robots and a heating pad hand warming blanket to honest fortune-telling machines, and even aDungeons and Dragons dice-throwing gauntlet, the Arduino can be used as the brains behind almost any electronics project.

_Wear your nerd cred on your sleev… err, arm. _

What's on the board?

There are many varieties of Arduino boards (explained on the next page) that can be used for different purposes. Some boards look a bit different from the one below, but most Arduinos have the majority of these components in common:



Power (USB / Barrel Jack)

Every Arduino board needs a way to be connected to a power source. The Arduino UNO can be powered from a USB cable coming from your computer or a wall power supply (like this) that is terminated in a barrel jack. In the picture above the USB connection is labeled **(1)** and the barrel jack is labeled **(2)**.

The USB connection is also how you will load code onto your Arduino board. More on how to program with Arduino can be found in our Installing and Programming Arduino tutorial.

NOTE: Do NOT use a power supply greater than 20 Volts as you will overpower (and thereby destroy) your Arduino. The recommended voltage for most Arduino models is between 6 and 12 Volts.

Pins (5V, 3.3V, GND, Analog, Digital, PWM, AREF)

The pins on your Arduino are the places where you connect wires to construct a circuit (probably in conjuction with abreadboard and some wire. They usually have black plastic ‘headers’ that allow you to just plug a wire right into the

board. The Arduino has several different kinds of pins, each of which is labeled on the board and used for different functions.

- **GND (3)**: Short for 'Ground'. There are several GND pins on the Arduino, any of which can be used to ground your circuit.
- **5V (4) & 3.3V (5)**: As you might guess, the 5V pin supplies 5 volts of power, and the 3.3V pin supplies 3.3 volts of power. Most of the simple components used with the Arduino run happily off of 5 or 3.3 volts.
- **Analog (6)**: The area of pins under the 'Analog In' label (A0 through A5 on the UNO) are Analog In pins. These pins can read the signal from an analog sensor (like a temperature sensor) and convert it into a digital value that we can read.
- **Digital (7)**: Across from the analog pins are the digital pins (0 through 13 on the UNO). These pins can be used for both digital input (like telling if a button is pushed) and digital output (like powering an LED).
- **PWM (8)**: You may have noticed the tilde (~) next to some of the digital pins (3, 5, 6, 9, 10, and 11 on the UNO). These pins act as normal digital pins, but can also be used for something called Pulse-Width Modulation (PWM). We have a tutorial on PWM, but for now, think of these pins as being able to simulate analog output (like fading an LED in and out).
- **AREF (9)**: Stands for Analog Reference. Most of the time you can leave this pin alone. It is sometimes used to set an external reference voltage (between 0 and 5 Volts) as the upper limit for the analog input pins.

Reset Button

Just like the original Nintendo, the Arduino has a reset button **(10)**. Pushing it will temporarily connect the reset pin to ground and restart any code that is loaded on the Arduino. This can be very useful if your code doesn't repeat, but

you want to test it multiple times. Unlike the original Nintendo however, blowing on the Arduino doesn't usually fix any problems.

Power LED Indicator

Just beneath and to the right of the word "UNO" on your circuit board, there's a tiny LED next to the word 'ON' **(11)**. This LED should light up whenever you plug your Arduino into a power source. If this light doesn't turn on, there's a good chance something is wrong. Time to re-check your circuit!

TX RX LEDs

TX is short for transmit, RX is short for receive. These markings appear quite a bit in electronics to indicate the pins responsible for serial communication. In our case, there are two places on the Arduino UNO where TX and RX appear – once by digital pins 0 and 1, and a second time next to the TX and RX indicator LEDs **(12)**. These LEDs will give us some nice visual indications whenever our Arduino is receiving or transmitting data (like when we're loading a new program onto the board).

Main IC

The black thing with all the metal legs is an IC, or Integrated Circuit **(13)**. Think of it as the brains of our Arduino. The main IC on the Arduino is slightly different from board type to board type, but is usually from the ATmega line of IC's from the ATMEL company. This can be important, as you may need to know the IC type (along with your board type) before loading up a new program from the Arduino software. This information can usually be found in writing on the top side of the IC. If you want to know more about the difference between various IC's, reading the datasheets is often a good idea.

Voltage Regulator

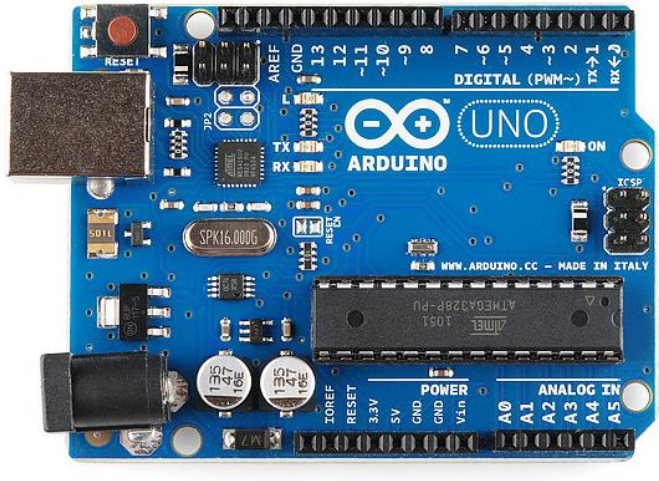
The voltage regulator **(14)** is not actually something you can (or should) interact with on the Arduino. But it is potentially useful to know that it is there and what it's for. The voltage regulator does exactly what it says – it controls the amount of voltage that is let into the Arduino board. Think of it as a kind of gatekeeper; it will turn away an extra voltage that might harm the circuit. Of course, it has its limits, so don't hook up your Arduino to anything greater than 20 volts.

The Arduino Family

Arduino makes several different boards, each with different capabilities. In addition, part of being open source hardware means that others can modify and produce derivatives of Arduino boards that provide even more form factors and functionality. If you're not sure which one is right for your project, check this guide for some helpful hints. Here are a few options that are well-suited to someone new to the world of Arduino:

Arduino Uno (R3)

The Uno is a great choice for your first Arduino. It's got everything you need to get started, and nothing you don't. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a USB connection, a power jack, a reset button and more. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.



Arduino/Genuino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.. You can tinker with your UNO without worring too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

"Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

Technical specs

Microcontroller	ATmega328P
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limit)	6-20V

Digital I/O Pins	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	6
Analog Input Pins	6
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328P) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328P)
EEPROM	1 KB (ATmega328P)
Clock Speed	16 MHz
LED_BUILTIN	13
Length	68.6 mm
Width	53.4 mm
Weight	25 g

Programming

The Arduino/Genuino Uno can be programmed with the (Arduino Software (IDE)). Select "Arduino/Genuino Uno from the Tools > Board menu (according to the microcontroller on your board). For details, see the reference and tutorials.

The ATmega328 on the Arduino/Genuino Uno comes preprogrammed with a bootloader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol (reference, C header files).

You can also bypass the bootloader and program the microcontroller through the ICSP (In-Circuit Serial Programming) header using Arduino ISP or similar; see these instructions for details.

The ATmega16U2 (or 8U2 in the rev1 and rev2 boards) firmware source code is available in the Arduino repository. The ATmega16U2/8U2 is loaded with a DFU bootloader, which can be activated by:

- On Rev1 boards: connecting the solder jumper on the back of the board (near the map of Italy) and then rese ing the 8U2.
- On Rev2 or later boards: there is a resistor that pulling the 8U2/16U2 HWB line to ground, making it easier to put into DFU mode.

You can then use Atmel's FLIP software (Windows) or the DFU programmer (Mac OS X and Linux) to load a new firmware. Or you can use the ISP header with an external programmer (overwriting the DFU bootloader). See this user-contributed tutorial for more information.

Communication

Arduino/Genuino Uno has a number of facilities for communicating with a computer, another Arduino/Genuino board, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The 16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, a .inf file is required. The Arduino Software (IDE) includes a serial monitor which allows simple textual data to be sent to and from the board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial communication on pins 0 and 1).

INTERNET OF THINGS (IOT)

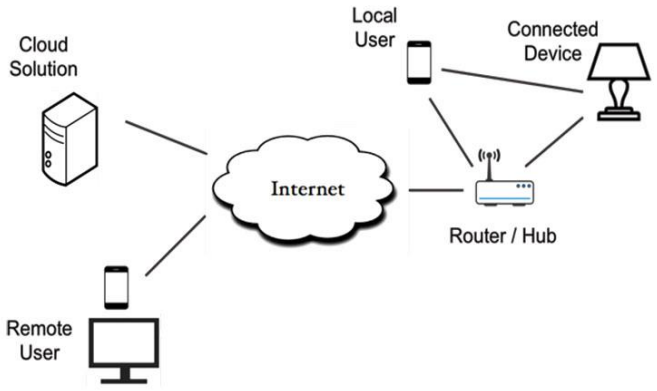
The **internet of things** (**IoT**) is the network of physical devices, vehicles, buildings and other items—embedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data. In 2013 the Global Standards Initiative on Internet of Things (IoT-GSI) defined the IoT as "the infrastructure of the information society." The IoT allows objects to be sensed and controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit. When IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smartgrids, smart homes, intelligent transportation and smart cities. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure.

"Things," in the IoT sense, can refer to a wide variety of devices such as heart monitoring implants, biochip transponders on farm animals, electric clams in coastal waters,[1] automobiles with built-in sensors, DNA analysis devices for environmental/food/pathogen monitoring[17] or field operation devices that assist firefighters in search and rescue operations Legal scholars suggest to look at "Things" as an "inextricable mixture of hardware, software, data and

service" These devices collect useful data with the help of various existing technologies and then autonomously flow the data between other devices Current market examples include smart thermostat systems and washer/dryers that use Wi-Fi for remote monitoring.

As well as the expansion of Internet-connected automation into a plethora of new application areas, IoT is also expected to generate large amounts of data from diverse locations, with the consequent necessity for quick aggregation of the data, and an increase in the need to index, store, and process such data more effectively. IoT is one of the platforms of today's Smart City, and Smart Energy Management Systems.

IoT BLOCK DIAGRAM



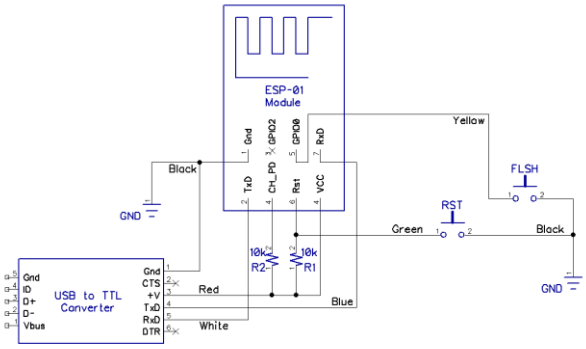
Applications

- Environmental monitoring
- Infrastructure management
- Manufacturing
- Energy management
- Medical and healthcare systems
- Building and home automation
- Transportation

- Large scale deployments

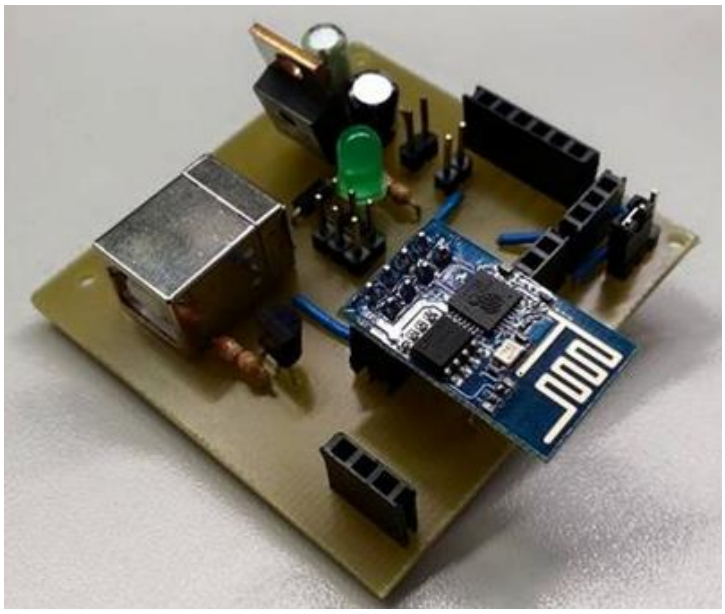
IoT MODULE

IoT INTERFACING CIRCUIT



ESP-01 Connection Diagram

IoT FULL BOARD



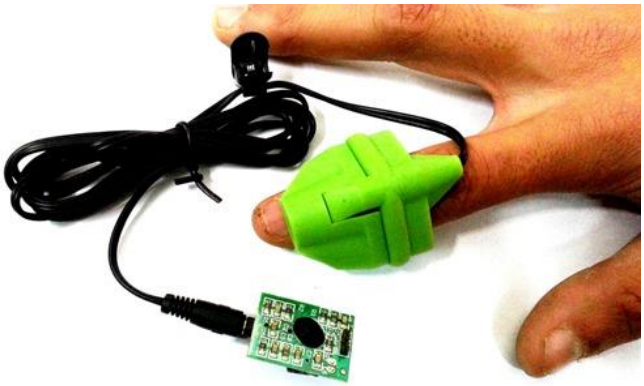
HARDWARE FEATURES

- Based on ESP-12F ESP8266 Wifi Board
- This relay board use one AC input, and supports two relay AC output. Please note the output AC power comes/connected from/with input AC power. Relay only play as on/off switch for AC power. Will be danergerous to use in any other cases.
- **Use mature AC-DC power module, input volatge 85 – 265VAC**
- Relay Specification: Songle Relay, 125VAC 10A, 250VAC 10A, 10A 30VDC, 10A 28VDC
- Plastic enclosure design support, **package includes the PCB board, plastic case, and self-drilled screws (screws are not assembled).** Case general dimension is 111*42 mm.
- Two Lead out buttons BTN1 and BTN2
- Two relay indication LEDs
- One status LED, indicating connecting status in demo code

- A few lead out pins, from top (left) to bottom (right):
- Resevered design for temperature sensor DHT22
- Screw terminal which are easy for wiring output.

HEART BEAT SENSOR:

A **heart rate monitor** is a personal monitoring device that allows one to measure his or her heart rate in real time or record the heart rate for later study. It is largely used by performers of various types of physical exercise.

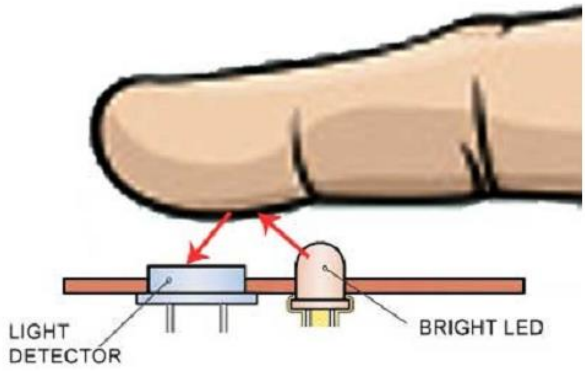


Heart beat sensor is designed to give digital output of heat beat when a finger is placed on it. When the heart beat detector is working, the beat LED flashes in unison with each heart beat. This digital output can be connected to microcontroller directly to measure the Beats Per Minute (BPM) rate.

WORKING PRINCIPLE

The heartbeat sensor is based on the principle of photo phlethysmography. It measures the change in volume of blood through any organ of the body which causes a change in the light intensity through that organ (a vascular region). In

case of applications where heart pulse rate is to be monitored, the timing of the pulses is more important. The flow of blood volume is decided by the rate of heart pulses and since light is absorbed by blood, the signal pulses are equivalent to the heart beat pulses.

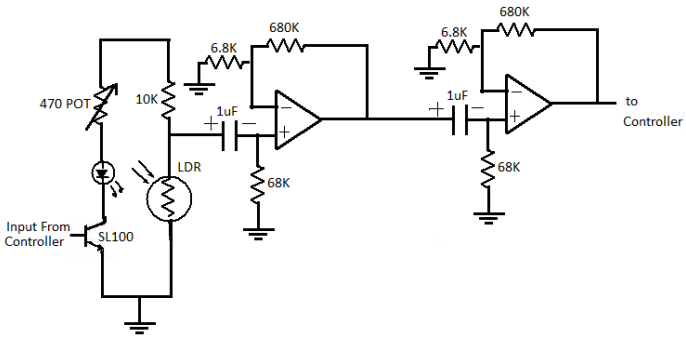


There are two types of photophlethysmography:

Transmission: Light emitted from the light emitting device is transmitted through any vascular region of the body like earlobe and received by the detector.

Reflection: Light emitted from the light emitting device is reflected by the regions.

CIRCUIT DIAGRAM



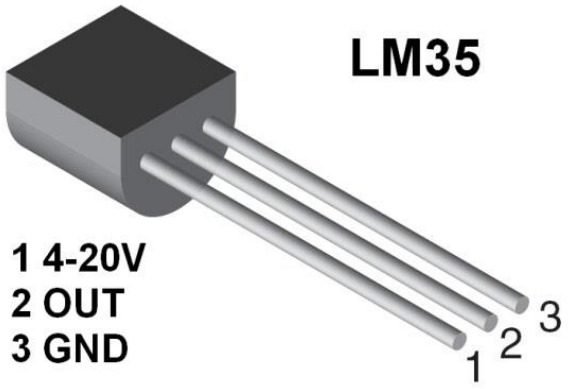
HEARTBEAT SENSOR BOARD

SPECIFICATIONS

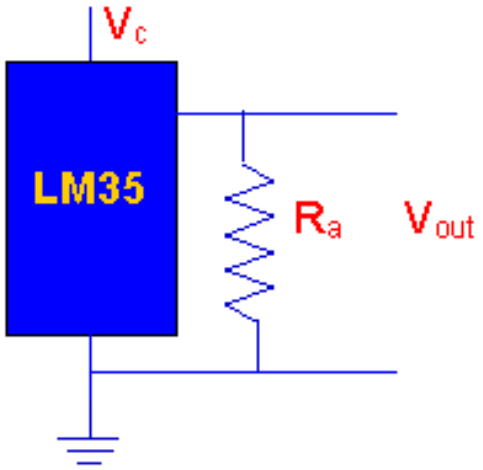
- Operating Voltage +5V DC regulated
- Operating Current 100 mA
- Output Data Level 5V TTL level
- Heart Beat detection Indicated by LED and Output High Pulse
- Light source 660nm Super Red LED

LM35 is a precision IC temperature sensor with its output proportional to the temperature (in ^{o}C). The sensor circuitry is sealed and therefore it is not subjected to oxidation and other processes. With LM35, temperature can be measured more accurately than with a thermistor. It also possess low self heating and does not cause more than 0.1 ^{o}C temperature rise in still air.

PIN DESCRIPTION



CONNECTION DIAGRAM



SPECIFICATIONS

- Linear + 10.0 mV/°C scale factor
- 0.5°C accuracy guaranteeable (at +25°C)
- Rated for full −55° to +150°C range
- Low cost due to wafer-level trimming
- Operates from 4 to 30 volts

- Less than 60 µA current drain
- Low self-heating, 0.08ºC in still air
- Nonlinearity only ±1⁄4ºC typical
- Low impedance output, 0.1 Ω for 1 mA load

GPS:

The Global Positioning System (GPS) is a space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites. The system provides critical capabilities to military, civil and commercial users around the world. It is maintained by the United States government and is freely accessible to anyone with a GPS receiver.

The GPS project was developed in 1973 to overcome the limitations of previous navigation systems, integrating ideas from several predecessors, including a number of classified engineering design studies from the 1960s. GPS was created and realized by the U.S. Department of Defense (DoD) and was originally run with 24 satellites. It became fully operational in 1994. Roger L. Easton is generally credited as its inventor.

Advances in technology and new demands on the existing system have now led to efforts to modernize the GPS system and implement the next generation of GPS III satellites and Next Generation Operational Control System (OCX).

BASIC CONCEPT OF GPS

A GPS receiver calculates its position by precisely timing the signals sent by GPS satellites high above the Earth. Each satellite continually transmits messages that include the time the message was transmitted satellite position at

time of message transmission. The receiver uses the messages it receives to determine the transit time of each message and computes the distance to each satellite using the speed of light. Each of these distances and satellites' locations define a sphere.

The receiver is on the surface of each of these spheres when the distances and the satellites' locations are correct. These distances and satellites' locations are used to compute the location of the receiver using the navigation equations. This location is then displayed, perhaps with a moving map display or latitude and longitude; elevation information may be included. Many GPS units show derived information such as direction and speed, calculated from position changes.

In typical GPS operation, four or more satellites must be visible to obtain an accurate result. Four sphere surfaces typically do not intersect. Because of this, it can be said with confidence that when the navigation equations are solved to find an intersection, this solution gives the position of the receiver along with the difference between the time kept by the receiver's on-board clock and the true time-of-day, thereby eliminating the need for a very large, expensive, and power hungry clock. The very accurately computed time is used only for display or not at all in many GPS applications, which use only the location. A number of applications for GPS do make use of this cheap and highly accurate timing. These include time transfer, traffic signal timing, and synchronization of cell phone base stations. Although four satellites are required for normal operation, fewer apply in special cases. If one variable is already known, a receiver can determine its position using only three satellites. For example, a ship or aircraft may have known elevation. Some GPS receivers may use additional clues or assumptions such as reusing the last known altitude, dead reckoning, inertial navigation, or including information from the vehicle

computer, to give a (possibly degraded) position when fewer than four satellites are visible.

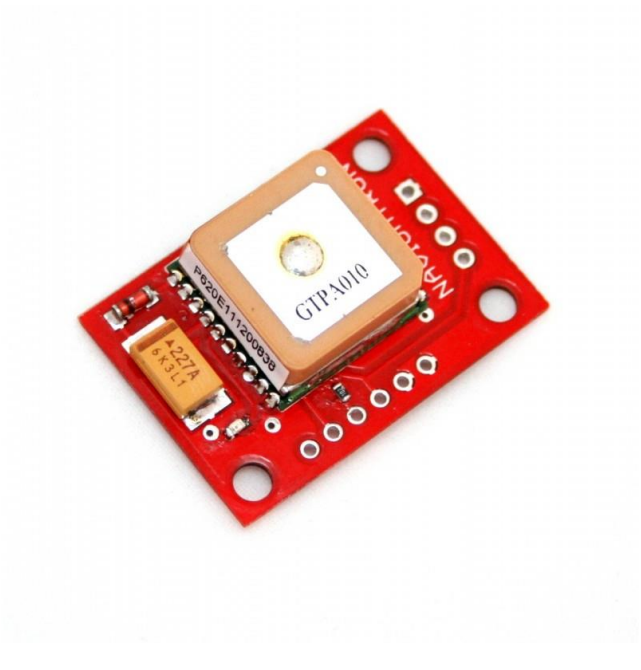
The current GPS consists of three major segments. These are the space segment (SS), a control segment (CS), and a user segment (US). GPS satellites broadcast signals from space, and each GPS receiver uses these signals to calculate its three dimensional location (latitude, longitude, and altitude) and the current time.

Applications:

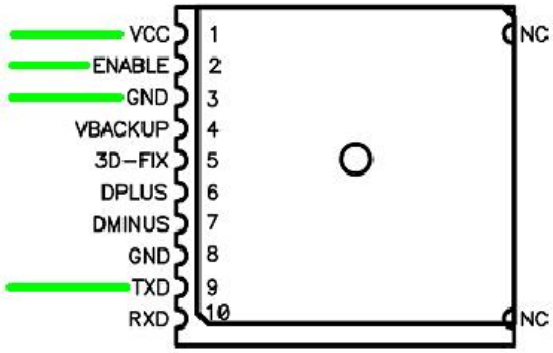
While originally a military project, GPS is considered a dual-use technology, meaning it has significant military and civilian applications.

GPS has become a widely deployed and useful tool for commerce, scientific uses, tracking, and surveillance. GPS's accurate time facilitates everyday activities such as banking, mobile phone operations, and even the control of power grids by allowing well synchronized hand-off switching.

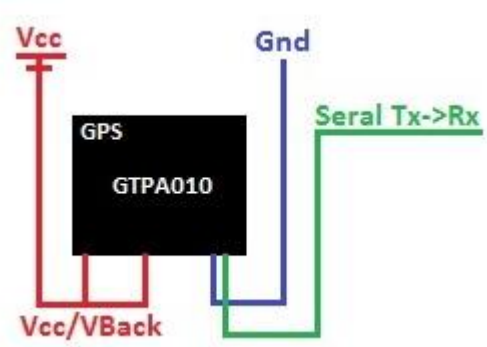
GPS MODULE



PIN CONFIGURATION



CONNECTION DIAGARM



SPECIFICATIONS

- MediaTek MT3329 Chipset, L1 Frequency, C/A code, 66 Channels
- 9 VDC supply @ 55 mA (typical)
- Data output Baud rate: 9600 bps(Default)
- Standard NMEA0183 output format
- Low Power Consumption: 55mA @ acquisition, 40mA @ tracking
- L1 Frequency, C/A code, 51-channel
- High Sensitivity, -165 dBm, TCXO Design , superior urban performances
- Position Accuracy: <3.0M 2D-RMS
- DGPS (WAAS/EGNOS/MASA/GAGAN) Support

- Multi-path Compensation ; E-GSM-900 Band Rejection
- Cold Start is Under 36 seconds (Typical)
- Warm Start is Under 34 seconds (Typical)
- Hot Start is Under 1 second (Typical)
- Max. Update Rate : 5Hz (Default: 1 Hz)

BATTERY:

An electric **battery** is a collection of one or more electrochemical cells in which stored chemical energy is converted into electrical energy. The principles of operation haven't changed much since the time of Volta. Each cell consists of two half cells connected in series through an electrolytic solution. One half cell houses the **Anode** to which the positive ions migrate from the **Electrolyte** and the other houses the **Cathode** to which the negative ones drift. The two cells are may be connected via a semi permeable membranous structure allowing ions to flow but not the mixing of electrolytes as in the case of most primary cells or in the same solution as in secondary cells.

WORKING PRINCIPLE

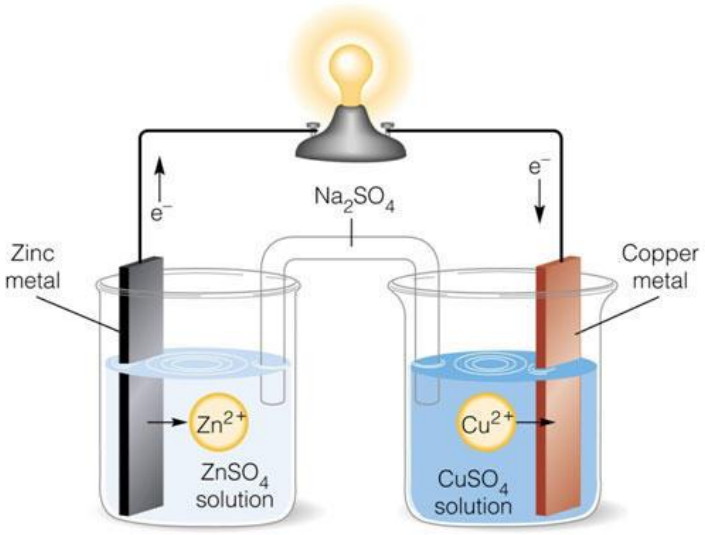
The energy released during accepting an electron by a neutral atom is known as electron affinity. As the atomic structure for different materials are different, the

electron affinity of different materials will differ. If two different kinds of metals or metallic compounds are immersed in the same electrolyte solution, one of them will gain electrons and the other will release electrons. Which metal (or metallic compound) will gain electrons and which will lose them depends upon the electron affinities of these metals or metallic compounds. The metal with low electron affinity will gain electrons from the negative ions of the electrolyte solution. On the other hand, the metal with high electron affinity will release electrons and these electrons come out into the electrolyte solution and are added to the positive ions of the solution. In this way, one of these metals or compounds gains electrons and another one loses electrons. As a result, there will be a difference in electron concentration between these two metals. This difference of electron concentration causes an electrical potential difference to develop between the metals. This electrical potential difference or emf can be utilized as a source of voltage in any electronics or electrical circuit. This is a general and basic **principle of** battery .

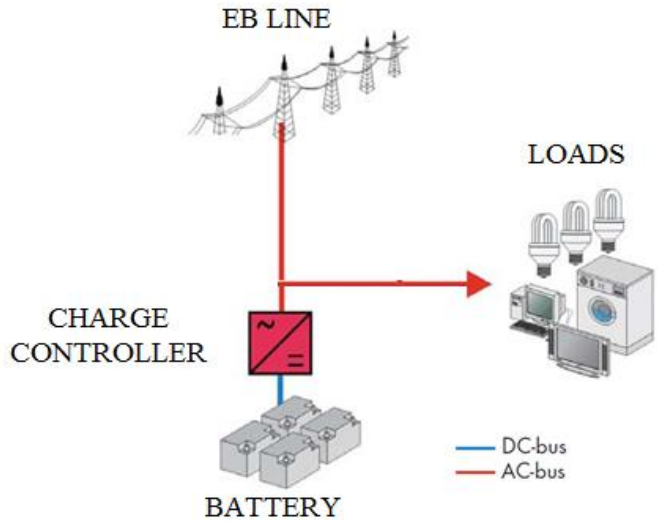
$$Zn \rightarrow Zn^{++} + 2e^{-}$$

$$H_2SO_4 + 2H_2O \rightarrow 2H_3O^{+} + SO_4^{--}$$

$$2H_3O^{+} + 2e^{-} \rightarrow 2H_2O + H_2$$



BATTERY CONNECTION BLOCK DIAGRAM



SPECIFICATIONS

NOMINAL VOLTAGE	12V
INTERNAL IMPEDANCE	0.25 Ω
CHARGING CUT OFF VOLTAGE	13.3 V

DISCHARGING CUT OFF VOLTAGE	10.5	
OPERATING TEMPERATURE	charging	0ºC ~ 45ºC
	discharging	-0ºC ~ 55ºC
Chemistry	Lead Acid	
Capacity	7Ah	
Rating whr	84	
Length	5.95 inches	
Width	2.56 inches	
Height	3.7 inches	
Weight	1 Kg	

ANDROID:

Android is now nearly eight years old and despite the green ~~robot~~android peeking out of phone shops up and down the high street, there are still plenty of people who don't know what Android is. If you fit into this category then have no fear; this article is your complete guide to understanding what Android is, what it can do and where to find it, including the best Android mobile phones, Android apps, which games you can play on Android devices, the very best features you can enjoy and how to update to the latest version.

What is Android?

Android is the name of the mobile operating system owned by American company; Google. It most commonly comes installed on a variety of smartphones and tablets from a host of manufacturers offering users access to Google's own services like Search, YouTube, Maps, Gmail and more.

This means you can easily look for information on the web, watch videos, search for directions and write emails on your phone, just as you would on your computer, but there's more to Android than these simple examples.

What can an Android phone do?

Android phones are highly customisable and as such can be altered to suit your tastes and needs; with wallpapers, themes and launchers which completely change the look of your device's interface. You can download applications to do all sorts of things like check your Facebook and Twitter feeds, manage your bank account, order pizza and play games. You can plan events on from your phone's calendar and see them on your computer or browse websites on your desktop and pick them up on your phone.

Another neat feature of Android is that it automatically backs up your contacts for you. When you set up an Android phone you'll need to create a Google

Account or sign in with an existing one. Every time you save a number to the address book of your Android phone it will be synced to your Google Account. The benefit of this is that if you lose your phone all of your numbers will be saved. The next time you get an Android phone (or an iPhone or Windows Phone if you prefer) and sign in with your Google Account, all of your contacts and friend's numbers will be displayed in your new phone's address book immediately, no need to transfer or back them up anywhere else.

Syncing is a way for your phone to keep all your information; websites, contacts, calendar entries and apps up-to-date. This can happen over your phone's mobile data or WiFi connection, seamlessly, in the background.

What apps can I get on an Android phone?

There are millions of apps and games available to download from the Google Play store (formerly Android Market). There are camera apps that allow you to take pictures with artistic effects and music players which allow you to stream songs from the web or create playlists. You can customise the appearance of your Android handset with a number of wallpapers based on pictures you've taken yourself or downloaded from the internet too.

An example of a widget on the home screen of an Android phone. This one lets you access music playback from Spotify without having to open the application.

There are also various on-screen widgets to download which allow access to, and the alteration of, settings on your phone, without the need to dive through menus as you would on non-Android devices. You can pretty much create your own system of shortcuts and menus to better suit how you uniquely use your phone.

How can I download apps onto an Android phone?

The majority of apps can be downloaded from the Google Play store (the equivalent of Apple's App Store), which includes a mix of free as well as 'premium' apps that you have to pay for. Some apps have 'lite' versions which are free, in the hope you'll enjoy them and upgrade to the full premium version. Others - like Angry Birds - are free, but include adverts or the ability to make in-app purchases.

The same account that lets you backup your contacts can also have financial details added to it, giving you the ability to purchase content from the Google Play store directly. You can pay either by debit or credit card and initial setup takes less than five minutes from a computer.

Although there are well over a million apps available to Android users in the Google Play store, some developers choose to make their apps available to download from their own sites or alternative app stores. In order to download them you have to change some settings on your phone before visiting these sites on your Android device's web browser. By downloading apps outside of the Google Play store, you do run the risk of attack in the form of data theft or by leaving yourself more susceptible to viruses, so be careful if you choose this route.

Should you upgrade or change your Android phone; log into your Google account and you'll be able to download your previously owned apps again, without being charged. In recent years, Google has expanded Google Play to offer more than just apps, with books, magazines, music and movies available for purchase and download in much the same way too.

Who actually makes Android phones?

Any handset maker is free to make an Android phone if they want to. The likes of Motorola, HTC, Samsung and Sony, Acer, Alcatel, Asus, Huawei, LG and ZTE have all made Android phones (and tablets). Blackberry also launched its very first Android phone, the strangely-named Blackberry Priv at the end of 2015.

Check out our guide to the best Android phones right now.

Does Google make any Android phones?

Although Google owns the OS (Android), the company has not made any of the smartphones on which it runs in-house (it did make the Android-powered Pixel C tablet in 2015). However, it has partnered with various handset manufacturers over the years to make its own-brand smartphones under the 'Nexus' name.

Android updates

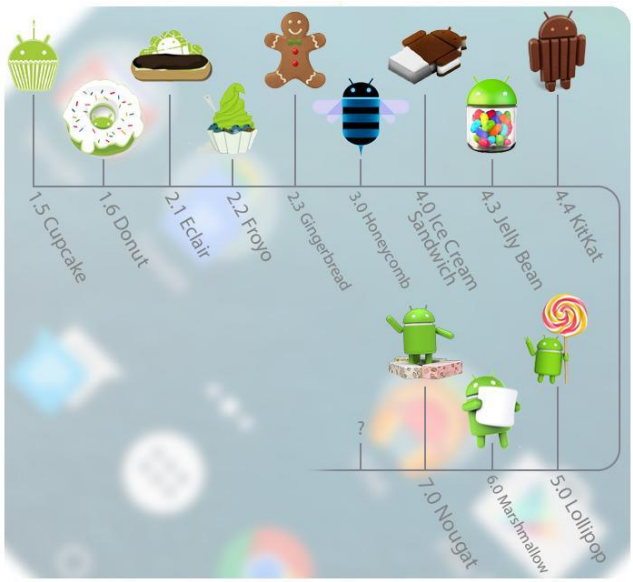
Google is constantly working on new versions of the Android software. These releases are infrequent; at the moment they normally come out every six months or so, but Google is looking to slow this down to once a year. Check out our handy, comprehensive guide to every Android version out there.

Versions usually come with a numerical code and a name that’s so far been themed after sweets and desserts, running in alphabetical order.

- Android 1.5 Cupcake
- Android 1.6 Donut
- Android 2.1 Eclair
- Android 2.2 Froyo
- Android 2.3 Gingerbread
- Android 3.2 Honeycomb - The first OS design specifically for a tablets, launching on the Motorola Xoom

- Android 4.0 Ice Cream Sandwich: The first OS to run on smartphones and tablets, ending the 2.X naming convention.
- Android 4.1 Jelly Bean: Launched on the Google Nexus 7 tablet by Asus
- Android 4.2 Jelly Bean: Arrived on the LG Nexus 4
- Android 4.3 Jelly Bean
- Android 4.4 KitKat: Launched on the LG Nexus 5
- Android 5.0 Lollipop: Launched on the Motorola Nexus 6 and HTC Nexus 9
- Android 6.0 Marshmallow: Launched on the LG Nexus 5X and Huawei Nexus 6P
- Android 7.0 Nougat: Launching on the rumoured HTC 'Marlin' and 'Sailfish'

The latest version, Android Marshmallow, aims to make the OS more user-friendly, with improved battery life and more control over your apps. Here's what's changed between the different Android versions.



Android tablets

Like Android phones, Android tablets come in all shapes and sizes. These can range from the 7-inch screen of the Asus-made Google Nexus 7 to far larger displays, such as the 10-inch display found on the Nexus 10.

Somewhat confusingly, some older Android tablets; like the original Samsung Galaxy Tab, launched running Android 2.2 Froyo - a version of Android designed for phones, whilst Android 3.0 Honeycomb was the first release of the OS specifically for tablets.

Older Android tablets which didn't run on 3.0 Honeycomb couldn't benefit from things like the redesigned YouTube app, improved widgets and certain tablet-specific apps like SwiftKey for Tablets.

This fragmentation between Android phones and tablets was eliminated with the launch of Android Ice Cream Sandwich, which was designed to operate on either type of device and scale accordingly. Android Jelly Bean introduced a number of improvements for both the smartphone and tablet experience over the likes of ICS (Ice Cream Sandwich) and that trend continues with the latest release, Android 7.0 Nougat, which brings features like split screen support to the table.

Do Android updates cost anything?

Android updates are free to download and install. Updates bring a number of new features and changes to Android each time. Generally, with each update the speed and overall performance of Android is improved upon.

Most of the high-end Android phones are scheduled to receive updates first. Most Android phones will have at least one update during their life cycle, with some having two. A life cycle is usually around 18 months, but depending on the phone this can be longer. These updates differ from app updates, which are

smaller, incremental releases for individual applications installed on your Android device.

How do I get an update?

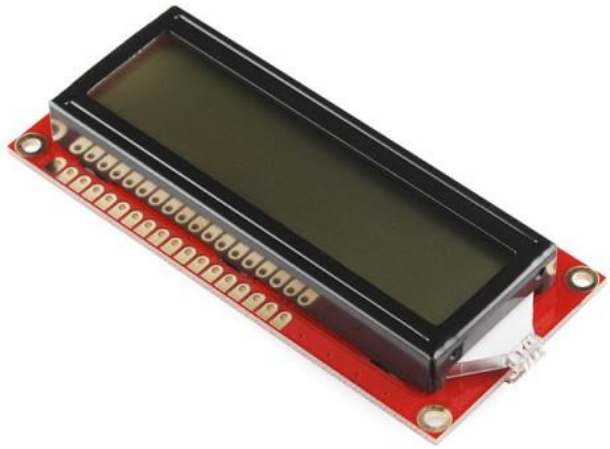
Android updates are normally received OTA (Over The Air), that is, sent directly to your Android phone without the need for a computer. Normally, once your Android phone or tablet is due to get an upgrade, you'll see a notification in the bar at the top of the screen. You'll then be prompted to connect to WiFi to avoid incurring extra data charges - updates can be quite big and downloading them over a mobile data connection isn't advised as it may result in expensive data charges.

Updates are generally one-stage processes and relatively straightforward, but in some cases you may need to backup/save any media (photos, movies, music) or apps you've downloaded before updating.

LCD:

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being:

- LCDs are economical
- Easily programmable
- Have no limitation of displaying special characters.



A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like

- Initializing it
- Clearing its screen,
- Setting the cursor position,
- Controlling display & etc.

The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. Click to learn more about internal structure of a LCD.

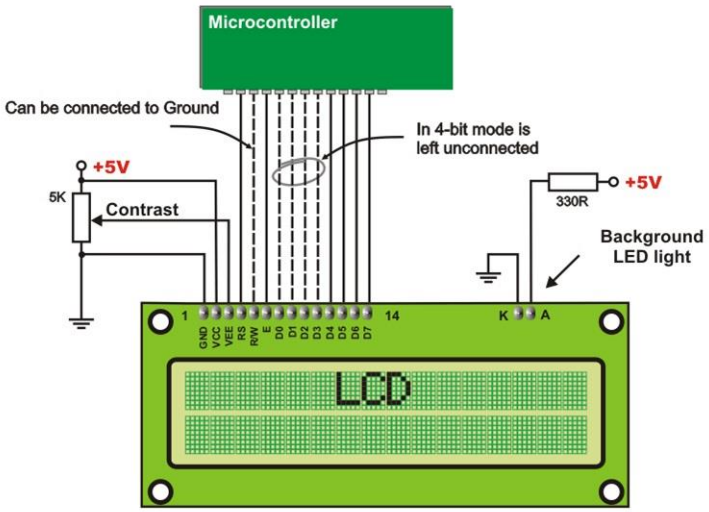
LCD COMMANDS

Code (Hex)	Command to LCD Instruction Register
1	Clear display screen
2	Return home
4	Decrement cursor (shift cursor to left)
6	Increment cursor (shift cursor to right)
5	Shift display right
7	Shift display left
8	Display off, cursor off
A	Display off, cursor on
C	Display on, cursor off
E	Display on, cursor blinking
F	Display on, cursor blinking
10	Shift cursor position to left
14	Shift cursor position to right
18	Shift the entire display to the left
1C	Shift the entire display to the right
80	Force cursor to beginning to 1st line
C0	Force cursor to beginning to 2nd line
38	2 lines and 5x7 matrix

LCD PIN CONFIGURATION

Pin	Name	Description
1	DB7	Data-bus bit 7
2	DB6	Data-bus bit 6
3	DB5	Data-bus bit 5
4	DB4	Data-bus bit 4
5	DB3	Data-bus bit 3 (not used in 4-bit mode)
6	DB2	Data-bus bit 2 (not used in 4-bit mode)
7	DB1	Data-bus bit 1 (not used in 4-bit mode)
8	DB0	Data-bus bit 0 (not used in 4-bit mode)
9	E	Enable (active high)
10	R/W	low = write, high = read
11	RS	Register select: low = instruction, high = data
12	V0	Contrast adjustment
13	GND	Ground
14	Vcc	Vcc (+5V)

LCD CONNECTION DIAGRAM



LCD CONFIGURATION FLOW CHART

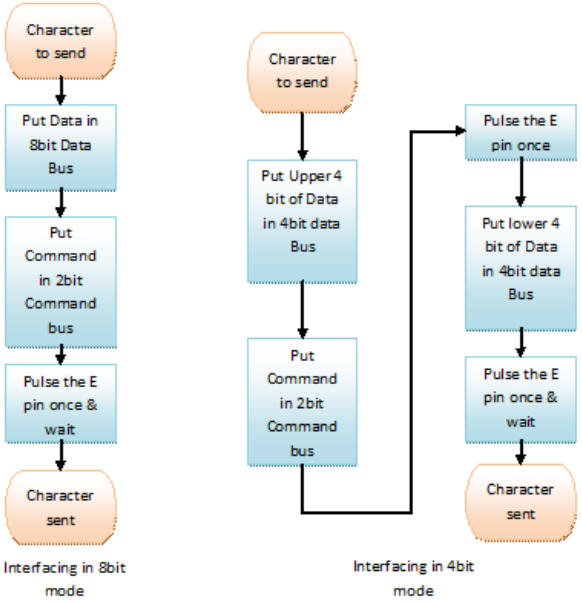


Fig: Flow chart of interfacing LCD display

16X2 LCD DISPLAY SPECIFICATIONS:

- Display Mode: STN, BLUB
- Display Formate: 16 Character x 2 Line
- Viewing Direction: 6 O'Clock
- Input Data: 4-Bits or 8-Bits interface available
- Display Font : 5 x 8 Dots

- Power Supply : Single Power Supply (5V±10%)
- Driving Scheme : 1/16Duty,1/5Bias
- BACKLIGHT（SIDE） : LED（WHITE）

CONCLUSION

The paper reports an IoT based system for the health monitoring and tracking of the soldiers. Arduino board is used which is a low cost solution for the possessing purpose. Biomedical sensors provide heartbeat, body temperature, and environmental parameters of every soldier to control room. This technology can be helpful to provide the accurate location of missing soldier in critical condition and overcome the drawback of soldiers missing in action. The addressing system is also helpful to improve the communication between soldier to soldier in emergency situation and provide proper navigation to control room. Thus we can conclude that this system will act as a lifeguard to the army personnel of all over the globe. In future, a portable handheld sensor device with more sensing options may be developed to aid the soldiers.

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