A MINI PROJECT ON

"LIGHT FOLLOWING ROBOT"

Submitted in partial fulfilment of requirement in

"MECHANICAL MEASUREMENTS AND CONTROLS"

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THIRD YEAR ENGINEERING IN MECHANICAL (SEM V)

GUIDED BY

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DEPARTMENT OF MECHANICAL ENGINEERING

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CERTIFICATE

This is to certify that this report entitled

"LIGHT FOLLOWING ROBOT"

Submitted by the following students of

"Mechanical Engineering"

Towards the partial fulfilment in the requirements in

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"MECHANICAL MEASUREMENTS AND CONTROLS"

Throughout their tenure of completion of task, they have been guided and assessed by me, I am satisfied that their contribution was proportionate, they were satisfactory progressive and their task is up to standard envisaged by University of Mumbai.

HOD MECHANICAL **PROJECT GUIDE**

(Prof. R.K. AGRAWAL) (Prof. NITIN NANDESHWAR)

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ACKNOWLEDGEMENT

"We have taken efforts in this project. However, it would not have been possible without the kind support and help of many individuals and web research. We would like to extend my sincere thanks to all of them.

We are highly indebted to **Prof. Nitin Nandeshwar** for his guidance and constant supervision as well as for providing necessary information regarding the project & also for his support in completing the project.

We would like to express our gratitude towards my parents & member of **YADAVRAO TASGONKAR COLLEGE OF ENGINEERING AND MANAGEMENT** for their kind co-operation and encouragement which help me in completion of this project.

Ours thanks and appreciations also go to my colleague in developing the project and people who have willingly helped me out with their abilities."

INTRODUCTION

Arduino is composed of two major parts: the Adriano board, which is the piece of hardware you work on when you build your objects; and the Arduino IDE, the piece of software you run on your computer. You use the IDE to create a sketch (a little computer program) that you upload to the Arduino board.

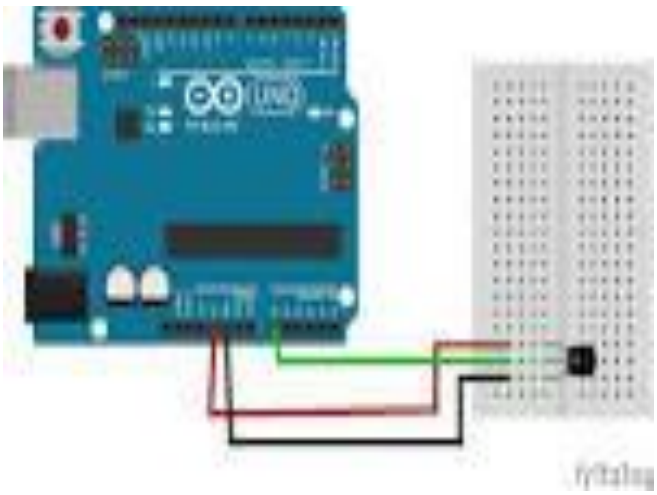


Figure 05: Arduino Development Module

The first Arduino was introduced in 2005, aiming to provide an inexpensive and easy way for novices and professionals to create devices that interact with their environment using sensors and actuators. Common examples of such devices intended for beginner hobbyists include simple robots, thermostats, and motion detectors.

Hardware An official Arduino Uno with descriptions of the I/O locations An early Arduino board[8] with anRS-232 serial interface (upper left) and an Atmel ATmega8 microcontroller chip (black, lower right); the 14 digital I/O pins are located at the top and the six analog input pins at the lower right. An Arduino board consists of an Atmel 8-, 16- or 32-bit AVR microcontroller with complementary components that facilitate programming and incorporation into other circuits. An important aspect of the Arduino is its standard connectors, which lets users connect the CPU board to a variety of interchangeable add-on modules known as shields, Some shields communicate with the Arduino board directly over various pins, but many shields are individually addressable via an I^2C serial bus—so many shields can be stacked and used in parallel.

Official Arduinos have used the mega AVR series of chips, specifically the AT mega8 , ATmega168 , ATmega328 , ATmega1280 , and ATmega2560 .A handful of other processors have been used by Arduino compatibles. Most boards include a5 volt linear regulator and a 16 MHz crystal oscillator (or ceramic resonator in some variants), although some designs such as the Lily Pad run at 8 MHz and dispense with the on board voltage regulator due to specific form- factor restrictions.

An Arduino's microcontroller is also pre-programmed with a boot loader that simplifies uploading of programs to the on-chip flash memory, compared with other devices that typically need an external programmer. This makes using an Arduino more straightforward by allowing the use of an ordinary computer as the programmer. Currently, opt boot loader is the default bootloader installed on Arduino UNO.

Requirements and Design :

The Following parts are required for this project:

1) Arduino Uno R3

2) 12V Battery

3) 12V Stepper Motor

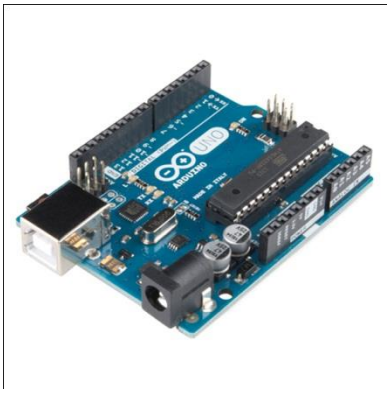
4) Breadboard

5) LDRs

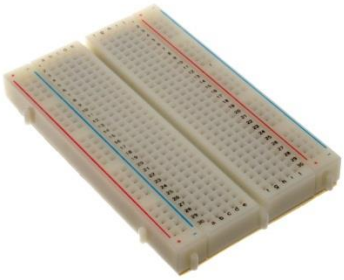
6) Photodiodes

7) Jumper Cables, Connecting wires

8) 12V Geared Motor



Arduino Uno R3



Breadboard

Photodiode

Stepper Motor

Light Dependent Resistor

Battery

Construction

ARDUNIO UNO:

Arduino is an open-source project that created microcontroller-based kits for building digital devices and interactive objects that can sense and control physical devices.

The project is based on microcontroller board designs, produced by several vendors, using various microcontrollers. These systems provide sets of digital and analog input/output (I/O) pins that can interface to various expansion boards (termed *shields*) and other circuits. The boards feature serial communication interfaces, including Universal Serial Bus (USB) on some models, for loading programs from personal computers. For programming the microcontrollers, the Arduino project provides an integrated development environment (IDE) based on a programming language named *Processing*, which also supports the languages C and C++.

BREADBOARD

A **breadboard** is a construction base for prototyping of electronics. Originally it was literally a bread board, a polished piece of wood used for slicing bread. In the 1970s the **solderless breadboard** (AKA **plugboard**, a terminal array board) became available and nowadays the term "breadboard" is commonly used to refer to these. "Breadboard" is also a synonym for "prototype".

Because the solderless breadboard does not require soldering, it is reusable. This makes it easy to use for creating temporary prototypes and experimenting with circuit design. For this reason, solderless breadboards are also extremely popular with students and in technological education. Older breadboard types did not have this property. A stripboard (Veroboard) and similar prototyping printed circuit boards, which are used to build semi-permanent soldered prototypes or one-offs, cannot easily be reused. A variety of electronic systems may be prototyped by using breadboards, from small analog and digital circuits to complete central processing units (CPUs)

.

BATTERY:

A battery is designed to store and release electricity. You're probably most familiar with car batteries used for starting. These are sold by many box retailers and automotive stores and are rated by their cold cranking amps (CCA). This is not the type of battery you want for your RV. You may also be familiar with marine or "hybrid" batteries which are used for starting boat motors and powering boat 12v systems

- The commercial use of the lead acid battery is over 100 years old.
- The same chemical principal that is being used to store energy is basically the same as our Great Grandparents may have used.
- If you can grasp the basics you will have fewer battery problems and will gain greater battery performance, reliability, and longevity.
- I suggest you read the entire tutorial, however I have indexed all the information for a quick read and easy reference.

JUMPER CABLE:

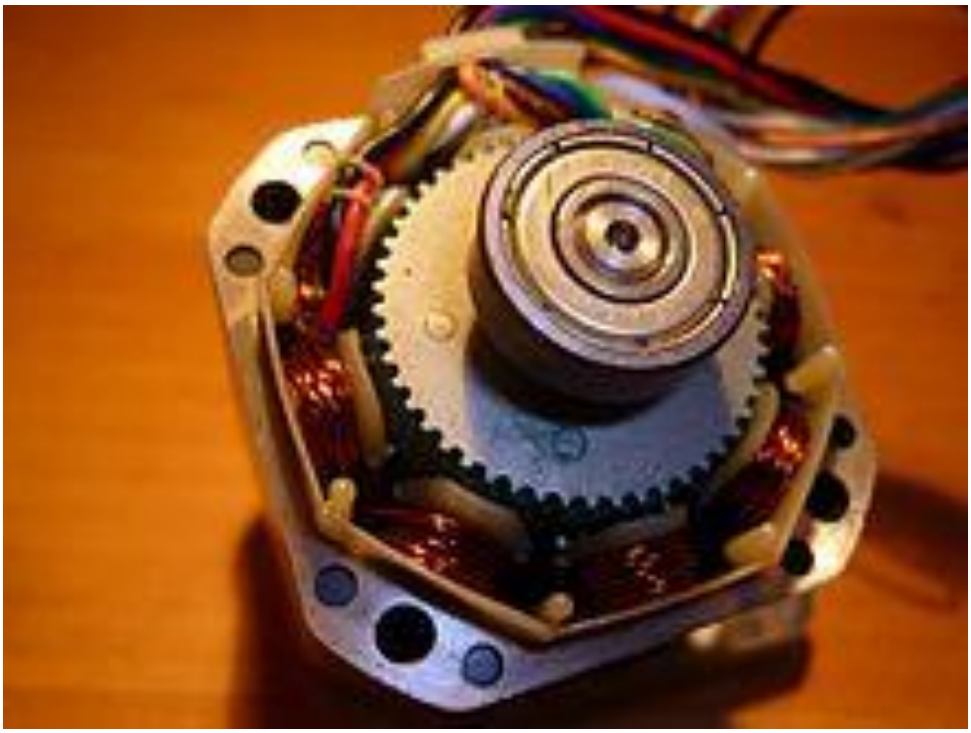
These are the cables that are used for the connecting purpose. The jumper gives us the connection between the Arduino to breadboard and gives use the supply.

- A car with a "dead" (discharged) battery can be made to start by supplying it with power from an external source, such as the battery of another car.
- The cables used to make the necessary temporary connection are also commonly called "**jumper cables**".
- These usually are equipped at the ends with alligator clips.

Stepper Motors:

DC brushed motors rotate continuously when DC voltage is applied to their terminals. The stepper motor is known by its property to convert a train of input pulses (typically square wave pulses) into a precisely defined increment in the shaft position. Each pulse moves the shaft through a fixed angle.

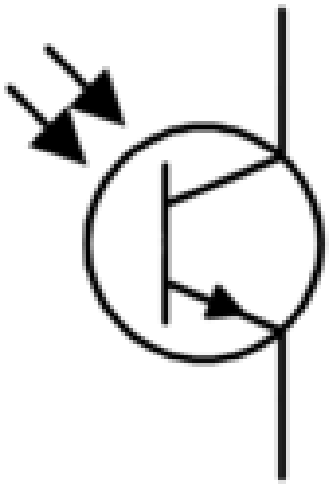
Stepper motors effectively have multiple "toothed" electromagnets arranged around a central gear-shaped piece of iron. The electromagnets are energized by an external driver circuit or a micro controller. To make the motor shaft turn, first, one electromagnet is given power, which magnetically attracts the gear's teeth. When the gear's teeth are aligned to the first electromagnet, they are slightly offset from the next electromagnet. This means that when the next electromagnet is turned on and the first is turned off, the gear rotates slightly to align with the next one. From there the process is repeated. Each of those rotations is called a "step", with an integer number of steps making a full rotation. In that way, the motor can be turned by a precise angle.



PHOTODIODE

A **photodiode** is a semiconductor device that converts light into current. The current is generated when photons are absorbed in the photodiode. A small amount of current is also produced when no light is present. Photodiodes may contain optical filters, built-in lenses, and may have large or small surface areas. Photodiodes usually have a slower response time as their surface area increases. The common, traditional solar cell used to generate electric solar power is a large area photodiode.

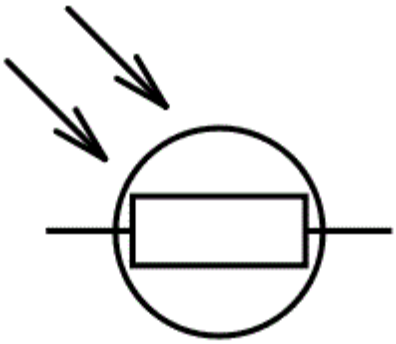
Photodiodes are similar to regular semiconductor diodes except that they may be either exposed (to detect vacuum UV or X-rays) or packaged with a window or optical fibre connection to allow light to reach the sensitive part of the device. Many diodes designed for use specifically as a photodiode use a PIN junction rather than a p–n junction, to increase the speed of response. A photodiode is designed to operate in reverse bias.



Electronic symbol for a photodiode

LIGHT DEPENDENT RESISTOR

A **Light Dependent Resistor** (LDR) or a photo resistor is a device whose resistivity is a function of the incident electromagnetic radiation. Hence, they are light sensitive devices. They are also called as photo conductors, photo conductive cells or simply photocells. They are made up of semiconductor materials having high resistance. There are many different symbols used to indicate a **LDR**, one of the most commonly used symbol is shown in the figure Below. The arrow indicates light falling on it



WORKING PRINCIPAL

Photo conductivity is an optical phenomenon in which the materials conductivity is increased when light is absorbed by the material. When light falls i.e. when the photons fall on the device, the electrons in the valence band of the semiconductor material are excited to the conduction band. These photons in the incident light should have energy greater than the band gap of the semiconductor material to make the electrons jump from the valence band to the conduction band. Hence when light having enough energy strikes on the device, more and more electrons are excited to the conduction band which results in large number of charge carriers. The result of this process is more and more current starts flowing through the device when the circuit is closed and hence it is said that the resistance of the device has been decreased.

APPLICATIONS:

- Xoscillo, an open-source oscilloscope
- Scientific equipment such as the Chemduino
- Arduinome, a MIDI controller device that mimics the Monome
- OBDuino, a trip computer that uses the on-board diagnostics interface found in most modern cars
- Ardupilot, drone software and hardware
- ArduinoPhone, a do-it-yourself cellphone
- *GertDuino*, an Arduino mate for the Raspberry Pi
- Water quality testing platform
- Homemade CNC using Arduino and DC motors with close loop control by Homofaciens
- DC motor control using Arduino and H-Bridge

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

Memory

- The ATmega328 has 32 KB (with 0.5 KB occupied by the bootloader).
- It also has 2 KB of SRAM and 1 KB of EEPROM (which can be read and written with the EEPROM library).

Communication

- Arduino/Genuine Uno has a number of facilities for communicating with a computer, another Arduino/Genuine 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 .info 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).
- A Software Serial library allows serial communication on any of the Uno's digital pins.
- The ATmega328 also supports I2C (TWI) and SPI communication. The Arduino Software (IDE) includes a Wire library to simplify use of the I2C bus; see the documentation for details. For SPI communication, use the SPI library.

Advantages:

1- Ready to Use:

The biggest advantage of Arduino is its ready to use structure. As Arduino comes in a complete package form which includes the 5V regulator, a burner, an oscillator, a micro-controller, serial communication interface, LED and headers for the connections. You don't have to think about programmer connections for programming or any other interface. Just plug it into USB port of your computer and that's it. Your revolutionary idea is going to change the world after just few words of coding.

2- Examples of codes:

Another big advantage of Arduino is its library of examples present inside the software of Arduino. I'll explain this advantage using an example of voltage. For example, if you want to measure voltage using ATmega8 micro-controller and want to display the output on computer screen then you have to go through the whole process. The process will start from learning the ADC's of micro-controller for measurement, went through the learning of serial communication for display and will end at USB – Serial converters. If you want to check this whole process, click on the link below.

DC voltage measurement using Atmel AVR micro-controller.

On the other hand, if you want to measure the voltage using Arduino. Just plug in your Arduino and open the Read Analog Voltage

3- Effortless functions:

During coding of Arduino, you will notice some functions which make the life so easy. Another advantage of Arduino is its automatic unit conversion capability. You can say that during debugging you don't have to worry about the unit's conversions. Just use your all force on the main parts of your projects. You don't have to worry about side problems.

4- Large community:

There are many forums present on the internet in which people are talking about the Arduino. Engineers, hobbyists and professionals are making their projects through Arduino. You can easily find help about everything. Moreover, the Arduino website itself explains each and every function of Arduino.

So, we should conclude the advantage of Arduino by saying that during working on different projects you just have to worry about your innovative idea. The remaining will handle by Arduino itself.

Disadvantages:

1- Structure:

Yes, the structure of Arduino is its disadvantage as well. During building a project you have to make its size as small as possible. But with the big structures of Arduino we have to stick with big sized PCB's. If you are working on a small micro-controller like ATmega8 you can easily make your PCB as small as possible.

2- Cost:

The most important factor which you cannot deny is cost. This is the problem which every hobbyist, Engineer or Professional should face. Now, we must consider that the Arduino is cost effective or not.

A year ago I was working on a project in which I have to build three smart energy meters. Now, for three smart energy meters present at some distance connected with different loads must have their own processor. So, I estimated my expenditures with and without the Arduino which you can see in the block diagram present below.

The thing must be noted that I multiplied Atmel Programmer with 1 because we don't need many programmers for all the micro- controllers. Only one programmer is enough. The difference between the costs is mainly due to this programmer reason. Still if you need one package then the cost difference will be as less as nearly $5 and it will rise when you have to use many packages.

3- Easy to use:

In my opinion, if you started your journey of micro-controllers with Arduino then it will be very difficult for you to make the complex intelligent circuitries in future. The easy to use hardware/software of Arduino unable a person to learn the basics of many things likes Serial communication, ADC, I2C etc.