

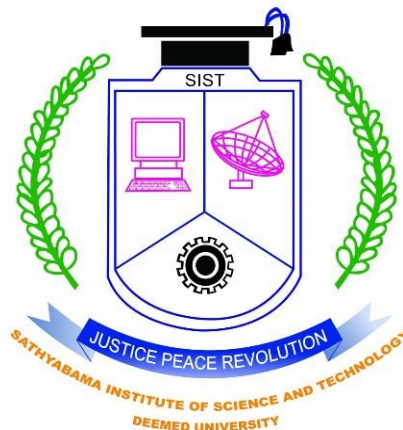
INDOOR NAVIGATION FOR VISUALLY IMPAIRED USING VISIBLE LIGHT COMMUNICATION

Submitted in partial fulfillment of the requirements for the award of
Bachelor of Technology degree in Biomedical Engineering

By

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**DEPARTMENT OF BIOMEDICAL ENGINEERING
SCHOOL OF BIO AND CHEMICAL ENGINEERING**

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited with Grade "A" by NAAC

JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119

APRIL-2021



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DEPARTMENT OF BIOMEDICAL ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **M.S. AHAMED NIZAMUDDIN** (Reg. No. **37240001**), **S. HEMANTH KUMAR** (Reg. No. **37240026**) who carried out the project entitled "**Indoor Navigation For Visually Impaired Using Visible Light Communication**" under our supervision from September 2020 to April 2021.

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Submitted for Viva voce Examination held on -----

Internal Examiner

External Examiner

DECLARATION

We, **M.S AHAMED NIZAMUDDIN (37240001), S. HEMANTH KUMAR (37240026)** hereby declare that the Project Report entitled “**Indoor Navigation for Visually Impaired Using Visible Light Communication**” done by us under the guidance of **Dr. ANIMA NANDA, Director, IQAC, Department of Biomedical Engineering** is submitted in partial fulfillment of the requirements for the award of **Bachelor of Technology** degree in **Biomedical Engineering**.

	1.
DATE:	2.
PLACE:	SIGNATURE OF THE CANDIDATES

ACKNOWLEDGEMENT

We are pleased to acknowledge our sincere thanks to **Board of Management of SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY** for their kind encouragement in doing this project and for completing it successfully. We are grateful to them.

At first we would like to express our prayer to the almighty for keeping us healthy in body and mind for successfully completing the project.

We express our sincere and heartfelt gratitude to our Project Guide **Dr. Anima Nanda, Ph.D., FNRS., FIAS, FAB, Director, IQAC, Department of Biomedical Engineering** for her valuable guidance, suggestions and constant encouragement which paved way for the successful completion of our project work.

We convey our sincere and deep sense thanks to **Dr. T. Sudhakar, M.Sc., Ph.D,** Head of the Department. We wish to express our thanks to all Teachers, **Dr. J. Prem Kumar, Ms.Bethanny Janney, Ms.Sindhu Divakaran, Dr. Krishna Kumar and Mr. G. Umashankar of Department of Biomedical Engineering** and the **Non-teaching staff** members for providing us necessary support and details at the right time during the progressive reviews in the entire duration of our project tenure.

Last but not least, we express our heartfelt gratitude to our beloved parents, family members and friends, who have played an instrumental role in finishing my project to receive the degree.

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ABSTRACT

Blindness is a subjective term that portrays the clinical condition whereby people have no light perception because of complete vision misfortune. The day-to-day life of a visually impaired individual is influenced to a great extent by route and portability issues. The most seasoned and conventional portability aids for the people with visual disabilities are the strolling stick and guide canines. The short comes of these aids are scope of movement and very little Information passed on. With the quick progression in current innovation, this Project proposes a smart shoe that helps the visually impaired in route through voice orders which are passed on through light source in their way. The shoe likewise detects any snags in their way. The principle point of this task is to give solid route and portability to the visually impaired.

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LIST OF ABBREVIATION

Li-fi	Light Fidelity
LED	Light Emitting Diode
LOS	Line Of Sight
Wi-fi	Wireless Fidelity
GPS	Global Positioning System
GSM	Grams per Square Meter
LCD	Liquid Crystal Display
Li-Fi Rx	Li-Fi Receiver
Li-Fi Tx	Li-Fi Transmitter
IR-Sensor	Infrared Radiation Sensor
AC	Alternating Current
DC	Direct Current
Arduino IDE	Arduino Integrated Development Environment
MOSFET	Metal Oxide Semi-conductor Field Effect Transistor
FAT	File Allocation Bus
USB	Universal Serial Bus

CHAPTER - 1

INTRODUCTION

1.1 GENERAL:

The insights by the World Health Organization (WHO) in 2014 assessments that there are 285 billion individuals in world with visual impairment, where 39 billion of individuals are visually impaired and 246 billion with low vision. The outwardly debilitated needed to rely upon a person or thing to do their day to day activities. The stick utilized by them are not beneficial while strolling or voyaging. This Smart Shoe is being proposed to assist them with being autonomous. Shoes being the essential need to walk puts this shrewd shoe turns into a wearable gadget. It is utilized as a wellbeing gadget just as a route gadget. Accordingly the principle inspiration of the paper is to advance easy mobility and dependable route.

1.2 OUTLINE OF THE PROJECT:

Li-Fi is a rapid remote correspondence like Wi-Fi. Li-Fi when contrasted with Wi-Fi, can be viewed as better compared to Wi-Fi in light of some impediment in Wi-Fi. We can move the information through LEDs which are reasonable utilizing Li-Fi innovation. It is ease and fast remote correspondence framework, contrasted with Wi-Fi. Li-Fi utilizes a free harmless to the ecosystem range and isn't influenced by any commotion as found in Wi-Fi. Utilizing Li-Fi in an indoor environment is much protected as there is no chance of light infiltrating through walls. A computerized line of 1 can be communicated if the LED is ON, the client can send a line of 0 if it's OFF. This is related to switching process which is quick, which gives the transmitting information a moment opportunity. Li-Fi require LOS (line of sight) for communication. The light from the LED is identified by utilizing a light identifier and the information is change to its unique structure to get the necessary yield. Utilizing this innovation, the issue of radio band emergency like in Wi-Fi can be arranged. Hence, giving an innovation that bargains ongoing, helpful route data that empowers a client to settle on convenient and proper choices on which route to continue in an indoor zone.

CHAPTER - 2

LITERATURE SURVEY

U. Sairam et. al., (2020) reported an answer utilizing the Internet of Things (IoT) worldview to give a medium between the visually impaired and the climate. A few sensors can be utilized to distinguish abnormalities like deterrents, flights of stairs and wet landscapes respectively. The model talked about here is a straightforward, complex and moderate keen visually impaired stick outfitted with different IoT sensors and modules. Additionally, this arrangement gives an approach to communicate something specific about the whereabouts of the client to the concerned individuals. Adding to the over, a product application is intended to help the colleagues of the oblivious in regards to deal with the stick's setup ex: add or erase telephone numbers to which ready messages must be sent. Losing the stick inside can likewise be a considerable issue. This arrangement likewise addresses this issue.

N. Chandrasekaran et. al., (2020) proposed a keen stick as an answer for help the outwardly impeded individuals in their everyday living without the assistance of others. This paper proposes an answer for the visually impaired individuals by utilizing a ultrasonic sensor in the visually impaired stick. The instrument stands used to see the obstructions at the scope of four meters and infrared instrument is castoff to see the closer intricacies before the visually impaired individuals. In this way the radio recurrence transmitter and beneficiary assist the client with tracking down the specific area of the brilliant stick with the assistance of bell. The vibration engine which is put in the keen stick gets enacted and creates a vibration when any deterrent is distinguished. This proposed strategy utilizes the Arduino UNO as regulator. The branch is refined of detecting all troubles before the client. The brilliant stick is of easy to understand, speedy reaction, low force utilization, lighter weight and it is not difficult to hold and overlap by the client.

Ali M. Madkhane et. al., (2019) introduced a shrewd visually impaired stick plan that helps the outwardly impeded clients adapt to their every day undertakings and make their lives easier. Adding adroitness to a light-weight stick by applying a few advances,

including the ultrasound sensor that distinguishes hindrances of different shapes and types, the GPS/GSM innovation that assists the clients with finding spots and move starting with one spot then onto the next with the guide of a correspondence framework, and the discourse acknowledgment innovation that encourages intelligent correspondence between the client and the stick. The viable tests show that the client can make discourse orders to the stick that can consequently call a pre-saved telephone number, in addition to the viable capacity of evading obstructions. In addition, the savvy stick can be modified so a pre-approved individual can call the stick and decide its GPS area for safety purposes.

Nkosinathi Emmanuel Shandu et. al., (2020) introduced the plan of a shrewd strolling stick for the visually impaired utilizing Raspberry Pi 3 b+ as a focal microcontroller, Ultrasonic sensors and Global Positioning System (GPS). The ultrasonic sensors are utilized for filtering the climate on walkway and sideways utilizing soundwaves at certain characterized distances, and GPS module is utilized for continuous bearings and route. It additionally contains Bluetooth-headset that is utilized for the sound route through the guide of understanding from the ongoing feed of ultrasonic sensors and directions from the GPS, in this manner giving the client the real course and potential turns until the objective point. Unique crisis messages utilizing watchwords of the area organizes got through GPS are sent by means of SMS membership account associated with the GPIO pins of the Raspberry Pi to parental figures for following purposes when required. The whole arrangement of the canny strolling stick makes route and following conceivable, subsequently adequately helping the outwardly impaired people.

Md Adil et. al.,(2020) reported an answer, introduced in a brilliant stick with an infrared sensor to identify flights of stairs and a couple of ultrasonic sensors to distinguish some other hindrances before the client, inside four meters. Besides, another sensor is put at the lower part of the stick to forestall puddles. Discourse cautioning message is set endless supply of any snag. Around 39 million individuals are forever visually impaired and around 285 billion are outwardly hindered. Dazzle individual, who doesn't walk alone, battles to do his own work. There's consistently dread of getting harmed and getting into a mishap. How might we take care of those issues? In fact, this paper has given an answer which can assuage the visually impaired from this issue. Which is "Visually impaired Stand

with voice control to direct visually impaired individuals" This is basically a gadget comprising of Arduino UNO, Ultrasonic Sensor and Voice Module that illuminates and informs the visually impaired individual of the risks This will assist a visually impaired individual with strolling serenely and guard themselves from threat.

Ayesha Ashraf et. al., (2020) reported that Blind individuals face part of obstacles in every day life. Daze individuals needs to rely upon others to play out their typical life exercises. Data innovation acquires unrest each field of existence with arising man-made reasoning, Internet of things, remote sensor networks and so forth Internet of Things is developing innovation that carefully interconnect the people, machines, sensors and everything for robotization. It change manual cycles to insightful computerized measures with the assistance of artificial knowledge. In this exploration, they have built up a touchy keen stick enabled by Internet of Things to help the outwardly debilitated people groups. Brilliant stick is fused with ultrasonic sensor and bell to detect and caution if there should arise an occurrence of any obstacle. Android application is created with savvy stick to produce the significant notice and forward to enrolled numbers alongside GPS area. This arrangement is financially savvy and executed with state for the craftsmanship equipment.

K.Osman and S.Subramoniam (2018) proposed a visually impaired route framework that sends data from the regulator mounted on white stick by means of Bluetooth association with a cell phone cautioning the client about hindrances through discourse notice and vibration. For this situation, Smartphone with haptic mode is picked to empower simpler recognition. A Bluetooth module is utilized to improve the exhibition of control circuit and in this way, an application was additionally evolved to change Text over to Speech. What's more, a Nano Arduino was utilized rather than regular UNO Arduino in the work to altogether lessen the size of the framework which requires four ultrasonic sensors for most amazing aspect is execution. The framework was then installed into a little packaging, situated on an essential situation of a white stick to distinguish beneath midriff snags. The stick was the being effectively approved by work force from Melaka of its effectiveness.

S. A. Hulukati and I. A .Salihi (2020) reported that more extensive the region of the visually impaired, the more troublesome it will be for them to do the exercises completed. This examination expects to build up an instrument that can be utilized to identify snags

for daze people. This device was created with Arduino NANO on account of its little size, so it doesn't meddle with their exercises and force utilization against the speed of low order execution. This apparatus is likewise evolved utilizing a nearness sensor (SRF-04), and GPS Tracking is a distant observing framework that utilizes GPS Satellites as a determinant of the area of vehicles/resources for move precisely and precisely as directions. The apparatus will be planned by the requirements of the visually impaired so they use have a sense of security and agreeable so it is planned with feeling and the situation of the sensor with the design required, in view of the aftereffects of testing the visually impaired visual guide to work accurately if objects are identified by closeness sensor and instrument doesn't work if this device is to distinguish openings in light of the fact that the sensor utilized is a distance sensor with a distance of 0 - 60 CM and GPS following can peruse the situation of the client well with the situation on scope: 0.555698 and longitude:123.056655.

Dr.M.S.S.Sai et. al., (2020) reported that the Outwardly Impaired are those people who have vision disaster or vision impedance. Issues looked by ostensibly impaired in actualizing step by step practices are in unfathomably enormous. They in like manner confronting more difficulties in cash related trades. They can't see the paper cash structures due to likeness of paper surface and size between different classes. This application makes the ostensibly incapacitated patients see and recognize money. Using this application daze people can talk and give request to open camera of a high level cell phone and camera will click picture of the note and tell the customer by talk how a ton of the money note is. For cash acknowledgment, this application uses Azure custom vision API using Machine learning game plan methodology to perceive money subject to pictures or paper using versatile camera.

K.V.Pramoda et. al., (2020) reported that Blindness is one the issues over which people actually have no control. It removes the actual right of the individual to observe the never-ending visual magnificence of the world from one's life. However, on the opposite side, the concerns are much more terrible, the unlimited issues looked by them during performing even the least difficult of the undertakings in everyday life impedes their existence. Being autonomous is the correct that everybody is brought into the world with,

which is to live and lead existence without being constrained by any activity, or intuition from any outer variables is legitimately named as being independent. Traveling is the most prevailing issue for individuals with visual deficiency, for example during finding a vehicle, going across streets, going through trains or transport, and it turns into an inconceivable errand to drive through open places. These issues lead to their absence of certainty and even crumble their wellbeing. With the current innovation driven time arrangement lies in building up a brilliant stick which empowers individuals without breaking a sweat their issues and assist them with excursion undertakings. In this manner the proposed work gives a brilliant stick for individuals with visual impairment. It is created and planned utilizing Ultrasonic sensors, GPS module and can give voice order to individuals through headsets. There by assisting individuals with visual impairment to securely explore through open places autonomously and helping in completing dailytasks.

Nazmat Surajudeen-Bakinde et. al., (2020) proposed a strategy for the advancement of a Li-Fi system utilizing off the shelf electronic parts. The proposed framework uses an installed framework with double center Advanced Virtual RISC (AVR) microcontroller (ATmega16L) interfaced with an information/yield circuit including the Light Emitting Diode (LED), LM358N Operational Amplifier and a photodiode. Additionally, by building up a client (Receiver PC) interface utilizing JAVA programming, the example information (text) moved was checked and the speed, proficiency, security and limit of the framework was inspected and found to be first class. This would make the framework an irreplaceable methods for correspondence in the closest future. This information transmission framework is not quite the same as those in presence in light of the fact that costly segments were not in the plan, perpetually decreasing the general expense of the usage.

Arnesh Sen Kaustav Sen Jayoti Das (2018) planned a artificial navigation system with flexible affectability with the assistance of ultrasonic closeness sensor and a GPS module to help these visually impaired people to walk valiantly and freely in both indoor and outside climate. This framework can distinguish any sort of forthcoming hindrances and pot holes utilizing the reflection properties of ultrasound. Connection of the framework to the garments, shoe, body zone and just as to the strolling stick make its usage more adaptable and dependable.

Manoj Kumar et. al., (2017) proposed a venture which first uses ultrasonic sensors to distinguish impediments ahead utilizing ultrasonic waves. On detecting impediments the sensor passes this information to the microcontroller. The microcontroller then cycles this information and ascertains if the snag is sufficiently close. On the off chance that the hindrance isn't that nearby the circuit sits idle. In the event that the deterrent is close the microcontroller imparts a sign to pivot the motor which thusly turns the wheel when obstruction is recognized so the visually impaired won't get disappointed because of ceaseless disturbing sound of ringer and he/she can explore effectively along the way. The framework has one further developed component incorporated to help the visually impaired discover their stick in the event that they fail to remember where they kept it. A remote RF based distant is utilized for this reason. Squeezing the far off button sounds a signal on the stick which encourages the visually impaired individual to discover their stick. Subsequently this framework considers obstruction discovery just as discovering stick whenever lost by outwardly incapacitated individuals.

M.J.Ahanaa et. al.,(2018) introduced that the keen strolling stick encourages daze individuals to perform route and to take care of their job effectively and easily. In ordinary stick, the identification of the deterrent isn't done and typical stick isn't effective for outwardly debilitated people. Since the visually impaired individual doesn't have the foggiest idea what kind of things or what sort of the items come before the person in question. The individual can't perceive what the size of that item is and how far is he/she from the article. It is hard for daze individual to move to a great extent. In brilliant strolling stick, the item is recognized with the assistance of a camera and furthermore it gauges the distance between objects by utilizing ultrasonic sensor. On the off chance that any obstruction comes before daze individual, he/she can think about the hindrance by hearing the sound created by the earphone. The framework is extremely valuable for individuals who are outwardly weakened and are frequently need assistance from others.

CHAPTER - 3

AIM AND SCOPE

3.1 AIM:

The Main Aim of this work is to propose a shrewd shoe to direct visually impaired individuals

- Utilizing li-fi innovation which uses light to send information and position between gadgets.
- To navigate by voice orders which are passed on through light sources in their way.
- To recognize Obstacles from 4cm to 150 cm.
- To recognize dump and fluid sort of impediments and others utilizing water sensor.
- To utilize sun based force back up in the shoe or a piezo plate to charge the battery.

3.2 SCOPE:

The project work has the scope of giving easy navigation to the visually impaired individuals

It is versatile and there is no need for the utilization of visually impaired stick independently for the visually impaired individual.

Presenting this Indoor Navigation innovation will make life of the visually impaired individual easier.

They don't have to rely upon another person for help or directing.

3.3 EXISTING SYSTEM:

The day to day life of a visually impaired individual is influenced generally by route and portability issues. The most seasoned and customary versatility helps for people with visual disabilities are the strolling stick and guide canines.

3.4 PROPOSED SYSTEM:

The proposed system has a point when the Ultrasonic Sensor identifies an obstruction in the way of the shoe, it imparts sign to the Microcontroller. The kit would help the Water sensor imparts sign to the Microcontroller when it identifies water. Since the product is introduced in the microcontroller to caution the individual at whatever point a hindrance is identified, a voice signal is played by it through the speaker.

3.5 ADVANTAGES:

- No hurtful beams that influence human existence.
- Energy utilization is exceptionally less.
- GPS Network Not Necessary
- Efficient and Ease.

3.6 APPLICATIONS:

- Administrations gave dependent on the spot.
- Shrewd Location Finder.
- Wi-Fi range alleviation
- Shrewd lighting

CHAPTER – 4

MATERIALS AND METHODS

4.1: METHODOLOGY:

At the point when the Ultrasonic Sensor identifies an obstruction in the way of the shoe, it imparts sign to the Microcontroller. Also the Water sensor imparts sign to the Microcontroller when it identifies water. As the product is introduced in the microcontroller to caution the individual at whatever point a hindrance is identified, a voice signal is played by it through the speaker. The Li-Fi module is a different circuit which are to be set on different areas in the general public. The Li-Fi module produces LED which communicates information to the shoe module. The Li-Fi recipient at the shoe detects this signal and the Microcontroller plays this information through the speaker. For the model to communicate distinctive information, the 5 keypad is utilized. The information is imparted just when the LED light falls on the Photo diode.

4.1.1 BLOCK DIAGRAM:

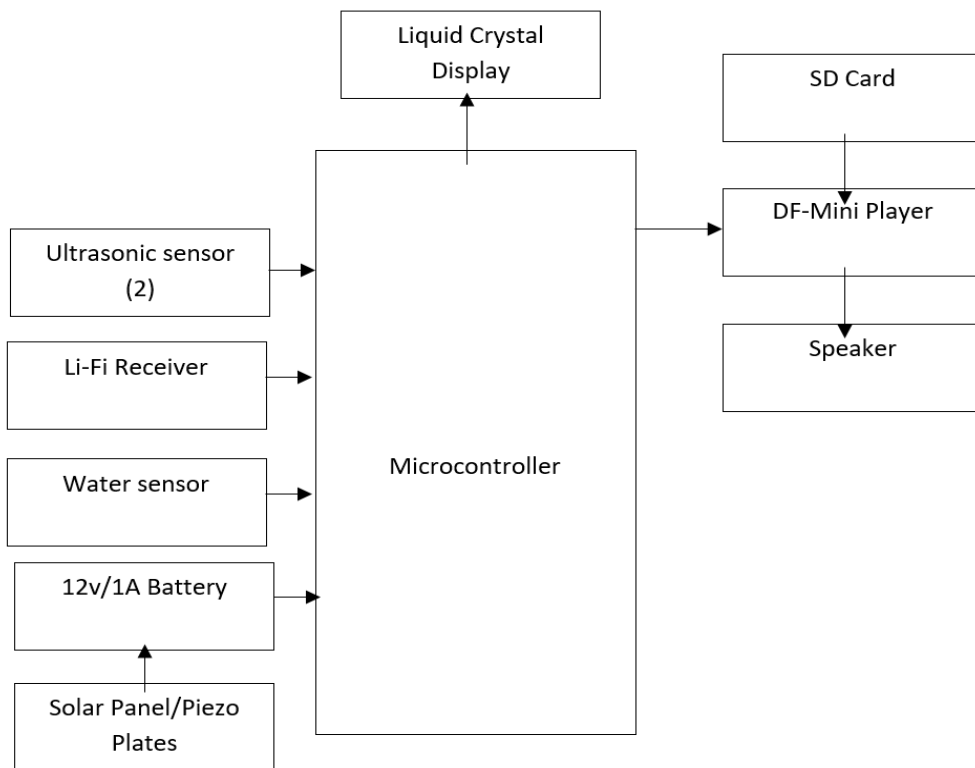


Figure 4.1 Block diagram of Shoe Kit (Receiver Side)

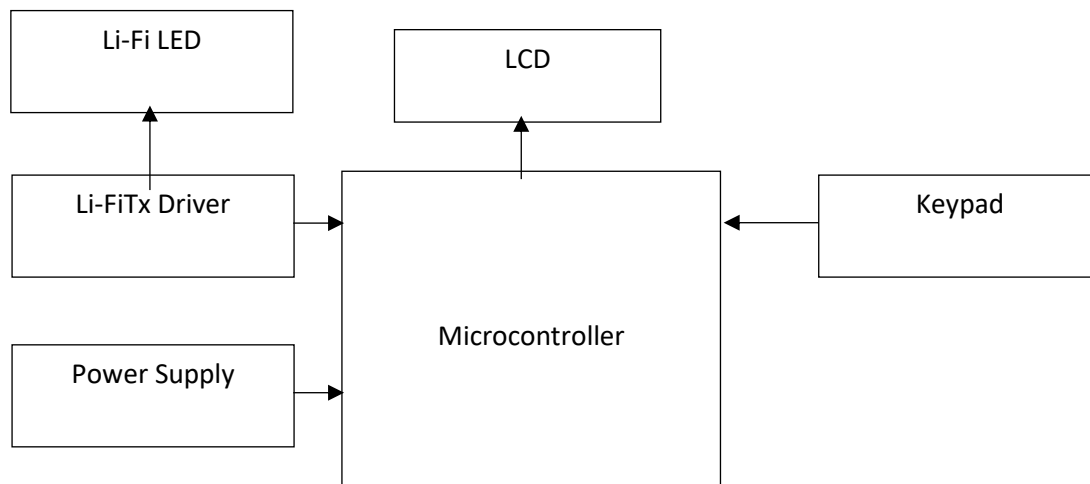


Figure 4.2 Block diagram of the Li-Fi kit (Transmitter Side)

4.1.2 Block diagram Explanation:

In our idea there are 2 equipment devices. One is the transmitter side and the other is the recipient side. The collector side of the gadget will be joined to a shoe and it will be charged through a battery. The transmitter side is fueled through a typical force supply as 230V and we have a transformer for charging the transmitter unit. The shoe module or the recipient side comprises of two ultrasonic sensors set on the front and side of the shoe for Obstacle discovery. Water sensor is additionally appended along the edge of the shoe to recognize watery substances The Microcontroller Used here is Arduino Nano Atmega 328P which interfaces with DF Mini Player and a Speaker which gives the voice sound yield after impediment or water detection. A Li-fi Receiver to get the information from the transmitter side or Li-fi module. A LCD screen is likewise associated with show the information got. A 12V/1A battery is utilized as a force supply in the recipient side. A Solar Panel or a piezo plate could likewise be utilized to re-energize the battery.

In the Transmitter side or the Li fi module, we utilize a transformer as a force hotspot for charging the pack. The miniature regulator utilized is Arduino Uno Atmega 328P which interfaces with a Li-fi LED and a Li-fi Tx Driver which sends the glimmering light as told by the regulator. It is a Li-fi transmitter which communicates the information through the Li-fi LED while glimmering. A keypad is utilized for changing the information being sent. A LCD

screen is likewise associated with show the information being communicated at the transmitter side or Li-fi module.

4.2 HARDWARE USED AS “RECEIVER KIT”:

The Receiver Kit (Shoe) contains:

- Arduino Nano At mega 328p
- Ultrasonic Sensor
- Water level sensor
- Li-Fi receiver
- DF Mini Player
- Speaker
- Solar Panel and Piezo electric plate
- 12V/1.3A Battery
- LCD display

4.2.1 Arduino Nano At mega 328p:

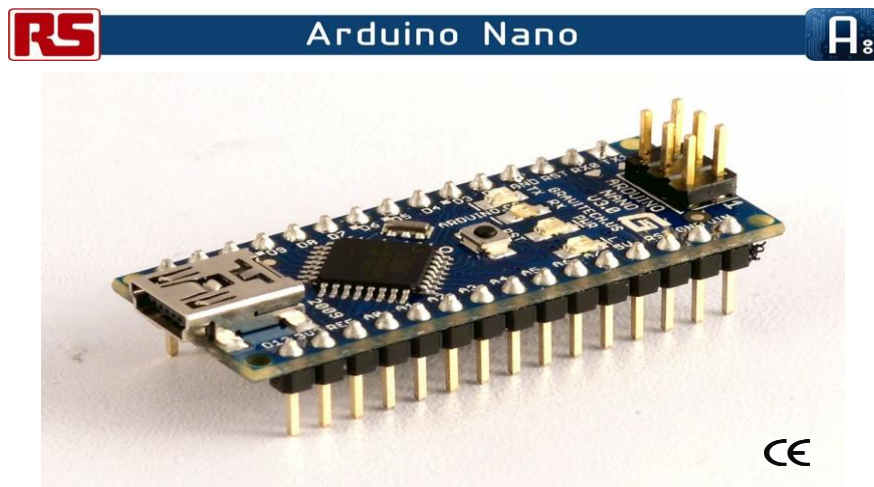


Figure: 4.3 Arduino Nano

The ArduinoNano is a little, complete, and breadboard-accommodating board dependent on the ATmega328 (ArduinoNano 3.0) or ATmega168 (ArduinoNano 2.x). It has pretty much a similar usefulness of the Arduino UNO, however in an alternate bundle.

It needs just a DC power jack, and works with a Mini-B USB link rather than a standard one. The Nano was planned and is being created by Gravitech.

In our idea it is the primary regulator in the Shoe module or the recipient side. It gets the contribution from every one of the sensors associated with it and gives the yield through the speaker

4.2.2 Ultrasonic Sensor HC-SR04:



Vcc Trig Echo GND

Figure: 4.4 Ultrasonic Sensor

Product features:

Ultrasonic running module HC - SR04 is utilized to decide the distance of an item and gives 4cm - 150cm non-contact estimation work, the going precision can reach to 3mm. The modules incorporates ultrasonic transmitters, collector and control circuit.

The essential rule of work:

1. Using IO trigger for at any rate 10us significant level sign,
2. The Module naturally sends eight 40 kHz and distinguish whether there is a pulse signal back.
3. IF the sign back, through significant level , season of high yield IO term is the

time from sending ultrasonic to returning.

Test distance = (significant level time × velocity of sound (340M/S))/2,
In our idea there are two ultrasonic sensors put on the front and side of the shoe. The ultrasonic sensor recognizes the presence of a deterrent in the way of the shoe. When the obstruction is distinguished a sound yield will be played through the DF audio player to the individual.

Wire connecting direct as following:

- 5VSupply
- Trigger Pulse Input
- Echo Pulse Output
- 0VGround

4.2.3 Water Level Sensor:



Figure: 4.5 Water Sensor

Product Introduction:

The Water sensor is a gadget used to recognize the presence of water for purposes, for example, to give an alarm to permit the anticipation of water surface. It is a simple sensor on the grounds that the explanation is water resistivity that is up to which level it directs the ebb and flow. In light of that it will recognize the water.

This Water Sensor is an Easy to utilize, smaller and light weight, significant expense of water, drops distinguishing proof and identification sensors. This sensor is working the guideline is to quantify the size of the follow measure of water beads through the line with a progression of equal wires uncovered. And

homegrown and unfamiliar Products analyzed not just little , amazing, and keenly planned with the accompanying highlights : First, the measure of water to recreate Conversion ; Second, versatility, in light of the sensor yield simple qualities ; Third, low force utilization , high affectability ;Fourth, can Directly associated with a microchip or other rationale hardware , and the regulator board for an assortment of, for instance : Arduino Controller, STC microcontroller , AVR microcontroller, etc.

In our idea the water sensor is joined to the side of the shoe. It recognizes the presence of water in the way of the shoe and imparts the sign to the regulator. At the point when the water is being distinguished it gives a sound alarm to the individual through the DF audio player and speaker.

4.2.4 Li-Fi Receiver:

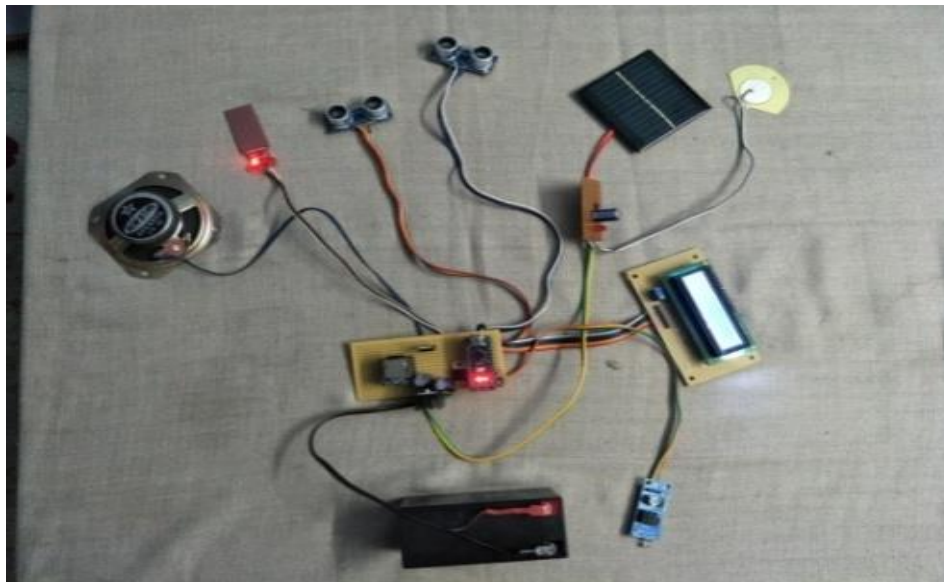


Figure: 4.6 Li-Fi Receiver

It is an IR sensor with a Photo diode. It is joined to the shoe module (receiver side).The photodiode is the Li-fi recipient here. It distinguishes the LED and sends it to the Micro controller for analyzing. In light of the information got it will give a sound yield to client. The receiver is indispensable in changing over the noticeable light waves created by LED's into electronic signals. The signals are then decoded into sound or text documents on an associated gadget.

PHOTODIODE

Photo Diode



Figure: 4.7 Photodiode

A Photodiode is a semiconductor p-n junction gadget that converts light into an electrical flow. When the photons are caught up in the photodiode, current is produced. Photo diodes may contain optical channels, worked in focal points, and may have enormous or little surface zones. In our idea it used to get the information sent by the Li-fi transmitter.

4.2.5 DF Mini Player:

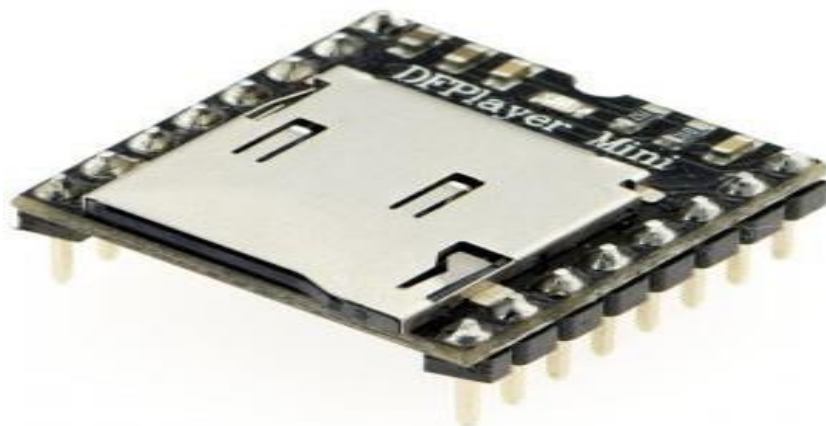


Figure: 4.8 DF Mini Player

The DF Player Mini is a little and ease MP3 module with an improved on yield straightforwardly to the speaker. The module can be utilized as an independent module with connected battery, speaker and press fastens or utilized in mix with an Arduino UNO or some other with RX/TX capacities.

The DF Player impeccably incorporates hard unraveling module, which upholds normal sound configurations like MP3, WAV and WMA. Other than, it additionally underpins TF card with FAT16, FAT32 record framework through a straightforward sequential port, you can play the assigned music with no other monotonous fundamental tasks.

In Our idea it is associated in the miniature regulator of the shoe module or the beneficiary side. It is the SD card Slot, where the orders to be played are put away. It is utilized to give the sound yield after hindrance or water identification.

4.2.6 Speaker:



Figure: 4.9 Speaker

A Speaker is utilized to give alarms to the visually impaired individual when a hindrance or water is being identified, through voice orders. It is incorporated with a voice recorder to give custom voice cautions to demonstrating the position or bearing of the deterrents

at the way and furthermore during water identification. It also gives the audio output of the data received from the Li-fi transmitter.

4.2.7 Solar Panel and Piezo electric plate:

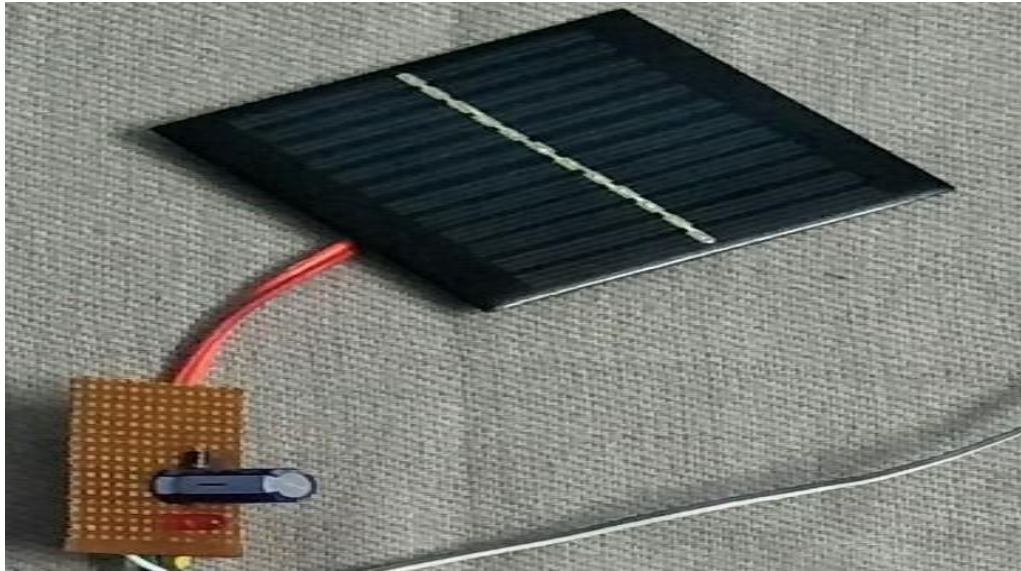


Figure: 4.10 Solar Panel

The term sunlight based Panel is utilized for a Photo voltaic module which is only a get together of photo voltaic cells mounted in a structure for establishment. It is used to change over light from the sun, which is made out of particles of energy considered photons into power that can be utilized to control the battery. It is utilized for charging the battery. In our idea as it is fixed to the shoe module, when presented to daylight or some other light source it would re-energize the battery consequently.



Figure: 4.11 Piezoelectric plate

It is a gadget that utilizes the piezoelectric impact to gauge the pressing factor, increasing speed, strain or power by changing them over to an electrical charge. The Piezoelectric impact is the capacity of specific materials to produce an electric charge in light of applied mechanical anxieties. It is utilized for charging a battery. In our idea as it is fixed to the shoe module, it will re-energize the battery consequently because of the pressure applied while strolling.

4.2.8 12V/1.3AH Battery:



Figure: 4.12 12V/1.3AH Sealed Lead Acid Battery

- The 'Online' scope of fixed lead corrosive batteries are without upkeep, valve directed and airtight unmistakably fit to every 'backup application's
- There will be no misfortune in influence yield over the battery life.
- Low self-release of around 2-3% each month contrasted and 20-30% for more normal battery frameworks.
- Quality development with no trade off on materials to guarantee a long assistance life.
- Low inner obstruction implies a high release rate.
- Wide working temperature range working between - 15° C to +50 ° C when completely energized.

- In our idea we are utilizing a 12V 1.3 AH fixed lead corrosive battery to give power supply to the regulator in the shoe module (receiver side) which thusly takes care of the necessary capacity to all sensors and modules associated with it.

Dimensions:

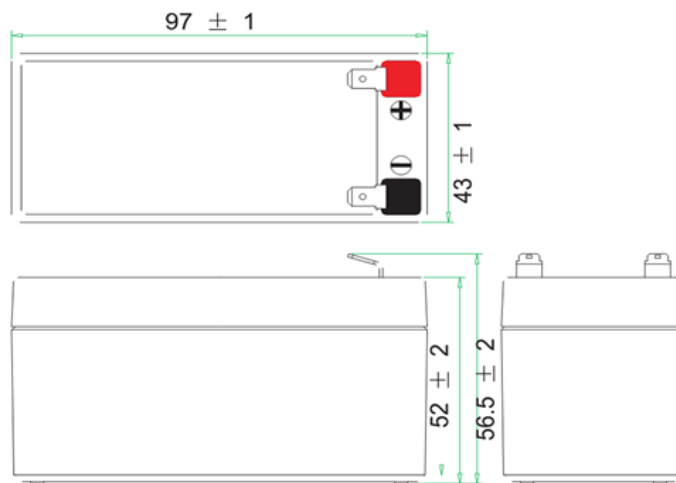


Figure: 4.13 Dimensions of battery

Applications:

- Lighting Equipment
- Emergency Lighting
- Toys & Consumer Electronics
- Fire Alarm & Security Systems

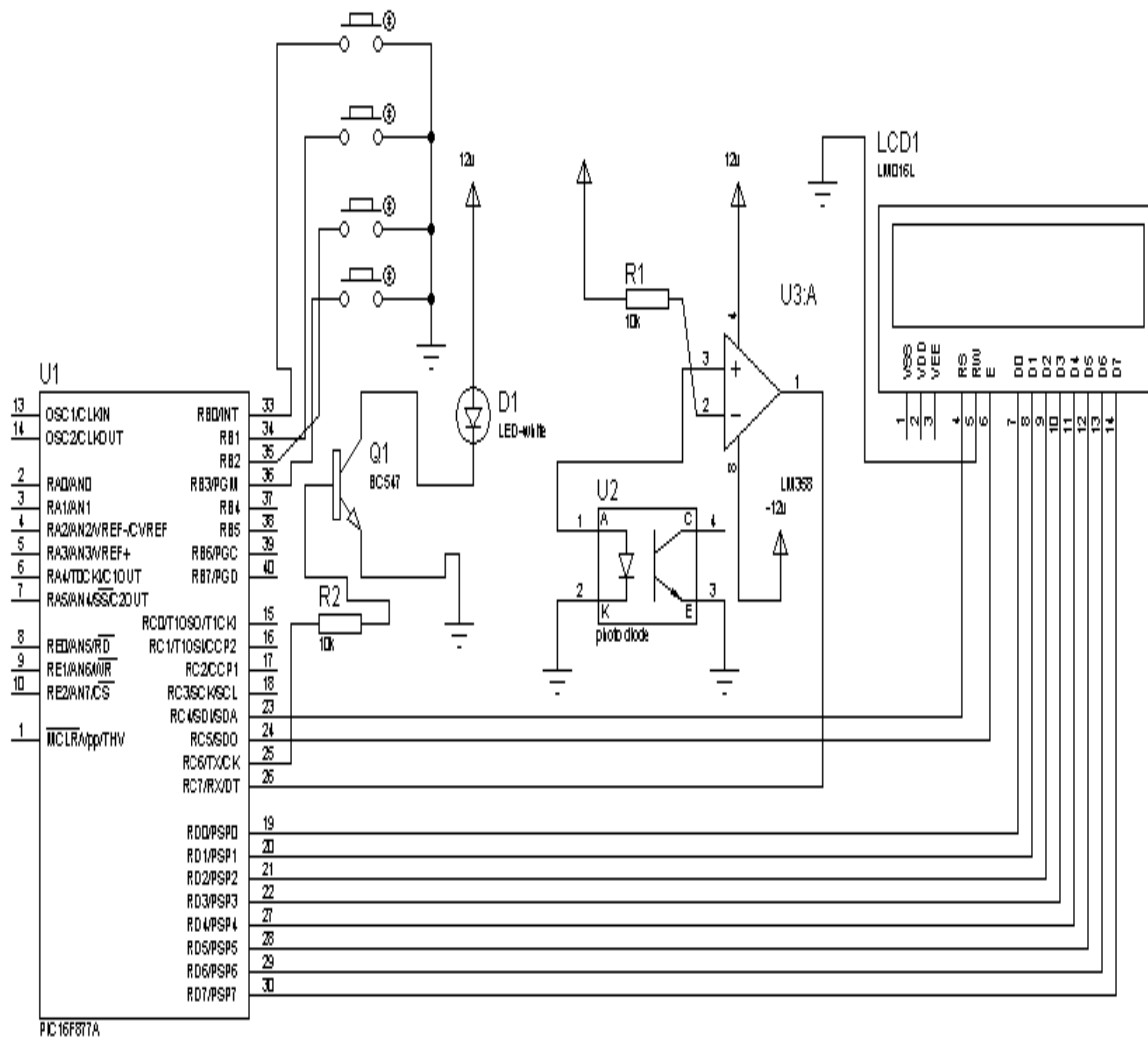
4.2.9 Liquid Crystal Display (LCD)



Figure 4.14 LCD display

Description on LCD:

1. The contrast between 4 bit and 8 bit activity is that information is conveyed as nibble rather than as one byte.
2. D3:0 are not utilized on the LCD when the module is worked in 4-bit mode and D7:4 are utilized to move nibble to/from the LCD module. Note: D7 is the MSB.
3. Commands and information are as yet 8 bits in length, yet are moved as referenced above as two 4-bit nibbles on information transport lines D7:4
4. The hugest nibble ought to be moved first, trailed by the un-huge nibble.
5. The ideal difference for the LCD is 3.3 - 3.7V.



Brief Description of LCD Modules

A Liquid Crystal Display (LCD) is a level board show or an optical gadget that utilizes the light-adjusting properties of fluid crystal joined with polarizers. It is utilized to show the yield information got or sent in the gadget. The LCD modules are regularly utilized in most implanted undertakings, the explanation being its modest value, accessibility and software engineer amicable. The greater part of us would have gone over these presentations in our everyday life, either at PCO's or number crunchers. 16×2 LCD is named so in light of the fact that; it has 16 Columns and 2 Rows. There are a ton of blends accessible like, 8×1, 8×2, 10×2, 16×1, and so on however the most utilized one is the 16×2 LCD. Thus, it will have $(16 \times 2 = 32)$ 32 characters altogether and each character will be made of 5×8 Pixel Dots. The 16 x 2 canny alphanumeric speck network show is equipped for showing 224 distinct characters and images. This LCD has two registers in particular Command and Data.

Presently, we realize that each character has $(5 \times 8 = 40)$ 40 Pixels and for 32 Characters we will have (32×40) 1280 Pixels. Further, the LCD ought to likewise be told about the Position of the Pixels. Subsequently it will be a chaotic errand to deal with everything with the assistance of MCU, thus an Interface IC like HD44780 is utilized, which is mounted on the rear of the LCD Module itself. The capacity of this IC is to get the Commands and Data from the MCU and interaction them to show important data onto our LCD Screen.

In our idea we have associated LCD in both the Shoe module (Receiver side) just as in the Li-fi module (Transmitter side). In the recipient side it shows the information being gotten by Li-fi receiver from the LED and furthermore demonstrates the position or bearing of the obstruction recognized and furthermore demonstrates when water is being identified. While in the transmitter side it is utilized to show the information being communicated by the LED on order of the regulator.

4.3 HARDWARE USED AS “LI-FI KIT”

The Li-Fi Kit(Transmitter Side) contains:

- Arduino UNO

- Li-Fi transmitter
- LCD
- Transformer power supply
- Keypad

4.3.1 Arduino UNO:

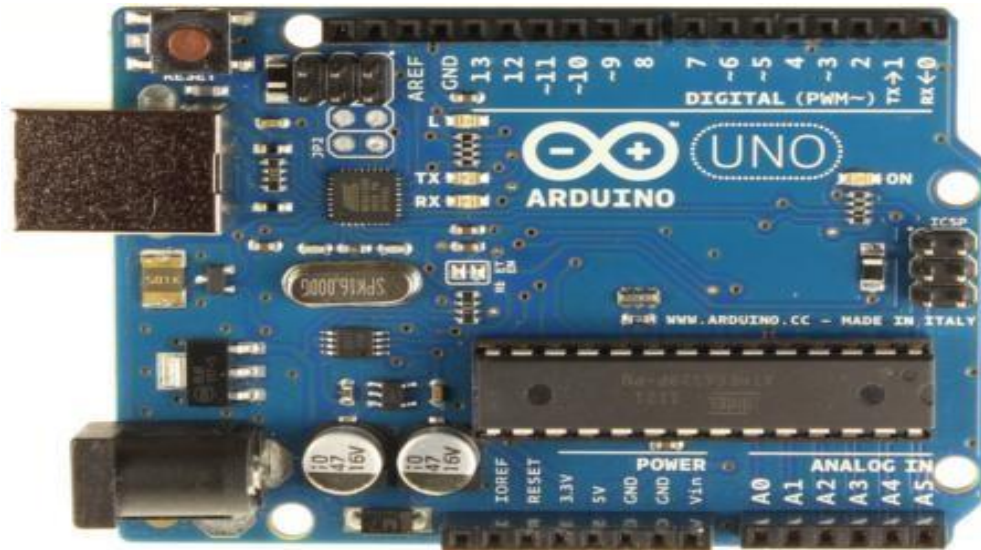


Figure: 4.16 Arduino Uno R3 Front

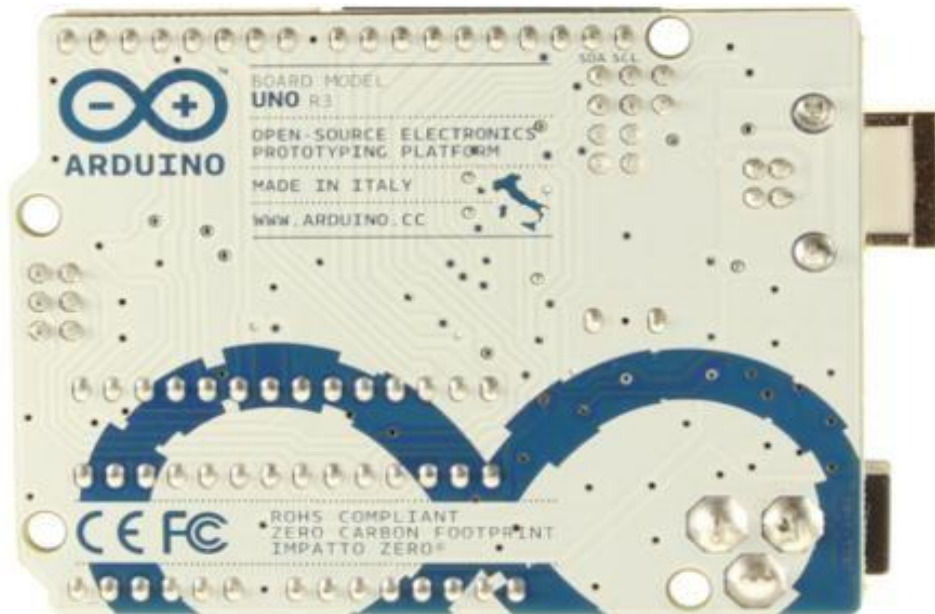


Figure: 4.17 Arduino Uno R3 Back

The Arduino Uno is an ATmega328 dependent Microcontroller board. It has 14 computerized input/output pins (of which 6 can be utilized as PWM yields), 6 simple data sources, a 16 MHz quartz resonator, a USB association, a power jack, an ICSP header, and a reset button. It contains all that expected to help the microcontroller; just associate it to a PC with a USB link or power it with an AC-to-DC connector or battery to begin.

In our idea it is the principle regulator in the li-fi module or the transmitter side. It gets order from the Keypad and shows the yield or the information sent in the LCD screen and sends the glowing light through LED.

4.3.2 LI-FI TRANSMITTER DRIVER (LI-FI Tx driver):

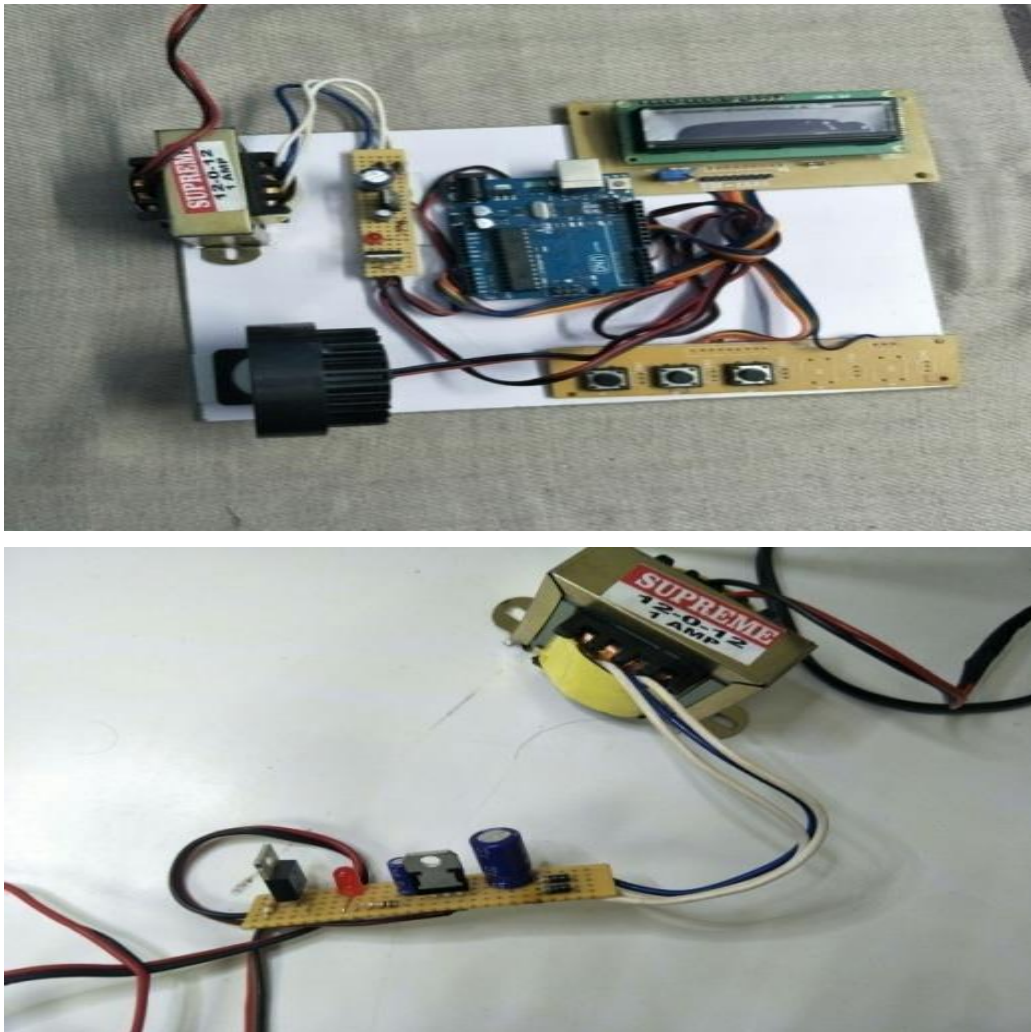


Figure: 4.18 Li-Fi Transmitter

The LED source in the transmitter unit is the Li-fi transmitter. It sends gleaming light as directed by the Microcontroller. While glinting the information will be communicated through the Li-Fi LED light. It uses light to send information and position between gadgets.

Li-Fi LED

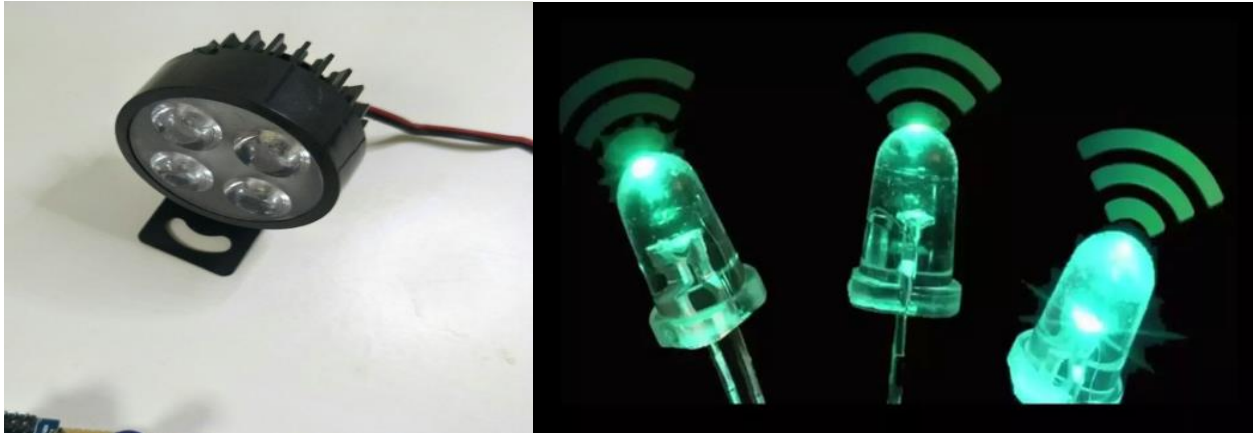


Figure: 4.19 Li-fi LED

Li-Fi transforms LED lights into web and broadcast information transmitters, making another type of rapid, optical remote correspondence that use the obvious and infrared (IR) light ranges. It transmits the data to the receiver as the flickering of light occurs.

IRFZ44 N-Channel MOSFET



Figure: 4.20 IRFZ44N – Channel MOSFET

The IRFZ44N is an N-channel MOSFET with a high channel current of 49A and low Rds estimation of 17.5 mΩ. It additionally has a low limit voltage of 4V at which the MOSFET will begin directing. Subsequently it is ordinarily utilized with microcontrollers to drive with 5V. Anyway a driver circuit is required if the MOSFET must be exchanged in totally.

Pin Configuration:

Table no. : 4.1 IRFZ44N MOSFET PIN Configuration

Pin Number	Pin Name	Description
1	Gate	Controls the biasing of the MOSFET
2	Drain	Current flows in through the Drain
3	Source	Current flows out through Source

USAGE OF IRFZ44N

The IRFZ44N is known for its high channel current and fast switching speed. For instance in a LED Light in any event, when the light switches for several times it won't be harmed rapidly due to its fast switching speed. Adding to that it likewise has a low Rds value which will help in expanding the productivity of switching circuits. The MOSFET will begin turning on with a small gateway voltage of 4V, however the channel current will be most extreme just when a gate voltage of 10V is applied. On the off chance that the MOSFET must be driven straightforwardly from a microcontroller like Arduino at that point attempt the logic level version IRLZ44N MOSFET.

IRFZ44N with 5V gate (Arduino)

On the off chance that the MOSFET gate pin is straightforwardly associated with an I/O pin of a microcontroller like, etc. At that point it won't open totally and the most extreme channel current will rely upon the voltage applied to the gate pin.

Applications:

- Switching high power devices
- Control speed of motors
- LED dimmers or flashers
- High Speed switching applications
- Converters or Inverter circuits

4.3.3 Transformer (Power Supply):

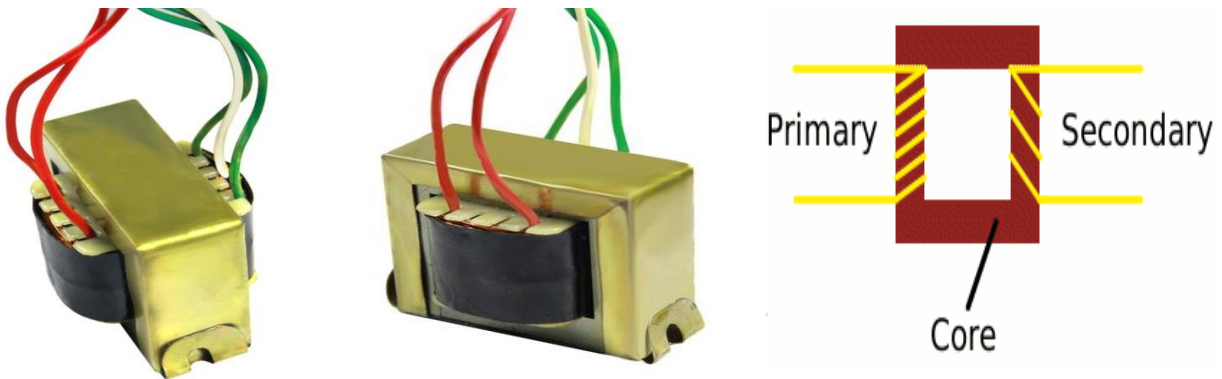


Figure: 4.21 Step down transformer

Step down Transformer:

A Step-down transformer cut the voltage into half and supplies to the gadget in like manner. It includes electrical segregation, voltage appropriation and control and it helps in energy saving. It is intended to diminish the voltage from primary to secondary. The change proportion of a transformer will be equivalent to the square base of its primary to secondary inductance (L) proportion. On the off chance that the first coil has more turns than the second coil, the auxiliary voltage is more modest than the essential voltage. This is known as a step down transformer. In the event that the second coil has half however many turns as the first loop, the secondary voltage will be a half portion of the size of the primary voltage; if the second coil has one 10th as numerous turns it has one 10th the voltage.

In general:

Secondary voltage ÷ Primary voltage = Number of turns in
secondary ÷ Number of turns in primary $\frac{V_S}{V_P} = \frac{N_S}{N_P}$

The current is transformed the opposite way—increased in size—in a step-down transformer:

Secondary current ÷ Primary current = Number of turns in
primary ÷ Number of turns in secondary $\frac{I_S}{I_P} = \frac{N_P}{N_S}$

So step down transformer with 100 coils in the primary and 10 loops in the secondary will lessen the voltage by a factor of 10 however duplicate the current by a factor of 10 simultaneously. The force is equivalent to the current occasions the voltage (watts = volts x amps is one approach to recollect this), so you can see the force in the secondary coil is hypothetically equivalent to the force in the essential coil. (In all actuality, there is some deficiency of force between the primary and the secondary since a portion of the "magnetic flux" spills out of the center, some energy is lost on the grounds that the center warms up, etc.)

In our idea we are utilizing a step down transformer as a power source at the Li-fi module (transmitter side). The supply will be given through the plug point. So it will come as a 230V AC, to cut the voltage that is to change over it as a 12V AC we are utilizing a Step down transformer. Utilizing this it will change over it as a 12V AC supply.

4.3.4 KEYPAD:

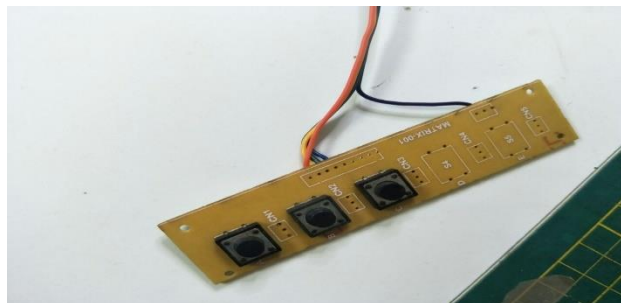


Figure: 4.22 Keypad

The Keypad helps in changing the information being communicated by the LED through the Micro controller. For the model to send distinctive information, the keypad is utilized. The information is conveyed just when the LED light falls on the photo diode. A sound yield will be played in the recipient side(shoe) for every information being sent.

4.3.5 Software Used:

The software used in our concept is Arduino IDE and the programming is done using Embedded C.

4.3.6 Introduction to Arduino:

- Arduino is a solitary board microcontroller to make utilizing hardware in multidisciplinary projects more available.
- The Equipment Comprises of a straight forward open source equipment board planned around an 8-digit Atmel AVR microcontroller, or a 32-bit Atmel ARM.
- The Software comprises of a standard programming language compiler and a boot loader that executes on the microcontroller.

4.3.7 Arduino IDE:

The Arduino Software (IDE) is used to compose code and transfer it to the board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and dependent on Processing and other open-source programming.

For any Arduino board this software can be utilized.

CHAPTER-5

RESULTS AND DISCUSSION

Li-Fi was a rapid remote correspondence like Wi-Fi. Li-Fi when contrasted with Wi-Fi, it was viewed as better compared to Wi-Fi in light of some impediment in Wi-Fi. We have moved the information through LEDs which were reasonable utilizing Li-Fi innovation. It was ease and fast remote correspondence framework, contrasted with Wi-Fi. Li-Fi utilizes a free harmless to the ecosystem range and wasn't influenced by any commotion as found in Wi-Fi. Utilizing Li-Fi in an indoor environment was much protected as there is no chance of light infiltrating through walls.

A computerized line of 1 was communicated and if the LED is ON, the client can send a line of 0 if it's OFF. This is related to switching process which is quick, which gives the transmitting information a moment opportunity. Li-Fi require LOS (line of sight) for communication. The light from the LED was identified by utilizing a light identifier and the information was change to its unique structure to get the necessary yield. Utilizing this innovation, the issue of radio band emergency like in Wi-Fi was arranged. Hence, giving an innovation that bargains ongoing was helpful to route data that empowers a client to settle on convenient and proper choices on which route to continue in an indoor zone.

In our idea there were 2 equipment devices. One was the transmitter side and the other in the recipient side. The collector side of the gadget was joined to a shoe and charged through a battery. The transmitter side was fueled through a typical force supply as 230V and we have a transformer for charging the transmitter unit. The shoe module or the recipient side comprises of two ultrasonic sensors set on the front and side of the shoe for Obstacle discovery. Water sensor was additionally appended along the edge of the shoe to recognize watery substances. The Microcontroller Used here is Arduino Nano Atmega 328P which interfaces with DF Mini Player and a Speaker which gives the voice sound yield after impediment or water detection. A Li-fi Receiver to get the information from the transmitter side or Li-fi module. A LCD screen was likewise associated with show the information got. A 12V/1A battery is utilized as a force supply in the recipient side. A Solar Panel or a piezo plate could likewise be utilized to re-energize the battery.

In the Transmitter side or the Li fi module, we utilized a transformer as a force hotspot for charging the pack. The miniature regulator utilized was Arduino Uno Atmega 328P which interfaces with a Li-fi LED and a Li-fi Tx Driver which sends the glimmering light as told by the regulator. It was a Li-fi transmitter which communicates the information through the Li-fi LED while glimmering. A keypad is utilized for changing the information being sent. A LCD screen was likewise associated with show the information being communicated at the transmitter side or Li-fi module.

5.1 OBSTACLE DETECTION:

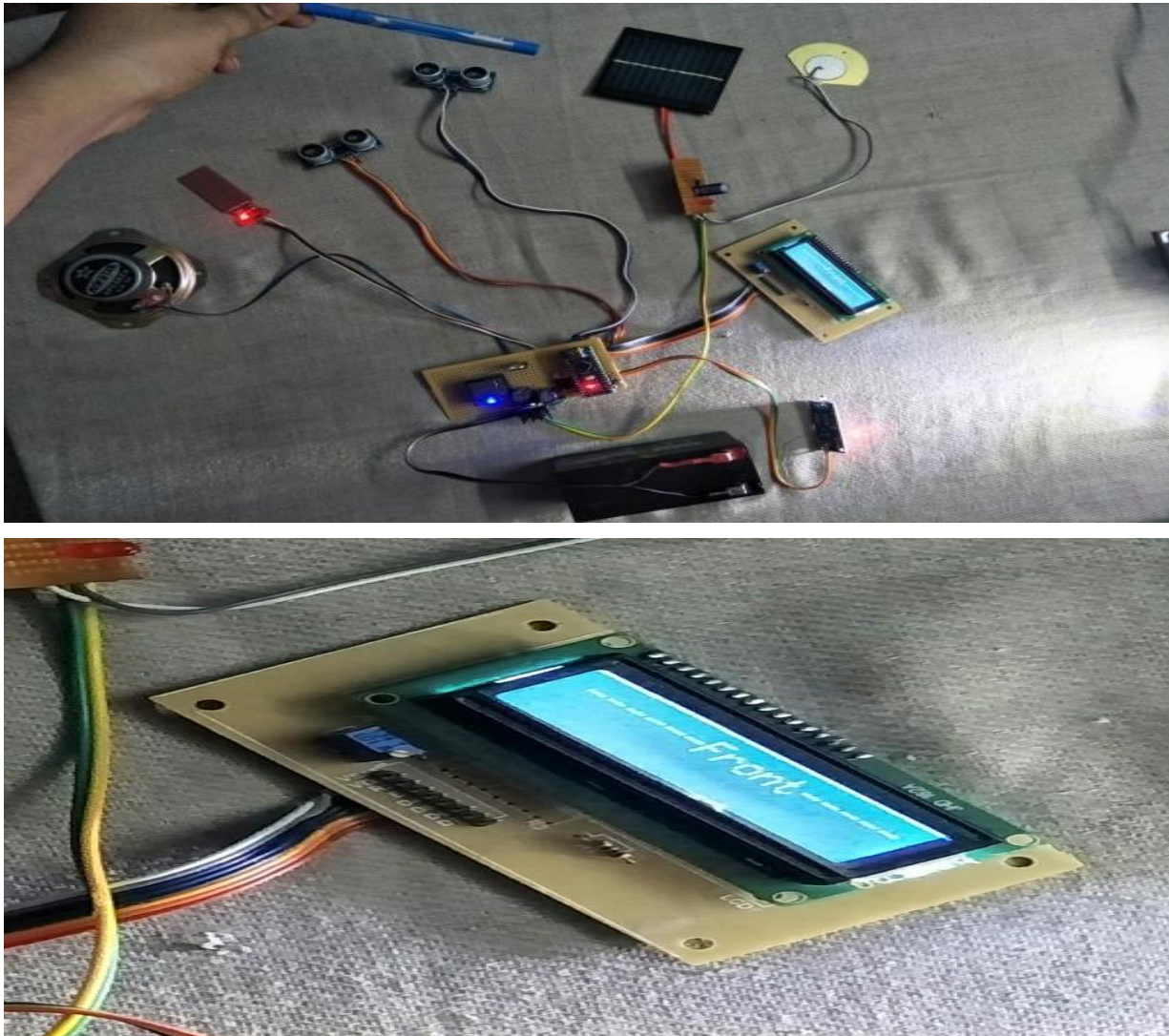


Figure: 5.1 Front Obstacle detected

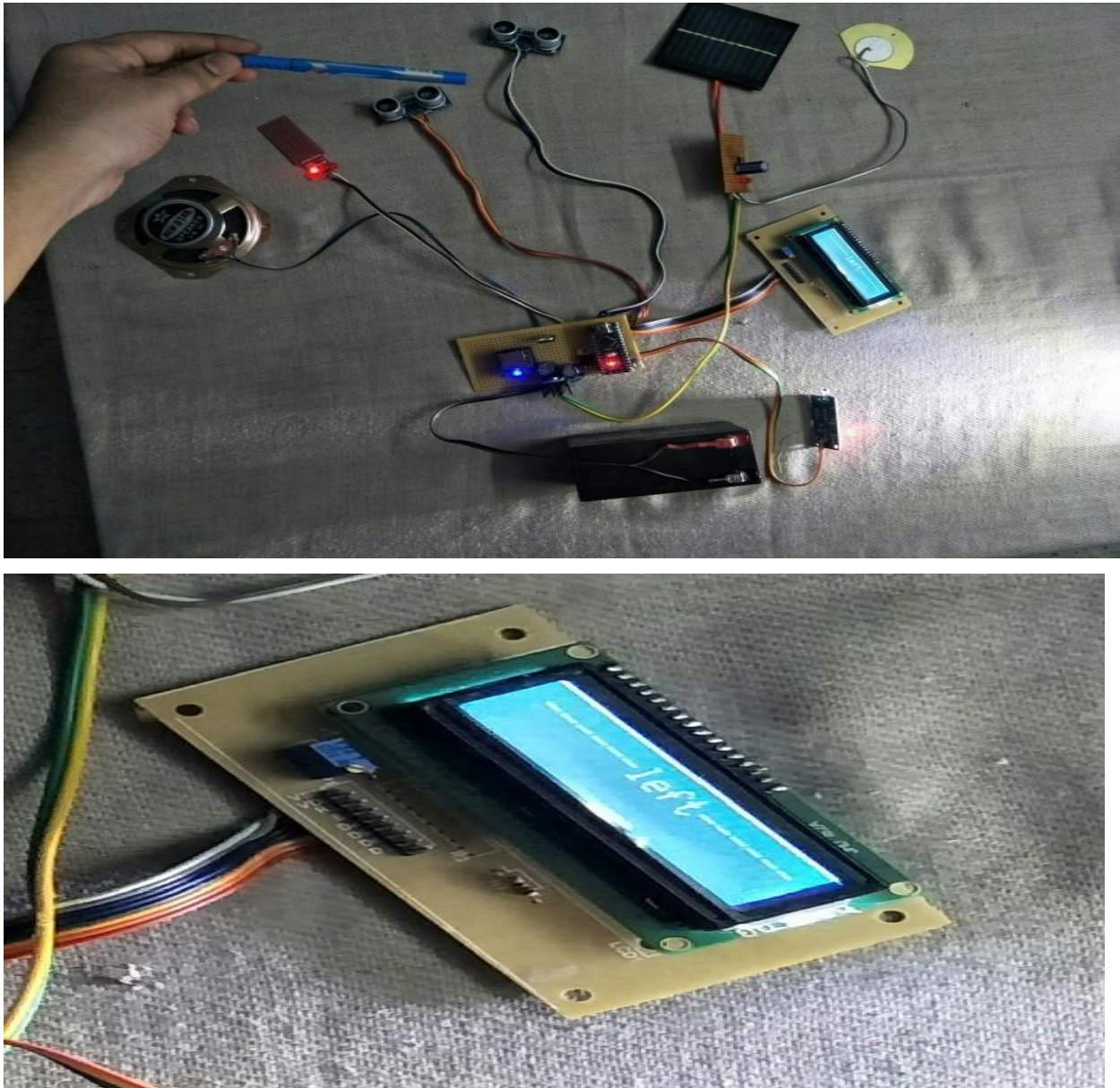


Figure: 5.2 Left Obstacle detected

The two Ultrasonic sensors HC-SR04 put on the front and side of the shoe recognizes the presence of snags in the way of the shoe inside a distance scope of around 10 to 15 cm according to our programming when cruising by. It gives a sound yield through the speaker as "Front Obstacle" or "Left Obstacle" when the impediment is being recognized. What's more, it additionally gives a visual feedback through the LCD screen showing the position or heading of the impediment being detected(Front or Left).

5.2 WATER DETECTION:

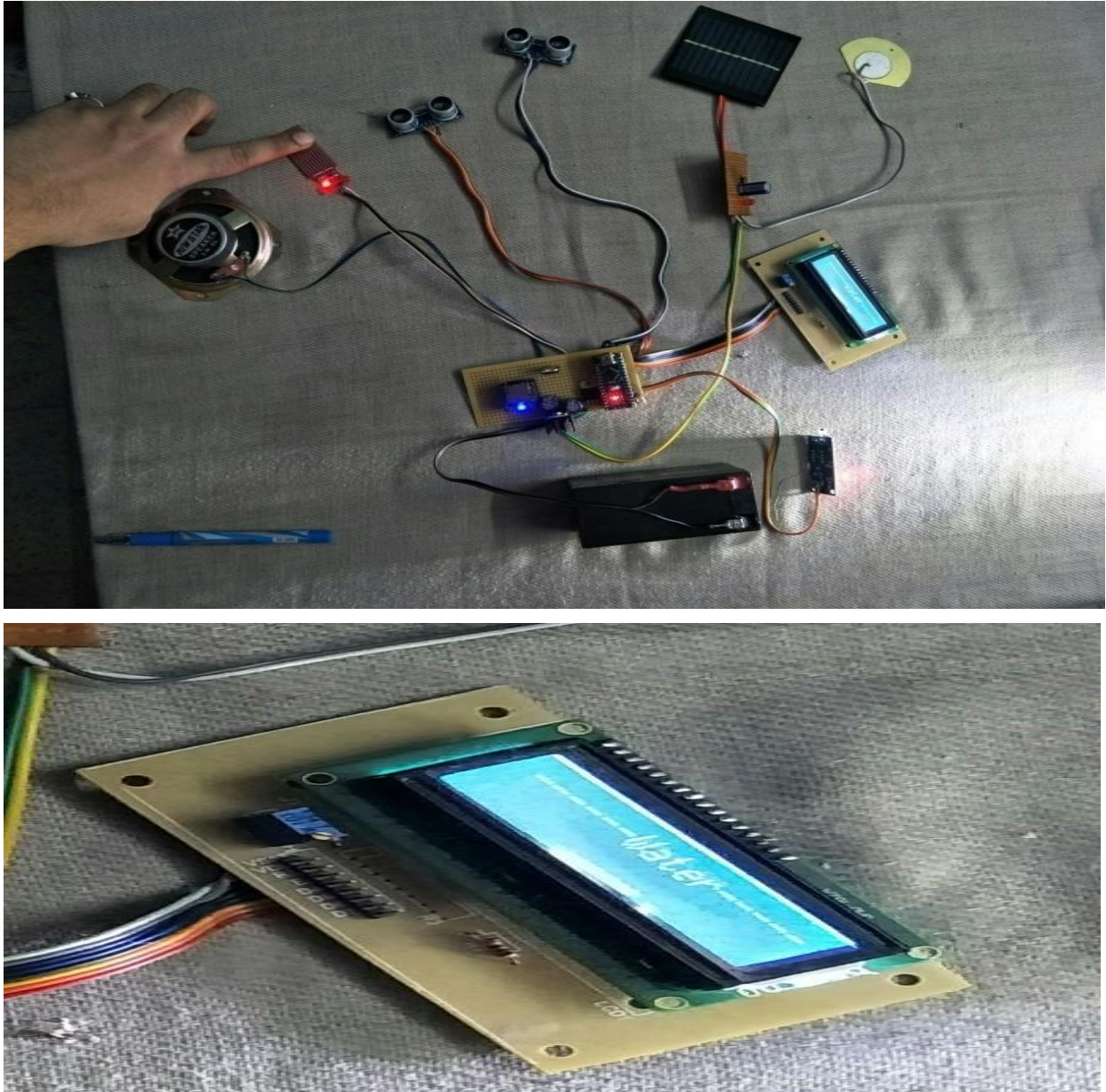


Figure: 5.3 Water detected

The water level sensor joined along the edge of the shoe identifies the presence of water in the way of the shoe and imparts the sign to the Micro controller and a sound yield will be given through the speaker as "Water detected" when the water is being recognized. What's more, it likewise gives a visual criticism through the LCD screen showing "Water" when the water is identified in the way.

5.3 INDOOR LOCATION DETECTION USING LI-FI:

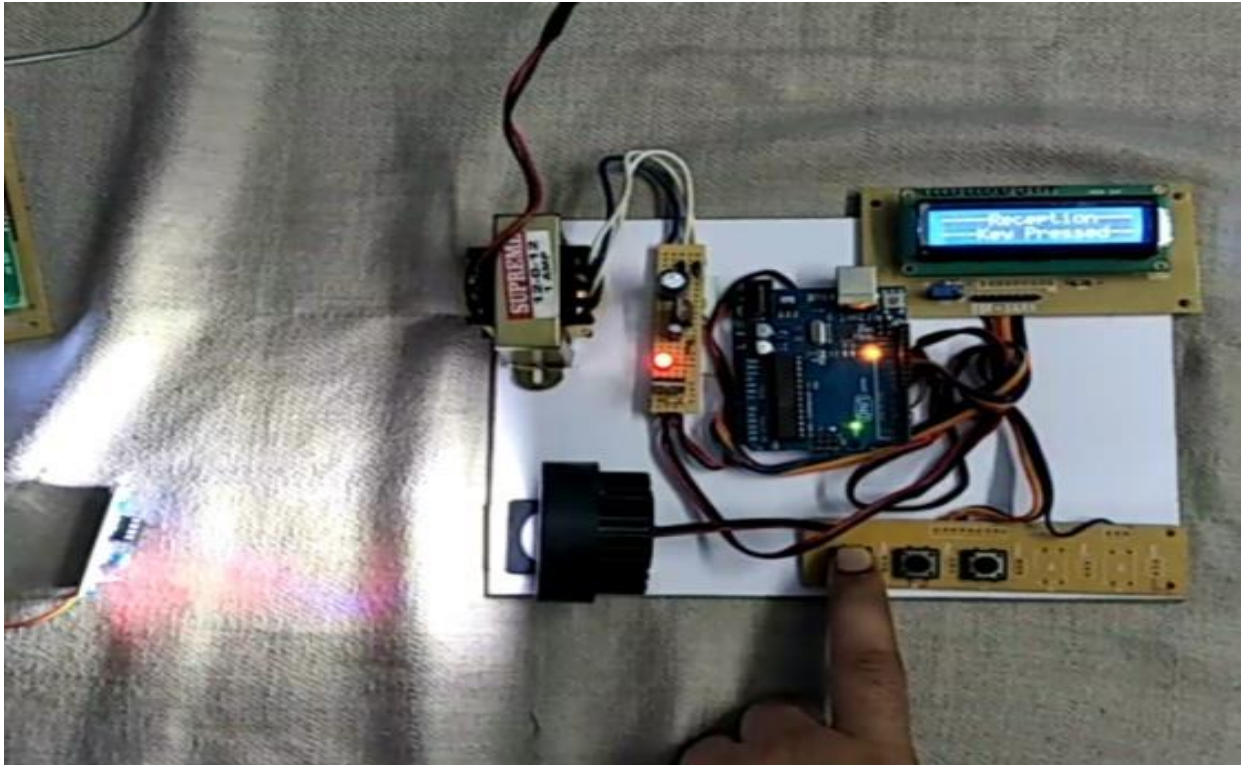


Figure: 5.4 - 1st location data being transmitted and received when pressing Key 1

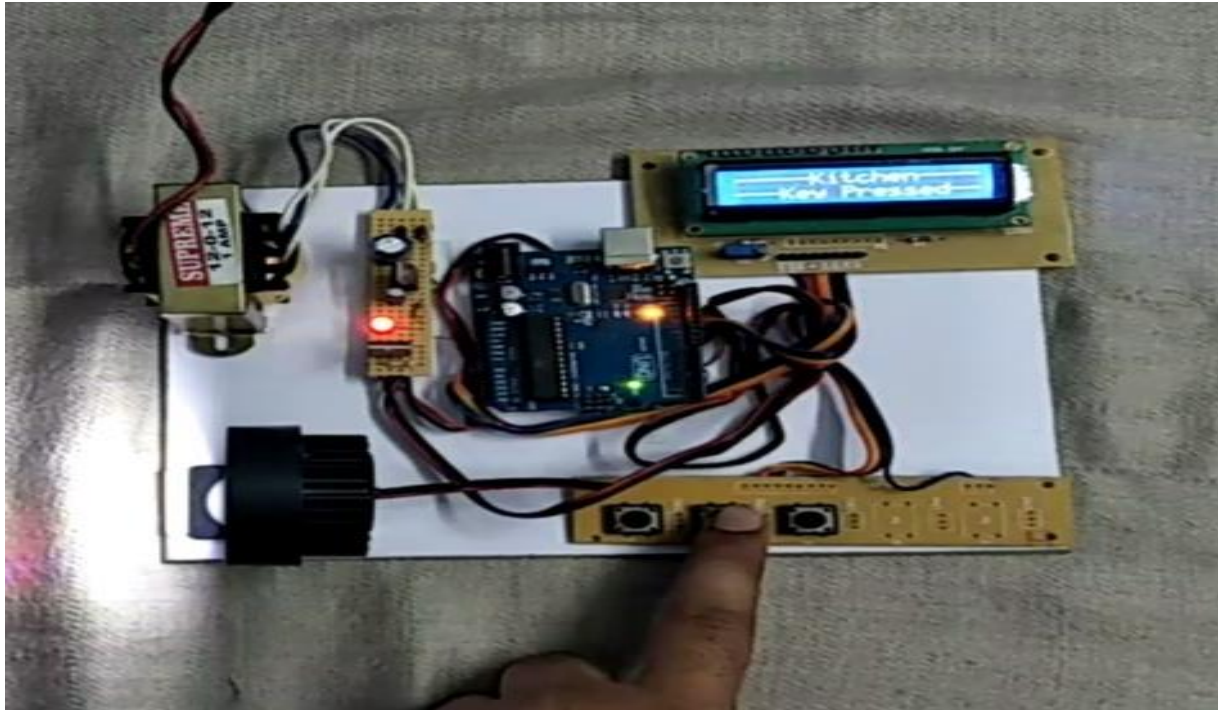


Figure: 5.5 - 2nd location data being transmitted and received when pressing Key 2

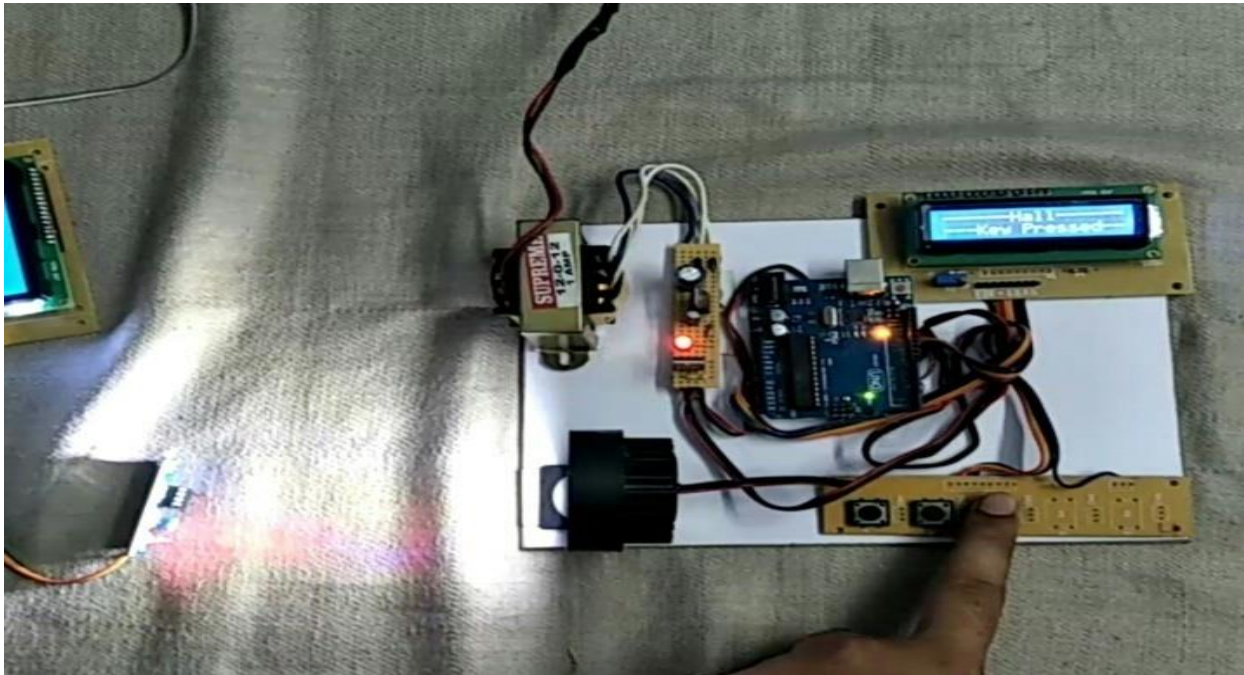


Figure: 5.6- 3rd location data being transmitted and received when pressing Key 3

The Photo diode is the Li-Fi receiver in the shoe kit. It identifies and gets the information communicated by the Li-fi LED at the transmitter side and sends it to the Microcontroller for analyzing. For the model to communicate diverse information at the receiver side, a keypad is utilized. The Keypad helps in changing the information

being communicated by the LED through the Micro controller at the transmitter side. For every information being communicated an alternate sound yield will be played through the speaker in the receiver side. Furthermore, it likewise gives a visual input for every information being communicated from the transmitter side to the receiver side through the LCD screen.

Table No.: 5.1 Keypad data or Li-fi transmitter data

S.No	Keypad	Data
1.	Key 1	Reception
2.	Key 2	Kitchen
3.	Key 3	Hall

5.4 BATTERY CHARGING:

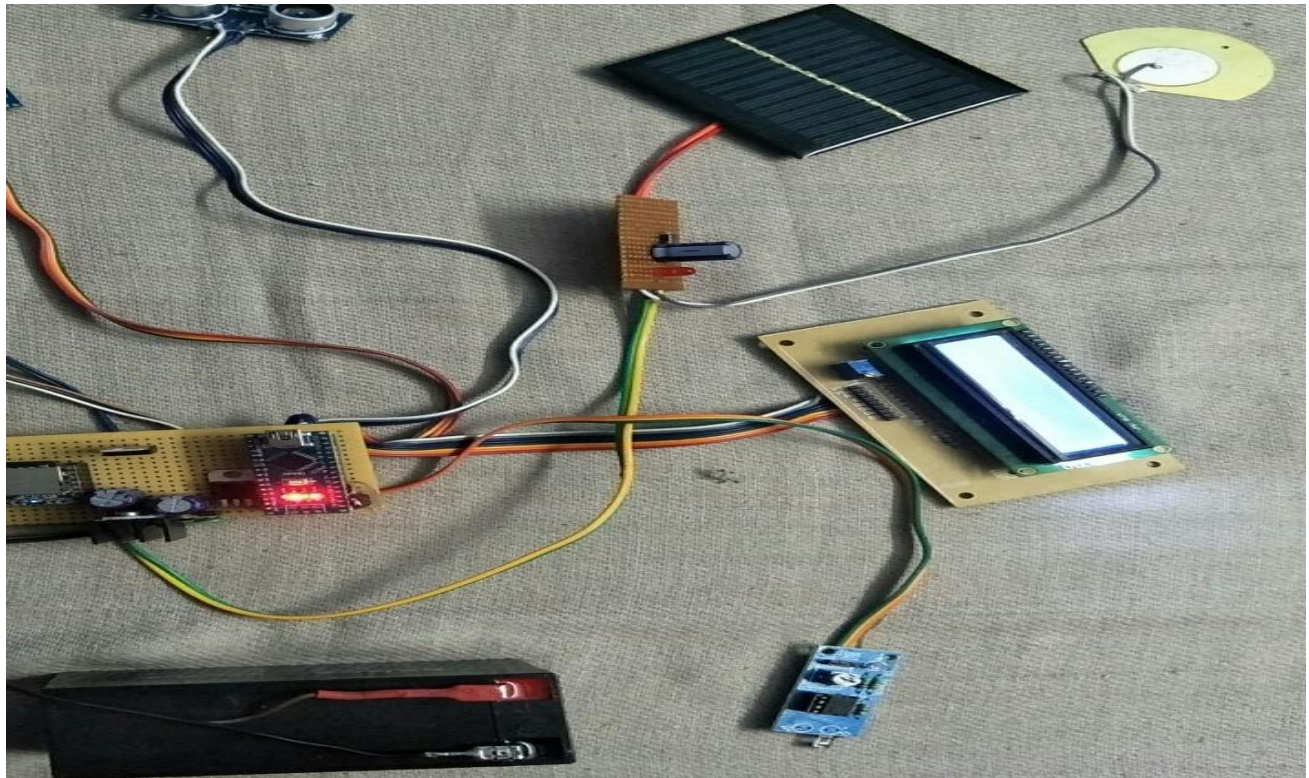


Figure: 5.7 Battery is Charging to the Prototype

A Solar panel and a Piezo plate is associated with the shoe unit for charging in the battery. The Solar board to charge the battery when presented to daylight or even

typical light sources and a Piezo plate to charge the battery dependent on the pressure applied. As it is joined to the shoe, in view of the pressure applied while strolling it will charge the battery consequently.

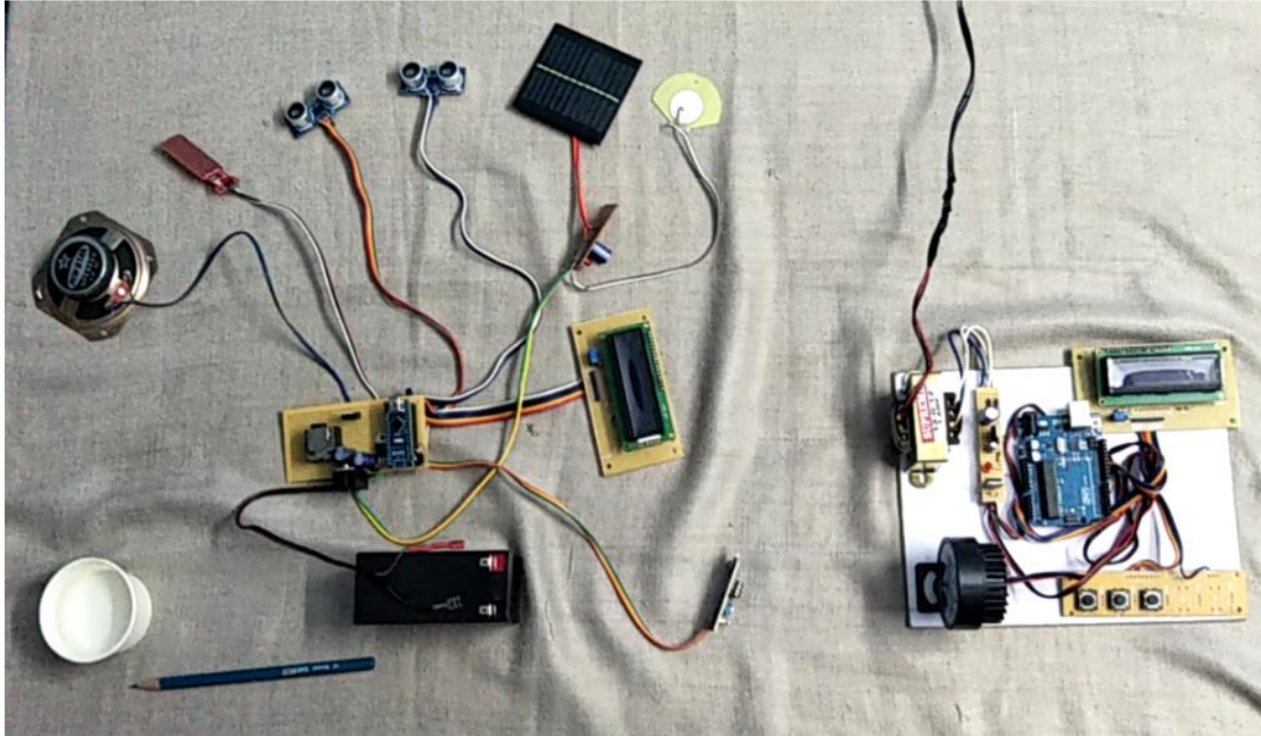


Figure: 5.8 The Overall Prototype For indoor Navigation

The working model arrangement was acquired as demonstrated in Fig. The accompanying outcomes were executed by the target of our task. The shoe model comprises of Arduino NANO Micro controller which is incorporated with ultrasonic sensor, water level sensor, Li-Fi receiver, DF mini player and speaker. The Li-Fi model comprises of Li-Fi transmitter, five keypad and LED. Every one of those parts co-operate through the Micro controller to give solid route and safe mobility.

CHAPTER - 6

SUMMARY AND CONCLUSION

6.1 SUMMARY:

For the most part, outwardly debilitated individuals lean towards a long stick or a guide canine to help their way on the everyday life premise. An assistive stick is a stick which is utilized to improve the steadiness during the walk and it additionally gives the data about the ground levels. On the opposite side, a guide canine aides by keeping away from impediments and signs in the circumstance of traffic. A large portion of the outwardly impeded people may not be in a circumstance to bear the cost of a guide canine. Notwithstanding, both long stick and a guide canine doesn't give a lot of data about the risks altogether the three distinct bearings. So in this exploration a Smart Shoe is being proposed to assist them with being free. Shoes being the fundamental need to walk puts this keen shoe turns into a wearable gadget. It is utilized as a security gadget just as a route gadget. It is utilized for impediment discovery, water location and furthermore for route purposes. So we at last reason that the fundamental intention of this exploration is to advance simple mobility and dependable route.

6.2 CONCLUSION:

This paper chiefly centers around the safe portability and solid route which would give straightforwardness to the outwardly disabled individual as a rule, like voyaging, shopping and other day today exercises. The Smart Shoe utilizes the most solid source, light, to convey information to the outwardly hindered. The use of Smart Shoe makes them free in the general public. This aides in route as well as helps overall data sharing like deals and offers. The smart shoe makes them to feel ordinary and it likewise expands their certainty level in the general public that would assist them with having a typical existence. With the assistance of Li-Fi innovation it causes individuals to recognize the area and to make their movement comfortable. By recognizing impediments, it turns into a wearable security gadget. Hence the Smart Shoe advances an autonomous visually impaired society.

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APPENDIX

Li-Fi Transmitter code:

```
#include<LiquidCrystal.h>
```

```
#include <SoftwareSerial.h>
```

```
LiquidCrystal lcd(13, 12, 11, 10, 9, 8);
```

```
SoftwareSerial Li_Fi_tx(2, 3);
```

```
#define splash splash1
```

```
#define key1 A0
```

```
#define key2 A1
```

```
#define key3 A2
```

```
int k1_r, k2_r, k3_r;
```

```
void setup() {
```

```
    // put your setup code here, to run once:
```

```
    LcDSet();
```

```
    Li_Fi_tx.begin(9600);
```

```
    pinMode(key1, INPUT_PULLUP);
```

```
    pinMode(key2, INPUT_PULLUP);
```

```
    pinMode(key3, INPUT_PULLUP);
```

```
}
```

```
void LcDSet() {
```

```

lcd.begin(16, 2);
delay(1000);
lcd.home();

splash(0, "Li-Fi");
splash(1, "Transmitter");

delay(2000);
lcd.clear();

}

void loop() {
  // put your main code here, to run repeatedly:
  k1_r = digitalRead(key1);
  k2_r = digitalRead(key2);
  k3_r = digitalRead(key3);

  if (k1_r == 0) {
    splash(0, "Reception");
    splash(1, "Key Pressed");
    Li_Fi_tx.print('1');
    delay(3000);
  }
  if (k2_r == 0) {
    Li_Fi_tx.print('2');
    splash(0, "Kitchen");
    splash(1, "Key Pressed");
    delay(3000);
  }
  if (k3_r == 0) {

```

```

    splash(0, "Hall");
    splash(1, "Key Pressed");
    Li_Fi_tx.print('3');
    delay(3000);
  }

}

```

Shoe Part Code(Receiver):

```

#include<LiquidCrystal.h>
#include "DFRobotDFPlayerMini.h"
#include <SoftwareSerial.h>

LiquidCrystal lcd(12, 11, 10, 9, 8, 7);
SoftwareSerial mp3_pl(2, 3);
DFRobotDFPlayerMini mp3_p;

#define splash splash1
#define t1 A1
#define e1 6
#define t2 A2
#define e2 5
#define wat A0

//UltraSonicDistanceSensor distanceSensor(A1, 6); // Initialize sensor that uses digital
pins 13 and 12.
//UltraSonicDistanceSensor distanceSensor2(A2, 5);

float frt, lft;

```

```

int frt_alert = 15, lft_alert = 15;
int ul_max = 150;

void setup() {
  // put your setup code here, to run once:
  pinMode(t1, OUTPUT);
  pinMode(e1, INPUT);
  pinMode(t2, OUTPUT);
  pinMode(e2, INPUT);

  Serial.begin(9600);
  LcDSet();
  mp3_pl.begin(9600);
  if (!mp3_p.begin(mp3_pl)) { //Use softwareSerial to communicate with mp3.
    Serial.println(F("Unable to begin:"));
    Serial.println(F("1.Please recheck the connection!"));
    Serial.println(F("2.Please insert the SD card!"));
    splash(0, "Check Player");
    splash(1, "SD Card");
    // while (true) {
    //   delay(0); //
    // }
    delay(3000);
  }
  Serial.println(F("DFPlayer Mini online."));

  mp3_p.volume(30); //Set volume value. From 0 to 30
  mp3_p.play(1); //Play the first mp3
  delay(1000);
}

void LcDSet() {

```

```

lcd.begin(16, 2);
delay(1000);
lcd.home();

splash(0, "");
splash(1, "");

delay(2000);
lcd.clear();

}

void loop() {
  // put your main code here, to run repeatedly:
  if (mp3_p.available()) {
    printDetail(mp3_p.readType(), mp3_p.read()); //Print the detail message from
DFPlayer to handle different errors and states.
  }

  int wat_r = analogRead(wat);

  if (wat_r > 600) {
    splash(0, "Water");
    mp3_p.play(7);
    delay(2000);
  }
  int dis1 = ultracm(t1, e1);
  int dis2 = ultracm(t2, e2);
  // float dis1=distanceSensor.measureDistanceCm();
  // float dis2=distanceSensor2.measureDistanceCm();

```

```

// Serial.println(distanceSensor.measureDistanceCm());
// Serial.println(distanceSensor2.measureDistanceCm());
frt = dis1;
lft = dis2;
// frt = distanceSensor.measureDistanceCm();
// lft = distanceSensor2.measureDistanceCm();

if (frt > ul_max) {
    frt = ul_max;
}
if (lft > ul_max) {
    lft = ul_max;
}
Serial.print(frt);
Serial.print(" | ");
Serial.print(lft);
Serial.print(" | ");
Serial.print(wat_r);
Serial.println();

if (frt < frt_alert) {
    // Serial.println("Object front");
    splash(0, "Front");
    mp3_p.play(1);
    delay(2000);

}
else if (lft < lft_alert) {
    // Serial.println("Object left");

```

```

    splash(0, "left");
    mp3_p.play(2);
    delay(3000);

}

else {
    lcd.setCursor(0, 0);
    lcd.print("          ");
    lcd.setCursor(0, 1);
    lcd.print("          ");
}

if (Serial.available()) {
    char k = Serial.read();
    if (k == '1') {
        mp3_p.play(4);
        delay(3000);
    }
    if (k == '2') {
        mp3_p.play(5);
        delay(3000);
    }
    if (k == '3') {
        mp3_p.play(6);
        delay(3000);
    }
}

delay(100);
}

```