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# Multifunctional Navigation Assistance Device for Visually Impaired Using Arduino Lilypad

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**Abstract:- This paper fundamentally deals in helping the visually impaired individuals to arrive at their destination with no challenges by making use of these shoes which are uniquely designed for the visually impaired people by the innovative technology "ARDUINO LILYPAD" as it can be easily fabricated to fit inside a shoe. This arrangement comprises of pair of shoes which comprises of Bluetooth gadget, vibrators and proximity sensors. These gadgets are associated with an android cell phone that can calculate the directions and the real time location with the help of Google maps, built-in GPS, and compass module. The Arduino Lilypad gadget offers a non-obtrusive navigation for these individuals. To know the desired destination, a voice recognizable method is used. Implementing the idea of internet of things, a Bluetooth gadget conveys message to the Arduino Lilypad. The internet of things links an object to the cloud and extracts the essential data from the internet.**

***Keywords:-*** *Compass Module, GPS, Google Maps, Proximity Sensors, Vibrators.*

## I. INTRODUCTION

These shoes are specially designed to offer a non-obtrusive route for blind people [3]. The system depicts about the Arduino Lilypad gadget connected with the shoes and its functioning principle. Bluetooth and proximity sensors are connected to Arduino Lilypad. It is the main gadget which controls the vibrators place at the sole of the shoe. This Arduino Lilypad perceives the instruction sent by the Bluetooth gadget and proximity sensors to work as required. The Google maps also plays a crucial part in finding the geological territory around the world. The three main things that we would discuss in this paper are about:

1. Description on Arduino Lilypad
2. Working of Arduino Lilypad shoes
3. Usage and functionality of the shoes

## II. LABVIEW

LabVIEW represents Laboratory Virtual Instrumentation Engineering Workbench. It began in 1983 by an organization National Instrument which famously represents NI. Like C, JAVA, this software is known as "G" language. It is specially designed for complex issues.

LabVIEW is a graphical programming language used to create programs called VI, which are in a pictorial structure called a block diagram, which eliminates lot of the syntactical details of other programming languages like C and MATLAB that utilizes a text-based programming approach. LabVIEW is accessible across all major platforms and is effectively portable across platforms. It is basic and adaptable since it is a graphical methodology no need of writing programs of 100 lines like other program languages. Every VI has two windows-Front Panel and Block Diagram windows. Front Panel is the UI which has controls and indicators. The expense of the LabVIEW is the major disadvantage for implementing into the application. Currently LabVIEW application is limited to just high scale applications in industrial levels but then is used in home level. The advantage of LabVIEW in home automation makes it simpler to configuration as well as increases the accuracy and speed of the system.

## III. ARDUINO LILYPAD

The Arduino Lilypad is designed in such a way that it can be sewn into clothes and different fabrics with conductive threads. The Arduino Lilypad can be controlled either from the USB association, Bluetooth or a 3.7v LiPo battery [2]. The board runs at 3.3v; applying more voltage, for example, 5v to the gadget may harm its pin. If user interfaces a cable from a PC and LiPo battery to Arduino Lilypad, it will charge the battery. The Arduino Lilypad switch permits the user to turn the board on or off. Like Arduino Leonard and micro, the Arduino Lilypad uses a single microcontroller called Atmel-AT mega which can be utilized for designing as well as communicating over USB with the PC. Therefore, it implies that it needs a USB link to program the Arduino Lilypad [2] yet it also implies that there are a few contrasts in the way that the USB connection works.

The Arduino Lilypad is a bunch of sewable electronic pieces intended to build delicate interactive textiles, comprising of small programmable PC called an Arduino Lilypad can be sewed along with conductive thread to make interactive clothing and accessories. Arduino Lilypad could detect the climate through the data sources and can follow up on the climate with output like LED lights, vibrator motors, and speakers. Arduino Lilypad planning was designed by Leah Buechley. The commercialized form of the kit was collaboratively designed by Leah and spark fun electronics.

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*A. Arduino Lilypad board Vs other board*

The USB in Arduino Lilypad utilizes a single processor to process both the sketches and communication over Bluetooth with the mobile phones & this gives more flexibility.

*B. Arduino Lilypad Vs Leonardo/ Micro*

The USB is restricted to an 8 MHz clock for Lilypad though it is 16MHz for Leonard and Micro. The sketches ought to act something very similar on one or the other board, however it is critical to accurately choose the proper board in the boards menu [2]. Transferring to Arduino Lilypad USB with the board set to "Arduino Leonardo" or "Arduino Micro" won't have the option to communicate over USB. If this occurs, the user needs to recover the gadget by utilizing the strategy to be depicted in the following section.

*C. Exporting Sketches to the Arduino Lilypad*

To install Arduino Lilypad USB as we do with the other Arduino boards: one should choose "Lilypad Arduino USB" in the Tools Board menu and the serial port from the Tools Serial Port menu and afterward press the upload button to transfer the Lilypad Arduino USB. The Lilypad will reset, dispatching the boot loader that gets new sketch from the PC and stores it on the board. The boot loader at that point will dispatch the new sketch. It says at what time the boot loader needs to run since the on-board pin 13 LED will blur in and out.

Yet sometimes anyway the programmed reset fails. For instance, transfer sketch to the Lilypad with various board chose in the Tools menu. And then press the reset button on the Lilypad twice to start the boot loader. To transfer with this strategy, the transfer button must be pressed, at that point, when you see the status message "Uploading" one should press the reset button twice. This will start the boot loader, and the Arduino software will transfer your sketch. The double press on the reset button must be done quickly when the transferring message happens.

*D. Pin Configuration*

The Lilypad has not many inputs and outputs as of contrasted with the Arduino main board. Totally there are of 9 I/O pins, one uncovered pin for: +3.3VDC, and the other pin is grounded. Each of the 9 digital I/O pins on the Lilypad Arduino can be utilized as an input or output, using a mode called pinmode(), digitalwrite(), and digitalread(). They work along 5V. Each pin in the gadget that can communicate or get a limit of 40mA and they have an internal pull-up resistor (it is detached by default) of 20 kOhms. In addition to that a few pins have capacities:

1. PWM: 5, 6, 9, 10, 11 Provide 8-cycle PWM output along with the analogwrite() work.
2. Analog Inputs: A2-A5. The Lilypad Simple Arduino has 4 simple analog inputs, named A2 through A5, which can all be utilized as a digital I/O. Each of the given input gives 10 bits of resolution (for example 1024 unique values). As a matter of course the input measure from ground to 5V, despite the fact that it is feasible to change the upper end range using the analogreference() work.

The Lilypad Arduino's pin design is addressed as a schematic diagram in the Fig1. The ATMEGA328 microcontroller is utilized in Lilypad Arduino. In this microcontroller there are totally 32 pins utilized which are clearly explained in Fig1.Each pin has its own functionality, and they are associated with various capacitors and resistors respectively. The MCP73831/2 gadgets are highly linear charge progressed the management controllers for use in restricted space and cost applications. The MCP73831/2 is also accessible in an 8-Lead, 2 mm x 3 mm DFN, and SOT-23 package. Along with their small size, utilization of a smaller number of parts makes the MCP73831/2 more reasonable for portable applications. The switch of the Lilypad shoes is explained in detail when the power ought to be turned on and off. This pin configuration outline was given by L.Buechley and N.Seidle. They built up this Arduino Lilypad pin design in the year 2009.The document number of the accompanying pin diagram is Spark Fun Electronics. The elaborate working of Arduino Lilypad is utilized for fitting different vibrators connecting them in their pins in the microcontroller. The proximity sensors are associated with the Arduino microcontroller pin and they work accordingly. The working and different explanations are referenced in the working segment.

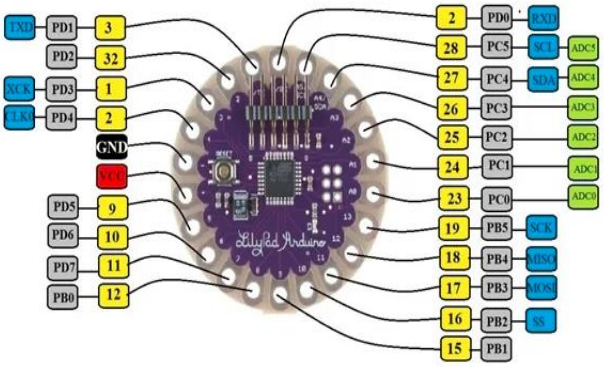


Fig.1. Pin configuration of Arduino Lilypad

*E. Programming and physical characteristics*

The Arduino programming can be utilized to program the Arduino Lilypad. The Lilypad Arduino should be customized along with software versions 0010 or higher forms [7]. The ATmega 328V on the Arduino Lilypad along with the boot-loader which permits the user to transfer new code to it with the Arduino software. The user can bypass the boot loader and program the ATmega through the IN-CIRCUIT SERIAL PROGRAMMING (ICSP) header is seen with the guidelines [3]. The Lilypad Arduino is a circular gadget, around 50mm (2") in diameter. The actual board is 0.8mm (1/32) thick. It can also be washed if necessary. The table below depicts the configurations and specifications along with their units of the Arduino Lilypad.

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Table I. Physical Characteristics And Configuration Of Lilypad Arduino

| I/O DEVICES | RANGE OF VALUE |
|---|---|
| Microcontroller | ATmega328V |
| Operating Voltage | 2.7-5.5V |
| Input Voltage | 2.7-5.5V |
| Digital I/O pins | 14 (out of which 6 of them provide PWM output) |
| Analog input pins | 6 |
| DC current per I/O pin | 40 Ma |
| Flash Memory | 16 KB (2KB of flash memory is used by boot loader) |
| SRAM | 1 KB |
| EEPROM | 512 bytes |
| Clock Speed 8 MHz | 8 MHz |

## IV. WORKING

The Arduino Lilypad is fitted in the shoes which gets data from the cell phones through Bluetooth and later conveys messages to the vibrators individually [1]. The user simply needs to say the destination before the getting started and the Android application which begins formulating route and calculate turn by turn directions which is sent to the shoe remotely by means of Bluetooth. Various vibrators inside the shoe are set at various positions dependent on the directions of GPS to facilitate and compass, which may activate the system to give feedback to the user relying upon the turn he/she needs to take. So basically, the system changes over navigation data into haptic feedback [4]. The vibrators will likewise get the feedback from proximity sensors, which detect physical obstructions up to a range of 10 feet [1].

The intensity of the vibrations contrasts relying on the proximity from the destination. For instance, in the beginning of the user's journey the feedback signal is more fragile, while as the user arrives nearer to the destination the strength of the signal increases. Voice directions might be distractive and wearable stuff is prominent and it might draw in pointless attention [9]. So, the system has been intended to make it non prominent for the users.

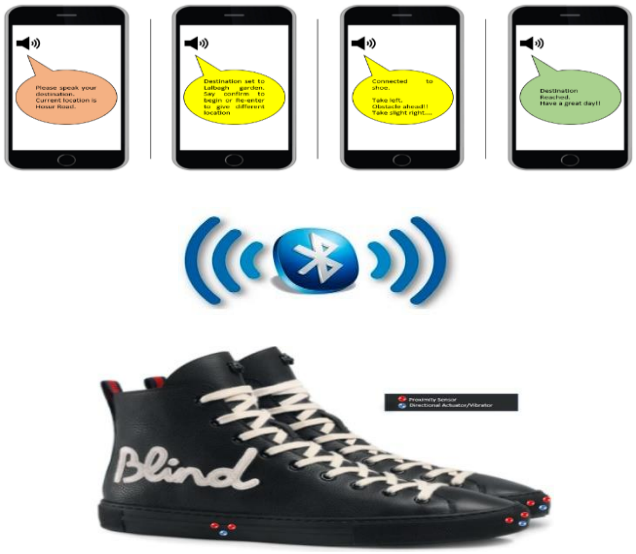


Fig.2. Working of Lilypad Arduino

There are very few steps which are to be followed to utilize this gadget proficiently. The steps to be done are:

1. The individual should turn on the GPS in his/her cell phone first to find their present location.
2. The user should then tell the destination as input.
3. Once the destination is good to go at that point say CONFIRM or RESET to re-enter the destination spot.
4. The Google maps then ascertains the route maps for the destination spot and conveys messages through Bluetooth to the Arduino. The proximity sensors are utilized to detect the nearby physical blocks to a range of 10 feet distance.[6]
5. According to the signals received, the vibrators vibrate at the specific corners indicating the individual to turn to appropriate direction.
6. The proximity sensors inside the Arduino Lilypad shoe would detect the objects or any obstructers on their way and would show them to take an alternate way.

## V. INTERNET OF THINGS

A thing on the Internet of Things, can be a human with a heart monitor implant, a creature with a bio-chip transponder, a vehicle which has built-in sensors which would caution the driver when the pressure factor in the tire is low or other normal or man-made item which can be allocated with an IP address and enabled with to ability transfer information over network. Until now, the Internet of Things is firmly connected with machine-to-machine (M2M) communication in assembling and power, oil and gas utilities. Items which are built with M2M communication capacities are frequently referred to as a smart. IPv6's immense expansion in address space which is a significant factor in the advancement of the Internet of Things.

As per Steve Leibson, who has identified him as an "Occasional docent at the Computer History Museum," the location space development which implies that one could "allot an IPV6 address to every molecule on the surface of the earth, they actually have enough address left to do another many earth." at the end of the day, individuals could easily assign an IP address to each "thing" on the planet [11]. An expansion in the quantity of smart nodes, just as the measure of upstream information then the nodes will be created. This may give raise to new concerns of data privacy, data sovereignty and data security. Even though the idea wasn't named until 1999, the Internet of Things has been in the process of improvement for many decades. The Arduino Lilypad which is a gadget that is associated with the cloud utilizing the idea of internet of things and the routes are taken from the Google map locater. Utilizing this, Arduino Lilypad passes a bunch of instructions to the vibrators and the intermediate nodes to guide them to their destination.

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## VI. COMPONENTS OF LILYPAD

In Fig3 shoe outline is shown. There are totally eight vibrators present at the sides of the shoe's sole in which four vibrators are available overall the four directions like east, west, north and the south.

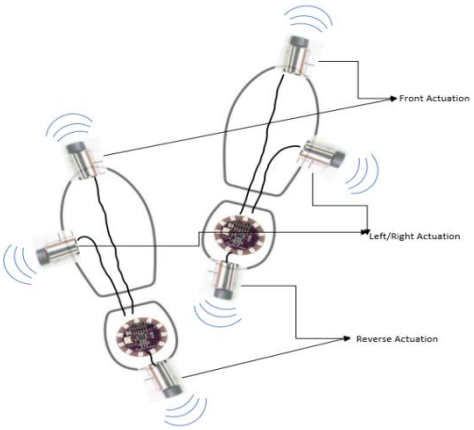


Fig.3. Components of Lilypad shoes

The other four vibrators fitted over the sole of the shoes are utilized as intermediates which are likewise utilized as vibrators. The intermediate directions show the obstructers on their way. There are two actuations, for example, Front actuation and Reverse actuation. The middle actuation addresses the left and right actuation.

## VII. USAGE AND ADVANTAGES

These shoes are often employed in all blind schools/ colleges and used by all unsighted folks because the value of it is very minimal and it's easy to use [10]. They merely ought to speak out their desired destination and they would reach the destined place without others guidance to the most level. It would change their lifestyle as they may tend to lead a standard life by being independent in few ways. They need minimal inputs to use this Lilypad shoes. They're as follows:

1. Smart phone with compass enabled GPS to pull location information from satellites.
2. Shoes with soles of the outlined dimensions to deal with the elements
3. Bluetooth Arduino Lilypad to synchronize devices
4. Mini vibrational motors to tell the user about the directions
5. Proximity Sensor device

One can build their Lilypad shoes by simply fitting the Arduino Lilypad inside the shoe and add few alternative connections to make it work.

## VIII. LIMITATIONS

This is a great idea and even though the implementation in firsthand has not been experienced, it's superior to see that this technology is being influenced to solve everyday problems faced by the differently abled. Not too sure about the quality of navigation and GPS modules fitted in the Smartphone devices, because they aren't always more accurate – especially in the Google Maps. Also, the naming convention for various places is not that much of coherent in India, which makes offering the perfect directions difficult.

A step in the right direction that must be taken up by a big product brand for a wider scale. When shoe companies and gadget makers can collaborate on fitness tracking devices, why can't they do something with the direction control.

## IX. CONCLUSION AND FUTURE WORKS

The Arduino Lilypad shoes can be used in multiple purposes for multiple occasions. It need not be used only by the visually challenged, instead it can be used by normal people for their navigation purpose, For instance mountaineers, trekkers, etc. It can also develop as a lifestyle product that tracks the number of steps you take; the number of calories you burn and lets you track fitness goals. Above all, you can also share routes with your friends who is also using the shoe. Ballet shoes are also available wherein the dancers fit these Arduino in their shoes for various purpose [5].

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