*i*Journals: International Journal of Software & Hardware Research in Engineering (IJSHRE)
ISSN-2347-4890
Volume 10 Issue 4 April 2022

Voice-Based Direction Indicator for the Cycle

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Abstract - Cycle is a mass consumer vehicle and used by the poorest in villages as a mode of travel. Voice-Controlled Interface (VCI) is an emerging region of research that is used to help in automating mechanical control. There is an increase in bicycles on the roads as people are becoming more health and environment-conscious, the current increase in the cycle on the roads has also increased accidents involving cycles. The main reason for these accidents is not following the traffic rule, inappropriate or no use of the indicator. In order to overcome this problem, the paper describes the VCI based indicator for the cycle.
This will help reduce the number of accidents on the road as well as an outrage that is caused as many streets share the same space for all vehicles on the road compared to having dedicated and separate tracks for cycles

Keywords- Voice-based, Direction indicator, Automatic light, Indicator, Vehicles, Speech recognition

1. Introduction:

Roadways are at most vital means of transportation. In India, every year 1.5 lakh citizens lose their lives in a road accident. Most accident injuries are caused by motorcycles or cars which make simple mistakes such as off-road driving or not giving indicator signs.

We have researched the various sections of the road where most of the cycling-related accidents happen and are described below in detail.

T-junctions
Filtering and overtaking
Roundabouts
Parked vehicles
Potholes

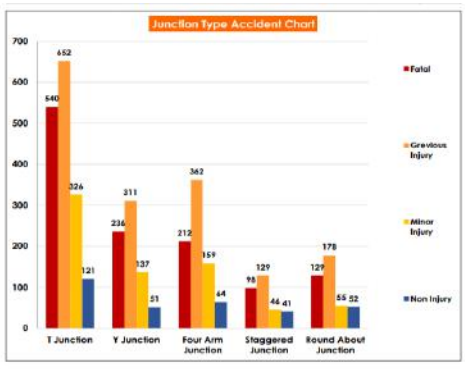

Fig No 1

A – T-junctions:

Accidents at T-junctions are, unfortunately, equally as common as accidents at roundabouts. In our research case there is an even split between:

- Accidents caused by motorists emerging on to main roads, highway and colliding with the bicyclists traveling to past the junction and
- Accidents caused by the motorists who fail to give indication when they turn across oncoming traffic.

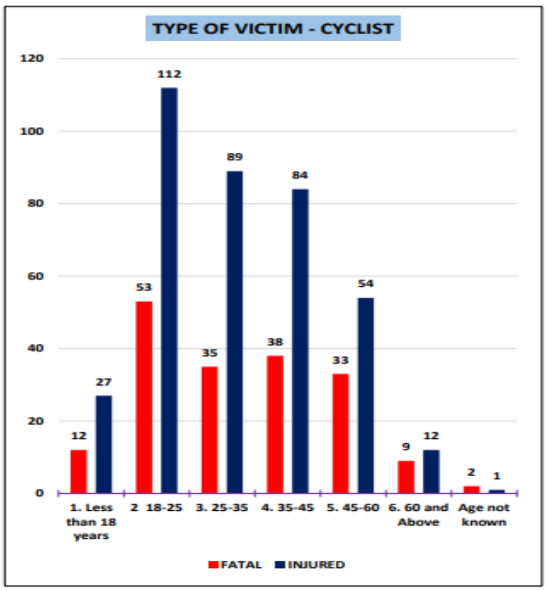

Fig No 2

B – Filtering and overtaking:

Many people go/commute to work by bike or cars. With so many cars or bikes on the road, the volume of traffic increases, and the impatience of many drivers can be cause of concern. Accidents in busy traffic while the bicyclists filter through or overtake stationary or slow-moving traffic are one of the most common types of accidents.

C – Roundabouts:

A roundabout (traffic circle) is a type of a circular intersection or junction in which road traffic is permitted to flow in one direction. It may be a surprise to learn about this roundabout, which is the most common location for accidents, especially bigger ones with numerous exits. Motorists emerge from a side road onto the roundabout without giving way to bicyclists. (normally because the driver has hasn't seen them)

- A car or bike overtakes the bicyclists and then turns off the roundabout leaving insufficient space. Their car, therefore, hits the cyclist before they leave the roundabout. Due to these accidents are caused by the negligent driving of the motorist

D – Parked vehicles:

Many accidents take place when someone in the parked vehicles opens the door without looking at the pedestrians or cyclists. So, these things sometimes can cause serious injuries.

E – Potholes:

Potholes can be dangerous too for the cyclists and sometimes seem to be unavoidable. It is important when riding in the group to look ahead and to point out the defects in the road, especially if your fellow riders are close behind you.

2. LITERATURE REVIEW

We typically only start thinking about the importance of the headlights in bikes for night rides in summer or wanting to extend our riding ability on those short daylight hours of winter. But the truth is having lights on your bicycle can have more benefits than you think. Here are the four benefits of bike headlights.

Safety: -having lights on a bicycle increases the ability to see roads. When you talk about a bike vs car situation. The car industry has moved towards the daytime running lights, so why shouldn't bikers change their mindsets?

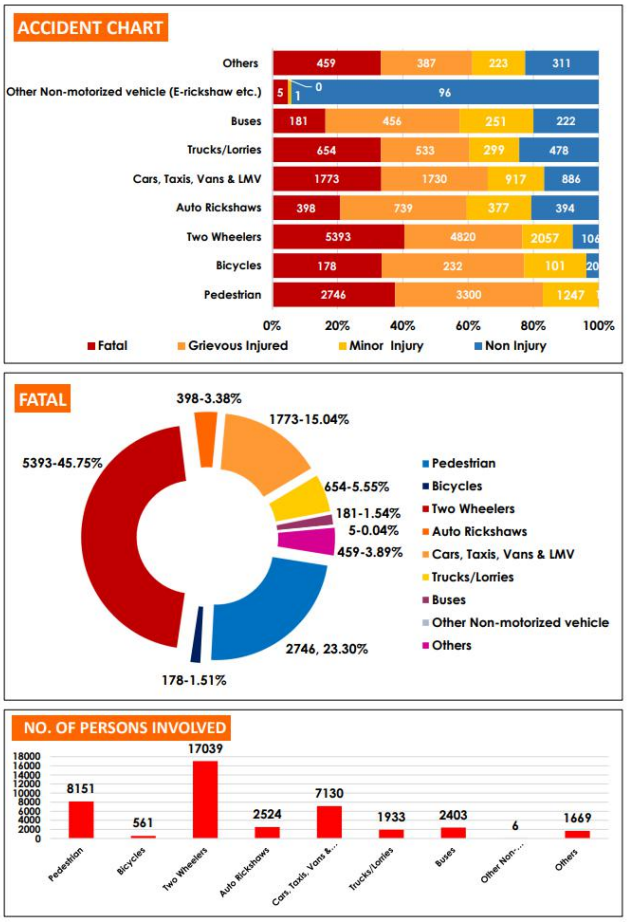

Fig No 3

Reflection: -Lights allow us to see reflective objects on the road. This all includes roads, animals, traffic signs or danger signs. Seeing this reflection could save us from the accident.

Visibility: -Bike lights help the bike rider to see the further road clearly. Having some visibility allows you to see and also have some more time to react to obstacles spotted in the road.

Requirements: -In many states bike lights are becoming a requirement for riding gear." every cycle must be equipped with a front facing headlight, and a red gear reflector or light, visible from at least 5 feet when used at nighttime". There are no requirements during the day, but if you want to ride through tunnels no matter what time of day we require lights.

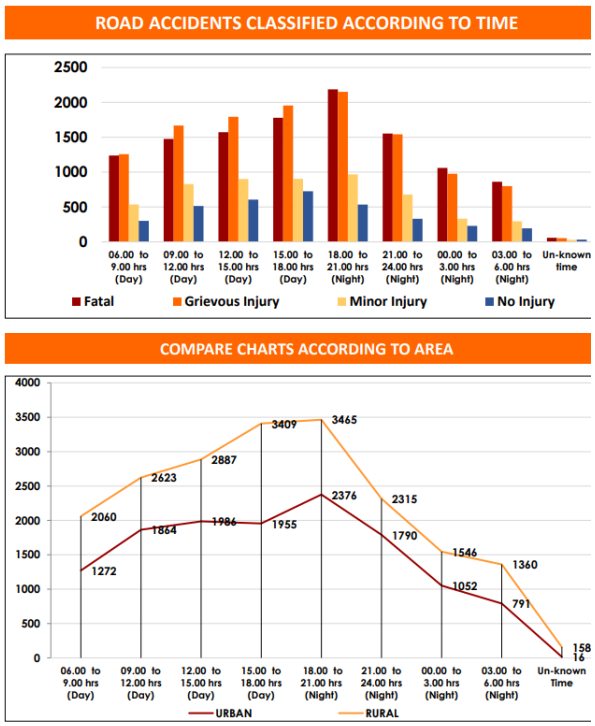

Fig No 5

Existing Solutions:

Bar Indicator:

Wing Lights Fixed are handlebar-mounted directional turn lights and indicators for bicycles and e-scooters that help avoid near misses by flashing amber and emphasizing your position on the road. Wing Lights Fixed are sleek, lightweight, and durable, and each device includes two CR2032 batteries.

Every year, roughly 19,000 bicycle accidents occur on UK roadways, with 75 percent of these occurring at intersections and significant turns. CYCL wants to help increase rider visibility in certain vulnerable regions and circumstances in order to lower this number. When you use Wing Lights as a secondary visual aid, you improve your chances of being seen by motorists and other cyclists. As a result, the likelihood of probable collisions is reduced.

Once the handlebar grip has been removed, the Wing Lights Fixed v3 screw directly into the handlebar ends. They're light and strong, and they stay put on your bike until you remove them. 2x CR2032 batteries are supplied with each unit of Wing Lights Fixed v3. The monsters fit handlebars with inner diameters ranging from 14.7mm to 23mm. They turn on with a simple press and flash bright orange to alert other drivers of your intentions. After 45 seconds, they will turn off on their own.

Fig 6

1.

Xcras LED bike indicator lights

If you prefer something wireless, Xcras' wireless bicycle turn signals are excellent. They come with an easy-to-use remote with three simple buttons (left, right, LED).

Its ultra-bright indicator lights produce up to 100 lumens, making them visible from up to 150 feet away, and its IPX4 waterproof certification ensures that it will work no matter how severe the rain.

Fig 7

It's USB-rechargeable, and after a full charge, it can flash for up to 10 hours. It's simple to operate; it just needs to be attached to the back of the saddle, the remote placed anywhere within reach, and the appropriate button hit.

2. FANCYWING LED signal Light Backpack Attachment:

This reflective LED backpack accessory responds to the buttons on its wireless remote control to offer those behind you a clear indication of which way

you're traveling while also increasing your visibility with its lights and reflective features.

It's simple to attach to your backpack because it's just a foam panel that snaps together. Meanwhile,

the wireless control eliminates the need to take your hands off the handlebar.

Fig 8

This USB-rechargeable device contains up to four LED signals: left, right, forward, and stop, to keep pedestrians informed at all times.

3. Our Solution

Fig 9

Fig 10

Fig 11

Our Solution works on the principle of simplicity. it has 2 main parts -

1. Prototype
2. Easy to use app - Dabble

Fig 12

wearable device that is linked to an app. The Bluetooth will take the command and give it to the Arduino and when the user gives the command to take a right or left turn the arrow will get displayed on the display. This is in line with our goal to boost social interactions.

The Prototype

This project's overall purpose is to assist bicycles in indicating their direction, as well as providing automatic headlight and horn. While it is turned on, the band can connect to the app and receive data from it.
prototype-

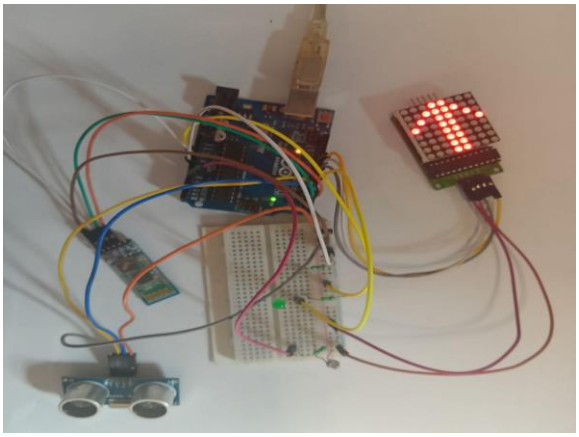

Fig 13

Flow diagram of the Working of the device:

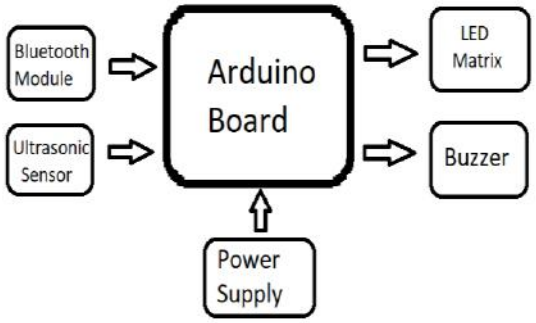

Fig 14

Circuit Diagram:

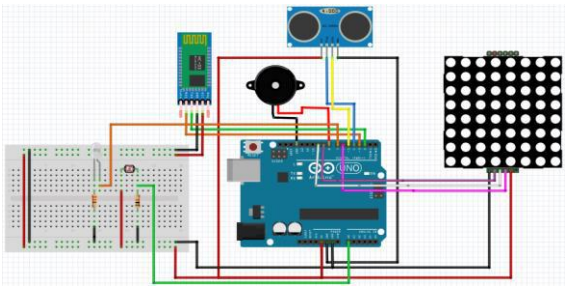

Fig 15

The above fig is a circuit diagram for all the components that were used in our band and their connections.
We have used AtMega328 as the main microcontroller for the device, HC-05 is the Bluetooth module that connects with the microcontroller using UART Protocol and sends data to the controller. Then the controller processes the data, then it sends the data to the LED matrix and the direction gets displayed on the matrix.
The circuit has the power supply module and the battery protection unit and has the following components-

1. 1000mAh li-ion battery
2. TP4056 Charging circuit
3. 3.7 to 5v Boost circuit

all three are connected to each other and provide consistent power to the device to work continuously.

Component List:
The parts used in the circuit are as follows:

Arduino UNO: The Arduino Uno is an ATmega328-based microcontroller board. It has a 16 MHz resonator, a USB connection, a power jack, an in-circuit system programming (ICSP) header, and a reset button. It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analogue inputs), a 16 MHz resonator, a USB connection, a power jack, an ICSP header, and a reset button. It has everything you'll need to get started.

Fig 16

To use a microcontroller, just plug it into a computer through USB or power it with an AC-to-DC converter or battery.

Battery - The circuit is powered entirely by the battery.

Fig 17

Switch: The switch allows the user to toggle the band on and off.

Bluetooth Module (HC-05): The HC-05 Bluetooth Module is a simple Bluetooth SPP (Serial Port Protocol) module that allows for the construction of a transparent wireless serial connection. It communicates through serial transmission, making it simple to connect to a controller or PC. The HC-05 Bluetooth module allows you to switch between master and slave mode, which means you may use it for both receiving and delivering data.

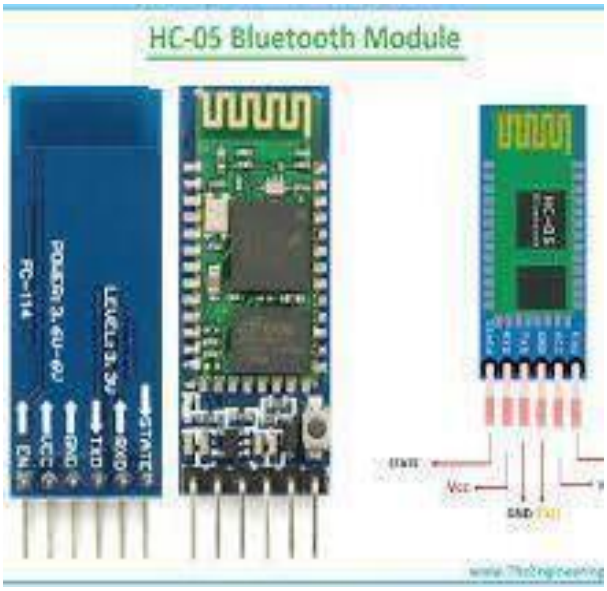

Fig 18

8x8 led matrix: The MAX7219/MAX7221 are common-cathode display drivers with serial input/output that connect microprocessors (Ps) to 7-segment numeric LED displays with up to 8 digits, bar-graph displays, or 64 individual LEDs. A BCD code-B decoder, multiplex scan circuitry, segment and digit drivers, and an 8x8 static RAM that saves each digit are all included in the device.

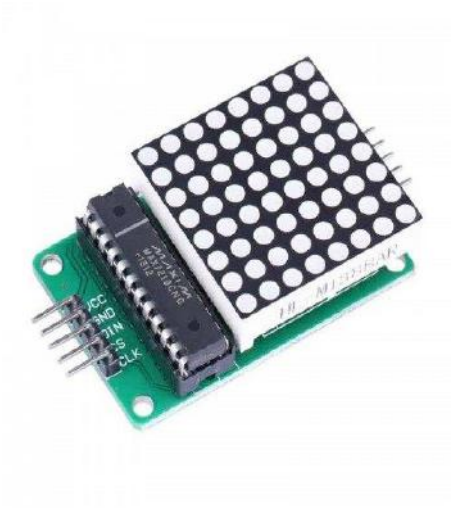

Fig 19

To set the segment current for all LEDs, only one external resistor is required. The MAX7221 is SPITM, QSPITM, and MICROWIRE compatible, with slew-rate-limited segment drivers to prevent EMI.

Ultrasonic Sensor: The ultrasonic distance sensor HC-SR04 is seen here. This inexpensive sensor has a range of 2cm to 400cm of non-contact measurement capability and a ranging accuracy of up to 3mm. An ultrasonic transmitter, a receiver, and a control circuit are all included in each HC-SR04 module.

On the HC-SR04, there are only four pins to worry about: VCC (Power), Trig (Trigger), Echo (Receive), and GND (Ground) (Ground). For any range-finding project, this sensor is really simple to set up and utilize!
Depending on the application, this sensor contains additional control circuitry that can prevent inconsistent "bouncy" data.

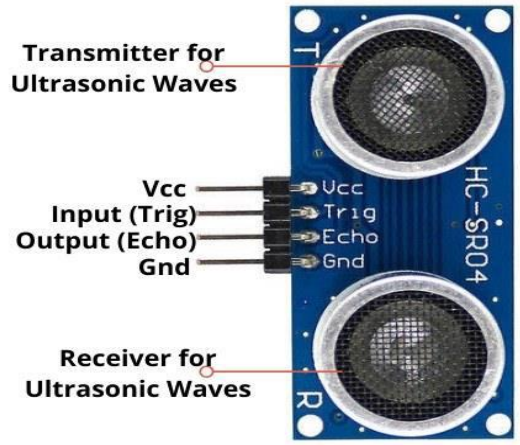

Fig 20

The timing diagram of HC-SR04 is shown.To begin measuring, the SR04's Trig must receive a high (5V) pulse for at least 10us, after which the sensor will broadcast 8 cycles of ultrasonic bursts at 40kHz and wait for the reflected burst. When the sensor detects ultrasonic from the receiver, it raises the Echo pin to 5V and delays for a duration (width) proportional to the distance. Measure the breadth (Ton) of the Echo pin to get the distance. Time (in uS) = Width of Echo Pulse (microsecond)

Time / 58 centimeters = Time / 148 inches = Time / 58 millimeters You can also use the sound speed, which is 340m/s.

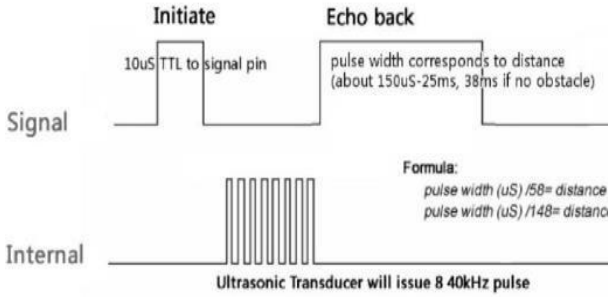

Fig 21

LDR (Light Dependent Resistor): The Light Dependent Resistor (LDR), also known as a Photoresistor, is a form of resistor that does not have polarity, allowing it to be used in a variety of applications.

Fig 22

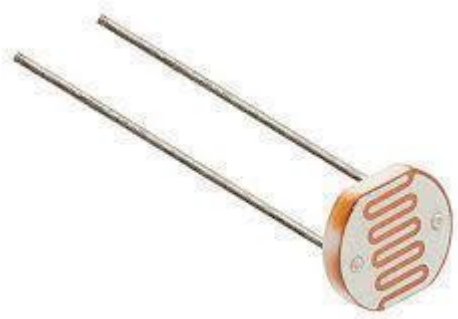

Fig 23

Any direction is related. They work well on a breadboard and can also be used on a perf board. The LDR symbol is similar to Resistor, but it contains inward arrows, as illustrated in the LDR pinout diagram above. The light signals are shown by the arrows.

***DC to DC Micro-Booster (FC - 400)*:** The function of a micro-booster is to translate the incoming voltage from one level to another. In his case we were using a DC to DC Micro-Booster as we needed to increase our voltage up to 6 volts.

We resolved the usb port from the micro booster to allow connections from the 4 flat pins just underneath it.

Buzzer: There are numerous ways for the user and the system to communicate a product. One of the best ways is audio communication using a buzzer IC.

Fig 24

An audio signaling device is like a beeper or buzzer, may be electromechanical or piezoelectric or mechanical. The main function of this is to convert the signal from audio to sound. Generally, it is powered through DC voltage and used in timers, alarm devices, printers, alarms, computers, etc. Based on the various designs, it can generate different sounds like alarm, music, bell & siren.

TP4056: The TP4056 is a single-cell lithium-ion battery charger with a complete constant-current/constant-voltage linear charger. The TP4056 is appropriate for portable applications due to its SOP packaging and minimal external component count. A USB and wall adapter are both compatible with the TP4056.

Because of the intrinsic MOSFET construction, no blocking diode is necessary, but it must prevent negative current.
Circuit for Charge Current. Thermal feedback controls the charge current to keep the die from overheating when the power is high or the ambient temperature is high. The charge voltage is set at 4.2V, and the charge current is controlled by a single resistor. When the charge current lowers to 1/10th of the programmed value after the ultimate float voltage is reached, the TP4056 automatically ends the charge cycle.

Fig 25

TP4056 Current monitor, under voltage lockout, automated recharge, and two status pins to indicate charge termination and the presence of an input voltage are some of the other features.

Mobile app:

Dabble App turns your Smartphone into a virtual I/O device, allowing you to operate hardware through Bluetooth, communicate with it, and access sensors such as the accelerometer, GPS, and proximity, among other things. You can use Dabble as a Bluetooth Controller App for Arduino Uno-Mega-Nano, ESP32, and revive for making various DIY projects or IoT applications. You can write the program in Arduino IDE or PictoBlox (graphical programming based on Scratch 3.0). Example codes are also provided in the Arduino library of Dabble.

This getting started guide will help you to understand the required hardware/modules, wiring diagram, connecting the board/Bluetooth module with mobile, and how to use Dabble library/extension

4. Future scope:

In this, our project is completely based on the command given by the bicyclist or user. But we can make it more advance by making it completely smart, while connecting to google map and give the direction to bicyclist and also add some more feature like smart breaks and camera in this project which makes the user or bicyclist completely relax and not think about the surroundings while riding the bicycle

5. Acknowledgement

I have been supported to complete this project by various subject matter experts whom I would like to acknowledge. Many thanks to OMOTEC coaches and mentors, who provided feedback and direction to arrive at the final research paper. And finally, thanks to my parents who supported me during this long process, always offering support and love.

6. Conclusion:

To conclude, we are getting the voice command converted into visual indication for the public which is displayed on the LED matrix in Arrow form, another feature is that the headlight of the bicycle works automatically depending on the surrounding lights and last feature is that the horn of the bicycle is also completely automatic which works when any object comes in front of bicycle and close to it. We have tested this project on the bicycle and found that it is really helpful for the cyclist as it provides the automation, and the rider does not have to care about unnecessary things which can be automated. While testing we found that the horn automation part was a little annoying as it honks without the consent and sometimes it honks unnecessarily in traffic. We are still working on improving the control over the horn automation, it can be improved to give better results.
Overall, we found that our solution is really helpful for the bike riders, but it still needs improvement in some parts.

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