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AN AID FOR VISUALLY IMPAIRED PEDESTRAIN

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ABSTRACT :- *An Aid for Visually Impaired Pedestrian (AVIP) is the project that aims to offer help to visually impaired citizens. It is difficult for a blind person to walk through the traffic and reach their designation without proper guidance. Commonly used form of support are the white canes. An typical white cane offers minimum safety and cannot guarantee protection against objects that interfere in their path. Hence AVIP is included with Ultrasonic object detection for detecting the obstacles below and above knee level. As the visually challenged people cannot get human assistance all the time, for such circumstances, traffic light detection model is used. By which the user can get voice alert of the signal displayed. Rechargeable batteries with primary and auxiliary batteries. Either primary or the secondary battery can be used as solar rechargeable battery for longer battery life. Another battery can be an normal USB chargeable. The components are interfaced and controlled using Arduino Microcontroller.*

KEYWORDS*: Smart canes, Arduino ATmega328p, TTS, Ultrasonic sensor HC-SR04, Solar battery charging*

1. INTRODUCTION

There are approximately 8.8 million people estimated to be blind who are in productive age and need independent mobility to work or go to school and be part of the mainstream. This model focuses on improving the lifestyle of visually impaired people by making them feel safe and secure. By developing this product in India, with affordable price, the blind people who lock them self in their home, afraid to walk in the streets can now able to suit themselves in the happy India existing outside their home. Half the walk canes used as imported from foreign countries. But by developing this product in India the visually challenged people may not pay a lot of money for the imported canes. These Indian made canes can be of low cost which should be easily affordable for the struggling visually impaired Indian.

2. EXISTING MODEL

This section narrates timely related works on the development of smart walking canes for the visually impaired people. According to, technology can help in reducing many barriers that people with disabilities face. These kinds of technologies are referred to as assistive technology (AT).there exist many types of disabilities they are physical disabilities, hearing disabilities and visually impaired. These assistive technologies have been utilized in assisting them. One of the main problems that the visually impaired people face, is most of them lack self-confidence and physical integrity. Here when the visually impaired people walk over the new environment they do not memorize the objects and obstacles they come across.

2.1 Smart canes:

The smart canes design have used RFID to detect objects and obstacles in front of the user and detect the RFID tag that has been placed in several areas to navigate the user. This is an normal blind stick attached to a bag, which is worn by the users, here the bag provides the electric supply to the stick and the user who also suffers from the hearing disabilities are provided with a special gloves which will vibrate at each finger that has different meaning, however, this invention has its own disadvantages and also used in a very particular areas. The mechatronic blind stick is a guiding system, which has been developed to facilitate the daily work of the visually impaired people.

This invention has many similarities with the smart blind stick. However this invention also has so many demerits, it cannot be folded and difficult to keep, in addition, this invention is not equipped with sensors to detect the water areas.

The survey of world health organization in 2011 says us that in the world about 1% of the population is visually impaired amongst them 10% are fully, here the existing model is provided with ultrasonic sensors, water sensors and Bluetooth module, where the ultrasonic sensor senses the objects at a distance of 2cm-450cm,thus if any object or obstacle find in their way will be detected and message sent to the controller where the process takes place and the alert message is given through a buzzer sound, the water sensor is used to find any water or fluid substances spilled over the floor or ground, the Bluetooth module has been attached to the stick for the purpose of finding the stick by the blind people if they were lost anywhere. There also present an existing model called 3 D ultrasonic stick was it helps in detecting the obstacles in three directions, thus the blind people could walk safely and easily without any guideline this 3D ultrasonic stick, there are other modules that are been equipped within it ,it consists of a microcontroller, dc vibration motor, and a buzzer. While the obstacle is found the dc motor and the buzzer gets activated .there are many other systems which are been provided with GPS module and an SMS message system, for their safety purpose.

However this model will also has its own demerits as the three

Direction section sometimes fails to support, as any one of the sensors disability will cost a life, thus it has its own disabilities to rectify.

3. PROPOSED MODEL

Most of the existing model consists of ultrasound object detector. Some walking canes are also designed along with text to speech converter. Our proposed model also consists of ultrasound sensor for object detection, the walking cane is to be designed with traffic light indicator which helps the blind to cross the road without any human help. The traffic light detector with a CCD camera, an image acquisition card, and a PC. Based on RGB color space, the algorithm extracts red, green, and yellow objects in the image firstly For the purpose of eliminating disturbance in the environment, the features of traffic lights are used to verify the object identity, and then the types of traffic signals are judged. Here this model is charged using a solar panel. Here the solar panel is used to recharge the battery, thus there will not be any issues faced for lack of power supply. We use text-speech converter to indicate the information that is stored in the module, for this we use text-speech converter and a voice recognizer, where the output is received in a speaker connected to it. In addition to it, we use Water detector, which are used to indicate the water in the way of visually impaired people. And also we use a piezo sensor to measure the temperature and pressure change in the environment.

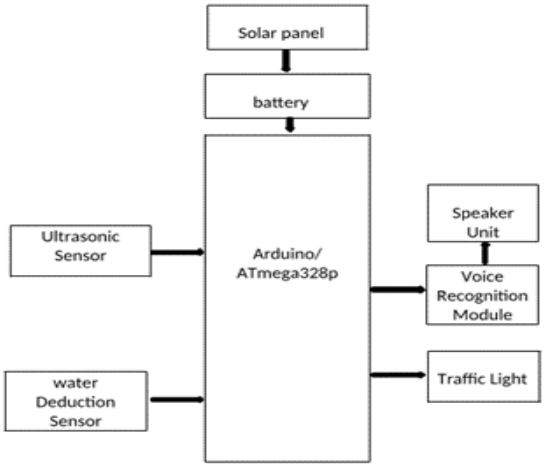


Figure1: Block Diagram Representation

The ultra-low-power MSP430™ microcontrollers for capacitive touch sensing that feature Captivate touch technology for buttons, sliders, wheels, and proximity applications. With 32 pin package option, the microcontroller is capable of performing against harsh environments including wet, greasy and dirty environments. A battery is connected to the controller. For battery charging solar panel is used, connected with the battery.

Ultrasonic sensor capable of object detection up to a particular Range is included. Water detection sensor for alerting the user in case of any water contact are included. The voice recognition module along with a speaker unit is used for text to speech conversion. The traffic light recognition is used for the detection of traffic lights displayed at the moment.

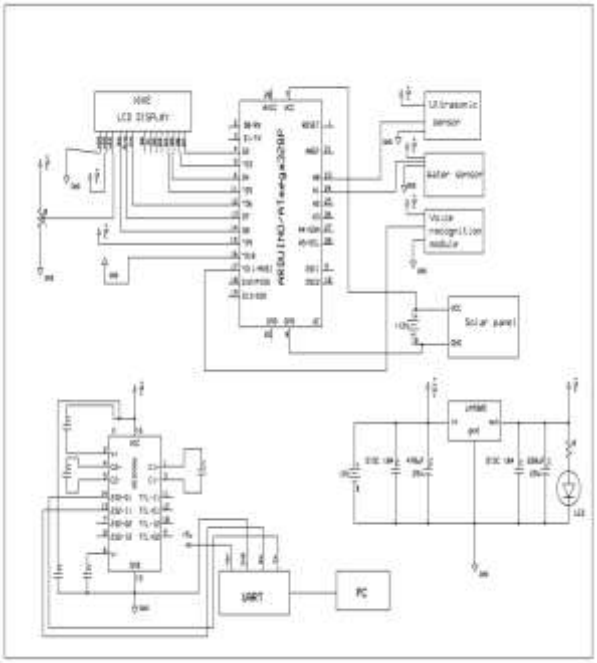


Figure 2 Schematic Representation

The used components for the device are portable and lightweight. They are capable of performing for longer period even with the use of the solar panel for charging the battery. Designed to help the user in any kind of environment and is user friendly.

The schematic diagram represents the working model of the proposed design. Here comes the design that has overcome the previous issues and also supports the people very well.

4. MICROCONTROLLER[us]

- ARDUINO - processor family
- ATmega - MCU platform
- 32 - Flash memory capacity that is 32KB.
- 8 - CPU type that is of 8 bit.
- p - Denotes that it needs less power to work than it earlier version.

4.1 Description

The **ATmega328** is a single-chip microcontroller created by Atmel in the mega AVR family (later Microchip Technology acquired Atmel in 2016). It has a modified Harvard architecture 8-bit RISC processor core. The Atmel 8-bit AVR RISC-based microcontroller combines 32 kB ISP flash memory with read-while-write capabilities, 1 kB EEPROM, 2 kB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter(8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. The device achieves throughput approaching 1 MIPS per MHz

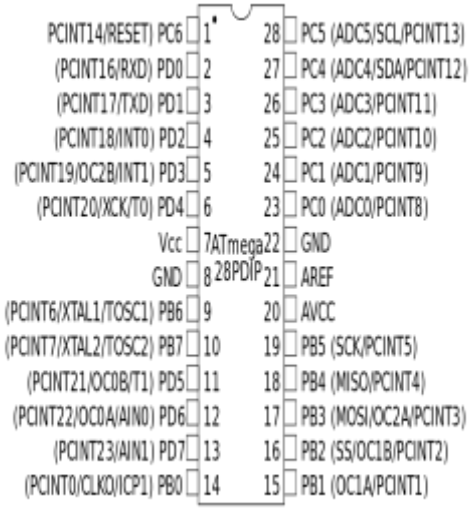


Figure 3: Diagram of Processor

4.2 Features

Parameter	Value
CPU type	8-bit AVR
Performance	20 MIPS at 20 MHz
Flash memory	32 kB
SRAM	2 kB
EEPROM	1 kB
Pin count	28 or 32 pin: PDIP-28, MLF-28, TQFP-32, MLF-32
Maximum operating frequency	20 MHz
Number of touch channels	16
Hardware QTouch Acquisition	No
Maximum I/O pins	23
External interrupts	2
USB Interface	No
USB Speed	–

5. TEXT TO SPEECH PLAYBACK[vo]

5.1 Features:

• Single-chip, high-quality voice recording & playback solution

- No external ICs required

- Minimum external components

• Non-volatile Flash memory technology

- No battery backup required

• User-Selectable messaging options

- Random access of multiple fixed-duration messages

- Sequential access of multiple variable-duration messages

• User-friendly, easy-to-use operation

- Programming & development systems not required

- Level-activated recording & edge-activated play back switches

• Low power consumption

- Operating current: 25 mA typical

- Standby current: 1 uA typical

- Automatic power-down

• Chip Enable pin for simple message expansion.

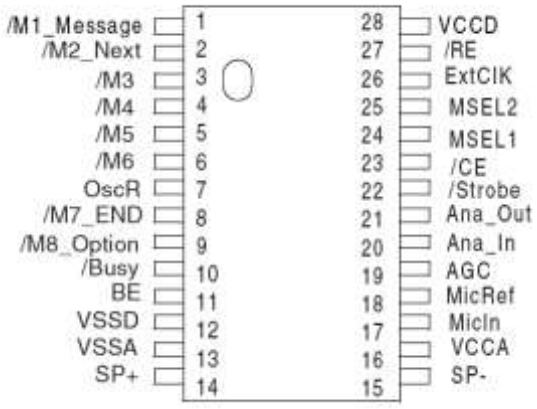


Figure4: Pin Diagram of voice module

5.2 Functional Description

The APR96 0 0 block diagram is included in order to give understanding of the APR9600i internal architecture. At the left hand side of the diagram are the analog inputs. A differential microphone amplifier, including integrated AGC, is included on-chip for applications requiring its use. The amplified microphone signal is fed into the device by connecting the Ana Out pin to the Ana In pin through an external DC blocking capacitor. Recording can be fed directly into the Ana In pin through a DC blocking capacitor, however, the connection between Ana In and Ana Out is still required for playback. The next block encountered by the input signal is the internal anti-aliasing filter. The filter automatically adjusts its response according to the sampling frequency selected so Shannon's Sampling Theorem is satisfied. After anti-aliasing filtering is accomplished the signal is ready to be clocked into the memory array. This storage is accomplished through a combination of the Sample and Hold circuit and the Analog Write/Read circuit. These circuits are clocked by either the Internal Oscillator or an external clock source. When playback is desired the previously stored recording is retrieved from memory, low pass filtered, and amplified as shown on the right hand side of the diagram. The signal can be heard by connecting a speaker to the SP+ and SP- pins. Chip-wide management is accomplished through the device control block shown in the upper right hand corner. Message managementis controlled through the message control block represented in the lower center of the block diagram. More detail on actual device application can be found in the Sample Applications section. More detail on sampling control can be found in the Sample Rate and Voice Quality section. More detail on message management and device control can be found in the Message Management section.

6. LCD

The most commonly used Character based LCDs are based on Hitachi's HD44780 controller or other which are compatible with HD44580. In this tutorial, we will discuss about character based LCDs, their interfacing with various microcontrollers, various interfaces (8-bit/4-bit), programming, special stuff and tricks you can do with these simple looking LCDs which can give a new look to your application.

7. OBJECT DETECTION

HC-SR04 ultrasonic sensing module used for object detection. Ultra ranging module provides 2cm-400cm Non-contact measurement function, the ranging accuracy can reach to 3mm. the module includes ultrasonic transmitter-receive and control circuit.

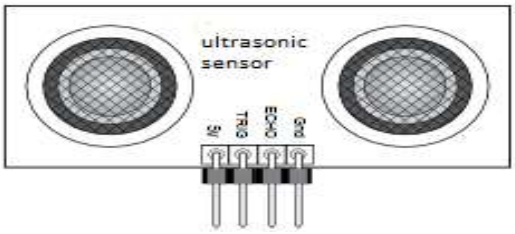


Figure5: Pin Diagram of Ultrasonic module

- Using 10 trigger for at least 10mA high level signal.
- The module automatically sends eight 40 KHz and detects whether there is a pulse signal back.
- If the signal back, through high level, time of high output duration is the time from sending ultrasonic to returning.
- Test distance=(high level time *velocity of sound(340m\s)/2

7.1 CONNECTIONS:

It is connected to a 5V supply with the Trigger pulse input and also connected to a Echo pulse output and has 0V gnd.

7.2 OPERATING MODES:

Voltage	DC 5 V
Working current	15mA
Working Frequency	40Hz
Maximum Range	4m
Minimum Range	2cm
Measuring angle	15 deg
Trigger input	10 micro sec TTL pulse
Echo output	Input TTL lever signal and range
Dimensions	45*20*15mm

7.2 SEQUENCE:

The short ultrasonic pulse is transmitted at the time 0, reflected by an object. The sensor receives this signal and converts it to an electrical signal. The next pulse can be transmitted when other echo is faded away. This time period

is called cyclic period. The recommended cyclic period should be no less than 50ms

If a 10 microsecond width trigger pulse is sent to the signal pin, the ultrasonic module will output eight 40 KHz ultrasonic signal and detect the echo back. The measured distance is proportional to the echo pulse width and can be calculated by the formula if no obstacle is detected, the output pin will give 38 ms high level signal.

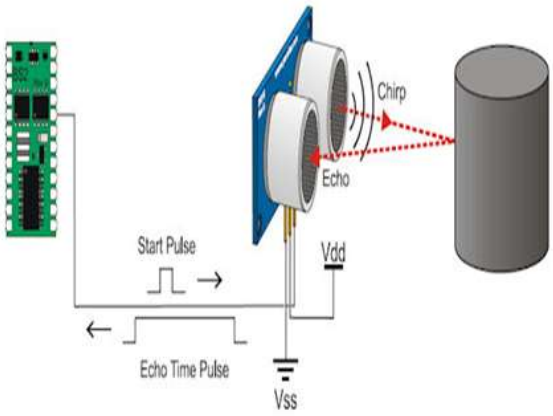


Figure6: Ultrasound working

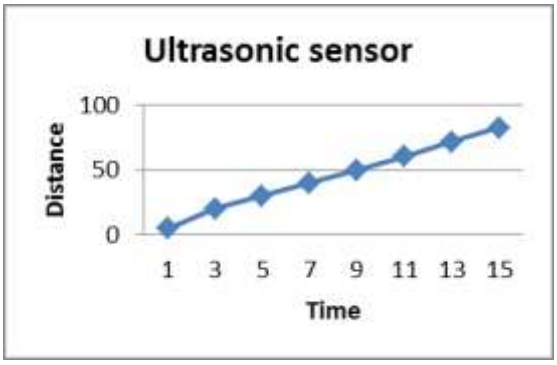


Chart-1: Ultrasonic sensor

Ultrasound sensors are placed to detect obstacles while the visually challenged pedestrian is outside. This helps the user to be aware of the object in front of him and creates awareness about the upcoming object. The distance up to which the user needs notification, is adjustable.

8. WATER DETECTION

The water sensor module is an easy tool for water detection. It can be used as a switch when drop falls through the board and also for measuring rainfall intensity. The module features, a rain board and the control board that is separate for more convenience, power indicator LED and an adjustable sensitivity though a potentiometer.

The analog output is used detection of drops in the amount of waterfall ,connected to 5V power supply, the LED will turn on when induction board has no rain drop, and do output is high. When dropping a little amount water, do output is low, the switch indicator will turn on. Brush off the water droplets, and when restored to the initial state, output high level.

Specifications: Adopts high quality of RF-04 double sided material. Area: 5cm x 4cm nickel plate on side,

- Anti-oxidation, anti-conductivity,
- with long use time;
- Comparator output signal clean waveform is good, driving ability, over 15mA;
- Potentiometer adjust the sensitivity;
- Working voltage 5V;
- Output format: Digital switching output (0 and 1) and analog voltage output AO;
- With bolt holes for easy installation;

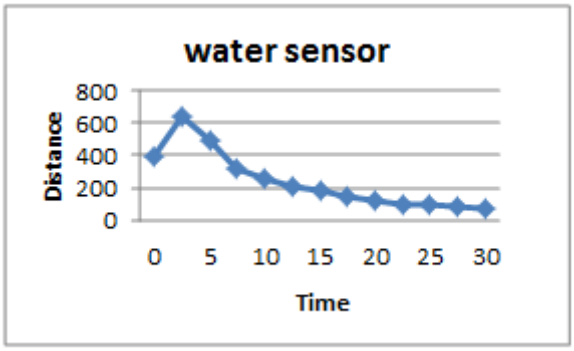


Chart-2: wet sensor

Wet sensors alert the user, in case of wet surface. Apart from wet sensor, Raindrop sensors or water level sensors can be used. Visually challenged citizens should be aware of any slippery wet surfaces or watery pits to prevent danger. Thus wet sensors are used to detect the wet path ahead and notify the user ahead through voice notification.

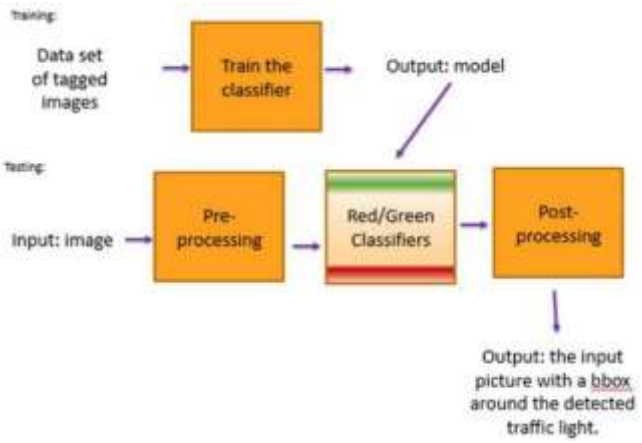
9. TRAFFIC LIGHT DETECTION[pr]

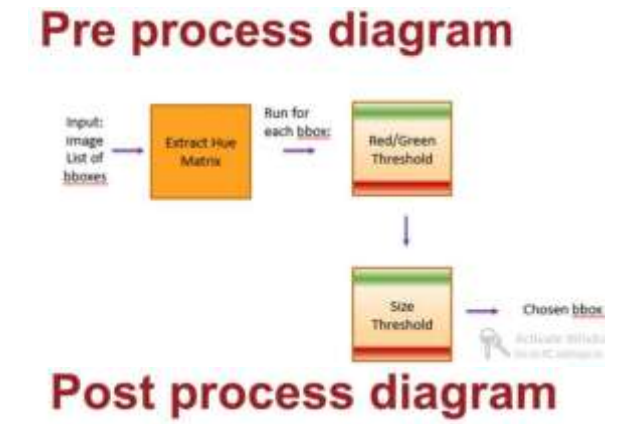
Traffic Light detection is implemented using MATLAB image processing. Distinguishing the Red/Green/Yellow colours using HSI model saturation. Distinguished loops of Red/Green/Yellow colour are created. To rely the message to the user, TTS(Voice recognition module) is used. By which the user gets the indication of the colour display.

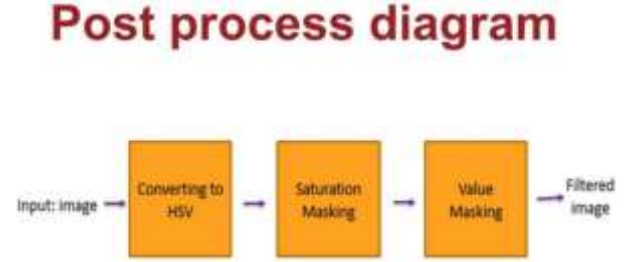
Detection of the traffic light is possible by training a classifier to analyse and verify pictures.

Algorithm contains two main levels,

1. Training the classifier using boosting methods.
2. Testing







- Input:original RGB image
- Transfer to HSV and create 2 mask to filter the original image(saturain & value filtering)
- Output:filtered RGB image

Figure6: Traffic light detection

10. SOLAR PANEL

Solar Electricity

If you truly wish your source of energy to be independent, there are only a few choices: solar in the form of solar electric panels, hot water panels, and passive heating; wind generators for electric production and windmills for water pumping; and hydro electric generators.

When people think about alternative or renewable energy, the first image that comes to mind is often large blue or black solar panels on rooftops or portable highway signs that have a small panel attached. These panels, also known as photovoltaic modules (or PV modules), convert sunlight into electricity, and they have been the backbone of renewable energy for decades. The Photovoltaic Effect (how sunlight is converted into electrical energy) was discovered over a hundred years ago! Yet widespread implementation of this technology has been very gradual. Only in very recent years has photovoltaic gained wide popularity as an alternative way to produce electricity.

Polycrystalline (aka multicrystalline) - Polycrystalline cell efficiencies range between 11-14% so solar panels are slightly less expensive than monocrystalline ones on a price-per-Watt basis.

Polycrystalline panels

Polycrystalline panels use a bunch of small cells put together instead of one large cell. Poly panels are slightly less efficient than mono panels. They are also claimed to be cheaper to manufacturer than mono panels although we have noticed them to be very similarly priced.

Solar power charging is used in the cane for an auxiliary battery support. The canes are already provided with primary battery. But these batteries can long last only for 8 hours. In case of any emergencies, these solar batteries can act as backup. In future, the canes can be decided with only the solar rechargeable power batteries if possible, which would be more eco- and user friendly.

11. WORKING

The Parallax PING ultrasonic distance sensor provides precise, non-contact distance measurements from about 2 cm (0.8 inches) to 3 meters (3.3 yards). It is very easy to connect to BASIC Stamp® or Javelin Stamp microcontrollers, requiring only one I/O pin.

The PING sensor works by transmitting an ultrasonic (well above human hearing range) burst and providing an output pulse that corresponds to the time required for the burst echo to return to the sensor. By measuring the echo pulse width the distance to target can easily be calculated

The APR9600 VOICE MODULE device offers true single-chip voice recording, non-volatile storage, and playback capability for 40 to 60 seconds. The device supports both random and sequential access of multiple messages. Sample rates are user-selectable, allowing designers to customize their design for unique quality and storage time needs. Integrated output amplifier, microphone amplifier, and AGC circuits greatly si mplify system design. The device is ideal for use in portable voice recorders, toys, and many other consumer and industrial applications. A 5V Polycrystalline Solar Panel Module System solar cells charger can charge the main battery with the help of Arduino solar interface. In case of drained solar battery, the auxiliary battery which acts as the main power source. The solar Panel is connected to the circuit by Solar Panel Interface the water level sensor connected to the microcontroller and it is made up of floating type of plastic, which floats in water to sense the level of water. When the water is full in the land the floating type sensor will float in water and reaches the top edge which used to indicate the water is full. Likewise when water is low in the land it reached the bottom and indicate the microcontroller that water is low. Automatic recognition of traffic signal started more recently but increasing rapidly especially in automatic vehicle. The objective is to investigate some appropriate methods that suitable road traffic light classification control system for blind people to recognize and identify the signals and cross the road freely. The module and method using for the productivity is under study.

12. TECHNICAL AND NON-TECHNICAL CONFRONTATIONS:

Depending on the technical aspect the text to speech conversion method is slightly difficult as it may sometimes deliver not so accurate data, while GPS tracking has its own disputes in tracking the latitude and longitudinal values to be programmed. Designing an all in one equipment is intricate getting the best out of the sources available.

13. ENVISIONED OUTCOME:

The model consists of ultrasound sensor for object detection, which would be used to detect the obstacle.Along with ultrasound object detector, the walking cane is to be designed with traffic light indicator which helps the blind to cross the road without any human help. The traffic light detector with a CCD camera, an image acquisition card, and a PC. Based on RGB color space, the algorithm extracts red, green, and yellow objects in the image firstly For the purpose of eliminating disturbance in the environment, the features of traffic lights are used to verify the object identity, and then the types of traffic signals are judged. Here this model is charged using a solar panel. Here the solar panel is used to recharge the battery, thus there will not be any issues faced for lack of power supply. We use text-speech converter to indicate the information that is stored in the module, for this we use text-speech converter and a voice recognizer, where the output is received in a speaker connected to it. In addition to it, we use Water detectors, which are used to indicate the water in the way of visually impaired people.

14. CONCLUSIONS:

This model helps the visually impaired peoples with lot of accessibilities, were they are tend to use the highly technical supported cane .These walking canes are very useful in one way or other. This model will be economical in the market and user friendly .here this model uses the natural power source to energize the battery, which are said to be the eco-friendly. Thus this product will be a boon in their market. The ultimate aim of this design is to make the visually impaired people to go along the roads and streets without any guidance.

By developing this product in India, with affordable price, the blind people who lock them self in their home, afraid to walk in the streets can now able to suit themselves in the happy India existing outside their home. Half the walk canes used as imported from foreign countries. But by developing this product in India the visually challenged people may not pay a lot of money for the imported canes. These Indian made canes can be of low cost which should be easily affordable for the struggling visually impaired Indian.

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