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A CENTRE OF EXCELLENCE IN SCIENCE & TECHNOLOGY BY THE CATHOLIC ARCHDIOCESE OF TRICHUR

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NBA accredited B.Tech Programmes in Computer Science & Engineering, Electronics & Communication Engineering, Electrical & Electronics Engineering and Mechanical Engineering valid for the academic years 2016-2022. NBA accredited B.Tech Programme in Civil Engineering valid for the academic years 2019-2022.

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Department of Electronics & Communication Engineering
JYOTHI ENGINEERING COLLEGE, CHERUTHURUTHY

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VISION OF THE INSTITUTE

Creating eminent and ethical leaders through quality professional education with emphasis on holistic excellence.

MISSION OF THE INSTITUTE

- To emerge as an institution par excellence of global standards by imparting quality engineering and other professional programmes with state-of-the-art facilities.
- To equip the students with appropriate skills for a meaningful career in the global scenario.
- To inculcate ethical values among students and ignite their passion for holistic excellence through social initiatives.
- To participate in the development of society through technology incubation, entrepreneurship and industry interaction.

VISION OF THE DEPARTMENT

Create eminent and ethical leaders in the field of Electronics and Communication through quality professional education to excel in academia and industry.

MISSION OF THE DEPARTMENT

- Provide theoretical and practical knowledge through quality education and life skills training to make competent graduates with leadership and social commitment.
- To impart entrepreneurial orientation and motivation for research among the students through knowledge transfer between industrial, academic & research institutions

PROGRAMME EDUCATIONAL OBJECTIVES (PEOS)

PEO I : Graduates shall have fundamental and advanced knowledge in electronics and communication engineering along with knowledge in mathematics, science and computing and get employed in national or international organizations or government agencies.

PEO II : Graduates shall have ability in analyzing, designing and creating innovative solutions which lead to a lifelong learning process or higher qualification, making them experts in their profession thus helping to solve electronics & communication engineering and social problems.

PEO III: Graduates shall have good organizing capabilities, presentation skills, communicating ability, leadership, team work and ethical practices.

PROGRAMME SPECIFIC OUTCOMES (PSO's)

Graduate possess:

- Professional skills: Associate the concepts related to Electronics, Communication, Embedded Systems, Signal Processing and VLSI to solve real life problems.
- Problem solving ability: Comprehend technology advancement to analyze and design systems using modern design tools for the benefit of the society.
- Lifelong learning and ethical Values: Have good communication skills, work as a team, develop leadership qualities, become professionals or entrepreneurs with ethical values.

PROGRAMME OUTCOMES (POS)

Engineering Graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and sustainability: Understand the impact of the professional engineering

solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.



The department of Electronics & Communication Engineering has consistently maintained an exemplary academic record. The well qualified faculty and courses of this department aid to prepare students for careers as professional engineers through an education in fundamental principles as well as in the context of real application and design environment. The department encourages all students to take advantage of the opportunities provided by the institute. I feel extremely proud and take this opportunity to congratulate the magazine committee in bringing out the platform 'ELECONS' in representation of the Electronics & Communication Department and wish them the very success in releasing it.

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We would like to thank all the staff and students of the Electronics & Communication Department for their constant effort in the launching of the Magazine. We are also thankful to our Management and Principal for their support and encouragement. We are grateful to our reviewers for their frank opinions and constructive suggestions, namely our colleagues and students.



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MICROSTRIP PATCH ANTENNA FOR BIO-MEDICAL APPLICATIONS



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Alex Davy



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Dr. Gaswin Kastro G



Bijoy Joshy

Research in body sensors networks (BSN) for wireless communications (or Body Centric Wireless Communication (BCWC)) is a relatively new topic with little work worldwide compared to mobile communications. Research in implanted devices - as one of BSN topics - for wireless medical applications has been growing rapidly over the past decade. In order to provide vital information such as glucose level, blood pressure, etc. the implantable devices are embedded into the body. This information can be transmitted from implantable devices to external equipment outside the body through a wireless communication link. Examples of electronic implants include heart pacemakers, cochlear implants and intraocular implanted antennas for retinal prosthesis application. Implantable devices increase the healthcare quality as it reduces the risk of some disease complications, by continuous monitoring of some disease developments. Moreover, it reduces healthcare cost, as for example patients can be continuously monitored without being admitted to the hospital. Figure 1.1 shows examples of implanted devices for continuous monitoring.



Figure 1.1: Body Sensor Network Systems

The main applications of implanted devices are either therapeutic - such as hyperthermia treatment - or diagnostic to detect and transmit data. Medical and biomedical

researchers show the importance of the continuous monitoring for many diseases such as heart rate, blood oxygenation levels in Chronic Obstructive Pulmonary Disease (COPD), blood sugar level for diabetes patient, blood pressure and patient's daily activity. This vital information can be obtained using sensors which can be implanted under the skin as a type of implanted device.

Implantable devices are playing a vital role toward increasing the quality of healthcare diagnose and treatment and medical research. Such applications have motivated research on implanted antennas as an important part of the implantable wireless devices. These areas of research are still immature and have significant potential, due to the many challenges that need to be overcome particularly antennas which are surrounded by highly lossy media. Hence the human body reduces the radiation efficiency of the radiating element due to electromagnetic absorption in the body tissues. The highly lossy medium causes radiation pattern distortion and affects antennas behavior and specifications. Therefore, the performance of implanted antennas is still one of the most challenging parts for implanted systems. This area of research motivates us to focus on increasing the performance of implanted antennas using different performance improvement techniques.

This work focuses on how to increase the implanted antennas performance changing the substrate material to air that has relative permittivity of 1.0006. These antennas will be modelled using CST software and will be fabricated and tested in the laboratory. The three layers of human body model (skin, fat and muscle) will be used for subcutaneous implanted antennas for a body phantom. These objectives are converted into designing an efficient, miniaturized and high-performance implantable antenna and improving its performance to high gains and developing a phantom in order to perform the measurements of the implanted antenna.

ML-BASED IMAGE PROCESSING FOR WEED DETECTION IN AGRICULTURAL FIELD



Aiswarya Satish



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The rapid growth of global population compounded by climate change is putting enormous pressure on the agricultural sector to increase the quality and quantity of food production. It is predicted that the global population will reach nine billion by 2050, and therefore, agricultural production must double to meet the increasing demands. However, agriculture is facing immense challenges from the growing threats of plant diseases, pests and weed infestation. The weed infestations, pests and diseases reduce the yield and quality of food, fiber and biofuel value of crops. Losses are sometimes cataclysmic or chronic, but on average account for about 42 percentage of the production of a few important food crops. Weeds are undesired plants which compete against productive crops for space, light, water and soil nutrients, and propagate themselves either through seeding or rhizomes. They are generally poisonous, produce thorns and burrs and hamper crop management by contaminating crop harvests. That is why farmers spend billions of dollars on weed management, often without adequate technical support, resulting in poor weed control and reduced crop yield. Hence, weed control is an important aspect of horticultural crop management, as failure to adequately control weeds leads to reduced yields and product quality. The use of chemical and cultural control strategies can lead to adverse environmental impacts when not managed carefully.

A low-cost tool for identification and mapping of weeds at early growth stages will contribute to more effective, sustainable weed management approaches. Along with preventing the loss of crop yield by up to 34 percentage, early weed control is also useful in reducing the occurrence of diseases and pests in crops. Many approaches have been developed for managing weeds, and they normally consider current environmental factors. Among these approaches, deep learning is promising. The image processing approach are used for monitoring crops and capturing the possible weeds in the fields.

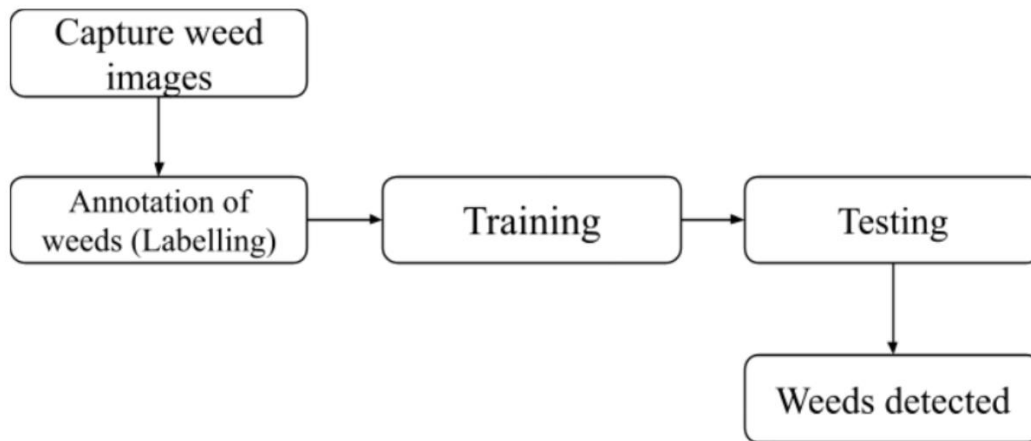


Figure 2.1: Weed Detection Procedure

A weed is a plant considered undesirable. Weeds have no botanical classification since a plant that is a weed in one reference is not a weed when growing where it is wanted. It is applied to any plant that grows or reproduces aggressively or is outside its native habitat. The term is occasionally used to broadly describe species outside the plant kingdom that can live in diverse environments and reproduce quickly. These have seeds that persist in the soil seed bank for many years. They compete with the desired plants for the resources that a plant typically needs, namely, direct sunlight, soil nutrients, water, and (to a lesser extent) space for growth. Weed classification is a serious issue in the agricultural research.

Weed classification is a necessity in identifying weed species for control. Weeds interfere with a variety of human activities, and many methods have been developed to suppress or eliminate them. These methods vary with the nature of the weed itself, the means at hand for disposal, and the relation of the method to the environment. Herbicide chemicals sprayed on a roadside to eliminate unsightly weeds that constitute a fire or traffic hazard are not proper for use on cropland. Mulching, which is used to suppress weeds in a home garden, is not feasible on large farms. Weed control, in any event, has become a highly specialized activity. Universities and agricultural colleges teach courses in weed control, and industry provides the necessary technology. In agriculture, weed control is essential for maintaining high levels of crop production.

As the costs of labor has increased, and people have become more concerned about health and environmental issues, automation of weed control has become desirable. Automated weed control systems can be beneficial both economically and environmentally. Such systems

can reduce labor costs by using a machine to remove weeds and, selective spraying techniques can minimize the use of the herbicides. To develop an automatic weed management system, an essential first step is to be able to detect and recognize weeds correctly. Detection of weeds in crops is challenging as weeds and crop plants often have similar colors, textures, and shapes. With advances in computer technologies, particularly in graphical processing units (GPU), embedded processors coupled with the use of Machine Learning (ML) techniques have become more widely used for automatic detection of weed species.

Simulation is done by using Deep learning approach known as Mask Region based Convolutional Neural Network. The major steps include Data Collection, Labelling or annotation of images by using label image tool, training of annotated data and testing. Deep learning is an effective approach because of their strong feature learning capabilities. Discriminated features can be extracted and selected even if the crops and weeds are similar.

SIGN LANGUAGE TO VOICE CONVERSION SYSTEM FOR DEAF AND MUTE PEOPLE



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Arun K Narayanan



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This project mainly addresses to facilitate deaf and dumb person's life style. They communicate with common people throughout the world using sign language. It simultaneously involves the use of:

- Facial expressions
- Orientation and hand movement
- Finger spellings
- Head movement
- Eye gazes
- Body language

But common people face difficulty in understanding the gesture language. The importance of sign language is emphasized by the growing public approval and funds for international project. At this age of technology, the demand for a perfect system is highly demanding for the dumb community. However, researchers have been attacking the problem for quite some time now and the results are showing some promise. To overcome the real time issues systems are developed. Many methods can be employed to avoid the risks caused due to the improper communication with society.

One such approach is vision-based technique which is more user friendly and economic system than a glove-based technique that uses various hardware equipment and sensors. The project aims to make computers to understand human language and develop a user-friendly human computer interface (HCI). Making a computer understand speech, facial expressions and human gestures are some steps towards it. Gestures are the non-verbally exchanged information. A person can perform innumerable gestures at a time. Coding of these gestures

from the continuous videos being obtained. Since human gestures are perceived through vision, it is a subject of great interest for computer vision researchers. Three different approaches to make communication with differently abled citizen in vision-based technique includes feature extraction approach, hand segmentation approach and gesture recognition approach.



Figure 3.1: Sign Language

We aim to help deaf and mute people by providing them with Computer Vision that provides various image processing functions. OpenCV (Open-Source Computer Vision) is a real time computer vision library with strong processing efficiency. OpenCV has a templated interface working in relation with STL containers. Four stages in OpenCV include image acquisition, Feature Extraction, Orientation detection and Gesture Recognition. Image taken by camera is processed by a computer. So that it improves picture, which converts their sign language and process them into text output. It Read and Write Images, Detection of faces and its features, Detection of shapes like circle, rectangle etc. in an image. E.g., Detection of coin in image, Text recognition in image. E.g., Reading Number Plates, Modifying image quality and colors, E.g., Instagram, Cam Scanner, Developing Augmented reality apps. It works with almost all the famous languages, it can support C++, Android SDK, Java, python, free to use. OpenCV is the core where actual function of translation takes place. OpenCV is a real time computer vision library with strong processing efficiency. OpenCV processes the image captured by camera by various approaches.

- Template Based Approaches;
- Knowledge Based Approaches;
- Statistical Based Approaches;
- The Artificial Intelligence Approach;

And as mentioned there are different things involved in sign language. In that we concentrate only the finger spelling. Hand shapes represent the letters in the alphabet. Finger spelling is used with many other building blocks; it is almost never used by itself. It is most often used with American Sign Language (ASL), Conceptually Accurate Signed English (CASE), and Manually Coded English (MCE) to spell out words that don't have a sign — such as the names of places or people. Again, there are different finger spelling categories American, Indian etc. Each of them is worldwide accepted standard one with its own features. They have many similarities and differences. The major difference is the usage of hands. In ASL it includes only one hand but in ISL it uses both hands at same time. So, for convenience in this project, we use the American finger spelling.

Currently, many frameworks or library machine learning for hand gesture recognition have been built to make it easier for anyone to build AI (Artificial Intelligence) based applications. One of them is Media Pipe. The Media Pipe framework is present by Google for solving the problem using machine learning such as Face Detection, Face Mesh, Iris, Hands, Pose, Holistic, Hair segmentation, Object detection, Box Tracking, Instant Motion Tracking, Objection, and KIFT. Media Pipe framework helps a developer focus on the algorithm and model development on the application, then support environment application through results reproducible across different devices and platforms which it is a few advantages of using features on the Media Pipe framework.

In this project, we focus on developing a manual user guide application with improving architecture application by applying hand gesture recognition using the Media Pipe framework and camera of OpenCV for capture hand pose to recognized. Using hand gesture recognition will improve our user guide application more interactive.

PROTECTION OF DRONE USING ULTRASONIC SENSORS



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Salma Mariya



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Obstacle avoidance in UAVs is becoming increasingly important as the industry expands. The avoidance system is made up of two parts: recognizing an obstruction within a safe operating range and determining a safe flight path to avoid the obstacle. Although a variety of flight controllers have now been widely used, none of them have an obstacle avoidance system. A quadrotor UAV is an aircraft that can take off and land vertically and is powered by four electric machines.

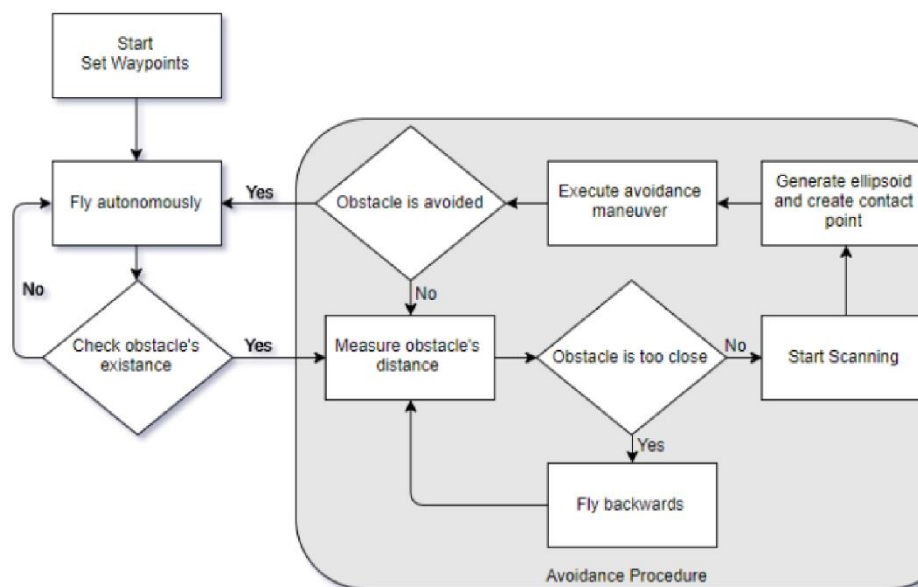


Figure 4.1: Avoidance Procedure Flowchart

Quadrotor UAVs have quickly expanded due to their simple structure, low cost, and great adaptability, and are currently widely utilized in industries such as aerial photography, environmental monitoring, geological prospecting, and line inspection. Because the existence of drones is critical to public safety, the Indonesian government, through the Ministry of Transportation, has issued drone guidelines based on ministry document No. 90 2015, which restricts flight to around 500 feet or 150 meters. This restriction was enacted after numerous

mishaps involving unsupervised drone flight, such as collisions with humans or their property. Meanwhile, collision avoidance services such as collision avoidance are rarely included in drone features. As a result, for existing drone devices, obstacle avoidance is required.

As technology advances the quad rotor UAV will become more important in people's job and lives. However, with quad rotor UAVs growing popularity has come a plethora of problems. The bulk of quad rotor UAVs are low attitude aircraft when compared to traditional aircraft. When the quad rotor is flying at a low height, avoiding obstacles using ultrasonic then taking the proper evasive action. Ultrasonic distance measuring is a form of detecting that does not require any contact. It is unaffected by light or color of the surface of the object. It has the ability to adjust to the dark, dust, smoke and electromagnetic interference to some extent.

Preventive services like collision avoidance are typically not included in drone functions. As a result, for existing drone devices, obstacle avoidance is required. The use of ultrasonic sensors and their evaluation for providing obstacle avoidance in existing drones was presented in this paper.

BLIND NAVIGATION SYSTEM



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Nibin Thomas



Chaithanya A B



Catherine Williams

The system provides the navigation for the blind that is by repeatedly explaining the things in front of him by continuously monitoring and recognizing the distance and direction of the object or obstacle in front of him. The objective is to help the blind to get a proper idea about where is he and how to move.

This project illustrates one way of overcoming this issue keeping visually impaired people in focus. We have devised a system capable of identifying objects and suggesting the user to choose his path based on the obstacle ahead of him. We have implemented YOLO algorithm for classification and identification of objects. This involves a client-server feature to ensure that the device is more real-time and efficient. The outcome of the project is to ensure the safest path to choose with respect to the object ahead of the user by audio guidance. This project illustrates one way of overcoming this issue keeping visually impaired people in focus. We have devised a system capable of identifying objects and suggesting the user to choose his path based on the obstacle ahead of him. We have implemented YOLO algorithm for classification and identification of objects. This involves a client-server feature to ensure that the device is more real-time and efficient. The outcome of the project is to ensure the safest path to choose with respect to the object ahead of the user by audio guidance.

A blind person can tap on the screen in a particular area and hear information about what they have tapped. They can tap again to activate that area. Thus, even those with no vision can understand what is on the screen based on audio feedback.

The biggest challenge for a blind person, especially the one with the complete loss of vision, is to navigate around places. Obviously, blind people roam easily around their house without any help because they know the position of everything in the house. People living with and visiting blind people must make sure not to move things around without informing or asking the blind person.

Blind individuals struggle when traveling from place to place and rely on predefined and repetitive routes with minimum obstacles to lead them to their destinations without assistance. However, there is a chance that the paths they have grown accustomed to may have new potential hazards or are blocked off due to inclement weather or construction. Therefore, it is important to have navigation devices that allow visually impaired individuals to maneuver and be directed throughout their journey independently and inform them of where their current position may be. Not only is it important for a blind individual to know how to get from one destination to another, it is essential to know what buildings, obstacles, potential hazards and traffic they may be nearby. A navigation device would not be limited to the aid of blind individuals, but can potentially be used to direct individuals with full vision and are inexperienced with a new environment.

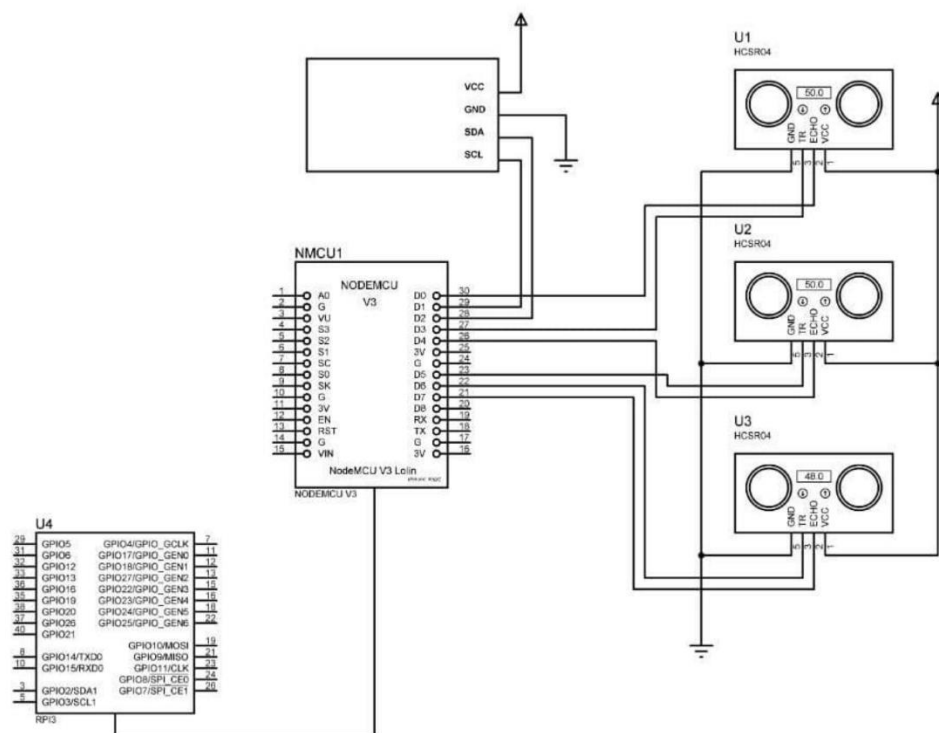


Figure 5.1: Connection Diagram

The proposed navigation system in this paper mainly focuses on these components:

- Sensing of the immediate surrounding environment against obstacles for the visually impaired person
- Warning about the obstacles by means of voice feedback system
- Multi-axis definition

This navigation aid can be an efficient and cutting-edge tool for indoor and outdoor environment for visually impaired people. Therefore, the project mission is to carry out the following functions: Detection of obstacles using ultrasonic sensors, Implementation voice feedback system. The system contains three ultrasonic sensors HC- SR04, which will detect the barriers in the path. The control system is developed using Raspberry pi and cutting-edge micro-controller. With the response from the ultrasonic sensors, the distance between the person and the obstacle is measured. so that the person can know the direction of the obstacle and sense its distance. Accelerometer MUP6050 helps us to measure velocity, orientation, acceleration, displacement and other mention like features. So, the overall system goal is to construct a portable, simple, less costly device that will help visually impaired people to move in unfamiliar environment.

AUTOMATIC DETECTION AND ENHANCMENT FOR COVID-19



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Salini T M



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Sreeshma Sasidharan



Shiny M I

Coronavirus disease 2019 (COVID-19) is found in Wuhan, China, in 2019, and this virus was declared as a global pandemic in march 2020 by World Health Organization (WHO). In December of the year 2019, the first coronavirus-infected patient was discovered. COVID-19 has since spread over the world as a pandemic. This pandemic is putting people all across the world in perilous positions. Every day, thousands of individuals get infected and die as a result of the disease. Nearly 52,20,69,120 infected cases have been confirmed as of the time of writing this report, with deaths. This number is increasing day by day. Fever, dry cough, tiredness, diarrhea, loss of taste, and smell are the major symptoms of coronavirus which is declared by the World Health Organization (WHO). To combat the coronavirus, many preventative steps have been implemented. Cleaning hands, keeping a safe distance, wearing a mask, and not touching eyes, nose, or mouth are the most important, with wearing a mask being the simplest. COVID-19 is a disease that spreads from person to person and can be prevented by wearing a face mask properly. COVID-19 can be kept under control if persons maintain tight social distance and use a face mask. Unfortunately, people are not following the guidelines, which is hastening the spread of the infection. Detecting persons who are not following the guidelines and contacting the appropriate authorities can help to reduce the spread of the coronavirus.

So, to reduce the corona virus and to control this pandemic we would be aware in some of cases. So here we are introducing some of methodologies to control the corona virus. That are to maintaining the social distance and wearing mask.

The first methodology Face mask detection model discussed in, the help of machine learning and image processing in order to identify the people wearing a mask or not wearing a mask. This work's experimental result is done using Open CV to detecting live stream objects,

TensorFlow, and Keras to implement the deep learning algorithms to classify 1000 data with mask and 750 without mask data. The result has been shown, 95.22 percentage accuracy performed by convolutional Neural Network, And 94 percentage accuracy was obtained using Fast Neural Network. Object detection and image processing are the most important features in advanced technology development to detect images by web camera, and other web-based technologies. Through the web cam the images are detecting and by machine learning technologies the images are processed. through this we are finding mask wears and not wears faces, using system and giving a voice command to the respected person about the mask wearing.

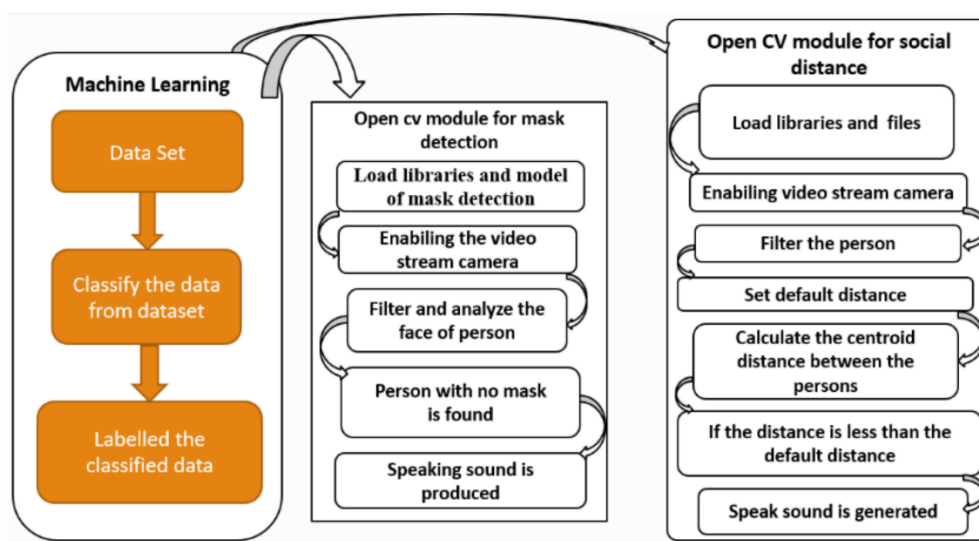


Figure 6.1: Block Diagram

The ongoing COVID-19 corona virus outbreak has caused a global disaster with its deadly spreading. Due to the absence of effective remedial agents and the shortage of immunizations against the virus, population vulnerability increases. In the current situation, as there are no vaccines available; therefore, social distancing is thought to be an adequate precaution (norm) against the spread of the pandemic virus. The risks of virus spread can be minimized by avoiding physical contact among people. The purpose of this work is, therefore, to provide a deep learning platform for social distance tracking using an overhead perspective. The framework uses the YOLOv3 object recognition paradigm to identify humans in video sequences. The transfer learning methodology is also implemented to increase the accuracy of the model. In this way, the detection algorithm uses a pre-trained algorithm that is connected to an extra trained layer using an overhead human data set. The detection model identifies peoples using detected bounding box information. Using the Euclidean distance, the detected bounding box centroid's pairwise distances of people are determined. To estimate social

distance violations between people, we used an approximation of physical distance to pixel and set a threshold. A violation threshold is established to evaluate whether or not the distance value breaches the minimum social distance threshold. In addition, a tracking algorithm is used to detect individuals in video sequences such that the person who violates/ crosses the social distance threshold is also being tracked. Experiments are carried out on different video sequences to test the efficiency of the model. Findings indicate that the developed framework successfully distinguishes individuals who walk too near and breaches/ violates social distances; also, the transfer learning approach boosts the overall efficiency of the model. The accuracy of 92 percentage and 98 percentage achieved by the detection model without and with transfer learning, respectively. The tracking accuracy of the model 95 percentage.

ELDERLY CARE SYSTEM



Elderly care has faced some problems such as elderly solitary, trained care givers insufficiency, and increasing cost of late diagnosis of diseases and accident. Regarding to these problems, smart home technology can be used as an efficient solution. It provides an expertise, long-term, and low-cost care that empowers elderly to have an independent life.

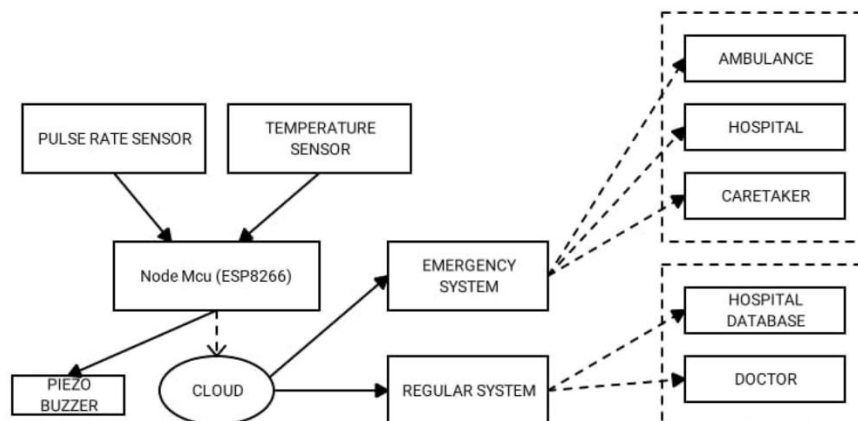


Figure 7.1: Block Diagram

Taking care of elders is an important job in a family specially when they are bedridden, the main problem faced by the caretakers are that its time consuming and they can't do other tasks. The various difficulties faced in the elderly age are:

- Family member face difficulty to take care of the bed ridden in this 24*7 moving world.
- Virtually all people work from 9am to 5pm.
- Government is failing to provide health care workers for each patient.
- Even we cannot trust all the caretakers whom we pay do take care.

The implementation of this system would help to go to work peacefully. They can check how the patient is doing whenever they want.

The proposed system is an IOT based system which can monitor the patient 24*7 using medical instruments and equipment. “The Internet of Things (IoT) is the network of physical objects that contain embedded technology to communicate and sense or interact with their internal states or the external environment.” Objects in IoT refers to any type of object, it can be a smart device with more artificial intelligence which can communicate with other objects very efficiently or it can be a dumb object which does not have any communication capabilities. Objects with communication capabilities become communicating nodes. Hence IoT is not only the concept of hardware or software, it also considers the interaction between the objects.

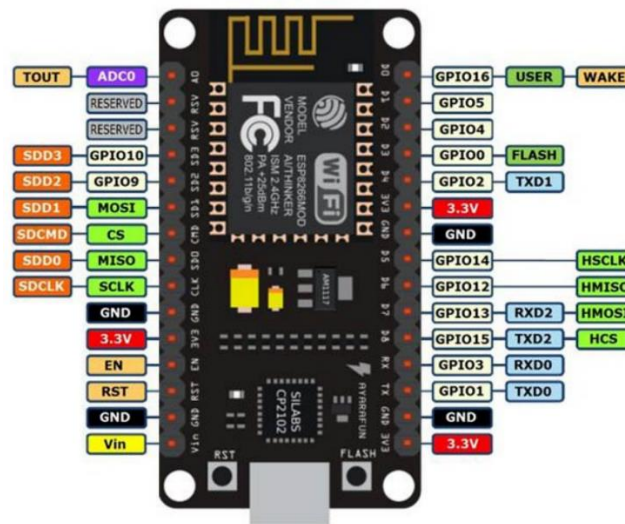


Figure 7.2: NodeMCU-ESP8266

The advantages of this system are:

- 24*7 camera surveillance and motion detector.
- Monitoring device to monitor the pulse rate, oxygen saturation, blood pressure, etc.
- Medicine reminder, Hourly health reports sent to respected doctors and caretakers.
- In case of emergency an SOS message will be send through an automated system including the details of patient and their location.

DESIGN AND DEVELOPMENT OF BIOSENSORS USING HEMT



Dr. Prajoon P



Sona Roy



Sneha A B



Shinto T S



Jelilie Rosa Jose

The recent COVID-19 pandemic has again brought in forefront the importance of electronic biosensors in detection of biomolecules. Gallium Nitride (GaN) high Electron Mobility Transistor (HEMT) is an excellent choice for Radio frequency, space applications, power applications and optoelectronics. Owing to its excellent electrical property like wide band-gap, higher thermal conductivity and higher electron mobility. HEMT devices based on AlGaN/GaN heterostructure have special electronic properties, such as piezoelectric and spontaneous polarization, leading to increased electron density of the two-dimensional electron gas (2DEG). GaN HEMT is chemically stable and form ionic bond, thus biomolecule can easily attach to the surface. This hereby largely modulates 2DEG. In this work, AlGaN/GaN HEMT using transconductance peak has been proposed for detection of biomolecule. Drain current is sensitive parameter to observe change in surface potential, 2DEG and gate voltage.

The HEMT is a heterojunction device with superior performance to its homojunction counterpart, the MESFET. The principle of operation in a HEMT is very similar to Metal Insulator Semiconductor Field Effect Transistor (MISFET). However, instead of carrying current in a thick channel, a HEMT relies on the formation of a two-dimensional electron gas (2DEG) at the heterojunction interface.

The device is usually grown on a semi-insulating substrate which has a high thermal stability and close lattice matching with GaN. A buffer layer is grown on top of the substrate to act as an isolation layer between the substrate and channel. Any lattice mismatching or crystal defects from the substrate are minimized using this GaN buffer layer. The device usually uses a Schottky gate contact and ohmic source and drain contact. The channel in a HEMT is formed at the heterojunction interface of the AlGaN barrier and GaN channel layer. The HEMT operations, formation of 2DEG, types of HEMT, are discussed in the following sections.

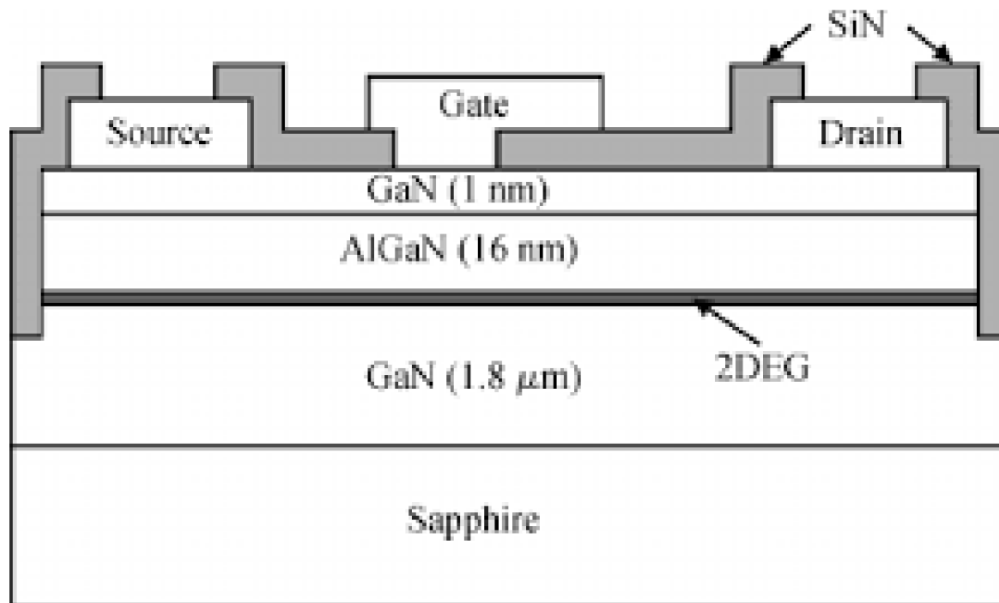


Figure 8.1: Structure of HEMT

HEMTs are essentially heterojunctions formed by semiconductors having dissimilar bandgaps. When a heterojunction is formed, the conduction band and valence band throughout the material must bend to form a continuous level. The wide band element has excess electrons in the conduction band as it is doped with donor atoms (or due to polarization charge in GaN-based HEMTs). The narrow band material has conduction band states with lower energy. Therefore, electrons will diffuse from wide bandgap material to the adjacent lower bandgap material as it has states with lower energy. Thus, a change in potential will occur due to movement of electrons and an electric field will be induced between the materials. The induced electric field will drift electrons back to the conduction band of the wide bandgap element. The drift and diffusion processes continue until they balance each other, creating a junction at equilibrium like a p-n junction. Note that the undoped narrow bandgap material now has excess majority charge carriers, which yield high switching speed. An interesting fact is that the low bandgap undoped semiconductor has no donor atoms to cause scattering and thus ensures high mobility. As an added advantage, surface scattering is also reduced by moving the current-carrying region below the barrier. To understand the principle of operation and techniques, the formation of 2DEG and different effects involved in the HEMT are explained in the following sections. The reduction of the specific on-resistance is strongly required to reduce the power device losses. For dramatic reduction of the specific on-resistance, AlGaN–GaN heterostructure devices are attractive due to the high electron mobility in a two-dimensional electron gas (2DEG) channel and large critical electric field.

Gallium Nitride (GaN) and high Electron Mobility Transistor (HEMT) is an excellent choice for Radio frequency, space applications, power applications and optoelectronics. Owing to its excellent electrical property like wide band-gap, higher thermal conductivity and higher electron mobility. HEMT devices based on AlGaN / GaN heterostructure have special electronic properties, such as piezoelectric and spontaneous polarization, leading to increased electron density of the two-dimensional electron gas (2DEG). GaN is more sensitive to stress as the conducting channel is very close to the surface to increase sensitivity. GaN based biosensor HEMT has exceptional good biological compatibility, stable material property and high sensitivity to surface charge change as the channel is close to the surface. Biomolecule, gas, polar liquids and other chemical substances has great effect over the surface potential. The change in the surface charge results in change in 2DEG, thereby higher sensitivity is obtained. In addition, the sensitivity of GaN based Biosensor is not affected by ambient temperature and harsh environmental condition because of its excellent chemical stability and thermal conductivity.

Sentaurus is a suite of TCAD tools which simulates the fabrication, operation and reliability of semiconductor devices. The Sentaurus simulators use physical models to represent the wafer fabrication steps and device operation, thereby allowing the exploration and optimization of new semiconductor devices. The Sentaurus TCAD tools work seamlessly and can be combined into complete simulation flows in 2-D and 3-D. Sentaurus TCAD supports silicon and compound semiconductor technologies, covering a broad range of semiconductor applications. Semiconductor manufacturers face the challenge of developing process technologies within strict time and cost constraints. One key factor impacting development time and cost is the number of engineering wafers needed to complete the development of the new process.

By simulating the process flow and device operation before any wafers are processed and during wafer-based process optimization, TCAD reduces the number of engineering wafers, saving time and money. Moreover, Sentaurus TCAD simulations provide engineers with important insights on the behavior of semiconductor devices which can lead to new device concepts.

FIRE EXTINGUISHER DRONE



Dr. Sindhu S



Jibin N V



Rinoy T R



Safa P S



Sheraz E S

Firefighter drones are unmanned air vehicles which are remotely controlled by humans to extinguish fires. Companies are using electromechanical sensor technology for firefighting drones with the continuous development of advanced technologies. Firefighter drones help in wildfires, motor vehicle accident scenes, hazmat incidents, and even in rescue operations. Fire accidents lead to loss of lives, property damage, and fatal injuries to firefighters. Therefore, governments of various countries are encouraging the incorporation of firefighting drones and increasing the use of advanced technologies. Moreover, leading drones manufacturing companies are designing and developing advanced firefighting solutions with a higher degree of safety features and functionality. There is a growing demand in drone technology and Governments are funding for the future development of firefighting drone. By the integration of the morphology technology to the firefighting drone system it opens a huge opportunity of using the firefighting drone inside building like flat, factories plants etc. And by thermal sensors, it can be used for sensing the fire affected place, building, forest etc.

The various challenges can be stated as

- Unable to pinpoint the exact location of the fire.
- To pinpoint the exact position of the fire.
- Requires human effort and is unsafe.
- Equipment or processes that are heat sensitive.
- Climate conditions.

These problems have been attempted to be solved by dispatching firefighters to the fire scene, however city traffic has proven to be an impediment. When the fire has spread too far through the forest, firefighters arrive. A parallel solution is employed only when the fire is out

of control; it involves sending a helicopter to collect water from the nearest water source (such as a lake or ocean) and dropping it above the forest, but it takes longer and costs more.

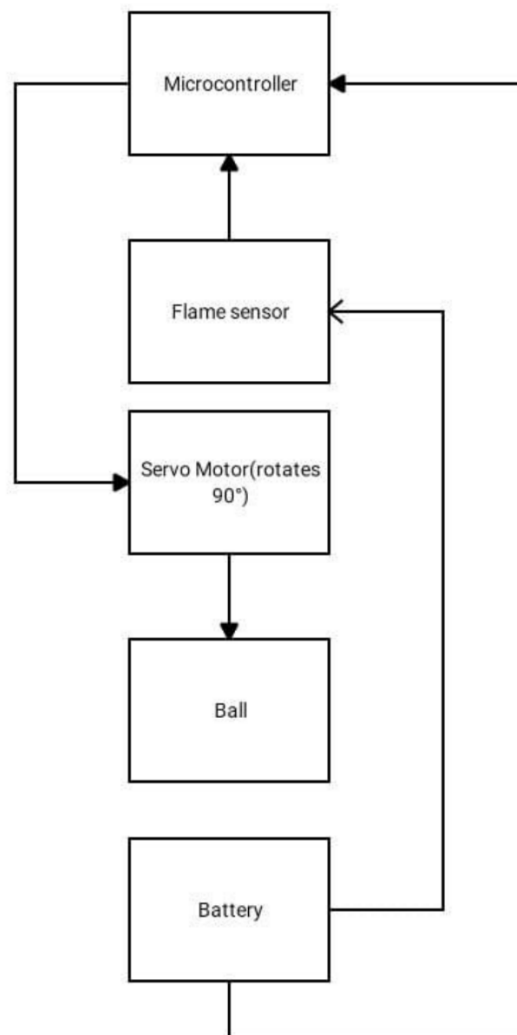


Figure 9.1: Block Diagram

Drones, for example, have been used to assist with unexpected cardiac arrests, and an ambulance drone carrying a defibrillator and instructions for various first aid operations is now in use. In cinematography, the perfect take is vital yet difficult to get with a handheld camera; however, employing a drone with professional cameras onboard makes it easy for them to achieve the right shot. Taking advantage of the drone's accessibility, it can be utilized for tough jobs such as military and rescue missions. Using the drone for these missions eliminates the chance of risking human lives. With the help of a drone, large areas of land and the animals that live there may be observed.

The purpose of this project is to develop a fire extinguisher drone that can aid firefighters during a fire. Fires not only harm the environment, but they also endanger people's

lives. As a result, this project comprises of a remote-controlled fire extinguisher drone. Other drones used for firefighting are sent to monitor the region with sensors and cameras, but they are only able to fly over it; our approach focuses on direct interaction with the area. We can reduce the risk area and assist firefighters by releasing fire extinguisher bombs.

In this drone we attach a fire ball with the help of clamping device, it can throw a ball in to the fire. The Fire Balls dropped into the Flame, where it activates and spread a dry powder fire Extinguisher agent. These Fire extinguisher puts off A, B or C class fires. The Flame sensor can be used to sense the presence of Fire.

AUTOMATIC PLANT IRRIGATION AND CROP PROTECTION FROM WILD ANIMALS



Neethu Rose Thomas



Jenet K Vincent



Evelin Jose



Christy Joseph



B Mithra

Agriculture plays an important role in the life of economy. Most of the irrigation system is manually operated hence it requires large amount of water for irrigation. Other problem faced by farmers are crop vandalization. In the states of Kerala, Tamil Nadu, Punjab, Haryana and many other states the issue of wildlife attack on crops increasing day by day. Wild animals do a lot of harm to crops by running over them, eating them and vandalizing them entirely. This leads to low crop yield and substantial loss for farmland owners. So, this system allows both automatic irrigation and keep the wild animals away from the farmlands. Depending on the need, the system is automated so there is no manual labor, thus saving time and also avoiding crop loss. The IoT technology can play a crucial role to improve the quality of lives in the application fields like transport, home appliances, healthcare, natural hazards and industrial automation. In several areas, surveillance plays a major role, be it at home, hospitals, schools, public places, farmlands, etc.

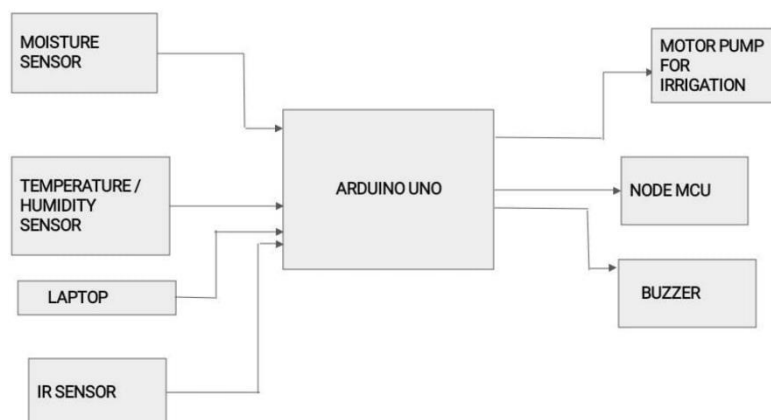


Figure 10.1: Block Diagram

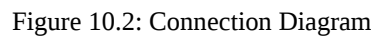
This system is developed with the help of embedded System design using WIFI technology. The main aim of this project is protecting the crops from wild animals. India is an

agriculturally based country. Agriculture is India's most important economic sector. Though maximum population of India depends on agriculture, there are many problems faced by farmers. Problem caused by wild animals is a major problem where large amount of are increasing. So, this zone is to be watched continuously to prevent entry of the animals or any other unauthorized entry. Human animal conflicts arise due to encroachment and illegal hunting, humans enter into the forest to satisfy their livelihood, for claiming of land for agricultural practices and rapid industrialization thereby reducing forest area and animals enter the nearby villages for water during the summer due to scarcity of water body. Elephants or wild boar enters agricultural field in search of nutritious food. Need of the animal or human imposes real danger, in this process, crops are spoiled and sometimes even there is a death. Human-elephant conflict is more in south Asia and in Africa. Usually, the technique used to protect farm is painful to the animals. Which makes animals behave abnormal and causes serious damage to resources.

Crop protection and animal intrusion system helps to develop a security system for the protection of farm and prohibit the entry of animal to the farm, system use IOT module for alerting the farmer. It also helps in Protecting crops from Wild Animals The system ensures that the alarm is not triggered by the presence of a human in the field, or via any random motion. The system is capable of turning On/Off automatically and warding off the animals thus protecting the fields from any damage.

In the proposed system, Crop monitoring is done where sensors are made to collect information in agricultural field. The crop protection can be done in different ways such as:

- By putting an electrical fence around the field.
- By using buzzers to make loud noise when animal is detected.
- By using crackers. But this method causes physical and biological harm to the animals.



28

ADAPTIVE TRAFFIC CONTROL SYSTEM



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Akhil K J

Conventional traffic light system is based on fixed time concept allotted to each side of the junction which cannot be varied as per varying traffic density. Junction timings allotted are fixed. Sometimes higher traffic density at one side of the junction demands longer green time as compared to standard allotted time. This project harnesses the processing capabilities and interfacing simplicity of Arduino to measure load input (here, the number of vehicles in each lane) and sets delay of corresponding signal LEDs accordingly. The heart of this circuit is an Arduino, which is connected to four IR sensors measuring the traffic density at the four lanes. The vehicle density of a lane is measured just before the lane is given green light, which is then processed and accordingly delays are set. Thus, the road with more vehicles is shown green light for a more duration which makes it possible for efficient traffic control. Arduino is an open-source computer hardware and software company, project and user community that designs and manufactures microcontroller-based kits for building digital devices and interactive objects that can sense and control the physical world. The sensors used in this project are Infrared Proximity sensors in line-of-sight configuration across the loads to detect the density at the traffic signal. The density of the vehicles is measured in a number of zones based on which timings are allotted accordingly.

Further the project can be enhanced by synchronizing all the traffic junctions in the city by establishing a network among them. The network can be wired or wireless. This synchronization will greatly help in reducing traffic congestion. The focus of the proposed work to apply novel image segmentation and other processing techniques in the context of registration number plate identification and realization. Most of the current works target standard Number plate formats such as the UK, Argentina or Russia. Nicolas et al. introduce a

novel approach called Intelligent Template Matching that is focused on Argentinian Number plates. In a vast country like India, most of the plates are not standard, so a solution is needed that targets multiple formats and fonts. Also, there is no standard data set available for Indian Plates, so images and videos of Cars with Number plates were manually taken, considering cases like low, non-uniform illumination, distant plates, blurry plates, varied fonts etc. Since all the data were collected in India and most of the Number plates are composed of four letters and six numbers; The assumption is that the Number plates are in the following format: AP 31 BA 1432, where the first two characters signify the State of the Vehicle's Registration. Firstly, Number Plate region (the Region-of-Interest) is required to be located and extracted amongst the larger captured image of the vehicle. Later, the task is to recognize the numbers and characters present in the region of interest. By localizing the search to the region of interest a minimum of 90percent of the full image can be avoided because the number plate region consists of only 10percentage of the full image of the vehicle under consideration. Another advantage of number plate identification is to optimize the time and space complexities.

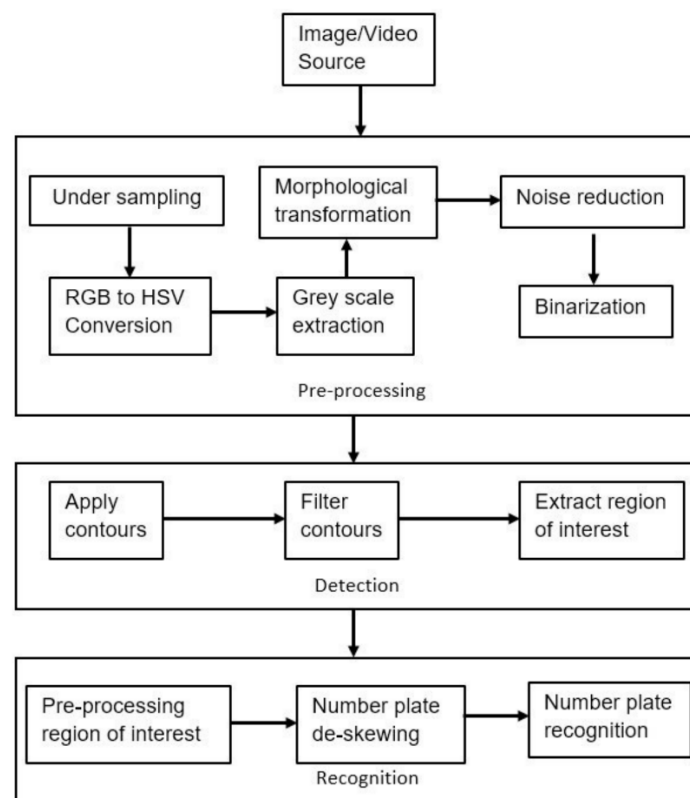


Figure 11.1: Proposed Number Plate Recognition System

Color edge mapping and Hue Saturation Intensity (HIS) based color transformation methods including fuzzy aggregation are used for number plate extraction. OCR techniques are used in character recognition. An accuracy of 93.7percent was reported with an advantage of

performance in noisy environments, different illuminations, and even damaged number plates. However, the Indian number plates are not tested. Tejas et al. proposed Indian number plate detection and recognition using techniques like Sobel edge detection, bounding box segmentation, and neural networks for recognition. However, bad environmental conditions were not tested in their method. A systematic review of several number plate recognition techniques can be found in. Salau et al. achieved an impressive accuracy of 99.8percent for number plate region detection, however, character recognition is not considered. In this work firstly, several image processing techniques viz., morphological transformation, Gaussian smoothing, Gaussian thresholding are used in the pre-processing stage. Next, for number plate segmentation, contours are applied by border following and contours are filtered based on character dimensions and spatial localization. Finally, after the region of interest filtering and de-skewing, K-nearest neighbor algorithm is used for character recognition. The major contributions of this work are to design an Indian vehicle number plate detection and recognition using image processing system to deal with the following challenges:

- Dealing with varying illuminated images.
- Dealing with bright and dark objects.
- Dealing with noisy images.
- Dealing with non-standard number plates.
- Dealing with cross-angled or skewed number plates.
- Dealing with partially worn our number plates.