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AUTOMATIC HEAD-LAMP SYSTEM WITH SMART ROAD-ACCIDENT DETECTION AND COMMUNICATION

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Abstract : Due to the lack of illumination, accidents frequently happen at night. Many drivers who use high beam headlights often forget to switch to low beams due to the low light circumstances. Several night time accidents are caused by the improper usage of high beam lights. Drivers are not allowed to turn on their high beams when approaching other vehicles since the driver receiving the light may be blinded and may temporarily lose vision, which could lead to accidents. When passing on dark uphill or downhill highways, many drivers fail to switch the vehicle's beam headlight setting. We require a system that can automatically switch the headlight mode of the vehicle for that. Whether driving on uphill or downhill routes, Automatic Headlamp can adjust the mode of its reflector lights using an accelerometer sensor. When a vehicle passes another one or travels through well-lit areas, the headlight can automatically switch between modes. The rising number of fatal traffic accidents is another major cause for concern. Human lives are frequently lost in traffic accidents as a result of inadequate medical care. Thus, we are creating a smart road accident detection and communication system using micro controller technology, which will alert the family, nearby hospitals, and police as well as the location of the accident.

Index Terms - Accident detection, Automatic headlight, communication, GPS, GSM, Accelerometer**.**

I. INTRODUCTION

The number of deadly traffic accidents is rising daily, posing a significant challenge to public health and concerned organizations. Road accidents are the leading cause of death in today's population. In only 2013 alone, about 1,37,000 individuals died in traffic accidents. The number of people listed here exceeds the number of soldiers who gave their lives in battle. Road accidents can occur for a variety of reasons, including poor road design and upkeep, congestion, and an increase in the number of cars. In addition, the lack of common sense displayed by the drivers and other road users has made situations much more problematic.

Most often, young people are dying on the highways from reckless driving, intoxicated driving, and other causes, which is a terrible loss for our country. The World Health Organization estimates that road traffic injuries contributed to 1.25 million fatalities worldwide in 2010, or one fatality every 25 seconds. The two states with the highest reported numbers of fatal two-wheeler accidents were Tamil Nadu and Maharashtra (3,668 and 3,146 respectively) (2018). Report on Road Accidents in India based on survey in 2016, the nation had at least 4,80,652 accidents, resulting in almost1,50,785 fatalities. The data indicates that 1,317 traffic incidents resulted in at least 413 fatalities each day, (2015). Nowadays, India is responsible for 10% of all traffic fatalities worldwide. Since car ownership has increased dramatically during the past 20 years at all societal levels, driving safety is a major concern. Humans, automobiles, cars, and the environment are some of the variables that contribute to traffic accidents.

Majority of collisions happen at night, particularly when there is no street lighting on the highway. Several night time accidents are caused by the improper usage of high beam lights. It is against the law for drivers to turn on their high beams when approaching other vehicles since the other driver may get temporarily blinded when they are dazzled by the high beams, which could result in accidents. Road accidents have increased as a result of greater transportation options. Although we cannot prevent the rapid development of transportation, we can certainly reduce the number of fatalities from road accidents by promptly and effectively notifying hospitals and the police of the incidents. Today, technology is what keeps our modern world moving forward. Thus, we created a smart road accident detection and communication system using micro-controller technology.

II. LITERATURE STUDY

Kumar (2018) describes an automobile headlight direction changing device and its rotation related to steering rotation with a rack and pinion mechanism through his paper steering controlled adaptive headlamps. It uses an accelerometer to detect the direction of the steering and to convert the signal and sent it to the Arduino which clarifies the signal and sent it to the servo motors to rotate the headlights. The servomotor helps the headlights to move with the direction of steering, Gupta (2022).

The active headlight steering control with brightness control, proposed by Raj et al. (2021), relates to a headlight arrangement that is operationally connected to the steering and front wheel assembly of an automobile operable to maintain headlight and the front wheels always pointed in the same direction and headlights that automatically dim/brighten with the opposite vehicle approaching. The Ackermann Steering Mechanism served as a model for the steering-controlled headlight mechanism

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Muhammed et al. (2020) have presented an autonomous headlight system that can alter the modes of lights and reflector lights while passing move uphill or downhill highways using accelerometer sensor and lux meter. The system is based on road contour and beam from other headlights.

A car accident detection and communication system were created by Vatti et al. (2018) to alert the police, nearby hospitals, and family members of the accident's location. The e-NOTIFY system was created by Fogue et. al (2012) and provides for quick identification of traffic accidents, enhancing the aid to injured passengers. Due to the effective communication of vital information, it also speeds up the response time of emergency services. Nevertheless, this system calls for the installation of on-board units (OBUs), which restricts the availability of this feature to high-end luxury vehicles.

III. PROPOSED SYSTEM

The proposed system is shown in Fig 1 given below;

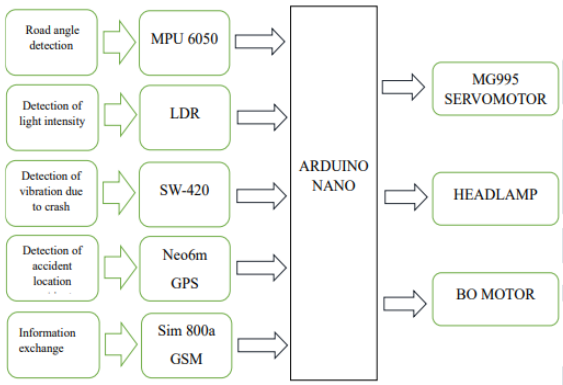

Fig. 1. Block diagram of proposed system

An Arduino Nano serves as the system's primary controller. The Nano is the smallest and most conventional breadboard-compatible board from Arduino. The Arduino Nano contains pin headers and a Mini-B USB connector, which make connecting it to a breadboard simple. A computer, another Arduino, or other microcontrollers can all be communicated with using the Arduino Nano's many communication features. In this project, an Arduino-based dual system for automatic headlight control and accident detection is set up.

MPU sensor, GSM and GPS modules are communication devices that provides sufficient data like location coordinates or time and requires multiple pins for communication. GPS module mainly is used for communicating the location of the device. GSM module can do all the functions of a sim card like carrying on or receiving a call and texts. GPS and GSM module provides serial communication and requires multiple pins for communication.

In order to transmit sufficient information, the digital pins of the Arduino are attached to the receiver and transport pins of GPS and GSM, which provide bidirectional communication. I2c protocol is used by the MPU sensor. I2C is an abbreviation for inter-integrated controller. This serial communication protocol can link devices that operate at low speeds. We may connect and control numerous slaves from a single master through this master-slave communication. Each slave device in this has a unique address. In order to communicate, the MPU sensor needs numerous pins, specifically Clock and Data.

Piezoelectric accelerometers called vibration sensors detect vibration. Accelerometers, by far the most used kind of vibration sensors, track changes in component velocity. Any motion of the device it is coupled to will result in a change in velocity, which will trigger an electrical signal from the accelerometer. For connecting to the Arduino, just one pin is needed. LDR is a light-sensitive device with a single pin connection for Arduino communication that is widely used to notify the presence or absence of

light or to detect light intensity. A servo motor is a type of motor that can rotate very precisely. Typically, this sort of motor contains a control circuit that provides feedback on the position of the motor shaft at the moment. This feedback enables the servo motors to rotate very precisely. It can be readily programmed and only requires a single pin connection to the Arduino, similar to the vibration sensor and LDR.

Motor drivers can control two devices at the same time like two motors or a motor and an LED. They act as a bridge connecting the motor and LED. Arduino cannot directly power LED and motor. So drivers are used to power them. The motors and LED are parallelly connected towards the driver. LDR detects light from opposite vehicles and its output is processed by Arduino to control servomotors that adjusts the position of headlight. Accelerometer gyroscope or MPU 6050 which is a three-axis gyroscope and three-axis accelerometer, detects the inclination of the vehicle to adjust the headlights for comfort viewing. Vibration sensor attached acts when collisions occur that produce change in velocity. Change in velocity is detected by the sensor and signal is send to Arduino to stop the vehicles by controlling the motor. Accelerometer gyroscope also serves the function of detecting vehicle rollovers due to accident. When vehicle rollovers happen due to change in the axis it is sensed by gyroscope and GPS module tracks the vehicle location by communicating with Arduino. The location coordinates are then communicated with required contacts like nearby police station.

IV. HARDWARE

4.1. LDR Sensor

Photo resistors, also known as light dependent resistors (LDR), are most frequently used to measure light intensity or to detect if light is present or absent. Depending on the light intensity, the resistance of the LDR sensor drops quickly when exposed to light, possibly down to a few ohms. Their resistance is particularly great in the dark, frequently approaching 1 M.

4.2 . Servo Motor

A servo motor is an actuator that enables precise control of angular or linear position, velocity, and acceleration. It comprises of a position feedback sensor coupled to a suitable motor. It also requires a rather complex controller, typically a unique module designed just for servomotor operation.

4.3. Vibration Sensor

To detect vibrations, a vibration sensor module based on the Comparator LM393 and Vibration Sensor SW-420 is employed. There is an on-board potentiometer that may be used to change the threshold. The sensor outputs Logic Low when there is no vibration and Logic High when there is vibration.

4.4. Accelerometer Gyroscope

full 6-axis Motion Tracking Device is the MPU6050 sensor module. With a compact design, it includes a 3-axis gyroscope, 3-axis accelerometer, and a digital motion processor. Moreover, it incorporates an on-chip temperature sensor as an extra function. In order to communicate with the micro controllers, it has an I2C bus interface.

4.5. Arduino Nano (V2.3)

Arduino Nano is one type of microcontroller board, built with a microcontroller like Atmega328. It is a flexible board that is modest in size and has many different uses. Although there is no DC jack, power can be supplied using a tiny USB port, which is otherwise directly connected to pins like VCC and GND. A mini-USB port on the board can be used to provide this board with voltage between 6 and 20 volts.

4.6. Motor Driver Module

The L298N Motor Driver Module is a high-power motor driver module that can run both DC and stepper motors. This module is composed of a 78M05 5V regulator and an L298 motor driver IC. The L298N Module can control up to 4 DC motors or 2 DC motors with speed and direction control.

4.7 Battery

For this project we are using a 12V Li-ion battery of 2000mAh. A Li-ion battery uses the reversible reduction of lithium ions and stores energy

4.8. GPS and GSM Module

GSM (sim600a) and GPS (neo6m) are the communication tools. The latitude and longitude coordinates used by the GPS module are obtained from satellites. This data is processed by the microcontroller and sent to the GSM modem. The owner's mobile phone receives the information from the GSM modem after that.

V. RESULTS AND DISCUSSION

This research develops automatic headlight systems based on road shapes and other headlight lights. The MPU6050 module was also employed in this investigation to evaluate the road contours. In this way, the Headlamp as shown in Fig. 2. can adjust when passing an uphill or downhill road in addition to changing the automatic mode based on the presence of other vehicles. Both of these sensors provide as input that Arduino will process. The lamp reflector is moved in either an upwards or downwards direction with the help of a driving servo developed.

Fig. 2. Hardware model

Fig.3. Headlamp arrangement

The system was put to the test by being installed in a toy automobile as shown in Fig.3. The system appears to be operating well. When the automobile is hit, knocked over, or tilted more than 40 degrees, the system correctly delivers the message to the pre-stored emergency numbers.

Future scope: An android app can be created that can precisely pinpoint the place on the map rather than just obtaining the location's coordinates. In order to assess the driver's status until medical assistance arrives, the app can also continually monitor heart rate. Also, with the aid of artificial intelligence along with gyroscope tilt analysis, we are able to visually comprehend the road's terrain.

VI. ADVANTAGES

Advantages of the proposed system are

- Ramp Adaptive Lighting
- Vehicle Rollover Identification and Assistance • Collision Detection and Communication
- Faster medical assistance
- Improved road vision
- Quick response to accidents

VII. CONCLUSION

The automatic headlight system designed controls intensity of headlight according to the light intensity from opposite vehicles with the help of LDR as well as to adjust the angle of headlight when the vehicle moves through different contours that is uphill or downhill using an accelerometer gyroscope. So the dual operation performed on the headlight helps us to avoid the accident caused due to high intensity lights from other vehicles, glares, lack of visibility and by providing adaptable headlights that give required lamination.

Accident detection and communication system helps to provide sudden medical care for the victims of an accident without any delay using GPS and GSM modules. So, through this project we provide a solution to reduce accident due to lack of visibility and provides a way for faster response to accidents.

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