SMART HELMET - INTELLIGENT SAFETY FOR MOTORCYCLIST USING RASPBERRY PI AND OPEN CV

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Abstract - *Smart Helmet - Intelligent Safety Helmet for Motorcyclist is a project undertaken to increase the rate of road safety among motorcyclists. The idea is obtained after knowing that there is increased number of fatal road accidents over the years. Through the study identified, it is analysed that the helmets used is not in safety features such as not wearing a helmet string and not use the appropriate size. Therefore, this project is designed to introduce safety systems for the motorcyclist to wear the helmet properly. With the use of Image processing unit using Raspberry Pi and Open Cv , the motorcycle can move if there is helmet pound wearing, in accordance with the project title Smart Helmet - Intelligent Safety for Motorcyclist using Raspberry Pi and Open Cv. Safety system applied in this project meet the characteristics of a perfect rider and the application should be highlighted. The project is expected to improve safety and reduce accidents, especially fatal to the motorcyclist.*

Key Words: **Safety, Standard Detection, Motor Ignition, Raspberry Pi, Open Cv.**

1. INTRODUCTION

Two-wheelers, the mode of transport most Indians use, continue to be the most vulnerable to accidents. Indian roads were at their deadliest in 2014 claiming more than 16 lives every hour on average. Over 1.41 lakh people died in crashes, 3% more than the number of fatalities in 2013. Accidents involving two-wheelers and accounted for nearly half of the lives lost in road crashes. While 13,787 two-wheeler drivers were killed in crashes, 23,529 other people were killed in accidents involving these vehicles, while close to 1.4 lakh people were left injured in them. The top five states - Uttar Pradesh, Tamil Nadu, Maharashtra, Karnataka and Rajasthan - accounted for over 40% of the fatalities. Among 53 mega cities, Delhi registered the highest number of fatalities at 2,199 and Chennai recorded 1,046 such deaths. Bhopal and Jaipur ranked third and fourth with the city roads claiming 1,015 and 844 lives respectively[1, 2].

A motorcycle's helmet is a type of protective headgear used by the motorcyclist. The main purpose is for safety, which is to protect the rider's head from the impact during an accident. It protects the rider's head as the helmet provides ventilation system. Speeding and not wearing a helmet are the main reasons of fatalities and injuries.

Here we are implementing a model which uses DC Motor, Relay and Raspberry Pi which in real time system is related to the ignition system of the Motorcycle.

2. RELATED WORK

The system automatically detects motorcycle riders and determines that they are wearing safety helmets or not. The system extracts moving objects and classifies them as a motorcycle or other moving objects based on features extracted from their region properties using K-Nearest Neighbour (KNN) classifier. The heads of the riders on the recognized motorcycle are then counted and segmented based on projection profiling. The system classifies the head as wearing a helmet or not using KNN based on features derived from 4 sections of segmented head region. Experiment results show an average correct detection rate for near lane, far lane, and both lanes as 84%, 68%, and 74%, respectively [3].

The helmet is the main safety equipment of motorcyclists, but many drivers do not use it. If an motorcyclist is without helmet an accident can be fatal. This paper aims to explain and illustrate an automatic method for motorcycles detection and classification on public roads and a system for automatic detection of motorcyclists without helmet. For this, a hybrid descriptor for features extraction is

proposed based in Local Binary Pattern, Histograms of Oriented Gradients and the Hough Transform descriptors. Traffic images captured by cameras were used [4].

It is known that head gesture and brain activity can reflect some human behaviours related to a risk of accident when using machine-tools. The research presented in this paper aims at reducing the risk of injury and thus increase worker safety. Instead of using camera, this paper presents a Smart Safety Helmet (SSH) in order to track the head gestures and the brain activity of the worker to recognize anomalous behavior. Information extracted from SSH is used for computing risk of an accident (a safety level) for preventing and reducing injuries or accidents. The SSH system is an inexpensive, non-intrusive, non- invasive, and non-vision-based system, which consists of an Inertial Measurement Unit (IMU) and dry EEG electrodes. A heptic device, such as vibrotactile motor, is integrated to the helmet in order to alert the operator when computed risk level (fatigue, high stress or error) reaches a threshold. Once the risk level of accident breaks the threshold, a signal will be sent wirelessly to stop the relevant machine tool or process[5].

A smart helmet is a special idea which makes motorcycle driving safer than before. This is implemented using GSM and GPS technology. The working of this smart helmet is very simple, vibration sensors are placed in different places of helmet where the probability of hitting is more which are connected to microcontroller board. So when the rider crashes and the helmet hit the ground, these sensors sense and gives to the microcontroller board, then controller extract GPS data using the GPS module that is interfaced to it. When the data exceeds minimum stress limit then GSM module automatically sends message to ambulance or family members[6].

This project is specially developed as to improve the safety of the motorcycle's rider. Motorcyclist will be alarmed when the speed limit is exceeded. A Force Sensing Resistor (FSR) and BLDC Fan are used for detection of the rider's head and detection of motorcycle's speed respectively. A 315 MHz Radio Frequency Module as wireless link which able to communicate between transmitter circuit and receiver circuit. PIC16F84a is a microcontroller to control the entire component in the system. Only when the rider buckled the helmet then only the motorcycle's engine will start. A LED will flash if the motor speed exceeds 100 km/hour[7].

Intelligent Safety Helmet for Motorcyclist is a project undertaken to increase the rate of road safety among motorcyclists. The idea is obtained after knowing that the increasing number of fatal road accidents over the years is cause for concern among motorcyclists. Through the study identified, it is caused the helmets used is not in safety features such as not wearing a helmet string and not use the appropriate size. Therefore, this project is designed to introduce security systems for the motorcyclist to wear the helmet properly. With the use of RF transmitter and RF receiver circuit, the motorcycle can move if there is emission signal from the helmet, in accordance with the project title Intelligent Safety Helmet for Motorcyclist. Security system applied in this project meet the characteristics of a perfect rider and the application should be highlighted. The project is expected to improve safety and reduce accidents, especially fatal to the motorcyclist[8].

3. SYSTEM DESIGN

3.1. System Requirements

3.1.1. Software Requirements :

- Operating System - Linux
- Front End - Python

3.1.2. *Hardware Requirements* :

- Raspberry Pi
- Pi Camera
- Relay
- DC Motor
- 12V DC Power Supply

3.2. Proposed System

Here we are implementing a model which uses DC Motor which in real time system is related to the ignition system of the Motorcycle. In our proposed system the DC Motor turns on only when the rider is wearing the helmet from which Standard symbol is detected with the use of Pi camera, which in turn will be connected to Raspberry Pi.

3.3. Flow Chart

Flowchart is a pictorial representation of a dataflow throughout the project. This is drawn based upon the algorithm of the system. The flowchart itself is called as a data flow diagram. The various notations used for drawing a flowchart is as shown below in Figure 3.1

Symbol	Name	Function
	Start/end	An oval represents a start or end point.
	Arrows	A line is a connector that shows relationships between the representative shapes.
	Input/Output	A parallelogram represents input or ouptut.
	Process	A rectangle represents a process.
	Decision	A diamond indicates a decision.

Figure 3.1. Notations used for drawing flowchart

The flowchart for our system is as shown in Figure 3.2 Here when the user tries to start his Motorcycle, the Raspberry Pi turns on which in turn turns on the Pi camera. Pi camera starts to detect for Standard symbol. If found Relay will be closed and DC motor turns on else Relay will remain open and DC motor does not start.

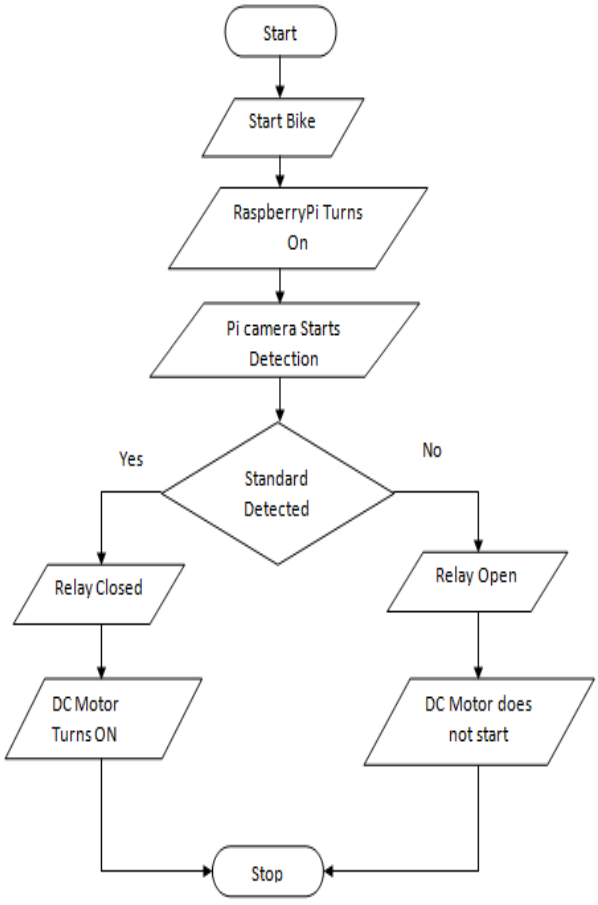

Figure 3.2. Flowchart of proposed system

3.4. Module Design

3.4.1. *Raspberry Pi:* The Raspberry Pi is a credit card-sized single-board computer. Raspberry Pi has a Broadcom BCM2835 system on chip (SoC),which includes an ARM1176JZFS 700 MHz processor, Video Core IV GPU ,and was originally shipped with 256 megabytes of RAM, later upgraded (Model B & Model B+) to 512 MB. Pi 2 Model B runs 6X Faster than the B+, and comes with 1GB of RAM--that's double the amount of RAM of the previous model.

3.4.2. *Raspberry Pi Camera Module:* The camera module utilizes the dedicated CSi interface, which is located behind the Ethernet port on the Raspberry Pi .The Raspberry Pi Camera Module as shown in the Figure 3.6 is a 5MP CMOS camera with a fixed focus lens that is capable of capturing still images as well as high definition video. Stills are captured at a resolution of 2592 x 1944, while video is supported at 1080p at 30 FPS, 720p at 60 FPS and 640x480 at 60 or 90 FPS. . This makes it ideal for projects such as hidden security cameras, high altitude balloon experiments, and even an onboard camera for RC car adventures. The camera is supported in the latest version of Raspbian, Raspberry Pi's preferred operating system.

3.4.3. *Relay:* A relay is an electrically operated switch. Many relays use a electromagnet to mechanically operate a switch. Relays are used where it is necessary to control a circuit by a low power signal, or where several circuits must be controlled by one signal. A type of relay that can handle the high power required to directly control an electric motor or other loads is called a contactor.

3.4.4. *DC Motor:* A DC motor is any of a class of electrical machines that converts direct current electrical power into mechanical power. The most common types relay on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor. Most types produce rotary motion; a linear motor directly produces force and motion in a straight line.

3.4.5. *Standard Symbol Detection Module:* When rider tries to start the bike, the pi camera will get activated and scans for standard symbol on the helmet. Then the noise is removed using different filtering and blurring techniques. Once this is done the standard symbol is detected using Edge detection technique.

4. IMPLEMENTATION

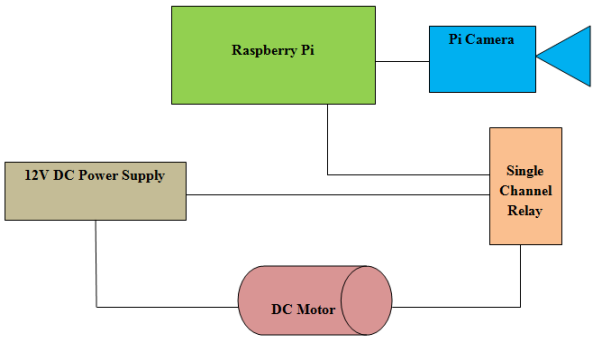

Figure 4.1. Block Diagram of System

Figure 4.1 shows the block diagram of the System. Our proposed system is the model that acts as ignition system of Bike. Here Raspberry Pi is used to control the vehicle's ignition system. There will be standard symbol on the helmet; pi camera is placed on the bike. OpenCV python language is used to detect the image.

When the user starts the bike, the Raspberry Pi will be powered and starts to boot. The Pi camera will then turn on and starts to detect for the Standard symbol. If the Standard symbol is detected then the relay will be closed and DC Motor turns on. If the Standard symbol is not detected then the relay will remain open and DC Motor does not start.The actual implementation of the system is shown in the Figure 4.2.

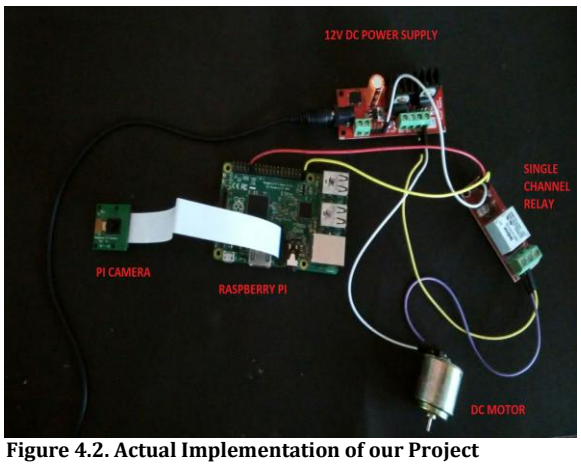

Figure 4.2. Actual Implementation of our Project

5. EXPERIMENTAL RESULTS AND FUTURE WORK

In our system we have taken Three circles as the Standard Symbol which is supposed to be on the Helmet. Figure 5.1 shows the original image of the Standard Symbol which is detected through Pi camera. It is then converted into grayscale image as shown in Figure 5.2.The grayscale image must next be blurred which is done using Gaussian Filtering to reduce the noise. This is shown in Figure 5.3.The blurred image is next converted into Threshold image which is done using Binary Thresholding function which is shown in Figure 5.4. Finally Pi camera identifies the Standard Symbol using Canny Edge Detection technique and Hough Transform as shown in Figure 5.5.

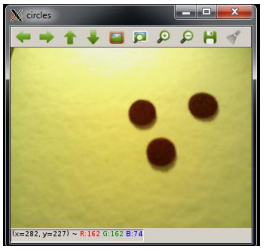

Figure 5.1. Original Image

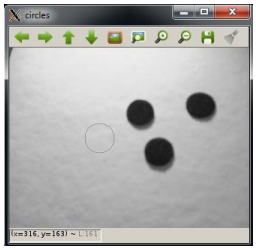

Figure 5.2. Grayscale Image

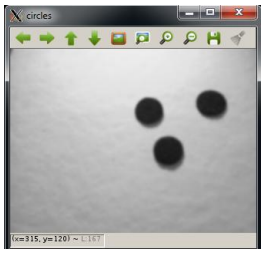

Figure 5.3. Blur Image

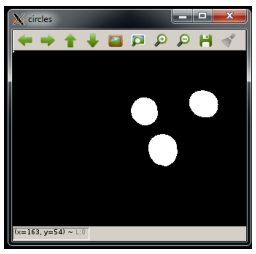

Figure 5.4. Threshold Image

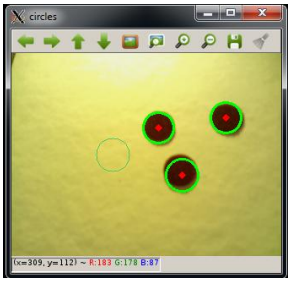

Figure 5.5. Standard Symbol detected Image

Once the Standard Symbol (Three Circles) is detected the relay which is connected to Raspberry Pi is closed and DC Motor turns on.

6. APPLICATIONS

- The project is expected to improve safety and reduce accidents, especially fatal to the motorcyclist.
- System with low cost and less complexity.
- Reduce workload of Traffic Policemen.

7. CONCLUSION

The scope of this project is a motorcycle rider that they care about their safety while riding. As we know, the motorcycle riders are now less concerned about their safety while riding, then the creation of this helmet safety rates can be increased and rate of road accidents can be reduced. The accident rates for motorcyclists are increasing from year to year, a Smart Helmet for Motorcyclist using Raspberry Pi and openCV which in future will inspire safety features for motorcyclists.

REFERENCES

[1] http://timesofindia.indiatimes.com/toireporter/author-Dipak-K–Dash–479213512.cms
[2] http://timesofindia.indiatimes.com/toireporter/author-Dipak-K–Dash–10519.cms
[3] Rattapoom Waranusast, Nannaphat Bundon, Vasan Timtong and Chainaron Tangnoi,"Machine Vision Techniques for Motorcycle Safety Helmet Detection," 2013,28th International Conference on Image and Vision Computing New Zealand.
[4] Romuere Silva, Kelson Aires, Thiago Santos, Kalyf Abdala, Rodrigo Veras "Atomatic detection of motorcyclists without Helmet,"Departamento de Computaco Universidade Federal do Piaui Teresina, Brazil.
[5] Ping Li, Ramy Meziane, Martin J,Hassan Ezzaidi,Philippe Cardou, "A Smart Safety Helmet using IMU and EEG sensors for worker fatigue detection," REPARTI Center, Laval University Quebec,Canada.
[6] Manjesh N, Prof. Sudarshan Raj,"Smart Helmet Using GSM &GPS Technology for Accident Detection and Reporting System," International Journal of Electrical and Electronics Research ISSN 2348-6988 (online) Vol. 2, Issue 4.
[7] Mohd Khairul Afiq Mohd Rasli, Nina Korlina Madzhi, Juliana Johari ,"Smart Helmet Sensors for Accident Prevention," 2013 International Conference on Electrical Electronics and System Engineering.
[8] Faezah Binti Hashim, "Intelligent Safety Helmet For Motorcyclist," Faculty of Electronic and Computer Engineering Universiti Teknikal Malaysia Melaka,2011.