

RASPBERRY PI BASED SMART HOME SURVEILLANCE ROBOT SYSTEM ENHANCED WITH WI-FI TECHNOLOGY

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ABSTRACT

This paper presents the control of crime throughout the world by monitoring and controlling of mobile robot via internet through Raspberry Pi Board. The Controlling and Monitoring of Robotic movements through wireless network by using a WI-FI Technology. The programming language of robot is based on LINUX platform which is interfaced with Raspberry Pi Board. The Smoke sensor detects the fire accidents by sensing the smoke level and PIR sensor detect a intruder or an object enters into a surveillance area. The output of sensors are Video call send to the owner and Alarm indication to the neighbours, the motor driver used to spread the Chloroform on the face of intruders. This mobile robot can be operated from everywhere in the world by using Internet of Things (IoT).

Keywords: Raspberry pi board, PIR sensor, Smoke sensor, Motor Driver, Mobile robot, WI-FI dongle.

1. INTRODUCTION

Robotics is an art of manipulative, applying by using robot in individual endeavors. The express growth of industry and advancement of technology has resulted in reduction of human efforts, the main reason for being machines. Machines are playing an important role in our life. Robots have found in increasing require in a wide range of applications in our life[13].We presented a paper includes one such instances of how robot can be of use to human race in general. In today's world, robots find use in various places be it to detonate buried bombs or in industrial applications or even robotic components used in children's toys[2]. The difficulty of computer software depends on how difficult the robot's tasks are. In this project we use internet to establish communication between the user and a robotic vehicle[10].Due to the use of internet, there is no restriction on range or distance between the customer and the robotic vehicle. Internet robotics has opened up a completely new range of real-world applications namely tele-manufacturing, tele-training, traffic control, space exploration, disaster rescue, power station Fault detection, Nuclear power plant leakage detection, border security bomb detection etc. and the list is supposed to increase further in the coming years. The mobile robot was fully prohibited by the webpage and the commands from the LINUX platform via RASPBERRY PI were received[2]. This system is proposed with the help of low cost PIR sensor and smoke sensor to trace out the intruders and to detect the fire accidents by using Raspberry pi [12].In case of any human movement or fire accident occur, the

system will activate the Web camera and simultaneously transmit the live video to social network via WI-FI in the meantime alert message also send to the respective people through GSM module or police station and control unit .The system consists of buzzer to alert the nearby neighbors[3]. The Sprayer sprays the chloroform liquid on the intruders

2. PROPOSED METHOD

In proposed system, Raspberry PI based smart home surveillance robot system enhanced with WI-FI technology. This system is proposed with the help of low cost PIR (Passive Infrared Sensor) to detect and trace out the unwanted intruders and low cost Smoke sensor is used to detect the fire accidents and smoke's like (Iso-Propane , Iso-butane ,LPG gas leakage etc....). The construction of Mobile robot with the help of programs an internet connection is established between the robotic vehicle and the user. This robot motion can be controlled by the webpage through Raspberry pi board.[2] The robot captures the images using a webcam and stored them into the memory. It captures and sent the live images using internet at a rate sufficient to make them as like a live video to the human eye. By overcoming the accessible technique, the sensors are included to increase the efficiency of the project.[2] In case of any fault occurs in the camera the PIR sensor detects the object motions and also introducing an advanced future of Smoke sensor that detects the smoke produced during fire accidents and bomb blast[10]. The LINUX operating system is used to reduce the hardware components[2]. The PC connection and the block diagram of proposed method are given below.

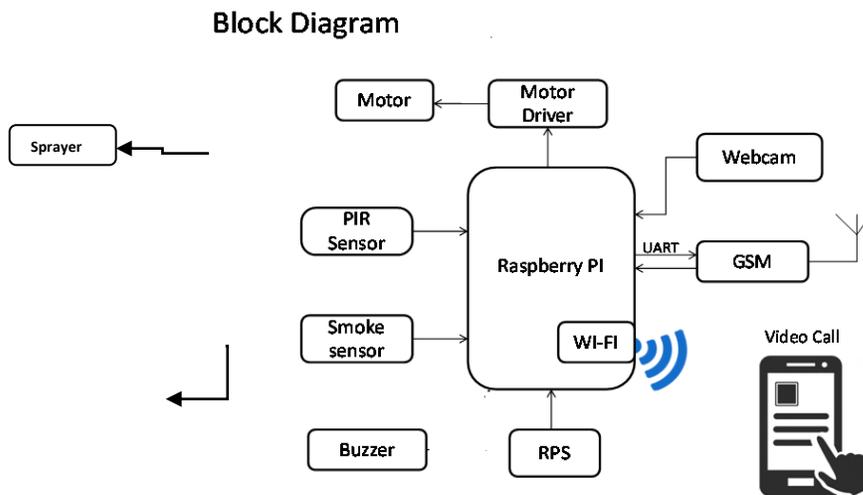


Fig.2. Block Diagram of Proposed system

3. DESIGN AND IMPLEMENTATION

3.1 Raspberry PI

The Raspberry Pi is a petite debt card sized single-board processor with an open-source platform that has a thriving community[15]. It is similar to the Adriano. It can be used in various types of projects from beginners learning and designing home automation systems. This higher-spec variant increases the GPIO pin count from 26 to 40 pins. There are four USB 2.0 ports in which 2 ports are available in Model B. The more modern push-push type micro SD slot is used[1]. It consumes slightly less power, provides better audio quality and a cleaner form factor. The inbuilt components of Raspberry PI is Broadcom BCM2837, 64bit with Quad core CPU at 1.2GHz, 1GB RAM, on-board WI-FI & Bluetooth 4.1, Micro SD card slot DSI Display port Micro USB-Power need <2.5A full size HDMI, CSI Camera port, 3.5mm Audio+Composite, 10/100 LAN.

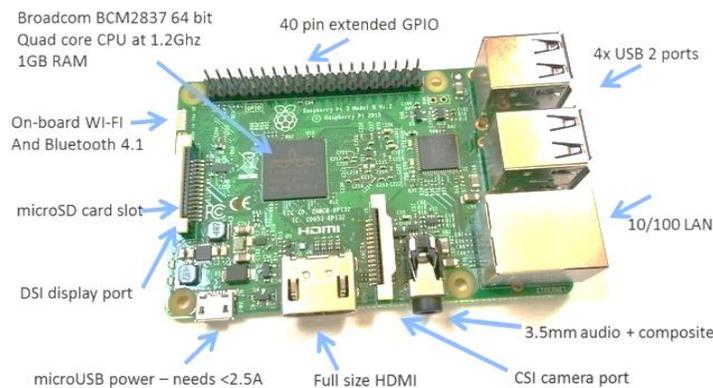


Fig.2. Raspberry Pi board diagram

This paper presents a basic application of Raspberry Pi in home automation control through internet with WI-FI where subject of received the Video call is read by the developed program and algorithm fed into raspberry Pi and system responds to the corresponding instructions. The presented system is interactive, professional and flexible according to the consumer needs[3]. It immediately replies the status of work done by raspberry Pi to the consumer. The proposed system has been tested practically using LEDs as switching signal indicators, which can be seen in the presented results[10]. The project can be extended for more applications apart from switching of home devices like surveillance, power monitoring, fault monitoring, power control, security etc When the demand is low on the CPU or it is running too hot, the performance is throttled, but if the CPU has much to do, and the chip's temperature is acceptable, performance is temporarily increased, with clock speeds of up to 1 GHz, depending on the individual board, and on which of the turbo settings is used. The five settings are:

- None; 700 MHz ARM, 250 MHz core, 400 MHz SDRAM, 0 over volt,
- Modest; 800 MHz ARM, 250 MHz core, 400 MHz SDRAM, 0 overvolt,
- Medium; 900 MHz ARM, 250 MHz core, 450 MHz SDRAM, 2 overvolt,
- High; 950 MHz ARM, 250 MHz core, 450 MHz SDRAM, 6 overvolt,
- Turbo; 1000 MHz ARM, 500 MHz core, 600 MHz SDRAM, 6 overvolt.

3.2 PIR SENSOR

PIR sensors allow you to sense motion. It is a human sensor(HC-SR501) model PIR sensor used because it is compatible with Raspberry Pi. Incorporating a FRESNEL LENS and motion detection IC, suitable for a wide range of supply voltages and with low current drain. The 'LOGIC' of the PIR sensor is that it must detect 'significant change' of the normal level of heat within the 'field' of its view[10].The FRESNEL LENS range is 500 Base Pair.

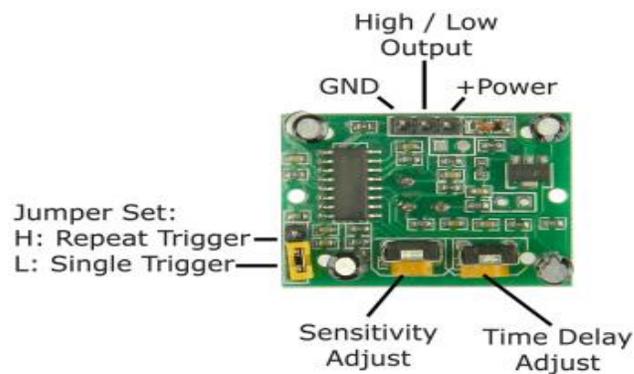


Fig.3.PIR Sensor

3.3 SMOKE SENSOR

A smoke detector is a device which detects the presence of various gases within an vicinity, usually as part of a safety system. This type of equipment is used to detect a gas disclose and interface with a control system so a process can be automatically shut down. Used in gas escape detecting equipments for detecting of LPG, iso-butane, propane, LNG combustible gases. The sensor does not get trigger with the noise of alcohol, cooking fumes and cigarette smoke.

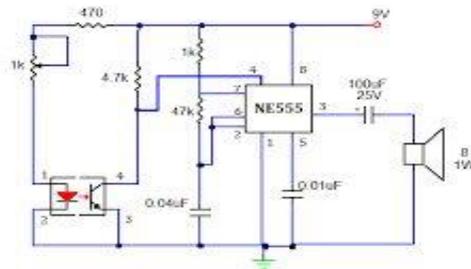


Fig.4. Smoke Detector

3.4 DC MOTOR

The stator is the stationary part of a motor. The rotor is the inner part which rotates. Just as the rotor reaches configuration, the brushes move across the commutator contacts and invigorate the next winding. The brushes of a dc motor have several limitations; brush life, brush residue, maximum speed, and electrical noise.

3.5 MOTOR DRIVER CIRCUIT

The Motor Driver will act like a Current Amplifier. Since they L293D is a dual-H-type Bridge motor driver. The pin diagram is given below:

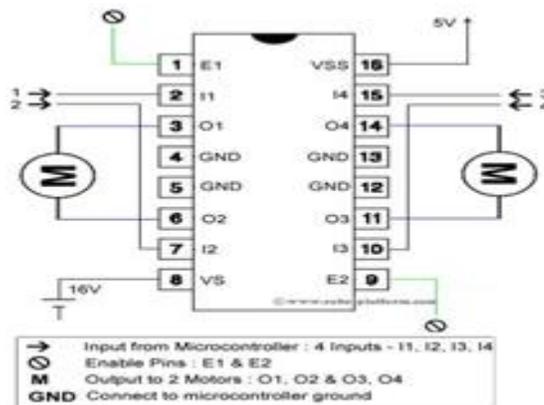


Fig.5. Motor Driver Pin Diagram

Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors. L293D contains two inbuilt H-bridge

driver circuits. In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction. Enable pins 1 and 9 (corresponding to the two motors) must be high for motors to start operating. When an enable input is high, the associated driver gets enabled. As a result, the outputs become active and work in phase with their inputs. Similarly, when the enable input is low, that driver is disabled, and their outputs are off and in the high-impedance state.

3.6 BUZZER

A buzzer or bepper is an auditory signaling piece of the equipment which may be mechanical, electromechanical ,or piezoelectric. The buzzer volume is 95dB @ 10cm(3.94), the current is 20mA. Piezo buzzers exhibit the reverse piezoelectric effect. The buzzer will be deliberate after applying quivering amplitude of 1.5 mm with 10 to 55 Hz band of quivering frequency to each of the 3 making a corner directions for 2 hours.

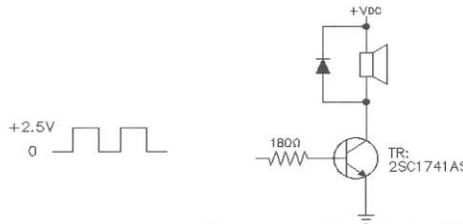


Fig.6. Buzzer of Circuit Diagram

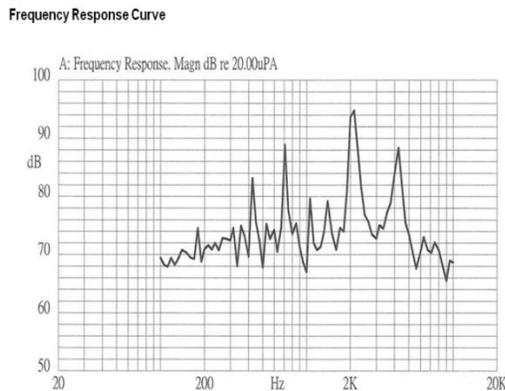


Fig.7. Waveform of Buzzer

3.7 WEB CAM

A simple webcam comprises a digital camera emotionally involved to a workstation. These cameras are easy to unite through a USB port. A part of the pack of software grabs frames from the camera. For example, the software might grab a tranquil illustration from the camera once every 30 seconds. The software then turns that illustration into a customary JPG file and uploads it to a Web server.

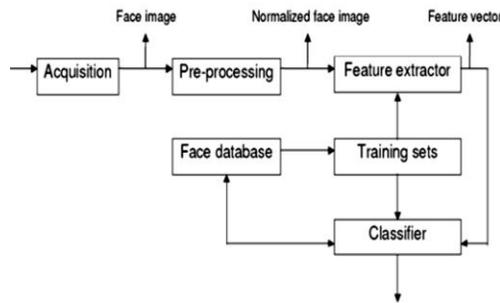


Fig.8. Web Cam Architecture

3.8 REGULATED POWER SUPPLY

Dual power supplies units are most common equipment for an **Electronics hobbyist**. The circuit given here is of a regulated dual power supply that provides +12V and -12V from the AC. The transformer steps down the AC mains voltage. It gives **positive polarity, negative polarity and ground potential**. It uses two types of **voltage regulator ICs 7812 and 7912**. 7812 is a positive voltage regulator where as 7912 is a negative voltage regulator IC.

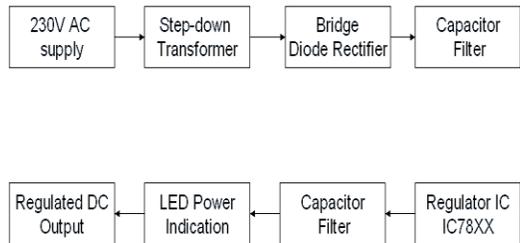


Fig.9. RPS Block Diagram

Power supply Calculation Formula:

- $Load\ regulation = V_{no-load} - V_{full-load}$
- $\% Load\ Regulation = [(V_{no-load} - V_{full-load})/V_{full-load}] * 100$
- $Minimum\ Load\ Resistance = V_{full-load}/I_{full-load}$.

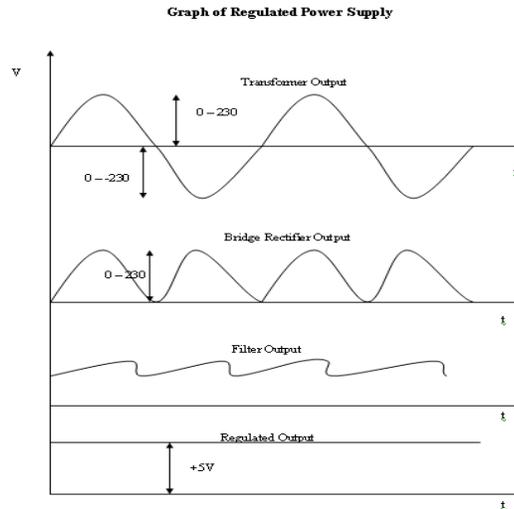


Fig.10. Graph of Regulated Power Supply

3.9 SPRAYER

A sprayer is a device used to spray a liquid with using of DC motor. This part is used for spraying the gooey pesticides from the tank as the pressure of compressor. We can change spraying passion by changing the pressure of compressor. Spraying pipe is connected with nozzle.

3.10 GSM (Global System for Mobile Communication)

GSM is nothing but Global System for Mobile communications. GSM is a cellular network, which means that mobile phones hook up to it by searching for cells in the immediate vicinity. There are five different cell sizes in a GSM network. They are macro, micro, pico, femto and umbrella cells. Macro cells can be regarded as cells where the pedestal rank antenna is installed on a mast or a building above standard roof top level. Micro cells are cells whose antenna height is under standard roof top level; they are typically used in metropolitan areas. Pico cells are small cells whose coverage diameter is a few dozen meters; they are mainly used indoors.

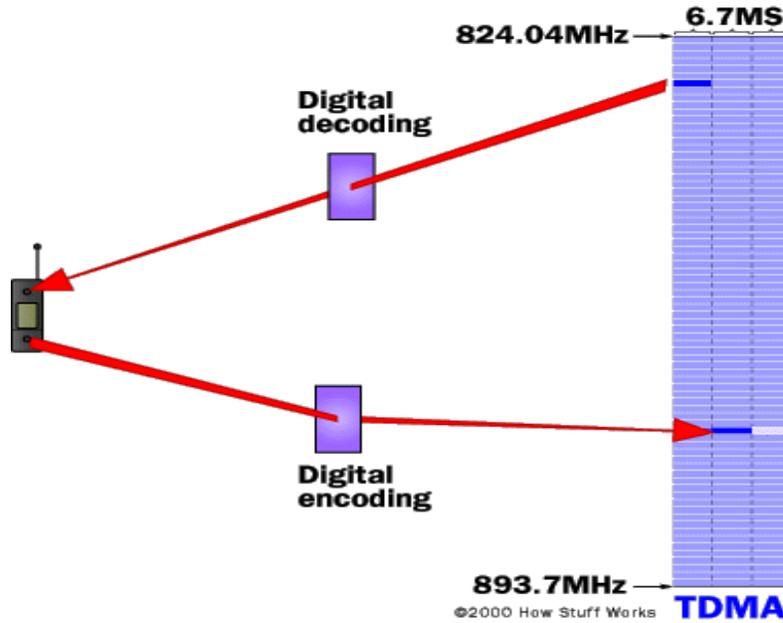


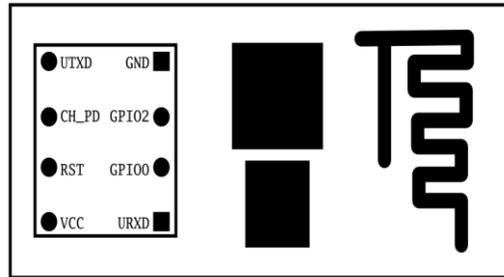
Fig.11. GSM Signal

3.11 WI-FI MODULE

ESP8266 is an striking, low cost WIFI module suitable for adding WIFI functionality to an existing microcontroller project via a UART serial connection. The module can even be reprogrammed to act as a standalone WIFI connected device—just add power! The feature list is impressive and includes: 802.11 b/g/n protocol Wi-Fi Direct (P2P), soft-AP Integrated TCP/IP protocol stack. The hardware connections required to connect to the ESP8266 module are fairly straight-forward but there are a couple of important *items* to note related to power: The ESP8266 requires 3.3V power—do not power it with 5 volts.

3.12 PIN DESCRIPTION

ESP8266 has 8 pins, 4 in the row of 2. The first pin on the top left is GND. The two pins right from the GND are GPIO 2 and 0. The pin on the top right side is the RX pin and the pin on the lower left is TX. These are the pins for communication. The middle pins on the bottom are CH_PD (chip power-down) and RST (reset).The main thing to remember is, that this device works with 3.3V; Even the RX and TX pins. Controller or many USB to serial converters work with 5V.



ESP8266 WiFi Pinout
Top View (Not to scale)

Fig.12. WI-FI Pin Diagram

4. RESULT AND OUTPUT

The wheel structure Robot is completed and interface of wireless Robot through internet. The camera is mounted on the mobile Robot and can rotate all directions to get better visibility. The sprayer is placed in front of robot to spray the chloroform on the intruders. The sensors are attached with the Robot for sensing even the camera get failure in features.

The output video send to owner and near by police station:

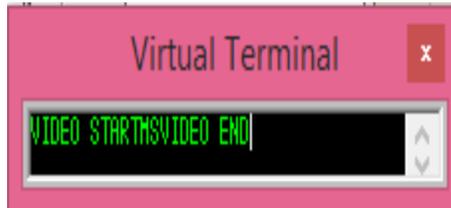


Fig.13. Output of both message and video sending picture



Fig.14. Output of video sending picture

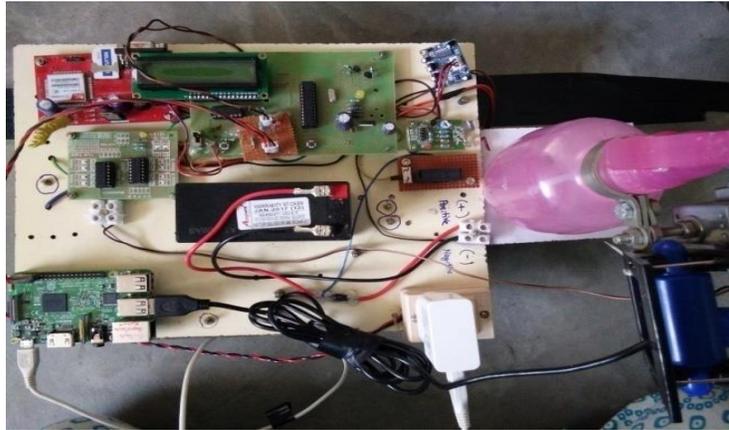


Fig.15. Raspberry Pi based smart home surveillance robot system enhanced with WI-FI Technology

When the prowler here in the vicinity of vigilant message send to relevant person and also hard by police station and then fire present that place means alert message to fire station.

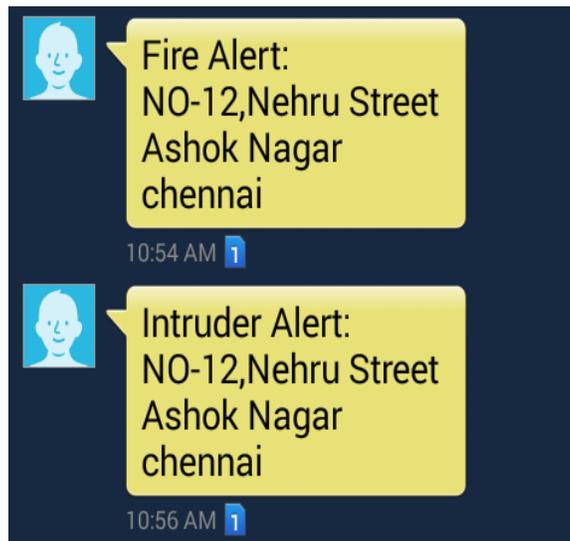


Fig.16. Message alert

The output is tabulated in table.4.

S.NO	OBSERATION	OUTPUT
1.a)	Power supply mode(1) mode(0)	Robot wheel – Rotate in Forward direction. Robot Wheel –Rotate in Backward direction
1.b)	Power supply mode(1) mode(1)	Robot Wheel-Rotate in Forward direction. Robot Wheel-Rotate in Forward direction
1.c)	Power supply mode(0) mode(1)	Robot Wheel –Rotate in Backward direction. Robot Wheel –Rotate in forward direction
1.d)	Power supply mode(0) mode(0)	Robot Wheel –in OFF Condition Robot Wheel-in OFF Condition
2.	PIR Sensor ON	Detect the intruders. Video call ON. Buzzer ON. Message send to owner
3.	Smoke Sensor ON	Detect the smoke. Message to fire station. Buzzer ON.

Table 4.Output

CONCLUSION

The Raspberry Pi based Smart Home Surveillance Robot system is enhanced with WI-FI Technology through the use of creating the web page is done effectively. It need only the Internet connection which can be obtained now the wide-reaching. There is no fracas can be occurred at some stage in the guidelines send to the robot from the robot to the consumer. By using smart phone or a personal computer the robot can be forbidden effortlessly. By using internet there will be a small time delay occurs which depend on aloofness and speed of network. This transportable robot can spread the Chloroform on the countenance of impostor to protect the consumer's adored things. This transportable robot can be controlled by the user from anywhere in the world through IoT (Internet of Things).

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