

Iot Based IMU For Home Automation

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Abstract: *Infrared remote controls for controlling the home appliances and electronics gadgets are very general. The complexity of buttons in these types of remote controls make its handling tough, they are not easy to understand and also to use. In this paper we propose an IOT based inertial measuring unit system for home automation which can provide an easy solution to this problem using gestures in a remote control for handling home appliances.*

Keywords: *Embedded, Gestures, Home automation, IoT*

I. Introduction

The main used technology in remote controls available today is infrared (IR) light, in the beginning these remote controls were made to operate electronic devices wirelessly. Later as electronic devices increased in a single household, no of remote controls also increased. As we are progressing in the modern era, there is need of home automation. Home automation is nothing but a smart home which involves control and the automation of lightning, ventilation, air conditioning, as well as other home appliances. In this proposed work we have implemented an iot based inertial measuring unit application. Considering day to day challenges that people face in their day to day life this system is developed the proposed model is helpful for old age people and person with disabilities. Embedded physical devices, such as household appliances are becoming smart .They are available with embedded microprocessors and wireless transceivers, offering limited communication capabilities and providing smart behavior. However recent development in the field of internet technology has enabled scientific communities to build IOT based applications, where everyday objects are uniquely addressable and interconnected. Devices and objects with built in sensors are connected to an Internet of Things platform, which integrates data from the different devices and applies analytics to share the most valuable information with applications built to address the specific needs of people. The Gesture plays very important role in the proposed system. A gesture is a form of non-verbal communication or non-vocal communication in which visible bodily actions communicate particular messages, either in place of, or in conjunction with, speech [7]. Gestures include movement of the hands, face, or other parts of the body. Gesture recognition is the mathematical interpretation of a human motion by a computing device. In other words, interface with computers or other equipment using gestures of the human body, typically hand movements. Energy consumption is one the most important aspect that needs to be considered along with development in technology. Human activity is one of the major causes for the both energy wastage and its proper conservation. The problem of energy consumption of electrical devices is gaining importance .As it effecting both economical and environmental status of a country. By monitoring the energy consumption by a device online better energy consumption is possible.

II. Related works

Though the concept of data integration and analytics is new to India a considerable amount of work is being carried out in this domain. P.N Arathi [1] discusses about capturing and recognition of gesture using webcam further processing is achieved via MATLAB programming using various algorithms such as NL Harris algorithm background separation, normalization, averaging 4 points and scaling filter. Kang [2] discusses about acquiring the data from the sensor, its interpretation and analysis which are further being used for controlling the smart home. Robert Mahony [3] discusses about the use of complementary in comparison to kalman filter which is stable, programmable robust, easily implementable and tunable. The filter is first order filter which enables to filter data continuously. Jeya Padmini [4] discusses about the problem of energy consumption and its conservation .Image processing technique is involved for further processing. Zeinab Kamal Aldein Mohammeda [5] discusses about the internet of things standardization and protocol, various application and challenges such as scalability, data volumes, interoperability, data interpretation which are faced while building an IOT based product. Kumar Mandula, Ramu Parupalli [6] discusses about IoT and how it can be used for building a sustainable smart home automation using a micro-controller base and mobile app.

III. WORKING

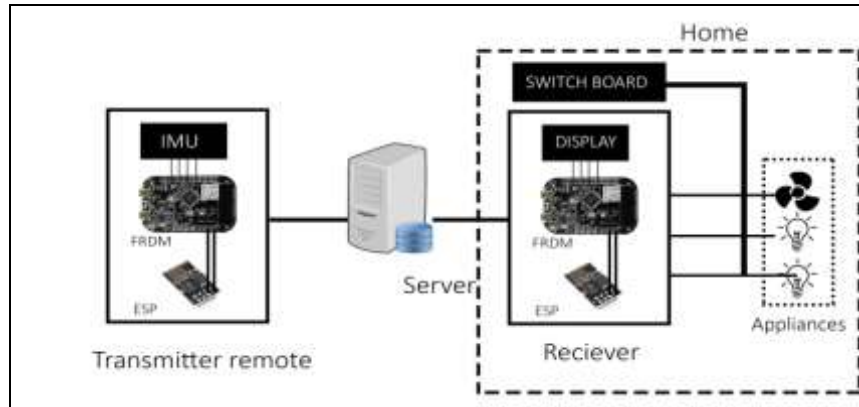


Fig.1 (IoT based IMU system)

The home automation system proposed here is realized using the ARM microcontroller FRDM-kl25z microcontroller which provides faster processing and has a good on board memory. Mbed is an open source platform to program the board for processing the various sensor data readings and control various applications by sensing the data incoming from the attached sensors. The home automation using gesture project uses an IMU i.e. an Inertial measuring unit is a 9 degrees of freedom device which has the capability of sensing and generating the accelerometer, gyroscope and magnetometer readings. GY87 a versatile IMU model is used in this system. The IMU is attached to the FRDM board consist of the remote. This remote is used to make gestures by the users which are then sensed by the FRDM and a signal is sent via the ESP8266 module attached on it. The ESP8266 is a low-cost Wi-Fi microchip with full TCP/IP stack and microcontroller capability. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands. The ESP8266 with 1 MiB of built-in flash is used for allowing single-chip devices that are capable of connecting to Wi-Fi. The command is sent over to the receiver end where another board controls all the appliances Of a particular room of the house. These gestures are made as such for switching between on/off for the appliances as well as speed control for the same. At the receiver end FRDM board and ESP8266 is connected, ESP board enables receiver to collect the data sent by the transmitter. This data is then processed by the receiver further to perform actions on the connected appliances, for basics four gestures can be used. Such as rotating remote on right/left, and tilting the remote up and down. This system can be used for small home. For homes having multiple rooms, buttons can be added which can decide the room and then do the gestures accordingly. Further advancements can be made by which data can be shown on website or app to tell the user about status of appliances connected in the smart home. As system is connected to the internet there is a possibility of connection breaking down due to unavailability of the internet signals, hence a normal switches are also added with the IoT and normal operation can also be chosen.

IV. Equations For Generation Of Parameters

The parameters used for stabilized readings for the motion analysis and object orientation are pitch and roll. The formula for both is generated by the incoming values of accelerometer and gyroscope for all three axis and a constant value.

$$Pitch = \arctan\left(\frac{-G_x}{G_z}\right)$$

$$Roll = \arctan\left(\frac{G_y}{\sqrt{G_x^2 - G_z^2}}\right)$$

G_x = acceleration in x direction

G_y = acceleration in y direction

PITCH = $180 * \text{atan}(\text{accelerationX} / \sqrt{\text{accelerationY} * \text{accelerationY} + \text{accelerationZ} * \text{accelerationZ}}) / M_PI$

ROLL = $180 * \text{atan}(\text{accelerationY} / \sqrt{\text{accelerationX} * \text{accelerationX} + \text{accelerationZ} * \text{accelerationZ}}) / M_PI$

V. Experimental Results And Challenges

This paper explains the concept of home automation using gesture, to control various electrical appliances using IoT. The emergence of Internet of Things provides the capabilities of connecting smart devices, small actuators and people anywhere any time to the internet. Currently, however the IOT itself lacks theory, technology architecture and the standards that integrate the virtual world and the physical world in the unified framework [8]. IoT deals with accumulation of data of various sensors over a smart environment so proper care should be taken for management of this data as they can further be used for data analysis and better monitoring of systems.

VI. Conclusion

Thus new methodology is proposed to control all appliances inside home using one remote based on gesture. It solves the issue of multiple buttons and helps elderly and physical challenged people to control the appliances more conveniently. The proposed system is IoT based, hence analysis can be done also for normal people options of generating bills of particular devices can be possible in future. Hence, current proposed system provides an unique solution to the problem of Infrared remote control.

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