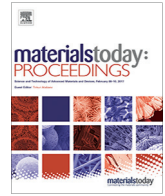




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Smart governance of home through IoT

J. Rajasekhar^a, M. Trinath Basu^b, N.S.S. Sowjanya^a^a Department of Electronics and Computer Science Engineering, KLEF, Vaddeswram, Guntur District, Andhra Pradesh, India^b Department of Computer Science Engineering, KLEF, Vaddeswram, Guntur District, Andhra Pradesh, India

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ABSTRACT

The invoking features of IoT in this age of modernization make life very easy and sophisticated. Smart home automation is one such trending advancement in IoT. In this paper, we present various intelligent devices like a smart aquarium, smart storage tank, smart lighting, and smart air purification. By utilizing all these smart things we analyze the shared resources used by these appliances based on them we reutilize the resources. Thereby we conserve energy as well as resources.

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1. Introduction

In recent times IoT is a big buzz across the world which creates a revolution in the modern era with its ability to connect the physical things through the internet. This feature leads to the innovation of home automation. Automation is nothing but we are intelligently making the devices work so that we save our efforts and energy. Thus home automation plays a vital role in human life.

Current studies convey that the standard of living of humans increased rapidly with the advancement of technology leads to rapid growth in home automation so this Opportunity is utilized by researchers and companies [1]. several surveys shows that the world home automation system market is expected to grow from USD 32.11 Billion in 2015 to USD 78.27 Billion by 2022, at a CAGR of 12.46 between 2016 and 2022 using IoT system [2]. As the usage of smart devices increases, day by day the companies also releases new products in the market more frequently that are enabled by IoT which includes fit bands, smart home appliances, etc. [1] There are many types of interconnecting home appliances comes in the market like Nest Thermostat and Philips Hue Light Bulb in one system which can be accessed from anywhere [3]. By the motivation of these products we proposed our home automation system according to our daily needs which are essential to lead an easy lifestyle.

In our paper, we approached four different novelties to build smart home automation enabled by IoT to ease the life of human beings. Those details are as follows smart aquarium which life-guards the fish's in the tank and a smart storage tank that monitors

the level of water. Smart lightning which conserves energy the last one is a smart air purifier by using all these four novelties and utilizing their common resources we are going to design smart home automation through raspberry pie to monitor the smart devices and also we can reduce power consumption.

The next sections organization is as follows section 2 is about state of art, the motivation of related projects, 3 to 6 describes the proposed thesis and implementation, section 7 comprises the evaluation and their analysis, and in the last section conclusion is summarized.

2. State of art

Smart governance is nothing but organizing of different smart things in an efficient manner by using a proper platform. In our paper we summarize various smart home automation concepts and based on them we analyzed the common resources utilized by them. This analysis is mainly focused on different parameters like sensing of different types of data, how we communicate this data through a medium and processing of data [4].

2.1. Smart sensors

For collecting a large amount of data from different types of smart devices sensors are widely used. sensors are the most essential elements in any smart applications where data has to be acquired. There are Different types of sensors like temperature sen-

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sor, LDR, PIR sensors rain gauge, etc to sense the different parameters.

2.2. Data transformation

Data transmission is the most crucial part in any application which is nothing but communicating the data through different types of technology like gsm, Bluetooth, ZigBee, Wi-Fi, etc [4]. usually most of the people use wifi as a medium for communication.

2.3. Data processing

Usually, the data generated by the sensor must be processed through controllers only. In market we are having various products for processing the data like raspberry pi, Arduino Node MCU etc. raspberry pi is the popularly used microcontrollers because of its performance in complex situations and speed [6]. Node MCU basically belongs to Arduino family generally used for simple applications [5]. According to the complexity of the application we can choose our own controller in our project we are using raspberry pie.

3. The home lighting

The home lighting system plays a lead role in keeping the track of situation of the home when nobody is around. By using different kinds of sensors, shown in (Fig. 1) the wind sensor is used to know the direction, speed of the wind in your home, (Fig. 1) we are using weather sensor to monitor the weather conditions around the home, (Fig. 1) Rain sensor activates the windows when the rain starts it will close all the windows (Fig. 1) video storming is used to observe the home condition through online.

LDR sensor activates the light when the light is low (Fig. 1) PIR sensor turn on and off the lights and fan when there is no one in the room the delay time is 5 min (Fig. 1) based upon the weather conditions the weather sensor activates the air conditioner or the heater, All these sensor information can be monitor by the server and from there we can control the devices manually.

4. Fish tank application

The fish tank provides a good atmosphere to the home and it is a good stress booster now days every individual is busy with their respective schedules so they are not able to feed or monitor the fish tank. But we can feed and keep an eye by using our smart technology.

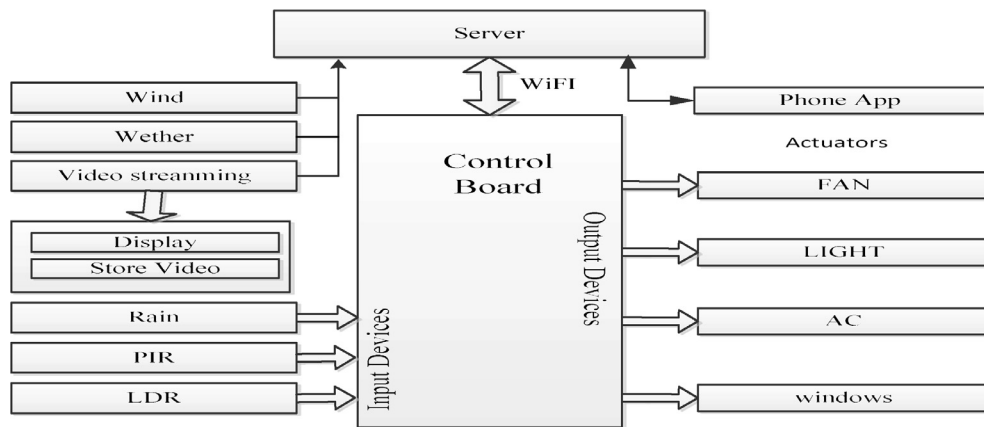


Fig. 1. The home lighting application functional block diagram.

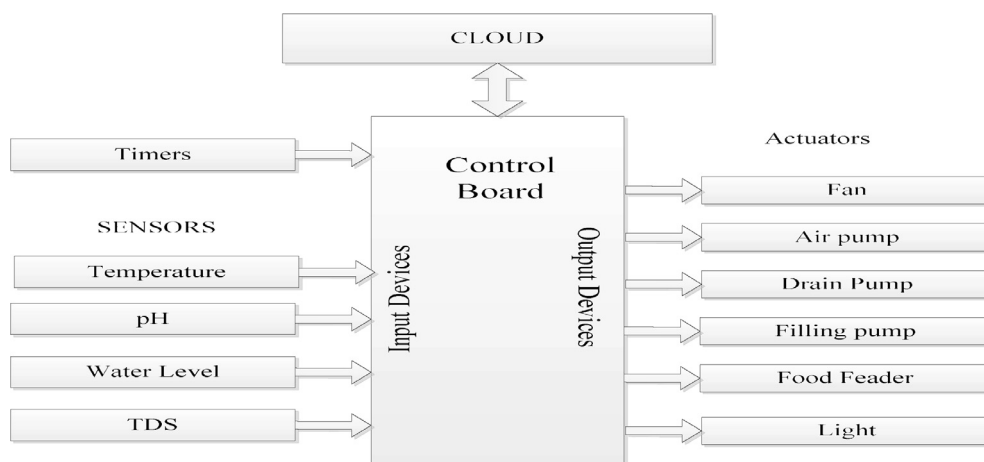


Fig. 2. Fish tank functional block diagram.

The server dashboard monitors all the temperature, pH, water level, and TDS values, and from this dashboard user will be able to manually control the actuators such as light, air pump, drain pump, and the fan.

Fig. 2 shows the block diagram of the fish tank, temperature sensor is used to keep track of water temperature. As most of the fish live in the temperature range of 76° to 80°F which indicates a sustainable environment for healthy fishes. If the temperature rises above this norm the fan will be on and cools the water, if the temperature is below the norm the heater will on and maintains the temperature in the fish tank.

The pH value of the fish tank for freshwater must be within the range of 6.8 to 7.6. Nowadays the pH value is increasing due to the organic waste and it leads to the hardness of the water. If the pH value is increased above the prescribed norm the drain pump will be on and the water is removed from the fish tank and fresh water is pumped into the tank from the filling pump.

Dissolved Oxygen (DO) monitors the oxygen levels in the fish tank for the hearty living of the fish. The dissolved oxygen level must be above 3–4 mg/L for a fish to live and this level must be 6 mg/L if this value decreases the actuator air pump will on to increase the dissolved oxygen in the water.

The Water level sensor checks the level of the water and if the water is below the level point it will on the filling pump and fill the water and the light is used to view the fish tank at the night times, the timer is used to fix the regular intervals to feed the fish and activates the actuator fish feeder to drop the food into the fish tank.

5. Smart air purification

Ventilation is one of the most important aspects of maintaining any house smart air purification is the best method in practice nowadays. In recent days generally we used to shut all the doors and windows of the room due to some disturbance and the prox-

imity of the neighborhood. Due to this the air will not go outside as a result content of the CO2 will be increased and temperature also. If so many people are there in the same room it leads to berating problems so to avoid this we are using a smart air purification system.

In this application, the Indoor CO2 (Fig. 3) measures the room CO2 and the outdoor CO2 is used as a reference.

The PM sensor (particulate matter) is used to detect the dust particulars, water particle, smoke composition, that are present

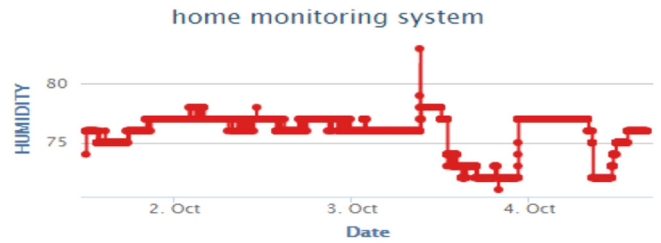


Fig. 5. Humidity sensor values.

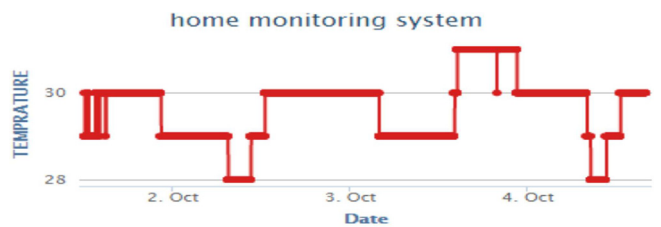


Fig. 6. Temperature sensor values.

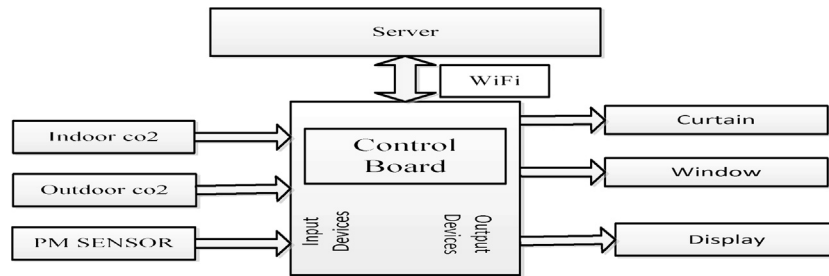


Fig. 3. Smart air purification functional block diagram.

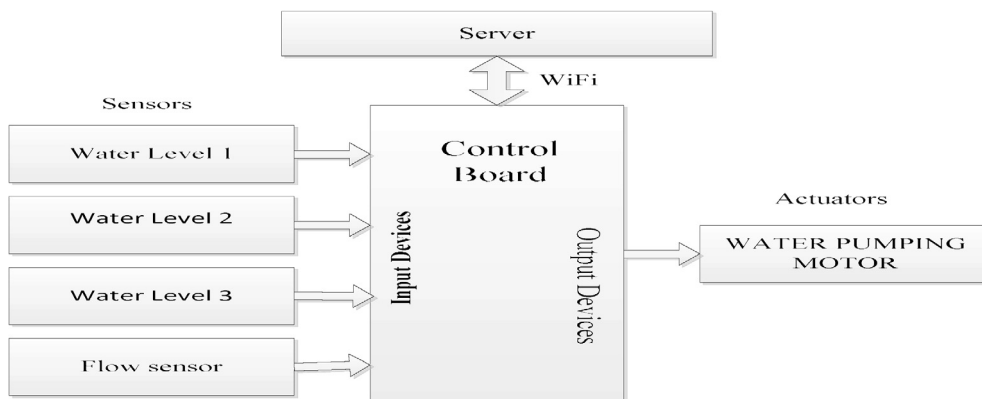


Fig. 4. Water tank application functional block diagram.

Table 1
Sensors used in smart home.

| Applications | Smart living | Smart Lighting | Smart Air Condition | Intrusion Detection | Smoke/Gas Detection | SMART WATER TANK | SMART Home |
|-------------------|--------------|----------------|---------------------|---------------------|---------------------|------------------|------------|
| Temperature | ✓ | X | ✓ | X | X | X | ✓ |
| Humidity | ✓ | X | ✓ | X | X | X | ✓ |
| Water level | X | X | X | X | X | ✓ | ✓ |
| CO2 | X | X | X | X | ✓ | X | ✓ |
| Timer | ✓ | X | X | X | X | X | ✓ |
| Camera | ✓ | X | X | ✓ | X | X | ✓ |
| Rain | X | X | X | X | X | X | ✓ |
| Wind | X | X | X | X | X | X | ✓ |
| Ph | X | X | X | X | X | X | ✓ |
| SMART PHONE | ✓ | ✓ | X | ✓ | ✓ | X | ✓ |
| DO | X | X | X | X | X | X | ✓ |
| PIR | X | ✓ | X | ✓ | X | X | ✓ |
| LDR | X | ✓ | X | X | X | X | ✓ |
| FLOW SENSOR | X | X | X | X | X | ✓ | ✓ |
| SOIL | X | X | X | X | X | X | ✓ |
| ultrasonic sensor | x | x | X | X | X | ✓ | ✓ |

in the air, if the particle size is more than the activators will activate, and these results will be transferred to the display.

When the indoor co2 is more than it (Fig. 3) automatically winds up the curtain and opens the windows.

6. Water tank application

Storage tank is one of the most common utility in every household. Nowadays every individual uses a storage tank. But due to the workload we switch on the MOTOR and forgetting it because of this we are wasting lots of water and power to overcome this situation we propose a smart storage tank. We are using the level sensor to measure the (Fig. 4) water levels of the tank when the level is at high the actuator will be off when it is low it is in on the condition are shown in Fig. 5 and Fig. 6.

Table 2
Water level monitoring.

| Ultrasonic Sensor | water level (in L) | WATER LEVEL | Water Percentage (%) |
|-------------------|--------------------|-------------|----------------------|
| 28 CM | 30 | LOW | 10 |
| 25 CM | 60 | | 20 |
| 22 CM | 90 | | 30 |
| 19 CM | 120 | MIDDLE | 40 |
| 16 CM | 150 | | 50 |
| 13 CM | 180 | | 60 |
| 10 CM | 210 | | 70 |
| 7 CM | 240 | HIGH | 80 |
| 4 CM | 270 | | 90 |

Table 3
Sensors used in SMART HOME.

| Applications | Smart living | Smart Lighting | Smart Air Condition | Intrusion Detection | Smoke/Gas Detection | SMART WATER TANK | SMART Home |
|-------------------|--------------|----------------|---------------------|---------------------|---------------------|------------------|------------|
| Temperature | ✓ | X | ✓ | X | X | X | ✓ |
| Humidity | ✓ | X | ✓ | X | X | X | ✓ |
| Water level | X | X | X | X | X | ✓ | ✓ |
| CO2 | X | X | X | X | ✓ | X | ✓ |
| Timer | ✓ | X | X | X | X | X | ✓ |
| Camera | ✓ | X | X | ✓ | X | X | ✓ |
| Rain | X | X | X | X | X | X | ✓ |
| Wind | X | X | X | X | X | X | ✓ |
| Ph | X | X | X | X | X | X | ✓ |
| SMART PHONE | ✓ | ✓ | X | ✓ | ✓ | X | ✓ |
| DO | X | X | X | X | X | X | ✓ |
| PIR | X | ✓ | X | ✓ | X | X | ✓ |
| LDR | X | ✓ | X | X | X | X | ✓ |
| FLOW SENSOR | X | X | X | X | X | ✓ | ✓ |
| SOIL | X | X | X | X | X | X | ✓ |
| ultrasonic sensor | x | x | x | X | X | ✓ | ✓ |

A flow sensor is used to measure the quantity of the water used in the home. thus smart storage tank plays a key in home automation.

7. Discussion

In Smart governance of home, we are placing four kinds of appliances that are useful for homemaking in this system the applications share a similar type of sources. In our work, we are using raspberry pie as a medium for communication and by machine learning algorithms we are designing the whole system. The details of the list of sensors used that share common resources and what type sensors and actuators are used and their outcomes are shown below.

In every home, we regularly use similar type of sensors and actuators. Even we can reuse the same sensor if they have common factors. In the above said examples the smart aquarium and the smart storage tank shares the same type of sensors to check the ph of water likewise the smart air purifier and the smart lighting can also shares the shared resources like according to the presence of people lights will be on similar if more no of people are there the air will be purified. These can be also done by the single sensors although there is no current implementation but based on your analysis in future we can implement this project.

And second one is all the four different parameters values are monitor by using smart phone through a graphical interface in this we are just summarizing the sensors and actuators data but through machine learning algorithms we can monitor and control

all these function in and around the house as it is not there in existing ones. The results are shown in [Table 1](#) [Table 2](#) and [Table 3](#).

8. Conclusions

This paper mainly focus on four different novelties that were enabled by iot through a single entity which are mainly used in home automation there by it reduces the effort of people and creates a user friendly environment. In future we integrate all these smart things to make a smart home.

CRedit authorship contribution statement

J. Rajasekhar: Data curation, Writing - original draft, Software, Validation. **M. Trinath Basu:** Conceptualization, Methodology, Software, Supervision. **N.S.S. Sowjanya:** Investigation, Visualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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