ONLINE HOME AUTOMATION &MONITORING SYSTEM

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ABSTRACT

In the present scenario, monitoring those resources and our own belongings by ourselves is of prime concern. The system here aims in implementing an online facility for monitoring our home and the equipment status at any instant of demand. Here, an online monitoring system is developed that enables such a monitoring activity. Here online monitoring and automation is facilitated for light detection, water level detection and unauthorized motion detection. The system implemented here uses the latest embedded processor of Intel namely Intel Galileo. The system serves more advantageous when we are apart from our home for a short period like for one week so. In such periods, it seems to be difficult for employing a person for monitoring the home. While considering the application for other periods this seems to be helpful in monitoring home and thereby avoiding the unwanted wastage of resources like water and electricity.

Keywords: Intel Galileo, Online Monitoring, Automation, Unauthorized Motion Detection, Water Level Detection, Light Detection

I. INTRODUCTION

Utilizing web services is the most open and interoperable way of providing remote service access or enabling applications to communicate with each other. IoTs can be described as connecting everyday objects like smart phones, internet televisions, sensors and actuators to the internet where the devices are intelligently linked together to enable new forms of communication amongst people and themselves. The significant developments and innovations over the last couple of years have created a new dimension to the world of information and communication technologies. The advancement is leading to anyone, anytime, anywhere (AAA) connectivity for things with the expectation being that this extend and create an entirely advanced dynamic network of IoTs. The IoTs technology can be used for creating new concepts and wide development space for smart homes in order to provide intelligence, comfort and improved quality of life limitations [1].

This system developed using the Intel Galileo proves to be advantageous and it demand will increase in the future as offers a powerful means for monitoring the automated devices at our home as well as the entire home dynamically from a distant location using internet. Here a micro web-server is embedded in the Intel's Galileo processor with a real time IP connectivity so that the system can be accessed and controlled from any distant location using a internet facilitated device like mobile phones, tablets, laptops, PCs, etc.

II. LITERATURE REVIEW

Smart home is not a new term for science society however it is still far more away from people's vision and audition. As electronic technologies are converging, the field of home automation is expanding. Various smart systems have been proposed where the control is via Bluetooth, internet, short message service (SMS) based,

etc. A Wi-Fi based home automation system in [2] uses a PC (with built in Wi-Fi card) based web server that manages the connected home devices. The users can manage and control the system through LAN or use an internet facility to monitor remotely. The system supports a wide range of home automation devices like power management components and security components. A similar architecture is proposed in [3] where the actions are coordinated by the home agent running on a PC. Other papers such as [4-7] also presented internet controlled systems consisting of adedicated web server, database and a web page for interconnecting and managing the devices.These systems utilize a PC which leads to a direct increase in cost and power consumption. Onthe other hand, the development and hosting of the web page will also result in additional costs. The online home automation and monitoring system designed and implemented here uses the latest embedded processor of Intel, Intel Galileo replaces the need of PC as well as serves the objective at low power. The web page is hosted in the processor itself which nullifies the need for spending additional expense on purchasing and hosting the webpage designed for the system. The on-board SD card available adds-on the advantage of implementing a database easily and at nullifies spending amount for its implementation or development.

III. SYSTEM DESIGN

3.1 System Overview

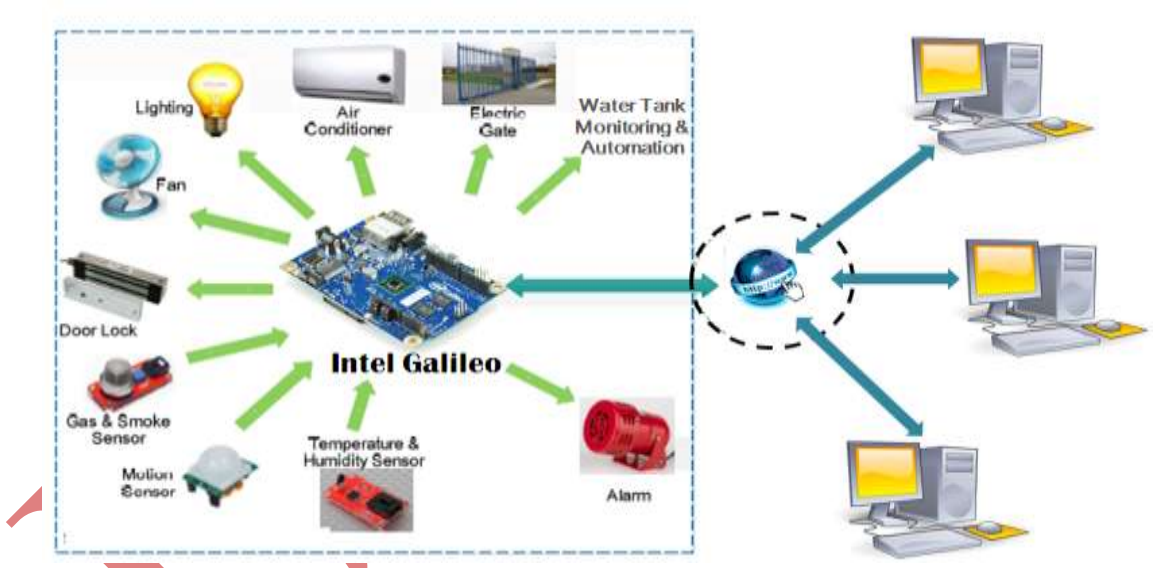

Figure1. System Overview of the Proposed Online Home Automation & Monitoring System

Here, an online home monitoring and automation system is developed that enables automation making our home a smart home & also facilitating the online monitoring feature. Apart from the proposed system here only a few features lighting, motion sensor, alarm, lighting and water tank monitoring & automation are implemented. For implementing the automation feature three sensors namely LDR, water level sensing units & PIR sensor are used. The actuations are automated and they can be controlled using the online portal and even their status of operation like lights (ON/OFF), water pump(ON/OFF) and alarm and camera(ON/OFF) are also displayed in the online portal page so that if any unwanted/unnoticed activation has happened they can be disabled using this web portal itself. For example, if the automatic e-system for light ON and OFF is not functioning properly and if the light is still turned ON during daytime it will be notified and we can turn OFF it using the web portal itself.

The LDR senses the presence of light in the surroundings and this information is passed to the processor in terms of variations in the analog voltage developed across its resistance. Here if the analog voltage is minimum

(0V), it indicates NIGHT and if the voltage is at the maximum (+5V) it indicates DAY. Values in between these limits show the variation from DAY to NIGHT. Once it is indicated that NIGHT has arrived the lamp gets turned ON and this action is indicated by a scrolling message on the web portal. So that even if the automatic switching unit doesn't function properly it can be detected by monitoring the message scrolling on the web portal at any instant. In case of motion detection system, PIR sensor is used to sense any unauthorized movement in the home. If the same is detected the status is updated in the web portal and if the portal is online then a warning sound is enabled in the webpage so that the owner is notified. In the same instance, 4 cameras connected to the processor gets activated which captures images and stores them in the SD card and after a small delay of 2 second the burglar alarm is also activated. In case of water tank monitoring and automation unit a simple water level indicator is implemented which measures the level of water in the tank. The same status is also updated in the portal. If the water level is below 25% the motor is automated and the status is also updated if the owner comes to know from portal that even after the water is filled full tank due to a failure in the system operation the motor is still on he can turn OFF the motor using the webpage. Similarly during peak summer in rural areas power failure is frequent and if the owner wishes to turn ON the motor at a water level of 50% he can simply do it using the webpage similarly while the time of leaving the home he forgets to turn OFF the motor and later he remembers the fact he need not come back or seek help of neighbours he can make use of the portal to monitor the status and take the required action.With this limited features implementation itself the system seems to be very lively and if it is extended for all the sensors features proposed in the Fig.1, it makes the system a complete home automated and efficient online monitoring system.

3.2 System Overview

3.2.1 Central Unit

Intel first low power embedded processor Intel Galileo serves as the heart of this system. Galileo is a microcontroller board based on the Intel Quark SoC X1000 Application Processor, a 32-bit Intel Pentium-class system on a chip [8]. It is the first board based on Intel architecture designed to be hardware and software pin-compatible with Arduino shields designed for the Uno R3. The Intel Galileo board is software-compatible with the Arduino software development environment, which makes usability and introduction a snap. In addition to Arduino hardware and software compatibility, the Intel Galileo board has several PC industry standard I/O ports and features to expand native usage and capabilities beyond the Arduino shield ecosystem. A full-sized mini-PCI Express slot, 100 Mb Ethernet port, Micro-SD slot, RS-232 serial port, USB host port, USB client port, and 8 Mbyte NOR Flash comes as standard on the board.

Figure2. Intel Galileo Board

3.2.2 Motion Detection Unit

3.2.2.1 PIR Sensor

PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensors range. They are small, inexpensive, low-power, easy to use and don't wear out. For that reason they are commonly found in appliances and gadgets used in homes or businesses. They are often referred to as PIR, "Passive Infrared", "Pyroelectric", or "IR motion" sensors. PIRs are basically made of a pyroelectric sensor which can detect levels of infrared radiation. Everything emits some low level radiation, and the hotter something is, the more radiation is emitted. The sensor in a motion detector is actually split in two halves. The reason for that is that we are looking to detect motion not average IR levels[9]. The two halves are wired up so that they cancel each other out. If one half sees more or less IR radiation than the other, the output will swing high or low. Along with the pyroelectic sensor there is a bunch of supporting circuitry, resistors and capacitors. It seems that most small hobbyist sensors use the BISS0001 ("Micro Power PIR Motion Detector IC"). This chip takes the output of the sensor and does some minor processing on it to emit a digital output pulse from the analog sensor. Features of the PIR sensor are as follows;

- **Size:** Rectangular
- **Output:** Digital pulse high (3V) when triggered (motion detected) digital low when idle (no motion detected). Pulse lengths are determined by resistors and capacitors on the PCB and differ from sensor to sensor.
- **Sensitivity range:** up to 20 feet (6 meters) 110° x 70° detection range
- **Power supply:** 3V-9V input voltage, but 5V is ideal.

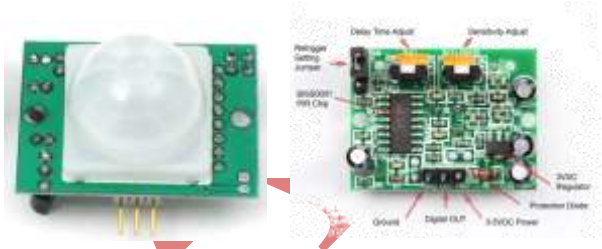

Figure 3.PIR Sensor Top and Bottom View [9]

3.2.2.2Camera

The camera module used is the one that was designed to be used in security systems and does two main things - it outputs NTSC monochrome video and can take snapshots of that video (in color) and transmit them over the TTL serial link. You can snap pictures at 640x480, 320x240 or 160x120 and they're pre-compressed JPEG images which makes them nice and small and easy to store on an SD card. Perfect for a data-logging, security, or photography project. It requires only two digital pins or a TTL serial port for interfacing and by default it transmits at 38400 baud.

Figure 4 Serial Camera Module [10]

3.2.2.3Alarm Buzzer

The alarm used in the system is the one that is suitable for usage burglar alarms and also in security system. Fig 5, shows the buzzer that was used in the system implemented. The features of the alarm buzzer used are as follows;

- Mount in 22.5 mm hole
- Continuous tone
- Simple connection with connector plug
- 80 decibels volume at one meter

Figure 5 High Pitch Alarm Buzzer [11]

3.2.3 Lighting Section

3.2.3.1 Light Dependent Resistor

Light Dependent Resistors (LDRs) are very useful especially in light/dark sensor circuits. Normally the resistance of an LDR is very high, sometimes as high as 1000000 ohms, but when they are illuminated with light resistance drops dramatically. When a light level of 1000 lux (bright light) is directed towards it, the resistance is 400R (ohms).When a light level of 10 lux (very low light level) is directed towards it, the resistance has risen dramatically to 10.43M (10430000 ohms)[12]. Fig 6 shows a bare LDR used in the system proposed here.

Figure 6 Light Dependent Resistor (Ldr)

3.2.3.2 LED Lamp

It is configured with 16, 1W ultra bright white LED's making a load of 16W which operates with an input voltage of 12V and current of 1.332A. The final encapsulated LED lamp is shown in Fig 7.

Figure 7 Encapsulated Led Lamp

3.2.4 Water Tank Monitoring & Automation

Here a simple water level indicator using4 sensor probes is used to indicate the water level and turns on automatically the motor when the water has reached the low level and turn OFF the motor when the level reaches the full level. Fig 8, shows the simple water level indicator implemented in the system.

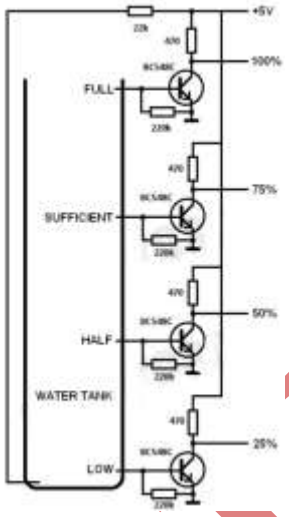

Figure 8 Simple Water Level Indicator Circuit Diagram

3.3 System Development

The system is realized using Intel Galileo processor which is programmed using the Arduino IDE. Eventhough using Arduino IDE for developing the code implies that the same can be fulfilled using any Atmel processors here the large size of flash memory (8MB) available for Galileo makes it attractive in the sense that if a web portal with more advanced features needs to be realized the same processor can be still opted. Also the on-board SD card add-ons the creditability of saving the information loaded and passed from the webpage to the database created in it and also the images from the camera so that if needed in future they can be accessed.

IV. FUTURE SCOPE

Currently the system implemented only incorporates three features from the proposed system features if the remaining features are also incorporated it makes the system an efficient, cost-effective and lively online home automation and monitoring system. The web portal is currently accessible by anyone who knows the web address incorporating security features like password authentication and face recognition makes the system more secure and prevents unauthorized access and control over the system. Enabling the instant sending of images captured to the owners mobile phone or gmail account helps in preventing the data to destruction by the thefts and also incorporating live streaming of the video captured during theft attempt makes the system to act as online theft detection with adequate proofs on robbery attempt.

VII. RESULTS& CONCLUSION

The Online Home monitoring and automation system using Intel Galileo was successfully implemented with incorporating the features of lighting, motion sensor, alarm, lighting and water tank monitoring & automation. A webpage was also successfully created to control and monitor these features and the same was embedded to the Galileo processor.

Figure 9. Various Snaps of the Final Prototype Implemented

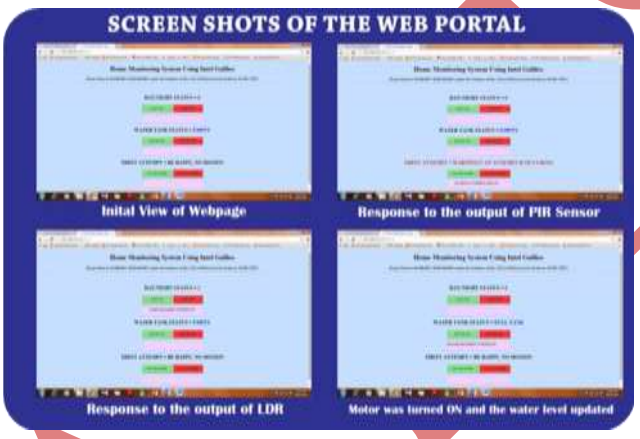

Figure10 Screen Shots of the Web Portal under Various Conditions

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